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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

ANCHOR QEA

East Branch Early Action Focused Feasibility Study – Draft Final

Prepared for the Newtown Creek Group

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Prepared for
The Newtown Creek Group

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ABBREVIATIONS

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
AC	activated carbon
Alt.	Alternative
AOC	Administrative Settlement Agreement and Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BAZ	biologically active zone
BERA	*Baseline Ecological Risk Assessment*
BHHRA	*Baseline Human Health Risk Assessment*
BMP	best management practice
BU	beneficial use
C19-C36	C19-C36 aliphatic petroleum hydrocarbons
CAD	confined aquatic disposal
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CO_2e	carbon dioxide equivalent
COC	contaminant of concern
CSM	conceptual site model
CSO	combined sewer overflow
CSTAG	Contaminated Sediment Technical Advisory Group
Cu	copper
cy	cubic yard
D/F TEQ	total dioxin/furan toxic equivalence quotient (mammal)
EA	Early Action
FFS	Focused Feasibility Study
Framework Memorandum	*Framework for the Operable Unit One Remedial Action Objective and Preliminary Remediation Goal Approach*
FS	Feasibility Study
GHG	greenhouse gas
GRA	General Response Action
H:V	horizontal to vertical ratio
IC	institutional control
IEM	interim evaluation measure
ISS	in situ stabilization/solidification
lf	linear foot

LTE	long-term equilibrium
LTE Report	*Interim Estimates of Post-Remedy Surface Sediment Concentrations*
mg/kg	milligram per kilogram
MLLW	mean lower low water
MNR	monitored natural recovery
MS4	municipal separate storm sewer system
NAPL	nonaqueous phase liquid
NCG	Newtown Creek Group
NCP	National Contingency Plan
ng/kg	nanogram per kilogram
NPV	net present value
NSR	net sedimentation rate
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYCDOT	New York City Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OMM	operations, maintenance, and monitoring
OSHA	Occupational Safety and Health Administration
OSR	Off-Site Rule
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PDI	pre-design investigation
ppm	part per million
PRG	preliminary remediation goal
PTW	principal threat waste
RAL	remedial action level
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RG	remediation goal
RI	Remedial Investigation
RI Report	*Remedial Investigation Report*
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
SWAC	surface-weighted average concentration
TBC	to be considered
TBD	to be determined
TPAH (34)	total polycyclic aromatic hydrocarbon (34)
TPCB	total polychlorinated biphenyl
TS	treatability study
TSCA	Toxic Substance Control Act
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WWTP	wastewater treatment plant

Executive Summary

Introduction

This report presents a Focused Feasibility Study (FFS) for an Early Action (EA) in East Branch of the Newtown Creek Superfund Site. This East Branch EA FFS addresses a portion of the Newtown Creek Study Area and has been prepared by the Newtown Creek Group (NCG) to accelerate the Operable Unit 1 (OU1) Feasibility Study (FS) process. The Newtown Creek Superfund Site is located in New York City, New York, and is a 3.8-mile-long, tidally influenced tributary to the Lower East River that forms a partial border between the boroughs of Queens and Brooklyn.

In April 2023, the NCG completed and the U.S. Environmental Protection Agency (USEPA) approved the *Remedial Investigation Report* (Anchor QEA 2023a) for OU1. The NCG continues to perform the FS for OU1, and the East Branch FFS activities are progressing along a parallel path with the broader OU1 FS. The NCG is performing both the OU1 FS and the East Branch EA FFS under the 2011 Administrative Settlement Agreement and Order on Consent.

A subsequent administrative order or consent decree with the future performing parties will be needed to govern final remedial design (RD) and implementation of an EA remedy selected by USEPA in a Record of Decision (ROD). Thereafter, as part of the broader OU1 FS, USEPA will determine whether an EA remedy in East Branch adequately and reliably addresses East Branch or whether additional response actions may be necessary as part of a Study Area-wide remedy.

Purpose of the Early Action

An EA in East Branch is consistent with USEPA guidance: *"The primary goals of an early action are to achieve prompt risk reduction and increase the efficiency of the overall site response"* (USEPA 1992). An EA within East Branch would be beneficial, as it would:

- Expedite the overall site response by implementing a remedial action in one of the more contaminated portions of the Study Area sooner than would occur for the remedial action for the full extent of OU1.
- Immediately reduce risk and result in contaminant mass removal in this portion of the creek (and, to a lesser extent, within the Study Area as a whole).
- Provide an opportunity to gain direct remedial experience in the creek as well as provide valuable information on implementability and effectiveness of remedial technologies for the entire Study Area.
- Enable lessons learned from conducting the East Branch EA (and associated pre-design investigation, remedial construction, and evaluation monitoring[1]) to inform the OU1

[1] The project schedule as of April 2024 will not allow for incorporation of evaluation monitoring data to inform the draft OU1 FS.

site-wide FS alternative development, evaluation, and remedy selection, as the EA information becomes available and is appropriate.

- Accelerate post-remedy construction monitoring in a portion of the creek to provide information to update the Study Area conceptual site model (CSM) regarding the implications of ongoing sources to East Branch.

The specific steps of the East Branch EA FFS are as follows:

1. Present the remedial action objectives (RAOs).
2. Present the risk-based preliminary remediation goals (PRGs).
3. Identify and screen applicable General Response Actions (GRAs), remedial technologies, and process options.
4. Present the development and initial screening of remedial alternatives based on the RAOs and risk-based PRGs.
5. Perform a detailed and comparative analysis of remedial alternatives.

To accomplish these objectives, this FFS evaluates remedial alternatives to address areas of East Branch where concentrations of COCs in sediments exceed risk-based cleanup criteria (i.e., risk-based PRGs) established by USEPA for the Newtown Creek Study Area (USEPA 2023). The East Branch CSM and associated site-wide risk assessments form the basis for the development and evaluation of remedial alternatives from which the East Branch EA remedy would be selected.

East Branch Conceptual Site Model

The East Branch is a dead-end tributary of Newtown Creek with a surface area of approximately 11 acres and is generally characterized by steep nearshore slopes leading to a deeper federally authorized navigation channel spanning most of the tributary's width. The predominant land use around East Branch is industrial. There are numerous point source discharges into East Branch, including two combined sewer overflows (CSOs), two municipal separate storm sewer system (MS4) outfalls, and approximately 35 stormwater outfalls.

Although there is a federally authorized navigation channel in most of East Branch, there is limited current ship and barge traffic. An analysis of current and potential future maritime users of East Branch completed by the U.S. Army Corps of Engineers has concluded that the navigation channel in East Branch can be deauthorized (although this deauthorization has yet to be approved by Congress). The Grand Street Bridge, which crosses the middle of East Branch and limits vessel traffic in the upstream part of East Branch, is currently projected by New York City Department of Transportation to be replaced starting in 2028.

The *Baseline Human Health Risk Assessment* (Anchor QEA 2017) and *Baseline Ecological Risk Assessment* (Anchor QEA 2018) identified unacceptable risks to human health and the environment in the Study Area through consumption of fish and crabs by recreational anglers and crabbers and direct contact with contaminated sediment and/or consumption of contaminated prey items by ecological receptors (i.e., benthic invertebrates, fish, and birds).

The COCs causing unacceptable risks are total polycyclic aromatic hydrocarbon (34) (TPAH [34]), C19-C36 aliphatic petroleum hydrocarbons (C19-C36), total polychlorinated biphenyl (TPCB), total dioxin/furan toxic equivalence quotient 2005 (mammal; D/F TEQ), copper (Cu), and lead (Pb). COCs were detected throughout the surface and subsurface sediment of East Branch, with concentrations generally increasing with sediment depth; however, within the native materials below the subsurface sediment, COC concentrations are an order of magnitude (or more) lower than in the sediments.

Nonaqueous phase liquid (NAPL) blebs were observed in only a few subsurface sediment cores but not in surface sediment or native material. Also, NAPL was immobile under laboratory test conditions at all locations where subsurface sediment samples were tested, and these laboratory tests were conducted at much higher hydraulic gradients than those observed in the field.

Sheens were observed in more than half of the surface sediment samples and at various depths for most subsurface core locations. Sheens were only observed at one location in native material.

The solids that currently deposit on the sediment bed in East Branch originate primarily from CSO and stormwater outfalls, with a smaller influence from solids in surface water that originate in the East River and are transported up the creek during diurnal tides. The COC concentrations in depositing solids are generally lower than the concentrations of contaminants in the surface sediments.

Groundwater discharges to East Branch and has two components: 1) groundwater flow to the sediment from the underlying native material throughout East Branch and from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground); and 2) direct groundwater discharge into the water column from the upland Fill Unit at submerged vertical permeable shorelines (i.e., lateral groundwater) (both vertically upward into the subsurface sediment from native material and laterally through shallow fill materials and vertical permeable shorelines). The larger ongoing contributions to COC loads are from point sources, tidal exchange, and groundwater. Gas ebullition and atmospheric deposition are smaller contributors to COC loads.

Basis for Evaluation of the Potential Remedial Alternatives

Remedial Action Objectives

The following East Branch RAOs are similar to those developed for OU1 but modified as provided in USEPA Region 2's Responses to Contaminated Sediment Technical Advisory Group (CSTAG) Recommendations (USEPA 2023). This is consistent with USEPA Region 2's revised draft final memorandum, *Framework for the Operable Unit One Remedial Action Objective and Preliminary Remediation Goal Approach* (Framework Memorandum; USEPA 2023), which states, *"Any early action* *taken will have distinct RAOs and interim performance goals that will work towards achieving the overall site RAOs and interim performance measures."*:

- **Exposure-based RAOs:**
  - Reduce potential current and future human exposures to COCs from ingestion of fish and crab by preventing biota exposure to sediments in the East Branch with COC concentrations above protective levels.
  - Reduce ecological exposure to site COCs in sediment by reducing the concentrations of COCs in contaminated sediment in East Branch to protective PRGs/remediation goals (RGs).
- **Source Control RAO:** Reduce migration of COCs related to nonaqueous phase liquid (NAPL) and its constituents, and other sources of COCs within East Branch, to surface sediment and surface water to levels that are protective for human health and ecological exposure.

Consistent with USEPA Region 2's responses to CSTAG Recommendations, the RAOs would be achieved by reducing concentrations of COCs in sediments associated with the biologically active zone (BAZ) below risk-based PRGs. For Newtown Creek, the BAZ has been determined to be 6 inches (15 centimeters). This would also be considered surface sediment for this site.

Risk-Based Preliminary Remediation Goals

For purposes of evaluating the effectiveness of remedial alternatives in reducing risks to human health and the environment for the OU1 FS, USEPA developed risk-based PRGs (Anchor QEA 2021; USEPA 2023) for the COCs. These risk-based PRGs will eventually be developed into final, contaminant-specific RGs and will be published in the East Branch EA ROD.

USEPA concluded that conditions in East Branch preclude the need to develop remedial action levels (RALs) for COCs where the risk-based PRGs were developed on a Study Area-wide surface-weighted average concentration (SWAC) basis (i.e., TPCB, D/F TEQ, and Pb) (Schmidt 2024). This is because the nature and extent of surface sediment contamination in East Branch is such that risk-based PRGs for COCs that were developed on a not-to-exceed basis (i.e., Cu, TPAH [34], and C19-C36) exceed their respective risk-based PRGs throughout nearly the entire spatial extent of East Branch to such a degree that active remediation is necessary throughout East Branch. For the risk-based PRGs developed on a Study Area-wide SWAC basis, this is a conservative approach because not everywhere that exceeds a SWAC-based PRG needs to be remediated in order to meet the PRG at the applicable spatial scale.

The risk-based PRG for each COC is presented in Table ES-1.

Table ES-1
Summary of Risk-Based PRGs

COC	Risk-based PRG	Applicable Spatial Scale for Risk-based PRG for the East Branch FFS[1]
TPCB	0.3 mg/kg	East Branch-wide SWAC
D/F TEQ	18 ng/kg	East Branch-wide SWAC
Cu	490 mg/kg	Not to exceed
TPAH (34)	100 mg/kg	Not to exceed
C19-C36	200 mg/kg	Not to exceed
Pb	340 mg/kg	SWAC in East Branch intertidal areas only

Note:
1. Because the East Branch Early Action remedy will only be performed in East Branch, only post-remedy East Branch data can be used to show progress is being made toward reaching the risk-based PRGs within East Branch. The spatial scale of the application of the risk-based PRGs can be revisited in future decision documents, and supporting material, related to the OU1 Study Area.

Applicable or Relevant and Appropriate Requirements (and "To-Be-Considered")

Under CERCLA, remedial actions must be designed, constructed, and operated to comply with Applicable or Relevant and Appropriate Requirements (ARARs) unless waived.

Interim Evaluation Measures

The USEPA (2023) Framework Memorandum states, *"There are many external ongoing sources of contamination to the Creek, including MS4s, WWTP effluent, permitted and non-permitted discharges, overland flow, groundwater, seeps and the East River that may be outside the scope of OU1 of the site."*

A spreadsheet model was developed to quantify the ongoing external inputs of COCs to the Study Area and estimate the expected long-term equilibrium (LTE) COC concentrations in post-remedy surface sediments (see *Interim Estimates of Post-Remedy Surface Sediment Concentrations* [Anchor QEA 2024]). For purposes of this East Branch EA FFS, these preliminary values characterize interim LTE surface sediment COC concentrations expected in East Branch following remedy implementation due to ongoing external inputs. Although the draft Framework Memorandum (USEPA 2023) defines these LTE estimates as the initial interim evaluation measures, they are not intended to assess remedy performance, but rather approximate the effect (over the long term) of ongoing contributions of COCs from external sources after remedy implementation. Current estimates of LTE concentrations for certain COCs indicate that LTE concentrations within East Branch may, over time, be greater than some risk-based PRGs (specifically D/F TEQ and C19-C36 and potentially TPCB), regardless of the remedy selected due to ongoing external inputs.

Long-term evaluation monitoring would be performed after EA implementation to confirm the selected remedy is functioning as designed. The monitoring program would also need to be able to distinguish remedy performance from inputs of COCs from ongoing external sources and other portions of Newtown Creek.

Remedial Alternatives

Surface sediment COC concentrations were used as the metric to delineate the lateral extent of remediation in East Branch in each remedial alternative considered. Almost the entire spatial extent of East Branch has surface sediment concentrations that exceed the risk-based PRG for one or more COCs. Surface sediment areas where no risk-based PRG exceedances occur are relatively small and isolated; so, for constructability reasons, these areas were included for active remediation in all the active remediation alternatives. Therefore, the footprints associated with each active alternative are identical, covering the entirety of East Branch (approximately 11 acres).

The remedial alternatives for an EA are consistent with the East Branch CSM and composed of proven GRAs and remedial technologies that have been used at other contaminated sediment sites. The FFS considers five active alternatives, along with a no action alternative, as summarized in Table ES-2.

In situ stabilization/solidification (ISS) as a remedial technology is integrated into each of the active remedial alternatives for solidifying/stabilizing sediment adjacent to unstable shorelines or bulkheads. In addition, for the purposes of this FFS, ISS is included as a technology option, in comparison to other remedial technologies (i.e., amended capping or dredging), to assess it as a remedial technology that could be integrated into the selected remedial alternative for treating sediment with NAPL or principal threat waste (PTW). Although NAPL or PTW potentially warranting treatment using ISS are not currently known to exist in the East Branch, each of the three remedial technology options was evaluated independently to identify the most appropriate option for integration into the selected remedial alternative, if conditions warranting their use are identified during the pre-design investigation, as determined by USEPA. For the purposes of technology evaluation in this FFS, application of the three technology options was assumed within a 0.6-acre evaluation area within the Western Beef Slip. Note that other factors, such as the concentration of COCs in remaining sediment and constructability, may be taken into account during the design of the remedy when evaluating where to apply ISS as well.

There are several elements and assumptions that are common to each of the active remedial alternatives. Specifically, institutional controls, dredging, containment (placement of backfill and/or cap), in situ treatment, dredged material management (including dewatering and disposal), ex situ treatment, and evaluation monitoring are common elements for all active alternatives.

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Table ES-2
Summary of Remedial Alternatives

Alternative	Alternative Summary
Alternative EB-A	No Action
Alternative EB-B	**Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW:** Remove sediments to allow placement of a cap entirely at (or below) 0 foot MLLW. Technology options for treating NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-C	**Dredge to Allow Placement of a Cap to Maintain Existing Water Depths:** Dredge to allow placement of a cap to maintain the existing water depth. Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-D	**Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging:** Dredge to allow placement of a cap to maintain the existing water depth. In select areas, remove sediments to a deeper depth than what is necessary to accommodate a cap followed by placement of backfill to pre-construction mudline elevations, or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater). Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-E	**Dredge All Within Navigation Channel, Cap Outside:** Dredge the federally authorized navigation channel to a depth necessary to accommodate a cap below the current authorized depth plus a buffer or to native material, whichever is shallower. Outside of the navigation channel, dredge to allow placement of a cap or dredge to native material. Areas dredged to native material (inside and outside the navigation channel) would be followed by placement of backfill (if necessary to manage dredge residuals), or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater). In the Western Beef Slip, remove sediments to allow placement of a cap entirely at (or below) 0 foot MLLW. Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-F	**Dredge All:** Dredge all sediments to native material except for limited areas where sediment would be stabilized/solidified in place via ISS for shoreline stabilization. Place backfill (if necessary to manage dredge residuals), or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater).

Detailed Analysis, Comparison, and Key Findings of Alternative Evaluation

Each of the remedial alternatives are evaluated against seven of the nine National Contingency Plan criteria—two threshold criteria and five balancing criteria. The two modifying criteria (defined as state and community acceptance) will be evaluated by USEPA following the release of the Proposed Plan. Table ES-3 summarizes these evaluations.

Alternative EB-A would not meet the threshold criteria because it would not provide for overall protection of human health and the environment. Each of the active alternatives (Alternatives EB-B through EB-F) would be expected to meet the threshold criteria and would be expected to perform similarly in terms of overall effectiveness. A summary of how each alternative performs relative to the threshold and balancing criteria is included in Table ES-3.

Table ES-3
Comparative Analysis of Alternatives Summary

Superfund Criteria	Results of the East Branch EA FFS Evaluation
Threshold Criterion 1: Overall Protection of Human Health and the Environment Evaluates the overall ability of an alternative to eliminate, reduce, or control potential unacceptable exposures to hazardous substances in both the short and long term and evaluates whether an alternative provides adequate and reliable overall protection to human health and the environment (e.g., the degree to which each alternative can achieve the RAOs); this evaluation also examines whether alternatives pose any unacceptable short-term or cross-media impacts.	• Each alternative would be expected to meet this threshold criterion by meeting the exposure-based and source control RAOs, except for Alternative EB-A (No Action). Because Alternative EB-A does not meet the threshold criterion, it is not further discussed in this table. • Over the long term, post-construction surface sediment COC concentrations are expected to gradually increase because of ongoing external inputs to East Branch. Based on current data, these external inputs may result in accumulation of surface sediments with LTE concentrations that are greater than risk-based PRGs for some COCs, under any remedial alternative. These ongoing external inputs are outside of the scope of the EA, and long-term monitoring will be designed to confirm the remedy is functioning as intended while also understanding the impacts of these ongoing sources.
Threshold Criterion 2: Compliance with ARARs Evaluates whether the alternative attains the identified chemical-specific, action-specific, and location-specific ARARs. USEPA has concluded there are no potential chemical-specific ARARs for the East Branch EA.	• Each active alternative would be designed to comply with the substantive requirements of ARARs; therefore, each of the active alternatives is expected to meet Threshold Criterion 2 and perform similarly with respect to this criterion.
Balancing Criterion 1: Long-Term Effectiveness and Permanence Evaluates the magnitude of human health and ecological risk remaining after remedial action has been concluded and response objectives have been met (known as residual risk) and the adequacy and reliability of the controls to manage that residual risk.	• Each active alternative would be expected to perform similarly in terms of long-term effectiveness. Although alternatives that leave less contaminated sediment in place might pose lower residual risk, the use of capping as part of the active remedial alternatives to control residual risks has been used successfully at many other sediment sites, and long-term monitoring and maintenance would be performed to further verify the long-term effectiveness and permanence. While alternatives with smaller areas of capping would rely slightly less on long-term monitoring and maintenance, each of the alternatives includes capping over at least half of East Branch. The effectiveness and reliability of ISS as a stand-alone technology to control the residual risk is less certain, and therefore it may be necessary to place a cap on top of the ISS treated area to control diffusive COC flux. Regardless, the difference in the long-term effectiveness between the active alternatives is small.

Superfund Criteria	Results of the East Branch EA FFS Evaluation
Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment Evaluates the degree to which an alternative would use treatment to reduce the principal threats in East Branch through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.	• Each of the active alternatives meets the statutory preference for treatment as a principal element by providing permanent and significant reduction of toxicity, mobility, or volume through treatment over the entire footprint of East Branch (100%) by either providing in situ treatment of sediment left in place (or of flux of COCs from native groundwater) or ex situ treatment of sediment removed (or both). Alternative EB-B would provide the most in situ treatment, with Alternatives EB-C, EB-D, EB-E, and EB-F providing successively decreasing amounts. Alternative EB-F would provide the most ex situ treatment, with EB-E, EB-D, EB-C, and EB-B providing successively decreasing amounts.
Balancing Criterion 3: Short-Term Effectiveness Evaluates effects and potentially unacceptable risks to human health and the environment related to construction and implementation of each alternative and considers the duration of time until remedial response objectives are achieved.	• Alternatives with longer construction durations will take longer to meet the RAOs, and therefore rank lower for short-term effectiveness. • Alternatives with longer construction durations and greater dredge volumes present proportionately larger potential short-term risks to the environment (including water and air quality emissions), workers (e.g., worker safety), and the community, and therefore rank lower for short-term effectiveness. • The alternatives sequentially have longer construction durations and greater dredge volumes. Therefore, Alternative EB-B would have fewer negative short-term impacts compared to Alternative EB-C and so on, with Alternative EB-F having the most negative short-term impacts.
Balancing Criterion 4: Implementability Evaluates the ease or difficulty of implementing the alternative by considering technical feasibility, administrative feasibility, and availability of services and materials required for implementation.	• Alternatives with shorter durations for construction would generally be less challenging to implement than those with longer durations because the remedial technologies used are the same. The alternatives sequentially have longer construction durations, so Alternative EB-B is slightly more implementable than Alternative EB-C and so on, with Alternative EB-F being the least implementable. • Alternatives that involve significant amounts of shoreline/bulkhead improvements to facilitate the environmental remediation are expected to extend both the RD and implementation phases. Alternatives EB-C, EB-D, EB-E, and EB-F each will likely need shoreline stabilization over the majority of the shoreline and are anticipated to require many years for negotiations and legal agreements with property owners, site investigation, design, and construction of shoreline stabilization measures, all of which must be completed prior to the start of the sediment remediation. This is compared to likely only a few years for Alternative EB-B.

Superfund Criteria	Results of the East Branch EA FFS Evaluation
Balancing Criterion 5: Cost Evaluates present worth (net present value [NPV]), direct and indirect capital, and component costs of implementing an alternative.	• Alternative EB-B: $174.8M ($152.0M NPV) • Alternative EB-C: $270.2M ($235.2M NPV) • Alternative EB-D: $279.2M ($243.5M NPV) • Alternative EB-E: $499.8M ($418.7M NPV) • Alternative EB-F: $610.1M ($492.7M NPV)
Modifying Criterion 1: State Acceptance Evaluates the technical and administration issues raised by the supporting agencies about the alternatives.	• To be addressed by USEPA following release of the Proposed Plan.
Modifying Criterion 2: Community Acceptance Evaluates issues and concerns raised by interested persons in the community about the potential remedial alternative.	• To be addressed by USEPA following release of the Proposed Plan.

1 Introduction

This report presents a Focused Feasibility Study (FFS) for an Early Action (EA) in East Branch of the Newtown Creek Superfund Site. This East Branch EA FFS is being performed by the Newtown Creek Group (NCG) and represents an acceleration of the Operable Unit 1 (OU1) Feasibility Study (FS) process for a portion of the Newtown Creek Study Area.

The Newtown Creek Superfund Site is in Kings County and Queens County, New York City (NYC), New York. The creek is a 3.8-mile-long, tidally influenced tributary to the Lower East River and forms a partial border between the boroughs of Queens and Brooklyn (see Figure 1-1). The defined Newtown Creek Study Area (later designated by the U.S. Environmental Protection Agency [USEPA] as OU1) consists of the main channel of Newtown Creek and its five tributaries: Whale Creek, Dutch Kills, East Branch, English Kills, and Maspeth Creek.[2,3] The Site was placed on the National Priorities List in 2010. A Remedial Investigation (RI) and FS commenced in 2011 pursuant to an Administrative Settlement Agreement and Order on Consent (AOC) (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. CERCLA-02-2011-2011) between the USEPA and six Respondents, i.e., the New York City Department of Environmental Protection (NYCDEP) and a group of five parties that comprise the NCG. The NCG includes Phelps Dodge Refining Corporation; Texaco, Inc.; BP Products North America Inc.; The Brooklyn Union Gas Company d/b/a National Grid New York; and ExxonMobil Oil Corporation.

In April 2023, the NCG completed and USEPA approved the *Remedial Investigation Report* (RI Report; Anchor QEA 2023a) for OU1. The NCG continues to perform the FS for OU1. The NCG's work led to a request by USEPA for an EA in East Branch (see Figures 1-2 and 1-3), to be performed while the FS for OU1 continues.[4] The East Branch FFS activities should not impact the OU1 FS schedule. The NCG is performing both the OU1 FS and the East Branch EA FFS under the 2011 RI/FS AOC.

A subsequent administrative order or consent decree with the future performing parties will be needed to govern final remedial design (RD) and implementation of any EA remedy selected by USEPA in a Record of Decision (ROD). Thereafter, as part of the OU1 FS, USEPA will determine

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[2] The Newtown Creek Superfund Site Study Area is described in the 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 CERCLA).

[3] The term "Study Area" in this FFS refers to the OU1 Newtown Creek Study Area.

[4] "East Branch" is used interchangeably with "East Branch Early Action Area" in this FFS.

whether an EA remedy in East Branch adequately and reliably addresses East Branch or whether additional response actions may be necessary as part of a Study Area-wide remedy.

1.1 Basis for Early Action in East Branch

An EA in East Branch is consistent with USEPA guidance: *"The primary goals of an early action are to achieve prompt risk reduction and increase the efficiency of the overall site response"* (USEPA 1992). The USEPA Superfund Task Force also recommends the use of EAs to improve and accelerate the Superfund cleanup process, and USEPA guidance on EAs encourages the consideration of EA as part of the overall site strategy (USEPA 2017, 2019). An EA within East Branch would be beneficial, as it would accomplish the following:

- Expedite the overall site response by implementing a remedial action in one of the more contaminated portions of the Study Area sooner than would occur for the remedial action for the full extent of OU1.
- Immediately reduce risk and result in contaminant mass removal in this portion of the creek (and, to a lesser extent, within the Study Area as a whole).
- Provide an opportunity to gain direct remedial experience in the creek as well as provide valuable information on implementability and effectiveness of remedial technologies for the entire Study Area.
- Enable lessons learned from conducting the East Branch EA (and associated pre-design investigation [PDI], remedial construction, and evaluation monitoring[5]) to inform the OU1 site-wide FS alternative development, evaluation, and remedy selection as the EA information becomes available and is appropriate.
- Accelerate post-remedy construction monitoring in a portion of the creek to provide information to update the Study Area conceptual site model (CSM) regarding the implications of ongoing sources to East Branch.

1.2 Focused Feasibility Study Objectives

The overall objective of this East Branch EA FFS is to develop and evaluate remedial alternatives for the East Branch EA in accordance with the National Contingency Plan (NCP; 40 Code of Federal Regulations [CFR] §300), provide stakeholders (e.g., the community) and New York State Department of Environmental Conservation (NYSDEC) with sufficient information to provide input on the alternatives, and provide USEPA with sufficient information to select a remedy that meets NCP requirements.

The specific steps of the East Branch EA FFS are as follows:

1. Present the remedial action objectives (RAOs).
2. Present the risk-based preliminary remediation goals (PRGs).

[5] The project schedule as of April 2024 will not allow for incorporation of evaluation monitoring data to inform the draft OU1 FS.

3. Identify and screen applicable General Response Actions (GRAs), remedial technologies, and process options.
4. Present the development and initial screening of remedial alternatives based on the RAOs and risk-based PRGs.
5. Perform a detailed and comparative analysis of remedial alternatives based on the evaluation criteria developed by USEPA to address CERCLA requirements (USEPA 1988).

To accomplish these objectives, this East Branch EA FFS evaluates remedial alternatives to address areas of East Branch where concentrations of contaminants of concern (COCs) in sediments exceed risk-based cleanup criteria (i.e., risk-based PRGs) established by USEPA for the Newtown Creek Study Area (USEPA 2023).

The East Branch CSM is based on data collected and presented in the RI Report (Anchor QEA 2023a), as well as data collected during other investigation programs that were completed after the RI Report. This information is presented in Section 2 and Appendix A, which lists the sampling programs that were used to develop the CSM and details all important elements of the CSM that are pertinent to the development and evaluation of remedial alternatives for the East Branch EA FFS.

1.3 East Branch History

The Newtown Creek area of Brooklyn and Queens has a history of extensive industrial development dating back to the 1800s. This development resulted in major reworking of the natural banks and channels for drainage, industrial and municipal discharges, and use for navigation purposes. By 1884, present-day East Branch had been cut into marshy edges of the waterway (NYSDOT and FHWA 2005). With waterway expansions, Newtown Creek was almost entirely bulkheaded by 1900, and the Grand Avenue Bridge was constructed around this time. The channelizing and deepening of Newtown Creek and its tributaries were largely completed to its current configuration by the 1930s except for East Branch; funds from the Rivers and Harbor Act of 1919 for dredging of East Branch were not released until 1945. This dredging took the East Branch depth from 12 to 18 feet from Maspeth Avenue to the Grand Street Bridge (War Department 1945). The depth upstream of the Grand Street Bridge to Metropolitan Avenue remained at 12 feet. This historical development resulted in changes to Newtown Creek and its tributaries from a natural drainage condition to one that is largely governed by engineered and institutional systems.

By 1870, Newtown Creek was already heavily industrialized, and manufacturing operations continued development into the close of the nineteenth century and the beginning of the twentieth century (Goodwin and Associates 2012). The major operations surrounding East Branch, included bulk fuel storage and distribution, scrap metal processing and storage operations, automotive repair and storage yards, sawmills, and lumber and coal yards.

Since 1967, when the Newtown Creek wastewater treatment plant (WWTP) began operating, stormwater (from areas draining to East Branch served by combined sewer systems), sewage, and industrial wastewater flows have been conveyed to the Newtown Creek WWTP for treatment prior to discharge outside East Branch and the Study Area. However, in some portions of East Branch, direct discharges of stormwater from private sites and municipal separate storm sewer systems (MS4s), as well as combined sewer overflows (CSOs), have continued and are ongoing today. In an effort to meet water quality standards for dissolved oxygen, NYCDEP has installed and operates an aeration system in East Branch as well as other areas of Newtown Creek (NYCDEP 2018).

Much of the past manufacturing has ceased, and new commercial and industrial operations have begun. Many of the upland sites are also in various stages of investigation and remediation under multiple NYSDEC cleanup programs (e.g., voluntary cleanup program and state Superfund program). Today, the predominant land use around East Branch remains industrial, with pockets of mixed use, commercial, and residential developments (NYCPC 2021a, 2021b, 2021c, 2021d, 2021e). Current uses adjacent to East Branch include warehouse and distribution facilities, vehicle storage and maintenance, road service support facilities, construction materials storage, lumberyards, truck terminals, and ready-mix concrete plants.

1.4 Report Organization

The organization and content of this FFS adheres to USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), as well as *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005a), *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USEPA 2000), and the *Remedial Investigation/Feasibility Study Work Plan* (AECOM 2011). The sections of this FFS are organized as follows:

Section 2: East Branch Conceptual Site Model Summary

Section 2 provides a summary of the East Branch CSM. This area-specific CSM is based on a refinement of the detailed Study Area-wide CSM documented in Section 8 of the RI Report and incorporates additional data collected after the collection of the data included in the RI Report. All elements of the East Branch CSM pertinent to the development and evaluation of a remedial alternative and evaluation of the long-term success of a remedial action are summarized in this section. The East Branch CSM provides the foundation for the development and evaluation of remedial alternatives.

Section 3: Basis for Evaluation

Section 3 summarizes the rationale for remedial action based on the East Branch CSM presented in Section 2. This section includes a summary of the media of interest and exposure pathways for which unacceptable risk was identified in the site risk assessments, COCs that pose unacceptable risk, the RAOs against which the remedial alternatives are evaluated, and risk-based PRGs developed by USEPA. A summary of an initial evaluation of the contribution of ongoing external inputs of COCs to the Study Area, which includes preliminary estimates of future post-remedy surface sediment (i.e., top 15 centimeters [cm] [6 inches] of sediment) COC concentrations (termed long-term equilibrium [LTE] concentrations) in East Branch, is also included in this section. Draft Applicable or Relevant and Appropriate Requirements (ARARs) and "to-be-considered" categories (TBCs) for the East Branch EA are also provided here. An overall evaluation of areas requiring remediation is also included in this section.

Section 4: Identification and Screening of General Response Actions, Remedial Technologies, and Process Options

Section 4 identifies the potential GRAs and classes of remedial technologies that may be applicable to East Branch based on site-specific factors. This section also presents a screening of remedial technologies and process options based on their effectiveness, implementability, and cost.

Section 5: Development of Remedial Alternatives for Early Action

Section 5 describes the remedial alternatives developed for the East Branch EA that are evaluated in the detailed and comparative analysis. The alternatives were compiled using retained technologies and process options following the screening process outlined in Section 4.

Section 6: Individual Analysis of Remedial Alternatives

Section 6 presents an evaluation of each of the individual remedial alternatives, including the common elements between remedial alternatives developed in Section 5. Out of the nine NCP evaluation criteria (defined by USEPA [1988, 2005a] to address the overall requirements of the CERCLA and the NCP), the first seven (two threshold and five balancing) are used to evaluate the remedial alternatives. The last two modifying criteria—state and community acceptance—will be evaluated by USEPA following release of the proposed plan and prior to issuing the ROD.

Section 7: Comparative Analysis of Early Action Alternatives for East Branch

Section 7 presents a comparative evaluation of the advantages and disadvantages of the remedial alternatives discussed in Sections 5 and 6 with respect to the seven evaluation criteria, consistent with USEPA (1988, 2005a) guidance.

Section 8: References

Section 8 provides a list of references cited in this FFS.

Appendices

Appendix A	Conceptual Site Model
Appendix B	Upland Source Evaluation

2 East Branch Conceptual Site Model Summary

A CSM represents the environmental system and the physical, chemical, and biological processes that determine the transport of contaminants from sources to receptors (USEPA 2005a). The CSM for East Branch is illustrated in Figure 2-1. The East Branch CSM provides the current understanding of processes affecting East Branch and may be updated periodically throughout the East Branch EA FFS and OU1 FS process as new information becomes available.

The East Branch CSM is based on the OU1 CSM documented in Section 8 of the RI Report (Anchor QEA 2023a) and updated by data collected, analyzed, and interpreted from other investigations (see Section 2.1.2 of Appendix A for a detailed description of these investigations). Specifically, the East Branch CSM was developed using data collected as part of the RI and FS datasets and other sources of information, including the site history; current uses and creek configuration; and information derived from modeling of hydrodynamics, sediment transport, and chemical fate and transport conducted to date. The East Branch CSM and associated site-wide risk assessments form the basis for the development and evaluation of remedial alternatives from which the East Branch EA remedy would be selected.

This section summarizes all elements of the East Branch CSM pertinent to the development and evaluation of remedial alternatives. Detailed information regarding each element of the CSM is presented in Appendix A, including the following:

- Datasets used to develop the East Branch CSM
- The physical environment of East Branch, including human influences and upland activities adjacent to the Study Area
- The nature and extent of contamination in East Branch
- Ongoing external sources of contaminants to East Branch (Appendix A summarizes the ongoing external sources, and a full evaluation of these upland sources is presented in Appendix B)
- Physical and chemical processes that govern the movement of contaminants in East Branch
- Potential human and ecological receptors, risk assessments, and exposure pathways

The land use history and the urban landscape surrounding East Branch shape the CSM and inform the nature and extent of contamination and potentially significant sources, exposure pathways, and receptors. Detailed information regarding the East Branch CSM is presented in Appendix A, and a summary of the elements most important in the development and selection of remedial alternatives for East Branch is as follows:

- Environmental setting considerations
  - The hydrodynamics of East Branch are dominated by twice-daily tides and by rainfall-related inflows from point sources and overland flow. East Branch is

predominantly influenced by tidal currents during dry weather conditions and by discharges from larger point sources during wet weather conditions.

  - The surface area of East Branch is 11.2 acres. This represents approximately 6% of the surface area of the Newtown Creek Study Area.
  - The cross-sectional profile of East Branch is generally characterized by steep nearshore slopes leading to a deeper channel (i.e., the navigation channel) spanning most of the width of the tributary. The average width is approximately 210 feet, and the average water depth is -8.4 feet mean lower low water (MLLW).
  - The average sediment thickness is 13 feet, ranging from less than 1 foot to a maximum thickness of 28 feet. The sediment thickness represents the sediments deposited above the native material, where the underlying native material consists of glacial and post-glacial (historical marsh, lacustrine, and fluvial creek) deposits.
  - There is a federally authorized navigation channel in most of East Branch with limited current ship and barge traffic. The authorized depth of the navigation channel in East Branch is 20 feet below MLLW. An analysis of current and potential future maritime users of East Branch completed by the U.S. Army Corps of Engineers (USACE) has concluded that the navigation channel in East Branch can be deauthorized (USACE 2024). However, the deauthorization would need to be approved by Congress through the Water Resources Development Act, which has not occurred at the time of this FFS.
  - There are two CSO discharges at the Terminus of East Branch, two MS4 outfalls (one downstream of the Grand Street Bridge and one under the bridge, both on the Queens side of East Branch), and approximately 35 stormwater outfalls located throughout East Branch.
  - An aeration piping system that is connected to a series of diffusers that distribute air into the water column is present on the sediment bed, and there are known submerged utility crossings (such as presumed electrical cables) near the Grand Street Bridge.
  - With respect to structural or slope stability, approximately one-half of the total shoreline length is in fair to good condition with the other half being in poor condition.
  - The Grand Street Bridge crosses the middle of East Branch and limits vessel traffic in the upstream part of East Branch. The Grand Street Bridge is projected by the New York City Department of Transportation (NYCDOT) (based on verbal communication) to be replaced starting in 2028.[6]
  - The predominant land use around East Branch is industrial, with pockets of mixed use, commercial, and residential developments.
- Risk and nature and extent of contamination
  - The robust dataset used for the East Branch EA FFS includes the data documented in the RI Report, as well as additional datasets collected after those discussed in the RI Report.

[6] Per the minutes of a January 17, 2024, conference call between the Grand Street Bridge replacement project team, led by NYCDOT, and USEPA, the current estimated schedule for construction to begin on the bridge replacement project is late spring 2028.

These sampling programs span over a decade, from 2011 to 2022. In total, more than 550 samples at more than 150 locations have been collected within East Branch to date. Sampling media include surface sediment, subsurface sediment, native material, surface water, point source discharges, porewater, groundwater, and biota tissue. Additional sampling programs, including the NYCDEP Operable Unit 2 (OU2) Point Source sampling, USEPA Shallow Lateral Groundwater Study, and Supplemental FS sampling, are planned to be performed during the OU1 FS and as required by the OU2 ROD; these may further inform the East Branch CSM. As of June 2024, the NYCDEP OU2 sampling is scheduled to begin in summer 2024. The lateral groundwater discharge data and Supplemental FS sampling data are expected to be available for review in 2024. The field program for the Supplemental FS sampling began in summer 2023 and is scheduled to be completed in summer 2024.

- The *Baseline Human Health Risk Assessment* (BHHRA; Anchor QEA 2017) and *Baseline Ecological Risk Assessment* (BERA; Anchor QEA 2018) identified unacceptable risks to human health and the environment in the Study Area through consumption of fish and crabs by recreational anglers and crabbers and direct contact with contaminated sediment and/or consumption of contaminated prey items by ecological receptors (i.e., benthic invertebrates, fish, and birds)
- The COCs causing unacceptable risks and used to characterize nature and extent of contamination in East Branch are total polycyclic aromatic hydrocarbon (34) (TPAH [34]), C19-C36 aliphatic petroleum hydrocarbons (C19-C36), total polychlorinated biphenyl (TPCB), total dioxin/furan toxic equivalence quotient 2005 (mammal; D/F TEQ), copper (Cu), and lead (Pb).
- COCs were detected throughout the surface sediment.[7] COC concentrations in the sediment generally increase with depth. COC concentrations in surface sediment exceed one or more risk-based PRGs (see Section 3.4 for the risk-based PRGs) for almost the entire spatial extent of surface sediment in East Branch (see Section 3.6 for details). The range of COC concentrations in East Branch surface sediment is as follows:
  - TPAH (34): 3.4 to 690 milligrams per kilogram (mg/kg)
  - C19-C36: 35 to 7,300 mg/kg
  - TPCB: 0.024 to 16 mg/kg
  - D/F TEQ: 4.1 to 290 nanograms per kilogram (ng/kg)
  - Cu: 32 to 6,300 mg/kg
  - Pb: 39 to 1,100 mg/kg

[7] The surface sediment thickness (i.e., top 15 cm [approximately 6 inches]) generally represents the biologically active zone (BAZ) that is most relevant to evaluating risk and exposure (USEPA 2015). The surface sediment is generally soft in nature and exhibits high moisture content and high organic content.

- COCs were detected throughout the subsurface sediment.[8] COC concentrations in the sediment generally increase with depth. COC concentrations in subsurface sediment exceed one or more risk-based PRGs (see Section 3.4 for the risk-based PRGs) for almost the entire volume of sediment (see Section 3.6 for details). The range of COC concentrations in East Branch subsurface sediment is as follows:
  - TPAH (34): 21 to 6,100 mg/kg
  - C19-C36: 370 to 7,600 mg/kg
  - TPCB: 0.056 to 83 mg/kg
  - D/F TEQ: 7.5 to 740 ng/kg
  - Cu: 180 to 6,000 mg/kg
  - Pb: 79 to 2,400 mg/kg
- COCs were detected in native material, with concentrations that are an order of magnitude (or more) lower than COC concentrations in the subsurface sediment. COC concentrations are below all the risk-based PRGs (see Section 3.4 for the risk-based PRGs) in native material samples, except for a single sample with an exceedance for C19-C36. The range of COC concentrations in East Branch native material is as follows:
  - TPAH (34): 0.0060 to 92 mg/kg
  - C19-C36: 7.3 to 290 mg/kg
  - TPCB: 0.000050 to 0.27 mg/kg
  - D/F TEQ: 0.0056 to 3.3 ng/kg
  - Cu: 6.0 to 190 mg/kg
  - Pb: 1.9 to 77 mg/kg
- COCs were detected in other media: surface water, porewater, groundwater, and biota tissue. Sheens were observed in more than half of the surface sediment samples and at various depth for most subsurface core locations. Sheen was only observed at one location in native material. Nonaqueous phase liquid (NAPL) blebs were observed in only a few subsurface sediment cores but not in surface sediment or native material.[9]
- NAPL was immobile under laboratory test conditions in all subsurface sediment samples tested; laboratory tests were conducted at much higher hydraulic gradients than those observed in the field. This does not preclude changes to in situ conditions and/or sediment bed disturbances potentially mobilizing NAPL. Potential changes to in situ conditions from the range of remedial alternatives, and their influence on NAPL mobility, are discussed in Section 3.2.3 of Appendix C.

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[8] Subsurface sediment (i.e., from 15 cm [6 inches] below the sediment surface to the native material interface) tends to be medium stiff, with less moisture and higher organic content when compared to surface sediment.

[9] NAPL blebs—discrete droplets of NAPL—are present in the sediment, but for the most part, the sediment is not visually impacted. Typically, this is indicative of residual NAPL.

- Contaminant sources, fate, and transport
  - Depositing solids originate primarily from CSO and stormwater outfalls, with some influence from solids that originated in the East River.
  - East Branch is net depositional. Depositing sediment contaminant concentrations are generally lower than the concentrations of contaminants in the surface sediments. These natural recovery processes that may be ongoing in East Branch may result in a decreasing trend in the concentrations of contaminants in the surface sediments until a long-term equilibrium (LTE) condition is reached. However, insufficient data exist to determine the viability of monitored natural recovery (MNR; e.g., natural recovery rates) as a remedial approach for the East Branch EA.
  - Groundwater discharges to East Branch and has two components: 1) groundwater flow to the sediment from the underlying native material throughout East Branch and from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground); and 2) direct groundwater discharge into the water column from the upland Fill Unit at submerged vertical permeable shorelines (i.e., lateral groundwater). The measured seepage rates range from 0.10 to 1.0 cm per day through the sediment bed in East Branch. USEPA is performing a study designed to further characterize shallow lateral groundwater discharge along the shoreline of Newtown Creek, including East Branch. The resulting data are intended to be used to further understand lateral groundwater loads in the FS and be incorporated into the LTE model.
  - The larger ongoing contributions to COC loads are from point sources, tidal exchange, and groundwater. Gas ebullition and atmospheric deposition are smaller COC load contributors.
  - Ongoing external inputs will result in deposition of solids on a remediated surface that may result in concentrations of one or more COCs being greater than risk-based PRGs. Risk-based PRGs and an initial evaluation of the contribution of these ongoing external inputs are presented in Section 3.4.

3 Basis for Evaluation

This section summarizes the following key elements of the East Branch EA FFS evaluations:

- COCs presenting unacceptable risk in East Branch, based on the USEPA-approved OU1 human health and ecological risk assessments
- RAOs for the East Branch EA consistent with those proposed by USEPA (2023) that were developed for the entire OU1 site considering the contaminants and media of interest, and exposure pathways causing unacceptable risks
- ARARs identified for use in this East Branch EA FFS
- Risk-based PRGs developed by USEPA
- Initial evaluation of the contribution of ongoing external inputs of COCs to East Branch in support of the initial estimate of long-term post-remedy surface sediment COC concentrations and the concurrent development of interim evaluation measures for EA remedy selection and design as well as evaluation monitoring
- Definition of principal threat waste (PTW) in East Branch
- Approach used to identify remediation areas within East Branch that are included in remedial alternatives evaluated in this FFS

3.1 Contaminants of Concern

The USEPA-approved OU1 BHHRA and BERA (Anchor QEA 2017, 2018) identified unacceptable risks to human health and the environment in the OU1 Study Area. Although the risk assessments completed as part of the OU1 Remedial Investigation/Feasibility Study (RI/FS) program were developed on a Study Area-wide basis; where relevant to do so—based on the type of receptor and the specific exposure pathway—exposures and risks for some receptor/COC/exposure pathways were evaluated on a smaller scale than the entire Study Area. The human health and ecological assessments identified the six risk-based COCs included in Table 3-1 as the primary risk drivers in the Study Area.

For each of the six human health and ecological risk-based COCs included in Table 3-1, the OU1 risk assessments concluded the following:

- **TPAH (34):** There are no risks to human health in the Study Area resulting from exposure to TPAH. Ecological risks to the benthic community in some portions of the Study Area, including East Branch, are caused by exposure to TPAH (34) that exceeds risk-based thresholds developed by USEPA.
- **TPCB:** Risks to human health in the Study Area, including East Branch, are caused, in part, by exposure to TPCB through consumption of polychlorinated biphenyl (PCB)-contaminated fish and crab (i.e., striped bass, white perch, and blue crab) caught throughout the Study Area, including East Branch, by recreational anglers and crabbers. Risks to ecological receptors in the Study Area, including East Branch, result from exposure to TPCB, as measured by receptor

tissue TPCB concentrations or estimated dietary intake. These receptors include striped bass, mummichog, blue crab, bivalves, polychaetes, spotted sandpiper, black-crowned night heron, green heron, and belted kingfisher.

- **Cu:** There are no risks to human health in the Study Area due to exposure to Cu. Risks to ecological receptors, including in East Branch, result from exposure to Cu, as measured by receptor tissue Cu concentrations or estimated dietary intake. These receptors include mummichog, blue crab, and spotted sandpiper. Benthic invertebrate exposure to porewater Cu concentrations in a few Study Area locations, but not anywhere in East Branch, was also identified as a non-dietary ecological risk pathway.
- **D/F TEQ:** Risks to human health in the Study Area, including East Branch, are caused by exposure to D/Fs through consumption of D/F-contaminated fish and crab collected throughout the Study Area by recreational anglers/crabbers. Risks to ecological receptors in the Study Area, including East Branch, result from exposure to D/Fs, as measured by receptor tissue D/F concentrations in striped bass.
- **C19-C36:** Risks to human health were not evaluated for C19-C36 in the OU1 risk assessments. After the finalization of the BERA (Anchor QEA 2018), C19-C36 was identified by USEPA as a COC for benthic risk, including in East Branch, caused by exposure to C19-C36 in sediment at bulk sediment concentrations above risk-based thresholds (USEPA 2020).
- **Pb:** There are no risks to human health in the Study Area due to exposure to Pb. Risks to ecological receptors in the Study Area, including East Branch, result from dietary exposure to Pb. Per the BERA, spotted sandpiper is the only receptor affected by exposure to Pb in the diet, primarily through incidental ingestion of intertidal sediment while foraging.

Table 3-1
Contaminants of Concern for the Focused Feasibility Study

Risk Assessment	COC
Human Health	TPCB
	D/F TEQ
Ecological	TPCB
	TPAH (34)
	C19-C36
	D/F TEQ
	Cu
	Pb

Note:
COCs are based on the outcome of the BHHRA (Anchor QEA 2017) or BERA (Anchor QEA 2018) or were identified by USEPA outside of the OU1 risk assessments. C19-C36 was identified by USEPA as a COC for benthic risk, including in East Branch, caused by exposure to C19-C36 in sediment at bulk sediment concentrations above risk-based thresholds (USEPA 2020).

3.2 Remedial Action Objectives

RAOs provide a general description of what a cleanup is expected to accomplish and help focus remedial alternatives development and evaluation (USEPA 2005a). Importantly, the RAO(s) should also reflect objectives that the cleanup can meet. USEPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005a) states, *"When developing RAOs, project managers should evaluate whether the RAO is achievable by remediation of the site or if it requires additional actions outside the control of the project manager."*

The following draft East Branch RAOs are similar to those developed for OU1 but modified as provided in USEPA Region 2's Responses to Contaminated Sediment Technical Advisory Group (CSTAG) Recommendations (USEPA 2023). This is consistent with USEPA Region 2's revised draft final memorandum, *Framework for the Operable Unit One Remedial Action Objective and Preliminary Remediation Goal Approach* (Framework Memorandum; USEPA 2023), which states, *"Any early action taken will have distinct RAOs and interim performance goals that will work towards achieving the overall site RAOs and interim performance measures."*:

- **Exposure-based RAOs:**
  - Reduce potential current and future human exposures to COCs from ingestion of fish and crab by preventing biota exposure to sediments in East Branch with COC concentrations above protective levels.
  - Reduce ecological exposure to site COCs in sediment by reducing the concentrations of COCs in contaminated sediment in East Branch to protective PRGs/remediation goals (RGs).
- **Source Control RAO:** Reduce migration of COCs related to NAPL and its constituents, and other sources of COCs within East Branch, to surface sediment and surface water to levels that are protective for human health and ecological exposure.

Consistent with USEPA Region 2's responses to CSTAG Recommendations, the RAOs would be achieved by reducing concentrations of COCs in sediments associated with the biologically active zone (BAZ) below risk-based PRGs. For Newtown Creek, the BAZ has been determined to be 6 inches (15 cm). This would also be considered surface sediment for this site.

These East Branch RAOs are sufficient for the purposes of developing and evaluating remedial alternatives for the East Branch portion of the Study Area. Specifically, this is because the overall objective of any remedial alternative is to address COC surface sediment concentrations to reduce risks to human health and the environment to the extent practicable. Notwithstanding the fact that these two RAOs are considered sufficient to accomplish effective risk reduction in East Branch, it is recognized that they may be modified and/or that additional RAOs may be added by USEPA during finalization of the Framework Memorandum and/or during the completion of the OU1 FS process.

Additionally, some aspects of the alternatives that require site-wide (OU1) evaluations would not be finalized until a final remedy for OU1 is selected.

3.3 Applicable or Relevant and Appropriate Requirements and To-Be-Considered Information

Under CERCLA, remedial actions must be designed, constructed, and operated to comply with ARARs unless waived. Applicable requirements are those that establish cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws and regulations that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements include those that, although not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, nevertheless address problems or situations sufficiently like those encountered at the CERCLA site to indicate their use is well suited to the particular site. A requirement must either be applicable or both relevant and appropriate to be an ARAR. Other criteria, advisories, or guidance that were developed by USEPA or other federal or state agencies, collectively referred to as the TBC category, may be useful in developing CERCLA remedies. TBCs are important sources of information but should not be required as cleanup standards because they are neither promulgated nor enforceable and do not have the same status under CERCLA as ARARs (see 40 CFR 300.400[g][3]). ARARs include both requirements under federal environmental law and New York State requirements under state environmental or facility siting laws that are more stringent than federal requirements and have been identified by the state in a timely manner.

The potential location- and action-specific ARARs and TBCs for the East Branch EA are presented in Tables 3-2a and 3-2b, respectively. These potential ARARs and TBCs are evaluated for the East Branch EA, which if implemented would be an interim remedy. Additional ARARs, including chemical-specific ones, and TBCs will be identified and evaluated for the OU1 FS. Under certain circumstances, an ARAR may be waived as per CERCLA Section 121(d) (USEPA 1989). The six ARAR waivers provided by CERCLA are as follows:

1. **Interim Measures Waiver:** This waiver may be used when an interim measure that does not meet all ARARs is expected to be followed by a final remedy, which upon its completion will attain all ARARs. The interim measure should not cause additional migration of contaminants, complicate the site response, or present an immediate threat to public health or the environment and must not interfere with or delay the final remedy.
2. **Equivalent Standards of Performance Waiver:** This waiver may be used when an ARAR requires use of a certain design or operating standard, but equivalent or better remedial results could be achieved using an alternative design or operating method.

3. **Greater Risk to Health and the Environment Waiver:** This waiver is available when compliance with an ARAR would cause greater risk to human health and the environment than non-compliance with the ARAR.
4. **Technical Impracticability Waiver:** This waiver may be used when compliance with an ARAR is technically impracticable from an engineering perspective.
5. **Inconsistent Application of State Standard Waiver:** This waiver may be invoked when the ARAR is a state requirement that the state has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances.
6. **Fund-balancing Waiver:** This waiver may be invoked when meeting an ARAR would entail such cost in relation to the added degree of protection or reduction of risk that remedial action at other sites would be jeopardized.

3.4 Risk-Based Preliminary Remediation Goals

RAOs, as presented in Section 3.2, present a general description of what the remediation is expected to accomplish. RGs are developed as numeric expressions of the RAOs that are expected to meet acceptable risk levels targeted under the RAOs. RGs determine the need for (and areas to be considered for) remediation and are used to subsequently evaluate the effectiveness of potential remedial alternatives in reducing unacceptable risks to human health and the environment.

Development of RGs for a site should include consideration of ecological and human health risks from site-related contamination and ARARs identified for the site (see Section 3.3).

For purposes of evaluating the effectiveness of remedial alternatives in reducing risks to human health and the environment for the OU1 FS, USEPA developed risk-based PRGs (Anchor QEA 2021; USEPA 2023). These risk-based PRGs will eventually be developed into final, contaminant-specific RGs and will be published in the East Branch EA ROD.

Upland source control is the purview of NYSDEC and/or USEPA. Upland source control cleanup will be evaluated and implemented through state and/or federal enforcement authorities (to be determined on a case-by-case basis). Appendix B provides an evaluation of upland sources in relation to the East Branch EA and, based on publicly available information, concludes that ongoing sources should not adversely impact RD, implementation, or performance.

3.4.1 Risk-Based PRGs for East Branch

As detailed in *Development of Risk-Based Preliminary Remediation Goals* (Anchor QEA 2021), risk-based PRGs were developed based on the results of the human health and ecological risk assessments, which evaluated exposure to COCs in the following environmental media of concern: 1) tissue of fish and crab consumed by humans and ecological receptors; and 2) surface sediments of the creek (defined as the upper 6 inches of the sediment bed and considered the biologically active zone in Newtown Creek), which provide a route of exposure to ecological receptors through direct contact and/or incidental ingestion while foraging. The risk-based PRGs for these COCs are summarized in Table 3-3. The risk-based PRGs are sediment-based COC targets that would reduce risks to: 1) ecological receptors that contact contaminated surface sediments; and 2) human and ecological receptors that consume contaminated fish and crab tissue by reducing the degree to which sediment-based bioaccumulative COCs enter the food chain and accumulate in upper trophic level receptors.

TPCB and D/F TEQ risk-based PRGs were developed on a Study Area-wide surface-weighted average concentration (SWAC) basis, and the Pb risk-based PRG was developed on a SWAC basis in intertidal areas (Anchor QEA 2021). For TPAH (34), Cu, and C19-C36, the risk-based PRGs are evaluated within the surface sediments on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point). The rationale for applying a PRG on a point-by-point versus SWAC basis for a COC depends on the nature of exposure. Exposure of benthic macroinvertebrates to sediment-based COCs, which occurs over a very small area, is evaluated point by point, whereas exposure of receptors with a larger foraging range (such as fish and crabs) is averaged over larger areas, in some cases Study Area-wide, so it is evaluated as a SWAC. However, because the East Branch EA remedy will only be performed in East Branch, only post-remedy East Branch data can be used to show that progress is being made toward reaching the risk-based PRGs within East Branch. Therefore, for this East Branch FFS the risk-based PRGs are evaluated within the surface sediments on an East Branch-wide SWAC basis for TPCB and D/F TEQ and within surface sediments in intertidal shoreline areas on an East Branch-wide SWAC basis for Pb. The spatial scale of the application of the risk-based PRGs to the whole creek can be revisited in future decision documents, and supporting material, related to the OU1 Study Area.

Because of the nature of exposure to TPCB and D/F TEQ, which occurs over an area larger than East Branch, reducing surface sediment concentrations of these two COCs in East Branch would contribute to an incremental risk reduction on a Study Area-wide basis, but it would not reduce Study Area-wide SWACs to risk-based PRG levels. The same is true for Pb.

Table 3-3
Summary of Risk-Based PRGs

COC	Risk-based PRG	Applicable Spatial Scale for the East Branch FFS[1]	Basis for Risk-based PRG Value[2]
TPCB	0.3 mg/kg	East Branch-wide SWAC	Human health risk: crab consumption
D/F TEQ	18 ng/kg	East Branch-wide SWAC	Human health risk: crab consumption
Cu	490 mg/kg	Not to exceed	Ecological risk: dietary intake for mummichog
TPAH (34)	100 mg/kg	Not to exceed	Ecological risk: benthic invertebrate toxicity
C19-C36	200 mg/kg	Not to exceed	Ecological risk: benthic invertebrate toxicity
Pb	340 mg/kg	SWAC in East Branch intertidal areas only	Ecological risk: dietary intake for spotted sandpiper

Notes:

1. Because the East Branch EA remedy will only be performed in East Branch, only post-remedy East Branch data can be used to show that progress is being made toward reaching the risk-based PRGs within East Branch. The spatial scale of the application of the risk-based PRGs to the whole creek can be revisited in future decision documents, and supporting material, related to the OU1 Study Area.
2. As detailed in *Development of Risk-Based Preliminary Remediation Goals* (Anchor QEA 2021), risk-based PRGs were developed for all the human health and ecological receptors, exposure pathways, and COCs for which there are unacceptable risks. From those, the most protective risk-based PRG for each COC was selected as the risk-based PRG.

3.4.2 Interim Evaluation Measures

The Framework Memorandum (USEPA 2023) states, *"There are many external ongoing sources of contamination to the Creek, including MS4s, WWTP effluent, permitted and non-permitted discharges, overland flow, groundwater, seeps and the East River that may be outside the scope of OU1 of the site."* USEPA (2023) further goes on to state the following:

> *"There are many ongoing sources to the Creek that are not part of the Study Area and some of these may impact the protectiveness of the remedy. EPA will continue to work with the NYSDEC to identify and address any such ongoing sources … As part of an adaptive management approach, identification of upland sources that may affect the protectiveness of the remedy may occur at multiple stages, including during remedy design, during remedy implementation or during post-remedy operation, maintenance and monitoring."*

Known ongoing sources that are determined to have a high probability of adversely impacting the remedy or are found post-remedy implementation to be adversely impacting the remedy will need to be controlled. For purposes of determining what regulatory mechanism is best suited to controlling ongoing sources, USEPA has defined three categories of sources to East Branch and the Study Area in general: internal, external, and internal/external interface sources. Ongoing sources to East Branch are generally described in this FFS as "ongoing external sources" or "upland sources" (see also Section 2.4 of Appendix A and Appendix B). The categorization of individual ongoing sources will be evaluated based on additional information collected during a PDI and considered during the RD and long-term remedy evaluation monitoring.

To provide an initial evaluation of the contribution of these ongoing external inputs of COCs to the Study Area and to estimate the expected LTE COC concentrations in surface sediments post-remedy due to these ongoing external inputs, the NCG developed a spreadsheet model (see the 2024 draft *Interim Estimates of Post-Remedy Surface Sediment Concentrations* [LTE Report; Anchor QEA 2024]). These preliminary estimates of LTE surface sediment concentrations represent predicted long-term site-specific interim surface sediment COC concentrations in Newtown Creek years to decades after a remedy is implemented and are an important consideration given the urban setting of Newtown Creek.

Predictions from the LTE spreadsheet model are made on a reach-specific basis and include a base value established using central tendency metrics (e.g., arithmetic average) for COC concentrations or loads associated with each source type, along with upper- and lower-bound values to characterize the associated uncertainty range (e.g., based on the variance of the concentration or load values for each source type). USEPA has adopted the LTE modeling framework and is using it to conduct probabilistic simulations to develop updated ranges of LTE values concurrent with other revisions to the LTE model being made to address USEPA comments on the draft LTE Report (Anchor QEA 2024). For the purposes of this East Branch EA FFS, the ranges from the 2024 draft LTE Report (i.e., based on upper- and lower-bound values) are being used to represent East Branch LTE values. It is recognized that these ranges will be refined in the future based on the following: 1) updated probabilistic modeling performed by USEPA; 2) other revisions to the model framework; and 3) incorporation of new data on COC concentrations or loads from the East River, lateral groundwater discharge, and outfalls sampled as part of OU2.

The preliminary estimates of LTE concentrations for East Branch are presented in Table 3-4. The LTE model predictions assume post-remedy conditions in the entire Newtown Creek Study Area. As such, the actual LTE concentrations may be slightly higher than the current LTE model predictions for an EA in East Branch because other reaches of Newtown Creek that have not been remediated yet may result in some additional loading of COCs to surface sediments in East Branch. As discussed in the Framework Memorandum (USEPA 2023), these current LTE estimates are preliminarily defined as the initial interim evaluation measures for East Branch, although this terminology may change as the Framework Memorandum is finalized by USEPA. For purposes of this FFS, the NCG believes these values define interim site-specific background surface sediment COC concentrations in the Study Area. However, USEPA does not agree that these values define background. Moreover, USEPA has indicated that attempting to define background in this manner is inconsistent with USEPA's management approach for the East Branch EA. USEPA is using LTE concentrations to help define interim evaluation measures over time. The term "interim" recognizes that USEPA expects that these values may change over time as COC loadings from various external ongoing sources to East Branch (and the Study Area in general) decrease due to several reasons. These initial LTE values are compared to the risk-based PRGs in Table 3-4.

Table 3-4
Currently Estimated LTE Concentrations in East Branch Relative to Risk-Based PRGs

COC	Risk-based PRG	Currently Estimated LTE Range[1,2]	Currently Estimated LTE Range Compared to Risk-based PRGs
TPCB	0.3 mg/kg (East Branch-wide SWAC)	**East Branch LTE range: 0.27–0.40 mg/kg**[3]	Risk-based PRG is within the current SWAC LTE uncertainty bounds.
D/F TEQ[3]	18 ng/kg (East Branch-wide SWAC)	**East Branch LTE range: 50–79 ng/kg**	Risk-based PRG is below the current SWAC LTE uncertainty bounds.
Cu	490 mg/kg (not to exceed)	East Branch LTE range: 130–280 mg/kg	Risk-based PRG is above the current LTE uncertainty bounds on a reach-average basis (recognizing that because the LTE calculation does not provide point-based estimates, it is possible that isolated discrete locations could show risk-based PRG exceedances).
TPAH (34)	100 mg/kg (not to exceed)	East Branch LTE Range: 33–53 mg/kg	Risk-based PRG is above the current LTE uncertainty bounds on a reach-average basis (it is possible that isolated discrete locations could show risk-based PRG exceedances).
C19-C36[3]	200 mg/kg (not to exceed)	**East Branch LTE range: 1,500–2,000 mg/kg**	Risk-based PRG is below the current LTE uncertainty bounds on a reach-average basis.
Pb[4]	340 mg/kg (East Branch-wide SWAC in intertidal areas only)	The LTE spreadsheet model was not developed for Pb due to the limited spatial extent of the intertidal areas.	

Notes:

LTE values are **bolded** for COCs in which the risk-based PRG is below or within the current LTE uncertainty bounds.

1. USEPA is using the LTE model to develop LTE ranges using a probabilistic approach. The LTE values presented in this table are based on the LTE Report (Anchor QEA 2024). USEPA is refining the approach for determining the IEMs. The LTE ranges that will be used to determine the IEMs will be based on the USEPA's probabilistic approach.
2. LTE values are presented as a range based on the upper- and lower-bound uncertainty values for the LTE concentration (Anchor QEA 2024). Preliminary estimates of LTE concentrations were developed on a reach-average basis and were not developed to be able to make predictions on an individual point-by-point basis. The range of reach-average upper- and lower-bound uncertainty LTE estimates in East Branch is provided for each COC. It should be noted that smaller scale variability could exist within a given reach, such that the range of point-based LTE values would be greater than that indicated herein.
3. LTE estimates for D/F TEQ and C19-C36 are uncertain due to data limitations. There are sampling programs that are being designed that will help address these limitations—specifically, CSO, shallow lateral groundwater, East River particulate matter, and creek mile 0–2 surface sediment sampling.
4. Ecological receptor exposure to Pb is limited to incidental ingestion of intertidal sediment by spotted sandpipers (Anchor QEA 2018). The LTE evaluation was performed at the scale of an entire reach and, as such, is unable to be used to perform calculations at a smaller scale of an intertidal zone; therefore, Pb was not included in LTE evaluations.

As noted previously, USEPA (2023) expects the loadings from these ongoing external sources to decrease over time due to *"improved BMPs in general, ongoing cleanup actions and additional* *regulatory control."* Given this, USEPA lays out an approach in which the long-term PRGs are equal to the risk-based PRGs, and interim evaluation measures would be developed for remedy selection and RD and to evaluate the effect of ongoing external inputs post-remedy. Per USEPA (2023), interim evaluation measures are to be developed using empirical data as well as the LTE model, and the interim evaluation measures will be updated over time using empirical post-remedy monitoring data.

As set forth in the Framework Memorandum (USEPA 2023), interim evaluation measures are properly understood as a measure of the effect of ongoing inputs on future sediment contaminant levels in the creek. As such, the NCG believes that the term "interim evaluation measures" cannot be used to evaluate remedy effectiveness. Therefore, post-remedy monitoring of remedy effectiveness must focus on evaluating whether any potential future, unacceptable levels of COC concentrations in surface sediments following remedy implementation arise from beneath the remediated surface (cover or cap) as opposed to new COC-containing solids that deposit on the remediated surface (i.e., the new surface sediment layer). An effective and protective remedy implemented in East Branch will create a clean sediment surface immediately following remedy construction and reduce the migration of COCs from underlying contaminated sediment to concentrations below risk-based PRGs. The challenge in East Branch (and the rest of OU1) is not in reaching risk-based levels of COCs in surface sediments immediately post-remedy but in sustaining these levels in the face of ongoing inputs of COCs to the surface sediments occurring post-remedy due to ongoing external inputs or from other reaches of Newtown Creek that have not been remediated, which may result in some additional loading of COCs to East Branch surface sediment. Long-term monitoring would be performed after remedy implementation, which would help determine whether additional source control measures for ongoing external inputs would be needed in order to meet the risk-based PRGs in the long term.

3.5 Presence of Principal Threat Waste in East Branch

USEPA provided the following definition of PTW in an e-mail dated February 15, 2024 (Vaughn 2024), which was modified in USEPA's May 7, 2024, comments on the draft FFS:

> *"Principal threat wastes (PTW) are source materials that include or contain hazardous substances that act as a reservoir for the migration of contamination to groundwater, surface water or air, or act as a source for direct exposure. These materials are considered to be highly toxic or highly mobile and, generally, cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids or other highly mobile materials (e.g., solvents) or materials that have high concentrations of toxic compounds. By contrast, low-level threat wastes are defined as those materials that generally can be reliably contained and that would represent a low risk in the event of a release. They include materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.*

Based on this definition, for the East Branch portion of Newtown Creek, two classes of PTW are potentially present:

1. *Contaminated sediment with PCB concentrations above 500 ppm. This concentration is consistent with EPA's 1990 Guidance on Remedial Actions for Superfund Sites with PCB Contamination (https://semspub.epa.gov/work/07/30488131.pdf).*

2. *NAPL in subsurface sediment or upland soils that has the potential to migrate to surface sediment and surface water."*

Based on the findings of the RI/FS, there is no known PTW in the East Branch. However, additional investigation will be conducted to support the design of the remedy that is selected for the East Branch EA. If PTW is encountered during this investigation, it would need to be addressed to prevent migration of the PTW to surface sediment and surface water above concentrations that are protective of human health and the environment, consistent with CERCLA.

3.6 Areas to Be Considered for Remediation

Figures 3-1 through 3-6b show Thiessen polygons of surface sediment concentrations for the COCs listed in Table 3-3, with the surface sediment COC concentrations binned into colors relative to the risk-based PRG. Section 3.4.1 indicates that risk-based PRGs were developed at different spatial scales depending on the nature of exposure to a sediment-based COC in the Study Area (Anchor QEA 2021).

Notwithstanding that the risk-based PRGs for some COCs were developed on a Study Area-wide SWAC basis, and that RALs can be developed such that these risk-based PRGs can be met at that spatial scale, USEPA determined that conditions in East Branch preclude the need to apply RALs for these COCs (i.e., TPCB, D/F TEQ, and Pb) (Schmidt 2024). Specifically, the nature and extent of surface sediment contamination in East Branch is such that risk-based PRGs for COCs that were developed on a not-to-exceed basis (i.e., Cu, TPAH [34], and C19-C36) exceed their respective risk-based PRGs throughout nearly the entirety of East Branch.

The surface sediment COC concentrations were used as the metric to delineate the lateral extent of remediation in East Branch. Figures 3-1 through 3-6b show Thiessen polygons of surface sediment concentrations for the COCs listed in Table 3-3, with the surface sediment COC concentrations binned into colors relative to the risk-based PRG. Gray polygons represent areas where the existing surface sediment COC concentrations are less than the risk-based PRG. Colored polygons indicate an exceedance of the risk-based PRG. For Pb (Figure 3-6a), Thiessen polygons of surface sediment concentrations from all surface sediment data were developed consistent with the other contaminants, and then non-intertidal polygons were removed. Only the area of exposure, the intertidal areas, are shown in Figure 3-6a.[10] Figure 3-6b shows the Thiessen polygons of surface sediment concentrations from all surface sediment data prior to the removal of non-intertidal polygons. Figure 3-7 shows the maximum risk-based PRG exceedance ratios in surface sediment for all COCs with a risk-based PRG. These figures show that almost the entire spatial extent of surface sediment exceeds the risk-based PRGs for one or more of these COCs. The areas with no risk-based PRG exceedances of any of these COCs are relatively small and isolated. Therefore, for constructability reasons, these small areas would also be actively remediated in all the active remediation alternatives.

Based on the Study Area CSM, COC concentrations in surface sediment are not independent of subsurface sediments—they reflect interactions with the subsurface sediment—and they also reflect the influence of other sources of COCs within the Study Area. COCs present in the subsurface sediment can affect surface sediment through groundwater/porewater advection (seepage) and NAPL flux (if occurring). Surface sediment concentrations reflect COC contributions from those interactions with underlying subsurface sediment, as well as COC contributions coming from new sediment deposition. Concentrations and seepage rates of groundwater (i.e., flux of COCs from groundwater) in native material of East Branch were also considered as part of this FFS. Section 3.3.3 of Appendix B and Figures B3-5 and B3-6 provide evaluation of the flux of COCs from groundwater that was considered when evaluating areas for remediation to meet the RAOs. The matrices/processes discussed in this paragraph are considered during the identification and screening of technologies evaluation presented in Section 4 and in the development and evaluation of remedial alternatives presented in Sections 5, 6, and 7.

As discussed in Section 2.3.2 of Appendix A, COC concentrations in East Branch sediment generally increase with depth below the mudline. As discussed previously, Figure 3-7 shows that nearly the entire spatial extent of surface sediment in East Branch exceeds the risk-based PRG for one or more of these contaminants. Although the risk-based PRGs are specifically evaluated within surface sediments, COC concentrations in the subsurface sediment also exceed the risk-based PRGs in most of East Branch. As a point of comparison, the volume of all sediment that exceeds the risk-based PRG for one or more COCs in East Branch is estimated to be approximately 99% of the total sediment volume.[11]

Therefore, using risk-based PRGs based on surface sediment concentrations to define the lateral extent of remediation is consistent with meeting the interim exposure- and source-based RAOs

[10] Intertidal areas are areas between MLLW and mean high water. These areas have been updated using the 2022 bathymetric survey (see Section 2.1.2.3 of Appendix A) compared to the previous version of intertidal areas shown in Figure 5-4 of the BERA (Anchor QEA 2018).

[11] The calculation of the volume of sediment with COC concentrations that exceed one or more of the risk-based PRGs (shortened to "exceedances" in the remainder of this footnote for brevity) in East Branch was performed. The risk-based PRGs for TPCB, D/F TEQ, and Pb were developed on a SWAC basis, so evaluating exceedances of these risk-based PRGs on a point-by-point basis is a conservative approach. For surface sediment, the percent of samples with exceedances was calculated. For subsurface sediment, at each core location the percent of the total sediment core thickness having exceedances was calculated. Then the percent of all subsurface sediment having exceedances was calculated using a weighted average of the total thickness of each core location with the percent of exceedance in each core. The percent of surface sediment and subsurface sediment exceedances were then weighted by the volume of surface and subsurface sediment in East Branch to calculate a percent of East Branch sediments that exceed one or more risk-based PRGs.

presented in Section 3.2 because sediment-based remediation over the entire horizontal spatial extent of East Branch would reduce risks to acceptable levels in East Branch, and migration of site-related sources in East Branch sediments (including NAPL) to accessible sediments would also be reduced to acceptable levels. Specifically, for NAPL migration (via NAPL advection, the dissolved phase transport of NAPL constituents via groundwater, or the transport of NAPL via ebullition), NAPL was observed only in subsurface sediment in East Branch (i.e., it was not observed in surface sediment or native material); where NAPL was observed, it was characterized as a residual quantity (i.e., shake test blebs and/or bleb visual observations). To put the extent of NAPL in East Branch in perspective, an estimate of the volume of sediment that contains observations of NAPL is provided below. There is a significant amount of uncertainty around this estimate, given the intermittent and discontinuous nature of NAPL in the sediment, as well as the fact that shake tests were performed at discrete depths, but the thickness of the corresponding visual observation interval was used in the weighted average calculation. Based on the method used, the estimated volume of sediment in East Branch that contains observations of NAPL is approximately 7% of the total sediment volume.[12] No NAPL was observed in native material or surface sediment. With respect to the observations of sheens in sediment, the presence and extent of sheen observations are more widespread because approximately 67% of the volume of sediment in East Branch had an observation of sheen. Sheens were only observed at one location in native material.

The area considered for remediation within East Branch is the area below the ordinary high water mark, as defined in Section 1, for all EA alternatives. For the purposes of developing and evaluating remedial alternatives in the FFS, East Branch was kept as a single sediment management area because the remedial technologies would likely be similarly applied throughout the reach. East Branch could be further subdivided during the RD phase, if appropriate, to address more localized conditions.

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[12] The calculation of the volume of sediment that contains NAPL or sheen observations was calculated consistent with the method used to calculate the volume of sediment that exceeds one or more of the risk-based PRGs. This calculation was done separately for sheen and NAPL observations and was performed using a relatively simplistic approach by calculating the percent of sheen or NAPL observations in surface sediment and subsurface sediment separately and then calculating a weighted average for all sediment. Shake test observations were used, and in the absence of a shake test to confirm the presence of sheen or NAPL, visual observations were treated in the same fashion as shake test-confirmed visual observations based on the strong relationship observed between visual observations of sheen and NAPL in sediment and the corresponding shake test results (see Section 3.3 in Appendix C of the RI Report for further detail). An example of the calculation for sheen observations is as follows: For surface sediment, the percent of samples with observations of sheen was calculated. For subsurface sediment, at each core location the percent of the total sediment core thickness having observations of sheen was calculated. Then the percent of all subsurface sediment having observations of sheen was calculated using a weighted average of the total thickness of each core location with the percent of observations of sheen in each core. The percent of surface sediment and subsurface sediment observations of sheen were then weighted by the volume of surface and subsurface sediment in East Branch to calculate a percent of East Branch sediments with observations of sheen.

4 Identification and Screening of General Response Actions, Remedial Technologies, and Process Options

A key early step in the development of remedial alternatives that address RAOs for East Branch is the identification, screening, and selection of GRAs, remedial technologies, and process options that are then assembled into remedial alternatives.

GRAs represent categories of remedial technologies that can be applied to East Branch or portions thereof. The GRA evaluation presented in this section was performed in accordance with USEPA's general RI/FS guidance (USEPA 1988) and *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005a). As described in USEPA's general RI/FS guidance (USEPA 1988), remedial alternatives have the following three components:

- **GRAs:** Major categories of cleanup activities, such as source control, monitored natural recovery, ICs, containment, removal, or treatment
- **Remedial Technologies:** Types of technologies within each GRA, such as different sediment removal options (e.g., dredging or removal in the dry)
- **Process Options:** Specific variations in the way technologies are implemented, such as variations in dredging methods (e.g., mechanical or hydraulic dredging) and dredged material dewatering (e.g., filtration or gravity drainage)

This process starts with the identification of GRAs (Section 4.1) and continues with the identification and screening of remedial technologies and process options potentially applicable to the East Branch Study Area. Following USEPA's general RI/FS guidance (USEPA 1988), technologies and process options were initially screened based on technical implementability (Table 4-1) followed by an evaluation of effectiveness, implementability, and cost for those technology processes considered implementable for East Branch (Table 4-2), as follows:

- **Effectiveness:** The effectiveness evaluation for a given technology or process option refers to its ability to handle estimated areas and volumes of contaminated sediment, while meeting the RAOs (see Section 3.2) set forth for East Branch. In addition, effectiveness considers any potential impacts to human health and the environment during the construction and implementation phase, as well as how proven and reliable the process is with respect to the contaminants and conditions at the site within East Branch. Technologies or process options that were not anticipated to effectively achieve the RAOs were eliminated from further consideration. Similarly, technologies or process options that may result in unnecessary impacts to human health or the environment, or that do not reliably address all COCs, were eliminated from further consideration.
- **Implementability:** A remedial technology or process option's implementability refers to the technical and administrative feasibility of its implementation given any constraints due to site conditions or regulations. Technical implementability is used as an initial screen of technology

types and process options to eliminate those that are clearly ineffective at meeting RAOs or are unworkable at the site (USEPA 1998). This includes consideration of the availability of treatment, storage, and disposal services and the availability of necessary equipment to implement the technology. Technologies and process options that were deemed not effectively implementable based on site characterization, contaminant types and concentrations, on-site characteristics, and the availability of disposal or beneficial use (BU) options were eliminated from further consideration.

- **Cost:** The cost of implementation considers a given technology or process option, including any anticipated incidental costs, and the cost to implement long-term operations and maintenance activities. For the screening at this stage, costs were considered on a qualitative basis, rather than quantitatively, and were intended for general comparison relative to other process options for the same technology type. Technologies and process options that were anticipated to be prohibitively expensive or provide limited value were eliminated from further consideration.

The results of this two-step screening evaluation in Tables 4-1 and 4-2 were used to develop the remedial alternatives presented in Section 5 using the retained technologies and a representative process option for each retained technology. As noted in USEPA guidance, "*Although specific processes are selected [they] are intended to represent the broader range of process options within a general technology type*" and representative process options are used "*to simplify the subsequent development and evaluation of alternatives without limiting flexibility during remedial design*" (USEPA 1988). Therefore, unless otherwise noted in Section 4.2, the process options selected for developing the remedial alternatives in Section 5 should be considered representative, and final process options used to implement the remedial action may not be selected until the RD phase, consistent with USEPA guidance.

Given the range of conditions occurring in East Branch, remedial alternatives were developed and applied on the scale of East Branch as a whole. However, it is recognized that conditions may vary at even more localized scales (e.g., shoreline stability can vary on a property-by-property basis, or even within an upland property), and specific GRAs, technologies, or process options may be applicable at those smaller scales. Therefore, GRAs, technologies, and process options were identified and screened for their potential applicability at the scale of East Branch and localized areas, as presented in Table 4-2. GRAs, technologies, and process options that are not considered applicable on the scale of the entire East Branch, but are applicable on a more localized basis, were retained for consideration during the detailed RD phase to address localized conditions identified during the PDI, as discussed in Section 5.2. The exception to this is in situ stabilization/solidification (ISS), which was retained as applicable only at localized scales but also integrated into the alternatives presented in Section 5.

ISS was specifically evaluated as a technology option, in comparison to other remedial technologies (i.e., amended capping or dredging), for treating sediment with NAPL or PTW,[13] if either of these conditions were to be identified as being present during future site investigations. It should be noted that neither NAPL nor PTW warranting treatment using ISS have been identified to date in East Branch. Furthermore, NAPL mobility is not expected to change because of a change in overburden pressure resulting from capping (see Section 3.2.3 in Appendix C). However, future site investigations may identify locations where these conditions exist. Therefore, this evaluation of remedial technologies will be used to identify the most appropriate option for integration into the selected remedial alternative, if conditions warranting their use are identified during the PDI, as determined by USEPA. Note that other factors, such as the concentration of COCs in remaining sediment and constructability, may be taken into account during the design of the remedy when evaluating where to apply ISS as well.

4.1 General Response Actions

GRAs describe in broad terms the types of actions potentially applicable to cleanup of contaminated media. This section identifies GRAs that will meet the RAOs for the East Branch EA.

Sections 4.1.1 through 4.1.9 include brief descriptions of each GRA along with representative remedial technologies and process options; Table 4-1 provides an initial screening of remedial technologies and process options under the identified GRAs based on technical implementability (to enable RAOs to be met) and provides additional details for each. Section 4.2 summarizes the evaluation of those remedial technologies and process options that were selected for use (i.e., that were not screened out in the initial screening presented in Table 4-1) in assembling the remedial alternatives presented in Section 5 (these alternatives were developed based on the evaluation presented in Table 4-2 for their potential applicability in East Branch).

4.1.1 No Action

As required by the NCP (40 CFR 300.430[e][6]), no action provides a baseline against which other alternatives can be compared. Under a "no action" GRA, no remedial action is implemented, and no monitoring is performed. The no action response option would not change the existing sediment conditions, except by those processes that may be currently occurring, including upland source control measures and natural recovery mechanisms, as discussed in Section 2.5 of Appendix A. Because a "no action" GRA is required by the NCP, it was retained, as detailed in Table 4-1.

4.1.2 Monitored Natural Recovery

As discussed in USEPA's Contaminated Sediment Remediation Guidance (2005a), MNR is a remedy for contaminated sediment that considers the ability of ongoing, naturally occurring chemical and/or

[13] See Section 3.5 for a discussion of PTW.

physical processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. Long-term monitoring is a component of MNR and may include sampling and analysis of sediment, groundwater, surface water, fish tissue, or other aquatic species tissue. USEPA and other guidance indicates that MNR is a viable remedial option when "*contaminant concentrations are low and cover diffuse areas*" (USEPA 2005a) and when natural processes can "*decrease chemical contaminants in sediment to acceptable levels within a reasonable time frame*" (ITRC 2014). As such, areas with lower chemical concentrations and higher net sedimentation rates (NSRs) are generally considered more conducive to MNR as a remedial alternative. Specifically, MNR is most suitable where NSRs exceed 0.5 cm per year (ITRC 2014). Under an MNR remedy, monitoring is conducted over time to benchmark initial conditions and verify remedy success over time.

MNR is not currently applicable for East Branch EA due to the identified lack of data to evaluate the potential for MNR effectiveness in East Branch. Because active remedies have been determined to be required throughout most of East Branch, the necessary data to evaluate MNR effectiveness will not be collected during baseline monitoring (Section 5.3.8). Based on these considerations, MNR was not retained for the East Branch EA, as detailed in Table 4-1.

4.1.3 Institutional Controls

As defined in the USEPA guidance on contaminated sediment sites (USEPA 2005a), ICs are non-engineered measures, such as administrative and legal controls, that may be implemented to minimize the potential for human health or ecological exposure to sediment contamination and ensure the long-term integrity of the remedy. ICs may be used in the short term (during active remedy implementation to minimize potential for human exposures during construction) and in the long term (after active remedy implementation to minimize potential exposures for risks that may remain). The four general categories of ICs are as follows:

- **Proprietary Controls:** These are controls on private lands.
- **Government Controls:** These are land or resource use restrictions imposed by the authority of a government entity.
- **Enforcement and Permit Tools with IC Components:** These are legal tools that limit site activities or require the performance of certain activities.
- **Informational Devices:** These provide information or notification in property records or as advisories that residual contamination remains on site (USEPA 2012).

Examples of ICs are use restrictions and informational devices, including signage about fish consumption advisories that may be required to support a remedy. The New York State Department of Health (NYSDOH) has issued a fish/crab consumption advisory for the East River, which also incorporates Newtown Creek, as detailed in Section 2.4 of the BHHRA (Anchor QEA 2017). The advisory is expected to remain in effect for the foreseeable future; however, the BHHRA conducted as part of the OU1 RI for the Study Area calculates exposure and risks in the absence of any fishing and crabbing restrictions or consumption advisories.

The development of detailed ICs that are effectively integrated into the overall remedy can be a relatively complex process, and that activity will most likely be completed as part of the OU1 process. For example, Study Area-wide efforts, such as use restrictions and informational devices, may need to be developed as comprehensive plans, requiring close coordination among USEPA, other federal agencies, and New York State.

Therefore, ICs included with the EA alternatives will be necessarily focused on the ICs that can be completed prior to EA completion and that are needed to protect the East Branch EA constructed components (e.g., waterway use restrictions, land use restrictions, and government controls related work in the creek). Additionally, the objective of the ICs will be focused on their implementation in the near term (i.e., the time until an OU1 remedy decision is made and the OU1 remedy is implemented). The technical implementability of proposed ICs is discussed in Table 4-1 and further evaluated in Table 4-2.

4.1.4 In Situ Containment

In situ containment generally involves the isolation of sediment and contaminants from the overlying water column to prevent direct contact by humans and aquatic biota with contaminants and contaminated media. In situ containment for sediment includes capping as a remedial technology, which includes the process options of sand caps, amended sand caps, armored caps, or amended armored caps (as appropriate) based on evaluations and modeling of dissolved phase COC fate and transport conditions, the potential for NAPL advection, and the potential for ebullition-facilitated transport of NAPL and its constituents in the area to be capped. Caps designed according to USEPA and USACE guidance have been demonstrated to be protective of human health and the environment (USEPA 2005a). Caps are also designed to minimize the potential for erosion of the cap and contained sediment when subjected to anticipated design conditions.

For this FFS, the capping remedial technology includes the following five process options:

- **Sand Cap:** Consists of a layer of clean material (e.g., sand) placed on the sediment surface to physically and chemically isolate existing sediments
- **Amended Sand Cap:** Consists of addition of specialized or manufactured materials (e.g., activated carbon [AC] or organoclay) intermixed with typical cap aggregate materials (e.g., sand) at specified dosages to provide chemical isolation or enhanced sorptive capacity to the sand cap layer
  - Amendments are also considered a form of in situ treatment, which is described further in Section 4.1.5.

- **Armored Cap:** Consists of a layer of clean material placed directly on the sediment surface to physically and chemically isolate existing sediments and includes a top layer of armor material placed to provide erosion protection and additional physical isolation
- **Amended Armored Cap:** Consists of specialized or manufactured materials intermixed with typical cap aggregate materials (e.g., sand) at specified dosages to provide chemical isolation or enhanced sorptive capacity and includes a top layer of armor material placed to provide erosion protection and additional physical isolation
- **Low-permeability Cap:** Consists of natural clays and geomembranes (e.g., high-density polyethylene or linear low-density polyethylene) placed to provide physical isolation of existing sediments

To evaluate the feasibility and effectiveness of in situ capping, USEPA guidance (USEPA 2005) recommends consideration of site conditions including the physical environment, sediment characteristics, waterway uses and infrastructure, and potential habitat alterations.

If capping is retained as a technology for integration in the East Branch remedial alternatives, the cap design would be based on the following:

- Modeling of dissolved phase COC fate and transport
- Evaluation of NAPL flux from NAPL advection, gas ebullition-facilitated transport, and post-capping sediment consolidation
- Chemical and/or physical site conditions (e.g., potential for erosion) affecting cap design on a location-specific basis, which may result in variations in the cap design in different portions of East Branch

In addition to the vertical containment provided by capping, the in situ containment GRA also includes horizontal containment as a remedial technology. Vertical barrier walls can potentially be used to prevent uncontrolled upland contamination, including contaminated soil, groundwater, or NAPL, from entering East Branch. Specifically, sealed bulkheads (a form of barrier wall) can be effective in reducing the flow of materials through the interlocking joints of a sheet pile wall. A sealed bulkhead typically would be used in conjunction with other technologies (e.g., an upland groundwater and/or NAPL collection system on the upland site) because the wall itself would not control the source—it would only provide a temporary impediment to flow of groundwater or seeps, which would eventually be redirected around or below (if the wall is not driven into a confining layer) the sealed wall. The effectiveness of the sealant is dependent on the type of barrier system and sheet pile installation process and minimizing disturbance of the sealant by misaligned piles during driving or other difficult driving conditions. Although the current data and information do not indicate that there is an upland source to East Branch that would require sealing bulkheads, it is recognized that additional information may become available as the remedial process moves forward (e.g., during the PDI or arising from other work done or approved by USEPA). If appropriate, sealed bulkheads may be necessary as a measure to temporarily reduce migration from an ongoing source(s) while cleanup of the related upland source is evaluated and implemented through state and/or federal enforcement authorities (to be determined on a case-by-case basis).

Tables 4-1 and 4-2 provide additional details along with the screening and preliminary evaluation of these technologies.

4.1.5 In Situ Treatment

In situ treatment is any process that causes destruction, transformation, or a reduction in toxicity, mobility, or volume of contamination in a given media while the media remains in place (i.e., without first removing sediment). In situ treatments can include the addition of stabilization or solidification agents (e.g., Portland cement) to reduce mobility of contaminants through the impacted media. In situ treatments involve the application of physical, chemical, or biological methods to reduce or contain COC concentrations, mobility, or bioavailability, and include the following methods:

- **Immobilization Treatment:** Includes multiple process options: sequestration, which involves applying amendments (e.g., biochar, organoclay, and other non-carbon materials) either directly to contaminated sediments or as part of an amended cap (see Section 4.1.4); and ISS, which involves the mixing or injecting of solidification agents or chemical reagents (e.g., Portland cement) to solidify, stabilize, and immobilize contaminants in sediment. Each of these process options is considered treatment under the NCP.
- **Chemical Treatment:** Utilizes chemical additives (e.g., permanganate or hydrogen peroxide) to initiate oxidation or dechlorination processes to destroy contaminants within in situ sediments or via inclusion in an amended cap.
- **Biological Treatments:** Includes the use of micro-organisms or vegetation to degrade, remove, or immobilize contamination in sediment and can transform pollutants to substances that are less hazardous (USEPA 2006). Biological treatment technologies include bioventing, phytoremediation, and monitored natural attenuation. Biological treatment methods and products have been extensively used at contaminated upland sites but have not been widely implemented at contaminated sediment sites.

Tables 4-1 and 4-2 provide additional details along with the screening and preliminary evaluation of these technologies.

4.1.6 Sediment Removal (Dredging)

Sediment removal permanently removes impacted sediments from the aquatic environment. Dredging as a remedial technology is a well-developed method for sediment removal and is a primary remedial option recommended by USEPA for contaminated sediment sites (Palermo et al. 2008). By removing contaminants from an impacted environment, dredging has the potential to greatly reduce mobility and long-term exposure of contaminants to humans and ecological receptors. The dredging remedial technology includes the following process options:

- **Mechanical Dredging:** Removes sediment and debris through the direct application of mechanical force to dislodge and excavate the material, using an excavation bucket either suspended from a crane or connected to an articulated, fixed-arm excavator situated on land or on a barge.
- **Hydraulic Dredging:** Removes and transports sediment with entrained water in the form of a slurry. Hydraulic dredge types most often considered for environmental dredging are the cutterhead and the horizontal auger (Palermo et al. 2008).
- **Specialty Dredging:** Removes sediment using specialized equipment such as a suction-vacuum dredge. It is typically reserved for small-scale removal of material that cannot be feasibly accessed using traditional mechanical or hydraulic dredging equipment.

Tables 4-1 and 4-2 provide additional details along with the screening and preliminary evaluation of sediment removal technologies. In addition, several ancillary processes are associated with dredging. Although these processes are not screened as remedial technologies in Tables 4-1 and 4-2, they are briefly described in the following subsections.

4.1.6.1 Debris Removal

A variety of debris will be encountered that requires removal, including scrap metal, woody debris, marine salvage debris, wire/rope, and other materials present on the sediment surface or within the subsurface sediment. Debris removal options include dedicated mechanical removal (e.g., grapple and orange peel grabs) and mechanical removal with the dredge bucket. Debris removal is expected to be a component of the dredging operations in East Branch, regardless of the removal process option selected. If hydraulic dredging is used, separate debris removal equipment may be required to conduct debris removal prior to hydraulic dredging and may need to be on standby throughout the hydraulic dredging operation.

4.1.6.2 Sediment Transport and Management

Following removal, sediments must be managed and dewatered prior to transport, disposal, or BU. Dredged material can be transported via multiple methods, depending on the type of dredging selected and the proximity to the shoreline. Transport methods include, but are not limited to, pipeline, conveyor, barge, rail, and truck.

Sediment management requires an upland area for the staging of sediment and typically involves multiple handling steps, including dewatering and the treatment of dewatering effluent. Dewatering is used to reduce the moisture content of the material so that it is suitable for transport and disposal. Dewatering methods include gravity dewatering (e.g., stockpiles with sumps, geotextile tubes) and mechanical methods (e.g., filter presses or centrifuge).

4.1.7 Ex Situ Treatment

Ex situ treatment can be defined as any process, manufactured or naturally occurring, that causes destruction or a reduction in toxicity, mobility, or volume of contamination in a given media, after the media has been removed or transported from its original location (e.g., following sediment dredging).

Ex situ treatment includes thermal treatment, physical treatment, and immobilization treatment remedial technologies. Examples of ex situ thermal treatment process options include thermal desorption to volatilize organic contaminants such that they may be removed from the solid matrix, pyrolysis, vitrification, and incineration. Examples of ex situ physical treatment process options include pelletizing and sediment washing. Examples of ex situ immobilization treatments include the addition of solidification agents (e.g., Portland cement and quicklime) to reduce the mobility of COCs.

Tables 4-1 and 4-2 provide additional details along with the screening and preliminary evaluation of these technologies.

4.1.8 Beneficial Use

Dredged material that meets applicable standards and regulations may be suitable for BU rather than disposal in a regulated facility. Potential off-site BU options typically include use as an engineered fill or landfill daily cover or incorporation into construction materials such as concrete. Potential on-site or off-site BUs of sediment could include shoreline stabilization and construction of engineered features (such as islands, shallow water wetlands, or other habitat features) that simulate natural features.

For this FFS, the following process options were evaluated for the BU GRA and technology:

- BU
    1. Engineered fill
    2. Landfill daily cover
    3. Construction materials
    4. Shoreline stabilization
    5. Construction of engineering features

Tables 4-1 and 4-2 provide additional details along with the screening and preliminary evaluation of BU.

4.1.9 Disposal

Disposal is a component of the dredged material management process that ends with placement (disposal) in a facility where potential environmental impacts are controlled and monitored. Disposal can either be within an in-water disposal facility specifically engineered for the sediment remediation (i.e., in a confined aquatic disposal area or a confined disposal facility) or within an upland disposal facility, such as a permitted commercial landfill. Landfills permitted to accept dredged material are regulated and required to monitor and maintain the disposal facility to ensure long-term effectiveness.

In addition, any off-site transfer of CERCLA wastes (e.g., hazardous substances, pollutants, or contaminants) may only be to facilities that are operating in compliance with the Off-Site Rule (OSR), established in the NCP at 40 CFR 300.440 and discussed in Title 42 of United States Code Chapter 103, Section 121(d)(3). The OSR states that CERCLA wastes may be transferred to an upland disposal facility if the disposal management unit is not releasing any hazardous wastes, or constituents thereof into groundwater, surface water or soil, and any releases from other management units within the disposal facility are controlled by a corrective action.

Disposal typically requires ancillary technologies such as those discussed in Section 4.1.6.2, including dewatering of the dredged sediment, treatment, consolidation, and transport to the disposal facility (transport methods may include pipeline, conveyor, barge, rail, and truck). Final disposal locations depend on concentrations and management decisions; these may include BU.

Upland landfill disposal process options being considered are as follows:

- Subtitle C landfill
- Subtitle D landfill
- Toxic Substance Control Act (TSCA) waste landfill

In-water disposal process options that were evaluated but are not considered technically implementable in East Branch include the following:

- Confined aquatic disposal (CAD) facility
- Confined disposal facility (CDF)

Table 4-1 provides additional details and an initial screening, and Table 4-2 provides an evaluation of disposal technology and process options.

4.2 Evaluation of Remedial Technologies and Process Options

As described in Section 3.6, the proposed footprint of each of the active remedial alternatives is the entirety of East Branch. That is, one or more of the selected remedial technologies and process options described within this FFS would be applied individually, or in combination, to the entire area of East Branch.

The approach to evaluate specific remedial technologies and process options is based on existing data and focuses on a comparison to risk-based PRGs and long-term effectiveness evaluations.

Consistent with USEPA's general RI/FS guidance (USEPA 1988), technologies and process options have been subject to a two-step screening and evaluation process. Table 4-1 provides a description and an initial screening of remedial technologies and process options based on technical implementability. Table 4-2 provides an evaluation of remedial technologies and process options not screened out in Table 4-1 for effectiveness, implementability, and relative cost. The evaluation of effectiveness considered both short- and long-term effectiveness, and the evaluation of implementability considered both technical and administrative implementability. Also, consistent with guidance (USEPA 1988), cost was evaluated based on engineering judgment, and each process was evaluated as to whether costs are high, low, or medium relative to other process options of the same technology type.

Based on the screening and evaluation in Tables 4-1 and 4-2, the following GRAs, technologies, and representative process options were retained for use in the development of remedial alternatives for the East Branch EA FFS:

- **ICs:** Activity restrictions and consumption advisories for fishing/crabbing, waterway use restrictions, dredging restrictions, enforcement and permit tools with IC components, and information devices
  - ICs are included in each active remedial alternative to recognize their general function and necessity within the overall remedy.
- **In Situ Containment:** Sand cap, amended sand cap, armored cap, and amended armored cap
  - Refinements to the cap designs (e.g., amendments and armor specifications) would be considered during the RD phase.
  - Sealed bulkheads were also retained for the FS but would be considered in conjunction with an upland site cleanup.
- **In Situ Treatment:** Immobilization via ISS and amended cap technologies listed in the previous bullet (in situ containment), which are also considered a form of in situ treatment under the NCP
  - Other in situ treatment process options are not considered feasible for this East Branch FFS.
- **Removal:** Mechanical dredging, which includes transport and management of dredged materials
  - Hydraulic and specialty dredging (on a localized scale) would be considered during the RD phase.
- **Ex Situ Treatment:** Immobilization treatment via ex situ stabilization and solidification
  - Other ex situ treatment remedial technologies (e.g., thermal or physical treatment) and process options are not considered feasible for this East Branch FFS.
- **Beneficial Use:** BU opportunities would be considered during the RD phase.
- **Disposal:** Upland disposal at a Subtitle C landfill, Subtitle D landfill, or TSCA waste landfill, depending on the characteristics and classification of the material produced
  - In-water disposal process options (e.g., CDF or CAD) are not considered feasible in East Branch.

These retained remedial components (i.e., technologies/representative process options) are considered technically and administratively implementable and are generally proven technologies in sediment remediation projects implemented at other similar sediment sites. The equipment, materials, and personnel to implement the technologies/process options are expected to be available. In addition, evaluation monitoring of the remedy would be conducted following implementation. As a result, these technologies were retained for consideration when developing remedial alternatives.

Additional activities that are ancillary to the retained process options may be incorporated into the selected remedial alternative. Such ancillary processes include staging area development, installation of resuspension controls, sediment management (including ex situ chemical treatment with solidification/stabilization to facilitate transportation and disposal [or BU] of dredged sediment), and water treatment. Refer to Section 4.1.6.2 for ancillary technologies associated with dredging and off-site disposal.

5 Development of Remedial Alternatives for Early Action

This section describes how remedial alternatives were developed from the technologies screened in Section 4. The results of the screening identified remedial technologies that are applicable for implementation in East Branch. This section presents the integration of the retained technologies and representative process options[14] into a range of potentially viable remedial alternatives.

5.1 Basis for Development of Potential Remedial Alternatives

The applicable technologies retained on an East Branch-wide basis were used to assemble five alternatives with active remediation, as listed in this subsection and detailed in Section 5.2. In addition, this FFS also evaluates a no action alternative (as required by the NCP) for a total of six alternatives. Consistent with USEPA's *Consideration of Greener Cleanup Activities in the Superfund Cleanup Process* (2016), opportunities to implement greener cleanup activities, as well as the sustainability and climate resiliency of the alternative, will be considered throughout the CERCLA process, as further discussed in Section 5.3.9.

In addition to the remedial technologies presented for each alternative in this section, a range of remedial technologies are evaluated in Section 6 as options within the identified remedial alternatives for addressing NAPL or PTW that pose unacceptable risk. As discussed in Section 5.1.1, the remedial technology options evaluated include ISS, amended capping, and dredging. These technology options were evaluated to identify the most suitable technology for addressing these conditions if any warranting treatment using ISS were to be identified to be present during future site investigations (note that NAPL or PTW warranting treatment using ISS have not been identified to date in East Branch).

ISS also was integrated into each of the active remedial alternatives for solidifying/stabilizing sediment adjacent to unstable shorelines and bulkheads based on a preliminary shoreline and bulkhead stability evaluation, as discussed for each active alternative in Section 5.2 and presented in further detail in Appendix E.

For remedial technologies in which multiple process options could be applicable, a representative process option was selected for consideration as part of the remedial alternatives that is generally representative of the technology types included in each alternative. This approach is consistent with USEPA guidance (USEPA 1988) and reduces the number of remedial alternatives to be considered in this FFS to a manageable number. Although specific process options were selected for the alternatives development and evaluation, this should not be inferred as an indication that these process options are

[14] Although specific technologies and process options are identified in the remedial alternatives, there may be refinements to the local application of the identified technologies and process options of the selected remedial alternative during the design and implementation phases, due to engineering considerations or localized conditions identified during the PDI. These modifications would be made to improve the implementability, effectiveness, and/or cost of the selected approach without changing the ability of the remedy to achieve the RAOs or the outcome of the evaluation of the remedial alternatives. See additional discussion in Section 5.4.

necessarily preferred or superior compared to other potential process options. The specific process options used to implement the remedial action will likely not be finally selected until the RD phase.

USEPA's RI/FS guidance (USEPA 1988) states that, in some situations, "*the number of viable or appropriate alternatives for addressing site problems may be limited; thus, the screening effort may be minimized or eliminated if unnecessary.*" As noted in the FS Work Plan Addendum No. 1 (Anchor QEA 2022b), because this is an FFS for an EA, screening of all potential remedial alternatives is not required; rather, the alternatives that are evaluated in the detailed and comparative analysis (Sections 6 and 7, respectively) are limited to a reduced number of alternatives that are consistent with the CSM and composed of proven GRAs and remedial technologies used at other sediment sites.

As discussed in Section 4.1.4, future information and data may indicate the need to control an upland source(s). Recognizing that while temporary measures may be needed to reduce migration to address ongoing sources while cleanup of the related upland source is evaluated and implemented, through state and/or federal enforcement authorities (to be determined on a case-by-case basis), each of the active remedial alternatives includes the incorporation of sealed bulkheads for a portion of the permanent structural shoreline support. However, given the unknown need for sealed bulkheads at this time, the specific scope of these localized components is not specified in the FFS (although some assumptions about the length of sealed bulkheads that may be needed have been made when performing cost estimates for each active alternative) but would be determined during the RD based on information available at that time.

Consistent with USEPA guidance, engineering assumptions and considerations common to each alternative are presented separately (Section 5.3) and not repeated for each alternative. These engineering assumptions are presented with sufficient information to compare alternatives with respect to the NCP evaluation criteria and to ultimately select an appropriate remedy (USEPA 1988).

The following six alternatives were developed, as further summarized in Table 5-1. These alternatives are consistent with the alternatives presented in the *East Branch Early Action Focused Feasibility Study Alternatives Memorandum* (Anchor QEA 2023b).

- **Alternative EB-A:** No Action
- **Alternative EB-B:** Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW
- **Alternative EB-C:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths
- **Alternative EB-D:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging
- **Alternative EB-E:** Dredge All Within Navigation Channel, Cap Outside
- **Alternative EB-F:** Dredge All

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Table 5-1
Summary of Remedial Alternatives

Alternative	Alternative Summary
Alternative EB-A	**No Action**
Alternative EB-B	**Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW:** Remove sediments to allow placement of a cap entirely at (or below) 0 foot MLLW. Technology options for treating NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-C	**Dredge to Allow Placement of a Cap to Maintain Existing Water Depths:** Dredge to allow placement of a cap to maintain the existing water depth. Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-D	**Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging:** Dredge to allow placement of a cap to maintain the existing water depth. In select areas, remove sediments to a deeper depth than what is necessary to accommodate a cap followed by placement of backfill to pre-construction mudline elevations, or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater). Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, capping, and dredging.
Alternative EB-E	**Dredge All Within Navigation Channel, Cap Outside:** Dredge the federally authorized navigation channel to a depth necessary to accommodate a cap below the current authorized depth plus a buffer or to native material, whichever is shallower. Outside of the navigation channel, dredge to allow placement of a cap or dredge to native material. Areas dredged to native material (inside and outside the navigation channel) would be followed by placement of backfill (if necessary to manage dredge residuals), or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater). In the Western Beef Slip, remove sediments to allow placement of a cap entirely at (or below) 0 foot MLLW. Technology options for treating sediment with NAPL or PTW (if either of these conditions are present) include ISS, amended capping, and dredging.
Alternative EB-F	**Dredge All:** Dredge all sediments to native material except for limited areas where sediment would be stabilized/solidified in place via ISS for shoreline stabilization. Place backfill (if necessary to manage dredge residuals), or a cap if necessary (e.g., in areas with a relatively high flux of COCs from groundwater).

Notes:
The summary of each alternative is intended to provide a brief description of the primary components of the alternative. These summaries are not intended to be a comprehensive description. Additional details of the components of each alternative are provided in Section 5.2. Preliminary cap designs are presented in Section 5.3.3 and will be reevaluated and refined as needed in the RD phase.
For all alternatives with active remediation (i.e., all except Alternative EB-A), ISS is included adjacent to unstable shorelines or sensitive structures that could be negatively impacted by dredging, as well as a technology option for treating NAPL or PTW. For Alternative EB-F (Dredge All), no sediment containing NAPL requiring treatment by ISS, amended capping, or dredging will remain. NAPL has not been observed in native material in East Branch to date, but if NAPL is observed within native material during a PDI or RD, it would be further evaluated along with the flux of COCs from groundwater (see Section 3.1.4.2 of Appendix C). If appropriate, a cap may be designed to address NAPL or COC flux from groundwater after sediment removal.
The assumed vertical interface delineating site-related contamination in East Branch is the native material interface because COC concentrations in the native material samples are below all the risk-based PRGs (except for a single sample with an exceedance for C19-C36). However, if site-related contamination is identified in the native material during the PDI, active remediation consistent with the remedy approach identified in the remedial alternative may need to be performed.
As part of Alternatives EB-D, EB-E and EB-F, areas dredged to the native material interface were assumed to receive a 6- to 12-inch-thick sand backfill to mitigate anticipated generated residuals (Alternatives EB-E and EB-F), backfill to restore pre-construction mudline elevations (Alternative EB-D), or an amended armored cap where the flux of COCs from groundwater is relatively high, as described in Section 5.3.3.

As described in Section 3.6, the footprints associated with Alternatives EB-B through EB-F are identical, covering the entire 11.2 acres of East Branch. A description of each remedial alternative is included in Section 5.2.

Implementation of any of the active remedial alternatives would need to be coordinated with NYCDEP to remove the existing aeration system and coordinated with New York City Department of Transportation (NYCDOT) related to the planned Grand Street Bridge replacement (see Section 2.2.5 of Appendix A). These coordination efforts are further described in Section 5.3.9.

Each of the remedial alternatives with active remediation would include short- and long-term monitoring to assess the quality of implementation, completeness, and effectiveness of the remediation, as discussed in Section 5.3.8.

5.1.1 ISS and Other Technology Options for Addressing NAPL or PTW

As discussed in Section 4.2, ISS was retained as a potentially applicable remedial technology for sequestering NAPL or PTW or for solidifying sediment containing these materials to reduce advective or diffusive dissolved contaminant flux and/or ebullition-facilitated transport of NAPL and its constituents. However, it should be noted that NAPL or PTW warranting treatment using ISS have not been identified to date in East Branch. To assess ISS as a remedial technology for addressing NAPL or PTW, it was evaluated as an option (along with in situ treatment via amended capping and dredging) that could be integrated into each active alternative except Alternative EB-F. An area within East Branch was selected to evaluate ISS, amended capping, and dredging for managing these conditions if they were identified to be present through the PDI. Each of the three remedial technology options was evaluated independently assuming application over the entire evaluation area. For instance, ISS was assumed to treat all sediment above the native material interface within the evaluation area, capping was assumed over the entire evaluation area footprint, and dredging was assumed to remove all sediment above the native material interface within the evaluation area. Additional details on the basis for this evaluation are discussed in the following paragraphs.

The southern half of the Western Beef Slip (an approximately 0.6-acre area; 5.5% of the surface area of East Branch) was selected for evaluating remedial technology options for addressing NAPL or PTW in each of the alternatives (other than EB-A and EB-F) for two primary reasons. First, the southeastern portion of the Western Beef Slip was one of the limited number of locations in East Branch where NAPL was observed in the form of immobile blebs in subsurface sediment only, which is consistent with the other most significant NAPL observations in East Branch.[15] Second, the Western Beef Slip does not have an authorized navigation channel, unlike the rest of East Branch, which does have an

[15] NAPL blebs were visually observed in subsurface sediment at 7 of 53 core locations (two cores downstream of the Grand Street Bridge, two cores in the Western Beef Slip, and three collocated cores in the terminus of East Branch); the other 46 cores did not contain NAPL blebs.

authorized navigation channel that is generally characterized by steep side slopes that would present a logistical challenge for implementing ISS.[16]

Other locations in East Branch that contain observations of NAPL blebs in subsurface sediment were not selected because they are generally considered less amenable to the use of ISS given the physical conditions (e.g., within the navigation channel, on steep slopes adjacent to the navigation channel, or adjacent to structures that could be negatively impacted by the use of ISS [e.g., the CSOs, MS4s, or other major outfalls]). These structures could potentially be disturbed or damaged due to settlement or movement caused by the temporary reduction in shear strength of the sediments adjacent to the structures resulting from the ISS mixing and prior to amendment curing. Therefore, the Western Beef Slip is the most suitable location in East Branch to assess the implementability and effectiveness of ISS as an in situ treatment remedial technology for addressing NAPL or PTW.

The location in the Western Beef Slip was selected for evaluating these remedial technology options (i.e., ISS, amended capping, and dredging) in the FFS, but the exact location(s) and depths of where these technology options may be applied would be determined during the RD phase based on the presence of conditions that warrant their use—for instance, NAPL or PTW. However, as noted previously, these technology options are not considered applicable to Alternative EB-F because Alternative EB-F assumes removal of all sediment to native material (except for sediment that would be stabilized/solidified in place via ISS for shoreline stabilization), and no sediment containing NAPL or PTW would remain in place following remediation.

Although NAPL or PTW potentially warranting treatment using ISS are not currently known to exist in the East Branch, each of the three remedial technology options was evaluated independently to identify the most appropriate option for integration into the selected remedial alternative, if conditions warranting their use are identified during the PDI, as determined by USEPA. The location(s) where these technologies would be used would be finalized during the RD. Note that other factors, such as the concentration of COCs in remaining sediment and constructability, may be taken into account during the design of the remedy when evaluating where to apply ISS as well. Additional details related to the ISS elements that are common to all alternatives are provided in Section 5.3.5.

5.1.2 Navigation and Future Waterway Use

As discussed in Section 2.2.3 of Appendix A, USACE conducted a survey of current and reasonably anticipated future use of the federally authorized navigation channel in Newtown Creek and concluded that the navigation channel in East Branch can be deauthorized (USACE 2024). However, the deauthorization would need to be approved by Congress through the Water Resources Development Act, which has not occurred at the time of this FFS, although it is anticipated to occur

[16] Figure 1-3 shows the extent of the navigation channel in East Branch.

before the selection of an interim remedy for the East Branch EA.[17] If approval through the Water Resources Development Act does not ultimately occur, alternatives that include placement of backfill and capping materials within the vertical and horizontal limits of the navigation channel would be subject to compliance with the substantive requirements of Section 10 of the Rivers and Harbors Act of 1899. For the purposes of this FFS, the range of remedial alternatives was developed to include those that assume a cap would be installed at a depth shallower than the currently authorized navigation channel depth (Alternatives EB-B, EB-C, EB-D, and EB-F) as well as one that assumes a cap would be installed below the currently authorized depth plus a buffer (Alternative EB-E) as a contingency if the navigation channel is ultimately not deauthorized.

5.2 Description of Remedial Alternatives

A description of the remedial alternatives is provided in the following sections. The quantities associated with each remedial technology included in the alternatives (e.g., dredging, capping, or ISS) are summarized in Table 5-2. Table 5-3 presents estimates of the volume of sediment with various characteristics (e.g., exceeding risk-based PRGs, exceeding 50 mg/kg TPCBs, or containing observations of sheen or NAPL) that would remain following remediation for each of the alternatives.

[17] Draft language for the Water Resources Development Act 2024 legislation for the deauthorization of the navigation channel includes the relocation of the downstream boundary of the East Branch navigation channel reach to a point upstream of its current location. If this new boundary is finalized, USEPA anticipates that the downstream boundary of the East Branch Study Area will be adjusted to be coincident with the downstream boundary of the deauthorized East Branch navigation channel reach. The timing and the uncertainty around this potential change precluded any changes to the FFS.

Table 5-2
Summary of Remedial Technology Quantities for Remedial Alternatives

Alt.	Description[1]	Quantities						
		Dredge Volume[2] (cubic yards)	Dredge and Backfill[3] Area (acres)	Cap-only Area (acres)	Dredge and Cap Area (acres)	ISS (including pre-dredge and post-ISS cap) Area[4] (acres)	Shoreline Stabilization[5]	Sealed Bulkheads[6] (linear feet)
EB-A	No Action	0	0	0	0	0	0 of 5,090 lf (0%)	0
EB-B	Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	32,300	0	7.7	2.7	0.8	1,850 of 5,090 lf (36%)	60
EB-C	Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	92,300	0	0	10.8	0.4	3,850 of 5,090 lf (76%)	180
EB-D	Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	101,000	1.2	0	9.6	0.4	3,850 of 5,090 lf (76%)	180
EB-E	Dredge All Within Navigation Channel, Cap Outside	233,800	3.1	0.6	6.8	0.7	4,250 of 5,090 lf (84%)	490
EB-F	Dredge All	254,700	4.4	0	6.6	0.2	4,500 of 5,090 lf (88%)	850

Notes:

1. Sections 5.2.1 through 5.2.6 provide additional details on the components of each alternative. Section 5.3 provide additional details on the common elements integrated into the active remedial alternatives. Additional details on the cap designs are provided in Appendix C.
2. Dredge volume is for sediment removal only (i.e., does not include debris). Volumes include overdredge allowance and constructability considerations specific to each alternative, as discussed in Appendix F.
3. For the purposes of this FFS, backfill was assumed to consist of a 6- to 12-inch-thick layer of clean sand to manage post-dredge residuals, except for Alternative EB-D, where backfill to pre-construction mudline elevations was assumed for areas dredged to the native material interface.
4. ISS area includes dredging to remove swell caused by ISS and placement of a post-ISS cap to control potential COC diffusive flux, subject to treatability testing. Additional details are provided in Section 5.3.5. The area of ISS included in each alternative is based only on areas where ISS would be used to provide shoreline/bulkhead stability and not areas within the 0.6-acre portion of the Western Beef Slip where ISS is being evaluated as a technology option for treating NAPL or PTW, which could be integrated into the selected remedial alternative based on conditions determined during the PDI, as described in Section 5.1.1. The 0.6-acre area of the Western Beef Slip is accounted for in the quantities of the various remedial technologies included in each of the remedial alternatives, consistent with Figures 5-2, 5-3, and 5-5 through 5-7.
5. Length, in linear feet (lf), and percentage of East Branch shoreline length (total shoreline length of 5,090 lf in East Branch) that would require stabilization to implement the remedy via dredge offsets with amended capping; slot dredging; ISS; or bulkhead stabilization, replacement, or new installation
6. The use of sealed bulkheads for controlling an upland source(s) was assumed to be needed for 20% of the length requiring existing bulkhead replacement or new installation based on shoreline stability evaluations. However, the actual locations of sealed bulkheads would be determined during the RD phase and may not necessarily coincide with bulkhead installation for shoreline stability.

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Table 5-3
Summary of Volume of Sediment Remaining Post-Remediation

Alt.	Description[1]	Remaining Sediment Volume Exceeding Risk-based PRGs (cubic yards)[2]	Remaining Sediment Volume Exceeding a TPCB Threshold of 50 mg/kg (cubic yards)[3]	Remaining Sediment Volume with Observations of Sheen (cubic yards)[4]	Remaining Sediment Volume with Observations of NAPL (cubic yards)[5]
EB-A	No Action	219,000	14,200	148,200	16,200
EB-B	Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	187,000	13,900	126,600	16,200
EB-C	Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	127,700	11,500	86,400	16,000
EB-D	Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	119,100	11,500	80,600	16,000
EB-E	Dredge All Within Navigation Channel, Cap Outside	29,100	11,500	19,500	9,300
EB-F	Dredge All[6]	6,300	0	4,200	0

Notes:
General: A small amount of sediment exceeding risk-based PRGs, exceeding 50 mg/kg TPCBs, or containing observations of sheen or NAPL may exist in post-dredge residuals. However, these volumes are not quantified here.

1. Sections 5.2.1 through 5.2.6 provide additional details on the components of each alternative.
2. As discussed in Section 3.6, the estimated volume of all sediment that exceeds the risk-based PRG for one or more COCs is approximately 99% of the total sediment volume in East Branch. The risk-based PRGs for TPCB, D/F TEQ, and Pb are evaluated on a SWAC basis, so evaluating individual exceedances of these risk-based PRGs on a point-by-point basis is a conservative approach because not every location exceeding the risk-based PRG on a point-by-point basis would need to be remediated in order to meet the SWAC-based, risk-based PRG. For each alternative, the remaining total sediment volume post-remediation was multiplied by 99% to estimate the remaining sediment volume exceeding risk-based PRGs. For the COCs with risk-based PRGs developed on a SWAC basis (i.e., TPCB, D/F TEQ, and Pb), this is a conservative approach and likely overestimates the remaining sediment volume contributing to potential residual risk.
3. Sediment concentrations were evaluated relative to a TPCB threshold of 50 mg/kg. Only three sediment cores (EB046SC-B, EB075SC-J, and EB076SC-I) have samples with TPCB concentrations exceeding 50 mg/kg. Using the method presented in Section 3.6 that was used to estimate the sediment volume in East Branch with risk-based PRG exceedances (i.e., based on a length-weighted average of sediment core sample intervals with and without exceedances), the estimated volume of sediment in East Branch with TPCB concentrations exceeding 50 mg/kg is 6%. For each alternative, the dredge depth at each sediment core location with TPCB concentrations exceeding 50 mg/kg was used to determine the length of sediment with TPCB concentrations exceeding 50 mg/kg that would remain in place post-remediation. The sum of the length of sediment with TPCB concentrations exceeding 50 mg/kg was then weighted by the total length of all sediment core samples in East Branch to calculate the percent of the total sediment volume that would remain post-remediation with TPCB concentrations exceeding 50 mg/kg. This percentage was then multiplied by the total sediment volume in East Branch to estimate the sediment volume that would remain post-remediation with TPCB concentrations exceeding 50 mg/kg.

4. Observations of sheen are included because sheen could be indicative of site-related contamination at elevated COC concentrations. Sheen observed during a PDI would be further investigated. As discussed in Section 3.6, the estimated volume of sediment in East Branch that contains observations of sheen is approximately 67%. For each alternative, the total remaining sediment volume post-remediation was multiplied by 67% to estimate the remaining sediment volume with observations of sheen.
5. As discussed in Section 3.6, the estimated volume of sediment in East Branch that contains observations of NAPL is approximately 7%. There is a significant amount of uncertainty around this estimate, given the intermittent and discontinuous nature of NAPL in the sediment, as well as the fact that shake tests were performed at discrete depths but used to represent the thickness of the corresponding visual observation interval. For each alternative, the dredge depth at each sediment core location with NAPL observations was used to determine the length of all sediment core samples with NAPL observations that would remain in place post-remediation. The sum of the length of sediment with NAPL observations was then weighted by the total length of all cores in East Branch to calculate the percent of the total sediment volume that would remain post-remediation with NAPL observations. This percentage was then multiplied by the total sediment volume in East Branch for each alternative to estimate the sediment volume that would remain post-remediation with observations of NAPL.
6. Alternative EB-F targets removal of all sediment with the exception of a small volume targeted for ISS to stabilize a shoreline.

5.2.1 Alternative EB-A: No Action

Under this alternative, no active remediation would be conducted. Additionally, no monitoring would be conducted. Therefore, the existing conditions in East Branch would not change, except for those changes that result from ongoing natural recovery processes, if any, and changes in surface sediment concentrations as they equilibrate with ongoing external inputs over the long term (i.e., LTE). The existing conditions and footprint of Alternative EB-A are shown in Figure 5-1. Alternative EB-A is presented for comparison with the other alternatives, as required by the NCP (40 CFR 300.430[e][6]). Alternative EB-A would not include implementation of any new ICs. Current fish consumption advisories that have been implemented outside of the CERCLA process are expected to continue.

5.2.2 Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW

As shown in Figure 5-2, Alternative EB-B consists of dredging of sediments where necessary to allow for placement of an amended armored cap to be installed entirely at (or below) an elevation of 0 foot MLLW. Key components of Alternative EB-B are discussed as follows.

Dredging and Capping: The target dredge elevation is based on the thickness of the planned post-dredge cap; as discussed in Section 5.3.3 and Appendix C, the preliminary cap evaluations resulted in amended armored caps varying from 53 inches (including overplacement tolerances) in shallow water subject to vessel wave action (i.e., the wake zone) to 36 inches (including overplacement tolerances) in deeper water. In areas where the pre-construction mudline elevation would allow for placement of an amended armored cap to be installed entirely at or below 0 foot MLLW, an amended armored cap would be placed directly on the pre-construction mudline, which would result in an increased mudline elevation. In areas where the pre-construction mudline elevation would not allow for placement of an amended armored cap to be installed entirely at or below 0 foot MLLW, sediment would need to be dredged before the amended armored cap would be placed on the post-dredge surface below the pre-construction mudline. Depending on the amount of dredging required to install the cap entirely at or below 0 foot MLLW, cap placement after dredging could result in either an increased mudline elevation (e.g., less than 53 inches of sediment is removed prior to placement of a 53 inch-thick cap) or decreased mudline elevation (e.g., more than 53 inches of sediment is removed prior to placement of a 53-inch cap). Overall, for this alternative, there would be more cap material placed than sediment removed via dredging; therefore, this alternative would result in a mudline elevation in East Branch that is shallower on average than the pre-construction mudline. Currently, the water depths in East Branch range from approximately -21 to 4.4 feet MLLW. Under the proposed dredging and capping components for this alternative, the water depths would range from approximately -18 to 0 foot MLLW. Details on the dredging and capping components that are common to all alternatives are presented in Section 5.3. Debris removal would be a component of

Alternative EB-B within the dredging areas and all other alternatives with active remediation, as further discussed in Section 5.3.2.

Dredged material would be barged on an off-site processing facility (that meets the OSR requirements discussed in Section 4.1.9) where it would be treated through stabilization/solidification with amendment as necessary to reduce the moisture content of the material and meet transport and disposal requirements. Dredged material would then be transported by truck and disposed of in an off-site permitted Subtitle C, Subtitle D, and/or TSCA waste landfill, depending on the waste profile for a given dredged material management area.[18] Additional details related to the dredge material management elements that are common to all alternatives are provided in Section 5.3.4.

Shoreline Stabilization: To implement Alternative EB-B, shoreline stabilization measures would be required in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes, as determined through the preliminary evaluation presented in Appendix E. Based on this stability evaluation, and because stabilization measures are a common element anticipated to be included in each of the active alternatives, shoreline/bulkhead stabilization measures are summarized in Section 5.3.2.4.

Appendix E provides the results of the preliminary shoreline stability evaluations. Location-specific stability mitigation techniques for Alternative EB-B are shown in Figure 5-2. The site-specific stability mitigation measures proposed for Alternative EB-B include slot dredging, ISS, and bulkhead replacement. Under this alternative, dredging would be performed in the nearshore "wake zone" to accommodate placement of a 53-inch-thick amended armored cap at or below 0 foot MLLW. Based on the variable surface elevations within the wake zone of East Branch, this will require variable depths of dredging. Accordingly, based on the shoreline/bulkhead evaluation summarized in Appendix E (which is based on visual inspections conducted between 2011 and 2019 [as part of the RI/FS] and subsequent observations of recent changes), approximately two-thirds of the East Branch shoreline/bulkheads are categorized as Low Risk (typical of areas where little to no dredging is required). Other shoreline/bulkheads within East Branch have more significant dredge depths that may require shoreline/bulkhead stabilization mitigation measures.

ISS: ISS was integrated into Alternative EB-B for solidifying/stabilizing sediment adjacent to unstable shorelines and bulkheads. In addition, as described in Section 5.1.1, Alternative EB-B also includes ISS as a technology option for treating NAPL or PTW (if either were to be identified during the PDI) in comparison to in situ containment (via amended armored capping) and dredging in the southern half of the Western Beef Slip. Additional details related to the ISS elements that are common to all alternatives are provided in Section 5.3.5.

[18] Dredge management areas will be developed in the RD phase to break up the targeted dredge area into smaller units that will be used to verify that the required dredging elevations and remedial cleanup objectives have been achieved.

Institutional Controls: ICs would also be included in Alternative EB-B, which would necessarily be focused on those that can be instituted prior to EA completion and that would be needed to protect the East Branch EA constructed components (e.g., waterway use restrictions, land use restrictions, and government controls related to bulkhead/creek shoreline development). These ICs would be determined during the RD and are not expected to be differentiators between alternatives. Additional information on the ICs that are common to all the remedial alternatives is provided in Section 5.3.1.

Sealed Bulkheads: As discussed in Sections 4.1.4 and 5.1, Alternative EB-B (and all other active remedial alternatives presented in this FFS) assume the incorporation of sealed bulkheads for temporarily controlling an upland source(s) that could, post-remedy, potentially affect the success of the sediment-based remedy. Sealed bulkheads are included in Alternative EB-B for a portion of the areas designated for permanent structural shoreline support, as further discussed in Section 5.3.3.

5.2.3 Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths

Alternative EB-C would include the same remedial technologies and process options as Alternative EB-B. As shown in Figure 5-3, Alternative EB-C consists of dredging sediments prior to the installation of an amended armored cap across the entire footprint of East Branch. Key components of Alternative EB-C are discussed as follows.

Dredging and Capping: The depth of dredging would be the same as the amended armored cap thickness, which, based on preliminary analyses for the FFS, varies from 53 inches (including overplacement tolerances) in the wake zone to 36 inches (including overplacement) in deeper water (see Section 5.3.3 and Appendix C). Under this alternative, East Branch pre-construction mudline elevations would be maintained following remedy implementation to the extent practicable. Although the post-remedy surface sediment concentrations would be similar between Alternatives EB-B and EB-C, Alternative EB-C includes additional dredging so that the remedy would not alter the current water depths in East Branch.

Shoreline Stabilization: Shoreline stabilization measures described in Section 5.3.2.4 would be required to implement Alternative EB-C in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes. Appendix E provides the results of the preliminary stability evaluations. Location-specific stability mitigation measures for Alternative EB-C are shown in Figure 5-3.

The site-specific stability mitigation measures proposed for Alternative EB-C include slot dredging, ISS, bulkhead installation, and bulkhead replacement, as shown in Figure 5-3. Under this alternative, prior to placement of an amended armored cap with its required thickness, an equivalent thickness of sediment would be dredged to maintain existing water depths. Because the dredge depth along some shoreline areas is shallower for Alternative EB-C (and EB-D) than for Alternative EB-B,[19] more of the areas would be suitable for slot dredging as opposed to more intensive techniques, such as ISS. Compared to Alternative EB-B, more shoreline/bulkhead impacts are associated with the implementation of Alternative EB-C, with only approximately one-quarter of shorelines categorized as Low Risk. Due to the relatively shallow dredge thickness, much of the shoreline was categorized as Medium Risk and may be conducive to slot dredging as a stabilization technique. Under this alternative, approximately one-tenth of the shoreline/bulkheads were categorized as High Risk and may require bulkhead replacement or new bulkhead installation.

ISS: Like Alternative EB-B, Alternative EB-C includes ISS as an implementation option for treating NAPL or PTW (if either were to be identified during the PDI) in comparison to in situ containment (via amended capping) and dredging in the southern half of the Western Beef Slip.

Institutional Controls: Like Alternative EB-B, ICs would be instituted as part of Alternative EB-C but are not expected to be differentiators between alternatives.

Sealed Bulkheads: Like Alternative EB-B, Alternative EB-C incorporates sealed bulkheads as a common element for temporarily controlling an upland source(s) that could potentially affect the success of the sediment-based remedy.

5.2.4 Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging

Alternative EB-D would include the same remedial technologies and process options as Alternatives EB-B and EB-C. For most of East Branch, Alternative EB-D would be the same as Alternative EB-C (i.e., dredging to allow placement of an amended armored cap), but in select areas, sediment would be removed to a deeper depth than what is necessary to accommodate a cap (then capped or backfilled to the pre-construction mudline elevation) based on the following considerations:

- Potential for NAPL migration from the deeper sediment and/or native material
- Potential for exposure to PTW
- Depth of sediment to native material
- Comparatively higher COC concentrations in remaining sediment

However, for the purposes of the FFS evaluations, the areas of deeper dredge are identified only by the depth of sediment to native material. The FFS assumed that deeper dredging to native material

[19] The bed elevation for some portions of East Branch is currently above 0 foot MLLW, which for Alternative EB-B would require more dredging in these areas compared to Alternatives EB-C and EB-D prior to cap placement. In these areas, the depth of dredging for Alternative EB-B would be more than 3 feet to accommodate the placement of a cap that is at or below 0 foot MLLW. In some cases, the dredge depth would be too deep for slot dredging to safely remove sediment. Therefore, other shoreline stabilization techniques (e.g., ISS or bulkhead repair, replacement, or new installation) would be used to support the shoreline in these areas as part of Alternative EB-B that might be otherwise suitable for slot dredging under Alternatives EB-C and EB-D.

would occur in areas where sediment thickness above the native material is less than or equal to approximately 5.2 feet (as shown in Figure 5-4). This threshold was assumed based on practical consideration of dredging versus capping. However, the areas that would be dredged as part of this alternative would be evaluated during the RD based on the aforementioned four considerations. Mobile NAPL or PTW have not been identified to date in East Branch; however, if they are identified to be present during future site investigations, an evaluation will be performed to determine if amended capping, ISS, or dredging is the most appropriate technology, as discussed in Sections 5.1 and 5.1.1. The areas of dredge-and-capping versus dredging to native material are shown in Figure 5-5. Key components of Alternative EB-D are discussed as follows.

Dredging and Capping: In areas where dredging would be performed to accommodate capping, the depth of dredging would be the same as the amended armored cap thickness, which, based on preliminary analyses for the FFS, varies from 53 inches (including overplacement tolerances) in the wake zone to 36 inches (including overplacement) in deeper water (see Section 5.3.3 and Appendix C). In some areas with thinner deposits of sediment, dredging would target removal of all sediment down to the native material (see Figure 5-5). A PDI would be implemented during the RD phase to further delineate the native surface elevations, and construction verification methods would be developed to verify that dredging to the native material interface is achieved. To manage dredge residuals and to maintain consistent bathymetry, the areas dredged down to native material would be backfilled to the pre-construction mudline elevation with clean sand, as discussed further below. Similar to Alternative EB-C, under this alternative, East Branch pre-construction mudline elevations would be maintained following remedy implementation to the extent practicable.

Based on currently available data and modeling evaluations, it is anticipated that some areas of East Branch where the flux of COCs from groundwater is relatively high could result in an exceedance of the risk-based sediment PRGs over time if a sand-only backfill layer were placed on top of native material after dredging to remove contaminated sediment. For the purposes of this FFS, the extent of areas with elevated groundwater COC concentrations was established based on a model sensitivity analysis to identify threshold groundwater COC concentrations above which an amended armored cap may be needed if placed directly on native material (see Section 5.3.3 of this FFS and Section 3.1.4.2 of Appendix C). For this alternative, in two of the three discrete areas where dredge-to-native material is proposed, only a 6- to 12-inch-thick clean sand backfill would later be needed to manage post-dredge residuals; groundwater COC concentrations in these areas were not elevated enough to need the placement of an amended armored cap.[20] However, even though the modeling indicated only a 6- to 12-inch-thick clean sand backfill would be needed in these two areas, this alternative assumes that areas dredged to the native material interface would be backfilled to restore the pre-construction

[20] The need for a clean sand backfill layer to manage post-dredge residuals would be based on post-dredge sampling and the dredging compliance criteria to be developed during the RD phase. See additional discussion in Section 5.3.2.2.

mudline elevations (i.e., more than 12 inches of sand backfill might be placed). In the area where dredge-to-native material is proposed at the mouth of the East Branch, it is assumed that the relatively high flux of COCs estimated in this area would require an amended armored cap. Given the uncertainties in this analysis, it is considered conceptual and would require further evaluation during RD, should this alternative be selected. Section 5.3.3 and Appendix C provide additional details on the basis for the preliminary cap designs.

Shoreline Stabilization: Shoreline stabilization measures described in Section 5.3.2.4 would be required to implement Alternative EB-D in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes. Appendix E provides the results of the preliminary stability evaluations, and location-specific stability mitigation measures for Alternative EB-D are shown in Figure 5-5.

The site-specific stability mitigation measures proposed for Alternative EB-D include slot dredging, ISS, bulkhead installation, and bulkhead replacement, as shown in Figure 5-5. Similar to Alternative EB-C, under this alternative, prior to placement of an amended armored cap with its required thickness, an equivalent thickness of sediment would be dredged to maintain existing water depth in most areas. Alternative EB-D is differentiated from EB-C in that the dredge depth would be locally extended to the native material interface in select areas. This dredge optimization for Alternative EB-D occurs near the middle of the creek, away from the shoreline/bulkhead, thus resulting in the same shoreline risk categories for Alternatives EB-C and EB-D.

ISS: Like Alternative EB-B, Alternative EB-D includes the use of ISS in the southern half of the Western Beef Slip as an implementation option for treating NAPL or PTW (if either were to be identified during the PDI) in comparison to in situ containment (via amended capping) and dredging.

Institutional Controls: Like Alternative EB-B, ICs would be instituted as part of Alternative EB-D but are not expected to be differentiators between alternatives.

Sealed Bulkheads: Like Alternatives EB-B and EB-C, Alternative EB-D incorporates sealed bulkheads as a common element for temporarily controlling an upland source(s) that could potentially affect the success of the sediment-based remedy.

5.2.5 Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside

Alternative EB-E would include the same remedial technologies and process options as Alternatives EB-B through EB-D. Under Alternative EB-E, sediment would be dredged within the federally authorized navigation channel down to native material or to an elevation necessary to accommodate placement of an amended armored cap below the current authorized navigation channel depth plus a buffer, whichever is shallower. Outside of the navigation channel, a combination of dredging and/or capping with an amended armored cap would be performed. Key components of Alternative EB-E are presented in Figure 5-6 and discussed as follows.

Dredging and Capping: Sediment in the federally authorized navigation channel would be removed down to native material or to an elevation necessary to accommodate placement of an amended armored cap below the current authorized navigation channel depth plus a buffer, whichever is shallower.[21]

To remove sediment within the navigation channel down to the authorized depth (or deep enough to place an amended armored cap below the authorized depth), stable side slopes (i.e., 3 horizontal to 1 vertical [3H:1V]) would also need to be dredged outside of the channel limits. These side slopes would extend away from the navigation channel dredge elevation up toward the shoreline/bulkhead. Given the depth of dredging in the channel, the fact that the navigation channel takes up most of the width of East Branch, and the geometry of the steep banks, nearly all contaminated sediment outside of the channel (except for the Western Beef Slip, which does not have a navigation channel) would likely need to be removed to create stable side slopes. The exception, as shown on Figure 5-6, is two areas outside of the navigation channel with adjacent lengths of shoreline/bulkhead that are preliminarily identified as requiring a dredging offset and capping for stabilization, based on the analysis presented in Appendix E. These two areas would be dredged between 45 and 53 inches to facilitate capping such that East Branch pre-construction mudline elevations would be maintained following remedy implementation, to the extent practicable.

In areas where sediment was dredged to the native material, sand backfill (for dredge residuals management) would be placed on the native material or an amended armored cap would be placed in areas with relatively high flux of COCs from groundwater. As discussed in Section 5.2.4 for Alternative EB-D, it is anticipated that some areas of East Branch where the flux of COCs from groundwater is relatively high may result in an exceedance of the risk-based sediment PRGs over time even if a 6- to 12-inch-thick sand-only backfill layer were placed on top of native material after dredging to remove contaminated sediment; therefore the cap design in areas with relatively high flux of COCs would also consider management of these COC concentrations. In areas where sediment was not dredged to the native material, an amended armored cap would be placed atop the remaining sediment. Cap construction is based on the preliminary cap design presented in Section 5.3.3 and Appendix C. Specific areas with such conditions assumed for this FFS are uncertain and would need to be further evaluated during RD through a PDI if Alternative EB-E is selected.

Figure 5-6 shows the various dredge depths and cap type areas for Alternative EB-E within the remedial footprint. This alternative would result in an East Branch mudline elevation that is deeper, on average, than the pre-construction mudline.

[21] Based on the current bathymetry data and understanding of the native surface, all areas of dredging within the navigation channel under Alternative EB-E target complete removal to native material; there are no areas that would leave contaminated sediment in place below a cap. However, this option is retained in the event that new information is identified during the RD phase.

Shoreline Stabilization: Shoreline stabilization measures described in Section 5.3.2.4 would be required to implement Alternative EB-E in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes. Appendix E provides the results of the preliminary stability evaluations, and location-specific stability mitigation measures for Alternative EB-E are shown in Figure 5-6.

The site-specific stability mitigation measures proposed for Alternative EB-E include bulkhead stabilization, ISS, bulkhead installation, bulkhead replacement, and dredge offset with capping, as shown in Figure 5-6. Under this alternative, dredging would extend below and beyond the federally authorized navigation channel so that cap placement would not impinge on the navigation channel. One of the key assumptions included in this alternative was an assumed 3H:1V dredge slope in the sediment extending away from the navigation channel up toward the shoreline/bulkhead. This results in broader and more severe impacts to shoreline/bulkhead stability compared to Alternatives EB-B, EB-C, and EB-D. Nearly one-half of shoreline/bulkheads were categorized as High Risk under Alternative EB-E, with only approximately one-fourth categorized as Low Risk.

ISS: Like Alternative EB-B, Alternative EB-E includes the use of ISS in the southern half of the Western Beef Slip as an implementation option for treating NAPL or PTW (if either were to be identified during the PDI) in comparison to in situ containment (via amended capping) and dredging.

Institutional Controls: Like Alternative EB-B, ICs would be instituted as part of Alternative EB-E but are not expected to be differentiators between alternatives.

Sealed Bulkheads: Like Alternatives EB-B. EB-C, and EB-D, Alternative EB-E incorporates sealed bulkheads as a common element for temporarily controlling an upland source that could potentially affect the success of the sediment-based remedy.

5.2.6 Alternative EB-F: Dredge All

As depicted in Figure 5-7, Alternative EB-F consists of dredging down to native material in the entire East Branch footprint (except for limited areas where ISS would be used for shoreline stabilization), followed by the placement of a clean sand backfill layer to manage post-dredge residuals or an amended armored cap (if necessary) in areas where the flux of COCs from groundwater is relatively high, as discussed in the following paragraphs.

Dredging and Capping: Dredging would target removal of all sediment above the native material (and any site-related contamination within the native material if identified during the PDI).[22] However, because ISS would be performed as part of this alternative for shoreline stabilization (as discussed below), some stabilized/solidified contaminated sediment would remain in the East Branch as part of the ISS monolith. Like Alternative EB-E, an amended armored cap would be placed in areas where the

[22] If removal of sediment below the native material interface would be technically impracticable, alternate technologies included in Alternative EB-F (e.g., ISS or capping) would be evaluated.

flux of COCs from groundwater is relatively high, following removal of sediment down to native material, as discussed in Section 5.2.4 (noting that the specific areas with such conditions assumed for this FFS are uncertain and would need to be evaluated through a PDI if Alternative EB-F is selected). Areas not requiring a post-dredge cap would receive a 6- to 12-inch-thick, clean sand backfill layer for residuals management. This alternative would result in an East Branch mudline elevation that is deeper, on average, than the pre-construction mudline throughout East Branch.

Shoreline Stabilization: Shoreline stabilization measures described in Section 5.3.2.4 would be required to implement Alternative EB-F in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes. Alternative EB-F is the most intensive remedial measure, requiring that all sediments within East Branch be dredged (except for limited areas where ISS would be used for shoreline stabilization). This evaluation identified more severe impacts associated with the implementation of Alternative EB-F than any of the other alternatives, with more than four-fifths of shoreline/bulkheads categorized as High Risk and likely requiring either new bulkhead installation or bulkhead replacement.

Appendix E provides the results of the preliminary stability evaluations, and location-specific stability mitigation measures for Alternative EB-F are shown in Figure 5-7. Due to the depth of dredging, nearly the entire shoreline of East Branch would be subject to bulkhead replacement, new bulkhead installation, or ISS (along one small section).

ISS: Under this alternative, ISS would only be performed for the purposes of shoreline stabilization to facilitate the dredging activities (as discussed previously).

Institutional Controls: Like Alternative EB-B, ICs would be instituted as part of Alternative EB-F but are not expected to be differentiators between alternatives.

Sealed Bulkheads: Like Alternatives EB-B, EB-C, EB-D, and EB-E, Alternative EB-F incorporates sealed bulkheads as a common element for temporarily controlling an upland source that could potentially affect the success of the sediment-based remedy.

5.3 Common Elements and Assumptions

There are several elements and assumptions that are common to each of the alternatives described in Section 5.2 (the no action alternative, described in Section 5.2.1, would not include any of the active elements described in this section). ICs, dredging, in situ containment (placement of backfill and/or cap), in situ treatment, dredged material management (including dewatering and disposal), ex situ treatment, potential sealing of bulkheads, and evaluation monitoring (which includes both performance and effectiveness monitoring) are common elements for Alternatives EB-B through EB-F. Common elements for these active alternatives and assumptions are described in the remainder of this section.

5.3.1 Institutional Controls

ICs are assumed to be incorporated into each of the selected remedial alternatives. ICs included with the EA alternatives will be necessarily focused on the ICs that can be completed prior to EA completion and that are needed to protect the East Branch EA constructed components. The ICs retained in Section 4.2 are included in the alternatives to recognize their general function and necessity within the remedy without attempting to craft a detailed IC plan for each alternative. In general, it is anticipated that the IC plan would include the following restrictions and actions:

- **Fishing and Crabbing Restrictions:** Implemented through fishing and crabbing regulations, license programs, and posting and maintenance of signs. These restrictions/actions would require coordination with NYSDEC.
- **Consumption Advisories:** Implemented through posting and maintenance of signs; these restrictions and actions would require coordination with NYSDEC and NYSDOH. The current fish consumption advisories that have been implemented outside of the CERCLA process are expected to continue.
- **Dredging Restrictions:** Implemented through the permitting process for future dredging. These restrictions would require coordination with USEPA, NYSDEC, and USACE.
- **Waterway Access Controls:** This could include signage or restrictive navigational aids (e.g., restrictions on motorized boat traffic that could impact the remedy components).

A detailed IC plan for East Branch cannot be developed at this stage of analysis; these detailed IC plans are more appropriately developed during RD.

5.3.2 Sediment Removal (Dredging)

For the purposes of the remedial alternatives, it was assumed that barge-mounted mechanical dredging with an environmental clamshell bucket would be the method implemented within East Branch based on its common usage on sediment remediation projects in other urban waterways. As discussed in Table 4-1, hydraulic dredging is feasible and could be implemented within East Branch, but mechanical dredging was assumed for the purposes of developing remedial alternatives.[23] Additionally, specialty dredging is retained and reserved for potential areas that may be difficult or inefficient to access using traditional mechanical or hydraulic methods.

It is expected that dredging operations would result in sediment resuspension and release and the generation of residuals. Bridges et al. (2008) defines these terms as follows:

- "*Resuspension is the process by which a dredge and attendant operations dislodge bedded sediment particles and disperse them into the water column.*"

[23] Hydraulic dredging was retained for further evaluation during the RD phase but was not assumed for the FFS due to increased difficulties in handling debris, pipeline blockage concerns, and the requirement for a significant upland area near Newtown Creek for dewatering and water treatment (see Table 4-1).

- *"Release is the process by which the dredging operation results in the transfer of contaminants from sediment pore water and sediment particles into the water column or air."*
- "*Residuals refers to contaminated sediment found at the post-dredging surface of the sediment profile, either within or adjacent to the dredging footprint.*"

To the extent practicable, resuspension and release of sediment would be managed through implementation of engineering and operational controls, such as a resuspension control system (e.g., fixed or mobile turbidity curtains), proper equipment selection, use of trained and skilled operators, environmental monitoring, and best management practices (BMPs) (e.g., controlling bucket fall height, cycle time, and bucket handling procedures), among other controls. In addition, turbidity monitoring would be performed during construction in accordance with the water quality criteria applicable to the project.

5.3.2.1 Debris Removal

Each of the remedial alternatives that includes dredging would require removal of debris. As discussed in Section 4.1.6.1, debris removal may be performed with dedicated equipment prior to dredging and/or with the mechanical dredge equipment concurrent with sediment removal. Although debris removal is expected to be a component of the dredging operations in East Branch, it is not expected to be a differentiator between alternatives because each of the alternatives would utilize the same equipment, with the only difference being the quantity of debris, which was assumed to be a function of the dredge volume; this FFS assumes a debris removal volume equal to 5% of the dredge volume based on experience from similar sites.

5.3.2.2 Dredged Material Management

Removed sediments would be loaded into scows to be partially dewatered (e.g., via pumping of the supernatant water from the scow) before being transported to a commercially available upland sediment processing area in the New York/New Jersey region. Supernatant water would be treated via an on-barge water treatment system that is expected to treat organic and inorganic contaminants with flocculation and filtration (sand or bag filtration) followed by a carbon polishing step (specifics would be developed during RD). Treated water could be discharged to a receiving waterbody in accordance with regulatory requirements (assumed for the FFS costing) or to a publicly owned treatment works.

At the regional sediment processing facility, the dewatered dredged material would be offloaded into a lined and bermed sediment processing area for additional management and stabilization, as necessary to meet subsequent transport and disposal requirements. For the purposes of this FFS, it was assumed that dredged sediment would require processing at the regional sediment management facility through a combination of passive (e.g., gravity drainage) and active (e.g., mechanical mixing) processing. The active processing component was assumed to incorporate a solidification agent (e.g., quicklime) to pass paint filter testing and disposal facility requirements; this solidification would likely reduce the mobility of COCs in the material prior to placement in the disposal facility (i.e., it is a form of ex situ treatment, as discussed in Section 5.3.6). Management of dredged material would require that the sediment processing area be appropriately sloped to collect stormwater and water that drains from dredged materials, which would then be conveyed to an on-site water treatment system. The water treatment system at the regional sediment management facility would operate under the same assumptions described above for the dredge supernatant water.

5.3.2.3 Post-Dredge Sand Backfill

In areas where an amended cap is not needed to control long-term flux of COCs from groundwater in native material, a 6- to 12-inch-thick post-dredge backfill layer[24] would be necessary if post-dredge residuals remain that cannot be effectively dredged (e.g., "generated residuals"[25]). Placement of sand backfill would mitigate potential risks from post-dredge residuals and could also provide specific substrate for benthic recolonization or achieve desired post-dredge elevations, as needed. Turbidity from backfill materials during placement would be managed, to the extent practicable, using one or more of the methods described for dredging and would be monitored during implementation.

5.3.2.4 Shoreline Stabilization

To implement any of the active remedial alternatives, shoreline stabilization measures would be required in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes, as determined through the preliminary evaluation presented in Appendix E. Based on this stability evaluation, stabilization measures anticipated across each of the alternatives are summarized as follows. Each of these stabilization techniques has limitations and may only be implementable under certain conditions; therefore, they are not universally applied to all areas characterized.

- **Slot Dredging:** Slot dredging (also referred to as interval dredging) is the process where dredging is performed incrementally in short sections followed by immediate backfill placement to limit the slope lengths affected by the dredge cut. Slot dredging is generally implementable in areas with a relatively shallow dredge depth (e.g., less than 3 or 4 feet).
- **Dredging Offset with Capping:** Dredging could be offset from sensitive shorelines or structures and the offset area could be capped. A dredging offset with capping would only be applicable where the geometry of the slope and proximity to the steep slopes extending into the deep portion of the navigation channel allow this.
- **ISS:** As discussed in Section 4.1.5, ISS can be used to solidify/stabilize contaminated sediment in situ through the mixing of an amendment. Like dredging offset with capping, the implementability of ISS depends on the slope geometry, proximity to the navigation channel, and the depth of planned dredging adjacent to the ISS area. ISS cannot be performed

[24] Under Alternative EB-D, backfill to pre-construction mudline elevations was assumed for areas dredged to the native material interface.
[25] See Bridges et al. 2008 for a discussion of generated dredge residuals.

immediately adjacent to a deep dredge cut or on a steep slope because the stabilized sediment (i.e., the ISS monolith) will not be stable as an unsupported vertical "wall."

- **Temporary or Permanent Structural Support (e.g., bulkhead installation, repair, or replacement):** Shoreline stability can be provided by repairing or replacing an existing bulkhead or by installing a new bulkhead wall where one does not currently exist.

Appendix E provides the results of the preliminary stability evaluations. For all alternatives that include shoreline/bulkhead stabilization measures, it should be noted that current shoreline conditions may vary based on any construction or rehabilitation, or continued deterioration, since the date of the shoreline conditions assessments. Additional assessments would be performed as part of a future PDI to obtain the most current shoreline information for the RD.

5.3.3 In Situ Containment

The remedial alternatives in this FFS incorporate placement of an amended armored cap on top of sediment remaining after dredging and (in some areas) on top of native material in areas where the sediment has been dredged to the native material interface and the flux of COCs from groundwater is relatively high.[26] Areas of East Branch where an amended cap would be needed on top of native material due to groundwater concentrations and seepage rates (i.e., where flux of COCs from groundwater is relatively high) are shown in Figures B3-5 and B3-6 of Appendix B. Preliminary design evaluations presented in Appendix C demonstrate that placement of a multilayer engineered cap (including erosion protection and chemical isolation layers) is feasible in East Branch. The preliminary evaluations for caps installed on sediment, which incorporated conservative assumptions related to potential erosive forces, resulted in amended armored caps varying in thickness from 53 inches (including overplacement tolerances) in the wake zone to 36 inches (including overplacement) in deeper water (see Figure C5-1). Based on these capping evaluations, the preliminary cap designs (including overplacement tolerances, either placed on the pre-construction mudline or following partial removal of sediment) are depicted in Figure C5-1 in Appendix C and summarized as follows (see Figure 5-8 for a map of East Branch illustrating these capping water depth zones):

- In the wake zone (shallower than -4 feet MLLW), a 53-inch-thick cap composed of a 20-inch-thick erosion protection layer, 9-inch-thick geotechnical filter layer, 15-inch-thick dissolved phase chemical isolation layer (amended with a carbon-based amendment such as AC), and 9-inch-thick NAPL sorption layer (to address gas ebullition-facilitated NAPL transport using an organoclay amendment)
- In the shallow water/nearshore (-13.5 to -4 feet MLLW), a 45-inch-thick cap composed of a 12-inch-thick erosion protection layer, 9-inch-thick geotechnical filter layer (if necessary,

[26] Areas where an amended cap may be needed on top of native materials was determined based on an evaluation presented in Section 3.1.4.2 of Appendix C. This is also further discussed under Alternatives EB-D, EB-E, and EB-F where this issue is relevant.

based on final materials selection as part of the RD), 15-inch-thick dissolved phase chemical isolation layer, and 9-inch-thick NAPL sorption layer

- In the deep water (deeper than -13.5 feet MLLW), a 36-inch-thick cap composed of a 12-inch-thick erosion protection layer, 15-inch-thick dissolved phase chemical isolation layer, and 9-inch-thick NAPL sorption layer

For remedial alternatives with removal down to the native material interface other than Alternative EB-D, a 6- to 12-inch-thick post-dredge backfill layer would be necessary to manage post-dredge residuals. For Alternative EB-D, backfill would be placed to restore pre-construction mudline elevations (i.e., more than 12 inches of sand backfill might be placed). In some localized areas exhibiting relatively high flux of COCs from groundwater, an amended armored cap would be placed. NAPL was not identified in native material in East Branch, so a NAPL sorption layer would not be included in the armored cap in areas with capping on native material unless NAPL is identified in the native material during the PDI. See Figure C5-2 in Appendix C for preliminary amended armored cap designs over native material.

In areas where ISS is applied, it was assumed that ISS would change the geotechnical characteristics of the sediment, preventing the generation and passage of gas (and therefore NAPL if present) in the subsurface sediment, because ebullition gas bubbles would not be able to fracture the ISS monolith. In addition, the pH of ISS treated sediment is typically between 11 and 12 (Grubb et al. 2020), and high pH is generally incompatible with methanogenesis (Qiu et al. 2023). Therefore, these factors indicate that ebullition, which is mostly driven by methane production, is unlikely to occur in ISS-treated sediments. Therefore, it was assumed that a separate NAPL sorption layer would not be needed for a potential post-ISS cap. However, if ISS is implemented in East Branch, post-remedy monitoring may include visual monitoring for ebullition in areas treated with ISS to verify that ebullition-facilitated transport of NAPL has been eliminated.

Additional analyses and refinements may be appropriate during the RD phase if an alternative that includes capping is selected. Thus, in the remedial alternatives that include dredging to allow for cap placement below 0 foot MLLW or back to pre-construction mudline elevations (i.e., Alternatives EB-B through EB-D), the dredge depth may be adjusted during the RD.

Section 5 of Appendix C summarizes preliminary evaluations and considerations related to cap placement and performance that support the feasibility of cap placement in East Branch. During the RD phase, several additional detailed evaluations for the caps would be performed based on data collected as part of the Feasibility Study Field Program (Anchor QEA 2020a), the Treatability Study PDI (NRT 2020), and future PDI (see Section 5.3.9), including the following:

- Cap-induced settlement of the underlying sediment would be assessed to determine the anticipated rate and magnitude of consolidation. This would include consideration of any dredging prior to capping.

- Geotechnical stability of the caps placed on the existing sediment would be assessed to determine if restrictions on the means and methods (e.g., equipment used to place the cap material or layer thickness) would be warranted. While gas migration through the sediment and cap is not expected to impact the stability of overlying caps, as described in Section 5 of Appendix C, it will be reassessed during the RD phase.
- There is only one location in East Branch where a sheen was observed in native material; a cap has already been planned for that location due to relatively high COC flux from groundwater. If additional sheens are observed within native material during the PDI, they would be further evaluated along with the flux of COCs from groundwater (see Section 3.1.4.2 of Appendix C). If appropriate, a cap may be designed to address flux of COCs resulting from sheen and/or groundwater discharge.

For the purposes of this FFS, each of the remedial alternatives with active remediation (i.e., Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F) incorporates sealed bulkheads for a portion of the permanent structural shoreline support components (i.e., sheet pile walls), which are being evaluated as a common element of the alternatives. As discussed in Section 4.1.4, sealed bulkheads (a form of barrier wall) could be used as a component of an overall upland remedy (in conjunction with other source control technologies) to prevent uncontrolled upland contamination, including contaminated soil, groundwater, or NAPL, from entering East Branch. Specifically, sealed bulkheads would act to reduce the flow of materials through the interlocking joints of a sheet pile wall, while other technologies (e.g., an upland groundwater and/or NAPL collection and recovery systems) would be used to collect and treat the contained contaminated media. Given the currently unknown need for sealed bulkheads, the scope and quantity of these localized components would be determined during the RD based on information available at that time; in the FFS, for cost estimating purposes it has been assumed that 20% of the length of new bulkheads installed will be sealed bulkheads.[27]

5.3.4 Disposal

For the purposes of this FFS, it was assumed that processed dredged sediment and debris would be transported via barge from the site via tug to a commercially available upland sediment management facility in the New York/New Jersey region to be dewatered and stabilized. At the regional sediment management facility, processed sediment and debris would be transported to the appropriate upland disposal facility by truck or rail. This assumption would be revisited during RD. In addition, as noted in Section 4.1.9, CERCLA wastes (i.e., Newtown Creek sediments) may only be

[27] For the purposes of this FFS, the locations of sealed bulkheads for controlling an upland source were assumed to coincide with locations requiring existing bulkhead replacement or new installation based on shoreline stability evaluations. However, the actual locations of sealed bulkheads would be determined during the RD phase and may not necessarily coincide with bulkhead installation for shoreline stability.

transferred to disposal facilities that meet the requirements of the OSR in order to prevent present or future releases of hazardous materials.

Disposal of non-hazardous waste generated by dredging operations would occur at an upland Subtitle D landfill. Hazardous (e.g., Resource Conservation and Recovery Act [RCRA]) or toxic (e.g., materials subject to TSCA) waste materials would be disposed at an upland Subtitle C landfill. Within East Branch, TPCB concentrations greater than 50 parts per million (ppm) have been measured in select sediment samples. Sediment waste characterization evaluations are anticipated to be conducted during a future PDI; however, based on experience from similar projects and an evaluation of subsurface concentrations from existing data, only three cores had isolated samples with concentrations of TPCBs exceeding 50 ppm (refer to Section 2.3.3 of Appendix A); therefore, for the purposes of this FFS, it was conservatively assumed that 5% of dredged sediment (by weight) would need to be managed as TSCA or RCRA hazardous waste and disposed of at a Subtitle C landfill or TSCA landfill. The remainder of material was assumed to be suitable for disposal in a non-hazardous waste landfill (i.e., Subtitle D) either before or after amendment with a solidification agent, provided applicable land disposal restrictions are met. The extent of material requiring management and disposal under TSCA regulations for a given alternative would be refined as additional sediment data are collected during the PDI. Similarly, the extent of removed sediment requiring management and disposal under RCRA at a hazardous waste landfill would be delineated as additional data are collected prior to construction.

5.3.5 In Situ Treatment

As discussed in Section 5.1.1, ISS was evaluated as an option, in comparison to in situ containment (via amended capping) and dredging, for addressing NAPL or PTW warranting treatment using ISS if they were to be identified as present during the PDI (note that NAPL or PTW warranting treatment using ISS have not been identified to date in East Branch). However, future site investigations may identify locations where these conditions exist. Therefore, this evaluation of remedial technologies will be used to identify the most appropriate option for integration into the selected remedial alternative, if conditions warranting their use are identified during the PDI, as determined by USEPA. These remedial technology options could be integrated into any of the remedial alternatives except Alternatives EB-A and EB-F.[28] Note that other factors, such as the concentration of COCs in remaining sediment and constructability, may be taken into account during the design of the remedy when evaluating where to apply ISS as well.

For the purpose of evaluating ISS and the other technology options in this FFS, the southern half of the Western Beef Slip (an approximately 0.6-acre area; 5.5% of the surface area of East Branch) was

[28] Alternative EB-A is the no action alternative. Alternative EB-F would not include ISS within the Western Beef Slip because this alternative assumes removal of all sediment to native material, and no sediment containing NAPL or PTW would remain in place following remediation.

selected. There is an estimated 13,700 cubic yards (cy) of sediment above the native material interface that is within the 0.6-acre evaluation area that would require management. NAPL in the form of blebs has been observed in subsurface sediment in this area of the Western Beef Slip, and the amount of subsurface sediment containing observations of NAPL in this area is estimated to be 3,600 cy out of the total 13,700 cy of sediment.[29] For this evaluation, ISS was assumed to treat all sediment above the native material interface within the evaluation area.

ISS may also be used elsewhere in East Branch as a shoreline stabilization measure in areas of dredging adjacent to unstable shorelines, structures, or the navigation channel. Figures 5-2, 5-3, and 5-5 through 5-7 present the locations where ISS has been proposed to be a part of Alternatives EB-B through EB-F as an option for addressing NAPL or PTW (if either were to be identified during the PDI) or for shoreline stabilization based on the preliminary evaluation of shoreline/bulkhead stability presented in Appendix E.

ISS can also be effective at sequestering NAPL contaminated sediment to control contaminant flux. Although mobile NAPL has not been identified in East Branch and the mobility is not expected to change because of the change in overburden pressure resulting from capping included in the range of remedial alternatives (see Section 3.2.3 in Appendix C), future site investigations may identify locations where conditions exist that warrant ISS.

A bench-scale treatability test was performed to evaluate proof of concept of ISS in Newtown Creek. The program included three phases of testing using different stabilizing agents and mix ratios to determine an optimal type and ratio of amendments to achieve the preliminary strength and permeability performance criteria. In total, 39 combinations of stabilization agents and mix ratios were tested, and the results are summarized as follows:

- Twenty-eight mixes exhibited hydraulic conductivities less than the preliminary performance criteria.
- Fifteen mixes exceeded the preliminary unconfined compressive strength performance criteria at the end of the 28-day testing period.
- Fifteen mixes met the minimum preliminary performance criteria for both hydraulic conductivity and unconfined compressive strength.

For additional information, refer to the *Feasibility Study Geotechnical Data Evaluation Report* (Anchor QEA 2020a) and Section 2.1.2.2.2 of Appendix A.

[29] Using the method presented in Table 5-3 that was used to estimate the total sediment volume in all of East Branch with observations of NAPL (i.e., based on a length-weighted average of all sediment core sample intervals with and without NAPL observations), the estimated volume of sediment in the Western Beef Slip with observations of NAPL is approximately 3,600 cy. There is a significant amount of uncertainty around this estimate, given the intermittent and discontinuous nature of NAPL in the sediment, as well as the fact that shake tests were performed at discrete depths but used to represent the thickness of the corresponding visual observation interval.

For the purposes of this FFS, it was assumed that areas of ISS would be advanced to a depth equal to 2 feet below the sediment-native material interface. It was also assumed that a dosage of 20% Portland cement (by wet weight of sediment) would be effective based on the bench-scale treatability testing performed as part of the Feasibility Study Field Program to evaluate proof of concept of ISS (Anchor QEA 2020a). These details would be reviewed and refined on a location-specific basis during the RD phase.

Because the addition of an amendment during the ISS process would cause the sediment surface to swell, some amount of post-ISS dredging within the ISS areas to achieve target post-remedial elevations is likely to be necessary. For the purposes of this FFS, it was assumed that the sediments treated via ISS would experience a 20% volumetric swell, based on experience from upland and in-water ISS projects. In addition, as discussed in Section 4.1.5, ISS may need to be coupled with a post-ISS cap if diffusive flux of dissolved phase COCs (likely at a reduced rate) is anticipated to continue from the stabilized monolith at a rate that would impact the alternative's ability to meet RAOs.

For the purposes of this FFS, dredging of the entire swell volume was conservatively assumed within each ISS area followed by placement of a post-ISS cap.[30] The post-ISS cap was assumed to have the same construction as the caps detailed in Section 5.3.3, except for the exclusion of the NAPL sorption layer (because any NAPL within the sediment would be effectively stabilized through the ISS process). Figure C5-2 presents depictions of post-ISS caps for various depth scenarios.

Additional laboratory treatability studies would be performed during the RD phase to aid in determining the specific details of the ISS design and the need for a cap on top of the stabilized monolith to attenuate diffusive flux of dissolved phase COCs. In addition, the RD analysis would consider the bearing capacity of the existing sediments to support the ISS monolith and potential strain-related cracking of the ISS monolith due to differential settlement and/or effects from ISS implementation on slopes.

Although groundwater seepage rates in East Branch are relatively low compared to other portions of the Study Area with predominantly positive seepage (groundwater discharging to the creek) (Anchor QEA 2023a), if ISS is included as part of the remedy, groundwater would still flow around the ISS-treated zones and discharge at other portions of East Branch. The low groundwater seepage rate in East Branch is potentially related to the upland areas surrounding East Branch, including those adjacent to ISS areas (including the NAPL treatment evaluation area in the Western Beef Slip for Alternatives EB-B through EB-E and other shoreline stabilization areas), which are extensively covered with impervious surfaces (buildings and pavement) that limit groundwater recharge. Although the final identification of ISS areas will be determined during the RD following the PDI, the cumulative coverage is expected to

[30] Some amount of additional dredging was assumed for each alternative to facilitate post-ISS cap placement. For Alternative EB-B, it was assumed that sediments would be dredged where necessary to allow for placement of a post-ISS cap to be installed entirely at (or below) an elevation of 0 foot MLLW. For all other alternatives, it was assumed that sediment would be dredged to a depth equal to the post-ISS cap thickness.

be a small fraction of the total area of East Branch, leaving the majority of East Branch available for groundwater discharge. Although it is not expected that ISS would adversely affect groundwater flows, the RD will evaluate the potential influence of ISS on groundwater.

5.3.6 Ex Situ Treatment

As discussed in Section 5.3.2.2, dredged sediment would be loaded into barges and transported to a regional upland sediment management facility where processing operations would be performed. It is expected that dredged sediment would be dewatered through gravity drainage of stockpiles (with collection and treatment of effluent) and require some mechanical mixing to incorporate a stabilization/solidification agent (e.g., Portland cement, quicklime, or fly ash) to pass paint filter testing and disposal facility requirements by reducing the moisture content as well as reducing the mobility of chemical constituents (i.e., ex situ treatment), if necessary. Mixing would likely be performed using conventional earthmoving equipment (e.g., excavator) within designated lined mixing bins bordered by concrete bin blocks. For the purposes of this FFS, it was assumed the dredged sediments would be treated by mixing in 10% quicklime (by dry weight). This assumption is based on results of benchtop testing performed as part of the Sediment Characterization Study conducted for OU3 (Anchor QEA 2020b).

5.3.7 Construction-Phase Monitoring and Verification

Construction-phase environmental monitoring would be performed to assess and mitigate potential impacts during remedy construction. This program would involve monitoring of various parameters during the implementation, potentially including monitoring impacts to local biota, turbidity monitoring, visual monitoring for sheens, and other water quality criteria.

In addition to environmental monitoring, monitoring would be performed and data collected to verify that the remedy implementation is consistent with the RD. During and directly after construction, physical monitoring of completed work (e.g., cap construction coverage and thickness, dredging depths, backfill placement, and other elements of the design) would be performed to verify adherence to design specifications. This monitoring could be performed in multiple ways, including bathymetric surveys, diver inspections, and verification sampling. Completed construction verification monitoring and surveys would be documented in the construction completion report.

5.3.8 Baseline and Long-Term Remedy Evaluation Monitoring

Short- and long-term monitoring would be necessary to assess the quality of implementation and completeness, and the effectiveness of each alternative with active remediation.

Baseline monitoring would be conducted prior to remedy implementation to identify existing environmental parameters that also could be used as additional reference data throughout construction and long-term monitoring. Baseline monitoring does not include the same quantity of parameters and spatial extents as those during development of a CSM in the RI and FS. Rather, these prior studies would be used to develop a select list of areas and parameters for baseline monitoring. This baseline monitoring would differ from the PDI sampling that will be performed to collect data necessary to support the RD. A monitoring plan to determine baseline monitoring conditions will be developed in consultation with USEPA.

Operations, maintenance, and monitoring (OMM) refers to any monitoring and maintenance required after the remedy is implemented.[31] OMM may refer to near-term monitoring and repair of shoreline areas or marine facilities damaged because of remedy implementation. This may also include monitoring through site surveys or inspection (e.g., monitoring cap placement areas for damage and disturbance, and establishment of benthic communities). If shoreline restoration or other improvements are implemented that involve plantings or habitat elements, OMM could include monitoring of initial plantings and maintenance or repair to planting areas that may have experienced insufficient growth.

Long-term evaluation monitoring (after the remedy implementation) was assumed as a necessary part of each active alternative (i.e., not including the no action alternative) and would include East Branch-wide monitoring of the remedy to assess the general status and performance of the remedy and achievement of RAOs. Depending on the full scope of selected technologies, technology-specific long-term monitoring may be necessary to monitor remedy achievement of RAOs over time. The objectives and general framework that will be used for monitoring remedy performance as part of the East Branch EA are documented in Section 5.3.8.1. The exact long-term evaluation monitoring needs would be determined based on the selected remedy following completion of this FFS and in consultation with USEPA. Long-term maintenance was also assumed for all alternatives that include in situ containment via capping to account for potential impacts to caps (via erosive forces, physical impacts, or other unforeseen means) in the years following construction, as described in Appendix F.

5.3.8.1 Long-Term Evaluation Monitoring Objectives

The primary objective of the long-term evaluation monitoring program will be to document that the remedial action is functioning as designed (e.g., in the case of a sediment cap, that contaminant fluxes through the chemical isolation layer[s] of the cap are not producing concentrations that exceed established thresholds [such as risk-based PRGs] at its surface and that physical forces are not damaging the erosion protection layer of the cap). However, monitoring to achieve this objective is confounded by the presence of ongoing external sources of COCs and associated ongoing sedimentation that will result in detectable concentrations of COCs to accumulate atop the clean sediment surface created by the selected remedy. As such, the monitoring program will need to include elements that permit differentiation of remedy performance (bottom-up transport of COCs)

[31] OMM is a generally recognized acronym, but there are no “operations” anticipated as part of the remedial technologies assumed in this FFS, other than those at an off-site commercial landfill.

from ongoing sources (top-down transport of COCs). To that end, it is anticipated that the long-term monitoring program will need to incorporate a combination of methods, and a multiple-lines-of-evidence approach will need to be taken in interpreting the data to evaluate remedy performance and parse out the effects of ongoing external sources of COCs. Specific aspects of the monitoring program are anticipated to include the following:

- **Monitoring Methods and Media to Be Sampled:** Monitoring methods and media may include, but not be limited to, underwater inspections for physical damage to the cap and the presence of benthic communities, sediment core sampling, surface sediment sampling, sediment trap sampling, surface water sampling, porewater sampling, seep sampling, and monitoring of site bathymetry and topography.
    1. As stated previously, it is anticipated that a combination of several of these methods will be used to understand remedy performance independent of recontamination of surface sediment due to ongoing external sources. For example, sampling of surface sediment would need to be accompanied by sampling of deeper sediment and/or porewater to understand the potential for surface sediment recontamination via transport from below a cap, as well as potential sampling of depositing particulate matter to understand the contributions to recontamination (i.e., increased COC concentrations) from external sources.
    2. The sampling methods used to monitor a specific medium could vary spatially depending on the remedial technologies used (e.g., different methods could be used in dredge-to-native areas versus amended cap on sediment areas, and across different cap types); sampling below a sediment cap with heavy armor stone can be challenging.
- **Frequency of Sampling:** The monitoring program will also include a temporal component. Some types of sampling would be initiated prior to remedy construction (e.g., during RD) to provide a pre-remedy baseline as a point of comparison. Following that, periodic and episodic sampling would be implemented to allow conditions to be tracked over time and to establish temporal trends. This would likely include routine sampling at a set frequency, as well as event-triggered sampling (e.g., sampling triggered by a large storm event or a potential physical event such as a vessel running aground).
    1. Sampling frequency would likely be greater right after construction and then decrease over time (e.g., monitoring in Years 1, 2, 3, 5, and 10 after construction).
    2. Sampling frequency may differ by type of sampling/media type based on rates of expected change. For example, due to ongoing deposition from external sources, COC concentrations in surface sediment may be expected to change more rapidly than COC concentrations in porewater a few feet beneath the cap surface.
- **Spatial Density of Sampling:** The spatial sampling density should be determined through a data quality objectives process by considering the type and quantity of data needed to

evaluate remedy performance and effectiveness. The spatial sampling density will likely vary by medium and type of sampling; examples are as follows:

1. Data on cap surface elevation changes may be collected at a high resolution using multibeam surveys.
2. Surface sediment sampling density likely could be designed based on some type of statistical power analysis, considering that the concentrations would be compared against some target threshold values (see below).
3. The density of sediment core sampling or vertical porewater profile sampling might be less than that of surface sampling and limited to a subset of indicator locations (based on data from RI/FS and PDI sampling, for example).

- **Triggers/Metrics for Taking Further Action:** Consistent with an adaptive management approach, the long-term monitoring program work plan will establish comparative metrics against which each type of sampling data would be compared to establish whether that line of evidence confirms the remedy is functioning as designed. Additionally, triggers for future response actions would be identified by USEPA for cases in which the data are inconclusive or suggest that there could be a remedy performance issue. The metrics and triggers would differ depending on the type of sampling; examples are as follows:
  1. For physical sampling to confirm a cap is intact, metrics could be based on some percentage of cap area over which data suggest there was a loss of material. Triggered actions might include additional rounds and types of physical monitoring to investigate the area(s) where potential material loss was identified and then potentially followed by cap material replacement or repair if conditions are substantiated by the additional sampling.
  2. As a key metric for chemical monitoring, COC concentrations for new surface sediment deposited atop (or mixed with) the post-remedy surface will be compared to expected recontamination levels as predicted by the LTE model (as well as risk-based PRGs as a long-term goal). These comparisons will need to acknowledge differences in spatial scale because predictions from the LTE model are on a reach-average basis.

The full details of the long-term monitoring program will be documented in a work plan developed during RD.

5.3.9 Additional Implementation Details

Additional considerations needed to support the implementation of the remedial alternatives include, but are not limited to, the following:

- **Support Facilities and Monitoring:** Each alternative, except Alternative EB-A, would include the construction of support facilities, mobilization/demobilization operations, utility coordination, installation of resuspension controls, implementation of construction phase environmental and construction verification monitoring (as discussed in Section 5.3.7), and construction management oversight activities. Appropriate data quality objectives for the environmental monitoring program would be developed during the RD phase of the project.

- **PDI:** PDI data would be required to further refine specific aspects of the selected remedial alternative. Data needs would be evaluated at the outset of the RD phase but are expected to include collection of chemical and geotechnical data (including in the creek and along adjacent shorelines) to support dredge design, cap design, and shoreline stability evaluation; physical and geotechnical properties, including debris characterization, to support sediment management (i.e., sediment handling and dewatering); additional waste characterization data to support decisions on disposal options (including potential TSCA disposal) or BU; and possibly additional sediment COC data (e.g., to refine the remedial footprints and depths of various technologies within East Branch) and porewater and groundwater COC data (to refine cap designs). The PDI will also include additional data collection to further investigate NAPL mobility. If sheens are observed within native material during the PDI, they would be further investigated, including through sampling and analysis to estimate COC fluxes from the native material in these areas. The PDI will also include investigation (e.g., seep sampling) to inform a decision on the need for upland source control (e.g., sealed bulkheads).
- **Remedial Design:** The RD for the East Branch EA would be developed in a phased approach (e.g., preliminary, intermediate, and final design, or some combination thereof), incorporating specifications and drawings. Location-specific conditions (e.g., the presence of utilities and structures, or the condition of shoreline features including bulkheads) may limit or prohibit certain activities that are part of the selected alternative. Therefore, alternatives may include localized refinements to accommodate these features while maintaining the original intent of the alternative. These refinements may include offsets from structures or utilities (to avoid potential impacts or disturbances to existing utilities), use of ISS, or placement of a nearshore cap alone or in combination with dredging.
- **Construction Sequence:** Remedial activities would be conducted in a coordinated, sequential manner. Dredging operations would be separated from backfill or cap placement operations to mitigate recontamination potential. Debris is anticipated to be removed concurrently with sediment. Design refinements around utility corridors, bulkheads, and other structures would be further evaluated and developed during the RD phase. All remedial activities would comply with biological window restrictions developed for the project.
- **Sustainability:** Consistent with USEPA's *Consideration of Greener Cleanup Activities in the Superfund Cleanup Process* (2016), opportunities to implement greener cleanup activities will be considered throughout the CERCLA process. Although not integrated directly into the remedial alternatives, opportunities to integrate BU of dredged material were retained for future consideration during the RD phase. The objective of selecting more sustainable remedies that are protective of human health and the environment is consistent with the goal of increasing sustainability in USEPA programs pursuant to the 2021 Executive Order

14057 (Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability; Biden 2021) and the *Fiscal Year 2014 – 2018 EPA Strategic Plan* (USEPA 2014). Additionally, the NYSDEC Division of Environmental Remediation identifies the "Green Remediation" approach to remediating sites in DER-31 (NYSDEC 2011). DER-31 Section B (Role of Sustainability in Remedy Selection) states, "*Frequently the greatest benefit to the environment from the application of the green remediation concepts can be realized at the remedy selection phase … The consideration of sustainability in remedy selection is consistent with existing statutes, regulations and guidance*."

- **Integration with Existing Infrastructure:** Given the industrial nature of East Branch, each of the active remedial alternatives would need to address infrastructure in and around East Branch, including the following:
  - **Grand Street Bridge:** As discussed in Section 2, the Grand Street Bridge is projected by NYCDOT to be replaced starting in 2028. The plans for replacing the bridge include installation of a temporary bridge that is expected to be a fixed structure with similar clearance as the existing Grand Street Bridge, which may limit the size and type of vessels carrying remedial construction equipment that can pass underneath to the upper portion of East Branch. This is expected to have an impact on the pace of remedial construction and is considered in the detailed evaluation of alternatives (e.g., schedule and cost impacts). For the purposes of this FFS, it was assumed that the East Branch EA and bridge replacement projects would be sequenced such that remediation of the contaminated sediment would be completed within the footprint of the proposed replacement temporary bridge prior to installation and then within the footprint of the existing bridge immediately following bridge removal.
  - **Aeration System:** As discussed in Section 2.2.5 of Appendix A, NYCDEP would be required to remove the infrastructure associated with the aeration system in the creek for USEPA-required remedial activities within the creek. Therefore, the aeration system would not be expected to impact evaluation of alternatives or remedial construction, but coordination with NYCDEP would be needed to ensure the aeration system is removed before construction occurs and only replaced after construction is complete.
  - **Slopes, Bulkheads, or Other Shoreline Structures:** The shoreline of East Branch includes areas of natural and armored slopes and bulkhead walls of varying types and conditions. Given the condition of some of the shorelines, it is expected that some remedial actions could negatively impact shoreline stability. A range of stabilization measures may be applicable depending on the site-specific conditions, including limits on the means and methods of dredging (e.g., slot dredging), localized refinements to the remedy (e.g., ISS or dredging offsets with capping), and temporary or permanent structural support (e.g., bulkhead installation, repair, or replacement). Stabilization measures such as slot dredging may only be applicable in locations where the shoreline is generally stable and the dredge

depth is limited, but these measures would likely not be applicable in deeper dredge areas. Similarly, the applicability of other measures would be limited by site-specific factors including site geometry and proximity to the navigation channel. An evaluation of the shoreline stability and mitigation measures for each alternative is detailed in Appendix E.

- **CSOs and Other Outfalls:** There are approximately 39 total private and municipal outfalls[32] within East Branch, as shown in Figure C2-9 of Appendix C. This includes approximately 34 individual private outfall structures, two CSOs, two MS4s, and one major stormwater discharge outfall beneath the Grand Street Bridge. The selected remedy will need to be designed to accommodate continued use of these outfalls during and after remedy implementation. This will include protecting the outfalls from damage due to construction, as well as designing the remedy so that the outfall will not impact the effectiveness of the remedy—for instance, if caps are included in the remedy adjacent to outfalls, they need to be designed to resist scour from anticipated outfall discharges. Appendix C presents a preliminary evaluation of the necessary outfall scour protection for caps included in the remedial alternatives.

These details on approach and implementation for the common elements are assumptions for FFS purposes only. The specifications for implementation and construction of the selected remedy would be identified during RD, and means and methods for implementation would be identified by the selected contractor.

5.4 Remedial Alternative Optimization

The extensive PDI, RD, and multi-season construction phases characteristic of large engineering projects provide opportunities for optimization and refinements to the design and implementation approach as the project progresses. During the PDI, RD, or remedial action, it may be appropriate, or even necessary, to modify remedy components in localized areas. This would involve taking lessons learned or new information acquired during a project's lifespan to refine or revise the assumed GRA, technology, or process option proposed in the remedial alternatives to a more effective, implementable, or cost-efficient solution. This approach necessitates open communication among project partners and defined methods for easily implementing any refinements. Within East Branch, there are several site conditions that may require refinements during RD or remedy implementation, including the following:

- Based on analyses presented in Appendix E, preliminary shoreline/bulkhead stabilization measures were identified for each alternative. However, as more information is collected during the PDI phase, or as the condition of shorelines change, these preliminary measures may need to be refined.

[32] Outfall information is based the point source inventory process completed during the RI as documented in Section 2.1.2 of Appendix E of the RI Report (Anchor QEA 2023a). Some outfalls may be abandoned or no longer in use.

- Although the GRAs, remedial technologies, and process options were evaluated in Section 4 and representative technologies and process options were selected for each remedial alternative, more detailed evaluations during the RD phase may identify localized conditions during the PDI that may warrant use of another process option or use of another of the retained GRAs or remedial technologies.
- Utility crossings have been mapped based on site survey and available datasets such as as-built information as discussed in Section 2.2.5 of Appendix A. The RD, including items such as dredge depths or capping design, would be adjusted accordingly based on the discovery of previously unknown or undiscovered utility crossings or upon obtaining updated information on the depth and location of known utilities.
- To date, mapping of outfalls has been based on shoreline surveys and available datasets such as as-built information. As further data collection and field investigations take place, updated information on the presence, location, and depth of outfalls may need to be incorporated into the design. Outfall characteristics (such as protrusion into the waterbody and discharge rate) are important factors that could create the need for RD refinements.
- The planned Grand Street Bridge replacement may also necessitate updates to the engineering design, including (but not limited to) scour conditions, vessel use, and shoreline stability considerations.

6 Individual Analysis of Remedial Alternatives

The six East Branch remedial alternatives presented in Section 5 are evaluated in detail in accordance with 40 CFR 300.430(e)(9)(iii), using the first seven of the nine NCP evaluation criteria (two threshold and five balancing). The last two modifying criteria—state and community acceptance—will be evaluated by USEPA following release of the proposed plan and prior to issuing the ROD. The nine NCP evaluation criteria are grouped as follows:

- **Threshold Criteria:**
    1. Overall protection of human health and the environment
    2. Compliance with ARARs
- **Balancing Criteria:**
    - Long-term effectiveness and permanence
    - Reduction of toxicity, mobility, or volume through treatment
    - Short-term effectiveness
    - Implementability
    - Cost
- **Modifying Criteria:** (to be evaluated by USEPA following the release of the Proposed Plan)
    1. State acceptance
    2. Community acceptance

The following six alternatives were evaluated in detail:

- **Alternative EB-A:** No Action
- **Alternative EB-B:** Dredge to Allow Placement of a Cap Below 0 Foot MLLW
- **Alternative EB-C:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths
- **Alternative EB-D:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging
- **Alternative EB-E:** Dredge All Within Navigation Channel, Cap Outside
- **Alternative EB-F:** Dredge All

The detailed analysis of alternatives is provided in Table 6-1 with an overview of the methods used to perform the evaluation of each alternative relative to the NCP criteria provided in Section 6.1. Table 6-1 presents the detailed criteria evaluation in tabular form, so that the differences across alternatives, as discussed in Section 7, are easier to discern. The evaluation methods detailed in Section 6.1, which are applicable to each alternative, are best reviewed as supporting information to Table 6-1, which provides the entire detailed analysis.

6.1 Evaluation Methodology

This section discusses the methods that were used in the detailed evaluation of East Branch remedial alternatives, relative to the two threshold and five balancing NCP criteria.

6.1.1 Threshold Criterion 1: Overall Protection of Human Health and the Environment

This criterion evaluates an alternative's overall ability to eliminate, reduce, or control potential unacceptable exposures to hazardous substances in both the short and long term and evaluates whether an alternative provides adequate and reliable overall protection of human health and the environment. This evaluation also examines whether alternatives pose any unacceptable short-term or cross-media impacts.

The evaluation of this threshold criterion focuses on the ability of each alternative to meet the RAOs for East Branch (in Section 3.2), which are as follows:

- **Exposure-based RAOs:**
  - Reduce potential current and future human exposures to COCs from ingestion of fish and crab by preventing biota exposure to sediments in East Branch with COC concentrations above protective levels.
  - Reduce ecological exposure to site COCs in sediment by reducing the concentrations of COCs in contaminated sediment in East Branch to protective PRGs/RGs.
- **Source Control RAO:** Reduce migration of COCs related to NAPL and its constituents, and other sources of COCs within East Branch, to surface sediment and surface water to levels that are protective for human health and ecological exposure.

For the Exposure-based RAOs: Because this is an EA, and monitoring of the East Branch remedy will only last until the OU1 process is complete (at which point the OU1 ROD will include East Branch), the evaluation of these RAOs is focused mainly on the degree to which these RAOs are achieved at time zero (immediately after construction completion) and whether the remedial technologies are expected to function as intended and be effective over the long term. Each of the alternatives (except for EB-A [no action]) will create a new surface sediment layer via the placement of a clean cover and/or cap throughout East Branch. Attainment of these RAOs was determined by comparing post-construction COC concentrations in surface sediment to the risk-based PRGs presented in Section 3.4 at time zero. As evaluated in detail as part of Balancing Criterion 1 (Long-Term Effectiveness), each of the alternatives are composed of proven GRAs and remedial technologies used at other sediment sites and are expected to function as intended over the long term.[33]

Over the long term, post-construction COC concentrations in surface sediments are expected to gradually increase because of ongoing external inputs to East Branch (see Section 3.4.2). Based on current data, these external inputs may result in accumulation of LTE concentrations in surface sediments that are

[33] Although ISS has been implemented at other sediment sites with similar COCs, there is a limited record of long-term performance monitoring at sediment sites with regulatory closure. Therefore, the overall protectiveness of ISS would be subject to treatability testing during the RD phase. This testing will supplement the proof-of-concept ISS treatability testing performed as part of the FS field investigations summarized in Section 2.1.2.2.2 of Appendix A.

greater than risk-based PRGs for some COCs, under any remedial alternative. These ongoing external inputs are outside of the scope of the EA, and long-term monitoring will be designed to confirm the remedy is functioning as intended while also understanding the impacts of these ongoing sources.

For the Source Control RAO: Determination of attainment for this RAO was performed by evaluating each alternative's ability to reduce potential migration of COCs related to NAPL and its constituents and other COC sources within East Branch from subsurface sediment to surface sediment and surface water.

Important context when evaluating this RAO is that within East Branch, NAPL was not observed in surface sediment or native material. Where NAPL was observed in subsurface sediment, observations were intermittent (i.e., located sporadically throughout an area and not clustered at a particular location) and hence characterized as residual quantities (i.e., blebs). NAPL mobility testing demonstrated that NAPL at the East Branch locations tested is immobile and incapable of migrating upward by advection under reasonably foreseeable field conditions (see Section 2.5.1.4 of Appendix A). In addition, the NAPL mobility is not expected to change because of the change in overburden pressure resulting from capping included in the range of remedial alternatives (see Section 3.2.3 of Appendix C). The only remaining potential mechanism for NAPL transport is gas ebullition-facilitated transport (see Section 3.2.4 of Appendix C). Also, like high-concentration contaminant sources in the subsurface sediment, NAPL can contribute to dissolved phase COC concentrations that can then move through the sediment into the surface sediment or water column via advection or diffusion processes. Similarly, sheens, which may be indicative of site-related contamination at elevated concentrations, were observed in more than half of the surface sediment samples and at various depths for most subsurface core locations. The attainment of the source control RAO is evaluated in detail as part of Balancing Criterion 1 (Long-Term Effectiveness) as well as the other balancing criteria.

Regarding cross-media impacts, reducing concentrations of (or exposure to) COCs in surface sediments would reduce the flux of COCs into surface water. Alternatives that change the existing water depth in East Branch (either by making it shallower or deeper) could affect water quality in Newtown Creek as it relates to non-CERCLA substances such as pathogens and dissolved oxygen. Although this is not an issue that is evaluated under CERCLA, the change in water depth of each alternative is noted in Table 6-1 to the extent that it may impact water quality as it relates to non-CERCLA substances that are evaluated under a separate regulatory program.

6.1.2 Threshold Criterion 2: Compliance with ARARs

This criterion evaluates whether the alternative attains the identified preliminary chemical-specific, action-specific, and location-specific ARARs for the East Branch EA. Tables 3-2a and 3-2b list preliminary ARARs and TBCs for the East Branch EA. If an ARAR cannot be complied with, it is potentially eligible for a waiver if the alternative provides adequate protection of human health and the environment and if the alternative meets certain circumstances as described in 40 CFR 300.430(f)(1)(ii)(c). If these criteria are met, then the alternative would comply with Threshold Criterion 2 by obtaining a waiver in lieu of compliance with the ARAR.

6.1.3 Balancing Criterion 1: Long-Term Effectiveness and Permanence

This criterion evaluates the magnitude of human health and ecological risk remaining after remedial action has been concluded and response objectives have been met (known as residual risk) and the adequacy and reliability of controls to manage that residual risk.

Several methods were used to assess the magnitude of residual risk and the adequacy and reliability of controls, each of which relates to determining attainment of the East Branch RAOs. Specific elements of this criterion which were evaluated for each alternative include the following:

- **Magnitude of Residual Risk:** Per USEPA's Contaminated Sediment Remediation Guidance (2005a), determination of residual risk incorporates multiple lines of evidence and is different for a dredging remedy versus a capping remedy. Residual risk, after the cap is in place, considers the likelihood of cap erosion or disruption exposing contaminants, the likelihood of contaminants migrating through the cap, and risks from contaminants remaining in uncapped areas. Residual risk, after the dredging or excavation is complete considers the following: 1) risk from contaminated sediment left behind outside of the dredged or excavated areas and from contaminated sediment resuspended and transported by dredging; 2) residual contamination left in place after dredging; and 3) risk posed by untreated contaminants and treatment residuals at their disposal location. Specific to the active remedial alternatives (EB-B through EB-F), it is important to recognize that each of them was developed to include active remediation over the entire footprint of East Branch via either dredging, capping, and/or in situ treatment (e.g., amended cap and ISS). Therefore, although volumes of sediment exceeding risk-based PRGs or with observations of NAPL or sheen are considered as potentially contributing to residual risk in the evaluation, the volume of contamination left in place does not correlate directly to residual risk because no areas would remain un-remediated under each of the active alternatives.
  - **Post-remedy COC Concentrations in Surface Sediment:** COC concentrations in post-remedy surface sediment were compared to risk-based PRGs, as detailed in Section 3.6. Reducing concentrations (or exposure to) contaminants in surface sediments would reduce the flux of contaminants into surface water. The evaluation of this element is focused on the expected remedy performance of each alternative and does not consider impacts from ongoing external sources that are outside the scope of the CERCLA remedy. This evaluation includes consideration of post-dredge residuals and the need for a post-dredge cap or backfill layer to contain those residuals.

- **Potential Impacts from NAPL Advection:** Each alternative was evaluated to determine its ability to reduce migration of NAPL in East Branch to surface sediment and surface water to acceptable levels. As noted in Sections 2.3.4 and 2.5.1.4 of Appendix A, NAPL observed in East Branch was characterized as a residual quantity, and mobility testing demonstrated that NAPL in East Branch is immobile at the locations tested under laboratory test conditions. Changes of in situ conditions could mobilize NAPL, and the mobility of NAPL in untested areas of East Branch is unknown. Changes to in situ conditions and their potential impacts to NAPL mobility resulting from the range of remedial alternatives are presented in Section 3.2.3 of Appendix C, which concludes that NAPL would likely not be mobilized under the changed conditions (i.e., change in overburden pressure) resulting from capping.
- **Potential Contaminant Impacts from Dissolved Phase Transport of Contamination:** Sediment with high concentrations of COCs and NAPL are sources of dissolved phase contaminants that can be transported from the subsurface sediment into the surface sediment and surface water through advection and diffusion. Each alternative was evaluated to determine its ability to reduce transport of dissolved phase contaminants (from residual NAPL and other high COC concentration contaminant sources) to surface sediment and surface water. Quantities of sediment exceeding risk-based PRGs, sediment containing observations of NAPL, and/or sediment with observations of sheen left in place for each alternative and areas where contaminated sediment is left in place under a cap are summarized in Table 5-3 and are considered as part of this evaluation.
- **Potential Impacts from Gas Ebullition-facilitated Transport of NAPL:** Each alternative was evaluated to determine its ability to reduce impacts from gas ebullition-facilitated transport of NAPL to surface sediment and surface water. Quantities and areas of sediment containing observations of sheen or NAPL left in place for each alternative are summarized in Table 5-3 and are considered as part of this evaluation.
- **Potential Contamination Impacts Due to Erosion:** Each alternative was evaluated to determine its ability to reduce potential sediment contamination impacts due to propeller wash or hydrodynamic forces. Quantities of sediment and areas exceeding risk-based PRGs and/or with observations of NAPL or sheen left in place for each alternative are summarized in Table 5-3 and are considered as part of this evaluation.

- **Adequacy and Reliability of Controls:**
  - **Potential Contaminant Impacts from Contaminated Groundwater in Native Material:** Although contaminated groundwater is an external source, each alternative was evaluated to determine its ability to reduce the migration of dissolved COC fluxes from native material to sediment and surface water.
  - **Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** The ability of controls to adequately and reliably manage residual risks was evaluated based on the IC program assumed for each alternative, as well as

assessments of backfilling, capping and in situ treatment, and dredged material management from Section 4.2. The evaluation also considered each alternative's requirements for (and degree of) long-term monitoring and maintenance activities, the potential need for replacing or modifying remedial technology or process option components of an alternative, the magnitude of risk and potential pathways for exposure should an alternative fail, and the degree of confidence that adequate and reliable controls have been identified to prevent remedy failure.

6.1.4 Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. Additionally, this criterion evaluates the degree to which an alternative would use treatment to reduce the principal threats in East Branch through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media. Consistent with USEPA's RI/FS guidance (USEPA 1998), this criterion was evaluated based on the following specific factors:

- The treatment processes the remedy will employ and the materials they will treat
- The degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction (or an order of magnitude)
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment
- Whether each alternative would satisfy the statutory preference for treatment as a principal element

These factors are assessed by calculating the acreage and volume of contaminated sediment addressed for each alternative by both in situ and ex situ treatment. Additional discussion relative to each factor is included as part of the common elements for this Balancing Criterion in Table 6-1. Each of the active alternatives include treatment of contaminated sediment over the entirety of East Branch. As discussed in Section 3.5, no PTW has been identified in East Branch based on investigations to date.

6.1.5 Balancing Criterion 3: Short-Term Effectiveness

This criterion evaluates the short-term impacts and potentially unacceptable risks to human health and the environment related to construction and implementation of each alternative and considers the duration of time until remedial response objectives are achieved.

Short-term impacts for each remedial alternative were evaluated in accordance with the NCP short-term factors: potential impacts to the community, the environment, and remediation workers.

Short-term effects were evaluated qualitatively based on the magnitude of dredging and/or cap placement, as well as the duration of the remedial construction, which are discussed in Section 5 of Appendix F. The construction durations estimated for the FFS include consideration of the time necessary to implement shoreline stabilization measures but do not include the anticipated prolonged period of property owner negotiations, investigations, and design for the shoreline stabilization, which cannot be reasonably estimated at this time. These impacts are expected to be generally proportional to the extent and duration of remedy construction, as well as the extent of remediation adjacent to waterfront-dependent properties that utilize marine navigation.

The evaluation of short-term effectiveness considered the following:

- **Time to Meet RAOs:** It is assumed that all active alternatives (EB-B through EB-F) would achieve the RAOs immediately following construction, so the evaluation of this criterion is based on construction duration.
- **Impacts to the Community:** The short-term impacts on the community could occur through potential impacts to "quality of life" during the construction phase of each alternative. Quality of life generally refers to the human use environment and the potential for each alternative to impact aesthetics, odor and dust, traffic, noise, industrial and recreational navigation (although there are no water-dependent properties in East Branch), and traffic on area roads, which increases traffic congestion and the risk for vehicular accidents. Typically, alternatives with larger volumes of dredging and capping (and, therefore, longer construction durations) have larger potential impacts on quality of life for industrial properties adjacent to East Branch and the local community. In addition, alternatives that include shoreline stabilization (notably in areas of dredging adjacent to unstable shorelines or sensitive structures and slopes) have the potential for impacts to the community related to increased levels of noise and vibration and impacts to aesthetics, as well as restrictions to vessel traffic. Note that impacts to the community will occur beyond the industrial community adjacent to East Branch. Impacts to the greater community will occur due to increased vehicle traffic on area roads from trucks and construction personnel as well as air quality and noise impacts. The community located adjacent to the off-site sediment processing facility will also experience increased impacts to air quality, noise, and vehicular traffic. Measures to minimize and mitigate impacts to the industrial businesses adjacent to East Branch and the greater community would be addressed in construction health and safety plans and by using engineering controls and BMPs as detailed in Table 6-1.
- **Impacts to the Environment:** The short-term effects on the environment resulting from implementation of active remediation include potential impacts to the water column, air, and biota resulting from dredging-induced releases and sediment resuspension and/or the alteration or destruction of benthic communities and/or habitat by dredging. Dredging operations are expected to result in sediment resuspension and release. Placement of cap and sand backfilling materials may result in a short-term increase in turbidity within or outside of the

placement area. Shoreline stabilization is expected to have the potential for a higher amount of resuspension and release of COCs during implementation, and ISS implementation may also cause short-term environmental impacts, including potential COC releases to surface water and increases in turbidity. Measures to minimize and mitigate impacts to the environment would be addressed by using engineering controls and BMPs as detailed in Table 6-1.

- **Impacts to Remediation Workers:** Potentially unacceptable occupational risks to remediation workers are from direct contact, ingestion, and inhalation of COCs from the surface water and sediments, as well as routine physical hazards associated with construction work and working near and on water. These risks were evaluated qualitatively based on the duration of remedial construction, which is a function of the magnitude of sediment removal and placement of cap material. Measures to minimize and mitigate such risks would be addressed in worker health and safety plans, by following Occupational Safety and Health Administration (OSHA)-approved health and safety procedures, and by using BMPs and engineering controls detailed in Table 6-1.

6.1.6 Balancing Criterion 4: Implementability

This criterion evaluates the ease or difficulty of implementing the remedial technology or process option by considering technical feasibility, administrative feasibility, and availability of services and material required for implementation.

The amount of dredging and capping for each alternative directly correlates to the duration of construction. In general, alternatives with a longer construction duration or more construction seasons would be more challenging to implement than those with a shorter duration when using similar remedial technologies. Therefore, construction duration is an indicator of the relative implementability of the alternatives. In addition to construction duration, proximity of dredging and capping activities to shorelines (and conditions of those shorelines) and the depth of dredging in those locations was also considered; alternatives that require larger amounts of shoreline stabilization (e.g., ISS, bulkhead stabilization, replacement, or new installation) would be more difficult to implement and will extend the duration of the remediation.

Specific details related to the evaluation of the technical and administrative implementability and the availability of services and materials to implement the remedial components of the alternatives considered in this FFS are:

- **Technical Feasibility:** The technical feasibility evaluation includes assessment of the ability of the technology or process option to effectively be implemented to meet the requirements of the remedy based on East Branch conditions and the reliability of the technology. Technical feasibility includes the following factors:

- **Construction and Operation:** This factor was evaluated by assessing whether the remedial technologies can be implemented and reliably operated using well-established methods until a remedial action is complete. It also relates to the technical difficulties and unknowns with constructing and operating a remedial technology. In addition, this criterion was evaluated with consideration of other components and factors that are ancillary to the remedial technologies (e.g., shoreline/bulkhead stabilization measures and coordination with other waterway construction projects and infrastructure).
- **Reliability of the Technologies:** This factor considers the reliability of the various remedial components that compose the remedial alternative.
- **Ease of Undertaking Additional Remedial Action:** This includes consideration of what, if any, future additional remedial actions may need to be undertaken and how difficult it would be to implement such additional actions.
- **Ability to Monitor the Effectiveness of the Remedy:** This factor considers the ability to monitor the effectiveness of the remedy in relation to the East Branch RAOs.

- **Administrative Implementability:** Administrative implementability elements include the following:
  - **Regulatory Requirements:** Implementation of any of the active alternatives would require permits for off-site actions. In this case, the only off-site actions would be the processing of dredged materials at an off-site upland sediment management facility. For on-site actions, it would also require coordination with (or review by) other agencies and meeting substantive requirements of ARARs as part of the ARARs evaluation process.
  - **Access Agreements:** Investigation, design, and construction of bulkhead stabilization and replacement measures would require access agreements with each affected property owner and are anticipated to require significant time (several years) for each property. In addition, implementation of any of the active alternatives would require the lease of a property to provide for a staging area to support the remedial activities and other access needs. The support area would ideally have waterfront access and be located in close proximity to East Branch. For the purposes of this FFS, a preliminary evaluation was performed to identify underused parcels along Newtown Creek, and it is assumed that one or more of the identified underused parcels could be used as the upland staging area.
  - **Coordination with Agencies:** Implementation of any of the active alternatives would require the development of detailed ICs that are effectively integrated into the overall remedy. This can be a relatively complex process. However, consistent with the *East Branch Early Action Focused Feasibility Study Alternatives Memorandum* (Anchor QEA 2023b), the ICs included with the alternatives would necessarily be focused on the ICs that can be instituted prior to EA completion and that are needed to protect the East Branch EA constructed components (e.g., waterway use restrictions, land use restrictions, and

government controls related to bulkhead/creek shoreline development). These would be determined during RD and are not expected to be differentiators between alternatives.

- **Availability of Services and Materials:** This criterion evaluates the availability of services and materials needed to implement each alternative, including the availability of adequate off-site treatment, storage capacity, and disposal services; the availability of necessary equipment and specialists; and provisions to ensure the availability of any necessary additional resources, the availability of prospective technologies, and the potential for obtaining competitive bids from contractors.

6.1.7 Balancing Criterion 5: Cost

For this criterion, cost ranges were estimated and presented for each alternative consistent with USEPA guidance (USEPA 2000). In accordance with NCP guidance, capital costs—including construction and professional/technical services costs, evaluation monitoring costs (i.e., cap maintenance and long-term monitoring over 10 years), and net present value (NPV) of capital and evaluation monitoring component costs—are included in the estimates. NPV costs assume a 7% discount factor, consistent with USEPA guidance (USEPA 2000).

Estimated annual monitoring costs include costs for the first 10 years of the evaluation monitoring within East Branch. A 10-year monitoring program is assumed for this EA because future monitoring is expected to be folded into the OU1 FS and ROD.

A 30% contingency factor has been applied to all cost estimates to reflect the level of uncertainty in the scope of work and future bidding, as described in Appendix F.

7 Comparative Analysis of Early Action Alternatives for East Branch

Section 6 and Table 6-1 present a detailed analysis of each of the remedial alternatives developed for the East Branch EA against seven of the nine NCP evaluation criteria. In addition, three remedial technologies (amended capping, ISS, and dredging) were evaluated as remedial technology options for treating sediment with NAPL or PTW (if either were to be identified during the PDI). The results of those analyses are used in this section to compare the relative advantages and disadvantages of the alternatives, consistent with USEPA (1988, 2005a) guidance. Section 7 is structured to compare each of the seven NCP criteria across the six alternatives.

To be able to understand the differences more easily between the alternatives, the comparative analysis is summarized in Tables 7-1 and 7-2 and Section 7.8. Sections 7.1 through 7.7 provide a comparative analysis for each of the first seven NCP criteria. The last two modifying criteria—state and community acceptance—will be evaluated by USEPA following release of the proposed plan and prior to issuing the ROD.

7.1 Threshold Criterion 1: Overall Protection of Human Health and the Environment

Alternative EB-A would not meet Threshold Criterion 1 because this alternative would not change the existing conditions in East Branch, except for those changes that result from natural recovery processes that may be ongoing (however, there is a relative lack of existing data to assess natural recovery rates in East Branch), and there would be no monitoring to confirm that RAOs would be met.

Each of the active alternatives (Alternatives EB-B through EB-F) would meet the exposure-based RAOs by reducing surface sediment COC concentrations to "near-zero" immediately after remedy construction by creating a new surface sediment layer through a combination of dredging, capping or backfilling, and in situ treatment. Therefore, risk-based PRGs would be met following remedy construction at time zero for each of the alternatives. Each of the alternatives is composed of proven GRAs and remedial technologies used at other sediment sites[34] and is expected to function as intended over the long term.

Over the long term, post-construction COC concentrations in surface sediment are expected to gradually increase because of ongoing external inputs to East Branch (see Section 3.4.2). Based on current data and the LTE model (Anchor QEA 2024), these external inputs may result in LTE concentrations in surface sediments that are greater than risk-based PRGs for some COCs, under any remedial alternative. These ongoing external inputs are outside of the scope of the EA, and long-term

[34] Although ISS has been implemented at other sediment sites with similar COCs, there is a limited record of long-term performance monitoring at sediment sites with regulatory closure.

monitoring will be designed to confirm the remedy is functioning as intended while also understanding the impacts of these ongoing external sources.

Each of the alternatives (Alternatives EB-B through EB-F) would also meet the source control RAO by reducing the migration of COCs and NAPL to surface sediment and surface water through a combination of dredging, capping or backfilling, and in situ treatment. Reducing concentrations of (or exposure to) contaminants in surface sediments would reduce the flux of COCs into surface water.

Regarding cross-media impacts, each of the active alternatives would reduce the flux of COCs to surface water by reducing concentrations of (or exposure to) COCs in surface sediments. Alternatives that change the existing water depth in East Branch (either by making it shallower or deeper) could also affect water quality in Newtown Creek as it relates to non-CERCLA substances such as pathogens and dissolved oxygen, which are evaluated under a separate regulatory authority. Alternative EB-B would result in water depths that are shallower than existing, whereas Alternatives EB-E and EB-F would result in deeper water depths on average. Only Alternatives EB-C and EB-D would not change the existing water depth of East Branch.

7.2 Threshold Criterion 2: Compliance with Applicable or Relevant and Appropriate Requirements

There are no ARARs for Alternative EB-A because there is no CERCLA-related action performed. Alternatives EB-B through EB-F would be designed to comply with the substantive requirements of the potential ARARs for the East Branch EA as listed in Table 3-2a; therefore, each of the active remedial alternatives is expected to meet Threshold Criterion 2 and perform similarly with respect to this criterion.

7.3 Balancing Criterion 1: Long-Term Effectiveness and Permanence

Table 7-1 contains a tabular and quantitative summary of the various evaluations relative to the two NCP factors included in this criterion, including a summary of the quantities of material left in place after remedial action and the areas of capping or backfill. A narrative summary of the comparative analyses of the alternatives relative to the two NCP factors included in this criterion are presented as follows:

Magnitude of Residual Risk:

- **Post-remedy COC Concentrations in Surface Sediment:**
  - There would be no active remediation under Alternative EB-A, so COC concentrations in the surface sediments would only be reduced based on the process of natural recovery that may be ongoing in East Branch (however, there is a relative lack of existing data to assess natural recovery rates in East Branch), as discussed in Section 2.5.3 of Appendix A. However, it would likely take several decades to meet currently estimated LTE concentrations, and they would not be verified under Alternative EB-A because no monitoring would be performed.

- Each of the active alternatives (EA-B through EA-F) would perform similarly. COC concentrations in surface sediment would be expected to be near-zero immediately after construction because the entire surface area of sediment in East Branch would be remediated through a combination of dredging, capping, backfilling, and/or in situ treatment (e.g., amended capping and ISS). This means that COC concentrations in surface sediments would be below risk-based PRGs immediately after remedy construction.
    - Alternatives EB-B and EB-C include capping over the entirety of East Branch (11.2 acres).
    - For Alternatives EB-D, EB-E, and EB-F, each of these alternatives includes a decreasing amount of capping corresponding with an increase in area where all sediment would be removed to native material. In these areas, it is likely that some amount of post-dredge residuals that exceed risk-based PRGs will remain (Patmont et al. 2018). Therefore, post-dredge residuals management (with sand backfill) would be necessary to manage residual risks in surface sediments over 1.2 acres in Alternative EB-D, 3.1 acres in Alternative EB-E, and 4.4 acres in Alternative EB-F. Note that Alternatives EB-D, EB-E, and EB-F still also include capping in areas where sediment is removed to the native material interface in areas of relatively high groundwater flux.
- Post-remedy, ongoing sources that are outside the scope of the East Branch EA will continue to contribute loadings of COCs to both surface water and surface sediment. These ongoing loads from external sources would cause post-remedy surface sediment COC concentrations in East Branch to increase from the near-zero concentrations until the system reaches an LTE condition (see Section 3.4). Current estimates of LTE concentrations for certain COCs indicate that LTE concentrations within East Branch may, over time, be greater than some risk-based PRGs (specifically D/F TEQ and C19-C36 and potentially TPCB), regardless of the remedy selected due to ongoing external inputs. Therefore, additional source control outside the scope of the East Branch EA would likely be necessary to meet the long-term risk-based PRGs.
- Moreover, post-remedy monitoring for any alternative will need to distinguish between the potential for COC flux from beneath the cover/cap and accumulation of COCs on the surface sediments from external sources to assess long-term effectiveness and permanence of the selected remedy.

- **Potential Impacts from NAPL Advection, Dissolved Phase Transport of Contamination, Gas Ebullition-facilitated Transport of NAPL, and Erosion:**
    - Alternative EB-A would not provide additional protection for these factors above current conditions.
    - All active alternatives would perform similarly through a combination of dredging, capping, and/or in situ treatment (e.g., amended cap and ISS).

- As detailed in Table 7-1, each of the alternatives with active remediation (EB-B through EB-F) would successively remove increasing volumes of sediment and sediment with observations of NAPL via dredging, leaving less sediment containing COCs and observations of NAPL in place that could pose residual risk. Alternative EB-F would target removal of all sediment (although some post-dredge residuals would be expected) except within ISS areas identified for shoreline stabilization. Alternative EB-B would remove the least sediment, with remaining sediment to be contained by capping over the entirety of East Branch. Alternative EB-B would leave approximately 85% of the volume of contaminated sediment in East Branch in place to be contained by capping and in situ treatment, Alternatives EB-C and EB-D would leave approximately 50% to 60% of the volume of contaminated sediment in place, and Alternative EB-E would leave approximately 13% of the volume of contaminated sediment in place. As noted previously, Alternative EB-F would remove nearly all sediment, leaving only approximately 3% of the volume of contaminated sediment in place. However, the volume of contamination left in place does not correlate directly to residual risk (USEPA 2005a) because the potential for exposure is what matters. Technologies for controlling the residual risk are included in each alternative and the adequacy and reliability of those controls is discussed below.
- Caps would physically and chemically isolate remaining sediment left in place (including those containing observations of NAPL) and would be designed to control dissolved phase flux of COCs, reduce impacts from gas ebullition-facilitated transport of NAPL, and resist erosion. Long-term monitoring and maintenance of caps would be performed to verify their long-term effectiveness and permanence. Caps would be placed over the entirety of East Branch (11.2 acres) for Alternatives EB-B and EB-C. For Alternatives EB-D and EB-E, caps would be placed in areas where dredging has not removed all sediment, with Alternative EB-D including 9.7 acres of capping over contaminated sediment and Alternative EB-E including 2.8 acres of capping over contaminated sediment. A cap would also be needed in Alternatives EB-D, EB-E, and EB-F, even in some areas of removal of all sediment down to the native material interface, to control potential contaminant impacts from groundwater advection where the flux of COCs from groundwater is relatively high. These caps over native material would be limited in extent under Alternative EB-D (0.3 acre) but would be significantly larger under Alternatives EB-E (5.3 acres) and EB-F (6.6 acres).

Adequacy and Reliability of Controls:

- **Potential Contaminant Impacts from Contaminated Groundwater in Native Material:**
  - Although contaminated groundwater is an external source and does not directly correlate with residual risk, all alternatives would control contaminated groundwater in native material either with attenuation in existing subsurface sediments or with backfill or an amended cap.
- **Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:**
  - Alternative EB-A does not include any remedial action or monitoring, so it would leave contaminants in place. Existing ICs would continue under Alternative EB-A but by themselves would not be effective at controlling risks from those contaminants.
  - As detailed in Tables 6-1 and 7-1 and discussed previously in this section as part of residual risk, each of the alternatives would successively remove increasing volumes of sediment and NAPL (EB-B through EB-F) via dredging, leaving less sediment containing COCs and NAPL in place that could pose residual risk. Alternative EB-F would target removal of all sediment (although some post-dredge residuals would be expected) except for limited areas where ISS would be used for shoreline stabilization. Alternative EB-B would remove the least sediment, with the remaining sediment to be contained by caps.
  - Each of the active alternatives (EB-B through EB-F) would adequately and reliably control COCs that remain in subsurface sediment through a combination of capping and/or in situ treatment (e.g., amended capping and ISS).
    - **Capping:** Capping to manage any risks that are part of the active remedial alternatives has been used successfully at other sediment sites and would result in decreased residual risk. The caps would be monitored and maintained (if necessary) to verify long-term effectiveness.
    - **In Situ Treatment via ISS:** The effectiveness and reliability of ISS to control the residual risk would be subject to treatability testing during the RD phase and may require a post-ISS cap to adequately and reliably control the residual risk. The ISS monolith and any post-ISS caps would be monitored and maintained (if necessary) to verify long-term effectiveness.
  - **Dredged Material Management:** The residual risk of dredged material (i.e., sediment removed from East Branch) for all active alternatives would be controlled through ex situ treatment (via solidification/stabilization) and disposal in a permitted landfill.
  - **Sealed Bulkheads:** The adequacy of sealed bulkheads for controlling localized shoreline seeps would depend on site-specific factors to be determined during the PDI and RD phases and may need to be coupled with other upland source control measures.
  - **Evaluation Monitoring:** Evaluation monitoring would be used to assess the effectiveness of the remedy and identify the need for maintenance, which could include repair, modification, or replacement of remedial technology or process option components of the remedy. Based

on experience at similar sites, long-term maintenance of caps is expected to be limited and generally involves one-time repair events to address localized scour from unanticipated erosive forces (e.g., vessel impacts or significant storm/flow events). However, these impacts are typically minor and do not compromise the effectiveness of the remedy as a whole.

- **Adequacy of ISS as a Stand-alone Technology:** When considering all aspects of the remediation, any uncertainty regarding the long-term effectiveness related to residual risk between the alternatives is small, with the most substantive uncertainty being associated with the adequacy of ISS as a stand-alone technology; uncertainty in the adequacy of ISS as a stand-alone technology would be reduced by treatability testing during RD.

7.4 Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment

As described in Section 3.5, while PTW has not been identified to date in East Branch, additional investigations during the RD phase may identify previously unknown conditions that would be evaluated relative to the definition of PTW.

Alternative EB-A does not include any reduction of toxicity, mobility, or volume through treatment. Each of the active alternatives meet the statutory preference for treatment as a principal element by providing permanent and significant reduction of toxicity, mobility, or volume through treatment of the entire footprint of East Branch (100%), as further described in Table 7-1 and as follows for ex situ and in situ treatment:

- **Ex Situ Treatment:** Alternatives EB-B through EB-F include ex situ treatment (through stabilization of dredged material), although the amount of treatment varies by alternative relative to the volumes of sediment removed. Alternative EB-F includes the largest dredge volume, so it would provide the largest quantity of sediment receiving ex situ treatment (254,700 cy), whereas Alternative EB-B includes the smallest dredge volume, so it would provide the smallest quantity of sediment receiving ex situ treatment (32,300 cy). Alternatives EB-C, EB-D, and EB-E treat 92,300 cy, 101,000 cy, and 233,800 cy of sediment via ex-situ treatment, respectively.
- **In Situ Treatment:** Alternatives EB-B through EB-F include in situ treatment through placement of amended caps (for COCs that migrate into the amended capping layers) and ISS (for shoreline stabilization). The quantity of treatment varies by alternative relative to the volume and acreage of sediment addressed by amended cap placement and the acreage of ISS. Alternatives EB-B and EB-C include the same level of treatment through amended capping and ISS, with a larger footprint than all other alternatives (i.e., 100% of East Branch surface area), whereas Alternative EB-D includes in situ treatment over 89% of the surface area of East Branch, Alternative EB-E includes in situ treatment over 72% of the surface area of East Branch, and Alternative EB-F includes in situ treatment over 61% of the surface area of

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East Branch. Assuming that contaminated porewater would eventually migrate into the amended caps within the design lifetime of the cap and be treated, Alternative EB-B leaves the most contamination in place, and each alternative successively leaves less contamination in place, as detailed in Table 7-1. Alternatives EB-B and EB-E include the largest volume of sediment to be treated via ISS for the purpose of shoreline stabilization (26,000 cy for Alternative EB-B and 17,300 for Alternative EB-E), whereas Alternative EB-F includes the smallest volume of sediment to be treated via ISS (6,300 cy), with Alternatives EB-C and EB-D both treating 9,900 cy. A post-ISS amended cap would be placed above the ISS areas to control dissolved flux of residual COCs in the ISS monolith. Although the primary objective of the ISS in some locations is for shoreline stabilization, the ISS will still be a form of treatment because the contaminated sediments will be stabilized/solidified.

7.5 Balancing Criterion 3: Short-Term Effectiveness

Quantitative metrics relative to specific short-term impacts for the active alternatives during construction, with consideration to the duration of time until RAOs are achieved, are included as follows for comparative purposes:

- **Time to Meet RAOs.** For Alternative EB-A, there would be no monitoring to confirm that RAOs would be met, so the time is unknown. It is assumed that all active alternatives (EB-B through EB-F) would achieve the RAOs immediately following construction, so the evaluation of this criterion is based on construction duration. Alternative EB-B has the shortest construction duration so would meet the RAOs the soonest (13 months or two construction seasons), whereas Alternatives EB-C and EB-D would each take 22 months (three construction seasons), Alternative EB-E would take 37 months (five construction seasons), and Alternative EB-F would take 46 months (seven construction seasons). Times for construction are in addition to the time necessary for the PDI and RD.
- **Impacts to the Community:** Construction could result in short-term impacts to the environment and quality of life issues for the community. In general, remedial alternatives with longer construction durations would be expected to have greater quality of life impacts to the community. There are no short-term impacts from Alternative EB-A because no active work would be performed. Alternative EB-B would have fewer impacts on the quality of life in the community compared to Alternatives EB-C through EB-F due to a shorter construction duration. The estimated construction durations of each alternative, which exclude property owner negotiations,[35] are summarized as follows:
  - **Alternative EB-B:** 13 months of active construction over two construction seasons
  - **Alternative EB-C:** 22 months of active construction over three construction seasons

[35] These durations represent only remedial construction and do not include the time needed for property owner negotiations for shoreline/bulkhead assessment, design of any stabilization measures needed, agency review and approval of the design, or contractor procurement.

  - **Alternative EB-D:** 22 months of active construction over three construction seasons
  - **Alternative EB-E:** 37 months of active construction over five construction seasons
  - **Alternative EB-F:** 46 months of active construction over seven construction seasons
- **Additional Impacts to the Community:** Additional details on potential community impacts are summarized as follows:
  - Based on a qualitative comparison of current noise levels to those for similar remediation work at other sites, implementation of dredging, capping/backfilling, and ISS components of Alternatives EB-B through EB-F are not expected to increase noise above current levels near the site, due to the presence and abundance of industry currently near East Branch.
  - However, installation of sheet pile as part of the shoreline and bulkhead stabilization measures is expected to result in higher noise and vibration than ambient industrial operations. Noise and vibration may be of additional concern should nighttime work be required. The percentage of East Branch shoreline potentially needing stabilization ranges from 36% in Alternative EB-B to 76% in Alternatives EB-C and EB-D, 84% in Alternative EB-E, and 88% in Alternative EB-F, based on preliminary calculations. Bulkhead stabilization, replacement, or installation would be expected to create the most noise as well as vibrations. Lengths of shoreline potentially needing stabilization (including bulkhead stabilization, replacement, or new installation) are detailed in Table 7-1. Alternative EB-F would result in the largest short-term impacts from shoreline/bulkhead stabilization, and Alternative EB-B would result in the least short-term impacts. Alternatives EB-C, EB-D, and EB-E would have slightly fewer short-term impacts from shoreline/bulkhead stabilization than EB-F but substantially more than Alternative EB-B.
  - Development of support areas, dredging, and potential stockpiling and processing of dredge sediments in barges or at the sediment processing area could produce localized odors. Increased dust emissions could occur near material stockpile areas and locations where dredged material would be processed. These impacts would be the largest for Alternative EB-F (due to the largest dredge volume and longest duration), would be less for Alternatives EB-E, EB-D, and EB-C, and would be the least for Alternative EB-B.
  - Material transportation by truck[36] would result in temporary traffic impacts during construction of Alternatives EB-B through EB-F. These impacts would include additional traffic delays and increased risk of traffic accidents. The estimated number of truck trips and construction durations for each alternative is included in Table 7-1.
  - Commercial marine vessel traffic and recreational boating and kayaking, which is uncommon in East Branch, would be temporarily impacted by construction of Alternatives EB-B through EB-F due to remediation within the navigation channel and related shoreline stabilization activities (e.g., bulkhead stabilization, replacement, or installation). Alternative

[36] Material transport of dredged sediment by truck was assumed between the off-site sediment processing area to the final disposal location for each alternative. During the RD, other transportation options would be considered based on the infrastructure available.

EB-B would have the least impact on marine vessel traffic during remedy implementation due to the lowest number of material transport scows estimated for construction and the lowest duration of the remedial construction; Alternative EB-F would have the largest impact during implementation. The estimated number of material transport scow trips and construction duration for each alternative with active remediation is included in Table 7-1.

- BMPs, engineering controls, and other measures would be considered and implemented, as necessary, on an area-specific basis to reduce the negative short-term impacts from construction of Alternatives EB-B through EB-F, as discussed in Table 6-1.
- Construction of Alternatives EB-B through EB-F may result in potential impacts to communities surrounding Newtown Creek. Duration (as discussed in detail above) is the main differentiator because it does differ among alternatives. Therefore, Alternative EB-B would have the least impact compared to Alternatives EB-C, EB-D, EB-E, and EB-F (which would have the largest impact).

- **Impacts to the Environment:** The short-term effects on the environment are associated with resuspension, release, and residuals, which can result in potential impacts to the water column, air, and biota resulting from dredging-induced releases and resuspension; as well as the alteration or destruction of benthic communities and habitat in the areas subject to dredging activities. In addition, placement of cap and backfill materials, ISS, and shoreline stabilization activities can result in a short-term increase in turbidity within (or outside) of the placement area. Environmental monitoring during construction activities would help identify potential unfavorable impacts to the environment and is expected to include, at a minimum, water and air quality monitoring. In addition, engineering and operational controls and BMPs would be implemented during construction activities (e.g., turbidity control systems around construction activities, use of spill plates where dredged material is handled over water, and erosion and sediment control measures around upland disturbances) to reduce potential unfavorable impacts. Short-term effects would also include greenhouse gas (GHG) emissions from construction equipment, transportation, and the generation of materials and supplies).
  - There are no short-term impacts from Alternative EB-A because no active work would be performed. Alternative EB-B would result in the least short-term impact to the environment of the active alternatives because it includes the lowest volume of sediment removal over the shortest duration of time. Alternative EB-B would have fewer negative short-term impacts compared to Alternative EB-C, Alternative EB-C would have fewer short-term impacts compared to Alternative EB-D, Alternative EB-D would have fewer short-term impacts compared to Alternative EB-E, and Alternative EB-F would have the greatest short-term impact to the environment of all of the alternatives due to the largest dredge volume over the longest duration of implementation time. The removal, cap and backfill quantities, and duration of work for each of the alternatives are summarized in Table 7-1.

- Total GHG emissions during implementation were estimated[37] for the remedial alternatives with active construction, as detailed in Appendix D and summarized in Table 7-1. Alternative EB-F would result in the greatest increase in GHG emissions over current conditions (82,000 tons of carbon dioxide equivalent [CO_2e]), and Alternative EB-B would result in the smallest GHG emissions increase (17,000 tons CO_2e) of the active alternatives.

- **Impacts to Remediation Workers:** Sediment removal activities would pose potential occupational risks to workers from direct contact, ingestion, and inhalation of Study Area COCs from the surface water and sediments, as well as routine physical hazards associated with construction work and working on water. There are no short-term impacts from Alternative EB-A because no active work would be performed. Of the five alternatives with construction activities, Alternative EB-B is expected to have the lowest potential risk to remediation workers compared to Alternatives EB-C, EB-D, EB-E, and EB-F (which has the highest risk) because the total labor hours during the construction duration would be lowest for Alternative EB-B (see Table 7-1).

7.6 Balancing Criterion 4: Implementability

Alternative EB-A would not include remedial action or associated activities in East Branch, so there would be no technical or administrative implementability issues associated with this alternative.

Alternatives EB-B through EB-F have all been determined to be implementable, as detailed in Table 6-1, but alternatives with a longer construction duration are generally more challenging to implement than those with a shorter duration when using similar remedial technologies. Therefore, construction duration is an indicator of the relative implementability of the alternatives. In addition, alternatives that require more coordination/negotiation with other property owners are generally more challenging and add additional time to construction, prolonging the duration of remediation. Alternatives that involve significant amounts of shoreline/bulkhead improvements to facilitate the environmental remediation will require corresponding property owner negotiations and are expected to extend both the RD and implementation phases by years. The estimated construction durations of each alternative, which exclude the time needed for property owner negotiations,[38] are summarized as follows:

- **Alternative EB-B:** 13 months of active construction over two construction seasons
- **Alternative EB-C:** 22 months of active construction over three construction seasons
- **Alternative EB-D:** 22 months of active construction over three construction seasons
- **Alternative EB-E:** 37 months of active construction over five construction seasons
- **Alternative EB-F:** 46 months of active construction over seven construction seasons

[37] GHG emissions were estimated in general accordance with widely accepted international (WRI/WBCSD 2004; The Climate Registry 2019) and national (USEPA 2005b) GHG accounting protocols and guidance. Additional details regarding the approach and methods are discussed in Appendix D.

[38] These durations represent only remedial construction and do not include the time needed for property owner negotiations for shoreline/bulkhead assessment, design of any stabilization measures needed, agency review and approval of the design, or contractor procurement.

A comparison of each of the active alternatives is included as follows and is separated into technical feasibility and administrative implementability, as well as the availability of services and materials:

- **Technical Feasibility:** The technical feasibility evaluation includes assessment of the ability of the technology or process option to effectively be implemented to meet the requirements of the remedy based on East Branch conditions and the reliability of the technology, as follows:
  - **Construction and Operation**: Although each of the alternatives is ultimately implementable, and able to be reliability operated, there are some factors related to remediation near shorelines that should be discussed. The conditions of shorelines and bulkheads adjacent to remediation areas would require some stabilization measures to facilitate the remedial action with the length of shoreline needing stabilization measures varying by alternative (details can be found in Table 7-1). Placement of caps would reduce the water depth in parts of East Branch under Alternative EB-B, which could restrict vessel access in some areas. Although there are not any water-dependent properties in the East Branch, reduced water depths under Alternative EB-B may impact recreational uses of East Branch. Dredging prior to capping in each of the other alternatives would result in either no change or deeper water depths compared to existing conditions. Alternative EB-B would be more easily implemented than Alternatives EB-C through EB-F because less of the shoreline would need to be stabilized, with approximately 36% of the shoreline requiring some stabilization, including 5% that is categorized as High Risk (possibly requiring bulkhead replacement or new bulkhead installation to safely implement the remedy, which represents a technical difficulty and unknown) for Alternative EB-B. Alternative EB-F would be the most difficult to implement, with approximately 88% of the shoreline requiring stabilization and nearly all of that (83% of the entire East Branch shoreline) categorized as High Risk, possibly requiring bulkhead replacement or new bulkhead installation. Alternatives EB-C, EB-D, EB-E and EB-F each will likely need shoreline stabilization over the majority of the shoreline length and are anticipated to require many years for negotiations and legal agreements with property owners, site investigation, design, and construction of shoreline stabilization measures, all of which must be completed prior to the start of the sediment remediation. This is compared to a likely fewer number of years for Alternative EB-B. If sealed bulkheads are necessary to control an upland source(s), depending on the type of barrier system implemented, difficulty during sheet pile driving (e.g., misalignment and multiple attempts of driving/extracting) could damage the sealant, reducing its effectiveness (Steel Piling Group 2020; ESC Group 2023).
  - **Reliability of the Technologies:** The technologies that compose Alternatives EB-B through EB-F are considered reliable, as shown through their implementation at other similar sites nationwide, as well as sites near East Branch. However, given the uncertainties about the long-term effectiveness of ISS in controlling diffusive flux from

the treated sediments, a treatability study would be required during the RD to determine if a post-ISS cap atop the ISS monolith would be needed.

- **Ease of Undertaking Additional Remedial Action:** The post-construction evaluation monitoring framework discussed in Section 5.3.8 would be implemented to monitor the effectiveness of the remedy. Implementation of the early action would not prevent future remedial actions, if deemed necessary based on evaluation monitoring of the remedy effectiveness.

- **Administrative Implementability:** The administrative implementability of each active remedial alternative has been evaluated in consideration of regulatory requirements, the need for access agreements, and coordination with governmental agencies, as follows:
  - **Regulatory Requirements:** Implementation of Alternatives EB-B through EB-F would require obtaining permits for off-site actions (i.e., disposal of dredged material and debris at a permitted facility). In addition, implementation of each of the alternatives would require coordination with (or review by) other agencies and meeting substantive requirements of ARARs. However, this is expected to be implementable for all alternatives, and ARARs are not expected to be a differentiator between alternatives.
  - **Access Agreements:** Implementation of Alternatives EB-B through EB-F would require the lease of a property to provide a staging area to support the remedial activities, which is considered implementable for all alternatives. Investigation, design, and construction of bulkhead stabilization and replacement measures would require access agreements with each affected property owner.
  - **Coordination of Bulkhead Stabilization and Replacement Measures:** Coordination with upland property owners on investigation, design, and construction of bulkhead stabilization and replacement measures would require significant time (several years). Alternative EB-F would need the most coordination (83% of the East Branch shoreline would potentially require bulkhead replacement or new bulkhead installation), and Alternative EB-B would need the least (5% of the East Branch shoreline would potentially require bulkhead replacement or new bulkhead installation). Alternatives EB-C and EB-D would potentially require bulkhead replacement or a new bulkhead installation over 17% of the shoreline, whereas Alternative EB-E would potentially require bulkhead replacement or a new bulkhead over 50% of the shoreline.
  - **Coordination with Agencies and Other Public Entities:** For Alternatives EB-B through EB-F, in-water work would need to comply with biological window restrictions to be developed for the project. These active alternatives would also require coordination with other private and public entities to address infrastructure in and around East Branch, including the planned Grand Street bridge reconstruction, the NYCDEP aeration system, utility corridors, and shoreline slopes/structures. Coordination with agencies regarding ICs would also be required.

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- **Availability of Services and Materials:** Alternatives EB-B through EB-F would be implemented using well-established and available in-water remediation methods and equipment. Similarly, land-based support areas would be constructed using commonly available construction technologies. Further, well-established and readily available equipment would be used to monitor the selected remedial alternative both during and following implementation. All required services and materials, including off-site treatment areas and disposal facilities, are expected to be locally available or provided nationwide through the procurement process. In addition, multiple qualified contractors are available to competitively bid the project.

7.7 Balancing Criterion 5: Cost

There would be no cost associated with Alternative EB-A.

Detailed cost estimate information and assumptions for each of the active alternatives are provided in Appendix F. Costs for Alternatives EB-B through EB-F are presented in Table 7-3:

Table 7-3
Summary of Costs

Alternative	Total Cost in $ Millions (including evaluation monitoring and 30% contingency)	Net Present Value[1] Cost in $ Millions (including evaluation monitoring and 30% contingency)
EB-A	$0	$0
EB-B	$174.8	$152.0
EB-C	$270.2	$235.2
EB-D	$279.2	$243.5
EB-E	$499.8	$418.7
EB-F	$610.1	$492.7

Note:
1. As discussed in Section 6.1.7, the NPV was calculated using a 7% discount rate.

NPV costs for Alternative EB-F are estimated to be approximately 18% higher than those for Alternative EB-E. NPV costs for Alternative EB-E are estimated to be approximately 72% higher than those for Alternative EB-D. NPV costs for Alternative EB-D are estimated to be less than 4% higher than those for Alternative EB-C. NPV costs for Alternative EB-C are estimated to be approximately 55% higher than those for Alternative EB-B.

The cost estimates prepared for this FFS have inherent uncertainty given the FS level of the design, which is reflected in the 30% contingency applied to each of the active alternatives.

7.8 Summary of Comparative Analysis of Alternatives

This section provides a narrative summary of the comparative analysis of alternatives. Table 7-1 provides a summary in tabular form, and Table 7-2 ranks the performance of each alternative relative to one another.

Alternative EB-A would not meet Threshold Criterion 1 because it would not provide for overall protection of human health and the environment. Each of the active alternatives (Alternatives EB-B through EB-F) would be expected to meet Threshold Criterion 1.

Regarding Threshold Criterion 2, there are no ARARs for Alternative EB-A because there is no CERCLA-related action performed. Alternatives EB-B through EB-F would be designed to comply with the substantive requirements of the potential ARARs for the East Branch EA as listed in Table 3-2a; therefore, each of the active remedial alternatives is expected to meet Threshold Criterion 2 and perform similarly with respect to this criterion.

Each of the active alternatives would be expected to perform similarly in terms of Balancing Criterion 1: Long-Term Effectiveness. Although Alternative EB-F would remove the most contaminated sediment and NAPL potentially contributing to residual risk, and Alternative EB-B would remove the least, the volume of contamination in place does not correlate directly to residual risk (USEPA 2005a). This is because the controls to manage any contamination left in place (i.e., capping) that are part of the active remedial alternatives are proven technologies that have been used successfully at other sediment sites, and long-term monitoring and maintenance would be performed to further verify the long-term effectiveness and permanence. Alternative EB-B would leave approximately 85% of the volume of contaminated sediment in East Branch in place to be contained by capping and in situ treatment, Alternatives EB-C and EB-D would leave approximately 50% to 60% of the volume of contaminated sediment in place, Alternative EB-E would leave approximately 13% of the volume of contaminated sediment in place, and Alternative EB-F would leave approximately 3% of the volume of contaminated sediment in place. Whereas alternatives with smaller areas of capping would rely slightly less on long-term monitoring and maintenance, each of the alternatives includes capping over at least 60% of the surface area of East Branch (including capping after ISS for shoreline stabilization and areas dredged down the native material where elevated groundwater COC concentrations were observed). Alternatives EB-B and EB-C include capping over the entirety of East Branch, Alternative EB-D includes capping over 10 acres (89% of the surface area of East Branch), Alternative EB-E includes capping over 8.1 acres (72% of the surface area of East Branch), and Alternative EB-F includes capping over 6.8 acres (61% of the surface area of East Branch). Furthermore, the dredging process results in more significant short-term impacts, such as cross-media impacts (i.e., water quality degradation) and potential downstream COC transport, than other remedial technologies. Therefore, uncertainty regarding the differences in the long-term effectiveness between the alternatives composed primarily of dredging and capping is small. ISS is also included in each of the remedial alternatives for addressing contaminated sediment along unstable shorelines, but this technology has a limited long-term performance record at sediment sites; therefore, the reliability is less certain compared to dredging and amended capping, which have been proven effective in the long term at numerous other sediment sites.

With regard to Balancing Criterion 2, each of the active alternatives would meet the statutory preference for treatment as a principal element by providing permanent and significant reduction of toxicity, mobility, or volume through treatment over the entire footprint of East Branch (100%) by providing either in situ treatment of sediment left in place (or of flux of elevated COC concentrations from native groundwater) or ex situ treatment of sediment removed (or both). Additional details related to in situ and ex situ treatment are as follows:

- Alternatives EB-B through EB-F include in situ treatment through placement of amended caps (for COCs that migrate into the amended capping layers) and ISS (for shoreline stabilization). The quantity of in situ treatment varies by alternative relative to the volume and acreage of sediment addressed by amended cap placement and the acreage of ISS. Alternatives EB-B and EB-C include the same surface area of treatment through amended capping and ISS, with a larger footprint than all other alternatives (i.e., 100% of the East Branch surface area), but Alternative EB-C leaves less contaminated sediment in place that may be treated by the amended cap (assuming that contaminated porewater would eventually migrate into the amended caps within the design lifetime of the cap and be treated). Alternative EB-D includes in situ treatment over 89% of the East Branch surface area, Alternative EB-E includes in situ treatment over 72% of the East Branch surface area, and Alternative EB-F includes in situ treatment over 61% of the East Branch surface area. However, the amended caps in Alternative EB-F are included only to manage elevated flux of COCs from groundwater since all sediment would be removed (except within ISS areas identified for shoreline stabilization). Alternative EB-B includes the largest volume of sediment to be treated via ISS for the purpose of shoreline stabilization (26,000 cy for Alternative EB-B), whereas Alternative EB-F includes the smallest volume of sediment to be treated via ISS (6,300 cy), with Alternatives EB-C and EB-D both treating 9,900 cy and Alternative EB-E treating 17,300 cy.
- The quantity of ex situ treatment varies by alternative relative to the volume of sediment removed. Alternative EB-F includes the largest dredge volume, so it would provide the largest quantity of sediment receiving ex situ treatment (254,700 cy), whereas Alternative EB-B includes the smallest dredge volume, so it would provide the smallest quantity of sediment receiving ex situ treatment (32,300 cy). Alternatives EB-C, EB-D, and EB-E treat 92,300 cy, 101,000 cy, and 233,800 cy of sediment via ex-situ treatment, respectively.

For short-term impacts and implementability (Balancing Criteria 3 and 4), Alternative EB-B would perform best with the least short-term impacts and implementability concerns, followed by

Alternatives EB-C through EB-F, in order. Construction duration is one of the key metrics relative to short-term impacts and implementability, as discussed in Sections 6.1.5 and 6.1.6. Alternative EB-B has the shortest construction duration (13 months or two construction seasons), whereas Alternatives EB-C and EB-D would each take 22 months (three construction seasons), Alternative EB-E would take 37 months (five construction seasons), and Alternative EB-F would take 46 months (seven construction seasons). Times for construction are in addition to the time necessary for the PDI and RD or for design of shoreline/bulkhead stabilization. Alternatives that involve significant amounts of shoreline/bulkhead improvements to facilitate the environmental remediation are expected to extend both the RD and implementation phases. The percentage of East Branch shoreline potentially needing stabilization ranges from 36% in Alternative EB-B to 76% in Alternatives EB-C and EB-D, 84% in Alternative EB-E, and 88% in Alternative EB-F, based on preliminary evaluations of shoreline stability presented in Appendix E. Alternatives EB-C, EB-D, EB-E, and EB-F each will likely need shoreline stabilization over the majority of the shoreline and are anticipated to likely require many years for negotiations and legal agreements with property owners, site investigation, design, and construction of shoreline stabilization measures, all of which must be completed prior to the start of the sediment remediation. This is compared to a likely fewer number of years for Alternative EB-B.

Costs (Balancing Criterion 5) for Alternatives EB-B through EB-F are presented in Table 7-3. NPV costs for Alternative EB-F are estimated to be approximately 18% higher than those for Alternative EB-E. NPV costs for Alternative EB-E are estimated to be approximately 72% higher than those for Alternative EB-D. NPV costs for Alternative EB-D are estimated to be approximately 4% higher than those for Alternative EB-C. NPV costs for Alternative EB-C are estimated to be approximately 55% higher than those for Alternative EB-B.

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Tables

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
Potential Federal Location Specific ARARs				
1	Presence of floodplains within remediation work areas	This regulation requires that federal agencies take measures to incorporate floodplain management goals into planning, regulatory, and decision-making processes. It also requires that the agency promote the preservation and restoration of floodplains so that their natural and beneficial values can be realized. Long- and short-term impacts associated with the occupancy and modification of floodplains shall be avoided wherever possible. The agency shall avoid direct and indirect support of floodplain development wherever there is a practicable alternative.	Actions that could potentially adversely impact floodplains – **potentially applicable**. Federal Emergency Management Agency (FEMA) flood hazard zones delineating floodplains are indicated to be within the site.	Floodplain Management Regulations Federal Emergency Management Agency regulations at 44 CFR 9; 40 CFR Part 6 Appendix A
2	Presence of floodplain within remediation work areas	This regulation prohibits encroachments such as capping or placement of material in the river or on riverbanks that would result in any increase in flood levels during occurrence of base flood discharge	Actions that may adversely affect flood rise – **potentially relevant and appropriate**. Remedial actions that involve capping or other placement of material in the river or on adjacent riverbanks in the study area may increase flood levels.	Flood plain management criteria for flood-prone areas 44 CFR 60.3(d)(2)(3)
3	Presence of wetlands within remediation work areas	This regulation requires that federal agencies take measures to incorporate wetlands protection considerations into planning, regulatory, and decision-making processes. It also requires that the agency minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. The agency shall avoid direct and indirect support of wetlands development wherever there is a practicable alternative.	Actions made on jurisdictional wetlands – **potentially applicable**. Newtown Creek is listed as Estuarine and Marine Deepwater in the National Wetlands Inventory.	Protection of Wetlands Regulations 40 CFR Part 6 Appendix A
4	Presence of cultural resources within remediation work areas	This statute and implementing regulation requires federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (generally, 50 years old or older). Federal agencies are required to take into account their undertakings on historic properties and must determine if there will be an adverse effect and if so how the effect may be minimized or mitigated in consultation with the appropriate State Historic Preservation Office.	Identification of cultural resources on or eligible for the National Register by surveys – **potentially applicable**. Cultural resource surveys that would indicate this is not an ARAR have not been conducted at the site. Potential actions could impact cultural resource features both in-water and within upland areas used for staging or transload. Because of the location and area covered by the site, there is potential for cultural resources eligible for the National Register of Historic Places to be found within the remedial action area. There are currently no property or resources along the river that are included on the National Register; however, the confluence of Newtown Creek with the East River is indicated as historic on the National Register of Historic Places.	National Historic Preservation Act 16 U.S.C. §470 and Implementing Regulations 36 CFR 60, 63, 6.301(b), 800
5	Presence of archaeological or historical artifacts within remediation work areas	This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data that may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. The unauthorized removal of archaeological resources from a federal project or federally managed lands is prohibited without a permit and any archaeological investigations at a site must be conducted by a professional archaeologist. Note that under CERCLA 121(e), a permit is not required for on-site CERCLA response actions.	Identification of archaeological resources by an archaeological investigation – **potentially applicable**. Cultural resource surveys that would indicate this is not an ARAR have not been conducted at the site. Potential actions could impact cultural resource features, both in-water and within upland areas used for staging or transload.	Preservation of Historical and Archeological Data 54 U.S.C. §§ 312501-312504, 312506-312508, and Implementing Regulations 43 CFR 7, Protection of Archaeological Resources

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
6	Presence of habitat for Bald and/or Golden Eagles within remediation work areas	This statute makes it unlawful for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any Bald or Golden Eagle, or the parts, nests, or eggs of such a bird. In addition to immediate impacts, this requirement also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment. If Bald or Golden Eagles are identified during remedial design and remedial action, activities must be modified and conducted to conserve the species and their habitat.	Identification of Bald or Golden Eagles and actions that could impair the species and their habitat – **potentially applicable**. Surveys for Bald or Golden Eagles and their habitat, which would indicate this is not an ARAR, have not been conducted within the site. Although unlikely, there is the potential for eagle nests to exist on top of shoreline structures that could be affected by a remedial action.	Bald and Golden Eagle Protection Act 16 U.S.C. §§ 668(a) and 50 C.F.R. § 22.6
7	Presence of habitat for federally endangered or threatened species within remediation work areas	This statute and implementing regulations provide that federal activities do not jeopardize the continued existence of any threatened or endangered species. 16 U.S.C. 1536(a) of the Endangered Species Act requires consultation with the U.S. Fish and Wildlife Service to identify the possible presence of protected species and mitigate potential impacts on such species. Substantive compliance with the ESA means that the lead agency must identify whether a threatened or endangered species, or its critical habitat, will be affected by a proposed response action. If so, the agency must avoid the action or take appropriate mitigation measures so that the action does not affect the species or its critical habitat. If, at any point, the conclusion is reached that endangered species are not present or will not be affected, no further action is required. If threatened or endangered species are identified during remedial design and remedial action, activities must be modified and conducted to conserve the species and their habitat. A survey to identify the presence of any endangered or threatened species must be conducted.	Identification of threatened and endangered (T&E) species that could impair the species and their habitat – **potentially applicable**. Remedial actions may impact threatened and endangered species, both in water and in upland areas used for staging or transload. If threatened and endangered species are identified within the study area, actions that may negatively impact the species and their habitat must be modified and conducted to conserve the species and their habitat.	Endangered Species Act, 16 U.S.C. §1536(a)(2) and listing of endangered and threatened species per 50 CFR §§ 17.11 & 17.12, or designation of critical habitat per 50 CFR § 17.95
8	Presence of habitat for migratory birds in remediation work areas	This statute and implementing regulations make it unlawful for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird. If migratory birds are identified during remedial design and remedial action, activities must be modified and conducted to conserve the species and their habitat.	Actions that may negatively impact the migratory birds and their habitat – **potentially applicable**. Remedial actions may impact migratory birds because they are conducted in water bodies. Migratory bird surveys that would indicate this is not an ARAR have not been conducted at the site. However, water bodies and wetlands have been identified within the site that could provide potential habitat for migratory birds.	Migratory Bird Treaty Act 16 U.S.C. §703 and Implementing Regulations, 50 CFR 10.13 (List of Migratory Birds)
9	Presence of waterbodies and streams within remediation work areas	This statute and implementing regulations require coordination with federal and state agencies for federally funded projects to ensure that any modification of any stream or other waterbody affected by any action authorized or funded by the federal agency provides for adequate protection of fish and wildlife resources. Federal agencies must comply with substantive requirements identified by the U.S. Fish and Wildlife Service and the relevant state agency with jurisdiction over wildlife resources.	Modification of any stream or waterbodies that affect non-game fish and wildlife resources – **potentially applicable**. Remedial actions will involve federally funded modification of waterbodies that were identified from the National Wetlands Inventory. Consultation with the federal agencies will be conducted to identify substantive requirements for adequate protection of fish and wildlife resources.	Fish and Wildlife Coordination Act 16 U.S.C. §662 and 663 and Implementing Regulations 50 CFR 83
10	Presence of essential fish habitat within remediation work areas	Requires federal agencies consult with National Marine Fisheries Service (NMFS) on actions that may adversely affect Essential Fish Habitat (EFH), defined as "those waters the substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."	Actions that may adversely affect EFH – **potentially applicable**. Remedial actions may involve EFH because the Newtown Creek watershed falls within an area designated as EFH by the NMFS. Potential effects to EFH from the proposed remedial actions have not been evaluated.	Magnuson-Stevens Fishery Conservation and Management Act 16 U.S.C. §1801 et seq. and Implementing Regulations 50 CFR Part 600.920

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
11	Presence of marine mammal habitat within remediation work areas	This statute and implementing regulations imposes restrictions on the taking, possession, transportation, selling, offering for sale, and importing of marine mammals or marine mammal products. It also establishes that best management practices (BMPs) be used for observing and avoiding contact with such species.	Actions that may adversely affect marine mammals – **potentially applicable**. Remedial actions may impact marine mammals because they are conducted in water bodies. Surveys that would indicate this is not an ARAR have not been conducted at the site. However, water bodies and wetlands have been identified within the site that could provide potential habitat for marine mammals.	Marine Mammal Protection Act 16 U.S.C. § 1372 et seq. and Implementing Regulations 50 CFR 216.11 and 216.105
12	Presence of coastal zone management area within remediation work areas	Requires activities affecting land or water uses in a coastal zone to certify noninterference with coastal zone management. It establishes that federal agencies that conduct or support activities that directly affect a coastal use or resource must undertake those activities in a manner that is consistent, to the maximum extent practicable, with State coastal zone management programs that have been approved by the NOAA.	Actions that may adversely affect flood rise – **potentially applicable**. Remedial actions may impact coastal zones. The Newtown Creek watershed is entirely within the coastal zone management act boundary designated by NOAA for the State of New York.	Coastal Zone Management Act 16 U.S.C. § 1455b and 1456 and Implementing Regulations 15 CFR 930.32 through 930.34
		Potential State Location Specific ARARs		
13	Presence of tidal wetlands within remediation work areas	This statute and implementing regulation establishes requirements for undertaking activities in or adjacent to tidal wetlands in order to preserve, protect, and enhance present and potential values of tidal wetlands within New York State including development restrictions. Remedial actions shall comply with substantive requirements of the permits. Alternatives should be evaluated to minimize the destruction, loss, or degradation of tidal wetlands, to the extent practicable.	Presence of tidal wetlands within Newtown Creek or its tributaries – **potentially applicable**. The study area is within a New York State tidal wetland. The remedial action may include activities such as dredging and/or placement of fill, which is regulated under the Tidal Wetlands Act.	Tidal Wetlands New York State ECL Article 25, Title 4 and implementing regulation 6 NYCRR Part 661.6
14	Presence of State-Owned Tidal Wetlands	This statute and implementing regulation prohibits the following activities within state owned tidal wetlands: 46.7(a)(1) any use of a motor vehicle, including parking, more than one hour before sunrise or more than one hour after sunset except for specifically permitted nature appreciation, educational or research activities; 46.7(a)(5) removal of naturally occurring or introduced flora, whether living or dead, except for specifically permitted research or educational activities; 46.7(a)(6) operation of motorized, wheeled or tracked vehicles and air boats except as specifically permitted activities; 46.7(a)(7) construction, erection or maintenance of any structure, except temporary blinds or temporary structures associated with specifically permitted research or educational activities which are permissible under section 51-0713 of the Environmental Conservation Law; or 46.7(a)(8) disposal of any solid, liquid or toxic waste material.	Use of state-owned tidal wetlands within Newtown Creek or its tributaries – **potentially applicable**. The study area is within a tidal wetland that is owned and/or under the jurisdiction of New York State	New York State ECL Article 3, Title 3 and implementing regulation 6 NYCRR F 46
15	Presence of hazardous waste facilities in floodplain	This statute and implementing regulation establishes construction requirements for hazardous waste facilities in the 100-year floodplain. The remedial action may require disposal of material at a hazardous waste facility in the floodplain, which must comply with the provisions set forth under 6 NYCRR Part 373.	Presence of 100 year floodplain within Newtown Creek or its tributaries – **potentially applicable**.	New York State ECL Department of Environmental Conservation; General Functions, Powers, Duties and Jurisdiction Article 3, Title 3; and Collection, Treatment and Disposal of Refuse and Other Solid Waste Article 27 Titles 7 and 9, and implementing regulation 6 NYCRR Part 373

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
16	Presence of endangered or threatened species or species of special concern and their habitats within remediation work areas	This statute and implementing regulation provide protection for endangered or threatened species and species of special concern within New York State. The taking of any endangered or threatened species is prohibited, except under a permit or license issued by NYSDEC. In accordance with CERCLA Section 121(e), a permit is not required for on-site CERCLA response actions. If it is determined that response actions may destroy or degrade the habitat of a New York State-listed endangered or threatened species or cause "a "taking" of any endangered or threatened species, such response actions will comply with substantive provisions of these regulations.	Presence of endangered or threatened species or their habitat within Newtown Creek or its tributaries – **potentially applicable**. The study area may contain endangered, threatened, or species of special concern. Any protected species present within the study area should be identified.	New York Endangered Species Act New York State ECL Article 11, Title 5 and implementing regulation 6 NYCRR Part 182
17	Presence of protected native plants within remediation work areas	This statute and implementing regulation provide protection for endangered, threatened, rare, and exploitable vulnerable native plants within New York State. All listed species are "protected plants" and may not be removed or damaged without consent. If it is determined that response actions may destroy or degrade New York State-listed protected native plants or cause a "taking" of any protected native plants, NYSDEC should be consulted with respect to substantive requirements. The removal of any protected plant species is prohibited and requires consultation with NYSDEC. Protection of these species should be considered when developing the remedial action.	Presence of endangered or threatened species or their habitat within Newtown Creek or its tributaries – **potentially applicable**. The study area may contain New York State protected native plant species. Any listed protected plant species present within the study area should be identified.	New York State ECL Lands and Forests Article 9, Removal of Trees and Protected Plants Title 15 and implementing regulation Protected native plants 6 NYCRR Part 193.3
18	Presence of coastal areas and inland waterways within remediation areas	This statute and implementing regulation establish policies for the designation of use of coastal and inland waterway resources while preventing the loss of living marine resources and wildlife, diminution of open space area or public access to the waterfront, shoreline erosion, and impairment of scenic beauty or permanent adverse changes to ecological systems. Waterfront redevelopment, including removal and/or replacement of deteriorated structures, design/construction of new structures, should involve NYSDEC consultation for applicable regulatory requirements. The remedial action may require the construction/replacement of bulkheads, shoreline stabilization, or placement of rip rap which are considered alterations to shoreline and require NYSDEC consultation. In addition, the protection of ecological receptors, wildlife habitats, and coastal land features should be considered when developing and implementing the remedy.	Presence of coastal areas or inland waterways within Newtown Creek or its tributaries – **potentially applicable**. The study area is within a New York State coastal waterway.	New York State Waterfront Revitalization of Coastal Areas and Inland Waterways New York State ECL Article 42; Sections 910-923 and implementing regulation 19 NYCRR Parts 600-603
19	Presence of coastal erosion hazard areas	This statute and implementing regulation establish guidelines for coastal erosion management for natural and structural protection of erosion hazard areas. Regulated activities include replacement of bulkheads, dredging and/or placing of capping material. The remedial action must be designed in accordance with substantive requirements to address coastal erosion hazard areas which include restrictions on regulated activities and standards for erosion protection structures.	Presence of coastal erosion hazard areas within Newtown Creek or its tributaries – **potentially applicable**. The study area is within a designated coastal erosion hazard area.	New York State ECL Article 34 and implementing regulation Coastal Erosion Management 6 NYCRR Part 505
20	Presence of fish and wildlife within remediation work areas	This statute establishes Fish and Wildlife management practices to preserve and develop fish and wildlife resources and improve access to them for recreational purposes. During dredging, or placement of fill or structures (i.e., Bulkheads, shoreline stabilization (rip rap)) no deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife or waterfowl therein.	Presence of fish and wildlife within Newtown Creek or its tributaries – **potentially applicable**. The study area contains fish and wildlife.	Fish and Wildlife New York State ECL Article 11 Fish and Wildlife Management Practices Cooperative Program; Prohibitions; Taking of Fish, Wildlife, Shellfish and Crustacea For Scientific or Propagation Purposes; Destructive Wildlife; Rabies Control; Guides; Endangered Species Title 5

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
		Potential Federal Action Specific ARARs		
21	Point source discharges including discharge of stormwater and/or water generated during sediment dewatering to the creek, its tributaries, or other waters of the U.S. during implementation, construction, or operation of the remedy	Section 402 of the Clean Water Act regulates discharges of pollutants from point sources to waters of the U.S., and requires compliance with the standards, limitations, and regulations promulgated per Sections 301, 304, 306, 307, 308 of the CWA. Part 122.44 establishes permit conditions, which include effluent limitations and standards for discharges.	Discharge of pollutants from any point source into waters of the U.S., including the Newtown Creek or its tributaries – **potentially applicable**. CWA authorizes the issuance of permits for the discharge of any pollutant, including stormwater and/or sediment dewater discharges associated with industrial/remedial activity. The National Pollutant Discharge Elimination System authorizes permits for the discharge of treatment system effluents by establishing water quality standards to be met using the best available technology (BATs) and best management practices (BMPs). CERCLA requires that only substantive aspects of permits be complied with. Administrative components will not be addressed.	Clean Water Act 33 U.S.C. §§ 1342, et seq., and Implementing Regulation 40 CFR 122 (National Pollutant Discharge Elimination System) Subpart C (Permit Conditions)
22	Actions that discharge dredged or fill material into waters of the U.S.	CWA §404 regulates the discharge of dredged or fill material into waters of the U.S., including return flows from such activity. This program is implemented through regulations set forth in the 404(b)(1) guidelines, 40 CFR Part 230. The guidelines specify the restrictions on discharge (40 CFR 230.10); the factual determinations that need to be made on short-term and long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment (40 CFR 230.11) in light of Subparts C through F of the guidelines; and the findings of compliance on the restrictions (40 CFR 230.12). Subpart J of the guidelines provide the standards and criteria for the use of all types of compensatory mitigation when the response action will result in unavoidable impacts to the aquatic environment.	Discharge of dredged or fill material into waters of the U.S., including return flows from such activity – **potentially applicable**. Used for evaluating impacts to the aquatic environment from dredging contaminated sediment, placement of capping material and enhanced monitored natural recovery material, and in situ treatment of sediments that will occur in implementing the remedy.	Clean Water Act, 33 U.S.C. 1344 Section 404(b)(1) Guidelines, and Implementing Regulations 40 CFR Part 230 (Guidelines for Specification of Disposal Sites for Dredged or Fill Material)
23	Actions that discharge pollutants to waters of the U.S.	Any federally authorized activity that may result in any discharge into navigable waters requires reasonable assurances that the activity will be conducted in a manner that will not violate applicable water quality standards by the imposition of any effluent limitations, other limitations, and monitoring requirements necessary to assure the discharge will comply with applicable provisions of the Clean Water Act.	Activity that may result in any discharge into navigable waters potentially – **potentially relevant and appropriate**. CWA 401 requirement, if more stringent than state implementation regulations, that in-water response actions that result in a discharge of pollutants comply with water quality standards through the placement of water quality-based conditions and other requirements on the discharge deemed necessary. Actions to implement the remedial action that may result in discharges to waters of the U.S. include, but may not be limited to, dredging, capping, placement of material for enhanced natural recovery, riverbank remediation, return flows, or dewatering sediments. Conditions and other requirements deemed necessary so that water quality standards are not violated will be placed on any such discharge. CERCLA requires that only substantive aspects of certifications be complied with. Administrative components will not be addressed.	Clean Water Act, 33 USC 1341 (Section 401), and Implementing Regulations 40 CFR 121

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
24	Actions that discharge pollutants to the contiguous coastal zone	Establishes criteria for issuance of National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants from a point source into the territorial seas, the contiguous zone, and the oceans. Prohibits discharges causing unreasonable degradation of the marine environment.	Discharge of pollutants from a point source into the territorial seas, the contiguous zone, and the ocean – **potentially applicable**. The Newtown Creek watershed is entirely within the contiguous coastal zone designated by NOAA for the State of New York. CWA Section 403 requires that NPDES permit be issued for discharges into marine waters, including territorial seas, the contiguous zone, and the oceans, as defined in 40 CFR 122.2. A permit is not required if point of discharge is on-site; however, substantive requirements would be complied with as described in 40 CFR 125.123(b) and (d)(1).	Clean Water Act 33 U.S.C. 1343 Ocean Discharge Criteria and Implementing Regulations 40 CFR 125.122, 125.123(b) and 125.123(d)(1)
25	Actions that transport material for dumping into the territorial sea or a contiguous coastal zone affecting the territorial sea	Establishes criteria for issuance of ocean dumping permits for the discharge of material into the territorial seas, or the contiguous zone adjacent to the territorial sea.	Discharge of dredged material into the territorial seas or the contiguous zone adjacent to the territorial sea – **potentially applicable**. The Newtown Creek watershed is entirely within the contiguous coastal zone designated by NOAA for the State of New York. 40 CFR 220 requires that NPDES permit be issued for discharges into marine waters, including territorial seas or the contiguous zone adjacent to the territorial sea. A permit is not required if point of discharge is on-site; however, substantive requirements would be complied with.	Marine Protection, Research, and Sanctuaries Act 33 U.S.C. 1412 and 1418, and Implementing Regulations 40 CFR 220-223, 40 CFR 225-228, and 40 CFR 230-233
26	Discharge of CERCLA contaminants to publicly owned treatment works (POTW)	Establishes prohibitions on discharge of pollutants that pass through the POTW without treatment, interfere with POTW operation, contaminate POTW sludge, or endanger health/safety of POTW workers and establishes national pretreatment standards specifying quantities of pollutants or pollutant properties which may be discharged to a POTW.	Indirect discharge of treated water from dredged material dewatering to a POTW, including discharge to sewers leading to the POTW – **potentially applicable**.	Clean Water Act 33 U.S.C. 1251 et seq. and Implementing Regulations 40 CFR 403.5-403.20
27	Actions that discharge emissions during implementation, operation, or maintenance of a response action	Parts 64.3 and 64.7 provide substantive requirements for compliance assurance monitoring of pollutant-specific emissions units at a major source. Part 64.3 provides general criteria for the design of compliance assurance monitoring programs. Part 64.7 provides requirements for operation of the monitoring program.	Discharge of pollutants to air – **potentially relevant and appropriate**.	Clean Air Act, 42 U.S.C. §7409 et seq. and Implementing Regulations: 40 CFR 64 (Compliance Assurance Monitoring)
28	Actions handling PCB remediation wastes and PCB-containing material	TSCA Subpart D regulates storage and disposal of PCB wastes and establishes requirements for handling, storage, and disposal of PCB-containing materials, including PCB remediation wastes, and sets performance standards for disposal technologies for materials/wastes with concentrations in excess of 50 milligrams per kilogram (mg/kg). Establishes decontamination standards for PCB-contaminated debris.	Disposal of contaminated dredged material, debris, or surface water with PCB contamination – **potentially applicable**.	Toxic Substances Control Act, 15 U.S.C. §2601 et seq., and implementing regulations 40 CFR 761.50-761.79

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
29	Actions generating solid wastes that could contain hazardous wastes for management and disposal	Wastes generated during construction, monitoring, or remediation must be characterized and managed in accordance with substantive RCRA requirements prior to off-site disposal. This regulation requires determination if solid waste is a hazardous waste by using the following method: First, determine if waste is excluded from regulation under 40 CFR 261.4, then determine if waste is listed as a hazardous waste under Subpart D 40 CFR Part 261 or whether the waste is (characteristic waste) identified in Subpart C of 40 CFR Part 261 by either: 1) Testing the waste according to the methods set forth in Subpart C of 40 CFR Part 261, or according to an equivalent method approved by the Administrator under 40 CFR §260.21; or 2) Applying knowledge of the hazard characteristic of the waste considering the materials or the processes used. Dredged material that is subject to the requirements of Section 404 of the CWA is not a hazardous waste for purposes of regulation under RCRA. Similarly, industrial wastewater discharges that are point source discharges subject to regulation under Section 402 of the CWA, as amended, are not solid wastes for the purpose of hazardous waste management. This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected, stored, or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.	Hazardous waste characterization and determination for management and disposal – **potentially applicable**.	RCRA 42 U.S.C § 6901 et seq. and Implementing Regulations 40 CFR 261.1 through 261.24
30	Actions generating RCRA hazardous waste	This regulation requires that generators of hazardous waste determine if the hazardous waste has to be treated before land disposal. This is done by determining if the waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of the waste. This determination can be made concurrently with the hazardous waste determination required in 40 CFR 261.11. The generator must comply with the special requirements of 40 CFR § 268.9 in addition to any applicable requirements in 40 CFR § 268.7. The initial generator of solid waste must determine each USEPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 et seq. This determination may be made concurrently with the hazardous waste determination required in Sec. 261.11 of this chapter. The generator must determine the underlying hazardous constituents (as defined in 40 CFR 268.2(i)) in the characteristic waste.	Characterizing and treating dredged materials slated for disposal – **potentially applicable**.	RCRA 42 U.S.C. § 6901 et seq. and Implementing Regulations 40 CFR 268.7(a)(1) and 40 CFR 268.9(a)

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
31	Actions requiring temporary storage of hazardous waste	A generator may accumulate hazardous waste at the facility provided that (accumulation of RCRA hazardous waste on-site as defined in 40 CFR §260.10) the following criteria are met: • Waste is placed in containers that comply with 40 CFR 265.171–173 • Date upon which accumulation begins is clearly marked and visible for inspection on each container • Container is marked with the words "hazardous waste" or the container may be marked with other words that identify the contents; if accumulation of 55 gal or less of RCRA hazardous waste or 1 quart of acutely hazardous waste listed in §261.33(e) at or near any point of generation of hazardous waste regulations further require the following: – In addition to the requirements of 40 CFR 262.34, a generator may accumulate hazardous waste on-site for 90 days or less without a permit provided that, if storing in excess of 100 containers, the waste is placed in a storage unit that meets the Accumulation requirements of 40 CFR 264.175 A generator shall comply with provisions found in 40 CFR, Part 262 and each applicable requirement of 40 CFR 262.34(a), (b), (c), (d), (e), and (f).	Temporary storage of hazardous waste – **potentially applicable**. CERCLA requires that only substantive aspects of permits be complied with. Administrative components will not be addressed.	RCRA 42 U.S.C. § 6901 et seq. and Implementing Regulations 40 CFR § 262.34(a); 40 CFR §262.34(a)(1)(i); 40 CFR § 262.34(a)(2) and (3); 40 CFR § 262.34(c)(1)
32	Actions that involve storage and treatment of hazardous waste	These regulations provide standards for location, design, operation, and closure of units in which treatment of hazardous waste may occur. These regulations also provide requirements for use and management of containers, tank systems, surface impoundments, waste piles, and land treatment units one or more of which may be used for the storage and treatment of hazardous waste. Subparts AA, BB, and CC provide air emission standards for process vents, equipment leaks, and tanks, surface impoundments, and containers that may be used.	Siting, design, operation, and closure of any containers, tank systems, surface impoundments, waste piles, or land treatment areas used for the storage (more than 90 days) and/or treatment of hazardous waste on-site prior to disposal offsite – **potentially applicable**.	RCRA 42 U.S.C. § 6901 et seq. and Implementing Regulations 40 CFR Part 264, Subparts B, C, F, G, I, J, K, L, M, AA, BB, CC, and DD
Potential State Action Specific ARARs				
33	Actions that discharge pollutants to waters of New York State	This statute and implementing regulations require permits to modify, change or disturb any protected stream, its bed or banks, or remove from its bed or banks sand or gravel or any other material; or to excavate or place fill in any of the navigable waters of the state. Any applicant for a federal license or permit to conduct any activity which may result in any discharge into navigable waters must obtain a State Water Quality Certification under Section 401 of the Federal Water Pollution Control Act, 33 U.S.C. §1341. In accordance with CERCLA Sections 121(d)(2) and 121(e), neither a permit nor a water quality certification is required for on-site CERCLA response actions, although such actions must comply with substantive requirements of these regulations. Preventative measures should be established to minimize suspension of sediment during dredging and/or cap placement. Additional monitoring may be required to ensure remedial activities do not exceed water quality standards.	Activities that result in any discharge into Newtown Creek or its tributaries that are waters of New York State – **potentially applicable**. The remedial action may include dredging and/or capping which would disturb and remove material from the creek bed and/or banks, with the placement of material on top.	New York State ECL Water Resources Article 15, Protection of Water Title 5; Water Pollution Control Article 17, Jurisdiction of the Department; Authority; Powers and Duties Title 3 and implementing regulations 6 NYCRR Use and Protection of Waters Part 608 and Part 701 Classifications--Surface Waters and Groundwaters
34	Actions that discharge pollutants to waters of the State of New York	This statute and implementing regulations prohibit any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards adopted by NYSDEC pursuant to ECL 17-0301.	Activities that result in any discharge into Newtown Creek or its tributaries that are waters of New York State – **potentially applicable**.	New York State ECL Article 17 Water Pollution Control, Title 5 Prohibitions and implementing regulation 6 NYCRR Parts 701 and 703

Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

ID No.	Media/Location/Action	Requirements	Prerequisite	Statute/Regulation Citation(s)
35	Actions that involve point source discharge pollutants to surface water or groundwater in New York State	This statute and implementing regulations establish standards for point source discharges of wastewater and storm water to surface water and groundwater. In general, no person shall discharge or cause a discharge to New York State waters of any pollutant without a permit under the New York State Pollutant Discharge Elimination System (SPDES) program. In accordance with CERCLA Section 121(e), a permit is not required for on-site CERCLA response actions, although the selected remedy will comply with substantive requirements of 6 NYCRR Part 750 which include prohibited discharges and effluent limitations.	Activities that result in discharges into Newtown Creek or its tributaries or to groundwater – **potentially applicable**. The remedial action may result in discharge to surface water subject to SPDES requirements.	New York State ECL Article 17 Water Pollution Control, Title 8 State Pollutant Discharge Elimination System (SPDES) and implementing regulation 6 NYCRR Part 750
36	Actions that involve discharge of contaminants to air in New York State	This statute and implementing regulations establish that the emission of air contaminants to the outside atmosphere that jeopardize human, plant, or animal life, or are ruinous to property, or which unreasonably interfere with the comfortable enjoyment of life or property, is prohibited (6 NYCRR 211.2), New York State Air Quality Standards are promulgated at 6 NYCRR Part 257.	Activities that result in discharges to air – **potentially applicable**.	New York State ECL Article 19 Air Pollution Control Title 3 Powers and Duties implementing regulation 6 NYCRR Parts 200-257–Air Resources
37	Actions that involve the generation of solid waste for management and disposal in New York State	This statute and implementing regulation establishes requirements for the management and disposal of solid waste and the design, construction, operation, and closure of solid waste management facilities within New York State.	Activities that result in generation of solid waste that requires management and disposal at a solid waste management facility – **potentially applicable**. The remedial action may include dredging and removal of material that requires disposal as solid waste.	New York State ECL Article 27, Title 7 Solid Waste Management and Resource Recovery Facilities and implementing regulation 6 NYCRR Part 360 Solid Waste Management Facilities General Requirements
38	Actions that involve the generation of hazardous waste for management in New York State	This statute and implementing regulations establish New York State requirements for the identification, listing, and handling of hazardous wastes.	Activities that result in generation of hazardous waste that requires management and disposal – **potentially applicable**. The remedial action may require dredging or generation of material which must be identified as a hazardous waste.	New York State ECL Article 27, Title 9 Industrial Hazardous Waste Management and implementing regulation 6 NYCRR Parts 370 Hazardous Waste Management System and 371 Identification and Listing of Hazardous Wastes
39	Actions that involve the generation of hazardous waste for management and disposal in New York State	This statute and implementing regulation establish requirements for treatment, storage, and disposal of hazardous waste. Including permit requirements (from which on-site response actions are exempt, although substantive requirements would be met) and standards for construction and operation of hazardous waste management facilities within New York State.	Activities that result in generation of hazardous waste that require management and disposal – **potentially applicable**. The remedial action may include the removal of material that is a classified hazardous waste and requires disposal at a hazardous waste facility.	New York State ECL Article 3, Title 3; Article 27, Title 7 Solid Waste Management and Resource Recovery Facilities and 9 Industrial Hazardous Waste Management and implementing regulation 6 NYCRR Part 373 Hazardous Waste Management Facilities
40	Actions that involve the generation of hazardous waste for disposal in New York State	This statute and implementing regulation restrict specified hazardous wastes from land disposal and defines circumstances under which an otherwise prohibited hazardous waste may be land disposed.	Activities that result in generation of hazardous waste that require disposal – **potentially applicable**. The remedial action may require dredging or generation of material that is a listed hazardous waste and subject to these requirements	New York State ECL Article 27, Title 9 Industrial Hazardous Waste Management and implementing regulation 6 NYCRR Part 376 Land Disposal Restrictions
41	Actions that involve the transportation of hazardous waste originating or terminating in New York State	This statute and implementing regulation establish requirements for the transportation of regulated waste originating or terminating in New York State.	Activities that result in generation of hazardous waste that require collection, transportation, and disposal at a solid waste facility – **potentially applicable**. The remedial action may require dredging or generation of material that is a listed hazardous waste and subject to these requirements.	New York State ECL Article 27, Title 9 Industrial Hazardous Waste Management and implementing regulation 6 NYCRR Part 364 Waste Transporter Requirements

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Table 3-2a
Potential Federal and State Applicable or Relevant and Appropriate Requirements

Note:

1. Potential ARARs were provided by USEPA in July 2023 and have been revised consistent with Newtown Creek Group comments on potential ARARs provided to USEPA on March 15, 2024.

Abbreviations:
ARAR: Applicable or Relevant and Appropriate Requirement
BAT: best available technology
BMP: best management practice
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFR: Code of Federal Regulations
CWA: Clean Water Act
ECL: Environmental Conservation Law
EFH: Essential Fish Habitat
FEMA: Federal Emergency Management Agency
mg/kg: milligram per kilogram
NMFS: National Marine Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
NPDES: National Pollutant Discharge Elimination System
NYCRR: New York Codes, Rules and Regulations
OU1: Operable Unit 1
PCB: polychlorinated biphenyl
POTW: publicly owned treatment works
RCRA: Resource Conservation and Recovery Act
SD: Saline Class D
SPDES: State Pollutant Discharge Elimination System
T&E: threatened and endangered
TSCA: Toxic Substances Control Act
U.S.C.: United States Code
USEPA: U.S. Environmental Protection Agency

Table 3-2b
Potential Federal and State To-Be-Considered Information

ID No.	Media/Action	Requirement	Prerequisite	Citation(s)
1	Contaminants from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) releases found in streambank soil or sediment	The criteria for the protection of groundwater SSLs can be considered in the development of preliminary remediation goals (PRGs) for protection of groundwater from leaching of contaminants from soil.	Presence of contaminants of concern in streambank soil or sediment from CERCLA releases and/or as a result of a CERCLA action that could adversely affect groundwater through leaching – **TBC**	EPA Regional Screening Level (RSL), Summary Table, Protection of Groundwater Soil Screening Levels (SSLs) for Various Contaminants, May 2023
2	Contaminants from CERCLA releases found in/discharged to air from streambank soil, sediment, surface water, or groundwater	The criteria for the industrial air SSLs can be considered in the development of preliminary remediation goals (PRGs) for protection of industrial workers.	Presence of contaminants of concern in air from CERCLA releases and/or as a result of a CERCLA action that results in airborne emissions that could adversely impact human receptors – **TBC**	EPA RSL. Summary Table, Industrial Air Screening Levels for Various Contaminants, May 2023
3	Contaminants from CERCLA releases found in soil or sediment	The criteria for the development of ecological SSLs can be considered in the development of preliminary remediation goals (PRGs) for protection of plants and animals.	Presence of contaminants of concern in streambank soil or sediment from CERCLA releases and/or as a result of a CERCLA action that could adversely impact plant or animal ecological receptors – **TBC**	EPA Interim Ecological SSLs for Metals and Organic Contaminants, OSWER Directives 9285.7-56 et seq., various dates from 2003 to 2008.
4	PCB contamination from CERCLA releases found in/discharged to sediment or groundwater	Provides guidance on development of cleanups levels, for PCB contamination in sediment or groundwater that could adversely impact human or ecological receptors. Table 3-4 provides chemical and physical properties of PCBs that can be considered in determining cleanup levels for groundwater. Table 3-5 provides sediment quality criteria that can be considered in the development of cleanup levels for PCBs in sediment.	Presence of PCBs in sediment or groundwater from CERCLA releases and/or as a result of a CERCLA action that could adversely impact human or ecological receptors – **TBC**	Tables 3-4 and 3-5 within *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540/G-90/007, August 1990
5	Presence of wetlands	Requires federal agencies minimize the destruction, loss, or degradation of wetlands and to preserve and enhance beneficial values of wetlands and to avoid direct or indirect support of new construction in wetlands when there are practicable alternatives.	Federal actions that involve potential impacts to, or take place within, wetlands of Newtown Creek or its tributaries – **TBC** Note: Federal agencies required to comply with Executive Order 11990 requirements.	Executive Order 11990 Section 1(a) *Protection of Wetlands*
		Agencies shall avoid undertaking construction located in wetlands unless: (1) There is no practicable alternative to such construction, and (2) That the proposed action includes all practicable measure to minimize harm to wetlands which may result from such use.		Section 2(a) *Protection of Wetlands*
6	Presence of floodplains	Agencies shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.	Federal actions that involve potential impacts to, or take place within, floodplains of Newtown Creek or its tributaries designated as such on a map – **TBC** As provided in 44 CFR § 9.7 Determination of proposed action's location, Paragraph (c), Floodplain determination, one generally should consult the FEMA Flood Insurance Rate Map (FIRM), the Flood Boundary Floodway Map (FBFM) and the Flood Insurance Study (FIS) to determine if the Agency proposed action is within the base floodplain. Note: Federal agencies required to comply with Executive Order 11988 requirements.	Executive Order 11988 Section 1. *Floodplain Management*
		Agencies shall consider alternatives to avoid, to the extent possible, adverse effects and incompatible development in the floodplain. Each agency shall design or modify its action in order to minimize potential harm to or within the floodplain.		Executive Order 11988 Section 2(a)(2) *Floodplain Management*
		Where possible, an agency shall use natural systems, ecosystem processes, and nature-based approaches when developing alternatives for consideration.	Federal actions that involve potential impacts to, or take place within, floodplains of Newtown Creek or its tributaries – **TBC** As provided in 44 CFR § 9.7 Determination of proposed action's location, Paragraph (c), Floodplain determination, one generally should consult the FEMA Flood Insurance Rate Map (FIRM), the Flood Boundary Floodway Map (FBFM) and the Flood Insurance Study (FIS) to determine if the Agency proposed action is within the base floodplain. Note: Federal agencies required to comply with Executive Order 13690 requirements	Executive Order 13690 Section 2(c)

Table 3-2b
Potential Federal and State To-Be-Considered Information

ID No.	Media/Action	Requirement	Prerequisite	Citation(s)
7	Presence of Lower Hudson-Long Island Bays Basin designated wildlife habitat	The New York Comprehensive Wildlife Conservation Strategy is implemented through a State Wildlife Action Plan (SWAP) which provides guidance for managing and conserving New York State Species of Greatest Conservation Need (SGCN), a list of species that are experiencing a population decline or have identified threats that may put them in jeopardy. Alternatives should be evaluated to minimize the destruction, loss, or degradation of SGCN and their habitat. Modifications to activities that may have negative impacts should be evaluated, to the extent practicable. SWAP requirements for the Lower Hudson-Long Island include: • Monitor population and assess spawning habitat of banded sunfish. • Continue programs to restore and monitor populations of American shad. • Manage submerged aquatic vegetation to maintain communities dominated by natural vegetation. • Monitor Atlantic sturgeon population, spawning, recruitment, and habitat use. • Monitor shortnose sturgeon population. • Survey for presence of tidewater mucket mussel. • Remove barriers to the migration of alewife and American eel.	Actions that take place in Newtown Creek and its tributaries within habitat designated in the Lower Hudson-Long Island Bays Basin – **TBC**	New York State Comprehensive Wildlife Conservation Strategy, Final Submission Draft (2005) – Lower Hudson-Long Island Bays Basin, pages 281—320
8	Presence of New York State designated estuaries	Provides guidance to prevent habitat loss and degradation; toxic contamination through dredge materials management; pathogen contamination; floatable debris; and nutrient and organic enrichment.	Actions that take place in Newtown Creek and its tributaries designated as a New York State estuary – **TBC**	Comprehensive Conservation and Management Plan (CCMP), New York-New Jersey Harbor Estuary Program Including the Bight Restoration Plan, Final (1996)
9	Presence of New York State designated estuaries or embayments connected with the Atlantic Ocean	Provides guidance for restoring, strengthening, and maintaining the ecological integrity of the ocean ecosystem; promote sustainable coastal development; and increase resiliency of ocean resources to climate change related impacts.	Actions that take place in Newtown Creek and its tributaries designated as a New York State connecting estuary or embayment – **TBC**	New York Ocean Action Plan 2017-2027 (2017)
10	Actions that remediate contaminated sediment	Provides criteria and considerations for use of monitored natural recovery for remediation of contaminated sediments including data collection as part of evaluation and contingency measures.	Actions that perform remediation of contaminated sediment using monitored natural recovery – **TBC**	Chapter 4 (Monitored Natural Recovery) within *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, EPA-540-R-05-012, OSWER 9355.0-85, December 2005
		Provides criteria and considerations for use of in situ capping for remediation of contaminated sediments including criteria for use and function of caps.	Actions that perform remediation of contaminated sediment using in situ capping – **TBC**	Chapter 5 (In Situ Capping) within *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, EPA-540-R-05-012, OSWER 9355.0-85, December 2005
		Provides criteria and considerations for of dredging alternative for remediation of contaminated sediments including an evaluation of all phases of the project, including removal, staging, dewatering, water treatment, sediment transport, and sediment treatment, reuse, or disposal.	Actions that perform remediation of contaminated sediment using dredging – **TBC**	Chapter 6 (Dredging and Excavation) within *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*, EPA-540-R-05-012, OSWER 9355.0-85, December 2005

Note:
1. List of TBCs provided by USEPA in July 2023

Abbreviations:
CCMP: Comprehensive Conservation and Management Plan
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFR: Code of Federal Regulations
FBFM: Flood Boundary Floodway Map
FEMA: Federal Emergency Management Agency
FIRM: Flood Insurance Rate Map
FIS: Flood Insurance Study
PCB: polychlorinated biphenyl
PRG: preliminary remediation goal
RSL: regional screening level
SGCN: Species of Greatest Conservation Need
SSL: soil screening level
SWAP: State Wildlife Action Plan
TBC: To-Be-Considered Information
USEPA: U.S. Environmental Protection Agency

Table 4-1
Remedial Technology and Process Option Initial Screening

General Response Action	Remedial Technology	Process Option	Description	Technical Implementability Screening	Retained (Yes/No)
No action	No action		No remedial measures or monitoring will be conducted. Serves as a baseline for comparison of active technologies.	N/A (Required by NCP)	Yes
MNR	MNR		MNR considers ongoing, naturally occurring chemical and/or physical processes to contain, destroy, or reduce the bioavailability, mobility, or toxicity of contaminants in sediment. Monitoring is conducted over time to verify remedy success.	MNR is one of three potential remedy approaches that USEPA Contaminated Sediment Guidance recommends evaluating at every sediment site (USEPA 2005). Insufficient data exist to determine the viability of MNR as a remedial approach for the East Branch Early Action.	No
ICs	Proprietary controls		Controls on private lands that are typically established by private agreement between a property owner and a second party who can enforce the controls. Common examples include easements and deed restrictions.	Technically implementable.	Yes
	Government controls	Activity restrictions for fishing and crabbing	Includes catch-and-release fishing or crabbing restrictions to prohibit or limit those activities by the public, which would be posted on signs at accessible locations along East Branch. Activity restrictions could also include licensing programs and other fishing and crabbing regulations that would require coordination with NYSDEC and NYSDOH.	Technically implementable.	Yes
		Consumption advisory	Advisories established/maintained to limit consumption of certain biota. Consumption advisories would be established and posted on state and city websites, posted on signs, and would be issued as flyers during licensing.	Technically implementable. The NYSDOH has issued a fish consumption advisory for the East River that also incorporates Newtown Creek. The advisory is expected to remain in effect for the foreseeable future.	Yes
		Waterway use restrictions	Includes access controls and signage to restrict navigation in East Branch during and following remedy implementation. These controls could restrict motorized vessel traffic in East Branch that could impact the remedy components or cause unsafe working conditions for workers during remedy implementation.	Technically implementable.	Yes
		Dredging restrictions	Includes specific restrictions (e.g., restrictions on dredging depths or limits) that would be enforced during permitting for future maintenance or remedial dredging within East Branch.	Technically implementable.	Yes
	Enforcement and permit tools with IC components		Legal tools that limit site activities or require the performance of certain activities (e.g., monitoring and reporting). Typically, these tools are legally binding and may be issued unilaterally by a regulatory agency or via a negotiation process.	Technically implementable.	Yes
	Informational devices		Provide information or notification in records or on site. Existing regulations may or may not provide certain restrictions, but advisories will always provide information for use by local communities, recreational users of a facility or site, or other interested persons that contamination may remain at the site.	Technically implementable.	Yes

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Table 4-1
Remedial Technology and Process Option Initial Screening

General Response Action	Remedial Technology	Process Option	Description	Technical Implementability Screening	Retained (Yes/No)
In situ containment	Capping	Sand cap	A sand cap consists of a layer of clean material (e.g., sand or gravelly sand) placed on the sediment surface to physically and chemically isolate existing sediments or dredge residuals. Caps can be designed based on site-specific physical and chemical conditions to: 1) physically isolate contaminated sediment; 2) stabilize contaminated sediment and provide erosion protection of sediment and cap; and/or 3) chemically isolate contaminated sediment. Sand caps have been effective at other sites in containing the COCs present in East Branch, but the effectiveness evaluation is dependent on localized conditions and would be assessed as part of the detailed evaluation of alternatives. This includes consideration of the elevation of the caps relative to MLLW because exposure of unsaturated sand cap material to the atmosphere could potentially result in otherwise unexpected contaminant releases.	Containment by sediment cap (sand cap, armored cap, amended sand cap, and amended armored cap) is technically feasible. As noted above, caps have been successfully placed at many similar sites, but consideration must be given to the existing bathymetry (i.e., steep slopes and slope stability), location in relation to the authorized navigation channels, and the chemical and geotechnical characteristics of existing sediments (i.e., related to chemical transport and ability to support the cap during RD and construction). The installation of a cap without prior dredging would result in areas where post-remediation elevations are higher than existing conditions. Capping within a federally authorized navigation channel would need to be designed so as not to impinge on the authorized depth of the navigation channel or affect future maintenance of the channel. Caps placed within the federal navigation channel of Newtown Creek would need to be reviewed by the USACE, the agency responsible for maintaining navigational access. Although not governed by a federal authorization, post-placement water depths also need to be evaluated for capping outside of the navigation channel because it may impact property use, habitat, water quality, and/or other considerations.	Yes
		Armored sand cap	An armored sand cap is a sand cap with a layer of armor material placed to provide additional physical isolation and erosion protection of existing sediments. The design of the armor would be based on site-specific erosive conditions, such as hydrodynamic flows and vessel propeller wash, to protect underlying cap layers and sediment. Cap armoring may consist of aggregate (e.g., stone or cobble), armor mattresses (stone packed into interlocked steel, geogrid, or geotextile cells), or other manufactured products. Effectiveness of armored caps is dependent on localized conditions and would be assessed as part of the detailed evaluation of alternatives.		Yes
		Amended sand cap	Amended caps consist of specialized or manufactured materials (e.g., activated carbon and/or organoclay) intermixed with other aggregate materials (e.g., sand) at specified dosages to provide chemical isolation and/or enhanced sorptive capacity to the cap layer. Amended caps may include a sand erosion protection layer or an armor stone erosion protection layer. Amended caps may also be composed of sand-amendment mixes incorporated into marine armor mattresses or other armoring products. Note that under the NCP, amended caps are also considered a remedial technology/process option under the in situ treatment GRA for contaminants that come in contact with treatment media within the caps. Effectiveness of amended armored caps is dependent on localized conditions and would be assessed as part of the detailed evaluation of alternatives.		Yes
		Amended armored cap			Yes
		Low-permeability cap	Low-permeability cap materials include natural clays and geomembranes such as high-density polyethylene and linear low-density polyethylene.	Not implementable in the East Branch. In cases where liners or geomembranes are used to create the low-permeability layer, gas from ebullition or groundwater could build up below the low-permeability layer and potentially shift or damage the geomembrane or clay cap.	No
	Vertical containment	Sealed bulkhead	A sealed bulkhead is one example of technologies that can be used to control ongoing upland sources of contamination to the creek that could otherwise potentially affect the success of the sediment-based remedial technologies in Table 4-1. Sealing a bulkhead involves the application of a sealant (e.g., bituminous product, wax and mineral oil, or polymer) to the interlock joints between individual sheet piles to inhibit the flow of liquids (and entrained solids) through the interlock joints.	Technically implementable as an upland source control technology. A sealed bulkhead typically would be implemented in conjunction with other remedial technologies (e.g., a groundwater collection and treatment system) because the sealed bulkhead itself would not control the source but would, in the absence of other engineering controls, provide only temporary mitigation to the flow of groundwater or seeps, which may find alternate pathways around or below the sealed wall.	Yes

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Table 4-1
Remedial Technology and Process Option Initial Screening

General Response Action	Remedial Technology	Process Option	Description	Technical Implementability Screening	Retained (Yes/No)
In situ treatment	Immobilization treatment	Sequestration via direct amendment	Direct amendment involves applying amendments directly to in situ sediments. These amendments would aid in chemical isolation and sequestration of organic and inorganic contaminants. Amendments would be selected based on the East Branch COCs present in sediments. Chemical reactions and sorption would reduce the toxicity, bioavailability, and mobility of contaminants by altering geochemistry and increasing contaminant binding, which would result in eliminating or decreasing contaminant transport to surface water. Common sequestration amendments include biochar, activated carbon, organoclay, or non-carbon materials such as zero-valent iron or apatite.	Amendment application to in situ sediments is technically implementable.	Yes
		Sequestration via amended cap	Amended caps permanently sequester contaminants within the amended cap and isolate contaminants in sediment below the cap. Under the NCP, amended caps are also considered a remedial technology/process option under the containment GRA. Refer to the description for sand amended and armored amended caps under the containment GRA above for additional details.	Under the NCP, amended caps are also considered a remedial technology/process option under the containment GRA. Refer to the technical implementability screening for sand amended caps and armored amended caps under the containment GRA above.	Yes
		ISS	ISS involves the mixing or injecting of solidification agents or chemical reagents (e.g., Portland cement) to solidify and/or stabilize contaminants in sediment. Solidification refers to methods that physically immobilize the COCs in the sediment/reagent admixture. Stabilization refers to methods that chemically reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms (USEPA 1999). ISS results in improved geotechnical properties, resulting in a stronger sediment bed, which may facilitate use adjacent to sensitive shorelines or structures without the use of sheetpile to maintain sidewall stability during dredging operations. ISS can also be effective at sequestering NAPL and principal threat waste to control ebullition-facilitated transport of NAPL or dissolved phase transport of NAPL constituents.	In situ treatment via ISS is technically implementable in water depths up to 40 to 50 feet. The application is a proven technology for implementation at upland sites and has been used at a growing number of sediment sites. Implementation must account for anticipated swell of surface sediments that might reduce water depths and inhibit navigation, thereby requiring post-ISS dredging. The need for a cap on top of the stabilized monolith to attenuate diffusive flux of contaminants into the surface water would need to be determined by a treatability study during the RD phase. The implementability of ISS will also be dependent on the localized bathymetry, the presence of in-water and submerged infrastructure and utilities, and planned remedial actions adjacent to the location. For instance, it is not feasible to implement ISS immediately adjacent to a steep slope or area of targeted dredging; the ISS monolith will not serve as an unsupported vertical or near vertical "wall."	Yes
	Chemical treatment		Chemical treatment utilizes chemical additives to initiate oxidation or dechlorination processes to destroy contaminants. Common reagents include permanganate, hydrogen peroxide, or potassium hydroxide, which could be introduced directly into the sediment or via inclusion in an amended cap.	These process options have been implemented at upland sites; however, there is a lack of successful full-scale implementation of sediment sites, and they are not expected to be implementable anywhere within the EB. As noted in Renholds 1998, a *"disadvantage of [in situ] biological and chemical treatment is that it only is applicable to organic contaminants. If metals contamination is present, the only in situ treatment options available are stabilization or solidification."* USEPA 1993 further notes: *"Because of variances in sediment type and contaminant distribution, it is difficult to ensure uniform dosages of treatment chemicals or to measure treatment efficiency. This can result in different levels of treatment for different areas of the sediment. Another limitation … is the impact the [in situ treatment] process has on the water column. Ideally, a remediation method will not result in the release of contaminants to the water column. However, the mixing of treatment chemicals or microorganisms may result in the resuspension of sediments or contaminants."*	No
	Biological treatment		Biological treatment involves the introduction of oxygen, nitrate, hydrogen, sulfate, or other organic carbon-laden substrate directly into the sediment or through inclusion in an amended cap. Microbial activity is subsequently increased or altered to enhance the degradation of contaminants.		No

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Table 4-1
Remedial Technology and Process Option Initial Screening

General Response Action	Remedial Technology	Process Option	Description	Technical Implementability Screening	Retained (Yes/No)
Removal	Dredging	Mechanical dredging	Removal of sediment using mechanical means to dislodge and excavate the material by using an excavation bucket (e.g., clamshell) either suspended from a crane or connected to an articulated, fixed-arm excavator positioned on a barge.	Mechanical dredging is technically implementable.	Yes
		Hydraulic dredging	Removal and transportation of sediment in a liquid slurry form using hydraulic pumps. Hydraulic dredging typically involves using a cutterhead, auger, or similar equipment to dislodge sediments from the sediment bed prior to removal with a suction device.	Hydraulic dredging is technically implementable. Use of a hydraulic dredge would be limited to water depths less than approximately 20 to 30 feet due to the limits on the reach of typical equipment. The presence of debris (i.e., piles, drums, and miscellaneous debris) would reduce the technical implementability, due to potential clogging of the pipeline and inefficient removal in the presence of large debris. Therefore, a pre-dredge debris removal step would be necessary in areas where debris is encountered.	Yes
		Specialty dredging	Removal of sediment using specialized equipment such as a suction-vacuum dredge. It is typically reserved for small-scale removal of material that cannot be feasibly accessed using traditional mechanical or hydraulic dredging equipment.	Specialty dredging (e.g., diver-assisted vacuum dredging) is technically implementable. This is typically a slow production technology that is reserved for small quantities of sediment that are difficult or inefficient to access with traditional mechanical or hydraulic dredging equipment.	Yes
Ex situ treatment	Immobilization treatment	Solidification/ stabilization	Ex situ treatment can be defined as any manufactured or naturally occurring process that eliminates or reduces toxicity, mobility, or volume of contamination in a given media once it has been removed from the aquatic system (USEPA 2005). The solidification/stabilization process option is the process of mixing sediments ex situ with solidification/stabilization agents, including Portland cement, fly ash, quicklime, or lime kiln dust. Dredged material would be treated with one or more amendments that would permanently and irreversibly reduce the toxicity, mobility, and/or volume of the contamination in sediment. Ex situ stabilization/solidification may be used to further reduce the moisture content of the material, thereby meeting transport and disposal requirements, and/or to reduce the mobility of the chemical constituents (as necessary) to meet BU or landfill disposal criteria.	Solidification/stabilization is technically implementable. The type and dose of amendment needed for adequate solidification/stabilization may vary based on the characteristics of sediment from different portions of East Branch.	Yes
	Thermal treatment	Thermal desorption	Thermal desorption is a process that uses heat to increase the volatility of contaminants such that they can be removed (separated) from the solid matrix. The volatilized contaminants are then either collected or thermally destroyed.	Technically implementable, although additional stabilization may be needed to address some metals. Thermal desorption has been implemented at other sediment sites and local/regional facilities are available, although not at the scale needed for the total volume of East Branch sediment.	Yes
		Pyrolysis	Pyrolysis is a chemical decomposition process under high heat and pressure that targets organic contaminants and pesticides.	Not implementable. Pyrolysis does not address treatment of some metals and has not been implemented at full scale for a sediment remediation project. Additionally, no local facilities are available to accommodate the volume of sediment anticipated.	No
		Vitrification	Vitrification implements an electrical current to harden or solidify sediment to a glass-like, or vitrified, substance.	Not implementable. Vitrification has been used in pilot-scale applications but has not been implemented at full scale for a sediment remediation project. Additionally, no local facilities are available to accommodate the volume of sediment anticipated.	No
		Incineration	Incineration is a heat-based technology that is used to burn and destroy contaminated materials. Materials are placed in a combustion chamber and heated to extremely high temperatures for a specified period of time. Volatized contaminants are destroyed, and secondary combustion destroys remaining gases. Remaining particulate matter is removed via air pollution equipment.	Not implementable. Incineration does not address treatment of some metals. Ash remaining following incineration would likely require an additional handling step and disposal at a hazardous waste facility. Additionally, no local facilities are available to accommodate the volume of sediment anticipated.	No
	Physical treatment	Pelletizing	Pelletizing is a multi-step ex situ treatment process in which dewatered sediments are mixed with other solids such as shale fines and turned into pellets for eventual burning in a kiln; these pellets can be disposed of or reused in select applications such as structural fill, concrete, and insulation.	Not implementable. Pelletizing has not been used at full scale for a sediment remediation project. Additionally, no local facilities are available to accommodate the volume of sediment anticipated.	No
		Sediment washing	Sediment washing is a physio-chemical process that uses highly pressurized water jets in conjunction with additives to desorb contaminants from sediment particles. During this process, contaminants are extracted and concentrated into the sludge associated with water treatment.	Not implementable. The effectiveness of this technology for reducing contaminant concentrations in fine-grained sediments is uncertain and has not been implemented at full scale for a sediment remediation project.	No
BU	BU	Multiple options (e.g., engineered fill, landfill daily cover, or	Dredged material that meets applicable standards and regulations may be suitable for BU rather than disposal in a regulated facility.	BU would be implementable if a viable BU is identified. Determination of suitability would require pre-design testing to determine stabilization requirements based on the specific BU. Permanent ICs may be needed depending on the BU application and the characteristics of the sediment.	Yes

Table 4-1
Remedial Technology and Process Option Initial Screening

General Response Action	Remedial Technology	Process Option	Description	Technical Implementability Screening	Retained (Yes/No)
		incorporation into construction materials)		At this time, no specific BU opportunities have been identified. Opportunities will be further evaluated during the RD.	
Disposal	Upland disposal	Subtitle C landfill	Subtitle C landfills are designed and permitted to accept RCRA hazardous wastes. These landfills are often designed and permitted to accept TSCA-level toxic materials.	Technically implementable. Permitted facilities exist for disposal of hazardous and non-hazardous waste within a reasonable distance from East Branch. Facilities permitted to accept TSCA-level waste existing within a reasonable distance from the East Branch will be identified in future RD phases. Dredged material would require dewatering, likely through gravity dewatering and/or the addition of an amendment, to reduce moisture content to meet transport and disposal facility requirements.	Yes
		Subtitle D landfill	Subtitle D landfills accept all types of waste that are not regulated as RCRA hazardous or TSCA toxic materials.		Yes
		TSCA waste landfill	TSCA waste landfills are permitted to accept and would be effective at containing dredged sediment that includes TSCA-level toxic materials.		Yes
	In-water disposal	CAD	A CAD cell is an in-water disposal unit that isolates dredged material within a natural or constructed depression in the bottom of a waterbody, which is then capped with other material. Long-term monitoring and maintenance would be required.	Not implementable in the East Branch. Use of CAD cells is a proven technology that has been successfully implemented at other similar sites. However, no current facilities exist that would accept the sediment targeted for removal from East Branch.	No
		CDF	A CDF is a dredged material containment area designed to control potential releases of contaminants to the environment. Dikes, structural walls, or natural landforms (e.g., shorelines) may be used to isolate the dredged materials placed in a CDF. Long-term monitoring and maintenance would be required. The selected CDF could be an existing regional facility or facility constructed specifically for Newtown Creek.	Technically implementable. However, there are no currently operating CDFs in the New York/New Jersey area in permitted operational condition that could accept the sediment targeted for removal from East Branch.	No

Abbreviations:
BU: beneficial use
CAD: confined aquatic disposal
CDF: confined disposal facility
CM: creek mile
COC: contaminant of concern
FFS: Focused Feasibility Study
FS: Feasibility Study
GRA: General Response Action
IC: institutional control
ISS: in situ stabilization/solidification
MLLW: mean lower low water
MNR: monitored natural recovery
N/A: not applicable
NAPL: nonaqueous phase liquid
NCP: National Contingency Plan
NYSDEC: New York State Department of Environmental Conservation
NYSDOH: New York State Department of Health
OU1: Operable Unit 1
PRG: preliminary remediation goal
RAO: remedial action objective
RCRA: Resource Conservation and Recovery Act
RD: remedial design
TSCA: Toxic Substance Control Act
USACE: U.S. Army Corps of Engineers

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Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
No action	No action		A remedial alternative based on a no action response option would not change the existing sediment conditions, except by processes that may be occurring, including upland source control measures and natural recovery mechanisms. All potential current and future risks would remain the same except as subject to currently occurring or planned changes over time. Does not provide any controls for reduction of exposure, long-term management, or monitoring measures. Therefore, no action would not achieve the RAOs within a reasonable time frame. It would also not have any short-term impacts or be reliable in the long term.	N/A (Required by NCP)	N/A	Yes	East Branch-wide	N/A	Yes
ICs	Proprietary controls		These controls can prohibit activities that have the potential to compromise the effectiveness of the remedy or that pose an unacceptable risk to human health or the environment. Generally effective at limiting human exposure, this IC is expected to be ineffective at providing protection to ecological receptors and therefore would not achieve the RAOs by itself. ICs would not result in any short-term impacts to human health and the environment during the construction and implementation phase.	Administratively and technically implementable in East Branch.	N/A	Yes	East Branch-wide	N/A	ICs will be included in the active alternatives to recognize their general function and necessity as components of the overall remedy.
	Government controls	Activity restrictions for fishing and crabbing	These restrictions would minimize the potential for human exposure to COCs in sediment through the ingestion of fish or crabs but are expected to be ineffective at providing protection to ecological receptors. Similar to other ICs, this IC would not achieve the RAOs by itself and would not result in any short-term impacts.	Administratively and technically implementable. Would require coordination with NYSDOH and NYSDEC.	N/A	Yes	East Branch-wide	N/A	
		Consumption advisory	Minimizes the potential for human exposure by placing restrictions on the consumption of certain biota but is expected to be ineffective at providing protection to ecological receptors. Similar to other ICs, this IC would not achieve the RAOs by itself and would not result in any short-term impacts.	Administratively and technically implementable. The NYSDOH has issued a fish consumption advisory for the East River that also incorporates Newtown Creek. The advisory is expected to remain in effect for the foreseeable future.	N/A	Yes	East Branch-wide	N/A	
		Waterway use restrictions	Following construction of the remedy, certain waterway use restrictions could protect the remedy from marine vessel-related damage (e.g., propwash scour, vessel wake waves, and anchoring). This IC would help achieve the RAOs indirectly through restrictions intended to maintain an intact remedy designed to protect human health and the environment and to reduce migration of site-related contaminants, thereby maintaining the remedy's effectiveness over the long term. This IC alone would not achieve the RAOs and would not result in any short-term impacts.	Administratively and technically implementable. Would require coordination with U.S. Coast Guard.	N/A	Yes	East Branch-wide	N/A	
		Dredging restrictions	The permitting process for future dredging would provide a means of notifying regulatory agencies of potential dredging activities that could impact the long-term effectiveness of the remedy and the ability of the remedy to achieve the RAOs. Similar to other ICs, this IC would not achieve the RAOs by itself and would not result in any short-term impacts.	Administratively and technically implementable. Application for future dredging would be reviewed by NYSDEC and USACE.	N/A	Yes	East Branch-wide	N/A	
	Enforcement and permit tools with IC components		May be effective in helping maintain the long-term effectiveness of the remedy, subject to the exact nature of the tool or requirement but is expected to be ineffective at providing protection to human and/or ecological receptors. Similar to other ICs, this IC would not achieve the RAOs by itself and would not result in any short-term impacts.	Administratively and technically implementable in East Branch.	N/A	Yes	East Branch-wide	N/A	
	Informational devices		May be effective in helping maintain the long-term effectiveness of the remedy, subject to the exact nature of the information, notification, or method of delivery. It is expected to be ineffective at providing protection to human and/or ecological receptors. Similar to other ICs, this IC would not achieve the RAOs by itself and would not result in any short-term impacts.	Administratively and technically implementable in East Branch.	N/A	Yes	East Branch-wide	N/A	

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Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening			
						Applicable (Yes/No)	Area of Applicability	Comments	Retained for FFS (Yes/No)
In situ containment	Capping	Sand cap	Placement of a sediment cap (with or without amendment materials or an armor layer) would facilitate meeting the RAOs by placing a layer of clean material on top of contaminated sediment that physically and chemically isolates the contaminated sediment. Capping is a proven and reliable technology based on effective use at other sites with similar COCs. USEPA guidance (USEPA 2005) recommends considering the physical environment, sediment characteristics, waterway uses and infrastructure, and potential habitat alterations to evaluate the feasibility of in situ containment. In addition, in situ containment would also evaluate dissolved phase transport of COCs, NAPL flux from advection, and NAPL loading to the in situ containment system (e.g., cap) from ebullition and underlying sediment consolidation. Although sand caps can physically isolate sediments from certain erosive forces, they are not considered physical impediments to potential future dredging activities (if needed). Capping is also expected to achieve the RAOs by reducing the migration of dissolved phase COCs and gas ebullition-facilitated NAPL and COC transport to surface sediments from underlying contaminated sediments. A properly designed cap would provide a clean surface immediately following remedy construction and would be effective over the long term in physically and chemically isolating contamination. Cap placement would also limit resuspension of existing sediment in the long term. Chemical migration through the cap would be dependent upon contaminant transport mechanisms (i.e., diffusion, advection, and ebullition-facilitated transport), thickness, organic content of the cap material(s), or the addition of a treatment amendment. Post-construction natural deposition would be expected to result in long-term surface sediment concentrations at (or near) long-term equilibrium model predictions (see Section 3.4.2). Post-remedy monitoring would be required to confirm the remedial technology effectiveness. Placement of a cap may result in minor short-term impacts on water quality (primarily turbidity and surface foam from the backfill materials themselves) during the construction period but is not expected to result in short-term releases of COCs from sediments that may become resuspended from placement of overlying cap materials. Other potential impacts during construction would include impacts similar to those from general construction projects (e.g., accidents, noise, potential commercial disruption, and worker exposure). Engineering controls and BMPs may be necessary to minimize short-term impacts.	Containment by sediment cap (sand cap, armored cap, amended sand cap, and amended armored cap) is technically and administratively feasible. Equipment, materials, and personnel are readily available. Caps have been successfully placed at other similar sites, but consideration must be given to the pre-construction bathymetry (i.e., steep slopes and slope stability), location in relation to the authorized navigation channels, and the geotechnical characteristics of existing sediments to support the cap during design and construction. Caps composed of specialized, manufactured components (e.g., natural or manufactured materials packed into interlocked steel, geogrids, or geotextile cells) can be difficult to place where access is limited, may require diver assistance, and may need to be anchored into the sediment to avoid movement in a sloping environment. The installation of a cap without prior dredging would result in areas where post-remediation elevations are higher than existing conditions. Therefore, the administrative implementability of cap placement in an area would be subject to meeting the substantive requirements of any permits associated with placement of materials in a subaqueous environment. Capping within a federally authorized navigation channel would need to be designed so as not to impinge on the authorized depth of the navigation channel or affect future maintenance of the channel. Caps placed within the federal navigation channel of Newtown Creek would need to meet the substantive requirements of ARARs, unless waived. Although not governed by a federal authorization, post-placement water depths also need to be evaluated for capping outside of the navigation channel because it may impact property use, habitat, water quality, and/or other considerations.	Medium	Yes	East Branch-wide	Different cap designs may be applicable to localized areas. Sand caps would be effective at managing post-dredge residuals or could be placed in areas where the flux of dissolved phase COCs from groundwater is relatively low. Amended sand caps could be placed in areas where the flux of dissolved phase COC from groundwater might result in an exceedance of the risk-based sediment PRGs over time if a sand-only backfill layer were placed. Armored caps and/or armored amended caps could be placed where erosion protection or additional physical isolation is required. Additional armoring may be required in shallow water areas (i.e., the wake zone), adjacent to (or within) areas anticipated to experience vessel propwash, or near outfall or discharge structures where high and/or turbulent water flows are anticipated.	Yes
		Armored cap			Medium	Yes	East Branch-wide		Yes
		Amended sand cap			High	Yes	East Branch-wide		Yes
		Amended armored cap			High	Yes	East Branch-wide		Yes

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Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
In situ containment	Vertical containment	Sealed bulkhead	Installation of a sealed bulkhead may be effective in reducing the flow of materials through the interlocking joints of a sheet pile wall. The effectiveness of the sealant is dependent on the sheet pile installation process and minimizing disturbance of the sealant by misaligned sheet piles during driving. A sealed bulkhead typically would be used in conjunction with other technologies (e.g., groundwater collection and treatment system) because the wall itself would not control the source. In the absence of other engineering controls, it would only provide a temporary impediment to flow of groundwater or seeps, which would eventually be redirected around or under the sealed wall.	Sealed bulkheads are technically implementable in East Branch. Equipment, materials, and personnel are readily available. Difficulty during sheet pile driving (e.g., misalignment and/or multiple attempts of sheet pile driving/extracting) can disturb the sealant. Sealed bulkheads are administratively implementable as a temporary measure if and where needed to reduce migration to address ongoing sources while cleanup of the related upland source is evaluated and implemented, either through state and/or federal enforcement authorities (to be determined on a case-by-case basis).	High	Yes	Localized Areas	N/A	Yes
In situ treatment	Immobilization treatment	Sequestration via direct amendment application	Direct amendment application has the ability to achieve the RAOs by reducing COC concentrations and bioavailability to benthic organisms and reducing contaminant flux into the water column as well as inhibiting NAPL migration and has proven reliable and effective at other sites; however, favorable site conditions are required for sequestration via direct amendment application to be effective over the long term, including a low-energy environment with low scour potential (e.g., limited or no vessel traffic). Similar to placement of a cap, direct amendment application may result in limited short-term impacts to water quality from the amendments themselves. If the direct amendment application process involves disturbing the existing sediment, short-term water quality impacts may also be caused by sediment resuspension and potential COC release. Other potential short-term impacts from direct amendment application would be similar to those from typical construction activities (e.g., noise, dust, and potential commercial disruption), which would be limited to the period of construction. Potential impacts to human health and the environment during the construction would include impacts similar to those from general construction projects (e.g., accidents, noise, and worker exposure). Engineering controls and BMPs may be necessary to minimize short-term impacts.	Amendment application to in situ sediments is technically and administratively implementable and has been implemented at other similar sites. Equipment, materials, and personnel are readily available; however, sequestration is not implementable in East Branch due to the requirement for a low-energy environment for application (e.g., limited or no vessel traffic).	High	Yes	Localized areas	Due to the potential erosive forces from vessel traffic and/or flows from CSO and MS4 discharges, direct amendment is not considered implementable in East Branch.	No
		Sequestration via amended cap	Refer to amended sand cap and amended armored cap under the containment GRA above.						

Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
In situ treatment	Immobilization treatment	ISS	ISS would facilitate achieving the exposure-based RAO by solidifying and/or stabilizing COCs (subject to treatability testing) in place and limiting human and ecological contact with impacted sediment. Although ISS has been effectively implemented at other sediment sites with similar COCs, there is a limited record of long-term performance monitoring. ISS may also facilitate achieving the source control RAO by sequestering NAPL and reducing potential migration. However, mobile NAPL has not been identified in East Branch to date. ISS may also be effective for solidifying contaminated sediments, including those containing residual NAPL, to control advective or diffusive contaminant flux and flux associated with ebullition. See the "Comments" column for additional detail regarding NAPL mobility under existing and potential future conditions. A bench-scale treatability study has been performed on sediments from East Branch to evaluate proof of concept for ISS. The program included three phases of testing using different stabilizing agents and mix ratios to determine an optimal type and ratio of amendments. In total, 39 different combinations were tested, with the following results: 28 mixes exhibited hydraulic conductivities less than the preliminary performance criteria; 15 mixes exceeded the preliminary performance criteria for unconfined compressive strength at the end of the 28-day testing period, and 15 mixes exceeded the preliminary performance criteria for both hydraulic conductivity and unconfined compressive strength. For additional information, refer to the *Feasibility Study Geotechnical Data Evaluation Report* (Anchor QEA 2020) and Section 2.1.2.2.2 of Appendix A to the FFS. ISS may need to be coupled with a post-ISS cap if diffusive flux (albeit at a reduced rate) is anticipated to continue from the stabilized monolith at a rate that would impact a remedial alternative's ability to meet RAOs and to be effective over the long term. Additional treatability testing during the RD phase would aid in determining the need for a cap on top of the stabilized monolith to attenuate diffusive flux. Potential short-term impacts during construction would include increased water column turbidity from disturbance of contaminated sediment as well as impacts similar to those from general construction projects (e.g., accidents, noise, potential commercial disruption, and worker exposure). Engineering controls and BMPs may be necessary to minimize short-term impacts.	In situ treatment via ISS is technically implementable in water depths up to 40 to 50 feet. The application has been applied at a growing number of sediment sites. Specialized equipment, materials, and personnel would need to be available. ISS is administratively implementable, subject to meeting the substantive requirements of any permit approvals associated with placement of materials in the subaqueous environment. Implementation would need to consider the anticipated swell of surface sediments often resulting during ISS and whether that might reduce water depths and inhibit navigation, thereby requiring post-ISS dredging. The need for a cap on top of the stabilized monolith to potentially attenuate diffusive flux of contaminants into the surface water would need to be determined by a treatability study during the design phase. The implementability of ISS will also be dependent on the localized bathymetry and planned remedial actions adjacent to the location. For instance, it is not feasible to implement ISS immediately adjacent to a steep slope or area of targeted dredging; the ISS monolith will not serve as an unsupported vertical or near vertical "wall."	High	Yes	Localized areas	The NAPL saturation levels observed to date in East Branch are well below those that would be necessary for NAPL to be mobilized via advection; this has been confirmed by laboratory testing. There is potential that implementation of a particular remedy could change in situ conditions that may affect NAPL mobility. Alternatives that include capping may slightly increase the NAPL saturation by consolidating the sediment containing NAPL, but based on data collected in East Branch, this change would not reasonably be expected to change the field conditions (i.e., increase the NAPL saturation) such that NAPL would then become mobile via advection. ISS could be used to address issues associated with the dissolution of NAPL or NAPL migration via gas ebullition. ISS may be effective for solidifying/stabilizing contaminated sediment (which may include immobile NAPL) in localized areas of East Branch or where other GRAs and technologies are not feasible (e.g., adjacent to unstable shorelines or sensitive structures). ISS is retained for potential application in areas where conditions are such that sequestration could be effective. To assess ISS as a remedial technology, it will be included as an optional remedial component in each of the active remedial alternatives (see Section 5 for details).	Yes

Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening			
						Applicable (Yes/No)	Area of Applicability	Comments	Retained for FFS (Yes/No)
Removal	Dredging	Mechanical dredging	Sediment removal would facilitate meeting the RAOs by removing impacted sediment and NAPL from the environment and reducing/eliminating the potential for human or ecological contact with those impacted sediments. Mechanical dredging would be effective at reducing potential long-term exposure to human and ecological receptors if removal of all sediments containing COCs and NAPL is successful. Mechanical dredging is a proven and reliable technology that has effectively been used at other sediment sites. However, post-dredge residuals often remain that require management (e.g., post-dredging backfill and/or capping) to provide adequate long-term protection of human health and the environment. Mechanical dredging may also result in increased short-term exposure due to technological limitations of dredging (i.e., resuspension and residuals). Other potential short-term impacts from mechanical dredging would include turbidity during construction and impacts similar to those from typical construction activities (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure), which would be limited to the period of construction. Engineering controls and BMPs may be necessary to minimize short-term impacts. Ultimately, the overall long-term effectiveness of mechanical dredging targeted at complete removal of contamination may be dependent on the placement of post-dredge backfill or cap placement.	Mechanical dredging is technically and administratively implementable and has been implemented at many other similar sediment sites. Equipment, materials, and personnel are readily available. Use of fixed-arm equipment is limited to water depths of approximately 30 feet; dredging in water depths greater than 30 feet would require the use of a crane/cable-operated bucket. Debris may be removed with the mechanical bucket or in a separation operation. The need for a pre-dredge debris removal step will be evaluated in areas where debris is encountered. Dredged material handling requirements for mechanical dredging would include transporting the dredged material via barge from the site of dredging to the upland processing area for management. Dredged material management at the upland processing area typically involves multiple handling steps, including dewatering and the treatment of dewatering effluent prior to transport to the final disposal site, which could occur via barge, rail, or truck.	High	Yes	East Branch-wide	Mechanical dredging is effective and implementable in East Branch and was retained as a representative process option for the purposes of developing remedial alternatives.	Yes

Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
Removal	Dredging	Hydraulic dredging	Sediment removal would facilitate meeting the RAOs by removing impacted sediment and NAPL from the environment and reducing/eliminating the potential for human or ecological contact with impacted sediment. Hydraulic dredging would be effective at reducing potential long-term exposure to human and ecological receptors if removal of all sediments containing COCs and NAPL is successful. Hydraulic dredging is a proven and reliable technology that has been used at other sediment sites. Similar to mechanical dredging, post-dredge residuals often remain that require management (e.g., post-dredging backfill and/or capping) to provide adequate long-term protection of human health and the environment. Hydraulic dredging may also result in increased short-term exposure due to technological limitations of dredging (i.e., resuspension and residuals); however, because hydraulic dredging operation typically can take less time than mechanical dredging, less short term-exposure would be anticipated. Other potential short-term impacts from hydraulic dredging would be similar to those from typical construction activities (e.g., accidents, noise, dust, potential commercial disruption, worker exposure, and installation of supplemental infrastructure to support hydraulic dredging), which would be limited to the period of construction. Engineering controls and BMPs may be necessary to minimize short-term impacts. Ultimately, the overall long-term effectiveness of hydraulic dredging targeted at complete removal of contamination may be dependent on the placement of post-dredge backfill or cap placement.	Hydraulic dredging is technically and administratively implementable and has been implemented at other sites. Equipment, materials, and personnel are readily available. Use of a hydraulic dredge would be limited to water depths less than approximately 20 to 30 feet due to the limits on the reach of typical equipment. Depending on site conditions and dredge volume, hydraulic dredging can have an advantage over mechanical dredging in that it can be more cost-effective than mechanical dredging operations. Because dredged material can be pumped directly to the sediment processing area as opposed to requiring an intermediate handling step like mechanical dredging, the hydraulic dredging operation can take less time, resources, and generate fewer emissions. The presence of debris (i.e., piles, drums, and miscellaneous debris) would reduce the technical implementability, due to potential entanglement of equipment as well as pipeline blockage concerns. Therefore, a pre-dredge debris removal step would be necessary in areas where debris is encountered. Hydraulic dredges generate a large quantity of excess water (carriage water) for sediment conveyance; therefore, supplemental infrastructure (e.g., filter presses or geotextile tubes) to dewater the sediment is required. Hydraulic dredging would require a significant upland support area for dewatering and water treatment and typically requires additional dredged material handling requirements (compared to mechanically dredged material) to reduce the water content of the dredged material prior to transport and final disposal, which could occur via barge, rail, or truck.	High	Yes	East Branch-wide	Hydraulic dredging is effective and implementable in East Branch and was retained for further evaluation but was not assumed as a representative process option for the FFS due to increased difficulties in handling debris, pipeline blockage concerns, and the requirement for a significant upland area for dewatering and water treatment.	Retained for further evaluation during RD

Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
Removal	Dredging	Specialty dredging	Sediment removal would facilitate meeting the RAOs by removing impacted sediment and NAPL from the environment and reducing/eliminating the potential for human or ecological contact with impacted sediment. Specialty dredging would be effective at reducing potential long-term exposure to human and ecological receptors in select areas if removal of all sediments containing COCs and NAPL is successful. Specialty dredging is a proven and reliable technology that has been used at other sediment sites. Similar to mechanical and hydraulic dredging, post-dredge residuals often remain that require management (e.g., post-dredging backfill and/or capping) to provide adequate long-term protection of human health and the environment. Specialty dredging is typically a slow production technology that would be effective for small quantities of sediment that are difficult or inefficient to access with traditional mechanical or hydraulic dredging equipment. Like mechanical and hydraulic dredging, specialty dredging may also result in increased short-term exposure due to technological limitations of dredging (i.e., resuspension and residuals). Other potential short-term impacts from dredging would be similar to those from typical construction activities (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure), which would be limited to the period of construction. Engineering controls and BMPs may be necessary to minimize short-term impacts. Ultimately, the overall long-term effectiveness of specialty dredging targeted at complete removal of contamination in select areas unsuitable for mechanical or hydraulic dredging may be dependent on the placement of post-dredge backfill or cap placement.	Specialty dredging (e.g., diver-assisted vacuum dredging) is technically and administratively implementable and has been implemented at similar sites. Equipment, materials, and personnel are readily available. This is typically a slow production technology that is reserved for small quantities of sediment that are difficult or inefficient to access with traditional mechanical or hydraulic dredging equipment. Dredged material handling requirements for specialty dredging would include transporting the small amount of dredged material via barge from the site of dredging to the upland processing area for management, which, as noted, typically involves multiple handling steps, including dewatering and the treatment of dewatering effluent prior to transport to the final disposal site, which could occur via barge, rail, or truck.	High	Yes	Localized Areas	Specialty dredging could be effective and implementable in East Branch and was retained for further for consideration of use in localized areas during RD, but it was not assumed as a representative process option for the FFS.	Retained for further evaluation during RD
Ex situ treatment	Immobilization treatment	Solidification/ stabilization	Ex situ stabilization/solidification is a proven, effective means for indirectly aiding in achieving the RAOs in combination with removal by immobilizing chemical constituents as necessary to meet BU or landfill disposal criteria. Ex situ stabilization/solidification would be effective over the long term because stabilized and solidified contaminants would be in a less bioavailable, less mobile, and/or less toxic form (USEPA 2005). Short-term risks and impacts would be similar to those from other typical construction activities (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure) during the solidification/stabilization process at the upland sediment processing area.	Solidification/stabilization is technically and administratively implementable and has been successfully implemented at other similar sites. Equipment, materials, and personnel are readily available. The type and dose of amendment needed for adequate solidification/stabilization may vary based on the characteristics of sediment from different portions of East Branch.	Medium	Yes	East Branch-wide	Ex situ solidification/stabilization is only being considered in conjunction with off-site disposal.	Yes
	Thermal treatment	Thermal desorption	Thermal desorption has been demonstrated to be effective in removing organic contaminants at other sediment sites. However, it is not expected to be effective for all COCs (e.g., metals). Therefore, thermal desorption may need to be coupled with other technologies if sediments containing metals need to be treated. Potential impacts during construction would be similar to those from general construction projects (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure).	Thermal treatment of sediment is technically and administratively implementable and has been implemented at other similar sediment sites, although not at the scale of East Branch. Equipment, materials, and personnel are available. However, the process first requires the dredged sediments to be dewatered to remove excess moisture, which can significantly increase the cost and treatment time, and it would involve the transport of sediment to licensed facilities following dewatering and subsequent thermal desorption treatment.	High	Yes	East Branch-wide	Ex situ treated sediments could have potential beneficial use applications (e.g., engineered fill, concrete, and landfill cover) but was not assumed as a representative process option for the FFS. If selected as a remedial technology, bench-scale testing would be needed to evaluate the effectiveness based on the COCs present in the sediment targeted for treatment.	Retained for further evaluation during RD in combination with beneficial use

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Table 4-2
Remedial Technology and Process Option Evaluation

General Response Action	Remedial Technology	Process Option	Effectiveness (Achievement of Draft RAOs)	Implementability	Cost	Screening: Applicable (Yes/No)	Screening: Area of Applicability	Screening: Comments	Screening: Retained for FFS (Yes/No)
BU	BU	Multiple options (e.g., engineered fill, landfill daily cover, or incorporation into construction materials)	Like disposal at a landfill, dredging and the BU of dredged material would support meeting the RAOs by utilizing sediment removed from East Branch (with treatment, if necessary), thus reducing/eliminating the potential for human and/or ecological contact with impacted sediment. Depending on the intended beneficial use, ex situ treatment of the dredged material may be required before it is considered suitable for BU. To determine quantities of physical or chemical stabilization additives needed for such treatment, a treatability study and a leachability study would need to be performed on dredged materials. BU would be effective over the long term at containing dredged sediment and reducing/eliminating contact with receptors. The assumed effectiveness is pending final acceptance of dredged material for use in BU projects and pending the results of the treatability and leaching studies. Short-term impacts from BU would be similar to those from typical transportation and construction operations (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure) during remedy implementation.	BU would be technically and administratively implementable if a viable BU is identified. Determination of suitability would require pre-design testing to determine stabilization requirements based on BU. Permanent ICs may be needed depending on the BU application and the characteristics of the sediment. At this time, no specific BU opportunities have been identified. Opportunities will be further evaluated during the OU1 Site-wide FS and RD.	Medium	Yes	East Branch-wide	N/A	Retained for further evaluation during RD
Disposal	Upland disposal	Subtitle C landfill	Dredging and the disposal of dredged material would support meeting the RAOs by disposing of impacted sediment and NAPL, thus reducing/eliminating the potential for human or ecological contact with impacted sediment. Previous waste characterization testing performed in East Branch (with limited spatial coverage) and in the CM 0–2 area, as well as bulk sediment COC concentrations throughout East Branch and the Newtown Creek Study Area, indicates that dredged material from East Branch would likely be acceptable for disposal in a permitted upland landfill, which would be effective over the long term at containing contaminated dredged sediment. The assumed effectiveness is pending final acceptance of dredged material by the landfill facility following testing specific to the sediments within East Branch. Landfills permitted to accept dredged material are regulated and are required to monitor and maintain the disposal facility to verify the long-term effectiveness at reducing or eliminating the potential for human and/or ecological contact with impacted sediment. Potential short-term impacts during the construction and implementation phase would be similar to those from general construction projects (e.g., accidents, noise, dust, potential commercial disruption, and worker exposure) during remedy implementation.	Technically and administratively implementable. Permitted facilities operating in compliance with USEPA's Off-Site Rule exist for disposal of hazardous and non-hazardous waste within a reasonable distance from East Branch. Facilities permitted to accept TSCA-level waste within a reasonable distance from East Branch will be identified in future remedial design phases. Dredged material would require dewatering, likely through gravity dewatering and/or the addition of an amendment, to reduce moisture content to meet transport and disposal facility requirements.	High	Yes	East Branch-wide	The final disposal site may vary based on the characteristics of sediment from different portions of East Branch	Yes
		Subtitle D landfill			High	Yes	East Branch-wide		Yes
		TSCA waste landfill			High	Yes	East Branch-wide		Yes

Abbreviations:
ARAR: Applicable or Relevant and Appropriate Requirement
BMP: best management practice
BU: beneficial use
CM: creek mile
COC: contaminant of concern
CSO: combined sewer overflow
FFS: Focused Feasibility Study
FS: Feasibility Study
GRA: General Response Action
IC: institutional control
ISS: in situ stabilization/solidification
MS4: municipal separate storm sewer system
N/A: not applicable
NAPL: nonaqueous phase liquid
NCP: National Contingency Plan
NYSDEC: New York State Department of Environmental Conservation
NYSDOH: New York State Department of Health
OU1: Operable Unit 1
PRG: preliminary remediation goal
RAO: remedial action objective
RCRA: Resource Conservation and Recovery Act
RD: remedial design
TSCA: Toxic Substance Control Act
USACE: U.S. Army Corps of Engineers

References:
Anchor QEA, 2020. *Feasibility Study Geotechnical Data Evaluation Report*. Remedial Investigation/Feasibility Study, Newtown Creek. December 2020.
USEPA (U.S. Environmental Protection Agency), 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. Office of Solid Waste and Emergency Services*. EPA-540-R-05-012, OSWER9355.0 85. December 2005.

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Threshold Criterion 1: Overall Protection of Human Health and the Environment **(Section 6.1.1)** Evaluates the overall ability of an alternative to eliminate, reduce, or control potential unacceptable exposures to hazardous substances in both the short and long term and evaluates whether an alternative provides adequate and reliable overall protection to human health and the environment (e.g., the degree to which each alternative can achieve the RAOs); this evaluation also examines whether alternatives pose any unacceptable short-term or cross-media impacts.	Alternative EB-A would not meet Threshold Criterion 1 because this alternative would not change the existing conditions in East Branch, except for those changes that result from natural recovery processes that may be ongoing (however, there is a relative lack of existing data to assess natural recovery rates in East Branch), and there would be no monitoring to confirm that RAOs would be met.	This alternative would provide overall protection of human health and the environment by meeting the exposure-based RAOs and the source control RAO, as follows: • Alternative EB-B would meet the exposure-based RAOs by reducing surface sediment concentrations to "near-zero"[1] at the completion of construction (i.e., time zero) through a combination of dredging, capping over the entire extent of East Branch (11.2 acres, including capping after ISS over an 0.8-acre area identified for shoreline stabilization), and in situ treatment (e.g., cap amendments and ISS), as further detailed in Table 5-2. Therefore, risk-based PRGs would be met at time zero. • Alternative EB-B would meet the source control RAO by reducing the migration of COCs related to NAPL and its constituents, and other sources of COCs within East Branch, from East Branch sediments to surface sediment and surface water within East Branch and other Study Area reaches through a combination of capping over the entire extent of East Branch, dredging, and in situ treatment (cap amendments and ISS). Note that based on uncertainty about the long-term effectiveness of ISS and experience at other sites, it was assumed that a post-ISS amended cap[2] would be placed above the ISS areas to control dissolved flux of COCs. Reducing concentrations of (or exposure to) contaminants in surface sediments would reduce the flux of contaminants into surface water. However, external sources outside the scope of the East Branch EA and OU1 would also impact surface water and surface sediment COC concentrations. • The components of the remedy would be expected to function as summarized below with further detail provided as part of the common elements section at the end of Threshold Criterion 1. Short-term or cross-media impacts are also discussed below with further detail provided as part of common elements. Short-term impacts are also discussed in more detail as part of Balancing Criterion 3. – **ICs:** ICs would support protection of human health via fishing and crabbing restrictions and consumption advisories. – **Dredging:** Dredging would reduce the volume of contaminated sediments in East Branch, as detailed in Table 5-3. The effectiveness of dredging can be reduced due to short-term water quality impacts, elevated post-dredging residuals within dredging areas, and potential release of COCs and NAPL (if present) induced by dredging. However, for Alternative EB-B, all dredge areas would receive a post-dredge cap to contain remaining contaminated sediment and dredge residuals. – **Capping:** Placement of caps over the entire extent of East Branch would meet risk-based PRGs by reducing COC concentrations at the completion of construction (i.e., time zero) to "near-zero" in the surface sediment (i.e., top 15 cm of the cap); this would reduce the flux of COCs and NAPL (if present) from the underlying contaminated East Branch sediments beneath the cap to surface sediment (i.e., top 15 cm of the cap) and the water column within East Branch. – **ISS:** ISS would solidify and stabilize COCs and NAPL (if present) in place, thereby limiting human and ecological contact with impacted sediment. Treatability testing would be needed during the RD phase to verify the effectiveness of ISS as a remedial technology and to assess the potential for long-term diffusive flux of COCs from the ISS monolith. – **Sealed Bulkheads:** Sealed bulkhead could be used to address localized shoreline seeps that might otherwise affect the overall protectiveness of the sediment	Same as Alternative EB-B, except that Alternative EB-C would not alter current water depths in East Branch (see more below); see Table 5-2 for a complete summary of the quantities of each remedial technology (11.2 acres would be capped, including capping after ISS over a 0.4-acre area identified for shoreline stabilization). The additional components of Alternative EB-C include the following: • **Cross-media Impacts:** In addition to reduced flux of COCs into surface water (same as Alternative EB-B), the water depth of this alternative would not have an effect on water quality in Newtown Creek because it would not result in a change in the mudline elevation in East Branch.	Same as Alternative EB-B, except that in 1.2 acres of East Branch, a cap would not be placed because contaminated sediment would be removed down to the native material interface followed by placement of post-dredge backfill to the pre-construction mudline elevation, as noted below. Caps would be placed over the remaining 10 acres (including capping after ISS over a 0.4-acre area identified for shoreline stabilization) of East Branch, either to contain contaminated sediment left in place or to control potential contaminant impacts from groundwater advection (see Table 5-2 for a complete summary of the quantities of each remedial technology). The additional components of Alternative EB-D include the following: • **Dredging:** Dredging would reduce the volume of contaminated sediments in East Branch, as detailed in Table 5-3. Similar to the discussion for Alternative EB-B, the effectiveness of dredging can be reduced due to short-term water quality impacts, elevated post-dredging residuals within dredging areas, and potential off-site release of COCs and NAPL (if present) induced by dredging. Unlike Alternatives EB-B or EB-C, not all dredge areas under Alternative EB-D would receive a post-dredge cap because some areas target removal of contaminated sediment down to the native material interface. In these areas, post-dredge generated residuals may remain that exceed the risk-based PRGs and affect the overall performance of the remedy if they are not mitigated by a post-dredge backfill. The concentration of the generated residuals would likely be equivalent to the mass-weighted average of the overlying dredge cut. • **Backfilling:** Placement of a post-dredge clean sand backfill layer in areas that would not be capped would provide an immediate reduction of surface sediment COC concentrations after dredging. Placement of backfill is expected to mitigate risks from generated residuals remaining following dredging. Backfill would be placed to return the bathymetry to the pre-construction	Same as Alternative EB-D, except that sediment would be removed down to native material interface in the navigation channel, which would result in 3.1 acres where post-dredge backfill would be placed and 8.1 acres of capping (including capping after ISS over a 0.7-acre area identified for shoreline stabilization) after either to contain contaminated sediment left in place or to control potential contaminant impacts from groundwater advection (see Table 5-2 for a complete summary of the quantities of each remedial technology). The additional components of Alternative EB-E include the following: **Backfilling:** Due to the anticipated concentration of the generated residuals (e.g., equivalent to the mass-weighted average of the overlying dredge cut), a 6- to 12-inch-thick backfill would provide a clean (near-zero concentration) surface, when considering potential mixing of the base of the sand backfill layer with the generated residuals (which have a low density). **Cross-media Impacts:** In addition to reduced flux of COCs into surface water (same as Alternative EB-D), this alternative would result in deeper water depths than existing in some portions of East Branch while maintaining current water depths in the rest of East Branch. This could affect water quality in Newtown Creek as it relates to non-CERCLA substances such as pathogens and dissolved oxygen, which are evaluated under a separate regulatory authority.	Same as Alternative EB-D, except that Alternative EB-F would target removal of all contaminated sediment except for limited areas where ISS would be used for shoreline stabilization. Caps would still be placed over 6.8 acres (including capping after ISS over a 0.2-acre area identified for shoreline stabilization) to control potential contaminant impacts from groundwater advection, and 4.4 acres would be dredged to the native material interface followed by placement of post-dredge backfill (see Table 5-2 for a complete summary of the quantities of each remedial technology). Also, options for treating NAPL would not be included because all NAPL would be targeted for removal. One small area of ISS would be included in Alternative EB-F for shoreline stabilization purposes. **Cross-media Impacts:** Alternative EB-F would result in deeper water throughout East Branch (with the exception of the limited shoreline stabilization areas using ISS). This could affect water quality in Newtown Creek as it relates to non-CERCLA substances such as pathogens and dissolved oxygen, which are evaluated under a separate regulatory authority.

[1] The post-remedy concentration of near-zero represents a clean post-dredge backfill cover and/or cap surface. In practice, the concentration of COCs in cover and cap materials will be greater than zero, especially for inorganic COCs that occur naturally in materials that may be used as cover or backfill materials. However, the concentrations of COCs in any cover or backfill materials used as part of the remedy would be below risk-based PRGs. In addition, some amount of mixing of the cover/cap materials with the underlying sediment (especially in areas of pre-placement dredging that would result in generated residuals) would be expected at the base of the layer. However, controlled placement methods (potentially including multiple lifts) could be specified to limit this mixing, and the cover/cap thickness would be designed to avoid any such mixing in the upper portion (i.e., surface) of the cover/cap. Hence, a post-remedy concentration of "near-zero" is common to all alternatives.

[2] Based on the preliminary cap designs presented in Appendix C, an armor layer to protect against erosive forces is anticipated. However, for the purposes of this table, these caps are referred to only as "amended caps."

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Threshold Criterion 1 (continued)		remedy, if there has been a determination that upland controls are warranted to be protective of the sediment remedy. The ability of the sealed bulkhead to contribute to the overall protectiveness of the sediment remedy would depend on site-specific factors to be determined during the PDI and RD phase. – **Dredged Material Management:** Dredged material dewatering would be effective at preparing the materials for transportation and long-term containment in a permitted disposal facility. Ex situ treatment of dredged sediment via stabilization/solidification would be an effective means for immobilizing COCs, if necessary, to meet landfill disposal criteria. Disposal within a permitted landfill would provide effective long-term management of the dredged materials, controlling potential future exposure to human and environmental receptors to acceptable levels. – **Post-remedy Monitoring:** Monitoring will need to distinguish between the potential for COC flux from beneath the cover/cap/ISS and the accumulation of COCs in the surface sediments from external sources to assess long-term effectiveness and permanence of the selected sediment remedy. – **Cross-media Impacts:** Reducing concentrations of, (or exposure to), COCs in surface sediments would reduce the flux of COCs into surface water. This alternative would result in water depths in East Branch that are shallower than existing, which could affect water quality in Newtown Creek as it relates to non-CERCLA substances such as pathogens and dissolved oxygen, which are evaluated under a separate regulatory authority. • Post-construction, COC concentrations in surface sediment would gradually increase over time because of ongoing external sources, which are estimated to be above risk-based PRGs for some COCs based on currently estimated LTE concentrations. However, this increase in surface sediment concentrations is independent of remedy performance.		mudline elevation and would provide a clean (near-zero concentration) surface. • **Capping:** An amended cap (instead of clean backfill) would still be needed in areas where sediment is dredged to the native material interface where the flux of COCs from groundwater is relatively high[3]; this will control potential contaminant impacts from groundwater advection. • **Cross-media Impacts**: Same as Alternative EB-C.		
		To assess ISS as a remedial technology sequestering NAPL or PTW, it was evaluated as a technology option (along with in situ treatment via amended capping and dredging) for each active alternative except Alternative EB-F (which would target removal of all sediment containing NAPL). These technology options could be integrated as components within the holistic remedial alternatives evaluated above. An approximately 0.6-acre area within the Western Beef Slip of East Branch was selected to evaluate ISS, amended capping, and dredging for managing these conditions if either were identified to be present through the PDI, as further discussed in Section 5.1 (note that NAPL or PTW warranting treatment using ISS have not been identified to date in East Branch). There is an estimated 13,700 cy of sediment within the 0.6-acre evaluation area of the Western Beef Slip that would require management. Of the total 13,700 cy of sediment, 3,600 cy of sediment is estimated to contain observations of NAPL (in the form of immobile blebs). Options for treating sediment with NAPL or PTW,[4], if either were to be identified during the PDI (these technology options are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E), are as follows: • **Option 1 (Amended Capping):** An amended cap would meet the RAOs by reducing surface sediment concentrations to "near-zero" at the completion of construction and by reducing the flux of COCs and NAPL and/or NAPL constituents in the underlying contaminated sediments to surface sediment and the water column within East Branch. • **Option 2 (ISS):** ISS would contribute to meeting the RAOs by solidifying and stabilizing COCs and NAPL. The protectiveness of ISS as a stand-alone remedy, without the need for a post-ISS cap to control diffusive flux of COCs, would be subject to additional treatability testing beyond the proof-of-concept testing performed for the FS field investigation, as summarized in Section 2.1.2.2.2 of Appendix A. • **Option 3 (Dredging):** Dredging would meet the RAOs by removing COCs and NAPL constituents, but post-dredge residuals are expected and would need to be managed using a post-dredge backfill or cap. See additional details for each option below under the common elements discussion.				

[3] Areas where an amended cap may be needed on top of native material was determined based on an evaluation presented in Section 3.1.4.2 of Appendix C.
[4] See Section 3.5 for a discussion of PTW.

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Threshold Criterion 1 (continued)		The common elements among the alternatives that were evaluated in terms of their ability to provide overall protection of human health and the environment and how they contribute to meeting this criterion are as follows: • **ICs:** ICs are assumed to be incorporated into whichever remedial alternative is selected. However, a detailed IC plan for the Study Area cannot be developed at this stage of analysis; these detailed plans are more appropriately developed during RD. Based on experience on other projects and the location of the Study Area, it is anticipated that the IC plan will include (at least) fishing and crabbing restrictions, consumption advisories, and dredging restrictions. ICs will be necessarily focused on the ICs that can be completed prior to early action completion and that are needed to protect the East Branch early action constructed components. Fish consumption advisories implemented by NYSDOH outside of the CERCLA process are assumed to remain in place. • **Dredging:** All the active alternatives include various amounts of dredging that would reduce the volume of contaminated sediments in East Branch, as detailed in Table 5-2. However, the effectiveness of dredging can be reduced due to short-term water quality impacts, elevated post-dredging residuals within dredging areas, and potential release of COCs and NAPL (if present) induced by dredging. Such impacts are based on detailed evaluations of dredging effectiveness in published guidance (NRC 2007; USEPA 2005). Experience at a range of sites with mobile contaminants indicates that post-dredge residuals from 1% to 13% of the dredged contaminant mass should be expected. However, generated residuals are primarily related to site-specific in situ characteristics of the dredged sediment. That is, dredging sediments with relatively low in situ density results in greater generated residuals (Patmont et al. 2018). Based on the dry density of the East Branch sediments (see Section 2.2.1 of the FFS) and the regression equation in Patmont et al. (2018), post-dredge residuals of 8% to 10% can be anticipated for East Branch. The concentration of the generated residuals at a given location would likely be equivalent to the mass-weighted average of the overlying dredge cut and have an in situ dry density of about 20% less than the sediment in the dredge prism (Patmont et al. 2018). Therefore, residuals concentrations are expected to vary spatially across the East Branch. While each active alternative with increasing dredge quantities can be expected to generate a greater amount of dredge residuals, when coupled with appropriate controls during dredging (e.g., use of turbidity curtains) and post-dredge residuals management, dredging is effective and reliable at reducing the long-term potential for exposure of human and ecological receptors to contaminated sediments through removal and covering of contaminant(s) of interest. Post-dredge residuals would be managed through the placement of amended caps (or for select alternatives and scenarios, clean backfill), which is expected to result in a near-zero surface sediment concentration for all COCs immediately after construction completion. Turbidity impacts in the sediment removal area would be minimized using BMPs such as turbidity curtains, which have been shown to reduce the spread of contaminants sorbed to suspended particles in the water column; however, they have proved to be generally ineffective in reducing the release of dissolved phase contaminants from the sediment removal area (Palermo et al. 2008). • **Backfilling:** Placement of a post-dredge clean sand backfill layer where appropriate (i.e., areas that would not be capped following dredging to the native material interface and where the flux of dissolved phase COCs from groundwater is not high enough to require a cap) would provide an immediate reduction of surface sediment COC concentrations after dredging. Placement of backfill is expected to mitigate risks from post-dredge residuals. • **Capping:** All of the active alternatives include placement of amended caps in areas that vary by alternative, as detailed in Table 5-2. These caps would meet risk-based PRGs in the short term by reducing COC concentrations at the completion of construction (i.e., time zero) to "near-zero" in the surface sediment (i.e., top 15 cm of the cap); they would also reduce the flux of COCs and NAPL (if present) in the underlying contaminated East Branch sediments to surface sediment (i.e., top 15 cm of the cap) and the water column within East Branch. Caps included in the remedial alternatives would be designed in accordance with USEPA guidance (Palermo et al. 1998) to provide long-term chemical isolation, physical stability, integrity (e.g., preventing mixing between layers), and protectiveness under the range of anticipated erosional forces. As discussed in Section 5.3.3 and Appendix C, preliminary cap designs were determined through an evaluation of East Branch-specific information so that the caps would meet the following objectives: – Physical isolation of COCs in the sediment from the benthic environment – Erosion protection (i.e., to mitigate resuspension and transport of sediments to other areas) to maintain cap stability against forces resulting from open water flows, propwash, vessel wakes, and other forces – Chemical isolation (i.e., sequester COCs and NAPL [if present] that could be transported into the cap from the contaminated sediment below the cap via advection, dissolved phase transport, diffusion, and/or gas ebullition-facilitated NAPL transport). Although mobile NAPL has not been observed in East Branch, if mobile NAPL were to be found during RD, the NAPL sorption layer of the cap could readily be modified to address potential NAPL advection, or ISS could be considered. • **Sealed Bulkheads:** Sealed bulkheads may be integrated into any of the active remedial alternatives with the objective of addressing localized shoreline seeps when there has been a determination that upland controls (e.g., sealed bulkheads and/or other source control technologies) are warranted to be protective of the sediment remedy. The necessity for, location, and design of the sealed bulkheads would be determined during the RD phase based on the results of PDI and other USEPA-approved or USEPA-accepted investigations that are performed outside of the PDI, as well as evaluation of whether inclusion of a sealed bulkhead would be necessary to control a contaminant source that would affect the overall protectiveness of the sediment remedy in meeting the RAOs. • **Dredged Material Management:** – **Dewatering:** Dredged material dewatering technologies considered for all active alternatives would be effective at preparing the materials for transportation and long-term containment in a permitted disposal facility. Dewatering could be conducted on site by the contractor (e.g., via pumping supernatant water from the dredged material transport scows) and/or at an intermediate, off-site facility before disposal. – **Disposal:** For all active alternatives, disposal within a permitted landfill would provide effective long-term management of the dredged materials, controlling potential future exposure to human and environmental receptors to acceptable levels. As discussed in Table 4-1, beneficial use opportunities for the dredged sediment will be explored during RD. • **In Situ Treatment:** ISS is included in all active alternatives in varying areas and is expected (subject to treatability testing) to contribute to meeting the RAOs by solidifying and stabilizing COCs and NAPL (if present) in place, thereby limiting human and ecological contact with impacted sediment. A proof-of-concept treatability study of ISS was performed as part of the FS field investigations, as summarized in Section 2.1.2.2.2 of Appendix A. Additional treatability testing would be conducted during the RD phase to verify the effectiveness of ISS as a remedial technology; specifically, to assess the potential for long-term diffusive flux of COCs from the ISS monolith. Amended capping is also considered a form of in situ treatment (see relevant detail above). • **Ex Situ Treatment:** Ex situ treatment of dredged sediment via stabilization/solidification as part of all active alternatives would be an effective means for immobilizing COCs, if necessary, to meet landfill disposal criteria. • **Evaluation Monitoring:** COC surface concentrations are expected to gradually increase over time following remedy construction because of ongoing external inputs to East Branch, resulting in accumulation of LTE concentrations in surface sediments above the cover/cap/ISS that may exceed risk-based PRGs for some COCs based on currently estimated LTE concentrations, regardless of the remedy implemented. Therefore, post-remedy monitoring for any alternative will need to distinguish between the potential for COC flux from beneath the cover/cap/ISS and the accumulation of COCs in the surface sediments from external sources to assess the long-term effectiveness and permanence of the selected remedy.				

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Threshold Criterion 2: Compliance with ARARs **(Section 6.1.2)** Evaluates whether the alternative attains the identified chemical-specific, action-specific, and location-specific ARARs. USEPA has concluded that there are no potential chemical-specific ARARs for the East Branch EA.	There are no ARARs for Alternative EB-A because there is no CERCLA-related action performed.	Alternative EB-B would be designed to comply with the substantive requirements of ARARs. Alternative EB-B is the only alternative that results in water depths that are shallower than existing. With respect to floodplain impacts, this issue is evaluated in Section 4 of Appendix C, which concludes that there would be negligible change in peak water surface elevations during storm surge events.	Same as Alternative EB-B, except that post-remedy water depths would be the same as existing conditions; therefore, Alternative EB-C is unlikely to result in an increase in peak water surface elevations during storm surge events.	Same as Alternative EB-C.	Same as Alternative EB-D, except that post-remedy water depths would be deeper on average than existing conditions; therefore, Alternative EB-E is unlikely to result in an increase in peak water surface elevations during storm surge events.	Same as Alternative EB-E.
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E. Each of the options would be designed to comply with the substantive requirements of ARARs. These technology options could be integrated as components within the holistic remedial alternatives evaluated above.				

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1: Long-Term Effectiveness and Permanence **(Section 6.1.3)** Evaluates the magnitude of human health and ecological risk remaining after remedial action has been concluded and response objectives have been met (known as residual risk) and the adequacy and reliability of the controls to manage that residual risk.	**Magnitude of Residual Risk: Post-Remedy COC Concentrations in Surface Sediment** There is no active remediation under Alternative EB-A, so COC concentrations in the surface sediments would only be reduced by natural recovery processes that may be ongoing in East Branch (however, there is a relative lack of existing data to assess natural recovery rates in East Branch), as discussed in Section 2.5.3 of Appendix A. However, it would likely take several decades to meet LTE concentrations, and they would not be verified under Alternative EB-A because no monitoring would be performed.	**Magnitude of Residual Risk: Post-Remedy COC Concentrations in Surface Sediment**[5] COC concentrations in surface sediment would be expected to be "near-zero" immediately after construction because the entire surface area of sediment in East Branch would be remediated through a combination of dredging, capping over the entire extent of East Branch (11.2 acres), and/or in situ treatment (e.g., amended capping and ISS). This means that COC concentrations in surface sediments would be below risk-based PRGs immediately after construction. Below is a summary of how the key components of the remedy would be expected to perform relative to the magnitude of residual risk in surface sediment; further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1. • **Dredging:** Dredging would reduce the volume of contaminated sediments that would remain in East Branch, but this alternative does not target dredging in all areas of the East Branch, nor does it target complete removal of contaminated sediment down to the native material interface, so post-dredge COC concentrations in surface sediments would be controlled with a post-dredge cap. • **Capping:** Placement of an amended cap over the entirety of East Branch would physically and chemically isolate sediments left in place from the overlying water column to prevent direct contact between contaminants, contaminated media, and aquatic biota. For Alternative EB-B, dredging would be performed prior to capping such that the caps would be installed at or below 0 foot MLLW. As a result of the removal, the remaining contaminated sediment below the caps would generally be below -4.4 foot MLLW (i.e., to accommodate a 53-inch-thick [4.4-foot-thick] cap in the shallow wake zone), thereby maintaining saturation of the contaminated sediment and preventing desiccation, which could potentially result in otherwise unexpected contaminant releases. Furthermore, because the armor layer for each of the preliminary cap designs is at least 12 inches thick, the underlying chemical isolation layer would be no higher than -1 foot MLLW, such that the chemical isolation layer will remain saturated even at the lowest tides. In addition, the period of time when the armor layer could be exposed at low tide would typically be on the order of a few minutes to an hour for a given tidal cycle. This limited exposure to the atmosphere is not expected to result in any impact to the cap's effectiveness. The armor layer of the caps has been preliminarily designed to withstand the anticipated erosive forces, including consideration that the post-cap surface elevation may be higher than the pre-construction sediment bed elevation in some areas. Long-term monitoring and maintenance of the caps would be required to further verify their long-term effectiveness and permanence. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **In Situ Treatment:** In situ treatment via ISS would control the potential risk of exposure to COCs and NAPL remaining at the site by solidifying and stabilizing sediment in place and limiting human and ecological contact with impacted sediment. A post-ISS cap may be needed to reduce long-term flux of dissolved phase COCs from the ISS monolith. The effectiveness and reliability of ISS to control the residual risk, and the potential need for a post-ISS cap, would be subject to treatability testing during the RD phase. In addition to ISS, amendments included in the caps would permanently sequester contaminants that migrate into the treatment layer (chemical isolation layer) of the caps and would be considered a form of in situ treatment. Post-remedy, ongoing sources that are outside the scope of the East Branch EA will continue to contribute loadings of COCs to both surface water and surface sediment. These ongoing loads from external sources would cause post-remedy surface sediment COC concentrations in East Branch to increase from the near-zero concentrations until the system reaches an LTE condition, as discussed in Section 3.4. Comparison of the preliminary	**Magnitude of Post-Remedy Residual Risk: COC Concentrations in Surface Sediment** Same as Alternative EB-B, excepted as noted below: • **Dredging:** Dredging would target removal of existing surface sediment across the entire footprint of the East Branch, so it would reduce the volume of contaminated sediments that would remain in East Branch. However, because this alternative does not target complete removal of contaminated sediment down to the native material interface, post-dredge COC concentrations in surface sediments would be controlled with a post-dredge cap. • **Capping:** Dredging would be performed prior to capping to accommodate placement of the caps and maintain the pre-construction mudline elevations. As a result of the sediment removal, the remaining contaminated sediment below the caps would generally be below 0 foot MLLW, thereby maintaining saturation of the contaminated sediment and preventing desiccation. Furthermore, because the armor layer for each of the preliminary cap designs is at least 12 inches thick, the underlying chemical isolation layer would generally be no higher than -1 foot MLLW, such that the chemical isolation layer will remain saturated even at the lowest tides. In addition, the period of time when the armor layer could be exposed at low tide would typically be on the order of a few minutes to 1 or 2 hours for a given tidal cycle. This limited exposure to the	**Magnitude of Post-Remedy Residual Risk: COC Concentrations in Surface Sediment** Same as Alternative EB-C, except that some dredge areas will target removal of contaminated sediment down to the native material interface. Below is a summary of how the additional components of Alternative EB-C (beyond those described for Alternative EB-B) would be expected to perform relative to the magnitude of residual risk in surface sediment: • **Dredging:** In some portions of East Branch (1.2 acres; 11% of surface area), removal of all sediment without capping is targeted, but it is likely that some amount of post-dredge residuals that exceed risk-based PRGs will remain (Patmont et al. 2018). Therefore, post-dredge residuals management (with sand backfill) would be necessary to manage residual risks in surface sediments. • **Backfilling:** Placement of a post-dredge backfill layer (placed to restore the pre-construction mudline elevation) would provide an immediate reduction of surface sediment COC concentrations after dredging. Placement of clean sand backfill is expected to mitigate risks from post-dredge residuals.	**Magnitude of Post-Remedy Residual Risk: COC Concentrations in Surface Sediment** Same as Alternative EB-D, except as noted below: • **Dredging:** Removal of all sediment without capping is targeted in 3.1 acres (28% of surface area) of East Branch, and post-dredge residuals that exceed risk-based PRGs are expected to remain, requiring a post-dredge backfill layer. • **Backfilling:** Placement of a post-dredge backfill layer (6 to 12 inches thick) would provide an immediate reduction of surface sediment COC concentrations after dredging. Placement of clean sand backfill is expected to mitigate risks from post-dredge residuals.	**Magnitude of Post-Remedy Residual Risk: COC Concentrations in Surface Sediment** Same as Alternative EB-D, except as noted below: • **Dredging:** Removal of all sediment without capping is targeted in 4.4 acres (39% of surface area) of East Branch, and post-dredge residuals that exceed risk-based PRGs are expected to remain, requiring a post-dredge backfill layer.

[5] Surface sediment is defined as the top 15 cm of sediment. For alternatives that include capping or backfilling, surface sediment in areas of capping refers to the top 15 cm of the cap (i.e., the top 15 cm of the erosion protection layer) and in areas of backfilling refers to the top 15 cm of the backfill layer.

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)		estimates of LTE concentrations with the risk-based PRGs indicates that LTE concentrations within East Branch may be greater than some risk-based PRGs (specifically D/F TEQ and C19-C36 and possibly TPCB) based on currently estimated LTE concentrations, regardless of the remedy selected. Therefore, additional source control outside the scope of the East Branch EA (and OU1) remedies would likely be necessary in order to meet the long-term risk-based PRGs in surface sediments. Therefore, post-remedy monitoring for any alternative will need to distinguish between the potential for COC flux from beneath the cover/cap/ISS and the accumulation of COCs in the surface sediments from external sources to assess long-term effectiveness and permanence of the selected remedy.	atmosphere is not expected to result in any impact to the cap's effectiveness.			
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** Placement of an amended cap would physically and chemically isolate NAPL or PTW left in place. Long-term monitoring and maintenance of the caps would be required to further verify their long-term effectiveness and permanence. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **Option 2 (ISS):** The solidification/stabilization process would control COCs in the treated surface sediment, but a post-ISS cap may be needed to control long-term diffusive flux from the ISS monolith. • **Option 3 (Dredging):** Dredging would remove impacted sediment, but a limited amount of sediment is expected to remain as residuals on the post-dredge surface and would need to be managed with a post-dredge backfill.				

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Table 6-1
Detailed Analysis of Alternatives

<table>
<tr><th>Superfund Criteria</th><th>Alternative EB-A:
No Action</th><th>Alternative EB-B:
Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW</th><th>Alternative EB-C:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths</th><th>Alternative EB-D:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging</th><th>Alternative EB-E:
Dredge All Within Navigation Channel, Cap Outside</th><th>Alternative EB-F:
Dredge All</th></tr>
<tr><td rowspan="2">Balancing Criterion 1 (continued)</td><td rowspan="2">Magnitude of Residual Risk: Potential Impacts from NAPL Advection
This factor evaluates the potential for impacts associated with NAPL migrating by advection. Based on extensive field sampling, laboratory testing, and data evaluation within East Branch, NAPL was not observed in surface sediments or in native material; it was only observed in residual form (i.e., as NAPL blebs) in subsurface sediments, and quantitative NAPL mobility testing demonstrated that NAPL blebs observed in subsurface sediment (at the East Branch locations tested) are immobile under the laboratory test conditions (with hydraulic gradients greater than the maximum observed in the field) and have been interpreted to be immobile and incapable of migrating upward via advection under field conditions at the locations tested (Anchor QEA 2022). Regardless, Alternative EB-A would not provide additional protection for this criterion above current conditions.</td><td>Magnitude of Residual Risk: Potential Impacts from NAPL Advection
Same as Alternative EB-A, except in the event that changes to in situ conditions cause NAPL mobility. However, as discussed in Section 3.2.3 of Appendix C, NAPL is not expected to be mobilized under the changed conditions (i.e., change in overburden pressure) resulting from capping under any of the alternatives. See below for options for treating sediment containing NAPL.</td><td>Magnitude of Residual Risk: Potential Impacts from NAPL Advection
Same as Alternative EB-B.</td><td>Magnitude of Residual Risk: Potential Impacts from NAPL Advection
Same as Alternative EB-B, except that dredging deeper sediments under Alternative EB-D may have the potential to mobilize NAPL (if present) due to disturbance of the sediment bed (e.g., NAPL within the material dredged or NAPL below the targeted material) during dredging.</td><td>Magnitude of Residual Risk: Potential Impacts from NAPL Advection
Same as Alternative EB-D.</td><td rowspan="2">Magnitude of Residual Risk: Potential Impacts from NAPL Advection
Same as Alternative EB-D, except that in Alternative EB-F, sediment would be removed by dredging to the native material interface (except within ISS areas identified for shoreline stabilization), and NAPL was not identified in the underlying native material in East Branch. Dredging would remove all sediment with observations of any NAPL, and in areas of ISS, NAPL, if observed, would be sequestered. However, dredging has the potential to mobilize NAPL within the dredged material (if present) due to disturbance of the sediment bed. Therefore, Alternative EB-F would not rely on other technologies (e.g., amended capping) for NAPL migration control.</td></tr>
<tr><td colspan="4">Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above):
• Option 1 (Amended Capping): The NAPL sorption layer of the amended cap could be modified from the FFS preliminary cap design accordingly and would be effective in controlling NAPL advection.
• Option 2 (ISS): The solidification/stabilization process would be effective in controlling NAPL advection.
• Option 3 (Dredging): Dredging would remove NAPL-impacted sediment, thereby removing the majority of the risk. However, dredging has the potential to mobilize NAPL within the dredged material due to disturbance of the sediment bed. In addition, a limited amount of sediment (potentially containing NAPL) is expected to remain as post-dredge residuals and would need to be managed with a post-dredge backfill.</td></tr>
</table>

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)	**Magnitude of Residual Risk: Potential Impacts from Dissolved Phase Transport of Contamination** High COC concentrations in contaminated sediment and NAPL are sources of dissolved phase contaminants that may be transported from the subsurface sediment into the surface sediment and surface water through porewater advection and diffusion. Alternative EB-A would leave the following quantities of sediment in place (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 219,000 cy • Sediment with observations of sheen: 148,200 cy • Sediment with observations of NAPL: 16,200 cy Alternative EB-A would not provide additional protection for this factor compared to current conditions.	**Magnitude of Residual Risk: Potential Impacts from Dissolved Phase Transport of Contamination** Alternative EB-B would leave the following quantities of sediment in place, potentially contributing to residual risk (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 187,000 cy • Sediment with observations of sheen: 126,600 cy • Sediment with observations of NAPL: 16,200 cy However, the quantity of sediment left in place does not directly correlate to residual risk because Alternative EB-B would control potential dissolved phase contaminant impacts (associated with NAPL or other high-concentration sources in sediment) through a combination of dredging, capping, and/or in situ treatment options (e.g., amended capping and ISS), as summarized below; further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1. • **Dredging:** Dredging would reduce the volume of contaminated sediments that would remain in East Branch, but this alternative does not target complete removal of contaminated sediment, so dissolved phase transport of remaining contamination would be controlled with a post-dredge amended cap. • **Capping:** Placement of an amended cap over the entirety of East Branch (11.2 acres, including capping after ISS over a 0.8-acre area identified for shoreline stabilization), and in situ treatment (e.g., cap amendments and ISS) would physically and chemically isolate sediments left in place and control dissolved phase flux of COCs. Long-term monitoring and maintenance of the caps would be required to further verify their long-term effectiveness and permanence. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **In Situ Treatment:** The effectiveness and reliability of ISS to control dissolved phase flux following ISS implementation would be subject to treatability testing during the RD phase; the results of which may indicate the need for a post-ISS cap.	**Magnitude of Residual Risk: Potential Impacts from Dissolved Phase Transport of Contamination** Same as Alternative EB-B except that Alternative EB-C would leave the following quantities of sediment in place, potentially contributing to residual risk, under an amended cap over the entirety of East Branch (11.2 acres would be capped, including capping after ISS over a 0.4-acre area identified for shoreline stabilization of East Branch; see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 127,700 cy • Sediment with observations of sheen: 86,400 cy • Sediment with observations of NAPL: 16,000 cy	**Magnitude of Residual Risk: Potential Contaminant Impacts from Dissolved Phase Transport of Contamination** Similar to Alternative EB-C, except that Alternative EB-D would leave the following quantities of sediment in place, potentially contributing to residual risk, under an amended cap in 9.7 acres (including capping after ISS over a 0.4-acre area identified for shoreline stabilization) of East Branch (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 119,100 cy • Sediment with observations of sheen: 80,600 cy • Sediment with observations of NAPL: 16,000 cy Also, Alternative EB-D would not include amended capping in 1.2 acres of East Branch where all sediment would be removed to the native material interface. Areas dredged to the native material interface under this alternative would not need a cap because neither NAPL nor high-concentration dissolved COCs have been observed in native materials in those areas. Instead, clean backfill would be used. However, an amended cap (instead of clean backfill) would be needed in an additional 0.3 acre dredged to the native material interface where the flux of COCs from groundwater is relatively high; this will control potential COC impacts from groundwater advection.	**Magnitude of Residual Risk: Potential Impacts from Dissolved Phase Transport of Contamination** Similar to Alternative EB-D; except that Alternative EB-E would leave the following quantities of sediment in place, potentially contributing to residual risk, under an amended cap in 2.8 acres (including capping after ISS over a 0.7-acre area identified for shoreline stabilization) of East Branch (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 29,100 cy • Sediment with observations of sheen: 19,500 cy • Sediment with observations of NAPL: 9,300 cy Also, similar to Alternative EB-D, clean backfill would be used in 3.1 acres dredged to the native material interface and an amended cap would still be needed in 5.3 acres dredged to the native material interface where the flux of COCs from groundwater is relatively high.	**Magnitude of Residual Risk: Potential Impacts from Dissolved Phase Transport of Contamination** Alternative EB-F would control potential dissolved phase contaminant impacts as follows: • **Dredging:** Alternative EB-F would target removal of all sediment with observations of any NAPL or other high-concentration sources (except within ISS areas identified for shoreline stabilization, where 6,300 cy of sediment with exceedances of risk-based PRGs and 4,200 cy of sediment with observations of sheen would remain), but post-dredge residuals are expected to limit the effectiveness of dredging (Patmont et al. 2018). • **Capping or Backfilling:** Even though this alternative targets removal of sediment down to the native material interface, dredge residuals management (via backfilling) would be needed in 4.4 acres. In addition, capping would be required in 6.8 acres (including capping after ISS over a 0.2-acre area identified for shoreline stabilization) to control impacts from dissolved phase transport of contamination. The effectiveness of capping and backfilling is described for Alternative EB-B. • If high COC concentrations or NAPL are present within the small area of ISS included in Alternative EB-F for shoreline stabilization, they would be controlled (i.e., sequestered) by ISS, subject to confirmation through treatability testing as described for Alternative EB-B.
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** Amendments included in the caps would permanently sequester dissolved phase COCs from 13,700 cy of sediment (3,600 cy of which contains NAPL observations) if it were to migrate into the amended cap layer.[6] • **Option 2 (ISS):** ISS would treat 3,600 cy of sediment containing NAPL observations contained within the 13,700 cy of sediment that would be managed with ISS in the evaluation area within the Western Beef Slip. The effectiveness and reliability of ISS to control dissolved phase contaminant transport from NAPL would be subject to treatability testing during the RD phase. Based on experience at other sites, it may be necessary to place a cap on top of the area following ISS treatment to control diffusive flux. • **Option 3 (Dredging):** Dredging would remove 3,600 cy of sediment containing NAPL observations within the 13,700 cy of sediment to be dredged in the evaluation area within the Western Beef Slip, thereby removing most of the risk from dissolved transport of COCs from residuals. However, even with BMPs, dredging will release dissolved phase contaminants during the removal process. See additional details for each technology option below under common elements discussion.				

[6] The estimated volume of sediment with observations of NAPL in Western Beef Slip was calculated consistent with the method presented in Section 3.6 that was used to estimate the total sediment volume with observations of NAPL in the East Branch (i.e., based on a length-weighted average of core sample intervals with and without exceedances). Based on this methodology, the estimated volume of sediment with observations of NAPL in Western Beef Slip is only 1.6% of the total sediment in all of East Branch. This percentage (1.6%) was multiplied by the total sediment volume in East Branch to estimate the volume of sediment containing NAPL that is within the area in Western Beef Slip.

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Table 6-1
Detailed Analysis of Alternatives

<table>
<tr>
<th>Superfund Criteria</th>
<th>Alternative EB-A:
No Action</th>
<th>Alternative EB-B:
Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW</th>
<th>Alternative EB-C:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths</th>
<th>Alternative EB-D:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging</th>
<th>Alternative EB-E:
Dredge All Within Navigation Channel, Cap Outside</th>
<th>Alternative EB-F:
Dredge All</th>
</tr>
<tr>
<td rowspan="2">Balancing Criterion 1 (continued)</td>
<td rowspan="2">Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
This factor evaluates the potential for gas ebullition-facilitated transport of NAPL. Alternative EB-A would leave 16,200 cy of sediment with observations of NAPL in place.
Alternative EB-A would not provide additional protection for this factor compared to current conditions.</td>
<td>Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
Alternative EB-B would control potential impacts from gas ebullition-facilitated transport of NAPL from 16,200 cy of sediment with observations of NAPL that would remain in place through placement of an amended cap over the entirety of East Branch; further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1. It should be noted that the dredging component of Alternative EB-B would not remove any NAPL, based on existing site data, and therefore would not contribute to managing ebullition-facilitated transport of NAPL.</td>
<td>Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
Similar to Alternative EB-B, except that Alternative EB-C would dredge 200 cy of sediment with observations of NAPL, so 16,000 cy of sediment with observations of NAPL would remain under an amended cap over the entirety of East Branch. This remaining sediment could potentially contribute to ebullition-facilitated transport of NAPL.</td>
<td>Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
Same as Alternative EB-C, except that Alternative EB-D would contain 16,000 cy of sediment with observations of NAPL under an amended cap in 9.7 acres of East Branch. This remaining sediment could potentially contribute to ebullition-facilitated transport of NAPL. In addition, Alternative EB-D would not include capping in 1.2 acres of East Branch where all sediment would be removed to the native material interface. NAPL was not identified in the underlying native material, so material contributing to ebullition-facilitated NAPL transport would be removed in areas where all sediment would be removed to the native material interface (except for those post-dredge residuals, where NAPL may have been present in the sediments).</td>
<td>Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
Same as Alternative EB-D, except that Alternative EB-E would dredge 6,900 cy and leave 9,300 cy of sediment with observations of NAPL under an amended cap in 2.8 acres of East Branch. This remaining sediment could potentially contribute to ebullition-facilitated transport of NAPL. In addition, Alternative EB-E would not include capping in 3.1 acres of East Branch where all sediment would be removed to the native material interface (instead, sand backfill would be used to control post-dredge residuals here).</td>
<td rowspan="2">Magnitude of Residual Risk: Potential Impacts from Gas Ebullition-facilitated Transport of NAPL
All sediment with observations of NAPL in Alternative EB-F would be removed by dredging to the native material interface (except for post-dredge residuals if NAPL were present in the sediments and except for NAPL that may be identified during PDI within ISS areas designated for shoreline stabilization. It was assumed that ISS would eliminate the potential for gas ebullition-facilitated transport of NAPL due to the change in geotechnical characteristics of the post-treatment sediments).</td>
</tr>
<tr>
<td colspan="4">Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above):
• Option 1 (Amended Capping): The amended cap that would be placed throughout East Branch would include a NAPL sorption layer that would provide protection of the surface of the cap from ebullition-facilitated NAPL transport, while allowing the gas to pass through the cap without affecting its stability or creating preferential contaminant pathways.
• Option 2 (ISS): ISS would eliminate gas generation and bubble migration within the treated area due to the change in geotechnical characteristics of the post-treated sediments, and therefore would eliminate the potential for gas ebullition-facilitated transport of NAPL.
• Option 3 (Dredging): Dredging would remove NAPL-impacted sediments that contribute to ebullition-facilitated transport of NAPL.</td>
</tr>
</table>

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** The low-energy environment of East Branch results in minimal erosion of the sediment bed, but episodic erosion in specific areas or reworking of the upper layers of the sediment may occur due to elevated current velocities in some areas (e.g., near certain outfalls) or by vessel propwash. Alternative EB-A would leave the following quantities of sediment in place (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 219,000 cy • Sediment with observations of sheen: 148,200 cy • Sediment with observations of NAPL: 16,200 cy Alternative EB-A would not provide additional protection for this factor above current conditions.	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** Alternative EB-B would leave the following quantities of sediment in place, potentially contributing to residual risk (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 187,000 cy • Sediment with observations of sheen: 126,600 cy • Sediment with observations of NAPL: 16,200 cy However, the quantity of sediment left in place does not directly correlate to residual risk because Alternative EB-B would reduce the potential for sediment contamination impacts due to sediment erosion through a combination of dredging, capping, and/or in situ treatment (e.g., amended capping and ISS) as summarized below; further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1. • **Dredging:** Dredging would remove contaminated sediments, but this alternative does not target complete removal of contaminated sediment, so a post-dredge amended cap would be placed to manage residual risk. • **Capping:** Amended caps placed over the entirety of East Branch (11.2 acres) would be constructed with appropriate erosion protection layers to remain physically stable in the long term. Long-term monitoring and maintenance of the caps is included as an element of all capping alternatives to further verify their long-term effectiveness and permanence. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **In Situ Treatment:** The ISS process would solidify the sediment and minimize the potential for erosion. If a post-ISS cap is needed (based on treatability testing during the RD phase) to control long-term flux from the ISS monolith, the cap would be constructed with appropriate erosion protection and monitored/maintained.	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** Same as Alternative EB-B except that Alternative EB-C would leave the following quantities of sediment in place under an amended cap in the entirety of East Branch (11.2 acres), which could potentially contribute to residual risk (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 127,700 cy • Sediment with observations of sheen: 86,400 cy • Sediment with observations of NAPL: 16,000 cy	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** Similar as Alternative EB-C, except that Alternative EB-D would leave the following quantities of sediment in place under an amended cap in 9.7 acres of East Branch, which could potentially contribute to residual risk (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 119,100 cy • Sediment with observations of sheen: 80,600 cy • Sediment with observations of NAPL: 16,000 cy Also, Alternative EB-D would not include capping in 1.2 acres of East Branch where all sediment would be removed to the native material interface. Areas dredged to the native material interface under this alternative would not need a cap because all sediment has been removed and neither NAPL in native material nor high-concentration dissolved COCs have been observed in native materials in those areas. Instead, clean backfill would be used in this 1.2 acres to mitigate risks from post-dredge residuals. However, an amended cap (instead of clean backfill) would be needed in an additional 0.3 acre dredged to the native material interface where the flux of COCs from groundwater is relatively high; this will control potential COC impacts from groundwater advection.	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** Similar to Alternative EB-D; except that Alternative EB-E would leave the following quantities of sediment in place under an amended cap in 2.8 acres of East Branch, which could potentially contribute to residual risk (see Table 5-3 for details): • Sediment with exceedances of risk-based PRGs: 29,100 cy • Sediment with observations of sheen: 19,500 cy • Sediment with observations of NAPL: 9,300 cy Also, Alternative EB-E would not include capping in 3.1 acres of East Branch where all sediment would be removed to the native material interface. However, an amended cap (instead of clean backfill) would be needed in an additional 5.3 acres dredged to the native material interface where the flux of COCs from groundwater is relatively high; this will control potential COC impacts from groundwater advection.	**Magnitude of Residual Risk: Potential Contamination Impacts Due to Erosion** All sediment in Alternative EB-F would be removed by dredging (except within ISS areas identified for shoreline stabilization, where 6,300 cy of sediment with exceedances of risk-based PRGs and 4,200 cy of sediment with observations of sheen would remain). Because complete removal is not practicable, due to post-dredge residuals that are an inevitable outcome from dredging, post-dredge residuals management (by backfilling in 4.4 acres and capping in 6.8 acres [including post-ISS cap of 0.2 acre]) would be required to control impacts from sediment transport via erosion. Erosion protection of the caps would be as described for Alternative EB-B.
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** Amended caps constructed over NAPL-impacted sediment or PTW would be designed with appropriate erosion protection layers to remain physically stable in the long term. Long-term monitoring and maintenance of the caps would be required to verify their long-term effectiveness and permanence. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **Option 2 (ISS):** The ISS process would solidify the sediment and minimize the potential for erosion. If a post-ISS cap is needed to control long-term flux from the ISS monolith, the cap would be constructed with appropriate erosion protection and monitored/maintained. • **Option 3 (Dredging):** Dredging would remove NAPL-impacted sediment or PTW, but post-dredge residuals would remain and require management with a sand backfill or cap.				

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Although an external source (see Section 8.1 of the RI Report [Anchor QEA 2023]), groundwater discharge to the base of East Branch results in loads of some COCs to subsurface sediment; subsequently, some fraction of those loads may be transported to surface sediment and eventually to surface water. Alternative EB-A would not provide additional protection from such potential impacts from contaminated groundwater. However, as discussed in Section 2.5.1.2 of Appendix A, groundwater contamination is attenuated by the subsurface sediment and does not represent a significant source of loading to surface sediment or surface water under existing conditions (i.e., the COC load associated with flux of porewater from subsurface sediment to surface sediment and from surface sediment to surface water determines these loadings).	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Although an external source, upward flux of groundwater containing COCs is currently principally attenuated within subsurface sediment. An amended cap would be placed throughout East Branch that would provide further protection of the post-remedy surface from the upward migration of groundwater containing COCs. Further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1.	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Same as Alternative EB-B.	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Same as Alternatives EB-B, except that in 1.2 acres with limited sediment thickness and relatively low flux of COCs from groundwater COC concentrations, sediment would be removed down to the native material interface. These areas of dredging to the native material interface would be covered with a clean sand backfill layer to manage post-dredge residuals and return the bathymetry to pre-construction mudline elevations. In addition, an amended cap would be placed over 0.3 acre where sediment would be removed down to the native material interface and the flux of COCs in groundwater is relatively high. This amended cap would provide protection of the post-remedy surface from contaminated groundwater movement into the sediment and cap, similar to that described for Alternative EB-B. Amended caps placed in the 9.7 acres of East Branch where contaminated sediment would be left in place would also provide protection of the post-remedy surface from the upward migration of groundwater containing COCs.	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Same as Alternative EB-D, except Alternative EB-E would include 3.1 acres where sediment would be removed down to the native material interface and covered with a clean sand backfill and 5.3 acres where an amended cap would be placed after sediment removal down to the native material interface in areas where the flux of COCs from groundwater is relatively high. Amended caps placed in the 2.8 acres of East Branch where contaminated sediment would be left in place would also provide protection of the post-remedy surface from the upward migration of groundwater containing COCs.	**Adequacy and Reliability of Controls: Potential Impacts from Contaminated Groundwater in Native Material** Same as Alternative EB-D, except Alternative EB-F would include 4.4 acres where sediment would be removed down to the native material interface and covered with a clean sand backfill and 6.6 acres where an amended cap would be placed after sediment removal down to the native material interface where the flux of COCs from groundwater is relatively high.

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** Alternative EB-A does not include any remedial action or monitoring, so it would leave contaminants in place (including in surface sediment). Existing ICs would continue under Alternative EB-A, but by themselves, they would not be effective at controlling risks from those contaminants. Natural recovery processes, which may be ongoing in East Branch (however, there is a relative lack of existing data to assess natural recovery rates in East Branch) may result in reductions in surface sediment COC concentrations with or without active remediation, but the time frame for reduction to an LTE condition would be long (i.e., decades), and there would be no monitoring to confirm that RAOs would be met.	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** Alternative EB-B would adequately and reliably control contamination remaining at the site and potential contaminant impacts from contaminated groundwater in native material through a combination of ICs, capping, and/or in situ treatment (e.g., amended capping and ISS), as summarized below; further detail is provided as part of the common elements discussion at the end of Balancing Criterion 1, and quantities for remedial alternatives are presented in Table 5-2 and above as part of the evaluation of residual risk. These conclusions would be evaluated through evaluation monitoring. • **ICs:** ICs would not be effective on their own but would support the overall adequacy and reliability of the remedy via fishing and crabbing restrictions and consumption advisories. • **Dredging:** Dredging would remove contaminated sediments, but this alternative does not target complete removal of contaminated sediment, so a post-dredge amended cap would be placed over remaining contaminated sediment to be protective of human and ecological receptors. • **Capping:** Capping is a reliable technology for containing contaminated sediment, but long-term monitoring and maintenance would be performed to further verify the long-term effectiveness and permanence of the caps. If damage to the caps occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **In Situ Treatment:** ISS is expected to be reliable but would be subject to verification through a treatability study during the RD, which may identify the need for a post-ISS cap to control long-term COC diffusive flux from the ISS monolith. • **Dredged Material Management:** The residual risk of dredged material would be controlled through ex situ treatment and disposal in a permitted landfill. • **Sealed Bulkheads:** The adequacy of sealed bulkheads for controlling localized shoreline seeps would depend on site-specific factors to be determined during the PDI and RD phase and may need to be coupled with other upland source control measures. • **Evaluation Monitoring:** Evaluation monitoring would be used to assess the effectiveness of the remedy and identify the need for maintenance, which could include repair, modification, or replacement of remedial technology or process option components of the remedy. Based on experience at similar sites, long-term maintenance of caps is expected to be limited and generally involves one-time repair events to address localized scour from unanticipated erosive forces (e.g., vessel impacts or significant storm/flow events). However, these impacts are typically minor and do not compromise the effectiveness of the remedy as a whole.	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** Same as Alternative EB-B, except that the quantities of material left in place vary, as presented in Table 5-2.	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** Same as Alternative EB-B, except that the quantities of material left in place vary, as presented in Table 5-2, and except that selected areas with limited sediment thickness and relatively low flux of COCs from groundwater would be dredged to the native material interface and covered with a clean sand backfill layer, thereby further reducing the volume of contamination remaining at the site. In addition, some areas would be dredged to the native material interface but would still require a post-dredge cap in areas where the flux of COCs from groundwater is relatively high. Below is a summary of the adequacy and reliability of the additional/varying components of Alternative EB-D (beyond those described for Alternative EB-B): • **Dredging:** In some portions of East Branch, removal of all sediment without amended capping is targeted, but it is likely that dredging will not remove all targeted sediment and post-dredge residuals that exceed risk-based PRGs will remain. • **Backfilling:** Placement of post-dredge backfill material to return the bathymetry to pre-construction mudline elevations, which would also reliably control the post-dredge residuals.	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** Same as Alternative EB-D, except that the areas of capping and backfill and quantities of material left in place vary, as presented in Table 5-2. Also, in areas dredged to the native material interface, a 6- to 12-inch-thick backfill would reliably control the post-dredge residuals.	**Adequacy and Reliability of Controls: Effectiveness of ICs, Backfilling, Capping, In Situ Treatment, and Dredged Material Management:** All sediment in Alternative EB-F (except within ISS areas identified for shoreline stabilization) would be removed by dredging to the native material interface, except for post-dredge residuals; therefore, Alternative EB-F would adequately and reliably control contamination remaining at the site through a combination of ICs and backfilling. The residual risk of dredged material would be controlled through ex situ treatment and disposal in a permitted landfill. Capping would be required in areas where the flux of COCs from groundwater is relatively high.
		Technology options for treating sediment with NAPL or PTW sediment within the 0.6-acre evaluation area of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** The preliminary amended cap design developed for the FFS includes dedicated layers for chemical isolation and erosion protection that would adequately and reliably control the residual risk from remaining contamination (including NAPL) below the cap. • **Option 2 (ISS):** ISS would be expected to control the residuals risk by stabilization/sequestering COCs, but the effectiveness and reliability of ISS to control the residual risk would be subject to treatability testing during the RD phase. Based on experience at other sites, diffusive flux from the ISS monolith may continue over the long term, which could require the placement of a post-ISS cap over the monolith to control the residual risk. • **Option 3 (Dredging):** Dredging, if coupled with a post-dredge backfill for residuals control (or an amended cap in areas where the sediment was not removed to the native material interface), would be an adequate and reliable control because it would remove NAPL or PTW. The post-dredge backfill would be necessary to adequately control post-dredge residuals in areas dredged down to the native material interface.				

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 1 (continued)		The following are common elements among the alternatives that were evaluated in terms of their ability to reduce the magnitude of residual risk, as well as the adequacy and reliability of the control measures: • **ICs:** ICs have been shown to control risk reliably and adequately over time by implementing non-engineering controls intended to affect human activities in such a way as to prevent or reduce exposure to COCs. However, ICs for an Early Action will be necessarily focused on the ICs that can be completed prior to early action completion and that are needed to protect the East Branch early action constructed components. OU1 wide efforts such as use restrictions and information devices will likely not be completed until the OU1 remedy is completed. • **Dredging:** USEPA guidance (USEPA 2005) indicates that "*Residual risk, after the dredging or excavation is complete, is usually related to the following: 1) risk from contaminated sediment left behind outside of the dredged or excavated areas and from contaminated sediment resuspended and transported by dredging; 2) residual contamination left in place after dredging (an estimate of the likely post-dredging/post-backfilling surficial contamination levels should be developed); and 3) risk posed by untreated contaminants and treatment residuals at their disposal location.*" All of the alternatives with active remediation include various amounts of dredging that would reduce the volume of contaminated sediments that would remain in East Branch. Even when the most modern dredging equipment and BMPs are employed, short-term sediment resuspension and associated contaminant release still limits the effectiveness of environmental dredging (Mohan et al. 2016). Resuspension may also result in short-term release of dissolved contaminants into the water column, primarily by contaminant desorption or porewater release from resuspended sediments, dredging residuals, or other fluid layers with high suspended solids concentration (e.g., fluid mud or the nepheloid layer; Bridges et al. 2010). Even for the alternatives targeting removal of all sediment, it is likely that some amount of post-dredge residuals will remain. Therefore, post-dredge residuals management would be necessary for all active alternatives. When coupled with appropriate post-dredge residuals management (backfilling or capping), dredging activities are effective and reliable in reducing the long-term magnitude of residual risk through the removal of contaminant(s) of interest. • **Backfilling:** Placement of a post-dredge backfill layer where appropriate (i.e., areas dredged to the native material interface with low groundwater COC fluxes that would not be capped following dredging), would provide an immediate reduction of surface sediment COC concentrations after dredging. Placement of clean sand backfill is expected to mitigate risks from post-dredge residuals. • **Capping:** USEPA guidance (USEPA 2005) indicates that "*Residual risk, after the cap is in place, usually is related to the following: 1) likelihood of cap erosion or disruption exposing contaminants; 2) likelihood of contaminants migrating through the cap; and 3) risks from contaminants remaining in uncapped areas.*" Placement of an amended cap would physically and chemically isolate sediments left in place from the overlying water column to prevent direct contact between contaminants, contaminated media, and aquatic biota. Caps included in the remedial alternatives were based on preliminary designs following USEPA guidance (Palermo et al. 1998), as presented in Appendix C. Caps designed and constructed in accordance with this guidance would provide long-term chemical isolation and stability (USEPA 2005). As discussed in Section 3.1.2.3 of Appendix C, dredging would be performed prior to capping such that the contaminated sediment below the caps would remain saturated and prevent desiccation, which could potentially result in otherwise unexpected contaminant releases. Different cap designs have been developed to address the material to be contained (e.g., cap on sediment vs. cap on native material) and the range of potential erosional forces anticipated within different areas of East Branch (see Section 5.3.3 and Appendix C). Contaminant flux evaluations using conservative assumptions indicate that caps can be designed to minimize contaminant flux and meet risk-based PRGs in the top of the cap over the long term, if there were no ongoing external inputs to surface sediment COC concentrations. Similarly, the caps can be constructed with appropriate erosion protection layers to remain physically stable in the long term. Long-term monitoring and maintenance of the caps is included as an element of all capping alternatives to further verify their long-term effectiveness and permanence, consistent with USEPA guidance. Proper design and installation would reduce future maintenance requirements. If damage to the cap occurred, affected areas would be identified during post-construction monitoring and subsequently addressed. • **Sealed Bulkheads:** Sealed bulkheads may be integrated into any of the active remedial alternatives with the objective of addressing localized shoreline seeps when there has been a regulatory determination that upland controls (e.g., sealed bulkheads and/or other source control technologies potentially required of responsible upland parties) are warranted. The location and design of the sealed bulkheads would be determined during the RD phase based on the results of PDI and other USEPA-approved or USEPA-accepted investigations, as well as evaluation of whether inclusion of a sealed bulkhead would be necessary to control an upland contaminant source that would affect the long-term effectiveness of the alternatives because of ongoing deposition of COCs from external sources. The ability of the sealed bulkhead to mitigate ongoing external sources of COCs that would compromise the sediment remedy would depend on site-specific factors to be determined during the PDI and RD phase, along with other regulatory actions planned to address upland source in conjunction with sealed bulkheads, should they be needed to ensure remedy success. Such other regulatory actions, if required, are expected to occur outside of the East Branch remedial action. • **Dredged Material Management:** – **Dewatering:** Sediment removed as a component of the active alternatives would be processed and dewatered to meet transport and disposal requirements. It was assumed that dewatering would involve mixing the dredged material with an amendment, which would solidify and stabilize COCs (i.e., ex situ treatment; see below), thereby contributing to the long-term control of residual risks. Dewatering could occur within a dedicated sediment processing area before off-site disposal. – **Disposal:** Processed sediment would be disposed in an off-site permitted and regulated facility, thereby reducing potential future exposure to human and environmental receptors within East Branch. Landfills permitted to accept dredged material are regulated and required to monitor and maintain the disposal facility to verify long-term effectiveness. • **In Situ Treatment:** In situ treatment via ISS would control the potential risk of exposure to COCs and NAPL remaining at the site by solidifying and stabilizing sediment in place and limiting human and ecological contact with impacted sediment. In addition, amendments included in the caps would permanently sequester contaminants and would be considered a form of in situ treatment for COCs that may migrate through the treatment layer of the caps. The effectiveness and reliability of ISS to control the residual risk would be subject to treatability testing during the RD phase. Although ISS has been implemented at other sediment sites with similar COCs, there is a limited record of long-term performance monitoring. • **Ex Situ Treatment:** Ex situ treatment via stabilization/solidification as part of all active alternatives would be an effective means for immobilizing chemical constituents, if necessary, to meet landfill disposal criteria.				

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment **(Section 6.1.4)** Evaluates the degree to which an alternative would use treatment to reduce the principal threats in East Branch through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.	**Reduction of Toxicity, Mobility, or Volume Through Treatment:** Although PTW has not been identified to date in East Branch, Alternative EB-A does not include any reduction of toxicity, mobility, or volume through treatment.	**Reduction of Toxicity, Mobility, or Volume through Treatment:** Although PTW has not been identified to date in East Branch, Alternative EB-B would meet the statutory preference for treatment as a principal element (over 100% of East Branch) through the following: • In situ treatment of the sediment exceeding risk-based PRGs that is left in place (85% of the total sediment exceeding risk-based PRGs in East Branch) – Amended capping would provide treatment of COCs that migrate into the amended capping materials (e.g., activated carbon or organoclay). o In situ treatment of dissolved phase contamination via amended capping of 10.4 acres (93% of the surface area of East Branch) of sediment, including 187,000 cy of sediment exceeding risk-based PRGs (excluding post-ISS capping identified in subsequent bullet). – ISS would provide treatment through the mixing or injection of a solidification agent (e.g., Portland cement) to solidify and immobilize COCs and NAPL (if present). o In situ treatment via ISS of 26,000 cy of sediment over a 0.8-acre area (7% of the surface area of East Branch) identified for shoreline stabilization. However, based on uncertainty about the long-term effectiveness of ISS and experience at other sites, it was assumed that a post-ISS amended cap would be placed above the ISS areas to control dissolved flux of residual COCs in the ISS monolith • Ex situ treatment of the sediment that is removed (15% of the total sediment exceeding risk-based PRGs in East Branch) – Ex situ treatment via stabilization/solidification would immobilize COCs, thereby significantly and irreversibly reducing the toxicity, mobility, and/or volume of the COCs in sediment. o Ex situ treatment of 32,300 cy of dredged sediment including 300 cy of sediment with cores that had isolated samples with concentrations of TPCBs exceeding 50 mg/kg	**Reduction of Toxicity, Mobility, or Volume Through Treatment:** Same as Alternative EB-B except that Alternative EB-C would meet the statutory preference for treatment as a principal element (over the entirety of East Branch) by providing in situ treatment of 58% of the sediment exceeding risk-based PRGs and ex situ treatment of the other 42% through the following: • In situ treatment of dissolved phase contamination via amended capping of 10.8 acres (96% of the surface area of East Branch) of sediment, including 127,700 cy of sediment exceeding risk-based PRGs (excluding post-ISS cap identified in subsequent bullet). • In situ treatment via ISS of 9,900 cy of sediment over a 0.4-acre area (4% of the surface area of East Branch) identified for shoreline stabilization (also assumes a post-ISS cap) • Ex situ treatment of 92,300 cy of dredged sediment including 2,700 cy of sediment with cores that had isolated samples with concentrations of TPCBs exceeding 50 mg/kg and 200 cy of sediment with observations of NAPL	**Reduction of Toxicity, Mobility, or Volume Through Treatment:** Same as Alternative EB-B except that Alternative EB-D would meet the statutory preference for treatment as a principal element (over the entirety of East Branch) by providing in situ treatment of 54% of the sediment exceeding risk-based PRGs and ex situ treatment of the other 46% through the following[7]: • In situ treatment of dissolved phase contamination via amended capping of 9.6 acres (86% of the surface area of East Branch) of sediment, including 119,100 cy of sediment exceeding risk-based PRGs, as well as areas where no sediment remains but flux of groundwater is relatively high (excluding post-ISS cap identified in subsequent bullet). • In situ treatment via of 9,900 cy of sediment over a 0.4-acre area (4% of the surface area East Branch) identified for shoreline stabilization (also assumes a post-ISS cap) • Ex situ treatment of 101,000 cy of dredged sediment including 2,700 cy of sediment with cores that had isolated samples with concentrations of TPCBs exceeding 50 mg/kg and 200 cy of sediment with observations of NAPL	**Reduction of Toxicity, Mobility, or Volume Through Treatment:** Same as Alternative EB-B except that Alternative EB-E would meet the statutory preference for treatment as a principal element (over the entirety of East Branch) by providing in situ treatment of 13% of the sediment exceeding risk-based PRGs and ex situ treatment of the other 87% through the following: • In situ treatment of dissolved phase contamination via amended capping of 7.4 acres (66% of the surface area of East Branch) of sediment, including 29,100 cy of sediment exceeding risk-based PRGs, as well as areas where no sediment remains but flux of groundwater is relatively high (excluding post-ISS cap identified in subsequent bullet). • In situ treatment via ISS of 17,300 cy of sediment over a 0.7-acre area (6% of the surface area of East Branch) identified for shoreline stabilization (also assumes a post-ISS cap) • Ex situ treatment of 233,800 cy of dredged sediment including 2,700 cy of sediment with cores that had isolated samples with concentrations of TPCBs exceeding 50 mg/kg and 6,900 cy of sediment with observations of NAPL	**Reduction of Toxicity, Mobility, or Volume Through Treatment:** Same as Alternative EB-B except that Alternative EB-F would meet the statutory preference for treatment as a principal element (over the entirety of East Branch) by providing in situ treatment of 3% of the sediment exceeding risk-based PRGs and ex situ treatment of the other 97% through the following: • In situ treatment via ISS of 6,300 cy of sediment over a 0.2-acre area (2% of the surface area of East Branch) identified for shoreline stabilization (also assumes a post-ISS cap) • Ex situ treatment of 254,700 cy of dredged sediment including 14,200 cy of sediment with cores that had isolated samples with concentrations of TPCBs exceeding 50 mg/kg and 16,200 cy of sediment with observations of NAPL. This alternative additionally provides in situ treatment of dissolved phase contamination via amended capping of 6.6 acres (59% of the surface area of East Branch) having elevated COC flux from groundwater in native material (excluding post-ISS cap).

[7] The sum of the surface area percentages of in situ treatment for Alternatives EB-D, EB-E, and EB-F are less than 100% because in situ treatment would not occur in areas of backfilling.

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Table 6-1
Detailed Analysis of Alternatives

<table>
<tr><th>Superfund Criteria</th><th>Alternative EB-A:
No Action</th><th>Alternative EB-B:
Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW</th><th>Alternative EB-C:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths</th><th>Alternative EB-D:
Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging</th><th>Alternative EB-E:
Dredge All Within Navigation Channel, Cap Outside</th><th>Alternative EB-F:
Dredge All</th></tr>
<tr><td rowspan="3">Balancing Criterion 3: Short-Term Effectiveness
(Section 6.1.5)
Evaluates effects and potentially unacceptable risks to human health and the environment related to construction and implementation of each alternative and considers the duration of time until remedial response objectives are achieved.</td><td rowspan="2"></td><td colspan="4">Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area (5% of the surface area of East Branch) of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above):
Option 1 (Amended Capping): There is an estimated of 13,700 cy of sediment within the 0.6-acre evaluation area of the Western Beef Slip. Of the total, 3,600 cy of sediment is estimated to contain observations of NAPL (in the form of immobile blebs). Amended capping would provide treatment of COCs that migrate into the amended capping materials (e.g., activated carbon or organoclay). Amended caps permanently and irreversibly sequester contaminants within the amended cap and isolate contaminants in sediment below the cap.
Option 2 (ISS): ISS would provide treatment through the mixing or injection of a solidification agent (e.g., Portland cement) to permanently and irreversibly solidify and immobilize COCs, NAPL, or PTW if any were present within the 13,700 cy of sediment (3,600 cy of which contains observations of NAPL) within the evaluation area. However, a post-ISS cap may be needed to reduce long-term flux of dissolved phase COCs from the ISS monolith if residuals remain.
Option 3 (Dredging): Dredging itself would not provide treatment, but the process of ex situ stabilization/solidification of the dredged material prior to disposal would permanently and irreversibly reduce the toxicity, mobility, and/or volume of the COCs in the 13,700 cy of dredged sediment.</td><td></td></tr>
<tr><td colspan="5">The following are treatment-related components that are common elements among the alternatives. Reduction in toxicity, mobility, and/or volume through treatment would occur through in situ treatment (via amended capping and ISS) and ex situ treatment (via stabilization of dredged sediment). ICs, dredging, backfill, dewatering, and disposal do not include a treatment component, so they are not discussed in this section:
Capping: Capping is included in all active alternatives and provides treatment using amended capping materials (e.g., activated carbon or organoclay), which is considered a form of in situ treatment when COCs migrate into the amended chemical isolation layer of the cap. Amended caps permanently and irreversibly sequester contaminants within the amended cap and isolate contaminants in sediment below the cap.
In Situ Treatment: ISS provides treatment through the mixing or injection of a solidification agent (e.g., Portland cement) to permanently and irreversibly solidify and immobilize COCs and NAPL (if present). However, a post-ISS cap may be needed to reduce long-term flux of dissolved phase COCs from the ISS monolith if residuals remain.
Ex Situ Treatment: Ex situ treatment via stabilization/solidification is included in all active alternatives and would be an effective means for immobilizing COCs, if necessary, to meet landfill disposal criteria. Dredged material would be treated with one or more amendments (e.g., Portland cement, quicklime, or fly ash) that would permanently and irreversibly reduce the toxicity, mobility, and/or volume of the COCs in dredged sediment.
The level of treatment for each alternative would be a function of the volumes and acreages of areas addressed by these technologies.</td></tr>
<tr><td>Time Until RAOs Are Achieved:
There would be no monitoring to confirm that RAOs would be met, so duration is unknown.</td><td>Time Until RAOs Are Achieved:
RAOs would be achieved for Alternative EB-B at the end of construction, which is estimated to take 13 months (two construction seasons) in addition to the time necessary for PDI and RD.</td><td>Time Until RAOs Are Achieved:
Same as Alternative EB-B, except Alternative EB-C is estimated to take 22 months (three construction seasons) in addition to the time necessary for PDI and RD.</td><td>Time Until RAOs Are Achieved:
Same as Alternative EB-C.</td><td>Time Until RAOs Are Achieved:
Same as Alternative EB-D, except Alternative EB-E is estimated to take 37 months (five construction seasons) in addition to the time necessary for PDI and RD.</td><td>Time Until RAOs Are Achieved:
Same as Alternative EB-E, except Alternative EB-F is estimated to take 46 months (seven construction seasons) in addition to the time necessary for PDI and RD.</td></tr>
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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 3 (continued)	**Impacts to the Community** There would be no impacts from Alternative EB-A because there is no active remediation.	**Impacts to the Community** Construction duration and the magnitude of the scope of work are used to evaluate relative impacts to the community. This includes consideration of the time necessary to implement shoreline stabilization measures, although the durations presented here do not include the anticipated prolonged period of property owner negotiations, investigations, and design for the shoreline stabilization. Alternative EB-B is estimated to take 13 months to construct (two construction seasons) and includes the following: • Removal of approximately 34,000 cy of debris and sediment (32,300 cy of sediment and 1,700 cy of debris; 24 scow trips for sediment and debris) over 3.5 acres • Capping with 79,400 cy of material (40 scow trips), over 11.2 acres (including post-ISS cap of 0.8 acre). • ISS of 26,000 cy of sediment over a 0.8-acre area identified for shoreline stabilization • Shoreline stabilization along 1,850 lf (36%) of shoreline, including the following: – 680 lf (13%) of slot dredging – 890 lf (18%) of ISS – 280 lf (5%) of bulkhead stabilization, replacement, or new installation (with 20% [~60 lf]) of the sheet pile replacement/installation assumed to require a sealant to control an upland contaminant source) • 64,000 labor hours Additional impacts are as follows: • **Aesthetics:** Impacts to aesthetics would be expected to be minimal based on the industrial nature of the waterway. The FFS assumes daytime work only; however, if construction were to occur after dusk, there may be localized impacts due to light towers. • **Odors and Dust:** Development of support areas, dredging, and potential stockpiling and processing of dredge sediments in barges or at the sediment processing area could produce localized odors. Increased dust emissions could occur near stockpile areas and locations where dredged material would be processed. BMPs including stockpile covering (with tarps or PFAS-free foam sprays) would be used to minimize odor and dust generation, and air quality would be monitored during implementation to limit impacts related to odors and dust. Engineering controls and BMPs would be implemented to minimize impacts to the extent practicable. • **Noise:** Increased noise during construction would be expected. Bulkhead stabilization, replacement, or installation would be expected to create the most noise, as well as vibrations. Other noise impacts (e.g., from dredging, backfilling, capping, and ISS) would be expected to be minimal due to the industrial nature of the waterway and surrounding industry. Engineering controls and BMPs would be implemented to minimize impacts to the extent practicable. • **Recreation:** Some impact on local water-based activities would be expected, primarily recreational boating and kayaking. • **Traffic:** Increased traffic would likely result in temporary adverse effects on vehicular traffic conditions, cause additional traffic delays around the site, and increase the risk of traffic accidents. • **Commercial Marine Navigation Use:** Construction activities could cause delays in commercial marine traffic due to the increase in overall vessel traffic, and the staging of construction equipment could also impair commercial traffic. However, minimal commercial vessel traffic currently occurs within East Branch itself. The increased overall vessel traffic and potential cessations of construction activities to accommodate commercial vessel passage could increase the total duration of the remedial alternatives. Increase in vessel traffic would also be expected during transport of dredged material, backfilling, and capping materials.	**Impacts to the Community** Same as Alternative EB-B, except that Alternative EB-C is estimated to take 22 months to construct (three construction seasons) and includes the following: • Removal of approximately 97,200 cy of debris and sediment (92,300 cy of sediment and 4,900 cy of debris; 63 scow trips for sediment and debris) over 11.2 acres • Capping with 77,000 cy of material (39 scow trips), over 11.2 acres (including post-ISS cap of 0.4 acre). Because pre-cap dredging would be performed, post-cap water depths would be the same as pre-construction. • ISS of 9,900 cy of sediment over a 0.4-acre area identified for shoreline stabilization • Shoreline stabilization along 3,850 lf (76%) of shoreline, including the following: – 2,480 lf (49%) of slot dredging – 480 lf (9%) of ISS – 890 lf (17%) of bulkhead stabilization, replacement, or new installation (with 20% [~180 lf] of the sheet pile replacement/ installation to require a sealant to control an assumed upland contaminant source) – 114,000 labor hours Additional impacts are the same as outlined for Alternative EB-B.	**Impacts to the Community** Same as Alternative EB-C, except that Alternative EB-D is estimated to take 22 months (three construction seasons) in addition to the time necessary for PDI and RD and includes the following: • Removal of approximately 106,300 cy of debris and sediment (101,000 cy of sediment and 5,300 cy of debris; 69 scow trips for sediment and debris) over 11.2 acres • Capping with 69,600 cy of material (35 scow trips), over 10.0 acres (including post-ISS cap of 0.4 acre). Post-cap water depths would be deeper than current conditions due to pre-cap dredging in areas where dredging targets removal of all sediment down to the native material interface. • Backfilling of 1.2 acres dredged to the native material interface with 14,400 cy of sand (8 scow trips) • ISS: same as Alternative EB-C • Shoreline stabilization: same as Alternative EB-C • 120,000 labor hours Additional impacts are the same as outlined for Alternative EB-B.	**Impacts to the Community** Same as Alternative EB-B, except that Alternative EB-E is estimated to take 37 months to construct (five construction seasons) and includes the following: • Removal of approximately 246,100 cy of debris and sediment (233,800 cy of sediment and 12,300 cy of debris; 157 scow trips for sediment and debris) over 10.6 acres • Capping with 42,700 cy of material (22 scow trips) over 8.1 acres (including post-ISS cap of 0.7 acre). Post-cap water depths would generally be deeper than current conditions due to pre-cap dredging. • Backfilling 3.1 acres dredged to the native material interface with 7,200 cy of sand (4 scow trips) • ISS of 17,300 cy of sediment over 0.7 acre • Shoreline stabilization along 4,250 lf (84%) of shoreline, including the following: – 940 lf (18%) of dredge offsets with capping – 780 lf (15%) of ISS – 2,530 lf (50%) of bulkhead stabilization, replacement, or new installation (with 20% [490 lf] of the sheet pile replacement/installation to require a sealant to control an assumed upland contaminant source) – 223,000 labor hours Additional impacts are the same as outlined for Alternative EB-B.	**Impacts to the Community** Same as Alternative EB-B, except that Alternative EB-F is estimated to take 46 months to construct (seven construction seasons) and includes the following: • Removal of approximately 268,100 cy of debris and sediment (254,700 cy of sediment and 13,400 cy of debris; 171 scow trips for sediment and debris) over 11.2 acres • Capping with 31,500 cy of material (16 scow trips), over 6.8 acres (including post-ISS cap of 0.2 acre). • Backfilling over 4.4 acres dredged to the native material interface with 10,100 cy of sand (6 scow trips) • ISS of 6,300 cy of sediment for shoreline stabilization over 0.2 acre • Shoreline stabilization along 4,500 lf (88%) of shoreline, including the following: – 270 lf (5%) of ISS – 4,240 lf (83%) of bulkhead stabilization, replacement, or new installation (with 20% [~850 lf] of the sheet pile replacement/ installation to require a sealant to control an assumed upland contaminant source) – 269,000 labor hours – All other components would be the same as Alternatives EB-C, EB-D, and EB-E. Additional impacts are the same as outlined for Alternative EB-B.

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 3 (continued)		Technology options for treating sediment with NAPL or PTW the 0.6-acre evaluation area of the Western Beef Slip would be similar to those described, except as noted below that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** Amended capping with 4,300 cy of material (3 scow trips) over 0.6 acre for a duration of 1.3 weeks. • **Option 2 (ISS):** ISS of 13,700 cy of sediment over 0.6 acre for a duration of 14.2 weeks. • **Option 3 (Dredging):** Removal of 15,800 cy (9 scow trips for sediment and debris) over 0.6 acre for a duration of 3.3 weeks.				
	Impacts to the Environment There would be no incremental impacts from Alternative EB-A because there would be no active remediation.	**Impacts to the Environment** Impacts for Alternative EB-B include the following: • Unavoidable resuspension and release of COCs during sediment removal could result in short term increases in water and fish tissue COC concentrations, as well as increased turbidity near active remediation. Potential off-site and cross-media impacts may result from dredging-related resuspension and releases. The impacts from resuspension and release will be a function of the dredge volume and duration. A total of 34,000 cy of sediment and debris would be dredged over 3 months. • Dredging, capping, and ISS could result in loss of aquatic vegetation, if present, and may also result in the direct loss of benthic invertebrate communities and habitat. • Shoreline stabilization measures would be required to mitigate risk to the environment from dredging adjacent to unstable shorelines or sensitive structures and slopes. • Cap material placement, could result in minor effects on water quality and surface foam from the placed materials themselves (primarily turbidity). A total of 79,400 cy of capping material would be placed. However, post-dredge placement of cap materials would provide an immediate reduction of surface COC concentrations remaining on the post-dredge surface. • ISS could cause short-term environmental impacts, including potential COC releases to surface water and increases in turbidity. • Engineering controls, BMPs, and monitoring would be implemented during construction to mitigate impacts to the extent practicable. This may include turbidity controls or operational BMPs, as well as water quality monitoring during dredging, capping, ISS, and other in-water activities with the potential to generate turbidity. These controls and monitoring have been accounted for in the FFS cost estimates. • Total GHG emissions are estimated to be 17,000 tons of CO_2e.	**Impacts to the Environment** Same as Alternative EB-B, except for the following: • Total dredging volume of sediment and debris is estimated to be 97,200 cy over 9 months. • Total capping material volume is estimated to be 77,000 cy. • Total GHG emissions are estimated to be 35,000 tons of CO_2e.	**Impacts to the Environment** Same as Alternative EB-B, except for the following: • Total dredging volume of sediment and debris is estimated to be 106,300 cy over 10 months. • Cap or backfill material placement could result in minor effects on water quality and surface foam from the placed materials (primarily turbidity). Total capping material volume is estimated to be 69,600 cy and sand backfilling volume to be 14,400 cy. • Total GHG emissions are estimated to be 38,000 tons of CO_2e.	**Impacts to the Environment** Same as Alternative EB-B, except for the following: • Total estimated dredging volume of sediment and debris of 246,100 cy of sediment is estimated to be over 19 months. • Total capping material volume is estimated to be 42,700 cy and sand backfilling volume to be 7,200 cy. • Total GHG emissions are estimated to be 74,000 tons of CO_2e.	**Impacts to the Environment** Same as Alternative EB-B, except for the following: • Total dredging volume of sediment and debris is estimated to be 268,100 cy of sediment over 20 months. • Total capping material volume is estimated to be 31,500 cy and sand backfilling volume to be 10,100 cy. • Total GHG emissions are estimated to be 82,000 tons of CO_2e.
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip would be the same as described above (applicable to Alternatives EB-B, EB-C, EB-D, and EB-E).				

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 3 (continued)	**Impacts to Remediation Workers** There would be no impacts from Alternative EB-A because there would be no active remediation.	**Impacts to Remediation Workers** Impacts to remediation workers include the following: • It is estimated that Alternative EB-B would require 64,000 labor hours to implement. Occupational risks to workers would be minimized through implementation of a construction health and safety plan to be developed prior to implementation. • Remediation workers have potential occupational risks associated with direct contact, ingestion, and inhalation of COCs from the surface water and sediments during dredging, ISS, dewatering, ex situ treatment, and disposal activities. They are also exposed to risks from potential shoreline or structure failures associated with dredging adjacent to unstable shorelines or sensitive structures and slopes. The potential risk to remediation workers associated with exposures to COCs, noise, odors, dust, vapors, and other physical hazards would be mitigated through engineering controls, use of BMPs, and use of personal protective equipment.	**Impacts to Remediation Workers** Same as Alternative EB-B, except that it is estimated that Alternative EB-C will require 114,000 labor hours to implement.	**Impacts to Remediation Workers** Same as Alternative EB-B, except that it is estimated that Alternative EB-D will require 120,000 labor hours to implement.	**Impacts to Remediation Workers** Same as Alternative EB-B, except that it is estimated that Alternative EB-E will require 223,000 labor hours to implement.	**Impacts to Remediation Workers** Same as Alternative EB-B, except that it is estimated that Alternative EB-F will require 269,000 labor hours to implement.
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip would be the same as described above that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E.				
		Evaluations of the short-term effectiveness of remedial components common to all active alternatives with active remediation are summarized as follows: • **Dredging, Dredged Material Management (Dewatering and Disposal), and Ex Situ Treatment:** Dredging would result in the resuspension and release of particulate phase and dissolved phase COCs from sediment to surface water. These conditions may result in the temporary degradation of water quality, increased bioavailability and uptake of COCs by biota, migration of COCs upstream and downstream, and increased turbidity in the vicinity of active remediation. Additionally, residual impacts in surface sediment would be expected because of sediment removal operations. Unavoidable resuspension and release of COCs during sediment removal could result in short-term increases in surface water and fish tissue COC concentrations (Bridges et al. 2010). Although the impacts can be managed, they would not be eliminated. For example, turbidity curtains have been shown to reduce the spread of COCs sorbed to suspended particles in the water column; however, they have proved to be generally ineffective in reducing the release of dissolved phase COCs from the removal area (Palermo et al. 2008). Dredging would remove the natural bed material, debris, and aquatic vegetation (if present) that may be used as habitat by both fish and benthic invertebrates. The sediment removal activities will also result in the direct loss of benthic invertebrate communities residing in the sediments during removal; based on projects of similar magnitude and scope, the benthic community would be expected to recover within 6 months to 1 year. • **Capping and Backfilling:** Short-term impacts associated with cap and backfill material placement would include possible minor effects on water quality (primarily turbidity and surface foam from the capping and backfill materials themselves, which would be tested to verify chemical suitability prior to placement). These releases would only occur during construction. The placement of capping and backfilling materials is not expected to result in short-term releases of COCs from bottom sediments. • **Shoreline Stabilization/Sealed Bulkheads:** Short-term impacts and risks associated with shoreline stabilization (bulkhead stabilization, replacement, or installation) include noise, vibrations, and water quality impacts from water-borne support vessels. These impacts would be mitigated using engineering controls discussed below, as well as monitoring of noise and vibration, the restriction of repairs or installation to specific time frames, coordination with property owners, and the use of site-specific designs for bulkhead stabilization or installations. A variety of sealants can be applied to the joints of a sheet pile wall to create a sealed bulkhead, if necessary to control an upland contaminant source. Several environmentally friendly sealants are available. • **ISS:** Short-term impacts and risks related to ISS include resuspension and release of particulate phase and dissolved phase COCs from sediment to surface water. These conditions may result in the temporary degradation of water quality, increased bioavailability and uptake of COCs by biota, migration of COCs downstream, and increased turbidity in the vicinity of active remediation. • **Engineering Controls and BMPs:** Engineering controls and other measures would be considered and implemented, as necessary, on an alternative-specific and area-specific basis to reduce the negative short-term impacts of construction activities associated with the alternatives. The following provides a list of potential controls that may be implemented during construction to manage short-term impacts: – Resuspended and residual sediments would be managed through implementation of engineering and operational controls such as a resuspension control system (e.g., turbidity curtains) if necessary, proper equipment selection, use of trained and skilled operators, environmental monitoring, and BMPs (e.g., controlling dredge bucket fall height, cycle time), among others. Although sediment turbidity impacts in the removal area can be minimized in certain applications using BMPs and engineering controls such as turbidity curtains, such BMPs and controls have been demonstrated to be generally ineffective in reducing the release of dissolved phase COCs (NRC 2007). – Construction activities generating excessive noise would be minimized and/or scheduled during regular working hours on weekdays, to the extent practicable, to minimize impacts to the community. – Remedial construction activities would be closely coordinated with commercial vessel traffic. – All in-water construction and upland equipment would be maintained to decrease the likelihood of breakdowns and fuel leaks, as well as comply with regulatory-mandated air emission standards. – Appropriate traffic control measures would be implemented to promote the safety and well-being of the impacted communities (e.g., flag persons, signage, and/or consultation with local public officials). – Routine water and air monitoring would be performed during construction activities in accordance with project-specific water quality and community air monitoring plans. The plans would designate specific-action criteria should an issue be detected. – Dust and odors would be controlled via wetting and stockpile management, as needed. – Prior to (and throughout) the construction process, information would be distributed to the public through appropriate avenues (e.g., public notices, flyers, newspaper/internet ads, and/or public information meetings) to update the community on project status.				

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 4: Implementability **(Section 6.1.6)** Evaluates the ease or difficulty of implementing the alternative by considering technical feasibility, administrative feasibility, and availability of services and materials required for implementation.	There are no implementability issues associated with Alternative EB-A because it does not require any construction or monitoring activities.	Alternatives with a longer construction duration are generally more challenging to implement than those with a shorter duration when using similar remedial technologies. Therefore, construction duration is an indicator of the relative implementability of the alternatives. In addition, alternatives that require more coordination/negotiation with other property owners are generally more challenging and add additional time to construction, prolonging the duration of remediation. Alternatives that involve significant amounts of shoreline/bulkhead improvements to facilitate the environmental remediation will require corresponding property owner negotiations and are expected to extend both the RD and implementation phases by years. Alternative EB-B could be implemented in 13 months (two construction seasons). This duration does not include the time needed for property owner negotiations for shoreline/bulkhead assessment/repair, evaluation of upland sources to determine if sealed bulkheads would be necessary, final RD approval, or contract procurement, all of which may reasonably require multiple years. • **Technical Feasibility:** – Could generally be implemented using well-established and reliable technologies. – Placement of caps would reduce the water depth in parts of East Branch compared to existing depths, which could restrict vessel access in some areas. Although there are not any water-dependent properties in the East Branch, reduced water depths may impact recreational uses of East Branch. – Approximately 36% of the shoreline would require some stabilization measure (e.g., slot dredging, dredging offset with capping, ISS, or bulkhead stabilization, replacement, or new installation) to facilitate the remedial action, including 5% of the shoreline that is categorized as high risk and would require bulkhead replacement or new installation to safely implement the remedy. – If sealed bulkheads are necessary to control an upland source(s), difficulty during sheet pile driving (e.g., misalignment and multiple attempts of driving/extracting) could damage the sealant. – ICs could be implemented following construction through coordination with applicable regulatory agencies. ICs will be necessarily focused on the ICs that can be completed prior to early action completion and that are needed to protect the East Branch early action constructed components. – The post-construction evaluation monitoring framework discussed in Section 5.3.8 would be implemented to monitor the effectiveness of the remedy. – Implementation of the early action would not prevent future remedial actions, if deemed necessary based on monitoring of the remedy effectiveness. • **Administrative Implementability:** – Would be able to obtain permits for off-site activities (i.e., disposal of dredged materials and debris at a permitted facility) – Would require the lease of a property for a staging area, ideally located in close proximity to East Branch – In-water work would need to comply with biological window restrictions developed for the project. – Investigation, design, and construction of bulkhead stabilization and replacement measures would require access agreements with each affected property owner and is anticipated to require significant time (several years). – Would require coordination with (and review) by other agencies and meeting substantive requirements of ARARs	Same as Alternative EB-B, except for the following: • Construction duration is estimated to be 22 months (three construction seasons), excluding the time needed for property owner negotiations for shoreline/bulkhead assessment/repair, evaluation of upland sources to determine if sealed bulkheads would be necessary, final RD approval, or contract procurement, all of which may reasonably require multiple years. • Approximately 76% of the shoreline would require some stabilization measure, including 17% that is categorized as high risk and would require bulkhead replacement or new installation. • Investigation, design, and construction of bulkhead stabilization and replacement would require multiple years. • Dredging prior to capping throughout East Branch would result in no change in water depths compared to pre-dredge depths.	Same as Alternative EB-C, except for the following: • Construction duration is estimated to be 22 months (three construction seasons), excluding the time needed for property owner negotiations for shoreline/bulkhead assessment/repair, evaluation of upland sources to determine if sealed bulkheads would be necessary, final RD approval, or contract procurement, all of which may reasonably require multiple years. • This alternative would involve nearly identical dredge cuts along the shoreline as Alternative EB-C, so it would generally require the same shoreline/bulkhead stabilization measures. However, if select shoreline areas are targeted for dredge removal to the native material interface, alternative bulkhead stabilization measures may be required. • Dredging prior to capping or backfilling throughout East Branch would result in no change in water depths compared to pre-dredge depths.	Same as Alternative EB-D, except for the following: • Construction duration is estimated to be 37 months (five construction seasons), excluding the time needed for property owner negotiations for shoreline/bulkhead assessment/repair, evaluation of upland sources to determine if sealed bulkheads would be necessary, final RD approval or contract procurement, all of which may reasonably require multiple years. • Shoreline/bulkhead stability would pose significant implementability challenges requiring mitigation measures (stabilization techniques are expected to include bulkhead stabilization, replacement, or new installation) in nearly all areas of East Branch with exception of areas within the Western Beef Slip where ISS would be used to provide geotechnical stability. • Approximately 84% of the shoreline would require some stabilization measure, including 48% that is categorized as high risk and would require bulkhead replacement or new installation. • Investigation, design, and construction of bulkhead stabilization and replacement would require multiple years. • Dredging prior to capping or backfilling would result in deeper water depth in most of East Branch compared to pre-dredge depths.	Same as Alternative EB-E, except for the following: • Construction duration is estimated to be 46 months (seven construction seasons), excluding the time needed for property owner negotiations for shoreline/bulkhead assessment/repair, evaluation of upland sources to determine if sealed bulkheads would be necessary, final RD approval or contract procurement, all of which may reasonably require multiple years. • Approximately 88% of the shoreline would require stabilization, with nearly all of that (83% of the entire East Branch shoreline) categorized as high risk and would require bulkhead replacement or new installation. • Investigation, design, and construction of bulkhead stabilization and replacement would require multiple years. • Dredging throughout East Branch would result in deeper than existing water depths, on average, throughout East Branch.

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Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Balancing Criterion 4 (continued)		– Would require coordination with other private and public entities to address infrastructure in and around East Branch, including the Grand Street bridge, the aeration system, utility corridors, and shoreline slopes/structures – Use of sealed bulkhead for upland source control would be governed under a different regulatory framework (i.e., outside of the CERCLA sediment remedy addressed in this FS) and potentially require actions by responsible upland parties. – Would require coordination with agencies regarding ICs • **Availability of Services and Materials:** – Would be implemented using well-established and available remediation and monitoring methods and equipment – Permitted disposal facilities are available to accept dredged materials. – Multiple qualified contractors are available to competitively bid on the project.				
		Technology options for treating sediment with NAPL or PTW within the 0.6-acre evaluation area of the Western Beef Slip include the following that are applicable to Alternatives EB-B, EB-C, EB-D, and EB-E (these technology options could be integrated as components within the holistic remedial alternatives evaluated above): • **Option 1 (Amended Capping):** Amended capping is technically and administratively feasible and can be implemented using well-established and available remediation and monitoring methods and equipment. • **Option 2 (ISS):** ISS is technically and administratively feasible and can be implemented using available remediation and monitoring methods and equipment. • **Option 3 (Dredging):** Dredging is technically and administratively feasible and can be implemented using well-established and available remediation and monitoring methods and equipment.				
		Evaluations of the implementability of remedial components common to all alternatives with active remediation are summarized as follows: • **Dredging, Dredged Material Management (Dewatering and Disposal), and Ex Situ Treatment:** These activities are well established for sediment remediation and could be implemented with readily available equipment, materials, and labor. • **Capping and Backfilling:** Capping is a well-established technology for sediment remediation and could be implemented with readily available equipment, materials, and labor. • **In Situ Treatment:** ISS is a well-established technology at upland sites and has been used at a growing number of sediment sites, but has been performed at smaller scales at a limited number of sites (mostly pilot-scale projects). It is a well-established technology at upland sites. However, given the uncertainties about the long-term effectiveness of ISS in controlling diffusive flux from the treated sediments, a treatability study would be required during the RD to determine if a post-ISS cap atop the ISS monolith would be needed. • **Shoreline/Bulkhead Stabilization:** Existing shoreline conditions may pose implementability concerns. In some shoreline locations, existing bulkheads would need to be stabilized or replaced. In other areas with less degraded conditions, slot dredging with immediate backfilling would be performed to achieve the required dredging without destabilizing the shoreline/structures. Other stabilization techniques considered include a dredging offset with capping and the use of ISS. The type and amount of shoreline/bulkhead stabilization required varies by alternative. Bulkhead stabilization and replacement would require property-specific investigations and designs, which would require coordination with property owners and tenants. Due to the number of different properties and type of bulkheads affected, this effort will be considerable and would require significant time (several years). Construction would need to be coordinated and carefully implemented to minimize or prevent effects on the adjacent, upland properties. • **Sealed Bulkheads:** Sealed bulkheads are technically implementable and could be implemented with readily available equipment, materials, and labor. Difficulty during sheet pile driving (e.g., misalignment and multiple attempts of driving/extracting the sheet pile) can disturb the sealant, thereby reducing its effectiveness. • **Institutional Controls:** ICs (e.g., fishing restrictions, consumption advisories, or dredging restrictions) could be implemented following construction using readily available methods like those currently administered at the site and other Superfund sites in USEPA Region 2.				
Balancing Criterion 5: Cost **(Section 6.1.7)** Evaluates present worth (net present value), direct and indirect capital, and component costs of implementing an alternative.	**Total Cost:** $0 **Net Present Value Cost:** $0	**Total Cost:** $174.8 million **Net Present Value Cost:** $152.0 million	**Total Cost:** $270.2 million **Net Present Value Cost:** $235.2 million	**Total Cost:** $279.2 million **Net Present Value Cost:** $243.5 million	**Total Cost:** $499.8 million **Net Present Value Cost:** $418.7 million	**Total Cost:** $610.1 million **Net Present Value Cost:** $492.7 million
		• Technology options for treating sediment with NAPL or PTW (assessed for 0.6-acre area in Western Beef Slip; these technology options could be integrated as components within the holistic remedial alternatives evaluated above): – **Option 1 (Amended Capping):** Construction cost of $1.3 million plus a cost of $3.7 million for dredging to accommodate cap placement for a total of $5.0 million – **Option 2 (ISS):** Construction cost for ISS of $11.7 million and post-ISS cap (assumed to be necessary to control post-ISS diffusion) of $1.3 million for a total of $13.0 million – **Option 3 (Dredging):** Construction cost of $11.9 million for dredging and post-dredge residuals management with a 12-inch-thick sand backfill				

Table 6-1
Detailed Analysis of Alternatives

Superfund Criteria	Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	Alternative EB-C: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	Alternative EB-D: Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All
Modifying Criterion 1: State Acceptance **(Section 6.1.8)** Evaluates the technical and administration issues raised by the supporting agencies about the alternatives.	To be addressed by USEPA following release of the Proposed Plan.					
Modifying Criterion 2: Community Acceptance **(Section 6.1.9)** Evaluates issues and concerns raised by interested persons in the community about the potential remedial alternative.	To be addressed by USEPA following release of the Proposed Plan.					

Abbreviations:
ARAR: Applicable or Relevant and Appropriate Requirement
BMP: best management practice
C19-C36: C19-C36 aliphatics
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CFR: Code of Federal Regulations
cm: centimeter
CO_2e: carbon dioxide equivalent
COC: contaminant of concern
CSO: combined sewer overflow
cy: cubic yard
D/F TEQ: total dioxin/furan TEQ 2005 (mammal)
EA: Early Action
FFS: Focused Feasibility Study
FS: Feasibility Study
GHG: greenhouse gas
IC: institutional control
ISS: in situ stabilization/solidification
lf: linear foot
LTE: long-term equilibrium
MLLW: mean lower low water
MS4: municipal separate storm sewer system
NAPL: nonaqueous phase liquid
NYSDOH: New York State Department of Health
OU1: Operable Unit 1
PDI: pre-design investigation
PFAS: perfluoroalkyl and polyfluoroalkyl substances
PRG: preliminary remediation goal
propwash: propeller wash
PTW: principal threat waste
RAO: remedial action objective
RD: remedial design
RI Report: *Remedial Investigation Report*
SWAC: surface-weighted average concentration
TPCB: total polychlorinated biphenyl
USEPA: U.S. Environmental Protection Agency

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Table 7-1
Detailed Comparative Analysis of Alternatives

Alternative Comparative Criteria			Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Cap Placement below 0 Foot MLLW	Alternative EB-C: Dredge-and-Cap	Alternative EB-D: Dredge-and-Cap with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All	Remedial Components for Treating NAPL or PTW[6] Option 1: Amended Cap	Option 2: ISS[7]	Option 3: Dredging
Remedial Technologies	Dredge volume (cy)[1]		0	34,000 (32,300 sediment and 1,700 debris)	97,200 (92,300 sediment and 4,900 debris)	106,300 (101,000 sediment and 5,300 debris)	246,100 (233,800 sediment and 12,300 debris)	268,100 (254,700 sediment and 13,400 debris)	5,300 (5,100 sediment and 200 debris)	3,700 (3,500 sediment and 200 debris)	15,800 (15,000 sediment and 800 debris)
	Dredge and backfill area (acres)		0	0.0	0.0	1.2	3.1	4.4	0.6	0	0.6
	Cap-only area (acres)		0	7.7	0.0	0.0	0.6	0	0	0	0
	Dredge-and-amended-cap area (acres)		0	2.7	10.8	9.6	6.8	6.6	0.6 [8]	0.6 [9]	0
	ISS area (acres)[2]		0	0.8	0.4	0.4	0.7	0.2	0	0.6	0
	Total target remediation areas (acres)		0	11.2	11.2	11.2	11.2	11.2	0.6	0.6	0.6
Threshold Criterion 1: Overall Protection of Human Health and the Environment	Expected to meet exposure-based RAOs		No[4]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Expected to meet source control RAO		No[4]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Maximum pre-construction surface sediment concentration	TPAH (34) (mg/kg)	690	690	690	690	690	690	Not evaluated separately	Not evaluated separately	Not evaluated separately
		TPCB (mg/kg)	16	16	16	16	16	16			
		Cu (mg/kg)	6,320	6,320	6,320	6,320	6,320	6,320			
		D/F TEQ (ng/kg)	290	290	290	290	290	290			
		C19-C36 (mg/kg)	7,270	7,270	7,270	7,270	7,270	7,270			
	Maximum surface sediment concentration immediately post-construction (time zero)	TPAH (34) (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		TPCB (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		Cu (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		D/F TEQ (ng/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		C19-C36 (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
	Pre-construction surface sediment SWACs	TPAH (34) (mg/kg)	130	130	130	130	130	130			
		TPCB (mg/kg)	2.6	2.6	2.6	2.6	2.6	2.6			
		Cu (mg/kg)	520	520	520	520	520	520			
		D/F TEQ (ng/kg)	98	98	98	98	98	98			
		C19-C36 (mg/kg)	1,790	1,790	1,790	1,790	1,790	1,790			
	Immediately post-construction surface sediment SWACs (entirety of East Branch at time zero)	TPAH (34) (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		TPCB (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		Cu (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		D/F TEQ (ng/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
		C19-C36 (mg/kg)	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero	Near-zero			
Threshold Criterion 2: Compliance with ARARs	Is this alternative expected to meet all chemical/location/action-specific ARARs?[3]		N/A	Yes, if not waived.					Yes, if not waived.		

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Table 7-1
Detailed Comparative Analysis of Alternatives

Alternative Comparative Criteria			Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Cap Placement below 0 Foot MLLW	Alternative EB-C: Dredge-and-Cap	Alternative EB-D: Dredge-and-Cap with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All	Remedial Components for Treating NAPL or PTW[6]		
									Option 1: Amended Cap	Option 2: ISS[7]	Option 3: Dredging
Balancing Criterion 1: Long-Term Effectiveness and Permanence	Residual risk: Are COC concentrations in surface sediments expected to meet risk-based PRGs immediately after construction?		No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Residual risk: Is this alternative expected to be protective against potential contaminant impacts from NAPL advection?		No additional protection over current conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Residual risk: Is this alternative expected to be protective against potential impacts from dissolved phase transport of COCs?		No additional protection over current conditions	Yes	Yes	Yes	Yes	Yes	Yes	Uncertain[10]	Yes
	Residual risk: Is this alternative expected to be protective against impacts from gas ebullition-facilitated transport of NAPL?		No additional protection over current conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Residual risk: Is this alternative expected to be protective against potential contamination impacts due to erosion?		No additional protection over current conditions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Adequacy of Controls: Is this alternative expected to be protective against potential external source impacts from contaminated groundwater in native material?		No additional protection over current conditions	Yes	Yes	Yes	Yes	Yes	Yes	No	No
	Adequacy of controls: Are ICs, backfilling, amended capping, in situ treatment, and dredged material management expected to be effective?		Existing ICs would continue under Alternative EB-A, but by themselves, they would not be effective at controlling risks from those contaminants.	Yes	Yes	Yes	Yes	Yes	Yes	Uncertain[10]	Yes
	Areas of capping or backfill (acres)	Amended cap over contaminated sediment (includes capping after ISS in areas identified for shoreline stabilization)	0	11.2	11.2	9.7	2.8	0.2	0.6	0.6[9]	0
		Amended cap over native material where flux of groundwater COCs is relatively high	0	0.0	0.0	0.3	5.3	6.6	N/A	N/A	N/A
		Sand backfill over native material		0.0	0.0	1.2	3.1	4.4	N/A	N/A	N/A
	Quantities of material left in place after remedial action	Sediment with exceedances of risk-based PRGs (cy)	219,000	187,000	127,700	119,100	29,100	6,300	N/A	N/A	N/A
		Sediment with observations of sheen (cy)	148,200	126,600	86,400	80,600	19,500	4,200	N/A	N/A	N/A
		Sediment with observations of NAPL (cy)	16,200	16,200	16,000	16,000	9,300	0	3,600	3,600	3,600
Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment	Area of in situ treatment of COCs that may migrate into the amended capping materials via amended capping, excluding post-ISS cap (acres)		0	10.4	10.8	9.6	7.4	6.6	0.6	0	0
	Volume of sediment exceeding risk-based PRGs that would receive in situ treatment of dissolved COCs that may migrate into the amended capping materials via amended capping, excluding post-ISS cap (cy)		0	161,000	117,800	109,200	15,300	0	8,400	0	0
	Area of in situ treatment via ISS, also includes post-ISS cap (acres)		0	0.8	0.4	0.4	0.7	0.2	0	0.6[9]	0
	Volume of in situ treatment via ISS, also includes post-ISS cap (cy)		0	26,000	9,900	9,900	17,300	6,300	0	13,700	0
	Volume of ex situ treatment of dredged material via stabilization/solidification (cy)		0	32,300	92,300	101,000	233,800	254,700	5,100	3,500	15,000
	Volume of ex situ treatment of dredged material with cores that had isolated samples of concentrations of TPCBs exceeding 50 mg/kg via ex situ stabilization/solidification (cy)		0	300	2,700	2,700	2,700	14,200	N/A	N/A	N/A
	Volume of ex situ treatment of dredged material with observations of NAPL via ex situ stabilization/solidification (cy)		0	0	200	200	6,900	16,200	0	0	3,600

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Table 7-1
Detailed Comparative Analysis of Alternatives

Alternative Comparative Criteria				Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Cap Placement below 0 Foot MLLW	Alternative EB-C: Dredge-and-Cap	Alternative EB-D: Dredge-and-Cap with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All	Remedial Components for Treating NAPL or PTW[6] Option 1: Amended Cap	Option 2: ISS[7]	Option 3: Dredging
Balancing Criterion 3: Short-Term Effectiveness	Time until RAOs are achieved (not including time necessary to implement shoreline stabilization measures)			Unknown	13 months/ 2 seasons	22 months/ 3 seasons	22 months/ 3 seasons	37 months/ 5 seasons	46 months/ 7 seasons	Not evaluated separately	Not evaluated separately	Not evaluated separately
	Impacts to the environment, remediation workers, and community	Estimated construction duration (months and seasons)		There would be no impacts from Alternative EB-A because there is no active remediation.	13 months/ 2 seasons	22 months/ 3 seasons	22 months/ 3 seasons	37 months/ 5 seasons	46 months/ 7 seasons	1 month/ 1 season	4 months/ 1 season	1 month/ 1 season
		Removal quantities	Total volume of debris and sediment (cy)		34,000	97,200	106,300	246,100	268,100	5,300	3,700	15,800
			Volume of sediment (cy)		32,300	92,300	101,000	233,800	254,700	5,100	3,500	15,000
			Volume of debris (cy)		1,700	4,900	5,300	12,300	13,400	200	200	800
			No. of scow trips (sediment and debris disposal)[11]		24	63	69	157	171	4	3	9
			No. of truck trips (sediment and debris disposal)[11]		2,402	6,862	7,510	17,388	18,940	265	185	790
			Area of sediment and debris removal (acres)		3.5	11.2	11.2	10.6	11.2	0.6	0.6	0.6
		Amended capping quantities (excluding post-ISS cap)	Volume of capping materials (sand, gravel, amendments, and armor)		79,400	77,000	69,600	42,700	31,500	4,300	0	0
			No. of scow trips (amended cap material transport)[11]		40	39	35	22	16	3	0	0
			Area of amended capping (acres)		10.4	10.8	9.6	7.4	6.6	0.6	0	0
		Backfilling quantities (in areas where sediment is removed to native material without capping)	Backfill volume (cy)		0	0	14,400	7,200	10,100	0	0	900
			Area of dredging and backfilling (acres)		0	0	1.2	3.1	4.4	0	0	0.6
			No. of scow trips (backfill material transport)[11]		0	0	8	4	6	0	0	1
		ISS quantities (also includes post-ISS cap)	In situ treatment volume (cy)		26,000	9,900	9,900	17,300	6,300	0	13,700	0
			Area of ISS (acres)		0.8	0.4	0.4	0.7	0.2	0	0.6[9]	0
		Shoreline stabilization quantities	Total length of shoreline (lf)[5]		5,090					NA	NA	NA
			Length of shoreline stabilization (lf) / % of total		1,850 / 36%	3,850 / 76%		4,250 / 84%	4,500 / 88%	NA	NA	NA
			Dredge offsets with amended capping (lf / %)		0 / 0%	0 / 0%		940 / 18%	0 / 0%			
			Slot dredging (lf) / %		680 / 13%	2,480 / 49%		0 / 0%	0 / 0%			
			ISS (lf) / %		890 / 18%	480 / 9%		780 / 15%	270 / 5%			
			Bulkhead stabilization, replacement, or new installation (lf) / %		280 / 5% (60 lf assumed to require a sealant)	890 / 17% (180 lf assumed to required a sealant)		2,530 / 50% (490 lf assumed to require a sealant)	4,240 / 83% (850 lf assumed to require a sealant)			
		Total dredging volume (debris and sediments) (cy)			34,000	97,200	106,300	246,100	268,100	5,300	3,700	15,800
		Dredging duration (months)[11]			3	9	10	19	20	1	1	1
		Total GHG emissions (tons CO_2e)			17,000	35,000	38,000	74,000	82,000	Not evaluated separately	Not evaluated separately	Not evaluated separately
		Estimated total labor hours[11]			64,000	114,000	120,000	223,000	269,000	1,600	7,800	6,000

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Table 7-1
Detailed Comparative Analysis of Alternatives

Alternative Comparative Criteria				Alternative EB-A: No Action	Alternative EB-B: Dredge to Allow Cap Placement below 0 Foot MLLW	Alternative EB-C: Dredge-and-Cap	Alternative EB-D: Dredge-and-Cap with Localized Deeper Dredging	Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside	Alternative EB-F: Dredge All	Remedial Components for Treating NAPL or PTW[6]		
										Option 1: Amended Cap	Option 2: ISS[7]	Option 3: Dredging
Balancing Criterion 4: Implementability	Estimated construction duration (months/construction seasons)			There are no direct implementability issues associated with Alternative EB-A because it does not require any site construction or monitoring activities.	13 months/ 2 seasons	22 months/ 3 seasons	22 months/ 3 seasons	37 months/ 5 seasons	46 months/ 7 seasons	1 month/ 1 season	4 months/ 1 season	1 month/ 1 season
	Technical feasibility	Shoreline stabilization	% of shoreline requiring stabilization (via dredge offsets w/amended capping; slot dredging; ISS; or bulkhead stabilization, replacement, or new installation)		36%	76%	76%	84%	88%	NA	NA	NA
			% of shoreline categorized as high risk, requiring stabilization via bulkhead replacement or new installation		5%	17%	17%	48%	83%			
Balancing Criterion 5: Cost[12]	Total cost (including contingency)			$0	$174,800,000	$270,200,000	$279,200,000	$499,800,000	$610,100,000	$1,300,000 (Dredging and disposal would cost an additional $3,700,000)	$11,700,000 (Capping would cost an additional $1,300,000)	$11,900,000
	Net present value cost (including contingency)			$0	$152,000,000	$235,200,000	$243,500,000	$418,700,000	$492,700,000	Not evaluated separately		

Table 7-1
Detailed Comparative Analysis of Alternatives

Notes:

1. Dredge volumes for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F include a neatline factor to account for a 6-inch overdredge allowance, stable dredge prism side slopes, and refined dredge prism delineation during pre-design investigation. Additional information is included in Appendix F.
2. Sediment treated via ISS is also subject to treatment via amended capping; the area of post-ISS amended capping is reported separate from other areas of amended capping. In addition, for Alternatives EB-E and EB-F an amended cap would be placed in portions of the East Branch after removal of sediment down to native material where the flux of COCs from groundwater is relatively high (note that specific areas with such conditions assumed for this FFS are uncertain and would need to be evaluated during design through PDI).
3. Action-specific and location-specific ARARs are not applicable for Alternative EB-A.
4. Achievement of the RAO for the EA would not be verified under Alternative EB-A, because no monitoring would be performed.
5. Values for shoreline stabilization are rounded to the nearest 10 linear feet, which may result in sum of values not totaling the total length of shoreline.
6. To assess ISS as a remedial technology for treating NAPL or PTW that could be integrated into the selected remedial alternative based on conditions determined during the PDI, three technology options (in situ treatment via amended capping, ISS, and dredging) were evaluated within a 0.6-acre area of the Western Beef Slip. This 0.6-acre area is already accounted for in each of the remedial alternatives; therefore, the quantities associated with the remedial technology options for treating NAPL or PTW are not additive to the alternatives.
7. The effectiveness of ISS was evaluated as a stand-alone remedial component, but in order to implement ISS without changing the existing sediment bed elevation, it will be necessary to perform dredging to remove the volume of excess material caused by swelling from the ISS.
8. For the amended capping option within the 0.6-acre area of the Western Beef slip, the dredge and amended cap footprint accounts for dredging that would be needed prior to cap placement to maintain existing water depths.
9. For the ISS option within the 0.6-acre area of the Western Beef slip, the dredge and amended cap footprint accounts for dredging that would be needed to accommodate the swell from ISS. The need for a post-ISS cap would be determined based on treatability study testing during the remedial design.
10. The effectiveness and reliability of ISS to control the residual risk would be subject to treatability testing during the remedial design phase. Based on experience at other sites, diffusive flux from the ISS monolith may continue over the long term, which could require the placement of a post-ISS cap over the monolith to control the residual risk. Therefore, the related values noted as TBD in this table are as yet undetermined and would be determined during remedial design, if applicable.
11. Assumptions related to equipment sizing, production rates, and work schedules are provided in Appendix F.
12. Costs represent the "high" end of the range of bulkhead replacement/installation costs discussed in Appendix F.

Abbreviations:
ARAR: Applicable or Relevant and Appropriate Requirement
C19-C36: C19-C36 aliphatics
CO_2e: carbon dioxide equivalent
COC: contaminant of concern
CSO: combined sewer overflow
Cu: copper
cy: cubic yard
D/F TEQ: total dioxin/furan TEQ 2005 (mammal)
EA: Early Action
FFS: Focused Feasibility Study
GHG: greenhouse gas
IC: institutional controls
ISS: in situ stabilization/solidification
lf: linear foot
mg/kg: milligram per kilogram
MLLW: mean lower low water
NA: not applicable
NAPL: nonaqueous phase liquid
ng/kg: nanogram per kilogram
NPV: net present value
PDI: pre-design investigation
PRG: preliminary remediation goal
propwash: propeller wash
PTW: principal threat waste
RAO: remedial action objective
SWAC: surface-weighted average concentration
TBD: to be determined
TPAH (34): total polycyclic aromatic hydrocarbon (34)
TPCB: total polychlorinated biphenyl
USEPA: U.S. Environmental Protection Agency

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Table 7-2
Summary of Comparative Analysis of Alternatives

Alternative	Threshold Criteria		Balancing Criteria					
	Threshold Criterion 1: Overall Protection of Human Health and the Environment	Threshold Criterion 2: Compliance with ARARs	Balancing Criterion 1: Long-Term Effectiveness and Permanence	Balancing Criterion 2: Reduction of Toxicity, Mobility, or Volume Through Treatment		Balancing Criterion 3: Short-Term Effectiveness	Balancing Criterion 4: Implementability	Balancing Criterion 5: Total Cost ($ Million)[2]
				Treatment[1]	Ex Situ Treatment			
EB-A No Action	– –	– –	○	○	○	●	●	$0.0
EB-B Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW	✓	✓	◔	●	◔	◕	◕	$174.8
EB-C Dredge to Allow Placement of a Cap to Maintain Existing Water Depths	✓	✓	◑	◕	◑	◑	◑	$270.2
EB-D Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging	✓	✓	◕	◕	◑	◑	◑	$279.2
EB-E Dredge All Within the Navigation Channel, Cap Outside	✓	✓	●	◑	●	◔	◔	$499.8
EB-F Dredge All	✓	✓	●	◔	●	◔	◔	$610.1

Notes:
1. The relative assessment provided herein is a relative comparison of the alternatives for each criterion and should not be construed as absolute rankings of the alternatives evaluated.
2. Alternatives that include amended capping would provide in situ treatment for COCs that migrate into the amendment layer over time.
3. Costs have been rounded and include construction, cap operations and maintenance, long-term monitoring, and a 30% contingency and represent total costs that are non-discounted.

Abbreviations:
ARAR: Applicable or Relevant and Appropriate Requirement
COC: contaminant of concern
MLLW: mean lower low water

Threshold Criteria	
– –	Does not satisfy criterion
✓	Satisfies criterion

Balancing Criteria	Relative Assessment of Each Criterion
○	None to Low
◔	Low to Moderate
◑	Moderate
◕	Moderate to High
●	High

Figures

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Figure 1-1
Location Map
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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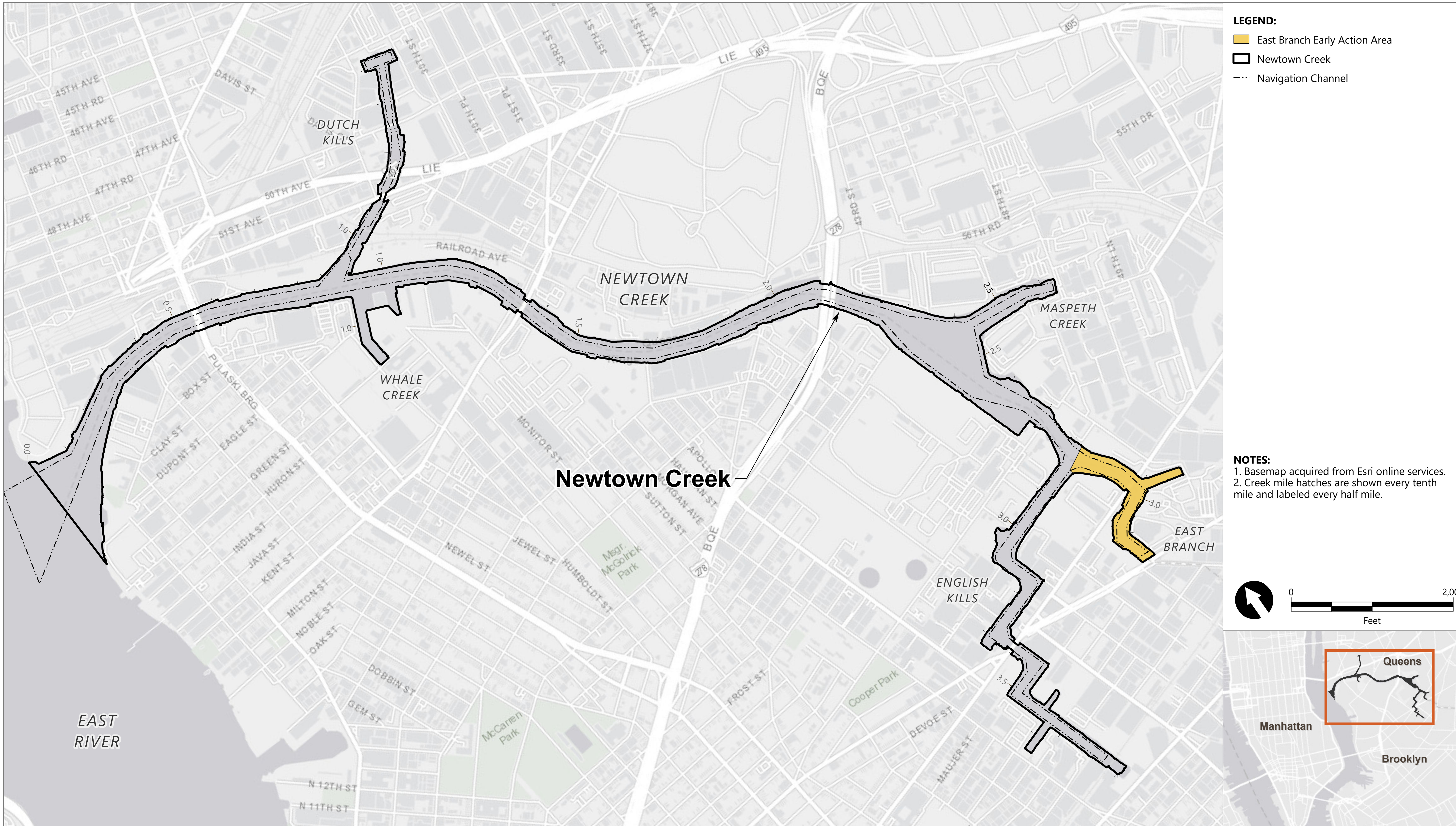

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ANCHOR QEA

Figure 1-2
OU1 Study Area and East Branch Early Action Area
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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LEGEND:
East Branch Early Action Area
Newtown Creek
Navigation Channel
Creek Mile

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

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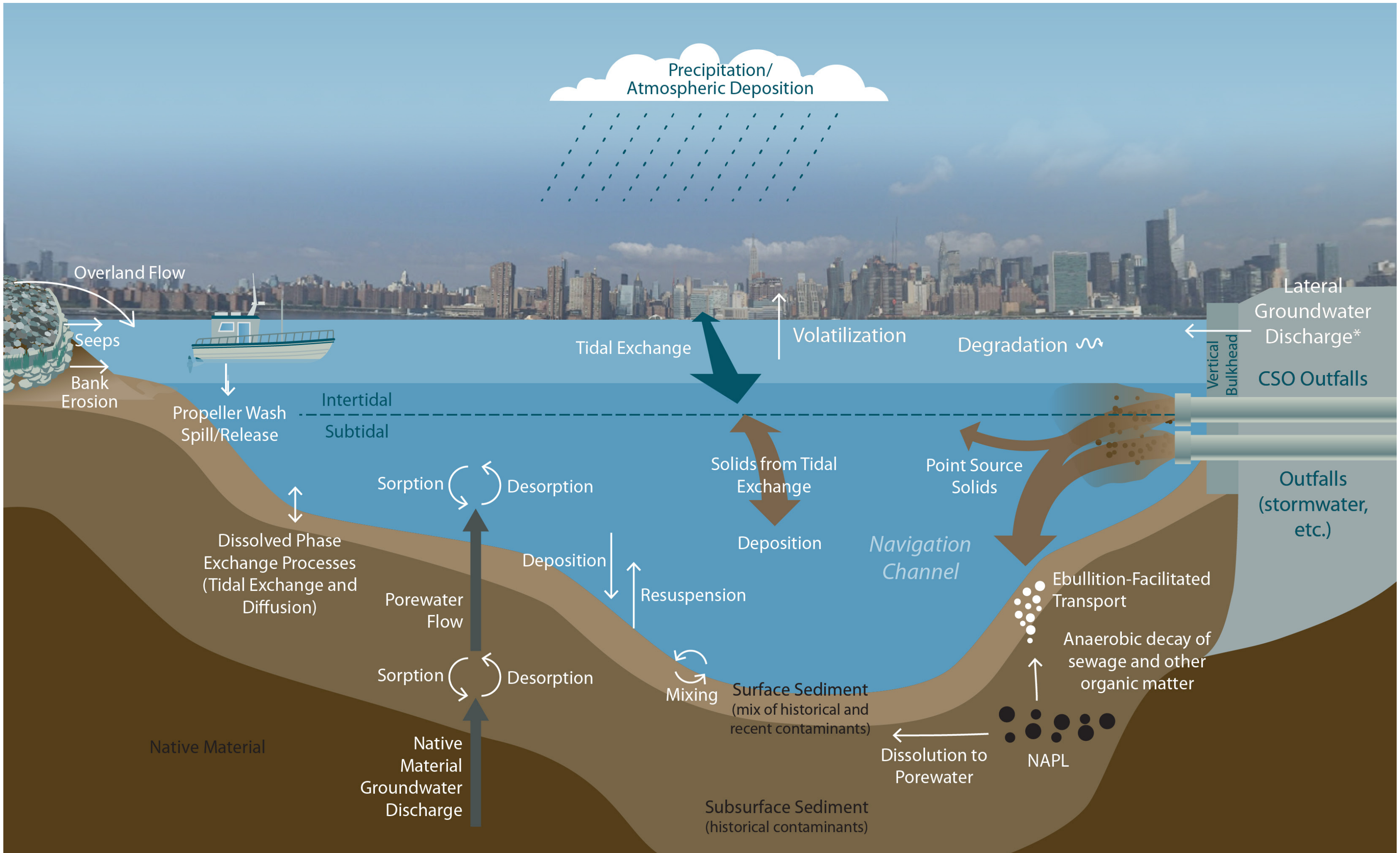
Figure 1-3
East Branch Early Action Area
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS



Notes:
This figure illustrates ongoing external inputs of solids and contaminants to the East Branch and in-creek processes that affect the redistribution of solids and contaminants in East Branch.
Tidal exchange represents a mix of East River surface water and surface water from the Newtown Creek Study Area outside of East Branch.
* Lateral groundwater discharges occur in vertical permeable shoreline areas that include vertical wood, wood, precast concrete, and pile-supported concrete bulkheads.

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Figure 2-1
East Branch Conceptual Site Model
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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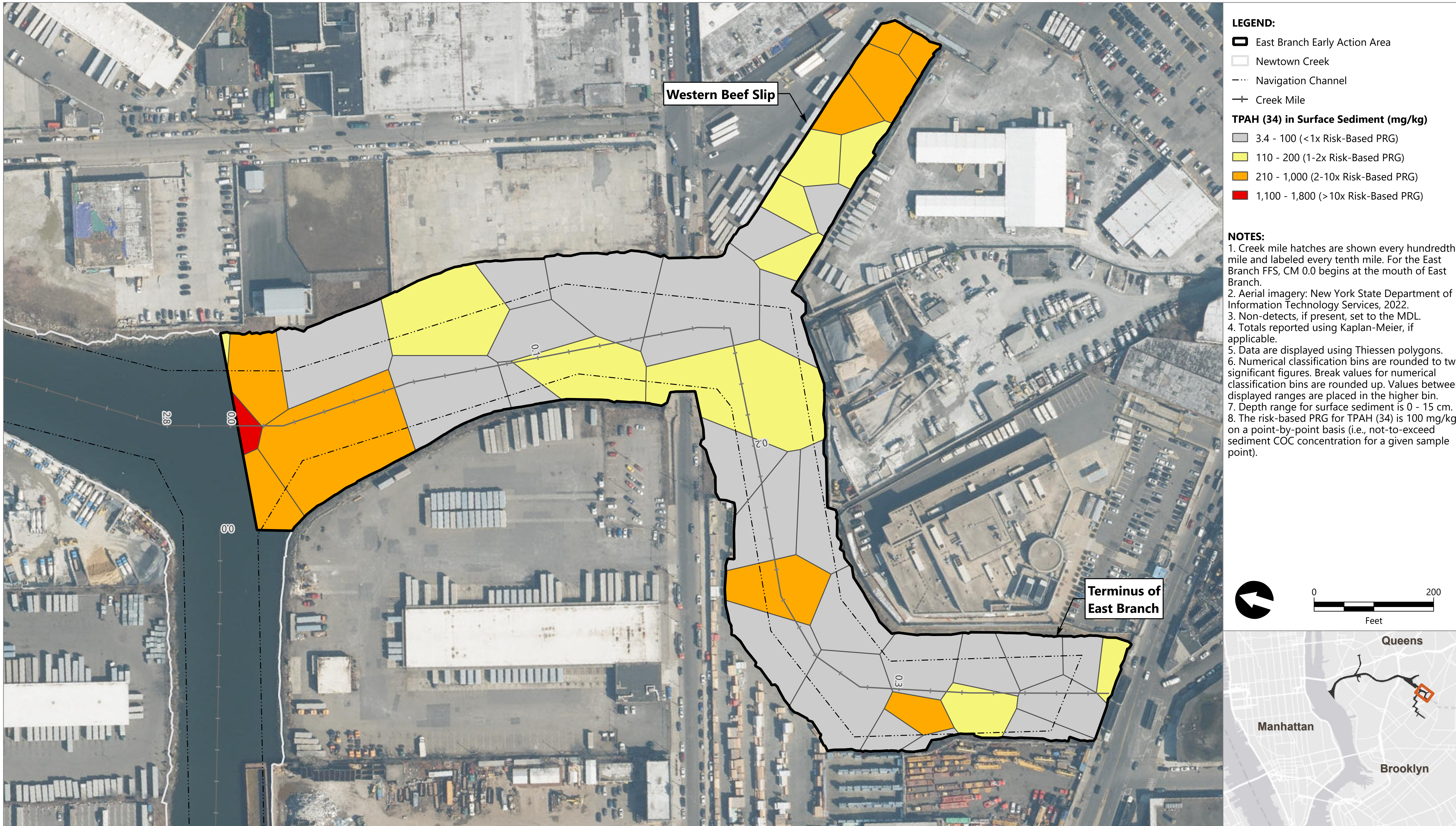

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for TPAH (34) is 100 mg/kg on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point).

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Figure 3-1
TPAH (34) Risk-Based PRG Exceedances in Surface Sediment
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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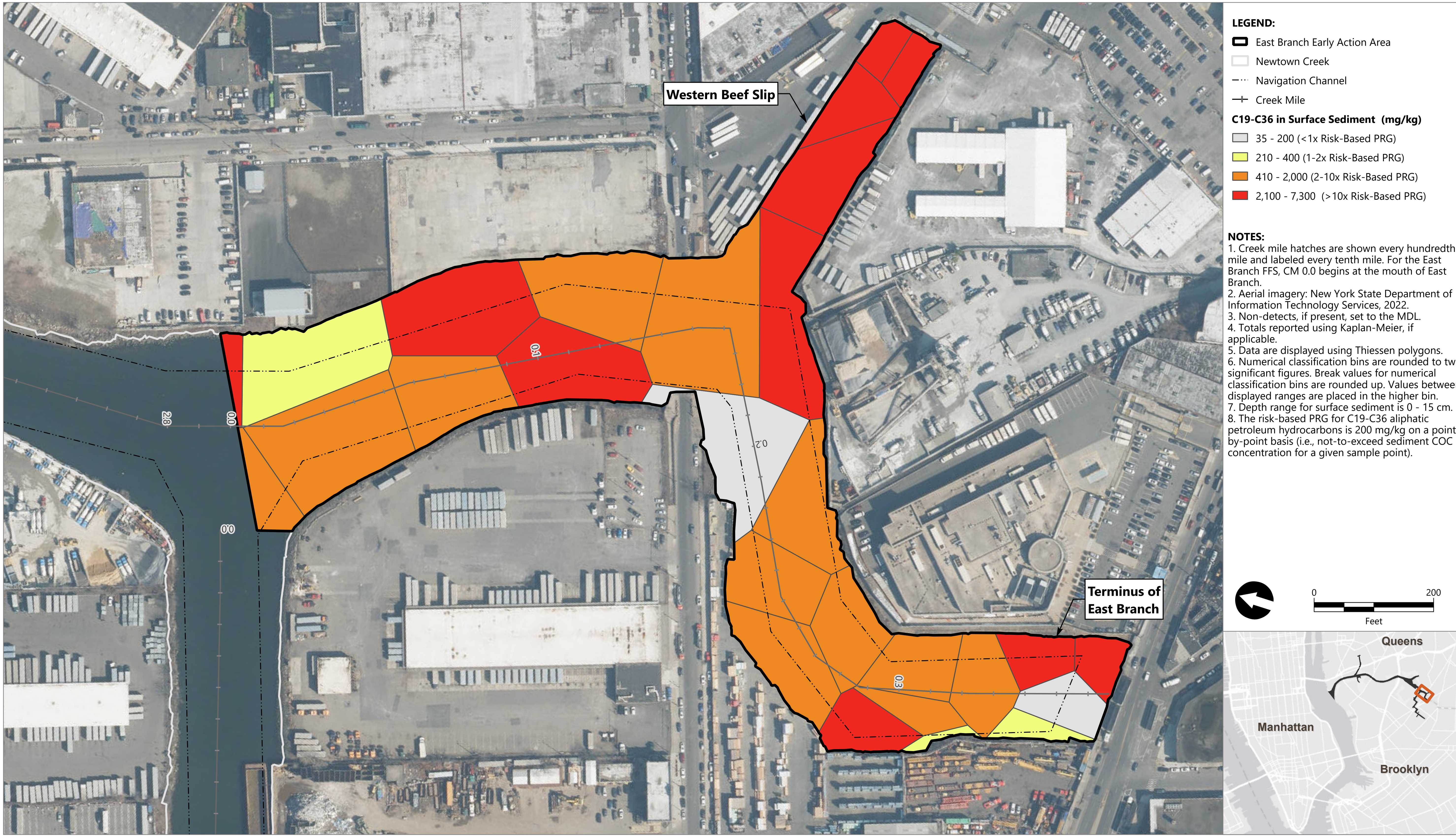

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Figure 3-2
C19-C36 Risk-Based PRG Exceedances in Surface Sediment
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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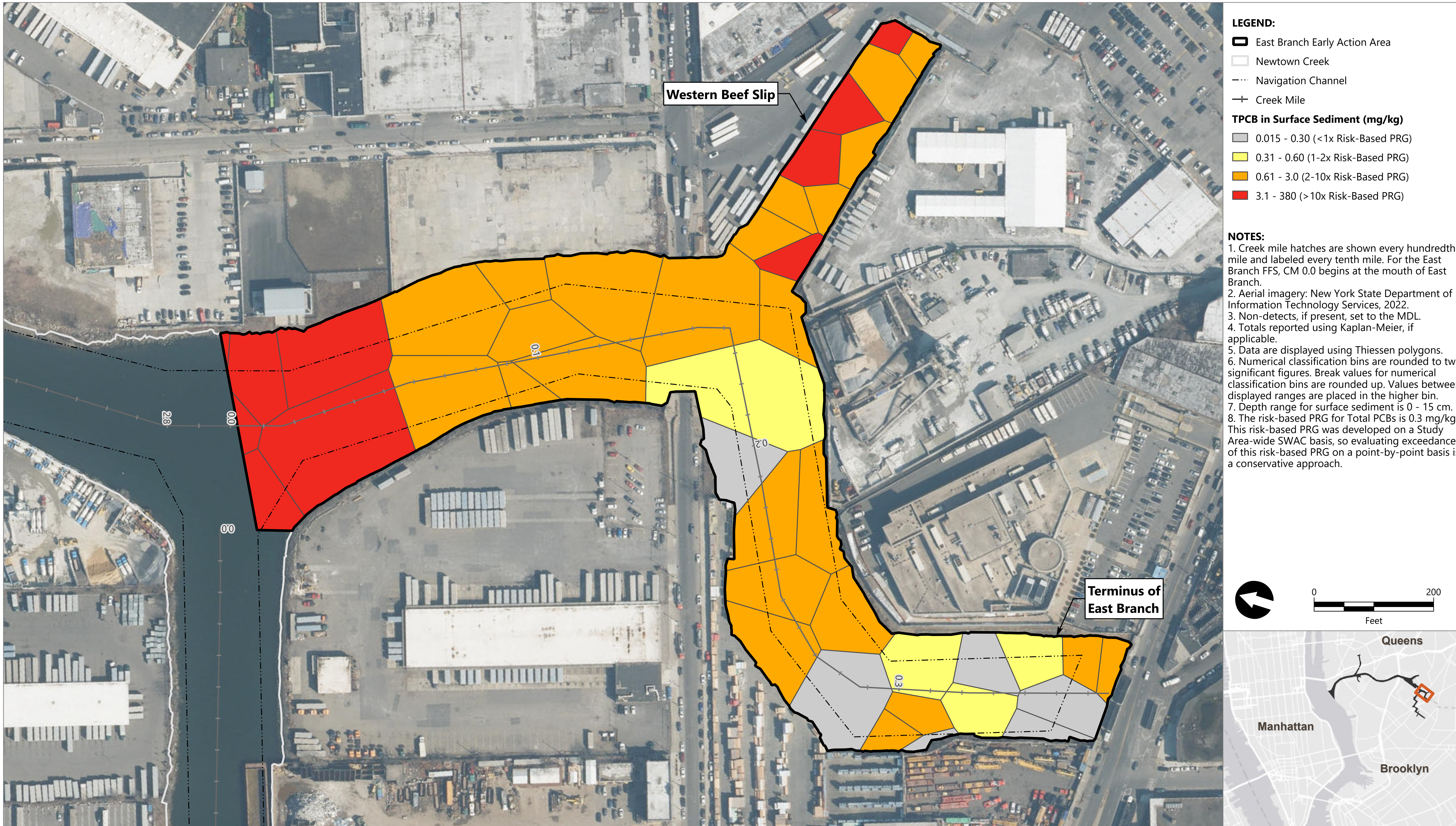

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

TPCB in Surface Sediment (mg/kg)

- 0.015 - 0.30 (<1x Risk-Based PRG)
- 0.31 - 0.60 (1-2x Risk-Based PRG)
- 0.61 - 3.0 (2-10x Risk-Based PRG)
- 3.1 - 380 (>10x Risk-Based PRG)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for Total PCBs is 0.3 mg/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

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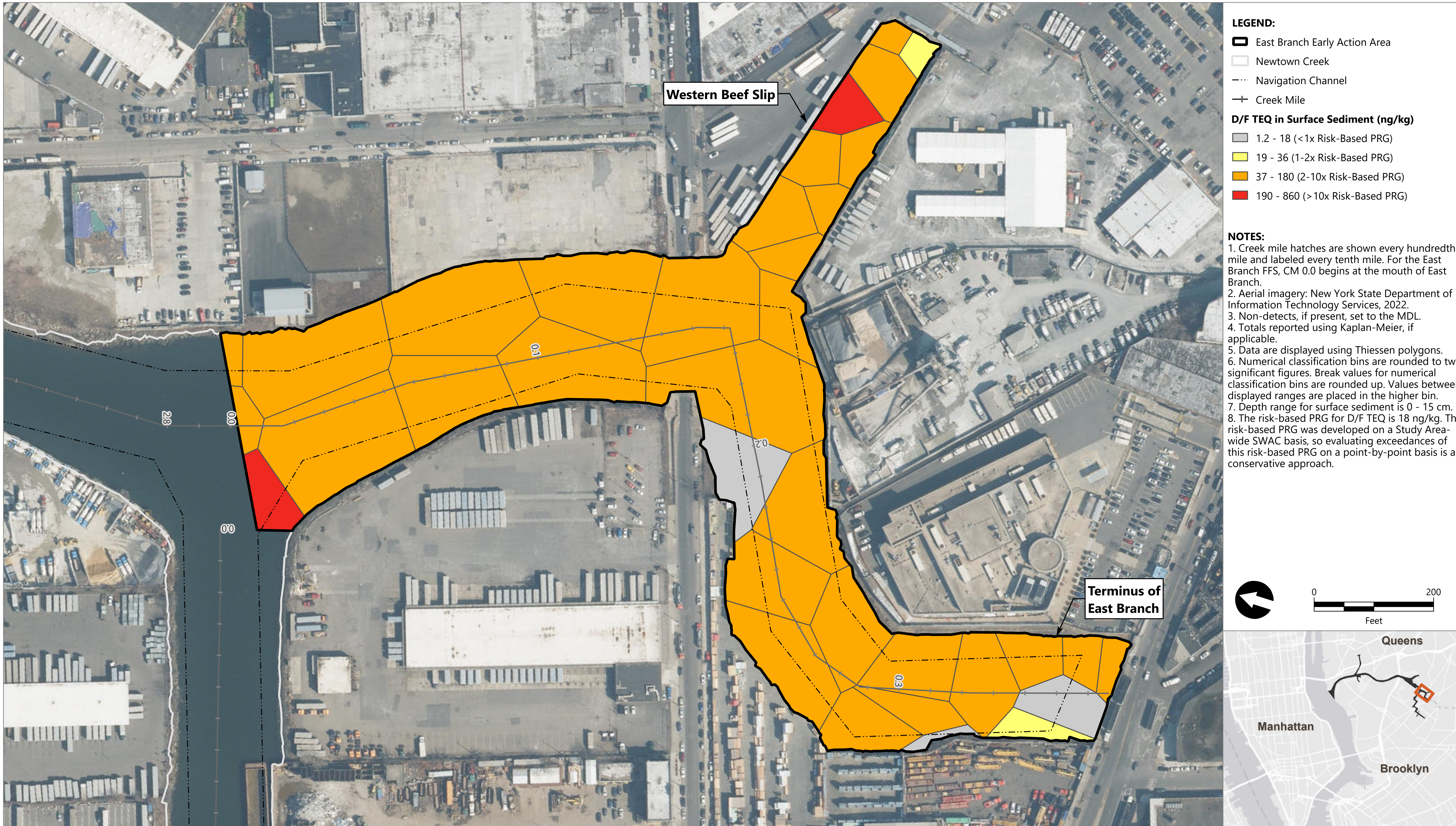
ANCHOR QEA

Figure 3-3
TPCB Risk-Based PRG Exceedances in Surface Sediment
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for D/F TEQ is 18 ng/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

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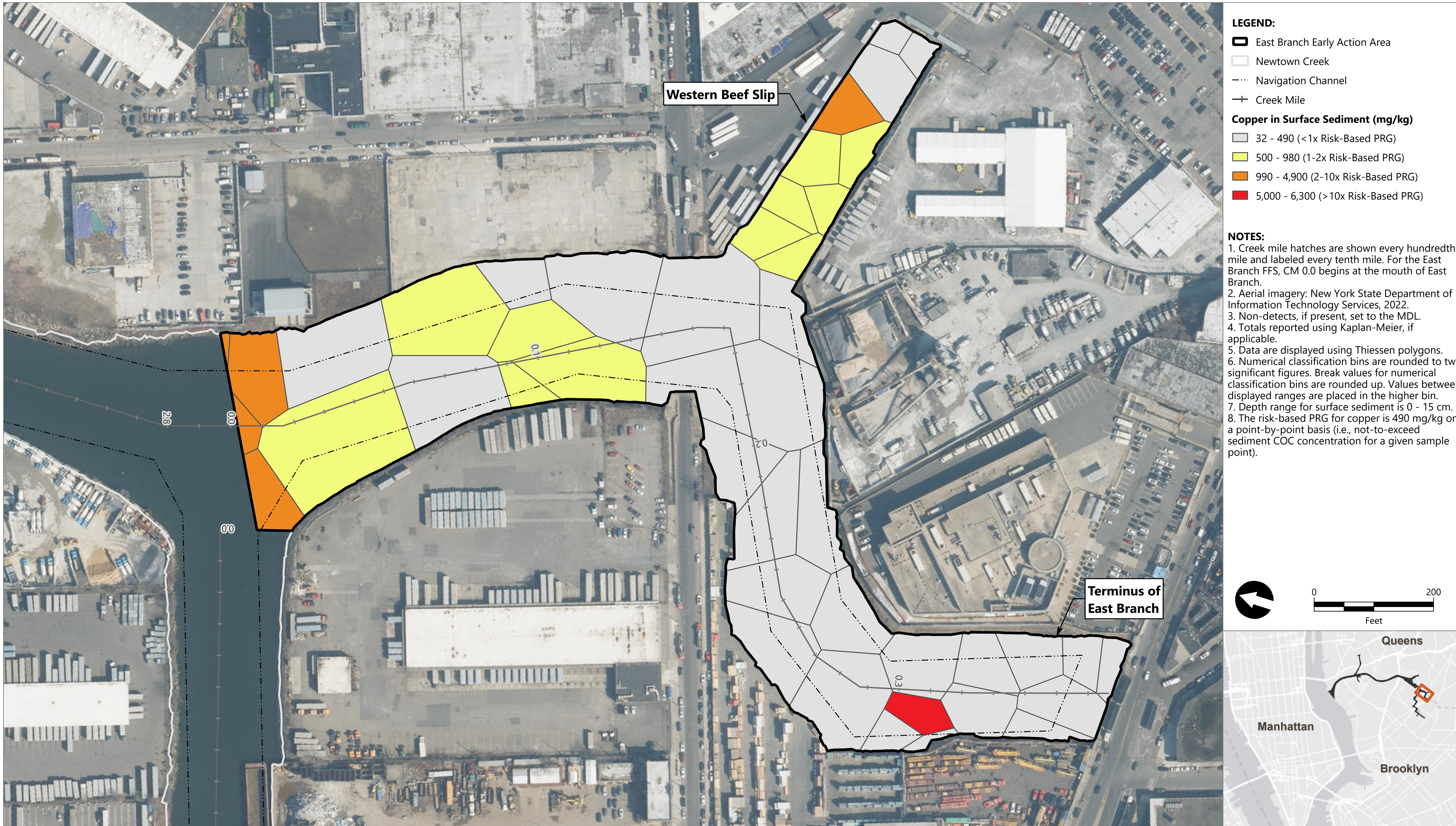
Figure 3-4
D/F TEQ Risk-Based PRG Exceedances in Surface Sediment
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for copper is 490 mg/kg on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point).

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Figure 3-5
Copper Risk-Based PRG Exceedances in Surface Sediment
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Lead in Surface Sediment (mg/kg)

- 9.0 - 340 (<1x Risk-Based PRG)
- 350 - 680 (1-2x Risk-Based PRG)
- 690 - 1,900 (2-10x Risk-Based PRG)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for lead is 340 mg/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis in intertidal areas, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.
9. Intertidal areas are areas between mean lower low water (MLLW) and mean high water (MHW). Intertidal areas shown in this figure were developed using the 2022 bathymetric survey.
10. Areas with surface sediment concentrations that are <1x PRG are shown in blue on this figure to make them easier to see given the limited spatial extent of intertidal areas.

0 200
Feet

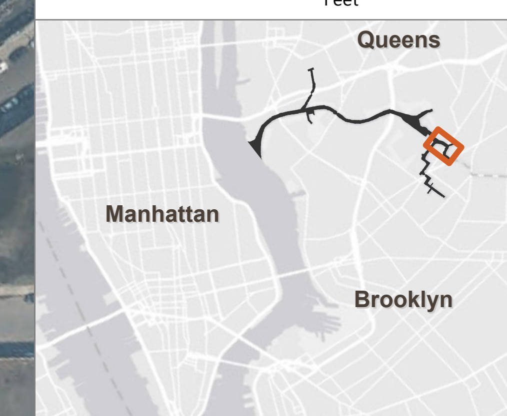

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Figure 3-6a
Lead Risk-Based PRG Exceedances in Surface Sediment in Intertidal Areas
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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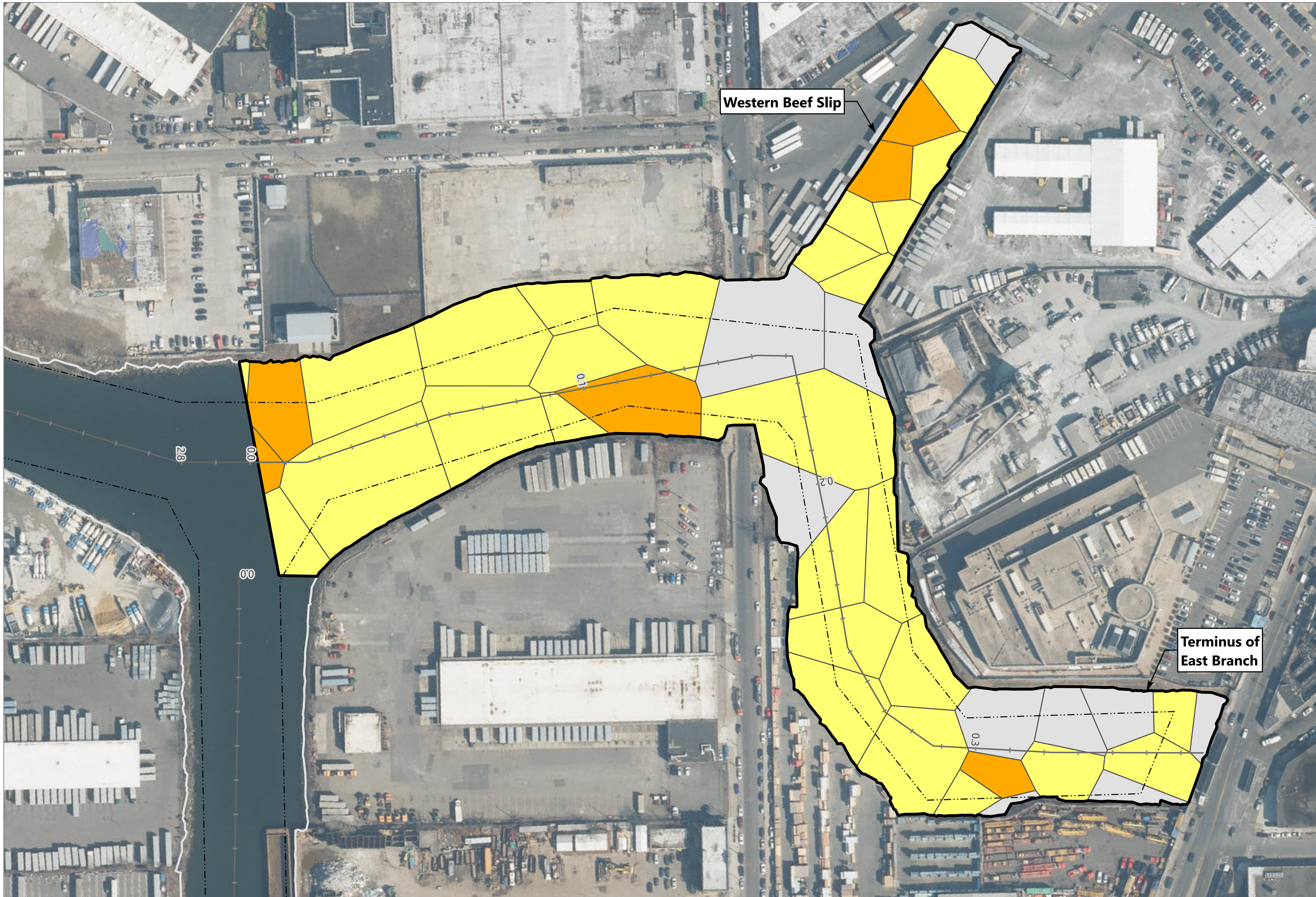

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Lead in Surface Sediment (mg/kg)

- 9.0 - 340 (<1x Risk-Based PRG)
- 350 - 680 (1-2x Risk-Based PRG)
- 690 - 1,900 (2-10x Risk-Based PRG)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRG for lead is 340 mg/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis in intertidal areas, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

0 200
Feet

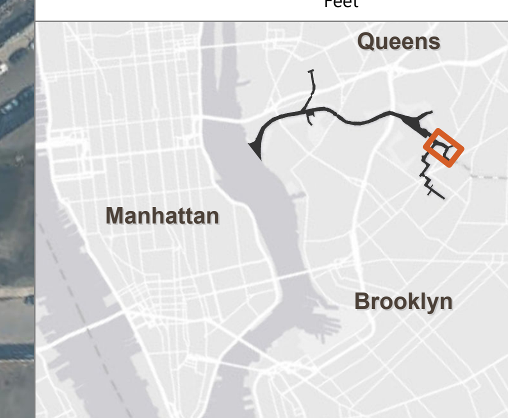

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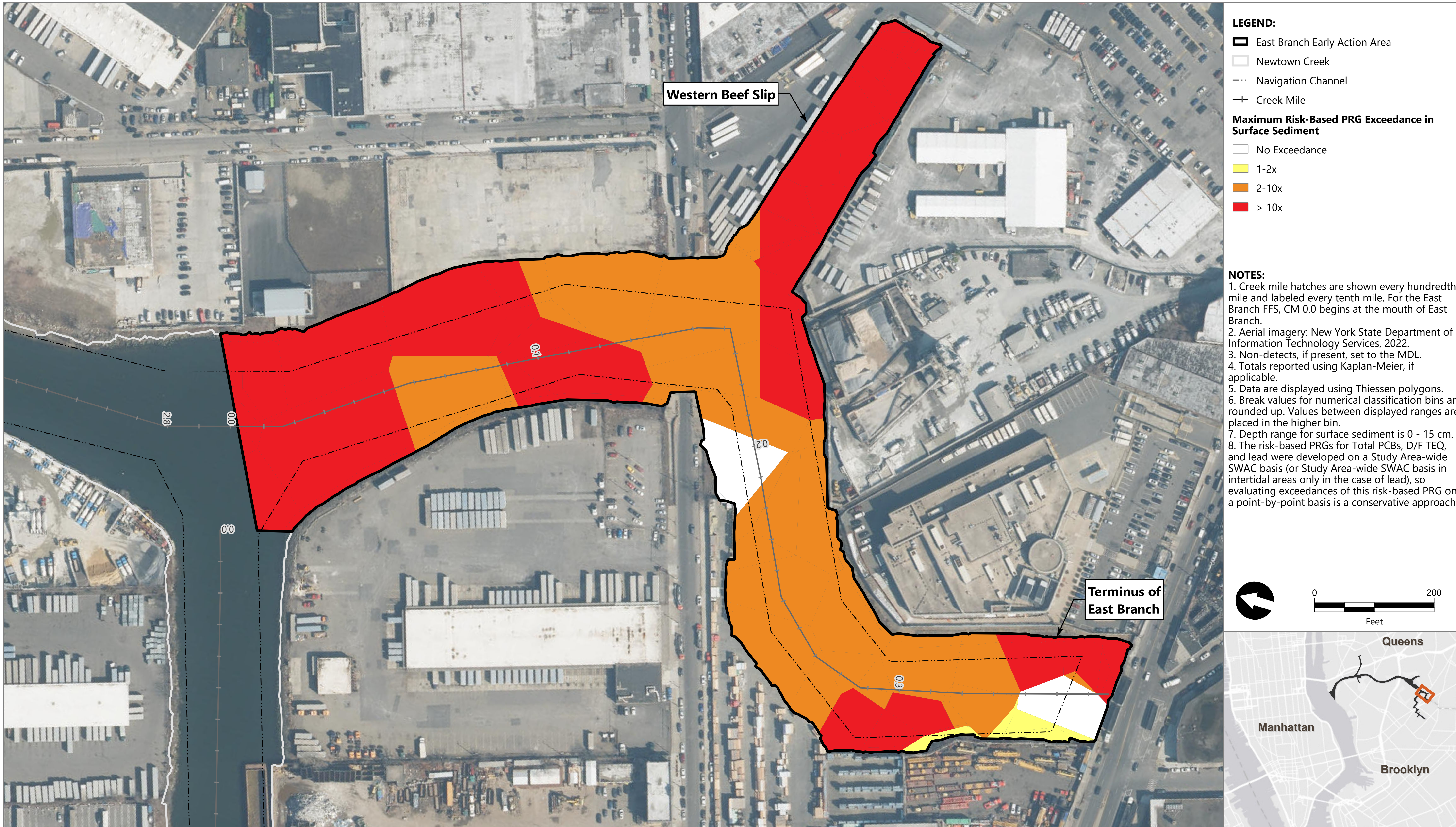
Figure 3-6b

Thiessen Polygons of Lead Risk-Based PRG Exceedances in Surface Sediment Before Non-Intertidal Area Polygons Were Removed

East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL



LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Maximum Risk-Based PRG Exceedance in Surface Sediment

- No Exceedance
- 1-2x
- 2-10x
- > 10x

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons.
6. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. Depth range for surface sediment is 0 - 15 cm.
8. The risk-based PRGs for Total PCBs, D/F TEQ, and lead were developed on a Study Area-wide SWAC basis (or Study Area-wide SWAC basis in intertidal areas only in the case of lead), so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

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Figure 3-7
Maximum Risk-Based PRG Exceedances in Surface Sediment for All COCs
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

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Figure 5-1
Alternative EB-A
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Dredge Footprint
- Amended 36-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 45-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 53-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- ISS and Potential Post-ISS Amended Cap, With Any Areas Requiring Dredging for ISS Swell Removal Indicated by Hatching
- Evaluation Area for NAPL or PTW (if Either of These Are Found to Be Present)

Shoreline/Bulkhead Stabilization Technique

- Slot Dredging
- In Situ Stabilization and Solidification (ISS)
- Bulkhead Replacement

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. ISS: In Situ Stabilization and Solidification
4. Preliminary cap thicknesses shown in this figure are based on the capping evaluations presented in Appendix C. Additional analyses and refinements may be appropriate during the remedial design phase if an alternative that includes capping is selected.
5. The location in the Western Beef slip has been selected for the purposes of evaluating remedial options for addressing NAPL or PTW (if either of these are found to be present during the PDI) in the FFS. However, the exact location of where ISS could be applied to the selected remedy would be determined during the remedial design phase based on previous and future site investigations that identify locations where conditions exist that warrant ISS, as determined by USEPA.

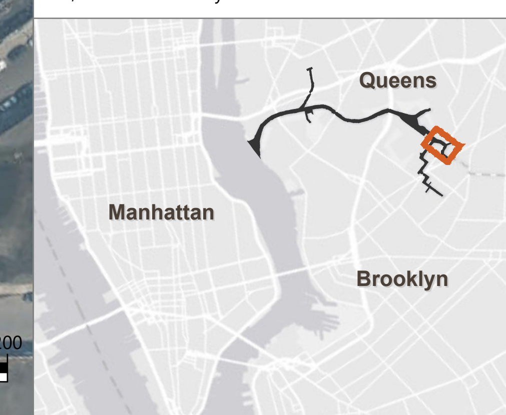

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Figure 5-2
Alternative EB-B

East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Dredge Footprint
- Amended 36-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 45-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 53-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- ISS and Potential Post-ISS Amended Cap, With Any Areas Requiring Dredging for ISS Swell Removal Indicated by Hatching
- Evaluation Area for NAPL or PTW (if Either of These Are Found to Be Present)

Shoreline/Bulkhead Stabilization Technique

- Slot Dredging
- In Situ Stabilization and Solidification (ISS)
- Bulkhead Installation
- Bulkhead Replacement

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. ISS: In Situ Stabilization and Solidification
4. Preliminary cap thicknesses shown in this figure are based on the capping evaluations presented in Appendix C. Additional analyses and refinements may be appropriate during the remedial design phase if an alternative that includes capping is selected.
5. The location in the Western Beef slip has been selected for the purposes of evaluating remedial options for addressing NAPL or PTW (if either of these are found to be present during the PDI) in the FFS. However, the exact location of where ISS could be applied to the selected remedy would be determined during the remedial design phase based on previous and future site investigations that identify locations where conditions exist that warrant ISS, as determined by USEPA.

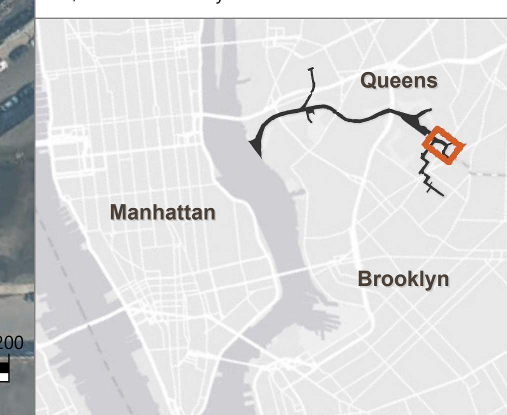

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Figure 5-3
Alternative EB-C

East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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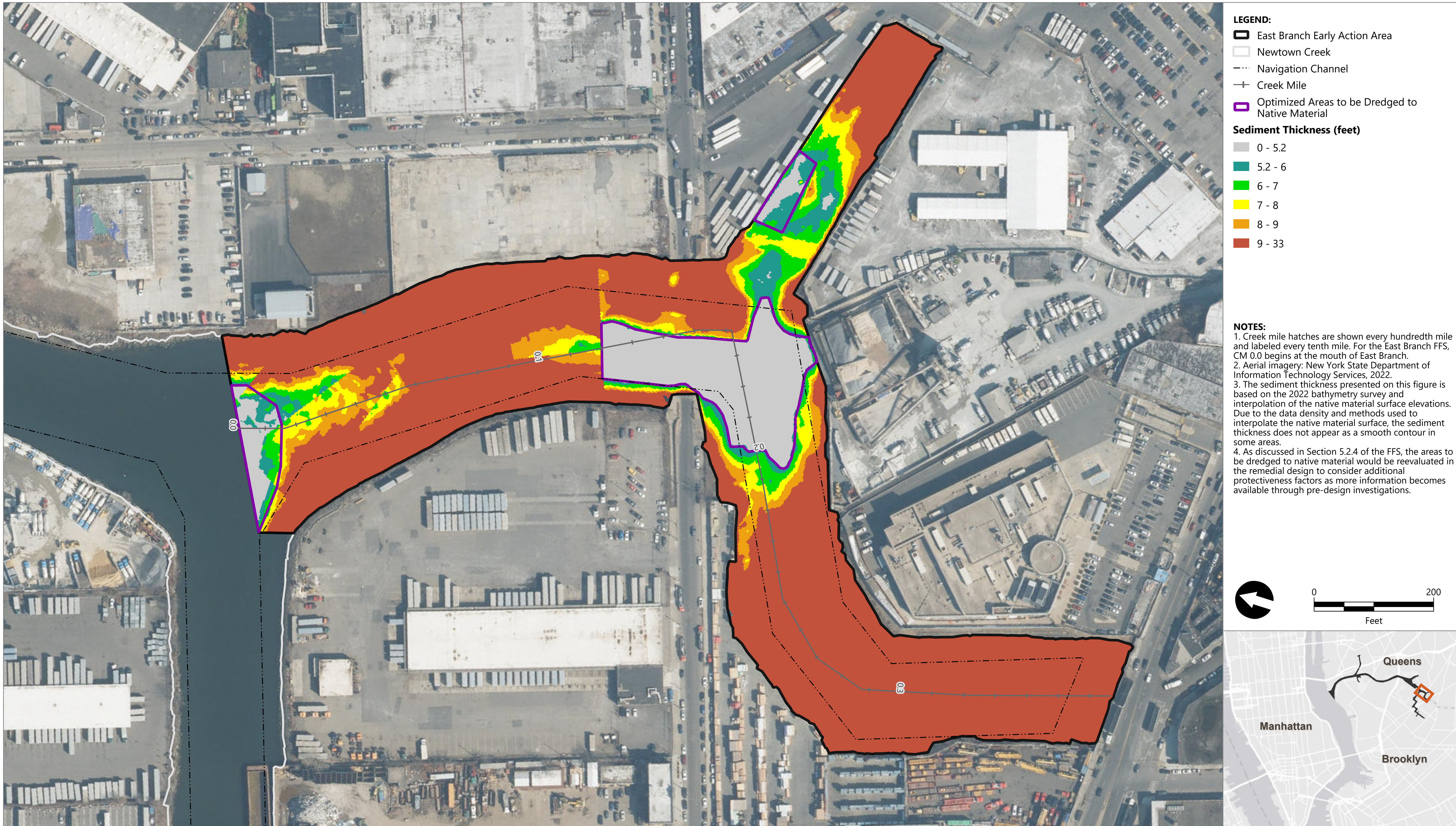

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Figure 5-4
Alternative EB-D Dredging Versus Capping Optimization Analysis
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Dredge Footprint
- Amended 36-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 45-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 53-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Dredge to Native and Place Amended 27-inch Thick Cap
- Dredge to Native and Place 12-inch Backfill for Post-dredge Residuals Management
- ISS and Potential Post-ISS Amended Cap, With Any Areas Requiring Dredging for ISS Swell Removal Indicated by Hatching
- Evaluation Area for NAPL or PTW (if Either of These Are Found to Be Present)

Shoreline/Bulkhead Stabilization Technique

- Slot Dredging
- In Situ Stabilization and Solidification (ISS)
- Bulkhead Installation
- Bulkhead Replacement

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. ISS: In Situ Stabilization and Solidification
4. Preliminary cap thicknesses shown in this figure are based on the capping evaluations presented in Appendix C. Additional analyses and refinements may be appropriate during the remedial design phase if an alternative that includes capping is selected.
5. The location in the Western Beef slip has been selected for the purposes of evaluating remedial options for addressing NAPL or PTW (if either of these are found to be present during the PDI) in the FFS. However, the exact location of where ISS could be applied to the selected remedy would be determined during the remedial design phase based on previous and future site investigations that identify locations where conditions exist that warrant ISS, as determined by USEPA.

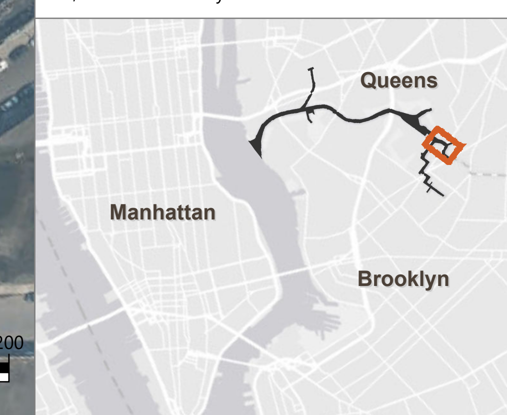

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Figure 5-5
Alternative EB-D

East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Dredge Footprint
- Amended 36-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 45-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Amended 53-inch Thick Cap, With Any Areas Requiring Dredging for Cap Placement Indicated by Hatching
- Dredge to Native and Place Amended 27-inch Thick Cap
- Dredge to Native and Place 12-inch Backfill for Post-dredge Residuals Management
- ISS and Potential Post-ISS Amended Cap, With Any Areas Requiring Dredging for ISS Swell Removal Indicated by Hatching
- Evaluation Area for NAPL or PTW (if Either of These Are Found to Be Present)

Shoreline/Bulkhead Stabilization Technique

- Bulkhead Stabilization
- In Situ Stabilization and Solidification (ISS)
- Bulkhead Installation
- Bulkhead Replacement
- Dredge Offset with Capping

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. ISS: In Situ Stabilization and Solidification
4. Preliminary cap thicknesses shown in this figure are based on the capping evaluations presented in Appendix C. Additional analyses and refinements may be appropriate during the remedial design phase if an alternative that includes capping is selected.
5. The location in the Western Beef slip has been selected for the purposes of evaluating remedial options for addressing NAPL or PTW (if either of these are found to be present during the PDI) in the FFS. However, the exact location of where ISS could be applied to the selected remedy would be determined during the remedial design phase based on previous and future site investigations that identify locations where conditions exist that warrant ISS, as determined by USEPA.

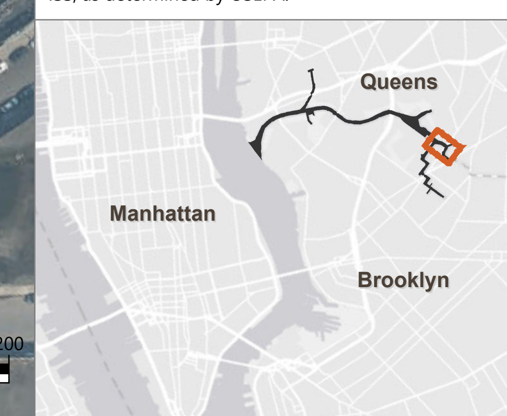

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Figure 5-6
Alternative EB-E

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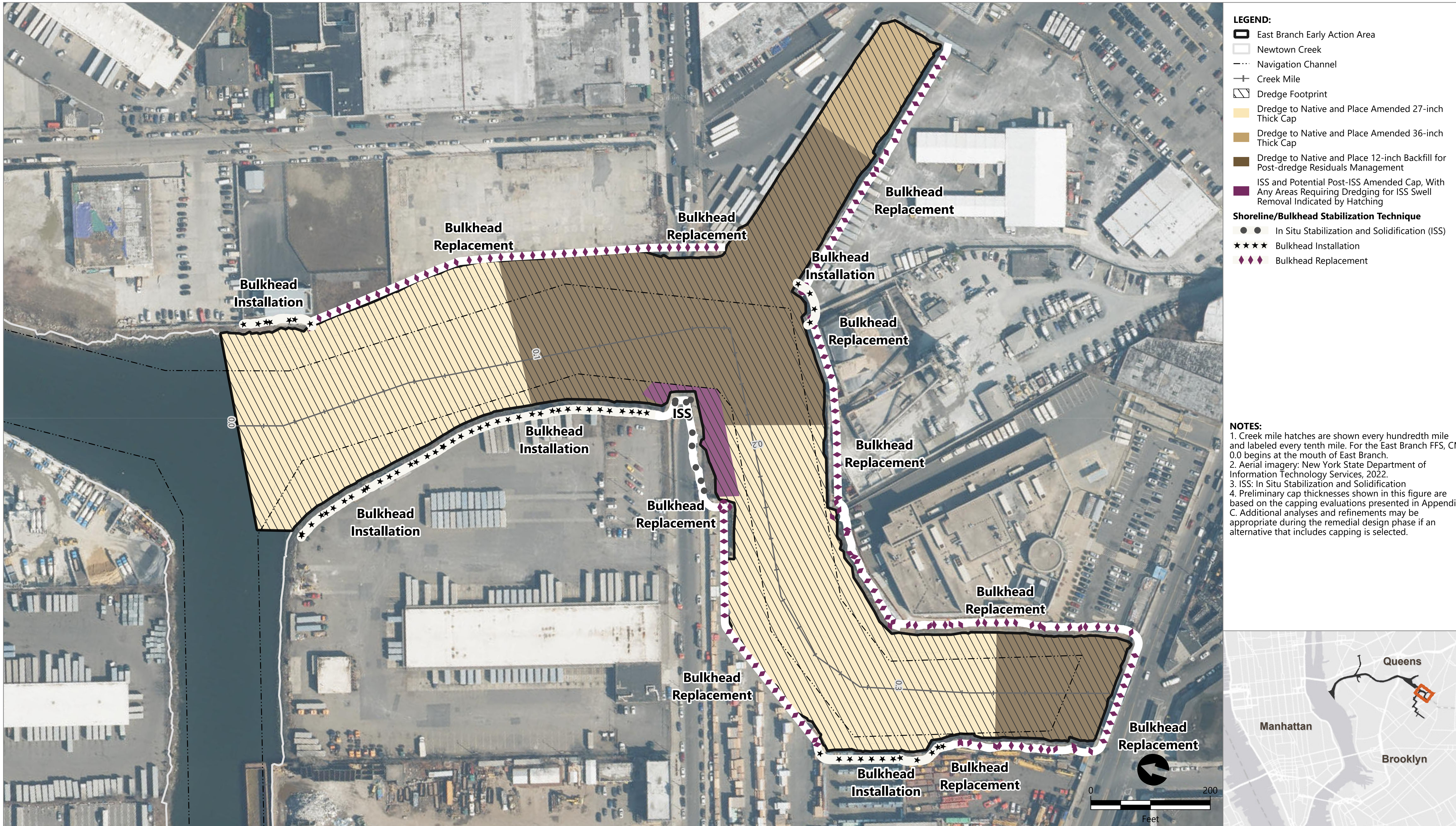

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. ISS: In Situ Stabilization and Solidification
4. Preliminary cap thicknesses shown in this figure are based on the capping evaluations presented in Appendix C. Additional analyses and refinements may be appropriate during the remedial design phase if an alternative that includes capping is selected.

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Figure 5-7
Alternative EB-F
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

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ANCHOR QEA

Figure 5-8
Water Depth Zones for Capping Evaluations
East Branch Early Action Focused Feasibility Study
Newtown Creek RI/FS

Appendix A
Conceptual Site Model

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

ANCHOR QEA

Conceptual Site Model East Branch Early Action Focused Feasibility Study

Prepared for the Newtown Creek Group

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Conceptual Site Model East Branch Early Action Focused Feasibility Study

Prepared for
The Newtown Creek Group

Prepared by
Anchor QEA
123 Tice Boulevard, Suite 205
Woodcliff Lake, New Jersey 07677

Project Number: E41037-01.01
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FIGURES

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ABBREVIATIONS

µg/L	microgram per liter
BERA	*Baseline Ecological Risk Assessment*
BHHRA	*Baseline Human Health Risk Assessment*
C19-C36	C19-C36 aliphatic petroleum hydrocarbons
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFT	chemical fate and transport
CFT Modeling Report	*Chemical Fate and Transport Model Development and Calibration Report*
cm	centimeter
cm/s	centimeter per second
CM	creek mile
COC	contaminant of concern
CSM	conceptual site model
CSO	combined sewer overflow
Cu	copper
DER	Data Evaluation Report
D/F	dioxin/furan
D/F TEQ	total dioxin/furan toxic equivalence quotient (mammal)
EA	Early Action
FFS	*East Branch Early Action Focused Feasibility Study*
FS	Feasibility Study
FS Gas Ebullition DER	*Feasibility Study Gas Ebullition Data Evaluation Report*
FS NAPL Mobility DER	*Feasibility Study Nonaqueous Phase Liquid Mobility Data Evaluation Report*
HQ	hazard quotient
ISS	in situ stabilization/solidification
LTE	long-term equilibrium
mg/kg	milligram per kilogram
MLLW	mean lower low water
MS4	municipal separate storm sewer system
NAPL	nonaqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NCG	Newtown Creek Group
ng/kg	nanogram per kilogram
ng/L	nanogram per liter

NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
PDI	Pre-Design Investigation
PRG	preliminary remediation goal
psi	pound per square inch
RI	Remedial Investigation
RI Report	*Remedial Investigation Report*
ROD	Record of Decision
SWAC	surface-weighted average concentration
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TPAH (17)	total polycyclic aromatic hydrocarbon (17)
TPAH (34)	total polycyclic aromatic hydrocarbon (34)
TPCB	total polychlorinated biphenyl
TS	Treatability Study
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
wt%	weight percent
Zn	zinc

1 Introduction

This appendix to the East Branch Early Action (EA) Focused Feasibility Study (FFS) provides additional information to support the development of the East Branch EA FFS.

This appendix provides details of the East Branch conceptual site model (CSM) that is summarized in Section 2 of the FFS. This area-specific CSM is based on a refinement of the detailed Study Area-wide CSM documented in Section 8 of the *Remedial Investigation Report* (RI Report; Anchor QEA 2023a) and incorporates additional data collected after collection of the data included in the RI Report. Supporting information for the most important elements of the East Branch CSM relating to the development and selection of a remedial alternative and evaluation of the long-term success of a remedial action is discussed in this section.

2 Conceptual Site Model

The East Branch CSM provides the current understanding of processes affecting East Branch. The CSM for East Branch is illustrated in Figure A2-1. A summary of all elements of the East Branch CSM pertinent to the development and evaluation of remedial alternatives is presented in Section 2 of the FFS. This appendix provides more detailed information regarding each element of the CSM, as follows:

- Section 2.1: Data used to develop the East Branch CSM
- Section 2.2: The physical environment of East Branch, including human influences and upland activities adjacent to the Study Area
- Section 2.3: The nature and extent of contamination in East Branch
- Section 2.4: Ongoing external sources of contaminants to East Branch
- Section 2.5: Physical and chemical processes that govern the movement of contaminants in East Branch
- Section 2.6: Potential human and ecological receptors, risk assessments, and exposure pathways

2.1 East Branch Focused Feasibility Study Data

East Branch EA FFS data include data documented in the RI Report, as well as additional datasets collected after those discussed in the RI Report. This section briefly summarizes these datasets, as well as additional investigations planned as part of the Operable Unit 1 (OU1) Feasibility Study (FS).

2.1.1 Data Presented in the Remedial Investigation Report

The Newtown Creek Remedial Investigation (RI) field data collection program was conducted in two phases (Phases 1 and 2). Part 1 of the FS field program was conducted in one phase. Together, these programs comprise the RI dataset, as follows:

- **Phase 1 of the RI sampling** was conducted between October 2011 and September 2013 to broadly characterize chemical and physical features of the Study Area and included the following:
  - Multiple physical and ecological surveys
  - Surface water, sediment, and air sampling in the Study Area and Phase 1 reference areas
- **Phase 2 of the RI sampling** was conducted between May 2014 and December 2015 to fill data gaps, as well as collect additional data needed to support the risk assessments; modeling; and evaluations of point sources, nonaqueous phase liquid (NAPL),[1] and groundwater. The Phase 2 field activities included the following:
  - Multiple physical and ecological surveys
  - Surface water, porewater, groundwater, point sources, sediment, and tissue sampling in the Study Area and Phase 2 reference areas
  - Groundwater seepage measurements

[1] NAPL is a separate phase material (i.e., a liquid that is not water).

- **Part 1 of the FS sampling** was conducted between May 2017 and April 2018 to collect data to support the development and evaluation of remedial alternatives for the OU1 FS. Part 1 of the FS field activities included the following:
  - Groundwater seepage measurements
  - Shoreline sediment and opportunistic seep sampling
  - A gas ebullition pilot study
  - Sediment sampling to refine the understanding of NAPL distribution in the Study Area and characterize NAPL mobility in creek mile (CM) 0–2

In total, more than 550 samples and 110,000 individual analytical measurements from more than 150 locations were collected within East Branch during the RI and Part 1 of the FS. The results of these field programs are presented in the RI Report.

Information from several other studies was also used to support the modeling efforts, groundwater evaluations, source evaluations, and human health and ecological risk assessments conducted as part of the RI. This includes regional surface water, sediment, tissue, groundwater, soil, and air data collected by the National Oceanic and Atmospheric Administration, New York City Department of Environmental Protection (NYCDEP), the Contaminant Assessment and Reduction Project, New York State Department of Environmental Conservation (NYSDEC), and various independent parties.

2.1.2 Additional Datasets Not Presented in the Remedial Investigation Report

This section summarizes the additional RI/FS field programs that are not presented in the RI Report but are included in the OU1 FS dataset and are relevant to the East Branch CSM.[2,3]

2.1.2.1 Treatability Study Pre-Design Investigation

A Treatability Study (TS) Pre-Design Investigation (PDI) was conducted in November 2020 to support a planned TS to evaluate remedial approaches in an area of East Branch that is referred to as the Western Beef Slip (see Figure 1-3 in the FFS). Field activities included surface sediment and subsurface sediment sampling, along with numerous other types of data collection to support the TS, as described in the *Treatability Study Work Plan* (NRT 2020a). A summary of the data collected during the TS PDI, including the data usability assessment, was presented in the *Treatability Study Pre-Design Investigation Data Summary Report* (NRT 2020b).

[2] Consistent with Phases 1 and 2 of the RI and Part 1 of the FS field programs, the additional RI/FS field data collection programs described in this section followed methods and procedures described in USEPA-approved work plans and were conducted under USEPA oversight.
[3] Datasets that are included in the FS dataset but are not relevant to the East Branch CSM, such as the Sediment Characterization Study that characterized surface sediment conditions in CM 0–2, are not discussed in this report.

TS PDI surface sediment sampling was performed at four stations, and cores[4] were collected at 37 subsurface sediment sampling stations. Surface and subsurface sediment samples were described in terms of visible physical characteristics and observations of sheen and NAPL. Surface and subsurface sediment samples were analyzed for an array of parameters, including chemistry (total polycyclic aromatic hydrocarbon [34] [TPAH (34)], total polychlorinated biphenyl [TPCB], copper [Cu], lead [Pb], dioxin/furan [D/F], and total organic carbon), physical properties (percent solids, Atterberg limits, bulk density [ratio of total (wet) mass to total volume], dry density [ratio of total (dry) mass to total volume], grain size distribution, moisture content, organic content, specific gravity, laboratory soil classification, vane shear test [using a Torvane], pocket penetrometer, consolidated undrained triaxial shear strength, consolidation, hydraulic conductivity, and compaction), and waste characterization parameters. In addition, in situ standard penetration testing was performed in the field. An in situ stabilization/solidification (ISS) laboratory TS was also performed on sediment and native material samples collected from the TS Area to evaluate aspects of ISS design and constructability. This ISS TS was used to develop ISS design assumptions (e.g., potential ISS amendments) in this FFS. A TS would need to be performed during the remedial design phase to aid in determining the specific details of the ISS design if a remedial alternative containing ISS is selected.

The discussion of the nature and extent of contamination for this reach-specific CSM, which incorporates the TS PDI data, is provided in Section 2.3.

2.1.2.2 Part 2 of the Operable Unit 1 Feasibility Study Field Program Studies

The OU1 FS Part 2 field activities focused on gas ebullition and geotechnical characteristics across OU1 and NAPL mobility in CM 2+ and tributaries. The *Feasibility Study Field Sampling Program Data Summary Report Part 2* (Anchor QEA 2020a) presents the results of the data collected during these field programs, and separate data evaluation reports evaluate the results of the geotechnical, gas ebullition, and NAPL mobility programs. The following subsections present a brief overview of these three FS Part 2 sampling programs.

2.1.2.2.1 Gas Ebullition

During the FS Part 2 gas ebullition field program, quantitative gas and NAPL/contaminant flux data were collected during two sampling events in July and October 2018, with 7 of the 31 Study Area locations being in East Branch. Samples were collected where the maximum NAPL/contaminant flux was expected to occur based on observations from previous gas ebullition surveys and investigations. These data (and data from the other 24 sampling locations in the Study Area) were then used to extrapolate flux measurements to other times of the year and other parts of the Study Area to develop a range of annual gas ebullition-facilitated NAPL/contaminant load estimates by Study Area reach.

[4] Cores are discrete samples collected from the mudline to several feet below the mudline. The depths of the cores vary from location to location, depending on sampling objectives.

The calculated annual gas ebullition-facilitated contaminant loads were incorporated into the fate and transport element of the East Branch CSM, as discussed in Section 2.5.1.3. The results of the FS Part 2 gas ebullition sampling program were discussed in detail in the *Feasibility Study Gas Ebullition Data Evaluation Report* (FS Gas Ebullition DER; Anchor QEA 2022a).

2.1.2.2.2 Geotechnical

During the FS Part 2 geotechnical program, physical properties of subsurface sediment and native material in the Study Area, including East Branch, were characterized using subsurface coring and in situ penetration testing. These data were collected to support evaluation of the effectiveness and technical implementability of potential remedial technologies and alternatives.

Laboratory testing consisted of geotechnical index parameter tests, including moisture content, grain size distribution, Atterberg limits, specific gravity, bulk density, and dry density. Based on the results of the geotechnical index tests, selected samples were analyzed for seepage-induced consolidation testing and ISS treatability testing.

A bench-scale treatability test was also performed to evaluate ISS in Newtown Creek at the proof-of-concept level. The program included three phases of testing using different stabilizing agents and mix ratios to determine an optimal type and ratio of amendments to achieve the preliminary permeability and strength performance criteria (hydraulic conductivity of 1×10^{-6} centimeter per second (cm/s) and unconfined compressive strength of at least 50 pounds per square inch (psi) after 28 days). In total, 39 different combinations of stabilization agents and mix ratios were tested, and the results are summarized as follows:

- Twenty-eight of the mixes exhibited hydraulic conductivities less than the preliminary performance criteria of 1×10^{-6} cm/s.
- Fifteen mixes exceeded the preliminary unconfined compressive strength performance criterion of 50 psi at the end of the 28-day testing period.
- Fifteen mixes met the minimum preliminary performance criteria for both hydraulic conductivity and unconfined compressive strength.
- The threshold for meeting both preliminary performance criteria using only Portland cement appears to occur between 10 weight percent (wt%) and 12.5 wt% Portland cement addition rates.

Additional details on the results of the FS Part 2 geotechnical sampling program were discussed in detail in the *Feasibility Study Geotechnical Data Evaluation Report* (Anchor QEA 2020b).

2.1.2.2.3 Nonaqueous Phase Liquid Mobility

The overall objective of the FS NAPL mobility field program was to evaluate whether NAPL may flow (i.e., move via advection) through pore spaces of sediment and native material under the field conditions present in Newtown Creek and its tributaries. Additionally, data were collected for physical parameters, as needed, to evaluate the effectiveness and technical implementability of potential remedial technologies and alternatives. Two NAPL mobility cores were collected in East Branch during the FS Part 2 NAPL mobility field program.

The results of the NAPL mobility program were incorporated into the nature and extent and fate and transport elements of the East Branch CSM and are discussed in Sections 2.3.4 and 2.5.1.4, respectively. The results of the FS Part 2 NAPL mobility sampling program were discussed in detail in the *Feasibility Study Nonaqueous Phase Liquid Mobility Data Evaluation Report* (FS NAPL Mobility DER; Anchor QEA 2022b).

2.1.2.3 Supplemental Feasibility Study Sampling Bathymetric Survey

A Study Area-wide bathymetric survey was conducted in 2022 to provide an updated mapping of sediment bed elevations for the FS and to assess potential changes in bathymetry since the previous surveys.[5] These data provide an updated understanding of water depths and sediment thicknesses throughout the Study Area. The survey also provides an updated dataset for sediment bed elevations in East Branch.

2.1.2.4 Additional Data to Be Collected

The East Branch CSM may be updated periodically throughout the East Branch EA FFS process as new information or data become available. This section briefly describes additional sampling programs planned to be performed (both during the OU1 FS for the U.S. Environmental Protection Agency [USEPA] Shallow Lateral Groundwater Study and the Supplemental Feasibility Study Sampling and as required by the Operable Unit 2 [OU2] Record of Decision [ROD] for the NYCDEP OU2 Sampling).

2.1.2.4.1 NYCDEP Operable Unit 2 Sampling

OU2 refers to the current and future discharge of OU1 contaminants of concern (COCs)[6] from combined sewer overflows (CSOs) to the Study Area, as described in a 2018 Administrative Order on Consent between the USEPA and NYCDEP (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. CERCLA-02-2018-2020). The ROD issued for OU2 (USEPA 2020) specifies that, as part of the selected remedy for addressing the release of current and future contaminants from CSOs to the Study Area, the four major CSO discharges to Newtown Creek will be sampled quarterly for 2 years. Per a 2022 Administrative Order on Consent between USEPA and NYCDEP (CERCLA Docket No. CERCLA-02-2022-2003), NYCDEP plans to collect samples from all of the point sources sampled in the RI, as well as from the East River, in addition to sampling the four CSOs, as required by the OU2 ROD. This includes CSOs, as well as stormwater discharges, individually permitted discharges, and the overflow from

[5] An initial bathymetric survey was conducted in 2011 and updated in 2012 following Hurricane Sandy, along with an East Branch-specific survey in the Western Beef Slip in 2020.

[6] The OU1 COCs are discussed in Section 3.1 and consist of TPAH (34), C19-C36, TPCB, Cu, Pb, and total dioxin/furan toxic equivalence quotient (mammal) (D/F TEQ).

the Newtown Creek wastewater treatment plant. Specific to East Branch, NCB-083 (a CSO identified as one of the four major CSO discharges in the OU2 ROD), NCQ-632 (a municipal separate storm sewer system [MS4]), and NCQ-442 (a stormwater discharge from an individual site) were sampled during the RI and will be sampled again under the OU2 Administrative Order. As of June 2024, the OU2 sampling is scheduled to begin in summer 2024.

2.1.2.4.2 U.S. Environmental Protection Agency Shallow Lateral Groundwater Study

USEPA is implementing a field program with the objective of improving the understanding of and better quantifying shallow lateral groundwater discharge to the Study Area (CDM Smith 2022). This program includes the following components:

- Reviewing existing information to select locations for installing a network of monitoring wells and tide gauges
- Performing long-term water level monitoring, slug tests, specific capacity tests, and groundwater velocity measurements
- Collecting groundwater samples from monitoring wells to characterize contaminant concentrations in shallow groundwater[7]
- Performing a shoreline seep survey and collecting opportunistic aqueous and NAPL seep samples, if observed, to characterize contaminant concentrations[7]

This field program includes four sampling locations along the shoreline adjacent to East Branch. USEPA implemented the field program in 2023 and anticipates that the results of the sampling program will be available in June 2024.

2.1.2.4.3 Supplemental Feasibility Study Sampling

A supplemental FS field program is currently being implemented to support remedial decision-making for CM 0–2. The program includes the following components:

- A Study Area-wide bathymetric survey, including East Branch, which was conducted in 2022 and is discussed in Section 2.1.2.3.
- Sampling and chemical analysis of particulate matter in surface water entering the mouth of Newtown Creek from the East River. The surface water program includes sampling of surface water entering the mouth of Newtown Creek from East River every other month for 1 year. This program began in summer 2023 and is scheduled to be completed in summer 2024. The objective of this field program is to characterize more fully the COC concentrations of surface water particulate matter entering the mouth of Newtown Creek from the East River under incoming (flood) tide conditions. The resulting data will support further refinement of the

[7] Groundwater and seep samples will be analyzed for total polycyclic aromatic hydrocarbon (17) (TPAH [17]), TPAH (34), semivolatile organic compounds, extractable petroleum hydrocarbons, volatile petroleum hydrocarbons, TPCB, D/F, metals, total dissolved solids, total suspended solids, total organic carbon, dissolved organic carbon, fluoride, and chloride.

understanding of this source of particulate matter to surface sediment, including providing direct measurements of COCs that were not included or not consistently detected by the methods used in previous sampling at this location. This information will help inform the fate and transport of East River solids that contain contaminants into the Study Area, including East Branch.

- Sampling and chemical analysis of surface sediments from CM 0–2. Surface sediment samples were collected in CM 0–2 in fall 2023. Although not directly applicable to East Branch, these data, coupled with the other program elements, will support refinement of the overall Study Area CSM by providing further information on the influx and deposition of solids and COCs entering the Study Area from the East River.

2.2 Environmental Setting

Newtown Creek extends from the confluence with the East River inland approximately 3.8 miles (to the head of English Kills). East Branch is one of Newtown Creek's five tributaries, with the mouth of East Branch starting at CM 2.8. East Branch extends from upstream of the Turning Basin (CM 2.8) approximately 0.16 mile before branching off into two lobes. One lobe extends up to Metropolitan Avenue and is referred to hereafter as the Terminus of East Branch in the FFS; the other lobe is referred hereafter to as the Western Beef Slip (see Figure 1-3 in the FFS). The navigation channel that runs through the main channel of Newtown Creek extends into East Branch up through the full length of the Terminus of East Branch (see Figure 1-3 in the FFS). The navigation channel does not extend into the Western Beef Slip.

Figure A2-2 depicts the bathymetric elevations within East Branch based on the 2022 bathymetric survey. The average bathymetric elevation in East Branch is -8.4 feet mean lower low water (MLLW; -11.0 feet in North American Vertical Datum of 1988 [NAVD88]), with a minimum elevation of approximately -21.4 feet MLLW (-24.0 feet NAVD88). The cross-sectional profile across East Branch is generally characterized by steep nearshore slopes leading to a deeper channel spanning most of the width of the tributary (i.e., the navigation channel spans most of the width of the tributary). The average width of East Branch is approximately 210 feet in the Terminus of East Branch and downstream of the Grand Street Bridge and 110 feet in the narrower Western Beef Slip. Water depths extend up to approximately -21 feet MLLW but generally are in the range of -5 to -15 feet MLLW within the center of the navigation channel. East Branch tends to be narrower and shallower than the mainstem of Newtown Creek. The shallower depths observed in East Branch are a result of alterations over the last century associated with reduced vessel traffic, no navigational dredging since 1961, and the ongoing deposition of solids.

Similar to the rest of Newtown Creek, East Branch is a highly engineered waterbody that was almost entirely bulkheaded by the early 1900s. Approximately 80% of the shoreline within East Branch is currently bulkheaded, with nearly all of the remaining shorelines containing riprap or other armoring. Approximately one-half of the total shoreline length of East Branch (including vertical bulkheads and shoreline armoring) is in fair to good condition, with the other half being in poor condition (see Figure A2-3). As shown in Figure A2-3, available information from visual inspections or records indicate bulkheads are generally constructed of timber (33% of total shoreline length), concrete (28%), or steel sheet pile (22%). The remaining shoreline consists of riprap or bare ground (17%). This preliminary information is relied upon in the FFS to assess the implementability and duration of each remedial alternative. However, after remedy selection, a more detailed investigation of shoreline structures will be necessary.

The hydrodynamics of East Branch are dominated by twice-daily tides driven by the creek's tidal exchange with the East River, with semidiurnal changes in surface water elevation of approximately 4 to 6 feet, and by rainfall-related inflows from point sources and overland flow. Although tidal mixing with East River water is most pronounced in CM 0–2 of the mainstem of Newtown Creek, it continues to a significant degree into East Branch (see Section 6.2.2 of the RI Report and Section 4 of the *Final Modeling Results Memorandum* [Anchor QEA 2022c; Appendix G of the RI Report]). The only freshwater inflows to East Branch are from point source discharges, overland flow, and groundwater discharge. Groundwater discharge has two components, as discussed in detail in Appendix F of the RI Report: 1) groundwater flow upward from the native material into the subsurface sediment within East Branch and from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground); and 2) direct groundwater discharge into the water column from the upland Fill Unit at submerged vertical permeable shorelines (i.e., lateral discharge). Based on tracer studies presented in Attachment G-E of Anchor QEA 2022c, the residence time of the water discharged within East Branch from point sources can be 24 hours or longer, due to mixing and exchange processes in the dead-end tidal channel. East Branch is predominantly influenced by tidal currents during dry weather and by discharges from larger point sources (CSOs and stormwater) in wet weather.

2.2.1 Sediment Bed Characteristics

The sediment throughout East Branch is a cohesive muddy bed, with varying amounts of fine (clay- or silt-size particles) and coarse (sand-size particles) material. The sediment bed is primarily net depositional, due to the low near-bed current velocities. The recent sediments are underlain by native material. The surface sediment (i.e., top 15 centimeters [cm] [6 inches] of sediment) is generally soft in nature and exhibits high moisture content and high organic content. Subsurface sediment (i.e., from 15 cm [6 inches] below the sediment surface to the native material interface) tends to be medium stiff, with less moisture and higher organic content when compared to surface sediment. The thickness of the sediment varies throughout East Branch. Based on data collected during the RI and the 2022 bathymetric survey, the sediment in East Branch is approximately 13 feet thick on average, with a maximum thickness of 28 feet (see Figure A2-4).[8] The underlying native materials consist of glacial and post-glacial (historical marsh, lacustrine, and fluvial creek) deposits. Section 3 of the *Feasibility Study Geotechnical Data Evaluation Report* (Anchor QEA 2020b) provides additional discussion of sediment and native material physical properties.

2.2.2 Site History

East Branch and the surrounding watershed have a long history of extensive urban and industrial development dating back to the early 1800s. Industrial development occurred in parallel with municipal use of East Branch as a receiving waterbody of stormwater and wastewater discharges, resulting in shoreline and drainage characteristics that are unique compared with other urban waterbodies. As a result of approximately 200 years of industrial, commercial, and residential development, almost all natural stream flow to East Branch has been eliminated. Flows in East Branch are dominated volumetrically by tidal exchange; freshwater inputs are dominated by CSO discharges and stormwater discharges (including point source discharges and overland flow) directly to the tributary. In addition, groundwater discharges to East Branch, as discussed in Section 2.2.

2.2.3 Navigation Channel and Dredging History

A federally authorized navigation channel is present throughout most of East Branch, except for the Western Beef Slip, as shown in Figure 1-3 of the FFS. The authorized depth of the navigation channel in East Branch is 20 feet below MLLW. Existing channel depths are different than the authorized depths because some (or all) of the East Branch channel was never dredged to the authorized depth[9] and due to a lack of maintenance dredging for many years,[10] as further discussed in Section 3.2.4 of the RI Report.

The portion of the navigation channel located in East Branch was established in 1945 to support the extension of commercial and industrial traffic in Newtown Creek and its tributaries. Over time, the types of vessels and navigational uses have changed. There is currently limited ship and barge traffic in East Branch because the tributary has no water-dependent use properties along its banks. The presence of the Grand Street Bridge, as seen in Figure A2-5, further limits vessel traffic in the upstream part of East Branch because the bridge is prone to maintenance issues; experience during RI/FS sampling efforts determined the bridge generally would not be opened when the air temperature was above approximately 85°F due to heat expansion.

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[8] The sediment thickness presented on this figure is based on the 2022 bathymetry survey and interpolation of the native material surface elevations. Due to the data density and methods used to interpolate the native material surface, the sediment thickness does not appear as a smooth contour in some areas.

[9] The preliminary findings from the USACE's review of use of the federal navigation channel indicate that the East Branch Channel was initially constructed to a depth of 16 feet below MLLW rather than the authorized depth of 20 feet below MLLW.

[10] USACE dredging records from 2012 show dredging in East Branch was last performed in 1974 to a depth of 16 feet below MLLW (USACE 2012).

As requested by USEPA, the U.S. Army Corps of Engineers (USACE) has conducted a survey of the current and reasonably anticipated future maritime use of the federally authorized navigation channel. The USACE's survey incorporated input from creek-side property owners and commercial vessel operators. Although USACE has not finalized its findings for all reaches, the USACE has preliminarily concluded that the navigation channel in East Branch can be deauthorized. Section 5.3.8 of the FFS provides additional details on the potential deauthorization of the navigation channel in East Branch and consideration of that on the development of remedial alternatives.

2.2.4 Current Upland Activities

Today, the predominant land use around East Branch remains industrial (DCP 2024). Current uses near East Branch include heavy equipment and tractor trailer storage and maintenance; storage of construction materials, lumber, and demolition materials; and a ready-mix concrete plant (see Table B2-1 in Appendix B).

2.2.5 Creek Crossings and Infrastructure

Existing infrastructure in East Branch is shown in Figure A2-5. This includes the Grand Street Bridge; a submerged utility crossing, presumed to be electrical cables based on available information, found approximately 25 feet below MLLW in the vicinity of the Grand Street Bridge; and an aeration piping system located on top of or slightly below the existing sediment bed (Anchor QEA 2012; Mechanical and Marine Construction Corp. 2017; NYCDEP 2018).

The Grand Street Bridge, which crosses the middle of East Branch, is projected by New York City Department of Transportation to be replaced starting in 2028.[11] The potential impact on the East Branch EA FFS process is discussed in Section 5.3.9 in the FFS.

In an effort to meet NYSDEC water quality standards for dissolved oxygen, NYCDEP has installed and operates an aeration system in East Branch, as well as other areas of Newtown Creek (NYCDEP 2018). The aeration system consists of sections of piping that are connected to a series of diffusers that distribute air into the water column. Per the permit to install the aeration system, NYCDEP would be required to remove the infrastructure associated with the aeration system for USEPA-required remedial activities within the creek (USACE 2016). Therefore, the aeration system is not expected to impact evaluation of remedial alternatives or remedial construction. Other submerged crossings, such as the presumed electrical cables, may be located at shallower depths that would not accommodate dredging to facilitate capping below the current federally authorized navigation channel depths. This limitation may not be applicable if the current authorized navigation channel is

[11] Per the minutes of a January 17, 2024, conference call between the Grand Street Bridge replacement project team, led by New York City Department of Transportation, and USEPA, the current estimated schedule for construction to begin on the bridge replacement project is late spring 2028.

deauthorized (additional information on the USACE's conclusions on potential East Branch navigation channel deauthorization is presented in Section 2.2.3).

2.2.6 Habitat

Currently, most of the East Branch shoreline is bulkheaded or has some form of armoring. Mudflat habitat is also very limited for wildlife use, ranging from 0% of the East Branch surface area at high tide to approximately 6% of the East Branch surface area at low tide.

2.3 Nature and Extent of Contamination

A primary focus of the RI was to delineate the nature and extent of contamination in the Study Area. Based on the results from the *Baseline Ecological Risk Assessment* (BERA; Anchor QEA 2018) and *Baseline Human Health Risk Assessment* (BHHRA; Anchor QEA 2017), contaminants found to contribute to human health and/or ecological risk were used to characterize the nature and extent of contamination in the RI Report. These contaminants are as follows:

- TPAH (34)[12]
- C19-C36 aliphatic petroleum hydrocarbons (C19-C36)[13]
- TPCB
- Total dioxin/furan toxic equivalence quotient (mammal) (D/F TEQ) 2005[14]
- Cu
- Pb
- Dieldrin

These seven contaminants (or groups of contaminants) are categorized into the following three classes:

- Hydrocarbons, which include TPAH (34) and C19-C36
- Bioaccumulative organics, which include TPCB, D/F TEQ, and dieldrin
- Metals, which include Cu and Pb

Although these contaminants (or groups of contaminants) were used to characterize nature and extent of contamination, the degree to which they contribute to human health and ecological risks

[12] The RI evaluations of sources and fate and transport used TPAH (17) rather than TPAH (34). However, as discussed in Section 4.2.5.1 of the RI Report and shown in RI Report Figures 4-40 through 4-42, the two chemicals exhibit correlation and collocation when compared longitudinally, by reach, and on an individual sample basis, which is to be expected because TPAH (17) is a component of TPAH (34). In addition, as discussed in Section 8.4 of the RI Report, USEPA determined that TPAH (34) was an important predictor of benthic toxicity for the FS.

[13] Risks to human health were not evaluated for C19-C36 in the OU1 risk assessments. After the BERA (Anchor QEA 2018) was finalized, C19-C36 was identified by USEPA as a COC for benthic risk, including in East Branch, caused by exposure to C19-C36 in sediment at bulk sediment concentrations above risk-based thresholds (USEPA 2020).

[14] For the evaluation of nature and extent of contamination in the RI Report, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) data were presented for D/F because 2,3,7,8-TCDD is a major contributor to the D/F TEQ. However, this document evaluates contaminant concentrations consistent with the list of OU1 COCs (discussed in Section 3.1), and D/F TEQ is the relevant D/F metric for the OU1 COCs. D/F TEQ is a toxicity-weighted mass of the mixture of D/F congeners detected in which the concentrations of individual congeners are multiplied by factors that reflect their relative toxicity and summed.

varies, as described in Section 3.1. Although dieldrin was evaluated for nature and extent in some media in the RI Report because elevated concentrations were observed in benthic invertebrate tissue in one portion of the Newtown Creek Study Area (i.e., English Kills), it is not considered a significant risk driver; similar to the OU1 RI, dieldrin is not considered further in the East Branch EA FFS. COCs evaluated as part of the FFS are discussed in Section 3.1.

The distribution of these contaminants in East Branch surface sediment, subsurface sediment, native material, surface water, and porewater is summarized in the following sections. Discussion of the nature and extent of NAPL in East Branch sediment is included as well. The distribution of contaminants in tissue samples of fish, crab, caged bivalves, and polychaetes (*Nereis virens*) collected within East Branch is also summarized.

Based on RI, FS, and other data programs as described in Section 2.1, patterns of COCs within East Branch are summarized in the following sections.

2.3.1 Surface Sediment

Contaminant concentration data for surface sediment in East Branch are summarized in Figures A2-6a through A2-6f. For each of the COCs, the highest surface sediment concentrations are generally observed in the Western Beef Slip or downstream of the Grand Street Bridge, although concentrations from the upper ends of the distributions occur at sample locations throughout East Branch for most COCs. The lowest concentrations tend to be observed in the Terminus of East Branch, although there is variability throughout the tributary.

The areas in East Branch where the surface sediment COC concentrations exceed the risk-based preliminary remediation goals (PRGs) were evaluated (see Section 3.4 of the FFS for the risk-based PRGs). The COC concentrations in surface sediment exceed one or more risk-based PRGs for nearly the entire spatial extent of surface sediment (see Section 3.6 and Figures 3-1 through 3-7 of the FFS for details). The risk-based PRGs for TPCB, D/F TEQ, and Pb were developed on a surface-weighted average concentration (SWAC) basis, so evaluating exceedances of these risk-based PRGs on a point-by-point basis is a conservative approach because not every location exceeding the risk-based PRG on a point-by-point basis would need to be remediated in order to meet the SWAC-based, risk-based PRG. The range of COC concentrations in East Branch surface sediment is as follows:

- TPAH (34): 3.4 to 690 milligrams per kilogram (mg/kg)
- C19-C36: 35 to 7,300 mg/kg
- TPCB: 0.024 to 16 mg/kg
- D/F TEQ: 4.1 to 290 nanograms per kilogram (ng/kg)
- Cu: 32 to 6,300 mg/kg
- Pb: 39 to 1,100 mg/kg

2.3.2 Subsurface Sediment

Throughout East Branch, subsurface sediment concentrations for each of the COCs are higher than the corresponding surface sediment concentrations in most sediment cores (see Figures A2-7a through A2-7f), recognizing there are a limited number of subsurface core samples analyzed for C19-C36 and D/F TEQ.

For each of the COCs, subsurface sediment concentrations generally increase with depth, either reaching a peak several feet below the mudline or increasing until native material is reached, and do not exhibit notable horizontal spatial patterns within East Branch (see Figures A2-7a through A2-7f and Figure A2-8). These results indicate that solids with lower contaminant concentrations (compared to those in the existing sediment bed) have been depositing on the sediment bed during more recent years.

Although risk-based PRGs were developed by USEPA based on exposure to COCs in accessible sediments (i.e., surface sediment), subsurface sediment COC concentrations were also compared to risk-based PRGs. The areas in East Branch where the subsurface sediment COC concentrations exceed the risk-based PRGs were evaluated (see Section 3.4 of the FFS for additional details on risk-based PRGs). As discussed in Section 2.3.1, evaluating subsurface sediment exceedances of the TPCB, D/F TEQ, and Pb on a point-by-point basis is a conservative approach because these risk-based PRGs were developed on a SWAC basis and not every location exceeding the risk-based PRG on a point-by-point basis would need to be remediated in order to meet the SWAC-based, risk-based PRG. The COC concentrations in subsurface sediment exceed one or more risk-based PRGs for nearly the entire volume of sediment. The range of COC concentrations in East Branch subsurface sediment is as follows:

- TPAH (34): 21 to 6,100 mg/kg
- C19-C36: 370 to 7,600 mg/kg
- TPCB: 0.056 to 83 mg/kg
- D/F TEQ: 7.5 to 740 ng/kg
- Cu: 180 to 6,000 mg/kg
- Pb: 79 to 2,400 mg/kg

Figures A2-9a through A2-9f show Thiessen polygons of depth-weighted subsurface sediment concentrations for the COCs, with the subsurface sediment COC concentrations binned into colors relative to the risk-based PRG. Gray polygons represent areas where the existing subsurface sediment COC concentrations are less than the risk-based PRG. Colored polygons indicate an exceedance of the risk-based PRG. These figures show that the entire spatial extent of East Branch (except for part of one Thiessen polygon at the confluence with English Kills) has COC concentrations in subsurface sediment that exceed at least one of the risk-based PRGs.

Only the following three cores, shown in Figure 2-7c, had samples with concentrations of TPCBs exceeding 50 mg/kg:

- EB046SC-B is not a continuous core (i.e., not all depth intervals were analyzed),[15] and the TPCB concentration was 68 mg/kg (5 to 10 feet below the mudline).
- EB075SC-J had two samples located 3.4 to 7.4 feet below the mudline with concentrations greater than 50 mg/kg, where the highest concentration is 83 mg/kg. The depth-weighted subsurface sediment concentration of 46 mg/kg for this core is less than 50 mg/kg.
- EB076SC-I also had two samples with concentrations greater than 50 mg/kg located 3.2 to 5.7 feet below the mudline, where the highest concentration is 64 mg/kg. The depth-weighted subsurface sediment concentration of 26 mg/kg for this core is less than 50 mg/kg.

2.3.3 Native Material

Concentrations of COCs in native material differ substantially from those in sediment (see Figures A2-7a through A2-7f). TPAH (34), TPCB, Cu, and Pb concentrations in native material are generally one to two orders of magnitude lower than those in subsurface sediment and do not exhibit notable spatial patterns within East Branch. As with subsurface sediment, C19-C36 and D/F TEQ data in native material are limited in East Branch. However, where detected, the native material concentrations are also much lower than in subsurface sediment for these two COCs.

Although risk-based PRGs were developed by USEPA based on exposure to COCs in accessible sediments (i.e., surface sediment), native material COC concentrations were also compared to risk-based PRGs. The COC concentrations are less than the risk-based PRGs (see Section 3.4 of the FFS for the risk-based PRGs) in native material except for a single sample (EB047SC-A; 10 to 15 feet below the mudline) with an exceedance for C19-C36. As discussed in Section 2.3.1, evaluating native material exceedances of the TPCB, D/F TEQ, and Pb on a point-by-point basis is a conservative approach because these risk-based PRGs were developed on a SWAC basis and not every location exceeding the risk-based PRG on a point-by-point basis would need to be remediated in order to meet the SWAC-based, risk-based PRG. The range of COC concentrations in East Branch native material is as follows:

- TPAH (34): 0.0060 to 92 mg/kg
- C19-C36: 7.3 to 290 mg/kg
- TPCB: 0.000050 to 0.27 mg/kg
- D/F TEQ: 0.0056 to 3.3 ng/kg
- Cu: 6.0 to 190 mg/kg
- Pb: 1.9 to 77 mg/kg

[15] Depending on the objective of the RI/FS sampling program, subsurface samples were either collected continuously throughout the core or were collected at selected intervals sampled within the core.

2.3.4 Nonaqueous Phase Liquid

Extensive RI/FS field sampling and investigations were performed to evaluate the presence and extent of sheen and NAPL. The presence and extent of sheen[16] and NAPL in sediment and native material were evaluated through a combination of visual observations and shake testing. Sheen and NAPL presence or absence was described using standardized terminology across the various sampling programs for visual observations and shake test results, as discussed in Sections 2.2.1.1 and 2.2.1.2 of Appendix C of the RI Report, respectively.

The evaluation and delineation of the distribution of NAPL in the Study Area, including East Branch, is reported in Appendix C of the RI Report. Based on the results of the RI NAPL evaluation and delineation, FS data were collected to evaluate NAPL mobility in the Study Area and included two locations in East Branch. The evaluation of NAPL mobility is presented in Section 2.5.1.4 and the FS NAPL Mobility DER (Anchor QEA 2022b). Notable patterns of sheen and NAPL observations in East Branch are as follows:

- Where NAPL was observed, NAPL observations in sediment were intermittent (i.e., located sporadically throughout an area and not clustered at a particular location) and characterized as a residual quantity (i.e., shake test blebs and bleb visual observations).
- NAPL was not observed in surface sediment. Sheen was observed in more than half of the surface sediment samples (see Figure A2-10a).
- NAPL was only observed in subsurface sediment at a limited number of locations, and sheen was observed at various depths for most core locations (see Figure A2-10b).
- NAPL was not observed in the native material. Sheen was observed in native material at only one location (see Figure A2-10c).

2.3.5 Surface Water Particulate Phase

To compare concentrations of contaminants in surface water with concentrations in other environmental media (such as sediment), surface water particulate phase contaminant concentrations are described in this section.[17] Particulate phase concentrations for chemicals with a strong affinity for solids, including the Study Area COCs, can represent a significant fraction of the total water column concentration. Figure A2-11 provides the estimated particulate phase concentrations in surface water samples collected during dry, transition, and wet weather sampling

[16] Sheen is the appearance of iridescence on the surface of sediment or water. Sheen can be present alone or with NAPL. Sheen can be due to biological degradation of organic material or other processes and is not necessarily indicative of the presence of NAPL.
[17] The particulate phase concentration is the mass of a chemical per unit mass of dried suspended sediment from a water sample. A detailed description of the calculations used to generate estimates of particulate phase conditions is presented in Attachment E-C of Appendix E of the RI Report.

for TPAH (34), TPCB, Cu, and Pb compared to the concentrations in surface sediment.[18,19] These results help provide insight into how sources of solids and chemicals to the system influence surface sediment concentrations in East Branch, as discussed in Sections 2.5 and 2.6.

Dry, transition, and wet weather surface water particulate phase concentrations in East Branch are generally lower than those in East Branch surface sediment for TPAH (34), TPCB, and Pb. For Cu, dry weather surface water particulate phase concentrations in East Branch are generally lower than those in East Branch surface sediment, but wet weather and transition surface water particulate phase concentrations are similar to surface sediment. Particulate phase surface water concentrations that are generally lower than surface sediment are expected to reduce surface sediment concentrations over time with ongoing net sedimentation, as discussed in Section 2.5.3.

In general, wet and transition weather surface water particulate phase contaminant concentrations are two to four times greater than dry weather concentrations, indicating the importance of ongoing point sources and stormwater-related events as sources of contaminants to East Branch.

2.3.6 Porewater

The porewater data in East Branch collected during the RI include shallow porewater (0 to 15 cm [0 to 6 inches] and 15 to 30 cm [6 to 12 inches]), as well as mid-depth porewater (1.5 to 3.5 feet below the sediment surface); porewater samples were also collected during the TS PDI at depths ranging from 1 to 5 feet below the sediment surface. COC concentration data for TPAH (34), TPCB, Cu, and Pb for porewater are summarized in Figures A2-12a through A2-12d.[20] Consistent with the patterns observed in surface sediment, for each of the COCs, the highest porewater concentrations are generally observed in the Western Beef Slip or downstream of the Grand Street Bridge. The lowest concentrations tend to be observed in the Terminus of East Branch, although there is variability throughout the tributary.

2.3.7 Tissue

Tissue samples from fish (striped bass [*Morone saxatilis*], Atlantic menhaden [*Brevoortia tyrannus*], mummichog [*Fundulus heteroclitus*]) and blue crab (*Callinectes sapidus*) were collected from within five fish sampling zones in the Study Area. Samples from East Branch and English Kills were collected and composited together as one zone, and tissue concentrations generally fall within the mid-range of the Study Area tissue COC concentration ranges (see Section 4.10 of the RI Report for details).

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[18] Surface water samples were not analyzed for this C19-C36. Particulate phase calculations for D/F TEQ were not performed because site-specific partitioning calculations were not possible, given that D/F was not analyzed in porewater samples. Whole-water surface water samples were analyzed for D/F; however, in East Branch, D/F was detected in 50% of the dry weather samples and less than 20% of the wet weather samples (see Appendix A-A4 of the RI Report for D/F TEQ whole-water surface water sample data).

[19] Wet weather surface water samples were collected in two rounds, the first during or immediately after a point source discharge event, which is referred to as “wet” condition, and the second on the following day, which is referred to as a “transition” condition because the concentration data were generally intermediate to those from dry and wet weather (see Section 4.7.4 of the RI Report).

[20] C19-C36 and D/F TEQ were not evaluated because shallow porewater samples were not analyzed for these chemicals.

For the field-based caged bivalve and laboratory-based polychaete bioaccumulation studies conducted as part of the RI, there were specific locations within East Branch tested (the location for the caged bivalve study was near the Grand Street Bridge, and for the polychaete bioaccumulation study, sediments were collected from the middle portion of the Terminus of East Branch). For both studies, tissue COC concentrations are at the low end of the range of concentrations measured from locations throughout the rest of the Study Area (see Section 4.10 of the RI Report for details).

2.4 External Sources

As part of the Newtown Creek watershed, East Branch has been affected by numerous known and potential sources of contamination throughout the past 200 years. The current distribution of contaminants in the sediments of the Newtown Creek Study Area, including East Branch, is due to historical and ongoing sources, historical and ongoing dynamic chemical fate and transport processes, and changes in contaminant loads over time. As such, the locations of impacts observed today cannot necessarily be directly linked to proximate upland sites or sources, including point sources. Historically, contaminant loads to surface sediment were much greater, as evidenced by the higher contaminant concentrations in subsurface sediment compared to surface sediment (see Section 2.3.2). Based on this trend, it is inferred that surface sediment concentrations have been declining over time because of the deposition and mixing of these recently deposited less contaminated solids with previously deposited solids. Because the constituents that characterize the nature and extent of contamination are also commonly present in the urban environment of East Branch, these contaminants may enter the system from multiple potential pathways.

Known ongoing sources that are determined to have a high probability of adversely impacting the remedy or are found post-remedy implementation to be adversely impacting the remedy will need to be controlled. For purposes of determining what regulatory mechanism is best suited to controlling ongoing sources, USEPA has defined three categories of sources to East Branch and the Study Area in general: internal, external, and internal/external interface sources. Ongoing sources to East Branch are generally described in this FFS as “ongoing external sources” or “upland sources” (see also Appendix B). The categorization of individual ongoing sources will be evaluated based on additional information collected during a PDI and considered during the remedial design and long-term remedy evaluation monitoring.

The major ongoing external sources of contamination to East Branch are as follows:

- Ongoing point sources and overland flow discharging to East Branch, which include the following[21]:
  - CSOs

[21] There are other types of point sources that discharge to Newtown Creek (individually permitted discharges and the overflow from the Newtown Creek wastewater treatment plant), but these types of discharges do not discharge directly to East Branch.

  - Stormwater (including individual point discharges and overland flow)
- Tidal exchange at the mouth of East Branch, which includes water, solids, and contaminants from the East River, as well as other reaches of Newtown Creek
- Groundwater (including native material groundwater discharge and lateral groundwater discharge)
- Other sources, including bank erosion, atmospheric deposition, overwater activities, and shoreline seeps

Current external sources to East Branch are the focus of this CSM (i.e., as opposed to historical sources), due to the importance of understanding ongoing sources and the status of source control in the design, implementation, and performance of any remedy selected. As such, current sources are summarized in this section. The CSM provided in Figure A2-1 illustrates the current sources to East Branch, along with the fate and transport processes that describe the movement of these contaminants through the system. Fate and transport processes are discussed in Section 2.5.

Consistent with the RI Report, the discussions of sources and fate and transport in Sections 2.4 and 2.5, respectively, focus on TPAH (34), TPCB, and Cu.[22]

See Section 5 of the RI Report for a comprehensive discussion of sources and how the contaminant loads associated with the different sources were developed. Historical industrial operations and municipal and industrial discharges to Newtown Creek are discussed in Sections 3.2.6 and 3.2.8.1 of the RI Report, respectively.

Appendix B provides a detailed evaluation of ongoing external sources to East Branch that have been characterized to date during the OU1 RI/FS process and evaluates (to the extent possible) any currently uncharacterized discharges to East Branch that may affect remedy design, implementation, and performance of an EA.

2.4.1 Point Sources and Overland Flow

As shown in Figure A2-13, numerous point sources currently discharge to East Branch; there are 2 CSO outfalls, 2 MS4 outfalls, and approximately 35 stormwater outfalls[23] that have been documented along the tributary. These outfalls discharge an estimated 640 million gallons of combined sewage and stormwater to East Branch each year (see Appendix E of the RI Report). Approximately 85% of the point

[22] The contaminants within a class do not all contribute to ecological or human health risk to the same degree: the primary drivers of ecological and human health risk are hydrocarbons and polychlorinated biphenyls (PCBs), with Cu and other constituents also contributing to ecological or human health risk (see Section 3.1 of the FFS for the conclusions of the OU1 human health and ecological risk assessments for each COC individually). As such, TPAH (34), TPCB, and Cu are representative contaminants from each of these three classes for evaluations of sources and fate and transport, consistent with the RI Report's focus on polycyclic aromatic hydrocarbons (PAHs), PCBs, and Cu.

[23] Outfall information is based on the point source inventory process completed during the RI, as documented in Section 2.1.2 of Appendix E of the RI Report. Some outfalls may be abandoned or no longer in use. There are no individually permitted discharges that discharge directly to East Branch.

source and overland flow discharges (by volume) to East Branch have been sampled and include the largest CSO (NCB-083; the largest contributor at 76% of the total estimated discharge to East Branch), the two MS4s (NCQ-632 and NCQ-633), and one stormwater discharge from an individual site (MCL001). The remaining 15% of point source discharges (by volume) consist of outfalls that emanate from properties that have similar use characteristics as those for which the outfalls were sampled.

An extensive sampling program was performed during Phase 2 of the RI to evaluate and quantify COC concentrations in ongoing discharges from the different categories of point sources (see Section 5.1 of the RI Report for additional information). Contaminant loads associated with point sources for TPAH (34), TPCB, and Cu are provided in Figures A2-14a through A2-14c, respectively.

Point sources and overland flow are further discussed in Section 3.1 of Appendix B of the FFS.

2.4.2 East River and Tidal Exchange

Through twice-daily tides, the East River transports solids that contain contaminant loads to the Study Area. Through the process of tidal exchange at the mouth of East Branch, some portion of the solids and contaminants exchanged originate from the East River, whereas the remaining portion comes from external sources entering the Study Area (e.g., point sources) outside of East Branch or from sources within the Study Area reaches themselves (e.g., movement from surface porewater to surface water). The tidal volumetric flow into East Branch is approximately 19 times greater than the total point source volumetric discharges into East Branch on an annual basis.[24] Based on sediment transport modeling, the East River contributes approximately 20% of the solids depositing in East Branch on average, with the East River contribution being lower in the upstream areas of the tributary and higher toward the downstream end. Accounting for uncertainty around the sediment transport model predictions of the net sedimentation rates and percent contribution of solids (see Section 4.3.1 of the 2024 draft *Interim Estimates of Post-Remedy Surface Sediment Concentrations* [Anchor QEA 2024]), the East River solids contribution to East Branch ranges from 13% to 35%.

To understand concentrations of chemicals in surface water entering Newtown Creek from the East River, surface water samples were collected as part of the RI (see Section 5.3 of the RI Report). Additional sampling and analysis of particulate matter in East River surface water near the mouth of Newtown Creek is ongoing as part of the supplemental FS sampling (see Section 2.1.2.4.3). Further evaluation of the East River inputs to the Study Area is being performed as part of the OU1 FS work using linked hydrodynamic, sediment transport, and long-term equilibrium (LTE) models. Contaminant transport associated with the East River is discussed further in relation to other fate and transport processes in Section 2.5.

[24] The total tidal volumetric flow into East Branch was estimated using the surface area of East Branch and a 4.5-foot change in surface water elevation per tidal cycle, which is the long-term difference in mean high water and mean low water from the National Oceanic and Atmospheric Administration tidal gauge station at The Battery.

2.4.3 Groundwater

Groundwater is a potential ongoing external source of contaminants to East Branch. Groundwater discharge to East Branch occurs from: 1) groundwater flow upward from the native material into the subsurface sediment within East Branch and from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground); and 2) direct groundwater discharge into the water column from the upland Fill Unit at submerged vertical permeable shorelines (i.e., lateral groundwater discharge).

2.4.3.1 Native Material Groundwater

Samples from temporary monitoring wells installed in native material were collected during the RI to characterize the spatial distribution of dissolved phase chemicals in groundwater below the East Branch subsurface sediment. Contaminant concentration data in groundwater are summarized in Figures A2-15a through A2-15e.[25,26] The locations with the highest groundwater concentrations vary by COC, with the highest TPAH (34) concentration in the Western Beef Slip, the highest Cu and Pb groundwater concentrations in the Terminus of East Branch, and samples with higher TPCB and C19-C36 groundwater concentrations in the Terminus of East Branch or downstream of the Grand Street Bridge.

The base of East Branch is defined as the interface between subsurface sediment and native material, as well as between subsurface sediment and the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground).[27] Groundwater discharge to the base of East Branch may provide contaminant loads to subsurface sediment, with some fraction of that load being transported subsequently to surface sediment and eventually discharging to surface water. Contaminant loads associated with groundwater discharge to the base of East Branch are provided in Figures A2-14a through A2-14c. Chemical transport associated with groundwater flow is discussed in relation to other fate and transport processes in Section 2.5.1.2.

Native material groundwater is further discussed in Section 3.3 of Appendix B.

2.4.3.2 Lateral Groundwater

Lateral groundwater discharge, which may occur in areas with vertical permeable shorelines (e.g., pile-supported concrete, precast concrete blocks, and vertical wood bulkheads), also may transport contaminants, including NAPL, to the water column in East Branch.[28] The RI Report presented a qualitative assessment of surface water quality in areas of relatively high lateral discharge (see Section 6.4 of Appendix F of the RI Report). That evaluation suggested that lateral

[25] Dissolved concentrations for organics were estimated using partitioning theory with literature-based organic carbon partition coefficients and include freely dissolved and DOC-bound phases (i.e., Method 2, see Section 3.7.2.1 of Appendix F of the RI Report).

[26] D/F TEQ was not evaluated because groundwater samples were not analyzed for D/F.

[27] The RI groundwater evaluation included estimation of groundwater discharge associated with shallow lateral groundwater flow through vertical permeable shorelines, and these discharge rates were added to the discharge from the base of sediment within corresponding segments to estimate total groundwater discharge in the RI.

[28] Nearshore discharge of groundwater from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground) is accounted for in the measurements of groundwater discharge at the base of East Branch.

groundwater discharges do not appear to have a notable effect on dry weather surface water quality over large spatial scales. USEPA is performing a study designed to further characterize shallow lateral groundwater discharge along the shoreline of Newtown Creek, including East Branch (see Section 2.1.2.4.2). The resulting data are intended to be used to further understand lateral groundwater loads in the FS and be incorporated into the LTE model.

Lateral groundwater is further discussed in Section 3.4 of Appendix B.

2.4.4 Other Sources

Bank erosion, atmospheric deposition, overwater activities (such as discharges from vessels transiting East Branch), and shoreline seeps (including NAPL seeps) represent additional potential sources of contaminants to East Branch that were evaluated as part of the RI.

Analyses of data collected during RI and FS field activities for the other sources, and from historical studies, indicate that these inputs represent comparatively minor sources of contaminants to surface water and surface sediment in East Branch. Quantitative estimates of mass loading could not be calculated for shoreline seeps including NAPL seeps because there are no associated flow data.

Bank erosion and seeps are further evaluated in Sections 3.2 and 3.4 of Appendix B, respectively.

2.5 Fate and Transport

A variety of physical and chemical processes that influence the fate and transport of contaminants in the Newtown Creek Study Area, including East Branch, have been investigated during the RI/FS, as discussed in detail in Section 6 of the RI Report, the FS Gas Ebullition DER (Anchor QEA 2022a), the FS NAPL Mobility DER (Anchor QEA 2022b), and the draft *Chemical Fate and Transport Model Development and Calibration Report* (CFT Modeling Report; Anchor QEA 2022d).[29] Because impacts to human health and the environment stem from contact with and uptake of contaminants by humans and ecological receptors, this section summarizes external contaminant loads and how contaminants already present in sediment and surface water move through East Branch. Figure A2-1 illustrates both the current sources to East Branch discussed in Section 2.4 and the fate and transport processes driving contaminant movement within East Branch, which are discussed in this section.

[29] In May 2024, USEPA determined that the chemical fate and transport (CFT) model is not necessary for further project decision-making or actions based on review of the project schedule and consideration of the successful development of the LTE model. As such, further development and finalization of the CFT model was discontinued (Ketu 2024). Although the site-specific CFT model will no longer move forward, many of the evaluations, approaches, and parameters that describe chemical fate and transport processes documented in the draft CFT Modeling Report still provide valid information for understanding the fate and transport of contaminants in Newtown Creek.

Annual loads associated with fate and transport processes compared to annual loads associated with external sources for TPAH (34), TPCB, and Cu are illustrated in Figures A2-14a through A2-14c.[30,31]

2.5.1 Sediment Fate and Transport Processes

This section discusses the following processes by which contaminants in subsurface sediment can be transported via fate and transport processes in the sediment and move between subsurface sediment and surface sediment or surface sediment and the water column:

- Physical processes, such as (deposition, erosion, and sediment bed mixing)
- Groundwater and porewater flow and contaminant transport
- Gas ebullition
- NAPL advection

2.5.1.1 Physical Processes

Hydrodynamic processes (i.e., tidal currents and density driven circulation) generate relatively low near-bed current velocities in East Branch. The low-energy environment creates a net depositional environment throughout East Branch. The deposition of solids originating from outside East Branch (primarily from the East River, point sources, and overland runoff) results in burial of the existing surface sediment over long time frames. Due to mixing processes, the biologically active zone (i.e., upper 6 inches of sediment, as discussed in Section 6.4.4.1 of the RI Report) contains a combination of newly deposited and historically deposited solids and contaminants. Over time, as deposition proceeds, historically deposited solids and contaminants are continually covered and diluted by less contaminated, newly deposited materials in a process called natural recovery (see Section 2.5.3). As a result of this process, the contribution of historically deposited, more heavily contaminated materials to the food web declines. Mixing processes in the surface sediment include propeller wash resuspension and bioturbation, which are largely limited to the surface layer. Other processes, such as maintenance dredging, bridge and bulkhead maintenance, and bulkhead and shoreline collapse, may result in localized deeper mixing or disturbances.

The low-energy environment of East Branch results in minimal erosion of the sediment bed, and the subsurface sediment bed is generally physically stable (i.e., net erosion that exposes subsurface sediment and deeper depths is not occurring in significantly large areas). Episodic erosion in specific areas or reworking of the upper layer of the bed may occur in some locations. In East Branch, higher velocities near CSO discharges during high-flow storm events can resuspend sediment, which can

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[30] As noted in Section 2.3, the RI found that the primary drivers of ecological or human health risk are hydrocarbons and PCBs, with Cu and other constituents also contributing to ecological or human health risk (see Section 3.1 of the FFS for the conclusions of the OU1 human health and ecological risk assessments for each COC individually). As such, load evaluations in the sources (see Section 2.4) and fate and transport (see Section 2.5) sections of the CSM focus on TPAH (34), TPCB, and Cu as representative contaminants from each of the classes of contaminants that are the primary drivers of risk, consistent with the RI Report's focus on PAHs, PCBs, and Cu.

[31] Tidal exchanges with other reaches, propeller wash, and degradation within East Branch are not quantified in these figures. These were evaluated as part of the draft CFT model and will be evaluated further, as appropriate, as part of the Feasibility Study.

then be transported downstream of the discharge point before redepositing. The processes of resuspension and redeposition contribute to the observed distribution of contaminants in surface sediment in areas near CSO discharges, primarily the head of the Terminus of East Branch (see Section 6.3.2 of the RI Report).

A key finding of the RI is that contaminant concentrations in the surface sediment layer have likely been declining at many locations over time. The mechanism is the mixing of less contaminated newly deposited solids with previously deposited solids that were more highly contaminated. This natural recovery process is occurring, and has occurred in the past, in the surface sediment throughout East Branch, resulting in reduced surface sediment contaminant concentrations (see Section 2.5.3).

2.5.1.2 Groundwater and Porewater Flow and Contaminant Transport

In addition to solids and contaminant loadings from ongoing point sources and the tidal exchange directly depositing on the surface sediment in East Branch, upward groundwater flow is an ongoing source of dissolved contaminants from the native material to subsurface sediment, where it can affect sediment concentrations via transport through the interstitial spaces (as porewater) and sorption onto the solid matrix. The net direction of groundwater flow is upward from the native material into the subsurface sediment within East Branch. Porewater within the subsurface sediment (subsurface porewater)[32] moves upward into the surface sediment and mixes with surface sediment porewater, which then partitions with the surface sediment and undergoes exchanges with the overlying water column.[33] During the RI, groundwater seepage rates were measured at three locations in East Branch, with values ranging from 0.3 to 1 cm/day. The lower end of the measured RI seepage rates is from a location downstream of the Grand Street Bridge, and the higher end is from the location near the Terminus of East Branch. During the TS PDI (see Section 2.1.2.1), groundwater seepage rates were measured at six locations in the Western Beef Slip, with values generally between 0.1 and 0.3 cm/day.

Groundwater discharge to the base of East Branch provides chemical loads to subsurface sediment, although the size of these loads varies by contaminant. The estimated annual loads of TPAH (34), TPCB, and Cu from groundwater to East Branch subsurface sediment, summarized in Figures A2-14a through A2-14c, were calculated as the product of groundwater discharge (i.e., flow rate) and dissolved phase groundwater chemical concentration measured within the native material during the RI. Groundwater contamination, where present, is attenuated by the subsurface sediment through the process of contaminant sorption to the subsurface sediment. For example, the total groundwater TPAH (34) annual load from the base of East Branch to subsurface sediment is estimated to be between 0.97 and 2.1 kilograms per year, but the annual load of TPAH (34) in porewater flowing from

[32] Once groundwater from the native material enters the subsurface sediment, it is referred to as porewater.

[33] Tidal exchange can result in the downward movement of surface water into the sediment bed due to a downward hydraulic gradient during high tide, with a reversal in gradient and flow direction at low tide. Evaluations presented in Section 6.4.3.1.2 of the RI Report concluded the tidal exchange does not exert a dominant influence on surface porewater.

subsurface to surface sediment is approximately 0.59 kilogram per year; see Figure A2-14a for the estimated TPAH (34) annual loads.

In addition to groundwater discharge to the base of East Branch from the underlying native material and from the upland Fill Unit in areas of sloping permeable shorelines, lateral groundwater discharge directly to the surface water also occurs through vertical permeable shorelines. Preliminary CFT diagnostic modeling from the draft CFT Modeling Report (Anchor QEA 2022d) showed that contaminant loads from lateral groundwater discharge, where present, likely contribute a fraction of the total load to surface water as compared to point sources and sediment/water exchange (upper bound of 60% on average for polycyclic aromatic hydrocarbons [PAHs], 20% for polychlorinated biphenyls [PCBs], and 2% for Cu).[34] Lateral groundwater discharge will be further evaluated in the OU1 FS through the field program implemented by USEPA as discussed in Section 2.1.2.4.2.

2.5.1.3 Gas Ebullition

Gas ebullition is the generation of biogenic gases (mostly methane and carbon dioxide) from sediment microorganisms using labile organic carbon as a food source; the gas nucleates, forms a bubble, fractures the sediment, and moves through the sediment to the water column. Gas ebullition originates primarily in surface and shallow subsurface sediment when water/sediment temperatures are highest and water depths are shallowest (near the hours of lowest tides) and where labile organic carbon content is sufficiently high. When gas ebullition occurs in the presence of sheen-bearing material (NAPL or other materials), or below these materials, those constituents may be transported with the gas bubbles to the water column and the surface of the waterbody. Some amount of these constituents may be retained by the sediment above the depths from where the bubbles originate (e.g., surface sediment), as discussed further below. Areas where conditions are favorable for gas ebullition, and where this transport mechanism has been documented, include portions of East Branch.

During the RI and FS field studies discussed in Section 2.1, the spatial extent of gas ebullition-facilitated sheen observations during surveys within East Branch was mapped (see Figure A2-16), and the NAPL/contaminant flux was quantified over a range of conditions.[35] Annual loads of the contaminant flux associated with gas ebullition were calculated and indicate that gas ebullition produces much smaller estimated loads from sediments to surface water for TPAH (34) and TPCB as compared to other loads (e.g., point sources and sediment/surface water exchange; see

[34] These estimates are based on preliminary diagnostic evaluations conducted with the draft CFT model (see Section 4.3.4 of the draft CFT Modeling Report [Anchor QEA 2022d]). This preliminary CFT diagnostic modeling was based on using a hypothetical upper-bound lateral groundwater chemical concentration applied as a spatially constant value (because the spatial variation associated with any lateral groundwater concentrations is unknown). The USEPA study discussed in Section 2.1.2.4.2 may further inform or constrain the uncertainty in lateral groundwater concentrations.

[35] One factor when evaluating the range of conditions (i.e., lower- and upper-bound scenarios) for the NAPL/contaminant flux was the use of different spatial extents. The spatial extent of the lower-bound scenario included the footprint of dynamic sheens observed on a single day with the largest areal extent during the 2015 and 2016 ebullition field surveys. The spatial extent of the upper-bound scenario included a "smoothed" footprint of dynamic sheen observations from all 27 days of surveys conducted in 2015, 2016, 2017, 2018, and 2019 overlain to create a maximum extent of observations.

Figures A2-14a and A2-14b, respectively). The gas ebullition results for the entire Study Area are presented in the FS Gas Ebullition DER (Anchor QEA 2022a).

Some amount of the COCs transported with gas bubbles generated by gas ebullition in subsurface sediments may be retained within the surface sediment. This process could potentially act to recontaminate upper portions of a sediment cap if a remedy with capping is selected. However, although mass loading to the surface sediment from gas ebullition is unquantified in East Branch, data collected during Part 2 of the FS (Anchor QEA 2022a) and the scientific literature suggests this may not be a significant process.

2.5.1.4 Nonaqueous Phase Liquid Advection

NAPL advection is the flow of NAPL through pore spaces of sediment or native material due to the hydraulic and gravitational forces acting on the NAPL. NAPL advection can occur if the combination of driving forces is sufficient to overcome the capillary forces that resist NAPL movement.

FS data were collected at two locations in East Branch to evaluate NAPL mobility in creek sediments. The FS NAPL mobility evaluation was designed specifically to evaluate whether migration of NAPL via advection is possible under observed field conditions present in the Study Area. Based on the results of laboratory testing, NAPL in East Branch sediment at the locations tested has been interpreted to be immobile. Therefore, where present in sediment in East Branch, NAPL cannot migrate upward via advection from East Branch subsurface sediments to surface sediments, nor from sediments to surface water at the locations sampled. This does not preclude changes to in situ conditions and/or disturbances potentially mobilizing NAPL, including potential upward migration of NAPL, in the future.

The NAPL mobility testing and evaluation results for the entire Study Area are presented in the FS NAPL Mobility DER (Anchor QEA 2022b).

2.5.2 Water Column Fate and Transport Processes

Section 2.4 discusses the current external sources of contaminants to the East Branch water column, such as point source discharges and overland flow, lateral groundwater flow, and tidal exchange driven by the East River. Internal sources of contaminants to the East Branch water column include discharge of surface porewater (driven by diffusive exchange and groundwater flow from native material through the sediment column and into surface water), localized sediment erosion in some areas, and contaminant flux from sediments due to gas ebullition. The importance of these sources differs by flow regime (wet versus dry weather) and tide (incoming versus outgoing).

In East Branch, it is likely that the flux from surface sediment porewater contributes to the generally higher contaminant concentrations reported in surface water during dry weather conditions, compared with those observed in the downstream reaches (as discussed in Section 6.4.2 of the RI Report). Contaminants associated with lateral discharge of groundwater through vertical permeable shorelines and shoreline seeps, including NAPL seeps, may also affect dry weather surface water concentrations. As described in Section 2.1.2.4.2, USEPA is performing a study to further characterize shallow lateral groundwater discharge along the shoreline of Newtown Creek.

Under wet weather conditions, point source discharges and overland flow are a source of elevated contaminant concentrations in the water column in East Branch. Contaminant concentrations in surface water during wet weather may also be affected by localized sediment erosion in some locations, especially in the areas where the current velocities are higher and the water is very shallow, such as near the CSOs at the head of the Terminus of East Branch.

Contaminants associated with wet weather conditions from point source discharges and overland flow do not flush out of East Branch over a single tidal cycle; instead, tracer simulations and sampling data indicate that it typically takes several tidal cycles over the course of a few days to return surface water concentrations to contaminant levels typically observed under dry weather conditions (see Section 6.2.2 of the RI Report). During this time, some contaminants disperse from their sources, partition between dissolved and particulate phases, and settle onto the sediment bed within East Branch and farther downstream. In addition, certain components of some contaminants (e.g., TPCB and TPAH [34]) may volatilize into the atmosphere to a limited degree, and degradation of COCs in the surface water is likely occurring for some organic contaminants. These degradation processes are more relevant for PAHs than for PCBs (and are not relevant for Cu), as discussed in Section 6.4.6 of the RI Report and Section 3.8.3.2 of the draft CFT Modeling Report.

Because many contaminants, including TPAH (34), TPCB, and Cu, sorb strongly to particles in the water, their transport and dispersal depends (in part) on the settling properties of the particulate matter. Larger particles settle closer to the release point, and finer particles are generally transported farther.

2.5.3 *Natural Recovery*

Natural recovery refers to the process by which chemical concentrations, primarily in surface sediment, decline over time without specific intervention designed for that purpose. Natural and anthropogenic processes that can reduce chemical concentrations in aquatic sediment include reductions in contaminant loads to the system, chemical or biological processes that reduce chemical mobility or convert contaminants to forms with lower toxicity, physical processes such as mixing or burial, and physical or biological processes that result in the loss of contaminants to surface water.

The sediment bed in East Branch is net depositional (see Figure A2-17), and depositing sediment contaminant concentrations are generally lower than the concentrations of contaminants in the surface sediments. The surface sediment mass balance for TPAH (34), TPCB, and Cu (see Figures A2-14a to A2-14c and Section 6.5 of the RI Report) indicates a net loss of contaminants each year (primarily through burial to the deeper subsurface sediment and replacement with less contaminated solids being deposited on the sediment surface). These natural recovery processes that may be ongoing in East Branch may result in a decreasing trend in the concentrations of contaminants in the surface sediments until a long-term equilibrium condition is reached. However, these processes are relatively slow in East Branch (e.g., decadal time frame), as evidenced by the surface sediment contaminant concentrations in East Branch generally still being among the highest in Newtown Creek and due to the presence of ongoing external inputs in East Branch. The RI investigation provides an initial temporal data point, and thereafter, a natural attenuation rate would need to be determined through multiple, temporally spaced sampling events, and the acceptability of that rate as a viable remedial approach would need to be determined by USEPA.

2.6 Risk and Exposure Pathways

The BHHRA (Anchor QEA 2017) evaluated potential risks to recreational users (i.e., boaters, swimmers/bathers, anglers and crabbers, and shoreline recreational users), residents and occupational workers living or working near the creek, industrial and construction workers, and unauthorized users (e.g., trespassers and sailboats illegally moored to bulkheads) on and near the creek that may be exposed to contaminated biota (e.g., fish and/or crabs), sediments and/or surface water. The BERA (Anchor QEA 2018) evaluated potential risks to the ecological receptors that may use the creek for various purposes and may also be exposed to contaminated sediments and surface water, including benthic invertebrates, fish and shellfish, birds, and mammals. Potential human and ecological receptors and exposure pathways relevant to East Branch are illustrated in Figure A2-18.

See Section 7 of the RI Report for a comprehensive discussion of the BHHRA and BERA.

2.6.1 Human Health Risk Assessment

The BHHRA (Anchor QEA 2017) was conducted following USEPA's guidance to evaluate the current and future potential human health risks associated with direct contact with surface water and surface sediment in the Study Area, ingestion of surface water and surface sediment, ingestion of fish and crab, and inhalation of volatiles emitted from the creek into the ambient air near the creek. Based on the current and future uses of the Study Area, human health risks were evaluated for the following 12 exposure scenarios: five categories of recreational users, four categories of occupational users, one category of unauthorized users (sailboat users), and one general exposure scenario involving residents and one involving occupational workers (local flooding scenario). A number of these current and reasonably anticipated future scenarios, however, were developed for specific areas and exposure scenarios within the Study Area that did not include East Branch. The exposure scenarios that did include East Branch were Study Area-wide exposure scenarios (e.g., fish and crab consumption, recreational boaters, swimmers/bathers, shoreline recreational users, and landside/dockside/general construction workers). Potential risks to human health greater than

USEPA's acceptable cancer risk range and/or non-cancer hazard threshold were identified for the following Study Area-wide exposure scenarios that include East Branch:

- Cancer risks and non-cancer hazards associated with consumption of fish and crab tissue obtained from the Study Area by recreational anglers/crabbers, primarily due to tissue concentrations of PCBs in fish and PCBs and D/F in crab
- In the reference areas:
  - Cancer risks and non-cancer hazards associated with consumption of fish and crab tissue obtained from reference areas by recreational anglers/crabbers, primarily due to PCBs in fish and crab, with some contribution from D/F in crab
  - Presence of human health risks in the reference areas suggesting regional exposure for migratory fish and crab species needs to be considered when evaluating risk management options for Newtown Creek

Sediment-based remedial actions completed in East Branch are, therefore, expected to contribute to an incremental reduction in risks to human health within the Study Area from consumption of fish and crab tissue, although as noted previously in this section, regional exposure may result in exceedances of USEPA's acceptable thresholds following the East Branch remedial action. The finalized BHHRA is provided in Appendix H of the RI Report and is summarized in Section 7.1 of the RI Report.

2.6.2 *Ecological Risk Assessment*

The BERA (Anchor QEA 2018) assessed risks to aquatic life and semiaquatic wildlife from exposure to CERCLA hazardous substances in the Study Area in the absence of control or mitigation measures. To focus the BERA on those contaminants that are likely the most important contributors to ecological risk, a screening level ecological risk assessment was first conducted. The BERA also considered the effect of non-CERCLA ecological stressors, including, but not limited to, surface water dissolved oxygen levels and benthic habitat quality, which affect the aquatic life and semiaquatic wildlife that use the Study Area, including East Branch.

The BERA used multiple lines of evidence to assess risk, including chemistry data in surface water, surface sediment, porewater, and tissue of aquatic organisms, as well as surveys of the aquatic life and semiaquatic wildlife that use the Study Area, including East Branch. The BERA also assessed risk in four reference areas, referred to as the Phase 2 reference areas, which represent the range of regional impacts for comparison to the Study Area and East Branch to assess the potential effects from industrial development and discharges from point sources, including CSOs.

The spatial scale of exposure to sediment, surface water, and dietary prey varies by receptor class and exposure pathway. For sessile organisms that compose the benthic invertebrate community, fish with small home ranges (e.g., mummichog), bivalves, and to some extent, crabs, exposure to sediments and surface water in East Branch define the primary source of exposure that may result in unacceptable risk to these receptors in East Branch. For wider ranging organisms, such as birds and migratory fish, exposure occurs throughout Newtown Creek and is evaluated on a Study Area-wide basis that includes East Branch. For these receptors, exposure in East Branch is generally less than in other parts of the Study Area, depending on the receptor and the COC, but contributes to risks to some degree. Based on this work, the BERA identified potential risks to ecological receptors, either on an East Branch-specific basis or on a Study Area-wide basis as follows:

- Exposure to COCs in surface sediment results in unacceptable risks to the benthic macroinvertebrate community in most of the Study Area, including East Branch. Risks are lowest and consistent with reference area risks in the lower portion of the Study Area. Risks to the benthic community may be associated with PAHs (in particular, alkylated PAHs) in porewater, with some contribution from porewater metals (Cu, Pb, and zinc [Zn]). Based on further evaluations completed after the BERA was finalized, USEPA concluded that toxicity also was correlated with bulk sediment concentrations of TPAH (34) and C19-C36.
- Hazard quotient (HQ) values greater than a threshold of 1 were exceeded in CM 2+ and the tributaries, including East Branch, for benthic fish due to PAHs, Cu, Pb, Zn, and TPCB in porewater.
- HQ values greater than 1 were calculated for various avian species, primarily due to dietary exposure to TPCB in CM 2+ and the tributaries, including East Branch, and exposure to Pb in intertidal areas.
- HQs were less than 1 for polychaetes in East Branch and slightly exceeded 1 for bivalves due to exposure to TPCB in East Branch.
- HQs greater than 1 were calculated for bivalves, polychaetes, blue crab, striped bass, primarily due to exposure to TPCB, with some limited contribution from D/F and Cu.
- In the reference areas, potential risks were identified for blue crab, striped bass, and mummichog, primarily due to exposure to TPCB, with some limited contribution from D/F.

The presence of ecological risks in the reference areas suggests that regional exposure for migratory fish and crab species needs to be considered when evaluating risk management options for Newtown Creek.

Sediment-based remedial actions completed in East Branch are expected to contribute to a reduction in risks to ecological receptors to varying degrees, depending on the receptor and the nature of exposure (e.g., East Branch-specific versus Study Area-wide). Natural recovery processes in some parts of the Study Area also will contribute to overall risk reduction. The final BERA is provided in Appendix I of the RI Report and is summarized in Section 7.2 of the RI Report.

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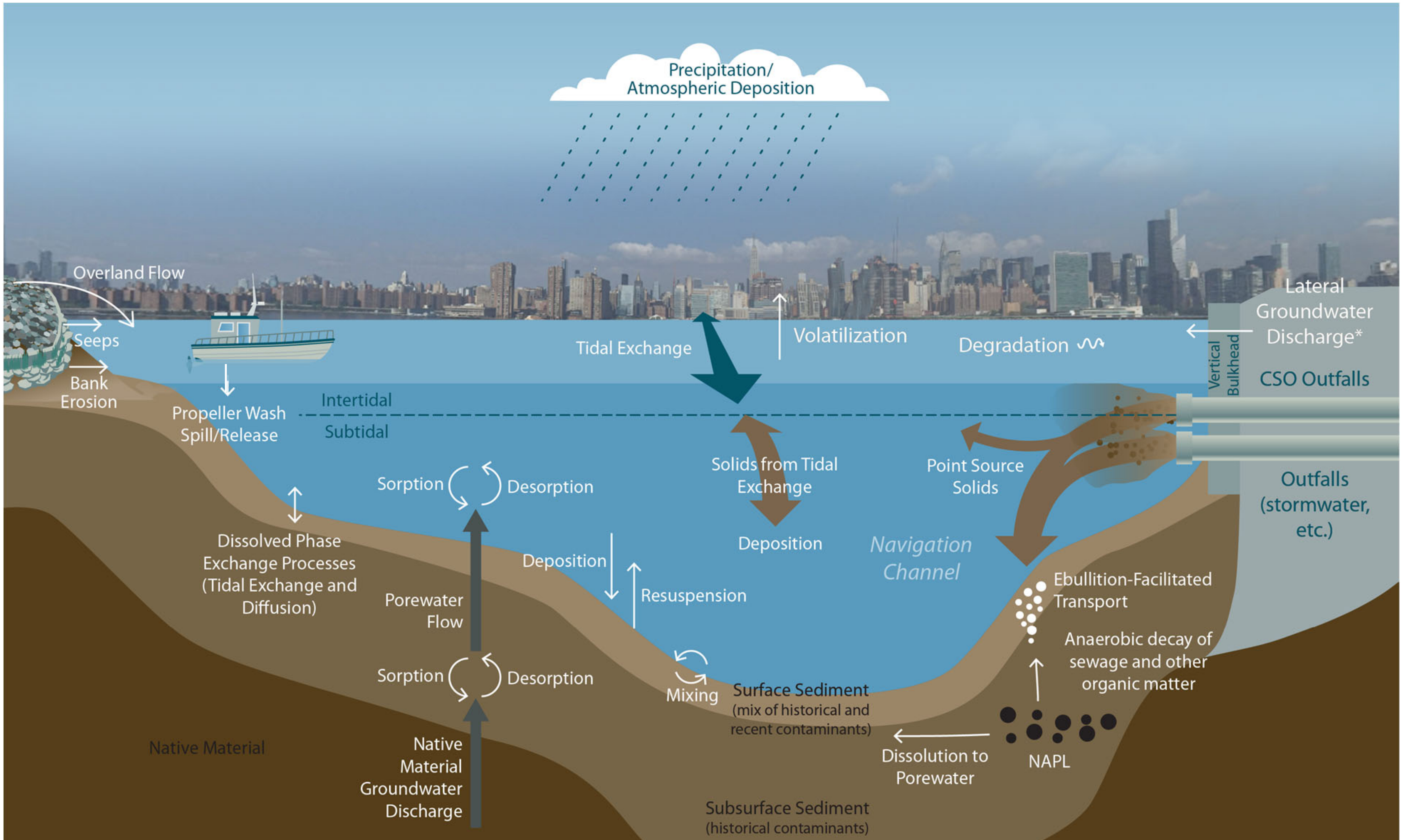

Notes:
This figure illustrates ongoing external inputs of solids and contaminants to the East Branch and in-creek processes that affect the redistribution of solids and contaminants in East Branch.
Tidal exchange represents a mix of East River surface water and surface water from the Newtown Creek Study Area outside of East Branch.
* Lateral groundwater discharges occur in vertical permeable shoreline areas that include vertical wood, wood, precast concrete, and pile-supported concrete bulkheads.

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Figure A2-1
East Branch Conceptual Site Model
Conceptual Site Model
Newtown Creek RI/FS

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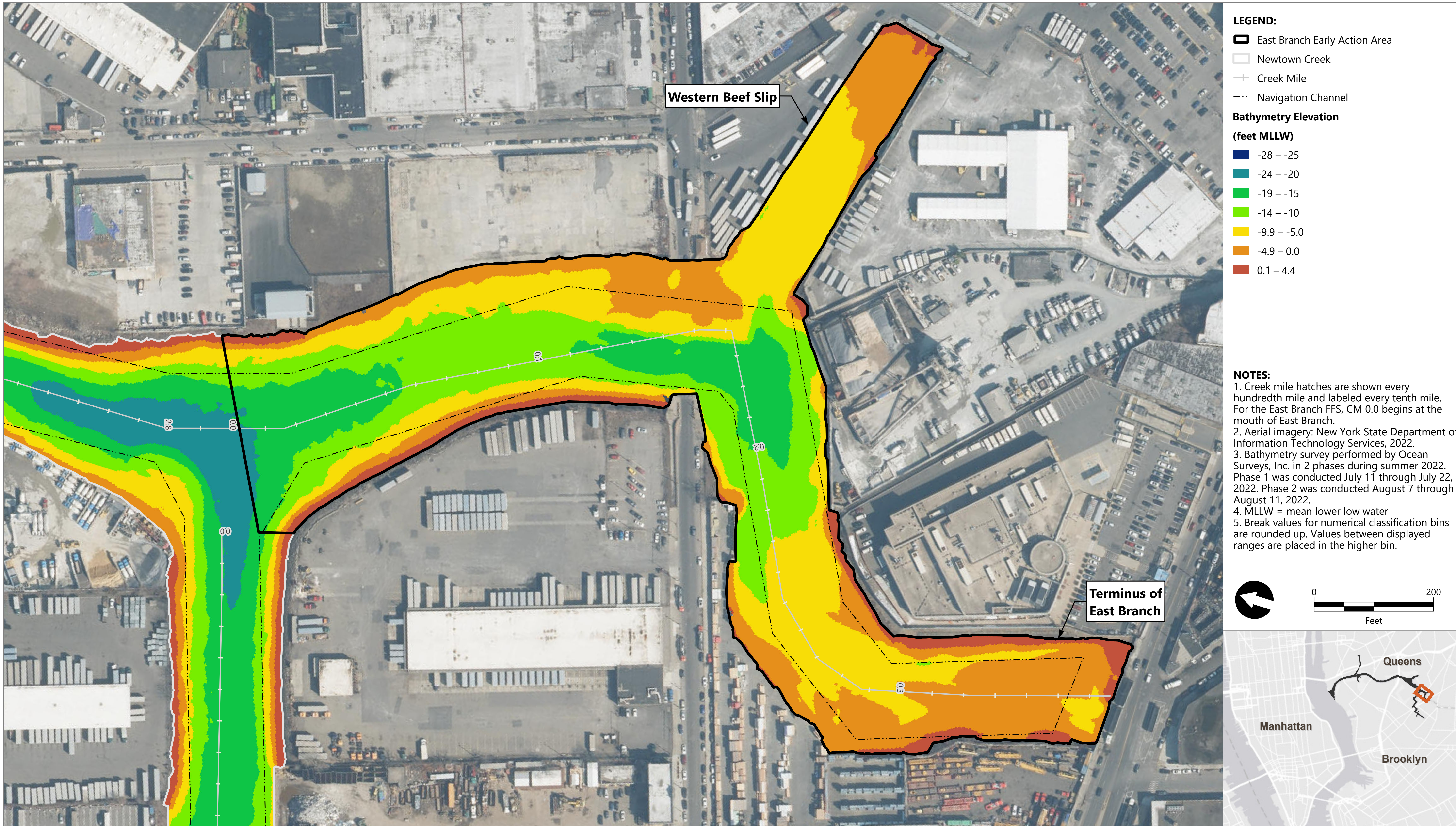

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Figure A2-2
East Branch Bathymetry
Conceptual Site Model
Newtown Creek RI/FS

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NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Shoreline stationing measures the length of shoreline along the Creek. Numbering begins at the north side (Queens) of the mouth of Newtown Creek and ends at the south side (Brooklyn) of the mouth of Newtown Creek. Labeled measurements are shown in terms of hundreds of feet (e.g., 295 = 29,500 feet from the mouth of Newtown Creek).
4. Shoreline material and condition data from the 2017 FS bulkhead survey and 2019 bulkhead survey.
5. Conditions represent existing condition of shoreline/structures and do not reflect anticipated performance resulting from remedy implementation.

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Figure A2-3
Existing Shoreline Conditions in East Branch
Conceptual Site Model
Newtown Creek RI/FS

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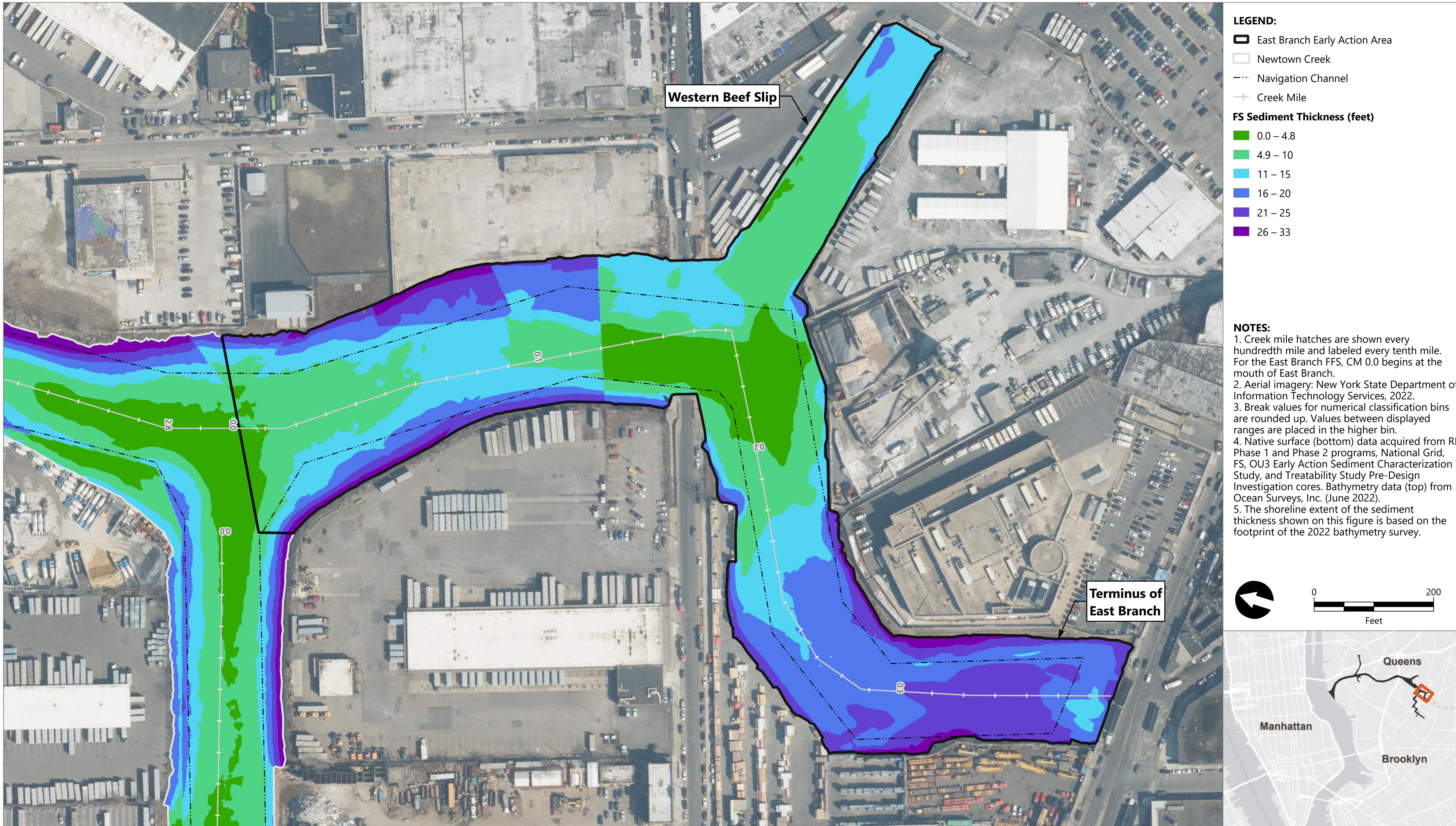

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
4. Native surface (bottom) data acquired from RI Phase 1 and Phase 2 programs, National Grid, FS, OU3 Early Action Sediment Characterization Study, and Treatability Study Pre-Design Investigation cores. Bathymetry data (top) from Ocean Surveys, Inc. (June 2022).
5. The shoreline extent of the sediment thickness shown on this figure is based on the footprint of the 2022 bathymetry survey.

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Figure A2-4
Sediment Thickness
Conceptual Site Model
Newtown Creek RI/FS

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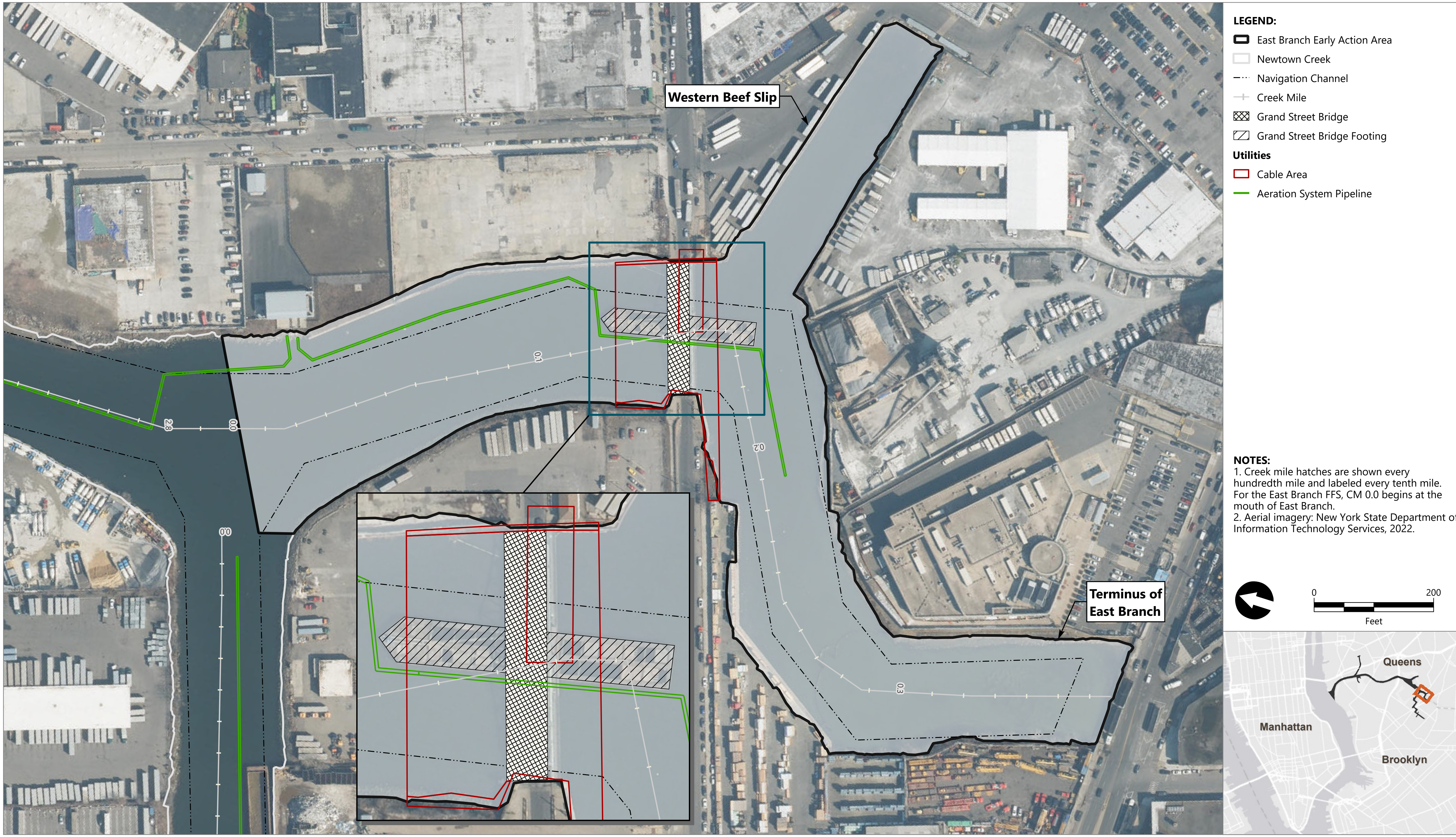

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

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Figure A2-5
Utilities and Creek Crossings
Conceptual Site Model
Newtown Creek RI/FS

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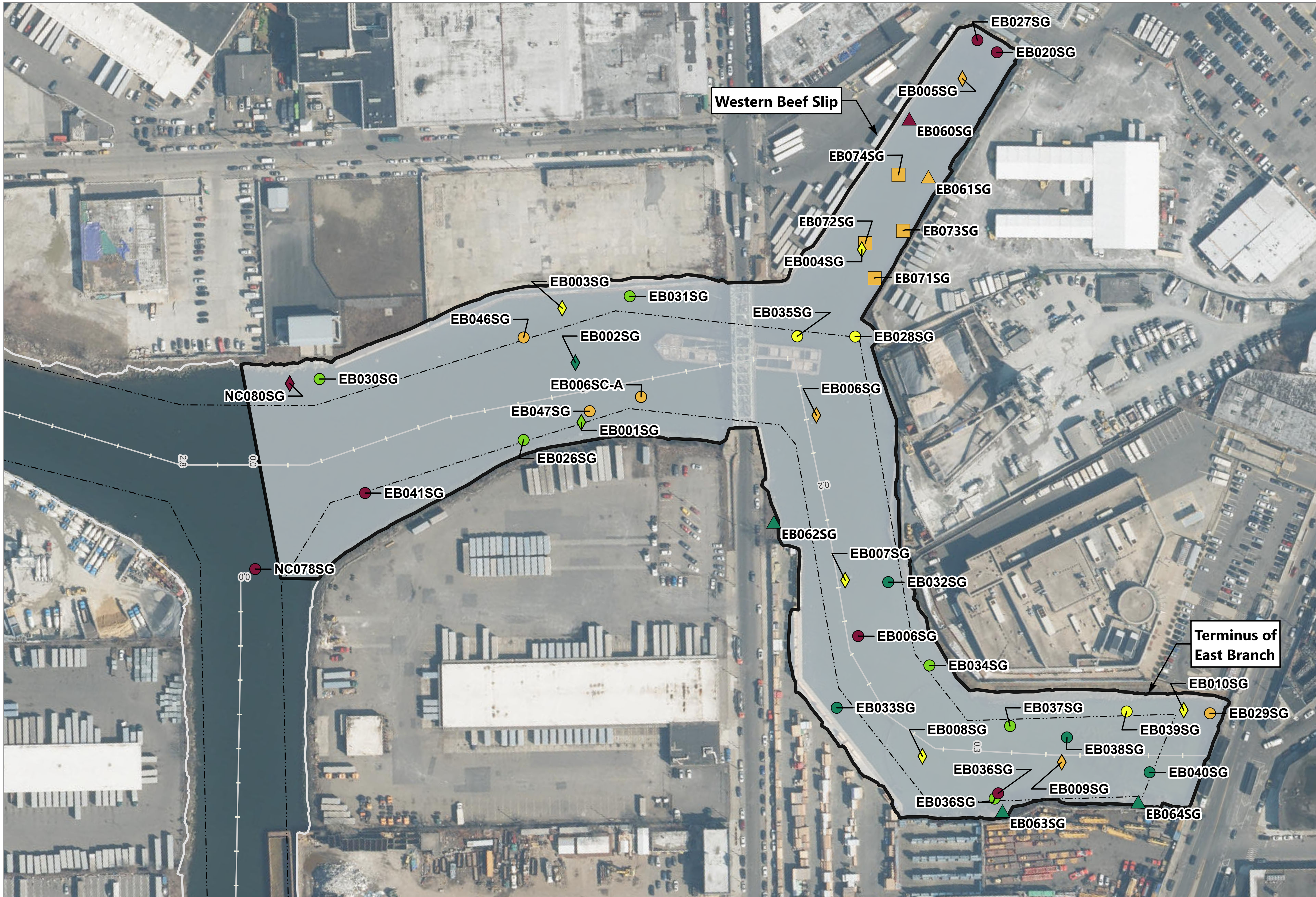

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Study

- RI Phase 1
- RI Phase 2
- FS Treatability Study PDI
- FS Part 1: Shoreline

Total PAH (34) (mg/kg)

- 3.4 - 54
- 55 - 75
- 76 - 91
- 92 - 220
- 230 - 690

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
6. Depth range for surface sediment is 0 - 15 cm.

0 200
Feet

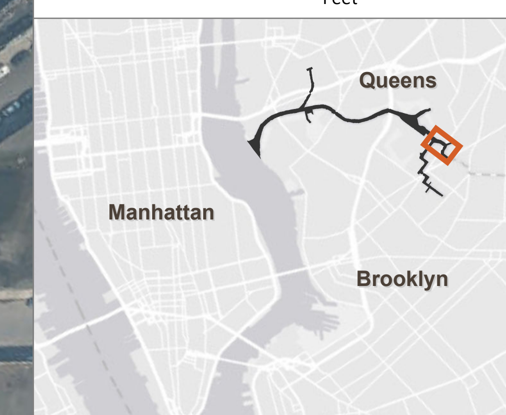

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Figure A2-6a
Total PAH (34) in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

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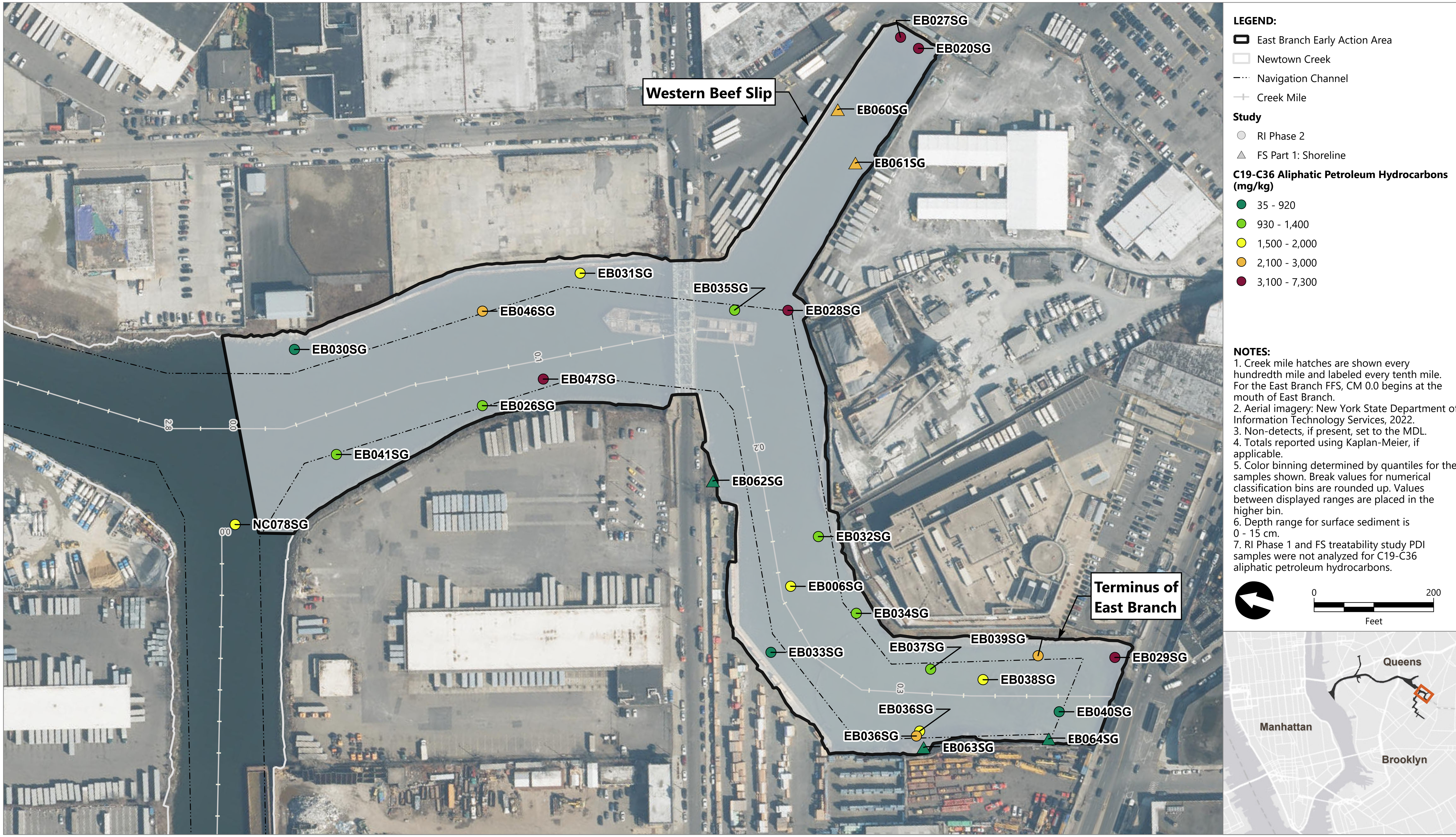

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Figure A2-6b
C19-C36 Aliphatic Petroleum Hydrocarbons in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

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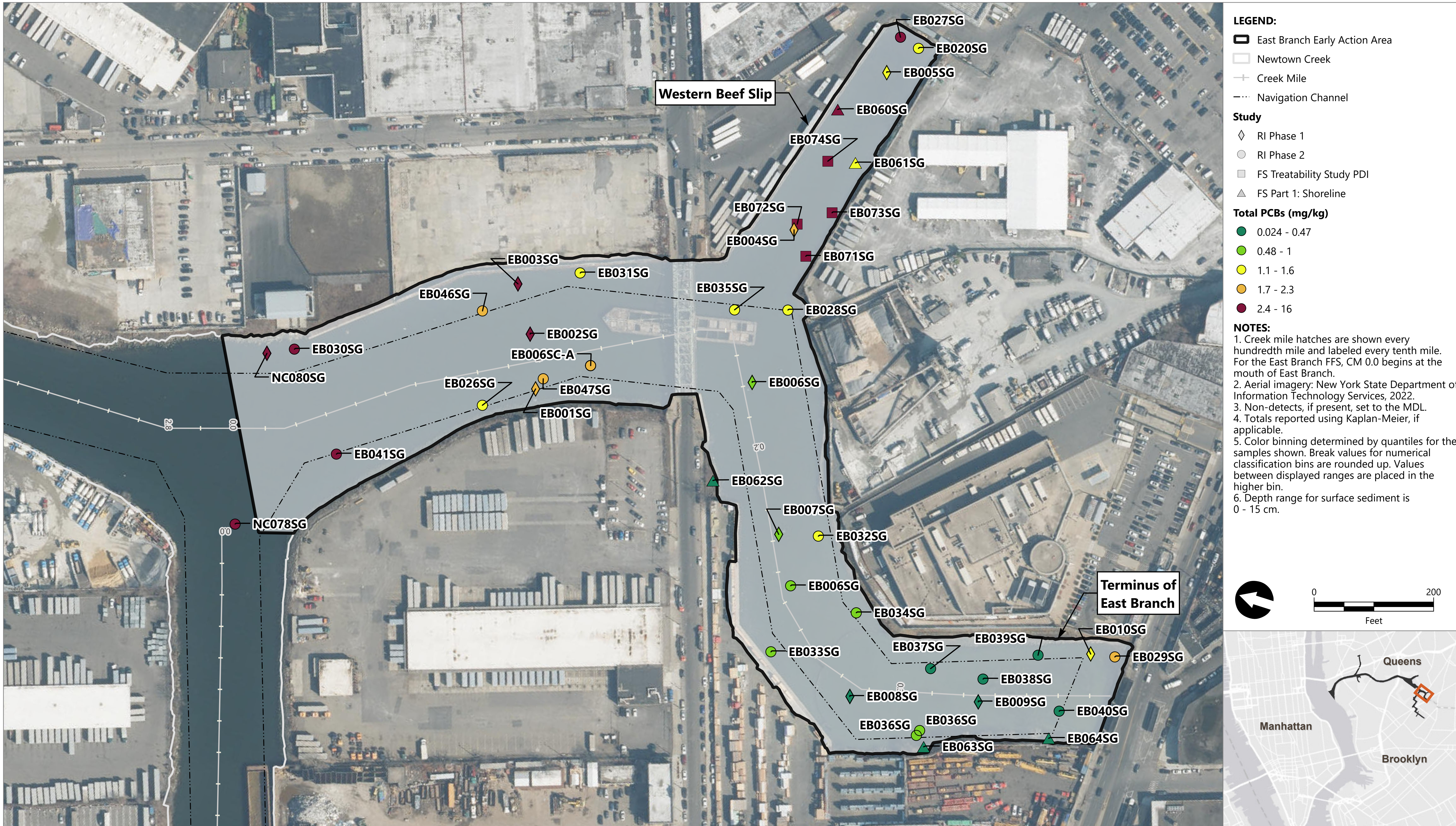

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ANCHOR QEA

Figure A2-6c
Total PCBs in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

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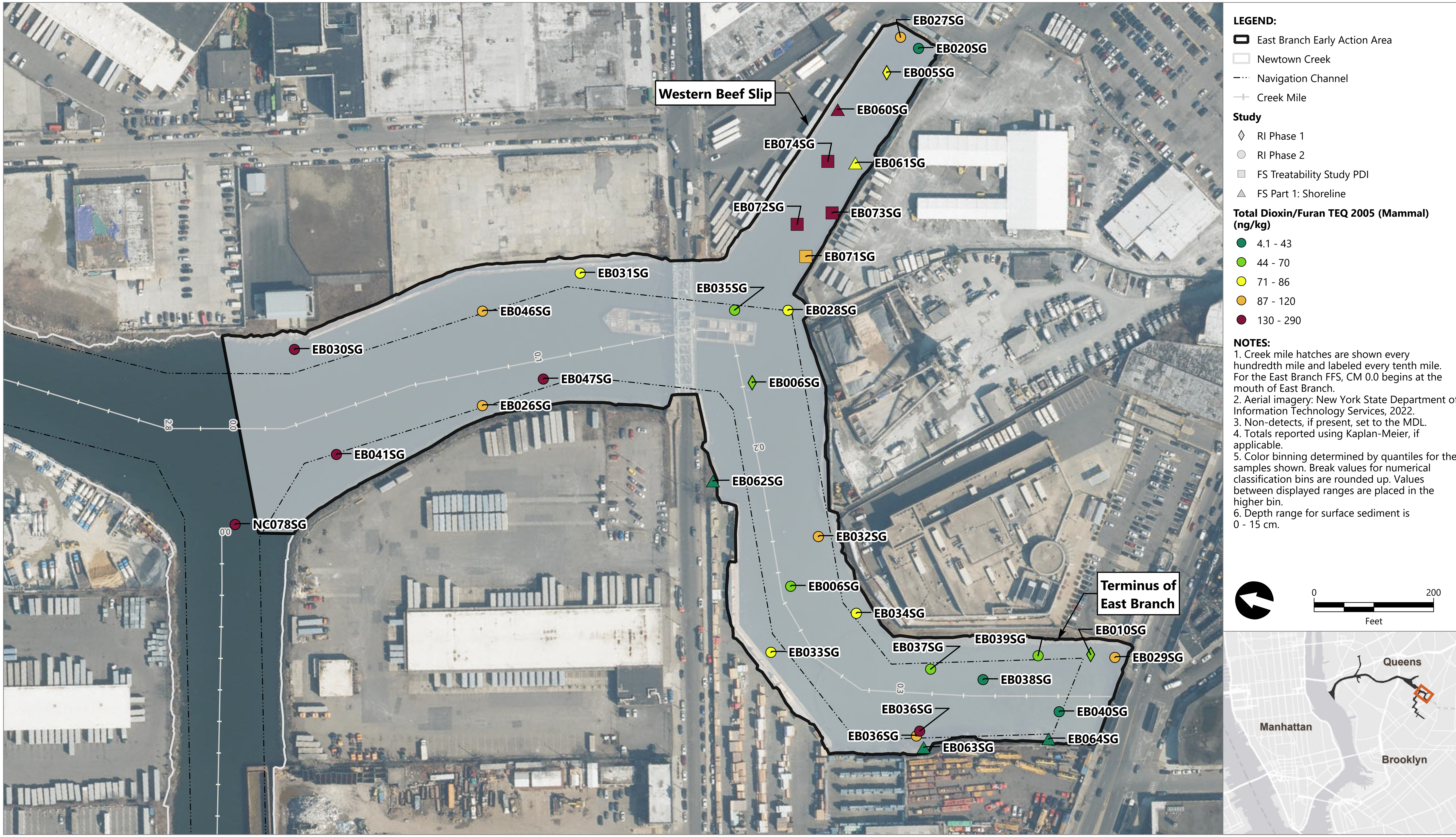

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ANCHOR QEA

Figure A2-6d
Total Dioxin/Furan TEQ 2005 (Mammal) in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

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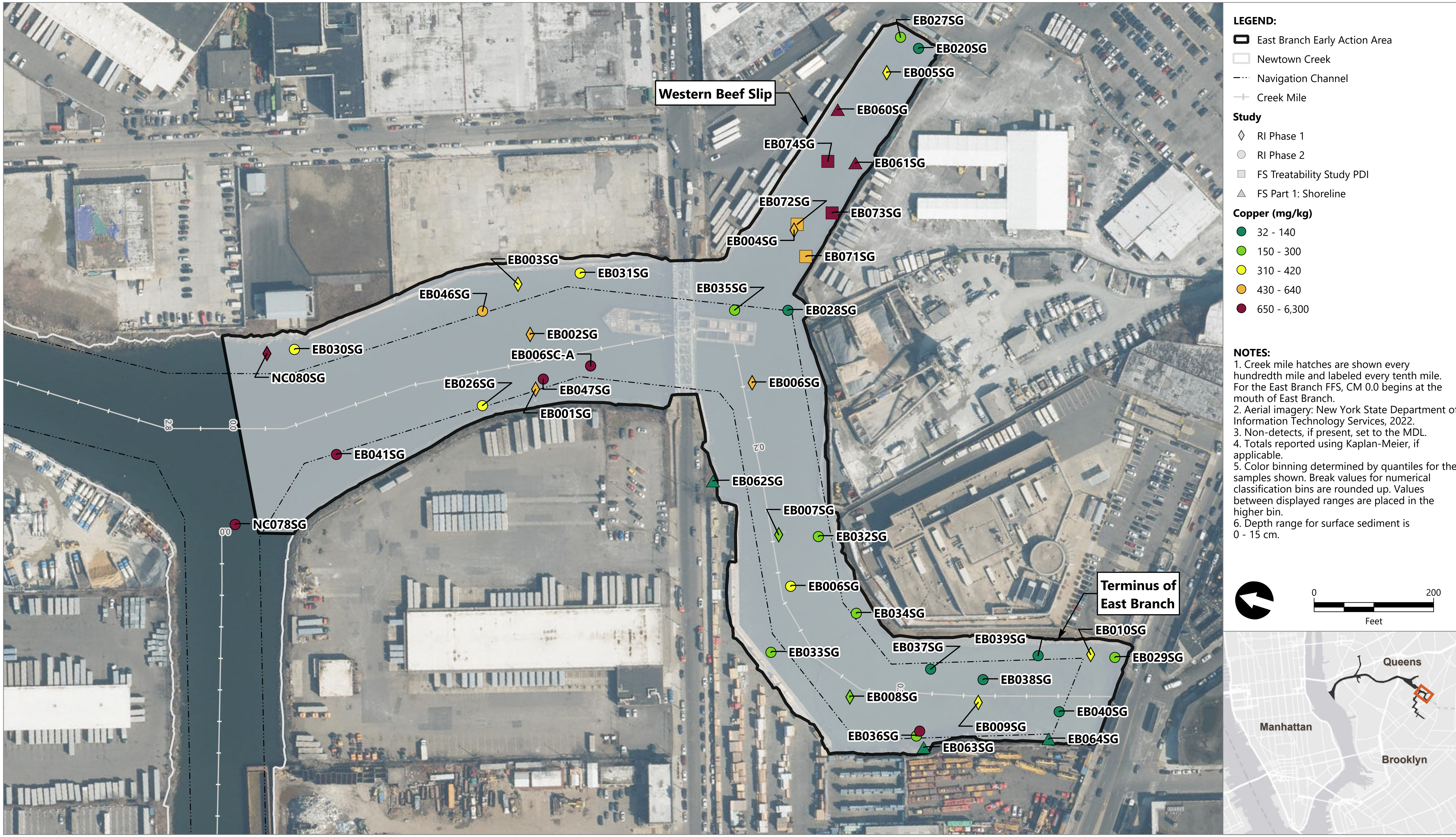

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ANCHOR QEA

Figure A2-6e
Copper in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

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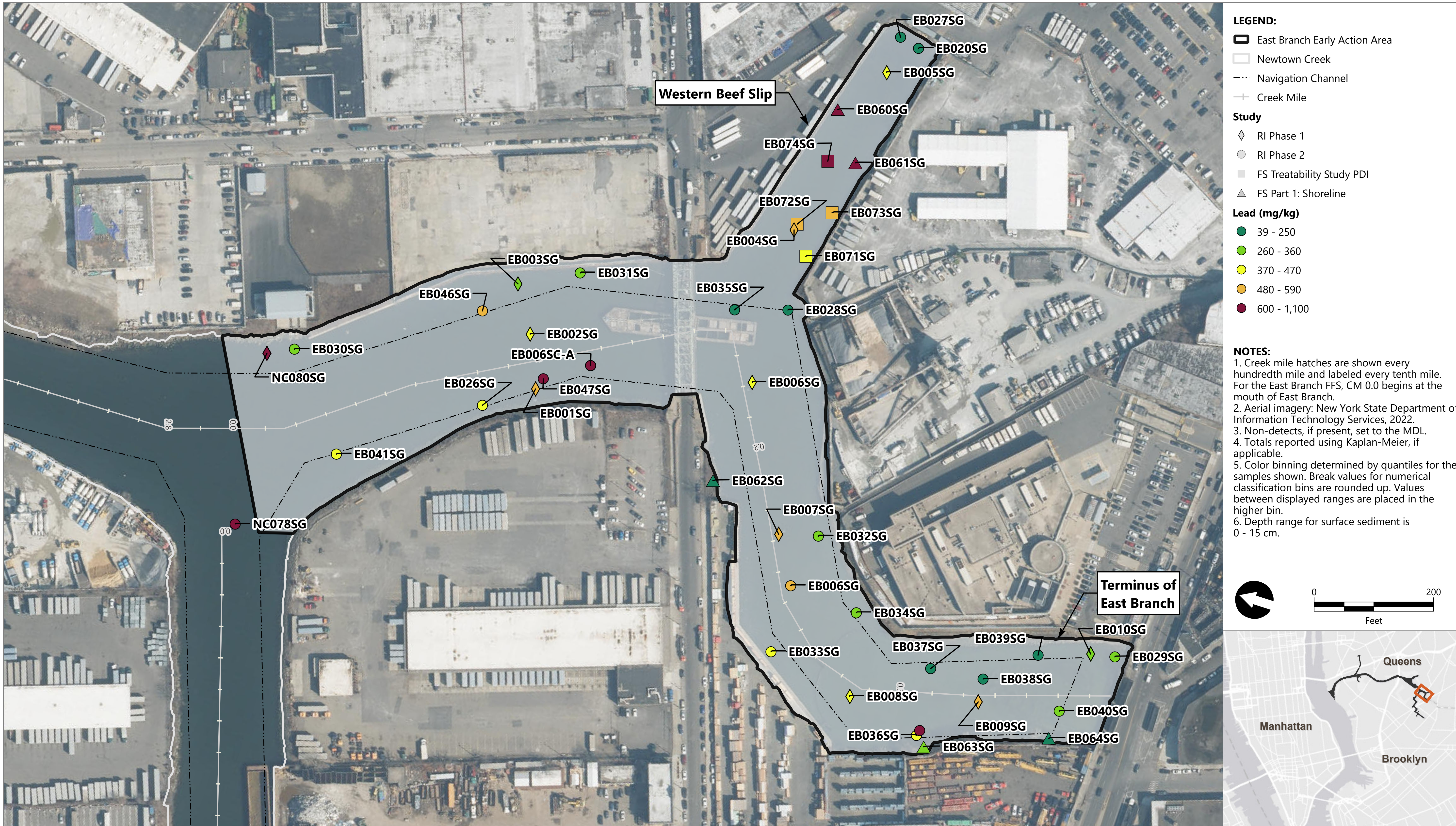

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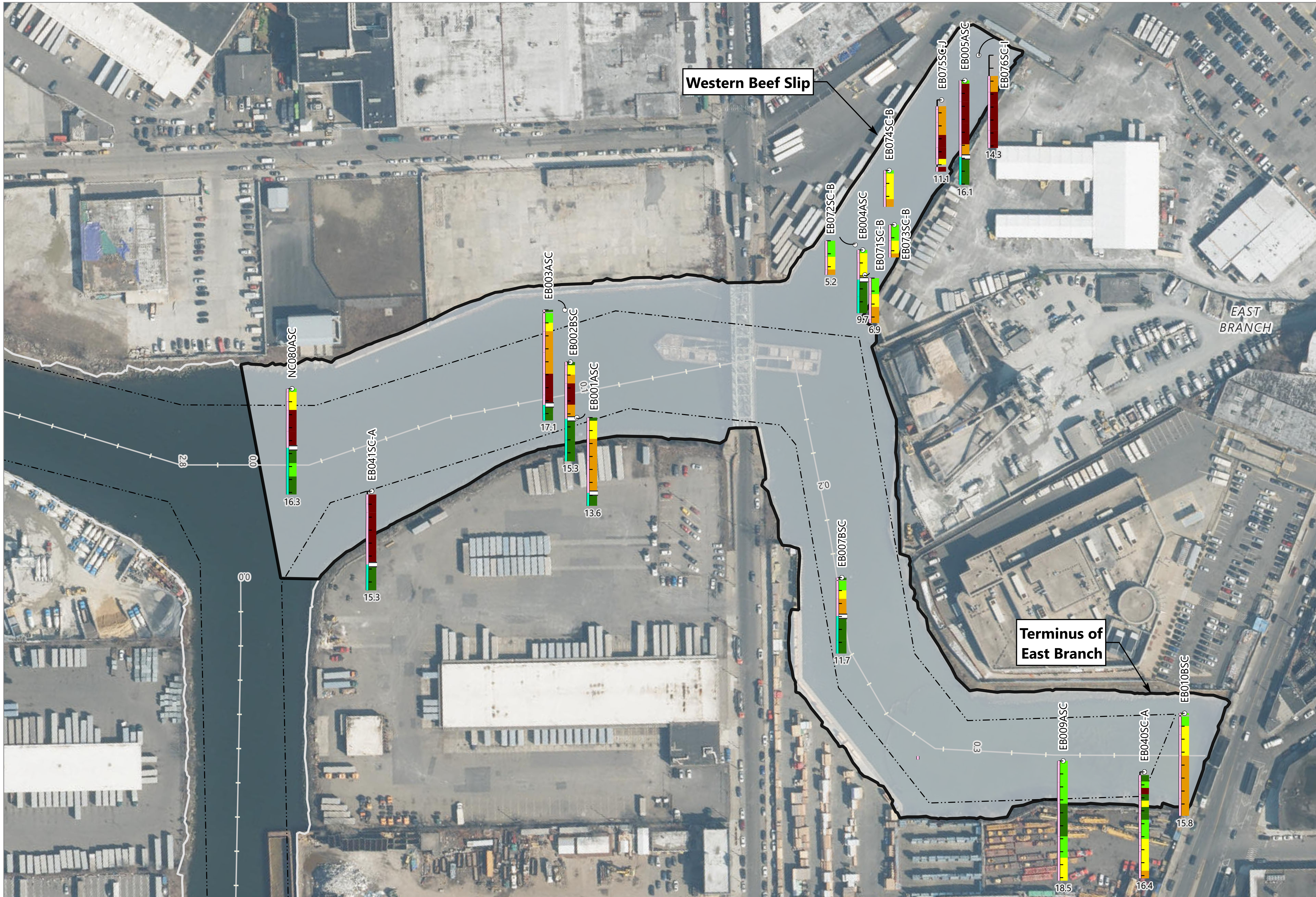
ANCHOR QEA

Figure A2-6f
Lead in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL



LEGEND:

East Branch Early Action Area

Newtown Creek

Navigation Channel

Creek Mile

Core Location

Total PAH (34) (mg/kg)

0.0060 - 84

85 - 270

280 - 630

640 - 1,100

1,200 - 6,100

No Data

NC080ASC — Core ID

Tick Marks at 2-Foot Depth Intervals

Indicates Portion of Core in Sediment

Indicates Sediment/Native Interface

Indicates Portion of Core in Native Material

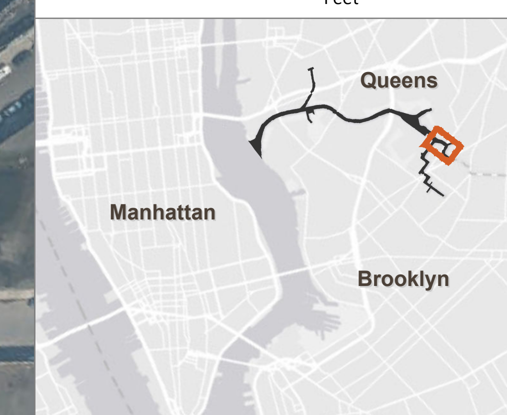
16.3 — Maximum Depth of Core (in feet below mudline)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Core locations are shown as circles at the sample location coordinates. The top of the core profiles start at the core location and extend downward. In some instances the core profile has been offset to prevent overlap with other core locations.
4. Figure shows subsurface sediment core locations from RI Phase 1, RI Phase 2, and FS treatability study PDI sampling programs.
5. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200

Feet



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ANCHOR QEA

Figure A2-7a

Total PAH (34) in Sediment and Native Material

Conceptual Site Model

Newtown Creek RI/FS

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NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Core locations are shown as circles at the sample location coordinates. The top of the core profiles start at the core location and extend downward. In some instances the core profile has been offset to prevent overlap with other core locations.
4. Figure shows subsurface sediment core locations from RI Phase 1, RI Phase 2, and FS treatability study PDI sampling programs.
5. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

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ANCHOR QEA

Figure A2-7b
C19-C36 Aliphatic Petroleum Hydrocarbons in Sediment and Native Material
Conceptual Site Model
Newtown Creek RI/FS

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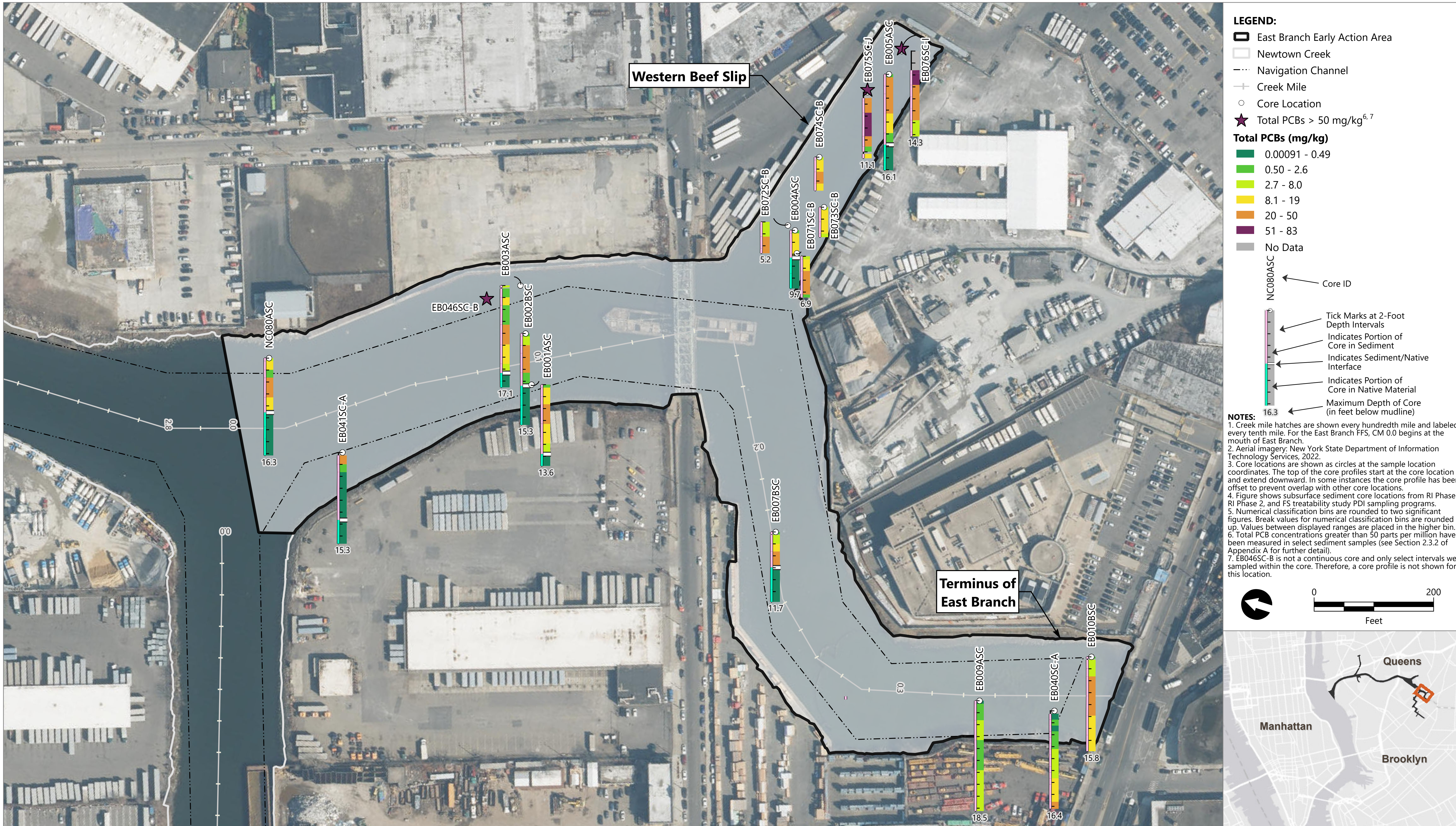

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ANCHOR QEA

Figure A2-7c
Total PCBs in Sediment and Native Material
Conceptual Site Model
Newtown Creek RI/FS

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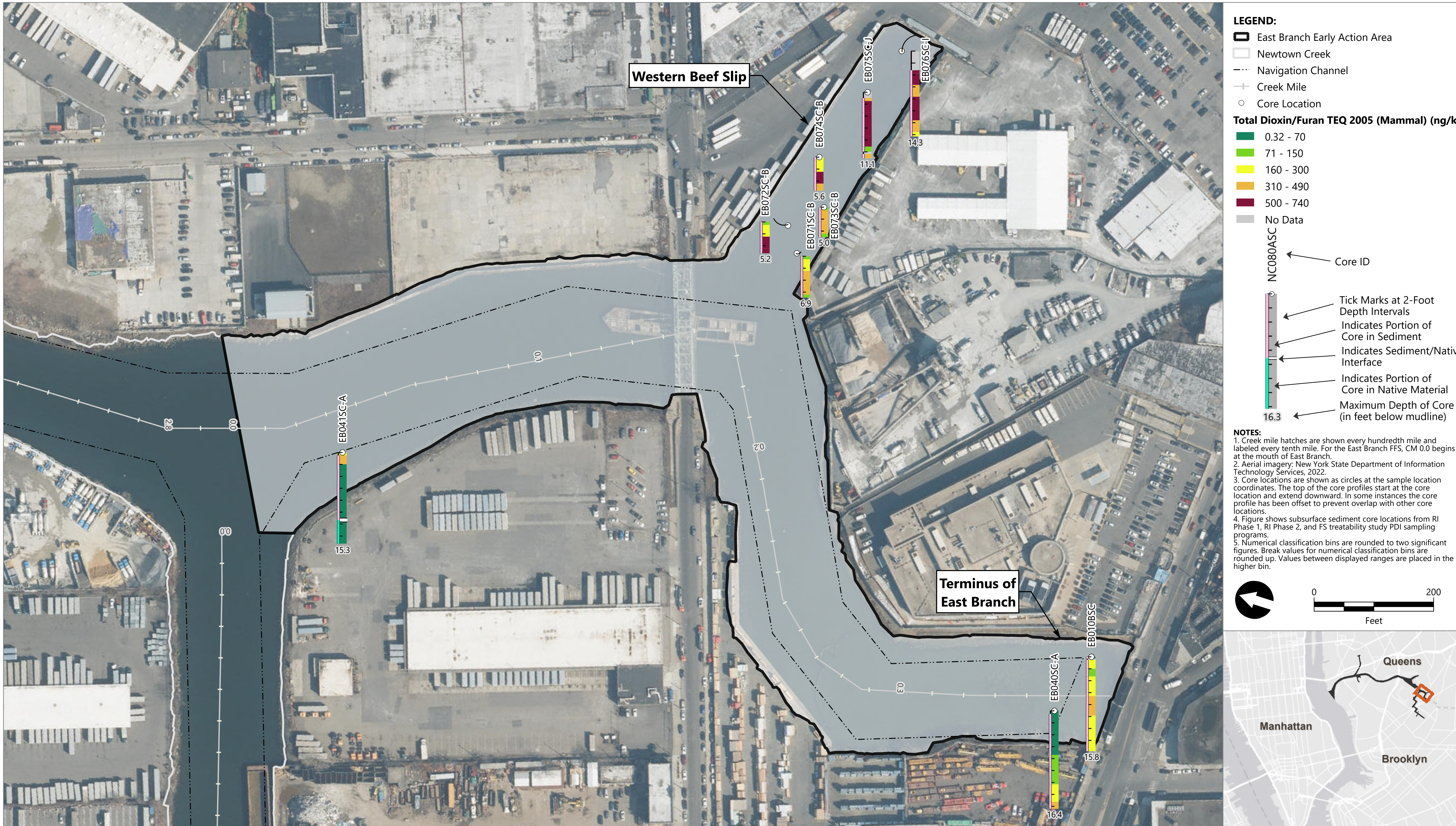

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ANCHOR QEA

Figure A2-7d
Total Dioxin/Furan TEQ 2005 (Mammal) in Sediment and Native Material
Conceptual Site Model
Newtown Creek RI/FS

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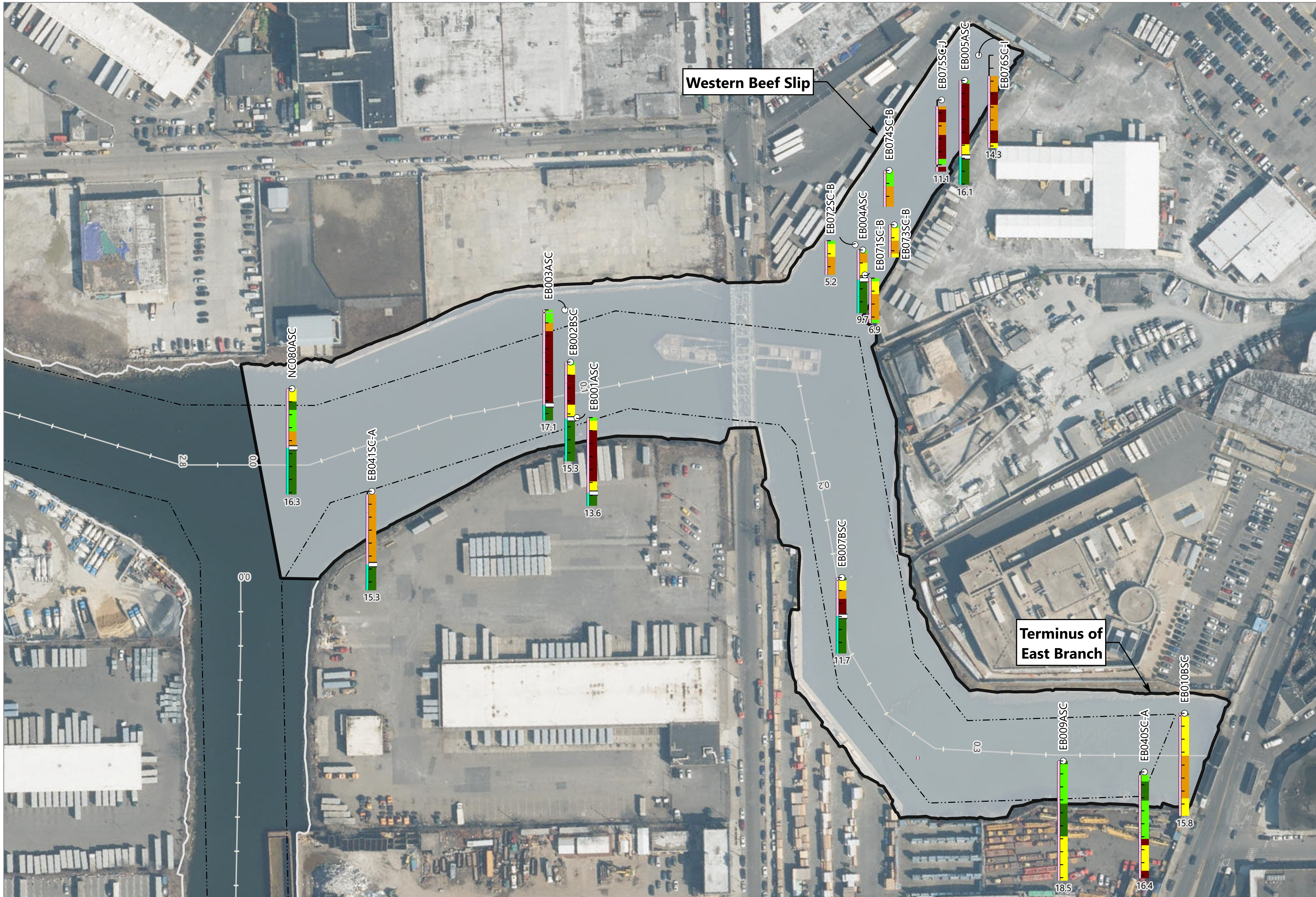


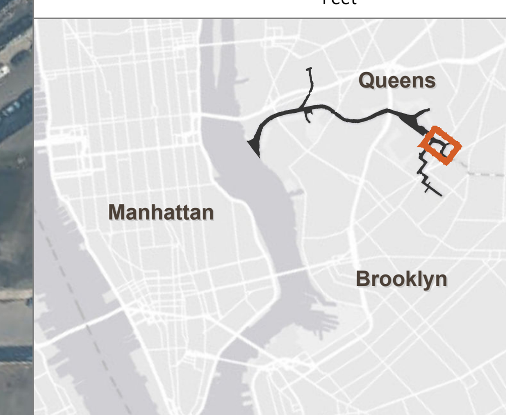
LEGEND:
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Core Location

Copper (mg/kg)
- 7.7 - 380
- 390 - 970
- 980 - 2,000
- 2,100 - 3,300
- 3,400 - 6,000
- No Data

NC080ASC — Core ID
Tick Marks at 2-Foot Depth Intervals
Indicates Portion of Core in Sediment
Indicates Sediment/Native Interface
Indicates Portion of Core in Native Material
16.3 — Maximum Depth of Core (in feet below mudline)

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Core locations are shown as circles at the sample location coordinates. The top of the core profiles start at the core location and extend downward. In some instances the core profile has been offset to prevent overlap with other core locations.
4. Figure shows subsurface sediment core locations from RI Phase 1, RI Phase 2, and FS treatability study PDI sampling programs.
5. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200
Feet



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ANCHOR QEA

Figure A2-7e
Copper in Sediment and Native Material
Conceptual Site Model
Newtown Creek RI/FS

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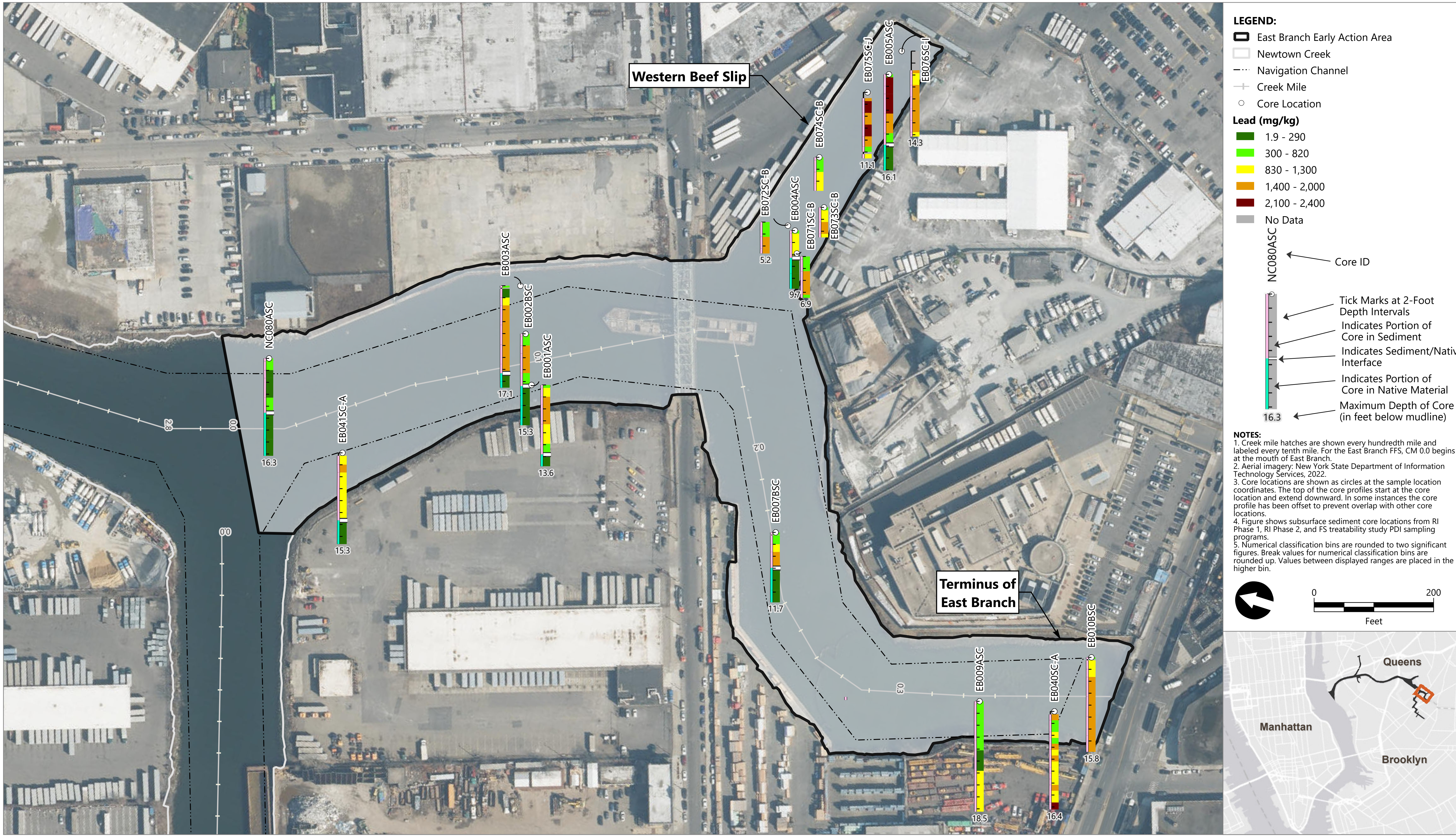

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Core locations are shown as circles at the sample location coordinates. The top of the core profiles start at the core location and extend downward. In some instances the core profile has been offset to prevent overlap with other core locations.
4. Figure shows subsurface sediment core locations from RI Phase 1, RI Phase 2, and FS treatability study PDI sampling programs.
5. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

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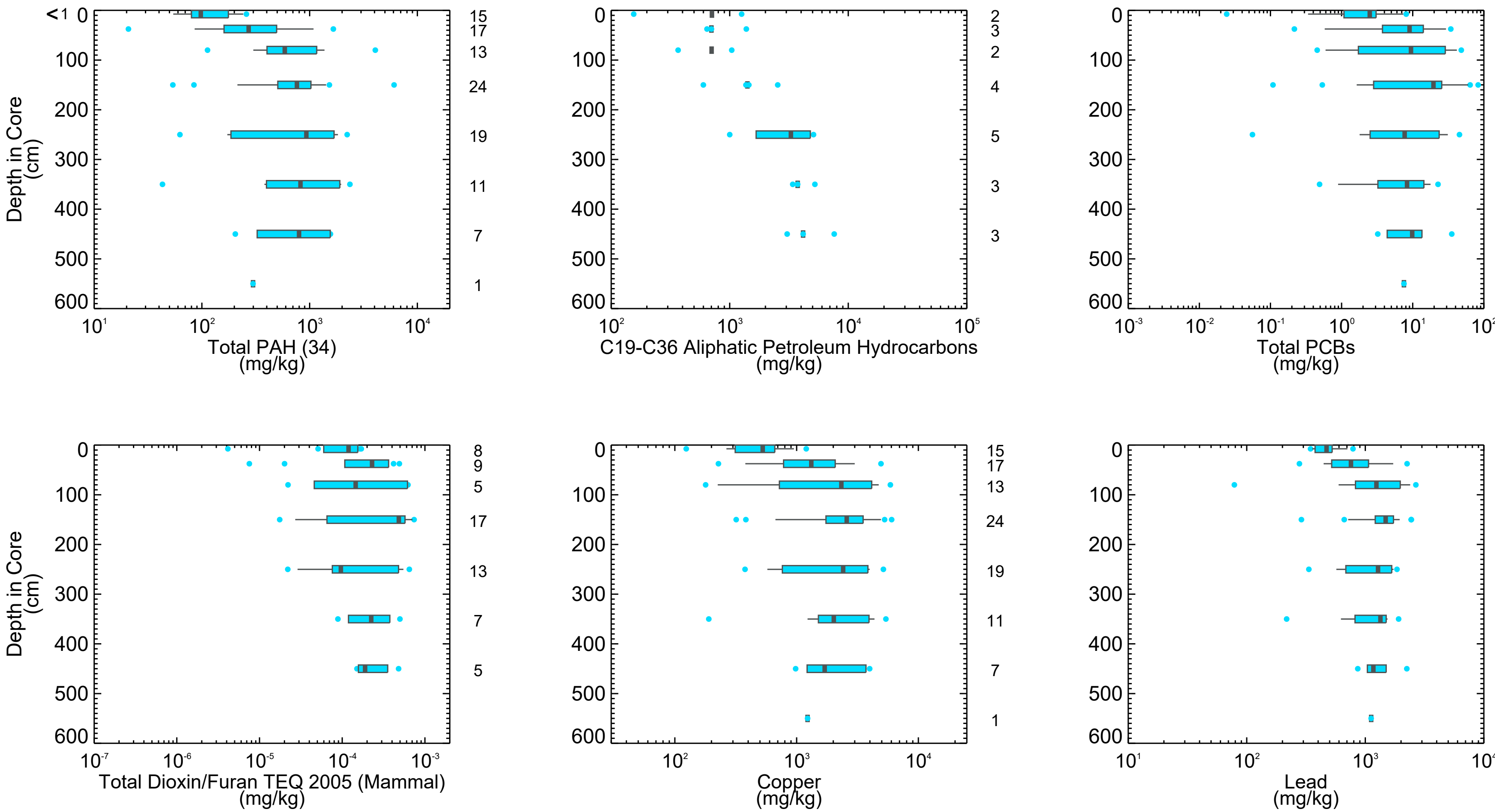
ANCHOR QEA

Figure A2-7f
Lead in Sediment and Native Material
Conceptual Site Model
Newtown Creek RI/FS



Notes: Non-detects, if present, set to the MDL. Totals reported using Kaplan-Meier, if applicable.
Plot includes only cores with continuous samples throughout core, grouped by sample mid-depth.
Sample size posted at the right. Box: median, 25th, 75th percentiles; whiskers: 10th, 90th percentiles. Symbols: data outside whiskers; for n <= 10, no whiskers; for n <= 4, no box (but median is shown as vertical bar).
Caret symbols and numbers left or right of panel, if present, indicate the number of values outside x-axis range.
RI Phase 1 samples were not analyzed for C19-C36 aliphatic petroleum hydrocarbons.

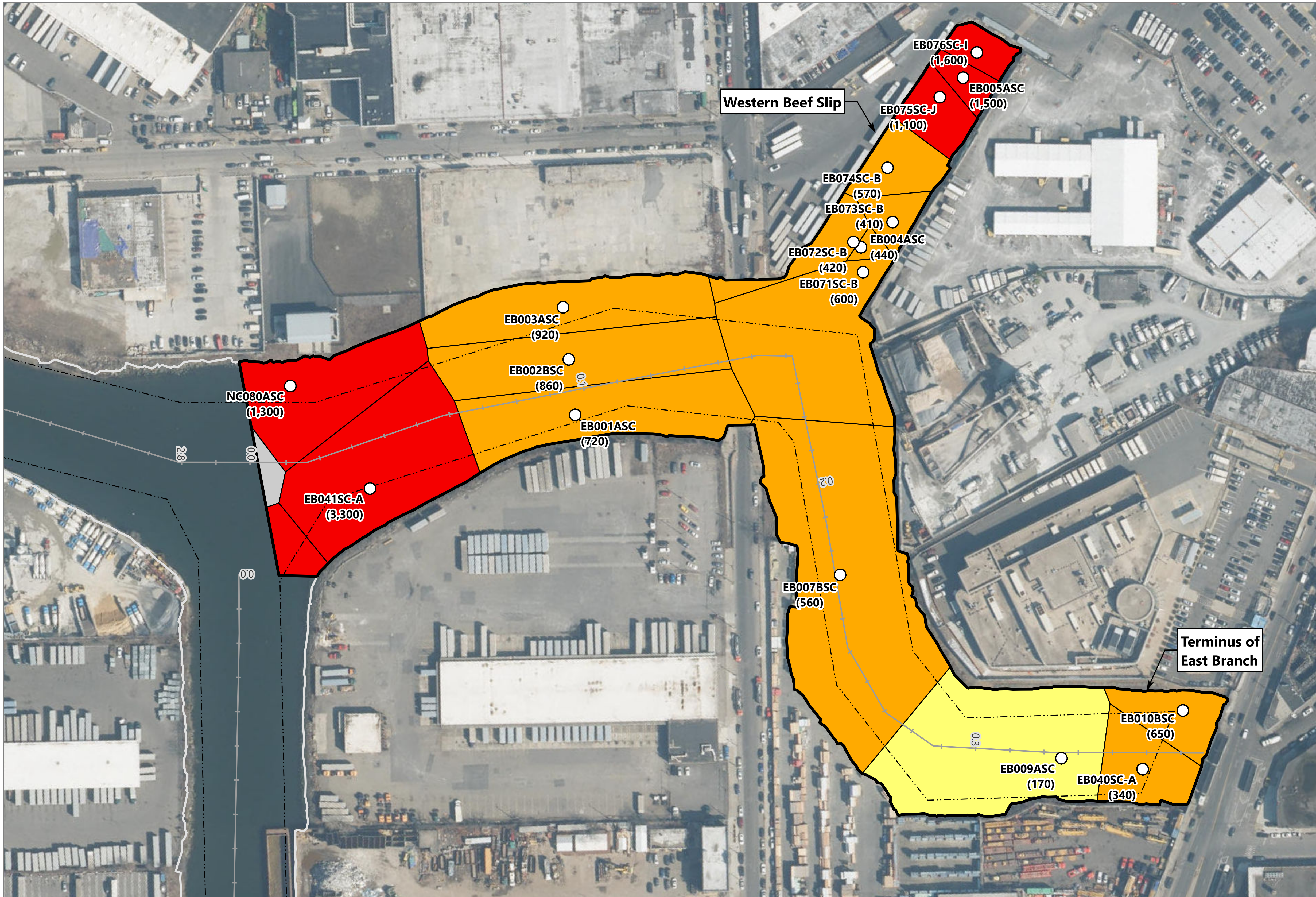
ANCHOR QEA

Figure A2-8
Surface Sediment and Subsurface Sediment Concentrations in East Branch - Box Plots by Depth

Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

DRAFT FINAL



LEGEND:

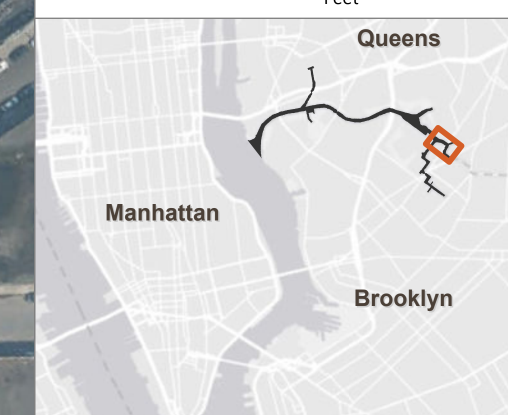
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Core Location

Total PAH (34) in Subsurface Sediment (mg/kg)

- 13 - 100 (<1x Risk-Based PRG)
- 110 - 200 (1-2x Risk-Based PRG)
- 210 - 1,000 (2-10x Risk-Based PRG)
- 1,100 - 3,300 (>10x Risk-Based PRG)

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for TPAH (34) is 100 mg/kg on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point).

0 200
Feet



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ANCHOR QEA

Figure A2-9a
Total PAH (34) Depth-Weighted Average Subsurface Sediment Concentrations
Conceptual Site Model
Newtown Creek RI/FS

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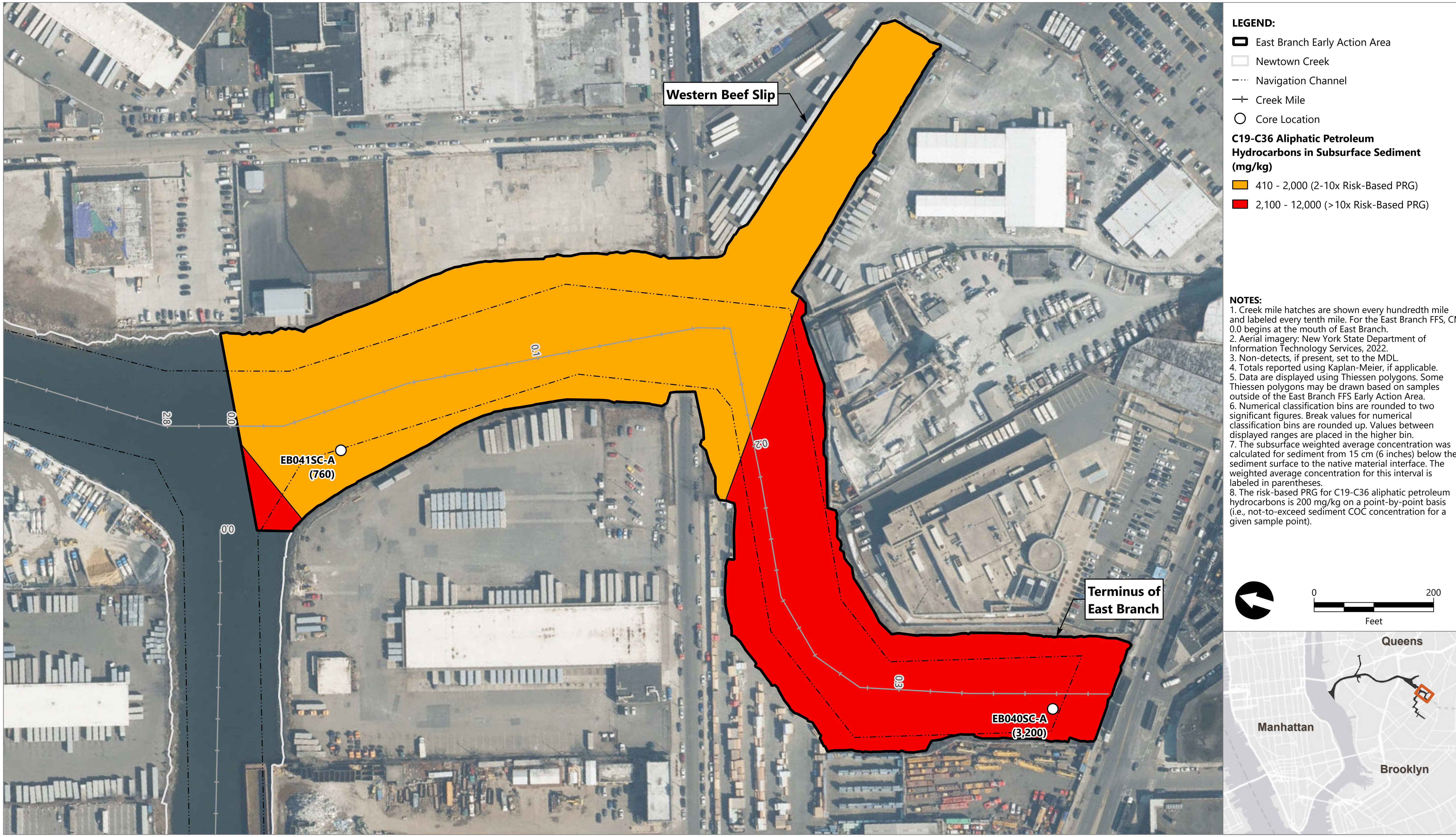

LEGEND:
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Core Location

C19-C36 Aliphatic Petroleum Hydrocarbons in Subsurface Sediment (mg/kg)
- 410 - 2,000 (2-10x Risk-Based PRG)
- 2,100 - 12,000 (>10x Risk-Based PRG)

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for C19-C36 aliphatic petroleum hydrocarbons is 200 mg/kg on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point).

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ANCHOR QEA

Figure A2-9b
C19-C36 Aliphatic Petroleum Hydrocarbon Depth-Weighted Average Subsurface Sediment Concentrations
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Core Location

Total PCBs in Subsurface Sediment (mg/kg)

- 0.026 - 0.30 (<1x Risk-Based PRG)
- 3.1 - 46 (>10x Risk-Based PRG)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for Total PCBs is 0.3 mg/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

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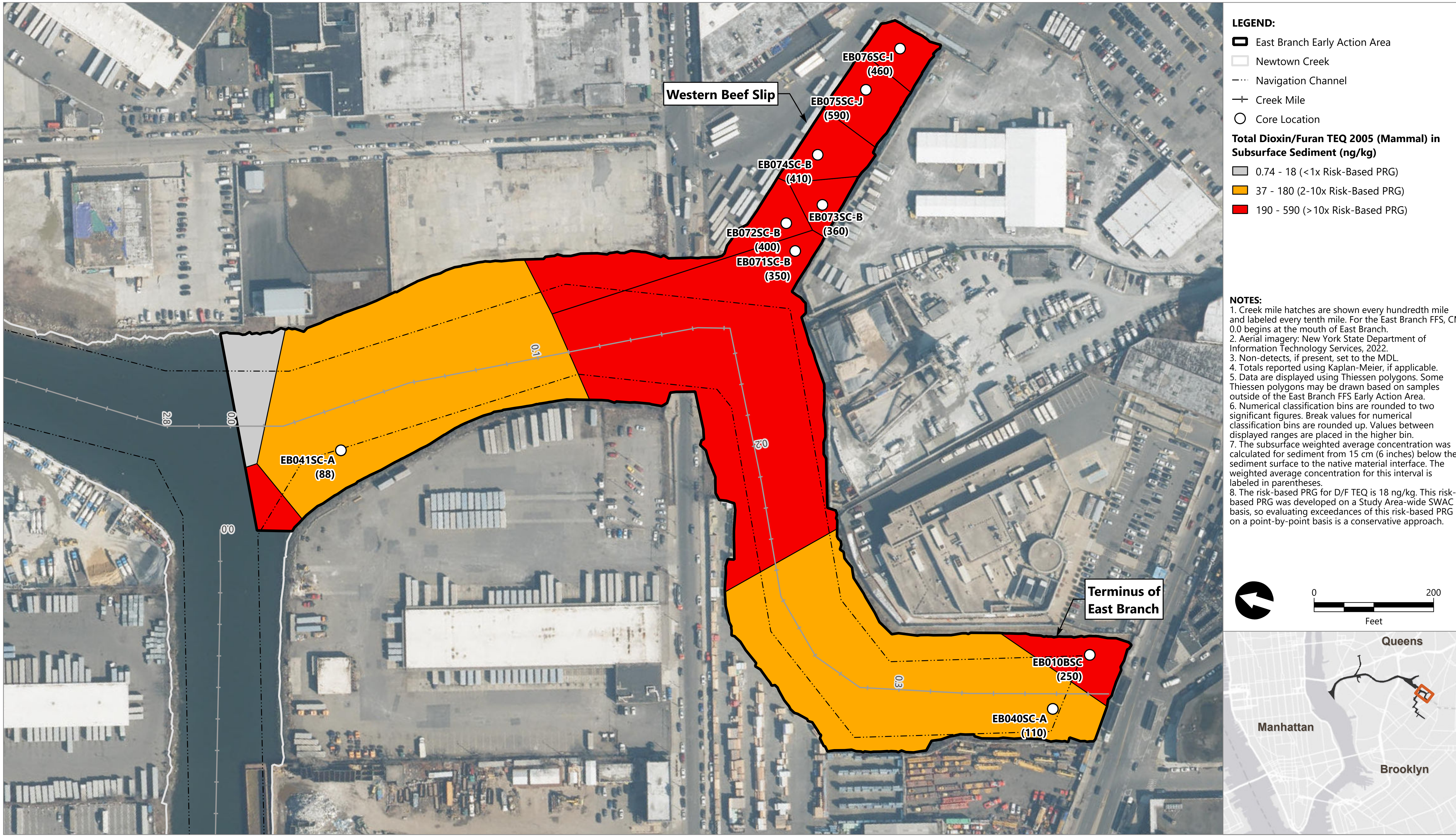
Figure A2-9c
Total PCBs Depth-Weighted Average Subsurface Sediment Concentrations
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for D/F TEQ is 18 ng/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.

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Figure A2-9d
Total Dioxin/Furan TEQ 2005 (Mammal) Depth-Weighted Average Subsurface Sediment Concentrations
Conceptual Site Model
Newtown Creek RI/FS

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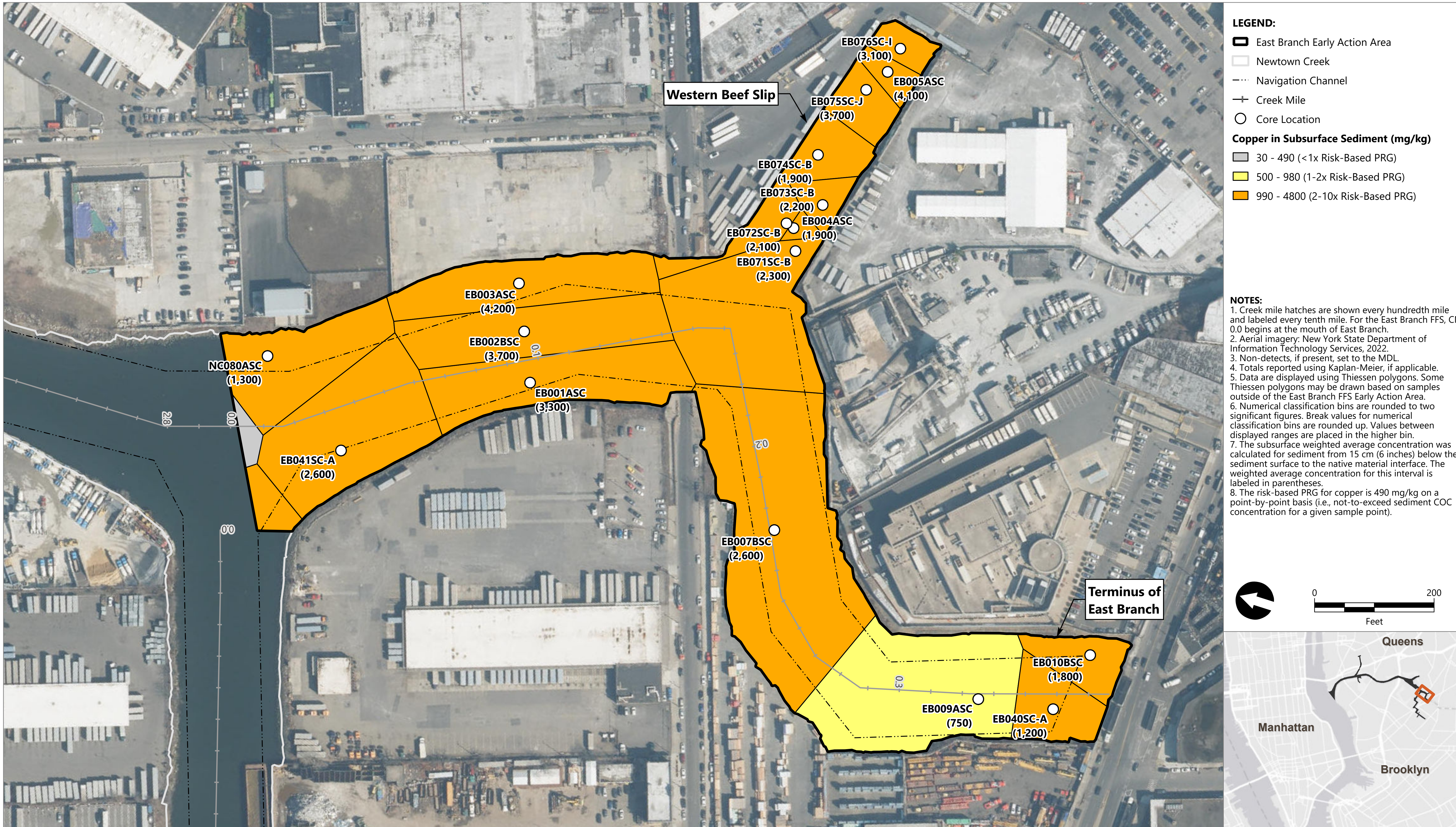

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for copper is 490 mg/kg on a point-by-point basis (i.e., not-to-exceed sediment COC concentration for a given sample point).

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ANCHOR QEA

Figure A2-9e
Copper Depth-Weighted Average Subsurface Sediment Concentrations
Conceptual Site Model
Newtown Creek RI/FS

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FINAL

LEGEND:

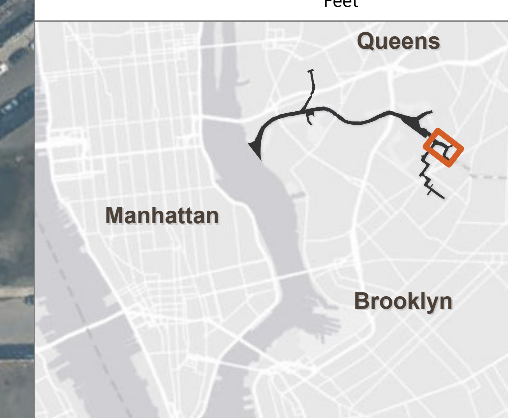
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Core Location

Lead in Subsurface Sediment (mg/kg)

- 350 - 680 (1-2x Risk-Based PRG)
- 690 - 2,100 (2-10x Risk-Based PRG)

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Data are displayed using Thiessen polygons. Some Thiessen polygons may be drawn based on samples outside of the East Branch FFS Early Action Area.
6. Numerical classification bins are rounded to two significant figures. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.
7. The subsurface weighted average concentration was calculated for sediment from 15 cm (6 inches) below the sediment surface to the native material interface. The weighted average concentration for this interval is labeled in parentheses.
8. The risk-based PRG for lead is 340 mg/kg. This risk-based PRG was developed on a Study Area-wide SWAC basis in intertidal areas, so evaluating exceedances of this risk-based PRG on a point-by-point basis is a conservative approach.
9. Intertidal areas are areas between mean lower low water (MLLW) and mean high water (MHW). Intertidal areas shown in this figure were developed using the 2022 bathymetric survey.



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ANCHOR QEA

Figure A2-9f
Lead Depth-Weighted Average Subsurface Sediment Concentrations in Intertidal Areas
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

East Branch Early Action Area
Newtown Creek
Navigation Channel
Creek Mile

Most Notable NAPL Observation in Top 15 cm of Sediment

Visual Observation

Sheen
No Visual Observation of Sheen or NAPL

Shake Test

Sheen
Negative

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. The most notable observation is the visual observation and shake test with the greatest relative degree of sheen or NAPL. By depicting the most notable visual observation and shake test result, the map conservatively presents the observations of sheen and NAPL.
4. Figure shows locations from RI Phase 1, RI Phase 2, FS Part 1 and Part 2, and FS treatability study PDI sampling programs.

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ANCHOR QEA

Figure A2-10a
Most Notable NAPL Observations in Surface Sediment
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. The most notable observation is the visual observation and shake test with the greatest relative degree of sheen or NAPL. By depicting the most notable visual observation and shake test result, the map conservatively presents the observations of sheen and NAPL.
4. Figure shows locations from RI Phase 1, RI Phase 2, FS Part 1 and Part 2, and FS treatability study PDI sampling programs.

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ANCHOR QEA

Figure A2-10b
Most Notable NAPL Observations in Subsurface Sediment
Conceptual Site Model
Newtown Creek RI/FS

DRAFT
FINAL

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. The most notable observation is the visual observation and shake test with the greatest relative degree of sheen or NAPL. By depicting the most notable visual observation and shake test result, the map conservatively presents the observations of sheen and NAPL.
4. Figure shows locations from RI Phase 1, RI Phase 2, FS Part 1 and Part 2, and FS treatability study PDI sampling programs.

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ANCHOR QEA

Figure A2-10c
Most Notable NAPL Observations in Native Material
Conceptual Site Model
Newtown Creek RI/FS

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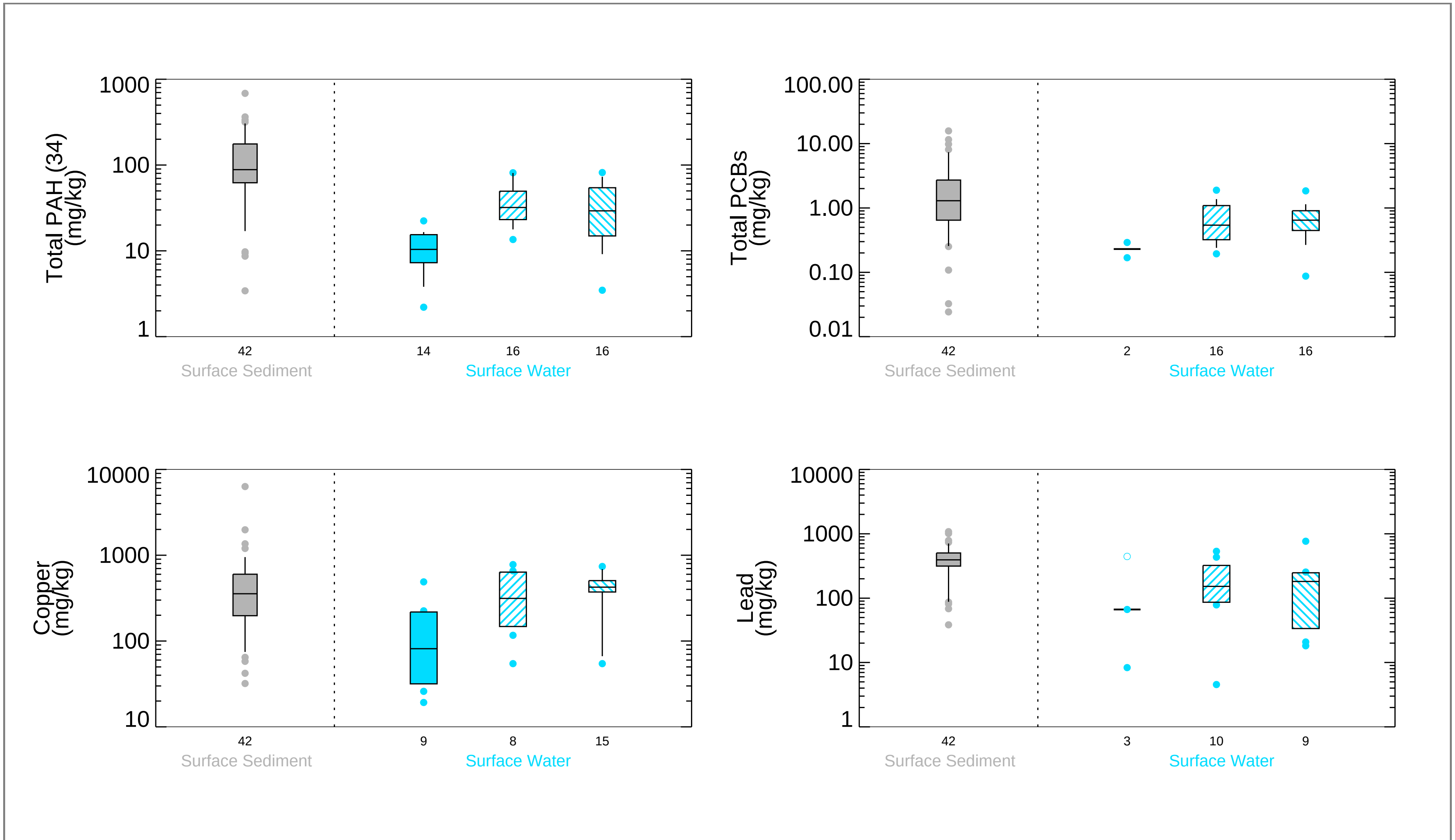

Notes: Non-detects, if present, are plotted with open symbol. Non-detect surface water samples, if present, are set to the estimated MDL for organics or calculated MDL for metals.
Non-detect surface sediment samples, if present, are set to the MDL. Surface sediment totals reported using Kaplan-Meier.
Surface water totals reported using estimated detection limit times 0.5. Sample size posted below x-axis.
Box: median, 25th, 75th percentiles; whiskers: 10th, 90th percentiles. Symbols: data outside whiskers; for n<=10, no whiskers; for n<=4, no box (but median is shown as horizontal line).
Surface water samples were not analyzed for C19-C36 aliphatic petroleum hydrocarbons. Particulate phase calculations for Total Dioxin/Furan TEQ were not performed because
site-specific partitioning coefficients could not be developed, given that Total Dioxin/Furan TEQ was not analyzed in porewater samples.
"Wet Weather" is round 1 of the wet weather sampling program. "Transition" is round 2 of the wet weather sampling program.

- Dry Weather Surface Water
- Wet Weather Surface Water
- Transition Surface Water

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Figure A2-11

Comparison of Particulate Phase Concentrations in Surface Water to Surface Sediment Concentrations in East Branch - Box Plots by Sampling Event

Conceptual Site Model
Newtown Creek RI/FS

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LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- RI Porewater: 0-15 cm
- RI Porewater: 15-30 cm
- RI Porewater: Mid-depth
- Treatability Study PDI Porewater

Total PAH (34) (µg/L)

- 0.0 - 0.60
- 0.61 - 1.9
- 2.0 - 6.1
- 6.2 - 23
- 24 - 620

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. For RI Porewater locations, circle symbols are located at the actual sampling location, with data from 15-30 cm (triangles) program stacked vertically.
4. Non-detects, if present, set to the MDL.
5. Totals reported using Kaplan-Meier, if applicable.
6. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200
Feet

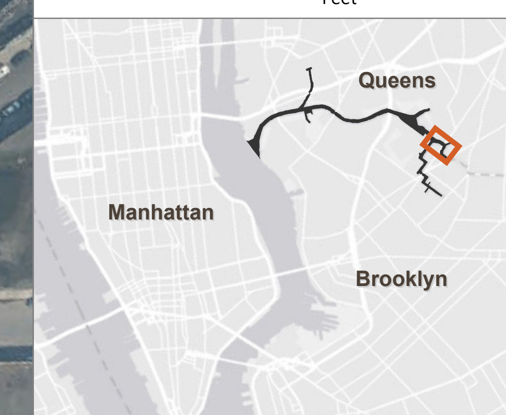

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Figure A2-12a
Total PAH (34) in Porewater
Conceptual Site Model
Newtown Creek RI/FS

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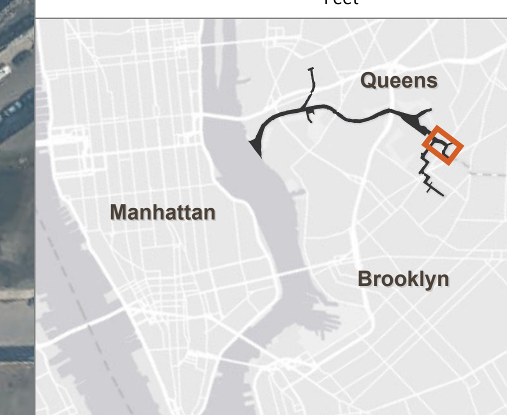

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- RI Porewater: 0-15 cm
- RI Porewater: 15-30 cm
- RI Porewater: Mid-depth
- Treatability Study PDI Porewater

Total PCBs (ng/L)

- 3.1 - 3.2
- 3.3 - 9.5
- 9.6 - 12
- 13 - 57
- 58 - 1,100

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. For RI Porewater locations, circle symbols are located at the actual sampling location, with data from 15-30 cm (triangles) program stacked vertically.
4. Non-detects, if present, set to the MDL.
5. Totals reported using Kaplan-Meier, if applicable.
6. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200
Feet

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Figure A2-12b
Total PCBs in Porewater
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

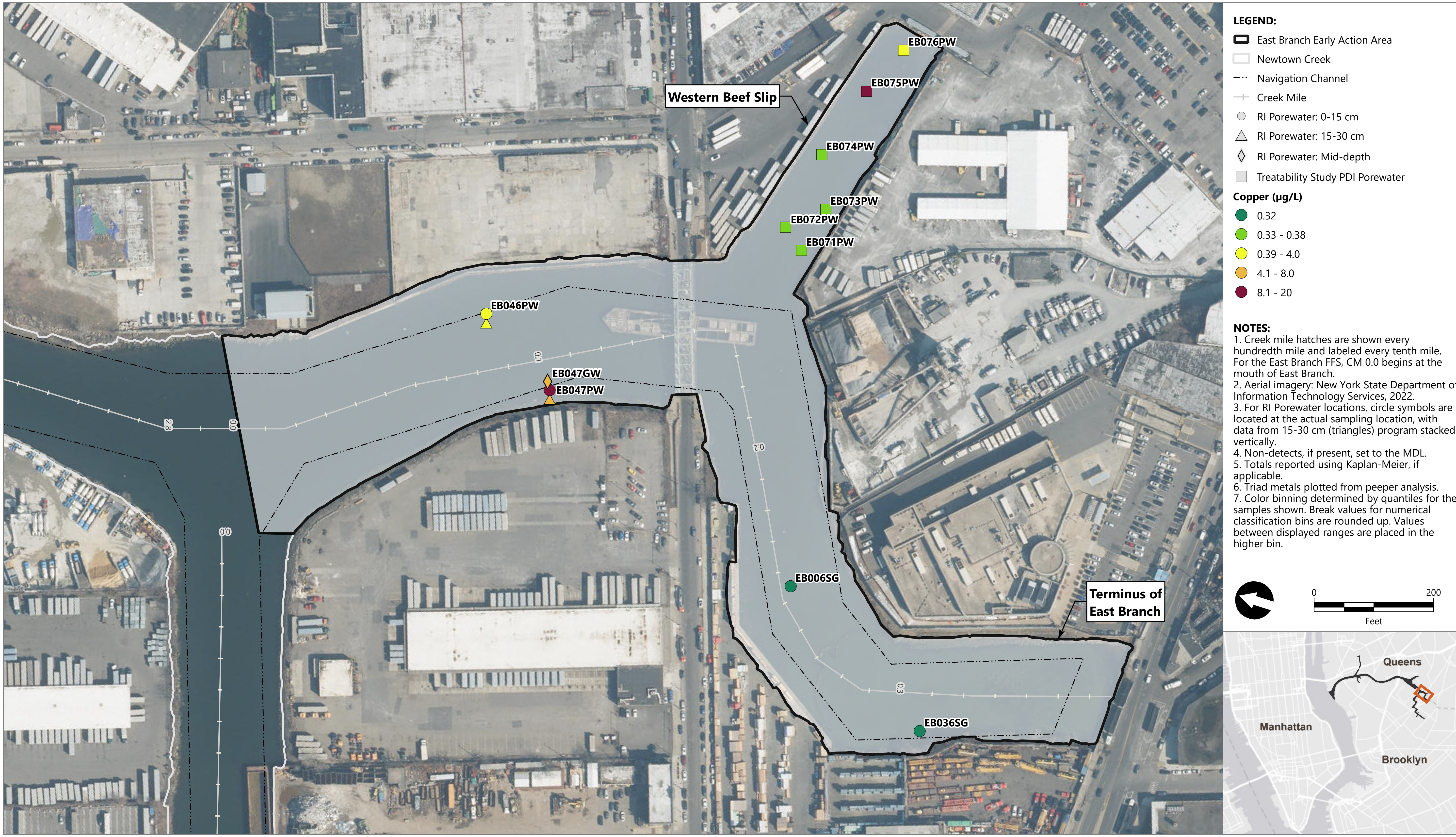

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Figure A2-12c
Copper in Porewater
Conceptual Site Model
Newtown Creek RI/FS

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LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- RI Porewater: 0-15 cm
- RI Porewater: 15-30 cm
- RI Porewater: Mid-depth
- Treatability Study PDI Porewater

Lead (µg/L)

- 0.17
- 0.18 - 0.34
- 0.35 - 3.4
- 3.5 - 4.0
- 4.1 - 8.6

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. For RI Porewater locations, circle symbols are located at the actual sampling location, with data from 15-30 cm (triangles) program stacked vertically.
4. Non-detects, if present, set to the MDL.
5. Totals reported using Kaplan-Meier, if applicable.
6. Triad metals plotted from peeper analysis.
7. Due to the low number of unique values in the data presented in this map, color binning was determined by quartiles instead of quintiles. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

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Figure A2-12d
Lead in Porewater
Conceptual Site Model
Newtown Creek RI/FS

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Figure A2-13
Point Source Discharge Locations to East Branch
Conceptual Site Model
Newtown Creek RI/FS

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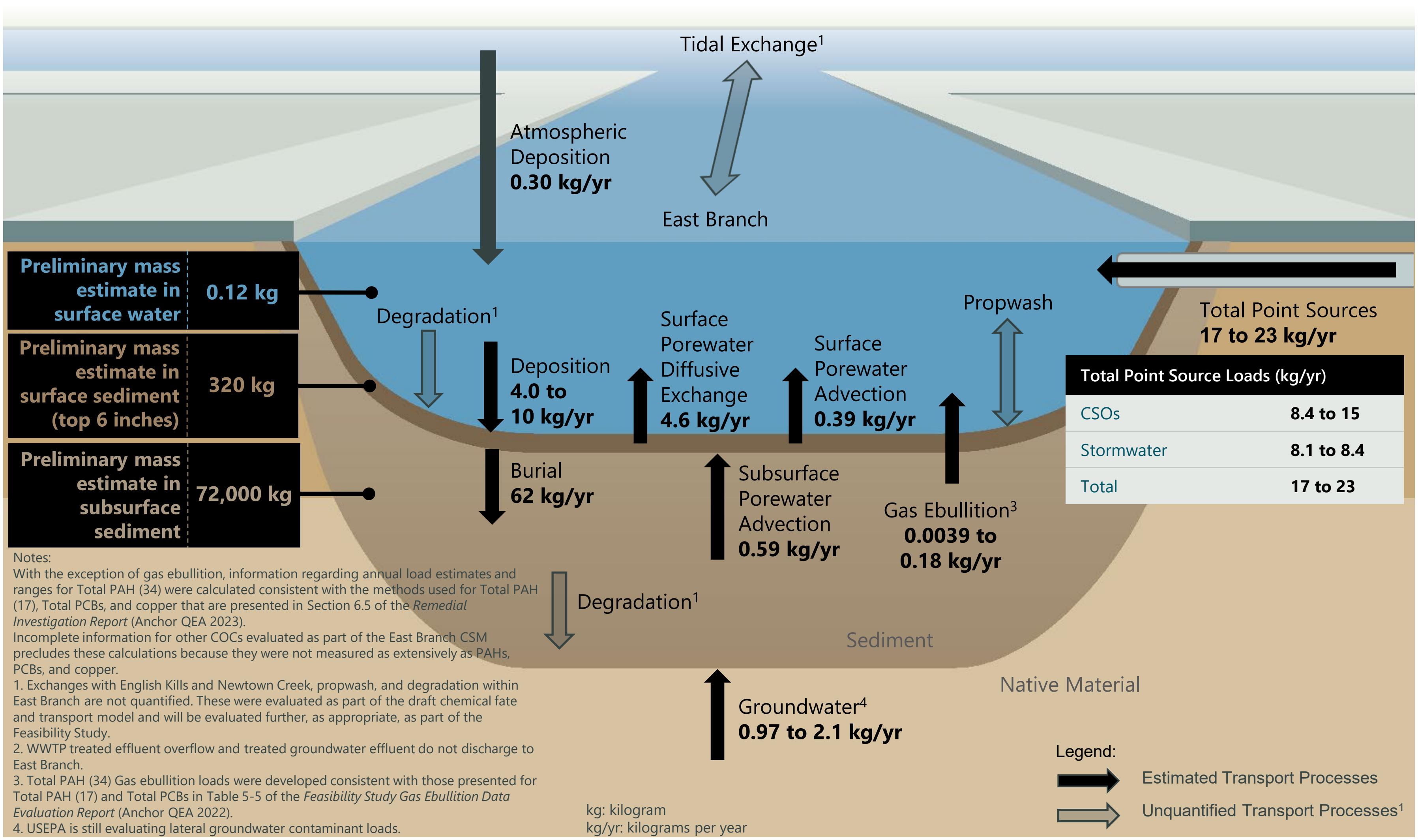

Total Point Source Loads (kg/yr)	
CSOs	8.4 to 15
Stormwater	8.1 to 8.4
Total	17 to 23

Notes:
With the exception of gas ebullition, information regarding annual load estimates and ranges for Total PAH (34) were calculated consistent with the methods used for Total PAH (17), Total PCBs, and copper that are presented in Section 6.5 of the *Remedial Investigation Report* (Anchor QEA 2023).
Incomplete information for other COCs evaluated as part of the East Branch CSM precludes these calculations because they were not measured as extensively as PAHs, PCBs, and copper.
1. Exchanges with English Kills and Newtown Creek, propwash, and degradation within East Branch are not quantified. These were evaluated as part of the draft chemical fate and transport model and will be evaluated further, as appropriate, as part of the Feasibility Study.
2. WWTP treated effluent overflow and treated groundwater effluent do not discharge to East Branch.
3. Total PAH (34) Gas ebullition loads were developed consistent with those presented for Total PAH (17) and Total PCBs in Table 5-5 of the *Feasibility Study Gas Ebullition Data Evaluation Report* (Anchor QEA 2022).
4. USEPA is still evaluating lateral groundwater contaminant loads.

kg: kilogram
kg/yr: kilograms per year

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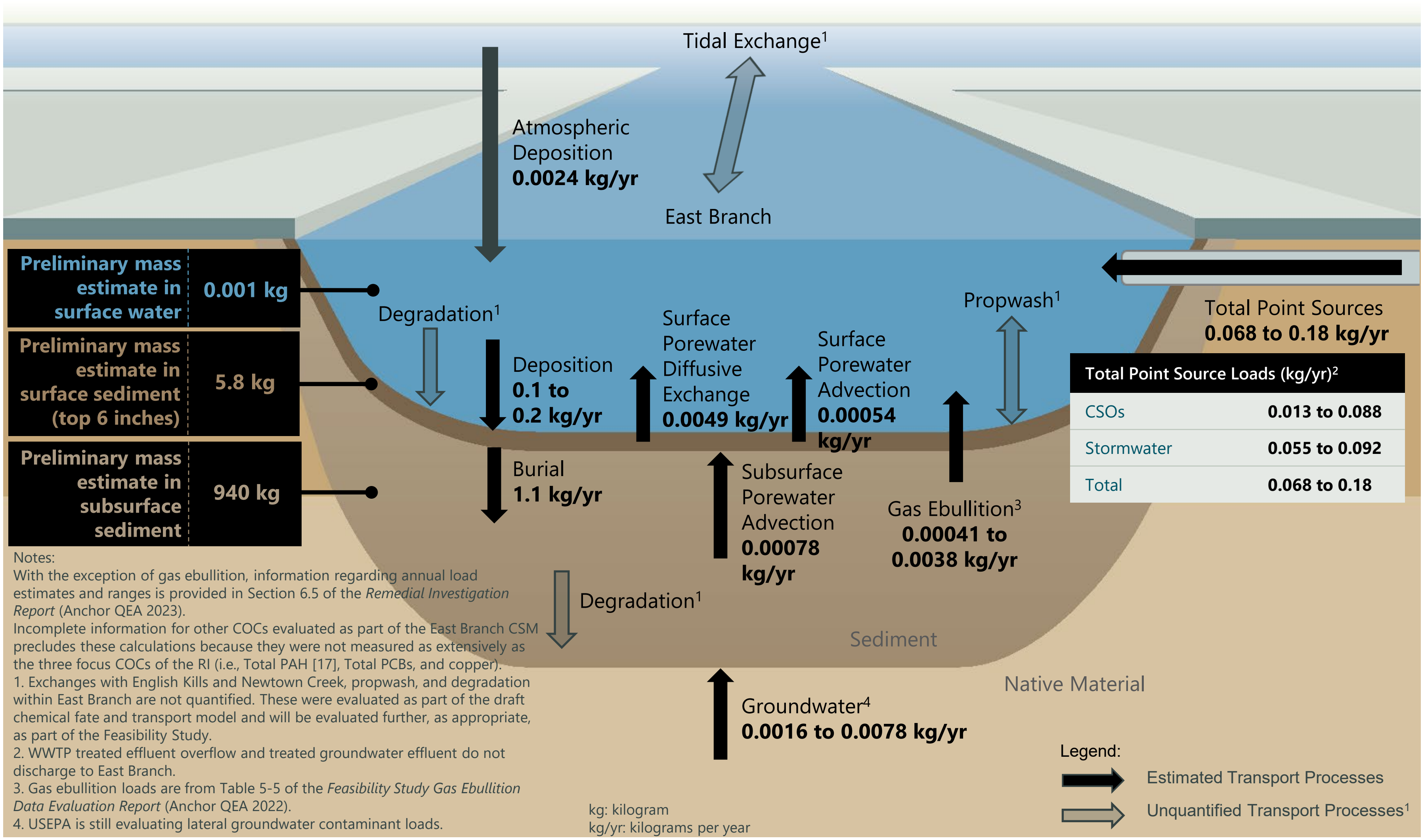
Figure A2-14a
Estimated Total PAH (34) Mass and Loads
Conceptual Site Model
Newtown Creek RI/FS



Total Point Source Loads (kg/yr)[2]	
CSOs	0.013 to 0.088
Stormwater	0.055 to 0.092
Total	0.068 to 0.18

Notes:
With the exception of gas ebullition, information regarding annual load estimates and ranges is provided in Section 6.5 of the *Remedial Investigation Report* (Anchor QEA 2023).
Incomplete information for other COCs evaluated as part of the East Branch CSM precludes these calculations because they were not measured as extensively as the three focus COCs of the RI (i.e., Total PAH [17], Total PCBs, and copper).
1. Exchanges with English Kills and Newtown Creek, propwash, and degradation within East Branch are not quantified. These were evaluated as part of the draft chemical fate and transport model and will be evaluated further, as appropriate, as part of the Feasibility Study.
2. WWTP treated effluent overflow and treated groundwater effluent do not discharge to East Branch.
3. Gas ebullition loads are from Table 5-5 of the *Feasibility Study Gas Ebullition Data Evaluation Report* (Anchor QEA 2022).
4. USEPA is still evaluating lateral groundwater contaminant loads.

kg: kilogram
kg/yr: kilograms per year

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Figure A2-14b
Estimated Total PCB Mass and Loads
Conceptual Site Model
Newtown Creek RI/FS

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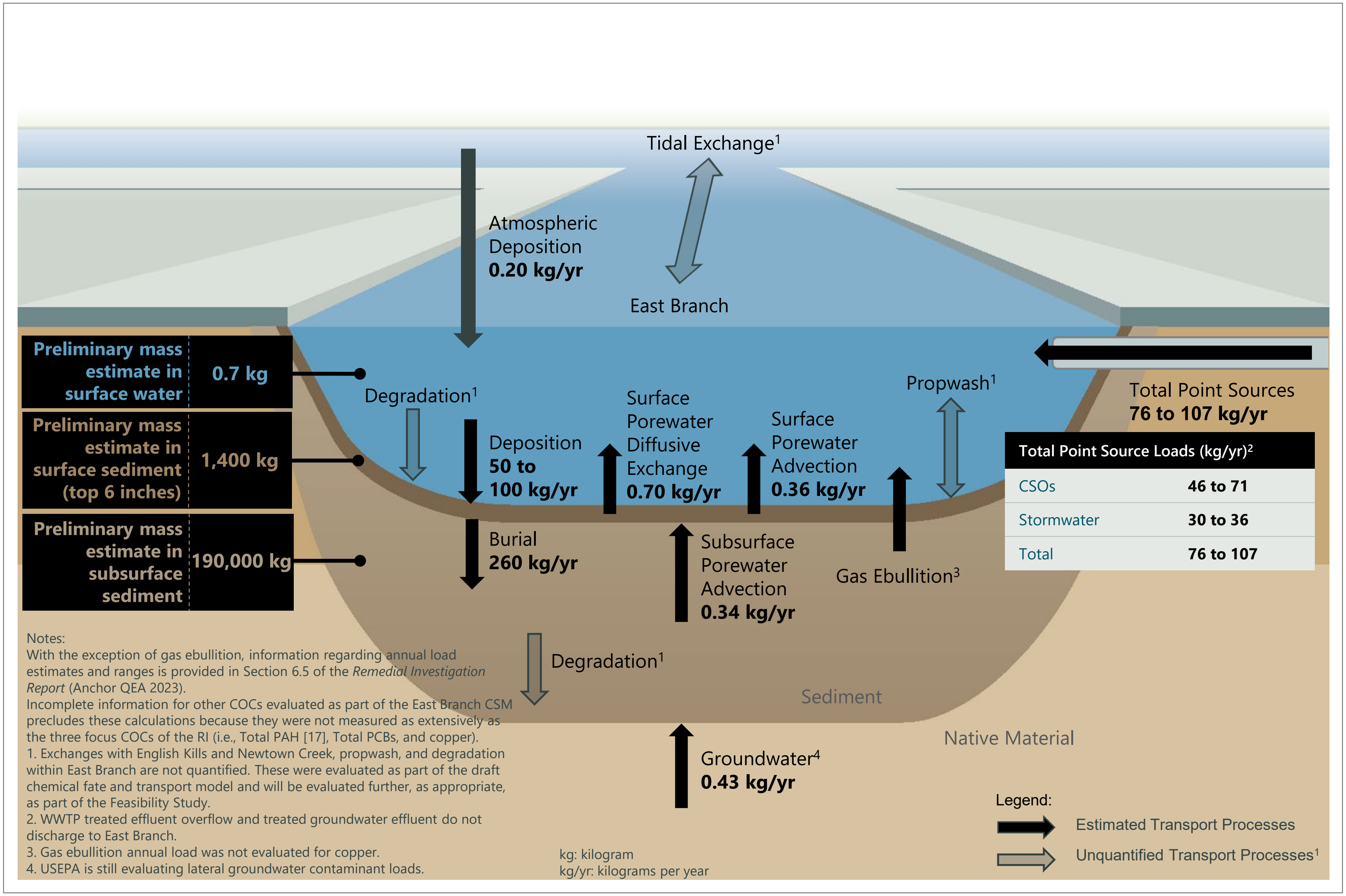

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Figure A2-14c
Estimated Copper Mass and Loads
Conceptual Site Model
Newtown Creek RI/FS

DRAFT FINAL

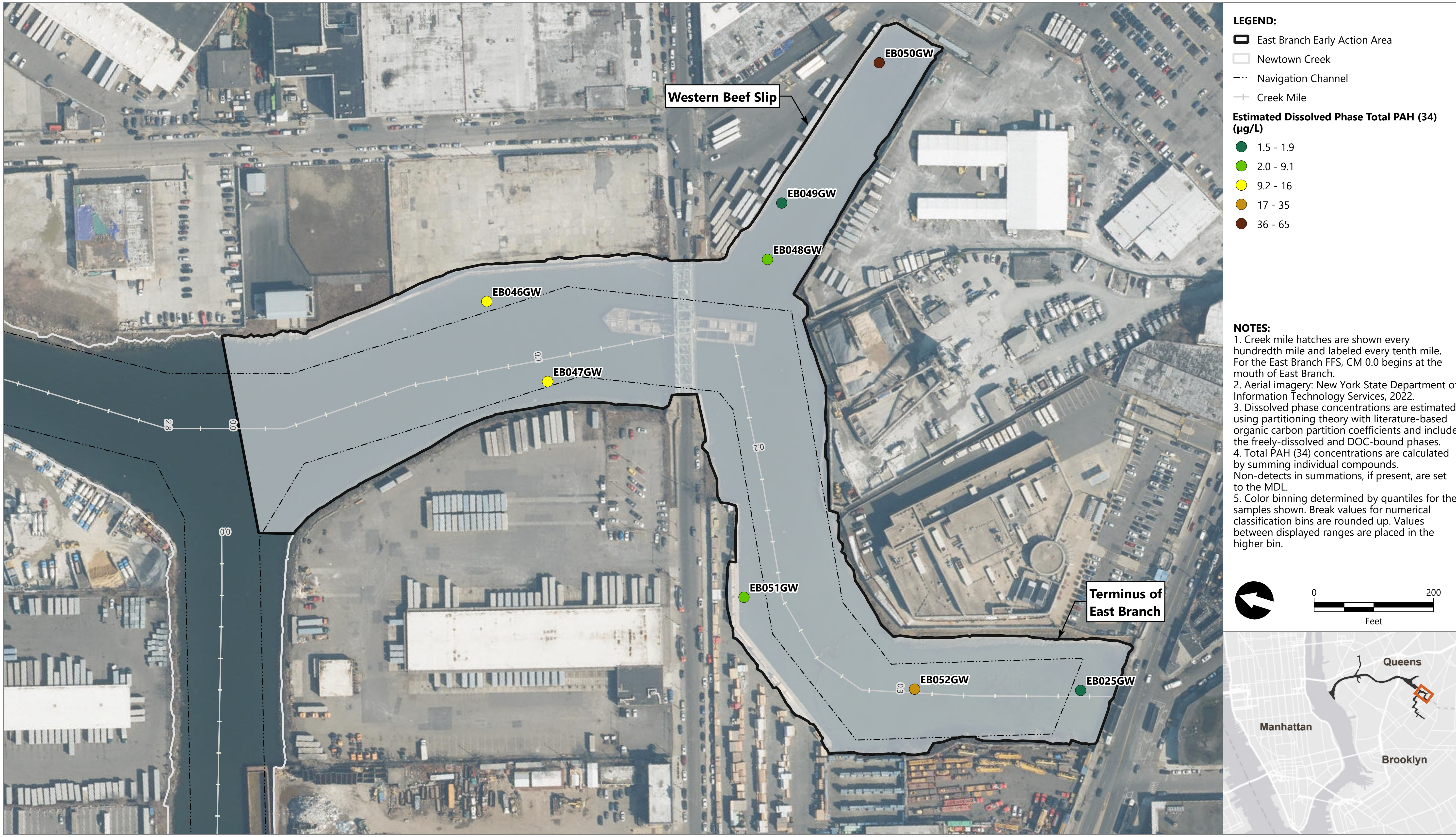

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Figure A2-15a
Estimated Dissolved Phase (Method 2) Total PAH (34) in Groundwater
Conceptual Site Model
Newtown Creek RI/FS

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FINAL

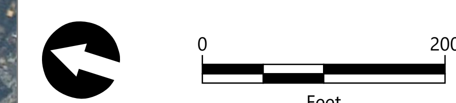
LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Estimated Dissolved Phase C19-C36 Aliphatic Petroleum Hydrocarbons (µg/L)

- 0.32 - 0.52
- 0.53 - 0.62
- 0.63 - 4.4
- 4.5 - 7.8
- 7.9 - 15

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Dissolved phase concentrations are estimated using partitioning theory with literature-based organic carbon partition coefficients and include the freely-dissolved and DOC-bound phases.
4. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.



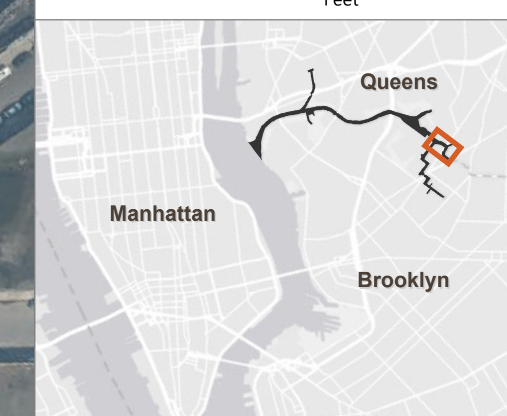


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Figure A2-15b
Estimated Dissolved Phase (Method 2) C19-C36 Aliphatic Petroleum Hydrocarbons in Groundwater
Conceptual Site Model
Newtown Creek RI/FS

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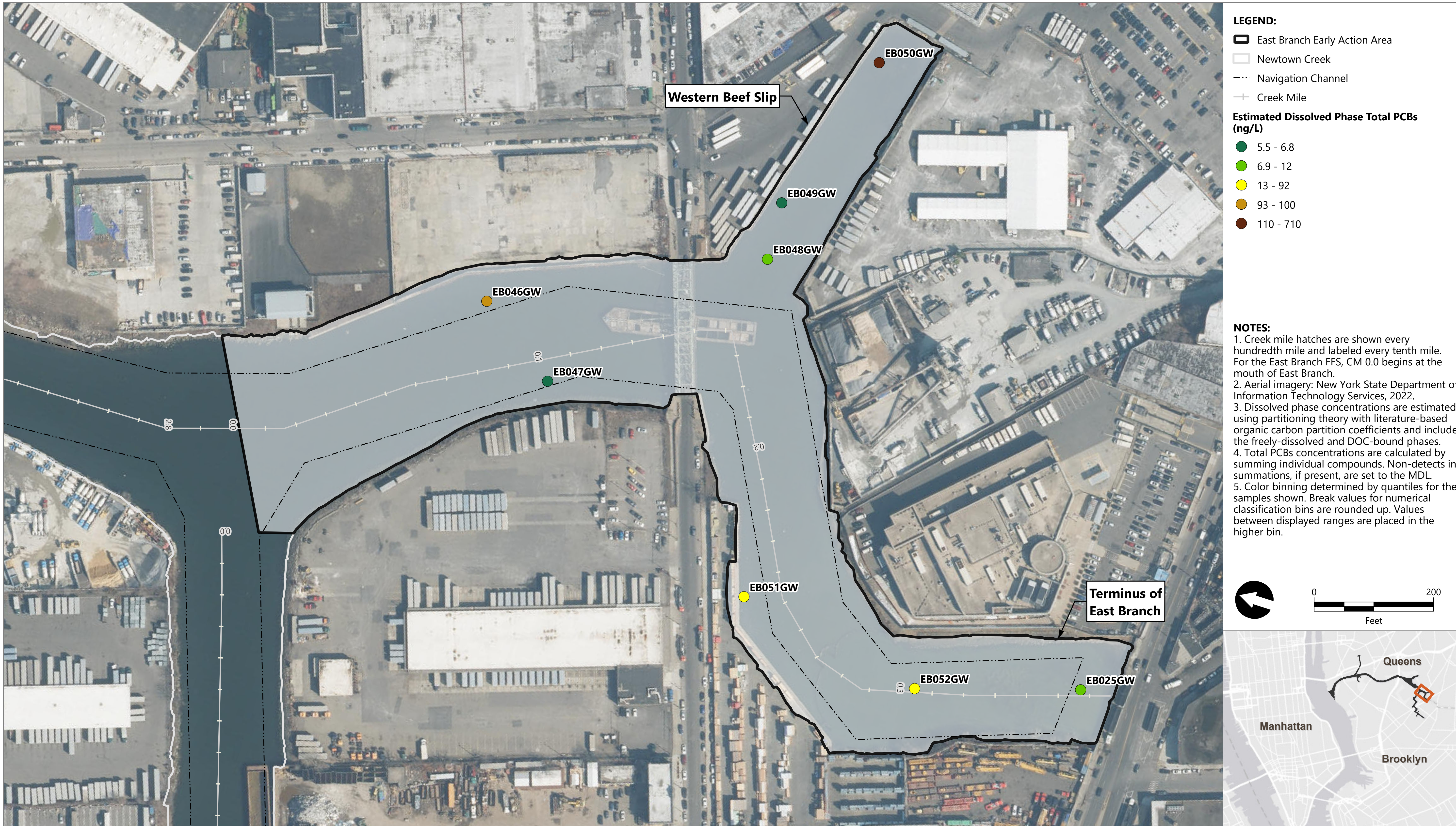

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Estimated Dissolved Phase Total PCBs (ng/L)

- 5.5 - 6.8
- 6.9 - 12
- 13 - 92
- 93 - 100
- 110 - 710

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Dissolved phase concentrations are estimated using partitioning theory with literature-based organic carbon partition coefficients and include the freely-dissolved and DOC-bound phases.
4. Total PCBs concentrations are calculated by summing individual compounds. Non-detects in summations, if present, are set to the MDL.
5. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

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Figure A2-15c
Estimated Dissolved Phase (Method 2) Total PCBs in Groundwater
Conceptual Site Model
Newtown Creek RI/FS

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LEGEND:
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Dissolved Copper (µg/L)
- 0.26
- 0.27 - 2.0
- 2.1 - 2.6
- 2.7 - 19

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200
Feet

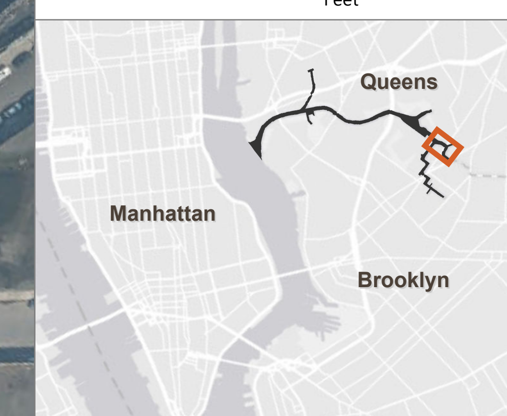

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Figure A2-15d
Dissolved Copper in Groundwater
Conceptual Site Model
Newtown Creek RI/FS

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FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Dissolved Lead (µg/L)

- 0.12 - 1.7
- 1.8 - 2.0
- 2.1 - 14

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Non-detects, if present, set to the MDL.
4. Totals reported using Kaplan-Meier, if applicable.
5. Color binning determined by quantiles for the samples shown. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

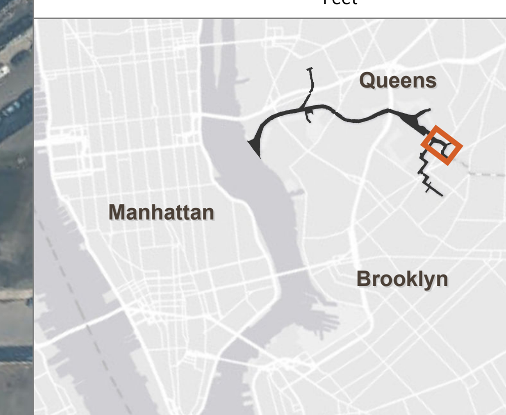

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Figure A2-15e
Dissolved Lead in Groundwater
Conceptual Site Model
Newtown Creek RI/FS

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Figure A2-16
Maximum Spatial Extent of Gas Ebullition Associated Dynamic Sheens
Conceptual Site Model
Newtown Creek RI/FS

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Figure A2-17
1991 to 2012 Differential Bathymetry Analysis Results: Spatial Variation in Net Sedimentation Rates
Conceptual Site Model
Newtown Creek RI/FS

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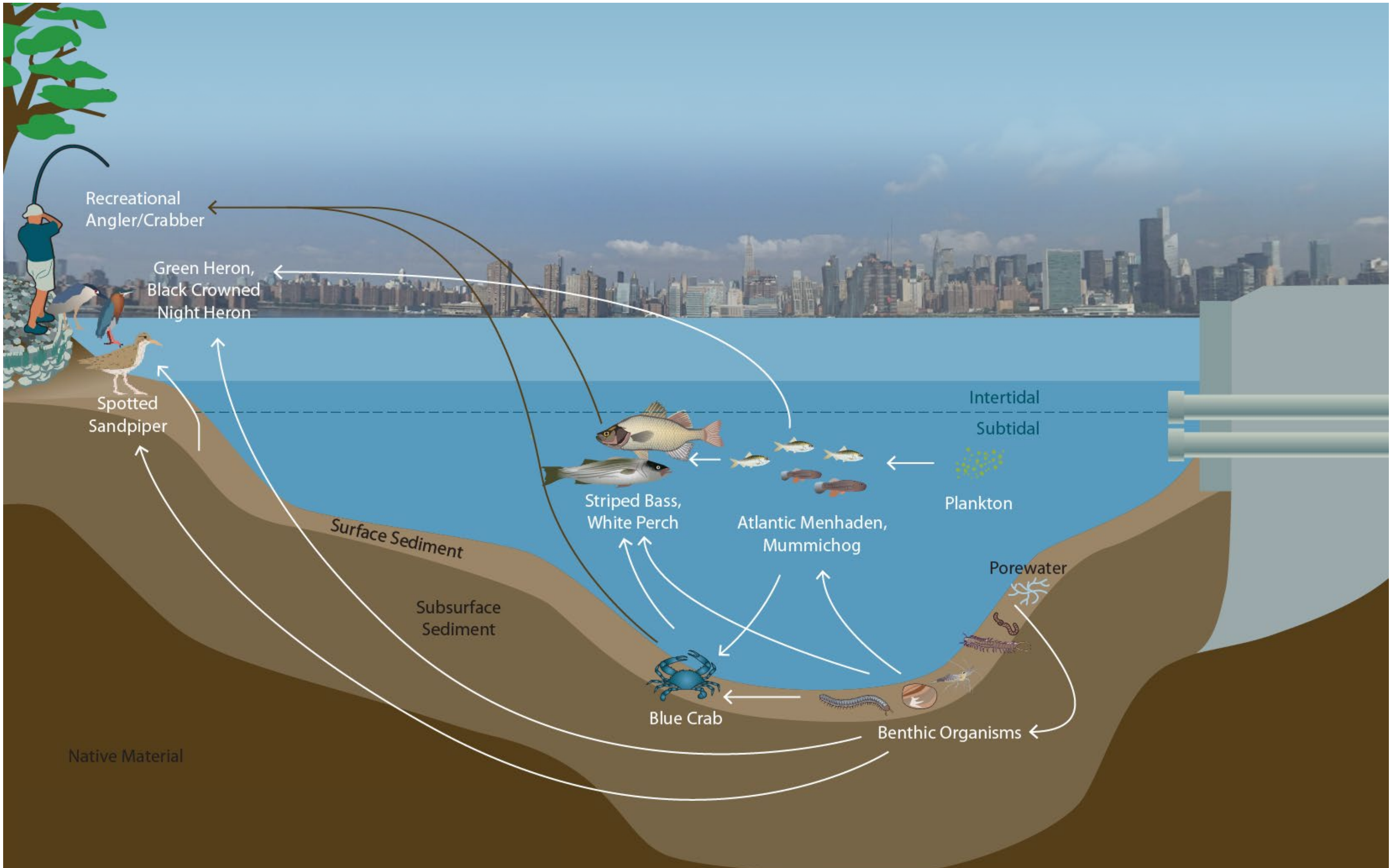

Notes:
Brown lines indicate pathways to human receptors.
Key risk receptors are those for which USEPA risk thresholds were exceeded, with the exception of Atlantic menhaden.

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Figure A2-18
Key Risk Receptors and Exposure Pathways
Conceptual Site Model
Newtown Creek RI/FS

Appendix B
Upland Sources Evaluation

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

ANCHOR QEA

Upland Sources Evaluation East Branch Early Action Focused Feasibility Study

Prepared for the Newtown Creek Group

DRAFT FINAL

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Upland Sources Evaluation East Branch Early Action Focused Feasibility Study

Prepared for
The Newtown Creek Group

Prepared by
Anchor QEA
123 Tice Boulevard, Suite 205
Woodcliff Lake, New Jersey 07677

Project Number: E41037-01.01
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TABLE

FIGURES

ABBREVIATIONS

µg/L	microgram per liter
C19-C36	C19-C36 aliphatic petroleum hydrocarbons
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	creek mile
COC	contaminant of concern
CSO	combined sewer overflow
Cu	copper
D/F	dioxin/furan
D/F TEQ	total dioxin/furan toxic equivalence quotient (mammal)
DAR	*Data Applicability Report*
DRO	diesel range organic
East Branch EA	East Branch Early Action
FFS	Focused Feasibility Study
FS	Feasibility Study
LTE	long-term equilibrium
LTE Report	*Interim Estimates of Post-Remedy Surface Sediment Concentrations*
MG/year	million gallons per year
MS4	municipal separate storm sewer system
NAPL	nonaqueous phase liquid
ng/L	nanogram per liter
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
ONPSI	Other Non-Point Sources Inventory
OHWM	ordinary high water mark
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCB	polychlorinated biphenyl
RD	remedial design
RI	Remedial Investigation
RI Report	*Remedial Investigation Report*
RI/FS	Remedial Investigation/Feasibility Study
SVOC	semivolatile organic compound
TPAH (17)	total polycyclic aromatic hydrocarbon (17)
TPAH (34)	total polycyclic aromatic hydrocarbon (34)
TPCB	total polychlorinated biphenyl

TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency

1 Introduction

The current distribution of contaminants in the sediments of the Newtown Creek Study Area, including East Branch[1], is due to historical and ongoing sources, historical and ongoing chemical fate and transport processes, and changes in contaminant loads over time.[2] As such, the locations of impacts observed today cannot necessarily be directly linked to proximate upland sites or sources, including point sources. Contaminants can enter East Branch from multiple pathways, including transport processes that act as sources internal to Newtown Creek, as well as external sources. External sources to East Branch are presented in Section 2.4 of Appendix A of the East Branch Early Action (East Branch EA) Focused Feasibility Study (FFS), and this appendix describes the results of the evaluation of the ongoing upland external sources (also generally referred to as upland sources) to East Branch.

Known ongoing sources that are determined to have a high probability of adversely impacting the remedy or are found during post-remedy implementation to be adversely impacting the remedy will need to be controlled. For purposes of determining what regulatory mechanism is best suited to controlling ongoing sources, the U.S. Environmental Protection Agency (USEPA) has defined three categories of sources to East Branch and the Study Area in general: internal, external, and internal/external interface sources. Ongoing sources to East Branch are generally described in this FFS as “ongoing external sources” or “upland sources” (see also Section 3.4.2 of the FFS and Section 2.4 of Appendix A). The categorization of individual ongoing sources will be evaluated based on additional information collected during a pre-design investigation and considered during the remedial design (RD) and long-term remedy evaluation monitoring.

1.1 Purpose of the Upland Sources Evaluation

The purpose of this upland sources evaluation is twofold: 1) provide updated information on ongoing external sources to East Branch that have been characterized during the Operable Unit (OU) 1 Remedial Investigation/Feasibility Study (RI/FS) process; and 2) evaluate to the extent possible any currently uncharacterized discharges to East Branch that may affect remedy design, implementation, and performance; this will allow the USEPA to determine whether response actions need to be taken before, during, or after remedy implementation to ensure that remedy performance is not adversely impacted by any of these currently uncharacterized sources. In addition, understanding whether there are potentially important but as yet uncharacterized ongoing upland sources to East Branch is important for gaining a better understanding of whether post-remedy conditions may differ from conditions that are characterized based on currently available data and predictions.

As described in the draft report titled *Interim Estimates of Post-Remedy Surface Sediment Concentrations* (LTE Report; Anchor QEA 2024) and Section 3.4.2 of the FFS, a spreadsheet model was developed to

[1] “East Branch” is used interchangeably with “East Branch Early Action Area” in this Focused Feasibility Study (FFS).
[2] The term “Study Area” in this FFS refers to the OU1 Newtown Creek Study Area.

quantify ongoing external inputs to the Study Area and estimate future post-remedy long-term equilibrium (LTE) surface sediment concentrations for contaminants of concern (COCs; Anchor QEA 2024). These LTE surface sediment concentrations represent interim estimates of long-term, site-specific, surface sediment COC concentrations in Newtown Creek years to decades after a remedy is implemented and are an important consideration given the Study Area's urban setting. USEPA has evaluated the LTE model and adopted it for use (with some modifications) in developing ranges of LTE concentrations for the project. Although interim LTE concentration estimates for Newtown Creek have not yet been finalized by USEPA, and notwithstanding the fact that these estimates will change as new information becomes available, the draft values for East Branch documented in the LTE Report are being used for the purposes of this FFS. Understanding whether there is the potential for significant but as yet uncharacterized sources to change these LTE concentration estimates is an additional purpose for the evaluation included in this appendix. As such, details on the information used to estimate LTE concentrations for specific source pathways are also provided in this appendix.

Consistent with the East Branch EA FFS, the discussions of sources focus on the Feasibility Study (FS) COCs (total polycyclic aromatic hydrocarbon [34] [TPAH (34)], total polychlorinated biphenyl [TPCB], copper [Cu], total dioxin/furan toxic equivalence quotient [mammal] [D/F TEQ], C19-C36 aliphatic petroleum hydrocarbons [C19-C36], and lead [Pb]) to evaluate sources for which sufficient data are available. Potential ongoing external source pathways to East Branch evaluated in this appendix include the following:[3]

- Point sources and overland flow that discharge to the surface water
- Bank erosion
- Groundwater that discharges to the subsurface sediment from the underlying native material and from the upland Fill Unit in areas of sloping permeable shorelines (riprap and natural ground)
- Groundwater that directly discharges into the water column from the upland Fill Unit at submerged vertical permeable shorelines (i.e., lateral discharge)
- Shoreline and bulkhead seeps

1.2 Appendix Organization

This appendix is organized as follows:

- **Section 2** – Sources of Information
- **Section 3** – Upland Sources Evaluation
- **Section 4** – References

[3] Two additional pathways—overwater activities and atmospheric deposition—were previously evaluated in the *Remedial Investigation Report* (RI Report; Anchor QEA 2023a) and per Section 8.5.2.4 of the RI are not considered significant ongoing sources to the Study Area. Therefore, those pathways are not further evaluated in this appendix.

2 Sources of Information

The sources of information for this upland sources evaluation include information gathered during, and documented in, the draft *Data Applicability Report* (DAR; Anchor QEA 2012a) and the *Remedial Investigation Report* (RI Report; Anchor QEA 2023a), as well as additional information gathered subsequent to those documents as part of the FS. The information used in the upland sources evaluation is compiled and summarized in Table B2-1. Throughout this appendix, when discussing individual upland properties, the common name of the property (as included in the first column of Table B2-1) is used.

Preliminary evaluations of upland sources pathways at select upland sites (DAR sites) were presented in the draft DAR. Following the submittal of the draft DAR in 2012, further evaluations were conducted to develop the Other Non-Point Sources Inventory (ONPSI) for both DAR and non-DAR sites, which was submitted to the USEPA in November 2014 as part of the *Draft Sources Sampling Approach Memorandum* (Anchor QEA 2014a). Additional information, including observations from wet-weather surveys conducted between December 2012 and June 2013, was used to update the ONPSI (Anchor QEA 2012b).

The draft DAR and ONPSI provide summaries of the historical data collection, the review and evaluation of historical documentation, as well as the collection and evaluation of pre-existing documents and data from upland areas adjacent to the Study Area. Environmental data were compiled and evaluated to help identify potential sources to the Study Area. These data were primarily gathered from regulatory databases, including those maintained by the New York State Department of Environmental Conservation (NYSDEC), New York City Department of Environmental Protection (NYCDEP), and USEPA.

Section 5 of the RI Report provides a comprehensive discussion of sources to the Study Area and how the contaminant loads associated with the different sources were developed. Source evaluations and data collection from the RI Report applicable to each upland source pathway are summarized in Section 3 of this appendix.

In addition, data, observations, and evaluations from certain studies performed outside of the RI/FS process, which have not been formally reviewed and approved by USEPA, were used to further inform this sources evaluation. Specifically, information from studies of seeps performed by NYSDEC (HRP 2022, 2023) and NYCDEP (2020) described in Section 3.4 was considered in this evaluation.

3 Upland Sources Evaluation

COCs released to environmental media (surface water, groundwater, or soil) may migrate via various pathways to East Branch. The pathways described in the following sections provide potential mechanisms capable of transporting COCs from an upland site to East Branch surface water or sediment. To evaluate each pathway, criteria for each pathway were applied at each upland site to assess the viability of that pathway to transport COCs from the upland site of interest to East Branch. The evaluation also makes use of the current LTE modeling results to help contextualize the relative magnitude of quantified sources.

Table B2-1 summarizes key source information, which is also described in Sections 3.1 through 3.4. Upland site locations (using the common names of properties) are shown in Figure B3-1.

3.1 Point Sources and Overland Flow

Solids and chemical loads that enter the Study Area from point source discharges and overland flow represent important ongoing sources to Newtown Creek. Point source discharges (including overland flow) were well characterized (both in terms of flows and COC concentration) during the RI as further discussed in this section.

3.1.1 Information from the RI on Point Sources and Overland Flow

The Remedial Investigation (RI) point sources sampling program was developed based on the characteristics of the stormwater and sewersheds that currently drain into the Study Area via private and municipal outfalls and as overland flow. The approach is based on an extensive review and analysis of available site-specific information, including permit documentation and monitoring data for regulated discharges; technical reports; a watershed model developed by NYCDEP for Clean Water Act compliance (NYCDEP 2015 geo-neutral point source model); an evaluation of historical and current land use; Phase 1 RI data; and shoreline surveys conducted during dry and wet weather for the Study Area. Information gathered during reconnaissance at proposed point source sampling locations served to refine the approach (Anchor QEA 2023a).

The characteristics of point source discharges to the creek may vary, with the possibilities ranging from a small volume discharge with a high concentration of contaminants to a large volume discharge with a low concentration of contaminants. Although there are numerous outfalls along the creek, a small number of these outfalls may contribute a large portion of the volumetric flow, or a large portion of the contaminant loading (or both) discharged to the creek. The RI point sources sampling approach prioritized direct measurement of concentrations from discharges contributing the largest percentage of the overall point sources flow volume to the creek, focusing on those discharges that likely contribute the greatest percentage of the contaminant load to the Study Area and minimizing the percentage of unsampled flow from discharges.

In the East Branch, there are 2 combined sewer overflows (CSOs), 2 municipal separate storm sewer system (MS4) outfalls, and approximately 35 other stormwater outfalls[4] that discharge an estimated 640 million gallons of combined sewage and stormwater to East Branch each year (see Appendix E of the RI Report). An inventory of known current point source discharges and overland flow discharges associated with or adjacent to each upland site in East Branch is presented in Table B2-1. COC concentrations from ongoing discharges from the different categories of point sources are shown in Section 5.1 of the RI Report. Direct sampling was conducted of discharges representing 85% of the total estimated volume of annual point sources discharge and overland flow to East Branch (see Figure B3-2). Estimated annual discharges to East Branch for each category and the percent of discharges that were directly sampled (defined as characterized) are summarized as follows:

- Two CSO outfalls with an estimated discharge volume of 490 million gallons per year (MG/year); one discharge (NCB-083) representing 99% of the total CSO discharge volume to East Branch was directly sampled
- Two MS4 outfalls with an estimated discharge volume of 88 MG/year[5]; one discharge (NCB632) representing 65% of the total estimated stormwater discharge volume from MS4 outfalls to East Branch was directly sampled
- Approximately 35 other stormwater discharges, as well as overland flow, with an estimated combined discharge volume of 62 MG/year; one discharge (MCL001) representing 4.4% of the total estimated stormwater discharge volume from non-MS4 stormwater outfalls to East Branch was directly sampled

3.1.2 LTE Point Source Evaluation

The current LTE input values for point sources were based on the estimated particulate phase COC concentrations for the RI Phase 2 point sources sampling program data for each of the point source types: CSOs, MS4s, stormwater and direct drainage, and wastewater treatment plant treated effluent overflow. The preliminary results of the LTE evaluation show that CSO and stormwater discharges are the largest COC contributors to overall estimated interim LTE concentrations in East Branch. Figure B3-3 shows the relative contributions to the overall estimated interim LTE concentrations for TPAH (34), TPCB, Cu, D/F TEQ, and C19-C36 from each individual ongoing external input included in the calculations, including point sources.

[4] Outfall information is based the point source inventory process completed during the RI as documented in Section 2.1.2 of Appendix E of the RI Report. Some outfalls may be abandoned or no longer in use. There are no individually permitted discharges that discharge directly to East Branch.

[5] Sampling location NCQ633 was sampled once before being removed from the sampling program so is not included in the percentage of sampled discharges.

3.1.3 Point Source Pathway Conclusion

East Branch point source data (discussed in Section 3.1.1) and the evaluation of point sources within the context of the LTE modeling results (discussed in Section 3.1.2) were used to evaluate whether currently uncharacterized discharges to East Branch would be expected to affect remedy design, implementation, and performance.

Point sources are the largest COC contributor to overall estimated interim LTE concentrations in East Branch, so they will be an important consideration in understanding post-remedy concentrations in East Branch. Approximately 85% of the point source and overland flow discharge volume to East Branch has been characterized. The remaining 15% of point source discharge volume consists of approximately 40 outfalls that emanate from properties that have similar use characteristics as those for which the outfalls were sampled, so it is not expected that the unsampled discharges have the potential to adversely affect remedy design, implementation, or performance—or create the need for adjustments to the current interim LTE estimates for East Branch.

As discussed in Section 5.3.7 of the FFS, it will be important to design a monitoring program that can confirm the selected remedy is functioning as intended while distinguishing remedy performance from inputs of COCs from ongoing external sources such as point sources in East Branch and contaminant migration from other portions of Newtown Creek.

Furthermore, additional sampling of point source discharges to East Branch is planned as part of the OU2 Monitoring Program (HDR 2022); OU2 refers to the current and future discharge of OU1 COCs from CSOs to the Study Area. Per a 2022 Administrative Order on Consent between USEPA and NYCDEP (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. CERCLA-02-2022-2003), NYCDEP plans to collect samples from all of the point sources sampled in the RI (including the largest CSO [NCB-083], the two MS4s [NCQ-632 and NCQ-633], and one stormwater discharge [MCL001]). As of June 2024, the NYCDEP OU2 sampling is scheduled to begin in summer 2024.

3.2 Bank Erosion

For purposes of the evaluation of upland sources, bank erosion refers to bank soils that have the potential to erode into East Branch and that are located beyond the limits of the Study Area, at an elevation that is higher than the ordinary high water mark (OHWM) to top of bank. In contrast, shoreline erosion (evaluated as a source pathway in the RI; see Section 3.2.1) refers to soil or sediment that is within the limits of the Study Area (i.e., at an elevation below OHWM, including the intertidal zone) and would be accounted for and addressed as appropriate as part of any of the five potential in-water remedial alternatives for East Branch, as detailed in Section 5.2 of the FFS.

The RI documented where potentially erodible banks and shorelines exist through multiple surveys conducted throughout the Study Area, including East Branch. Although areas of bank erosion were not directly sampled during the RI (because these areas are outside of the OU1 Study Area), areas of shoreline erosion (within the Study Area) were characterized during the RI, and the data collected for areas with shoreline erosion were used in the LTE evaluation to approximate concentrations for areas with bank erosion, as discussed in the remainder of this section.

3.2.1 Information from the RI on Bank Erosion

During the FS Part 1 field program, 35 shoreline sediment and in-water surface sediment samples near potentially erodible shorelines were collected below the OHWM, with three shoreline sediment and two in-water sediment locations in East Branch. These data were collected to supplement RI shoreline sediment data that had already been collected as part of the Phase 1 and 2 programs, where a total of 59 surface sediment samples were collected from eroding shoreline areas throughout the Study Area, with 7 samples collected within East Branch. Therefore, a total of 12 sediment samples were collected in (or near) potentially erodible shorelines in East Branch. The COC concentrations in shoreline or surface sediment in (or near) eroding shoreline sites in East Branch are documented in Table B2-1.

The shoreline surface sediment results for total polycyclic aromatic hydrocarbon (17) (TPAH [17]),[6] TPCB, and Cu collected during the RI and Part 1 of the FS field activities within East Branch are discussed in Section 5.4.2 of the RI Report and summarized as follows:

- TPAH (17) and TPCB shoreline surface sediment concentrations fall within the range of (or are lower than) other surface sediment data in East Branch (Figures 5-40 and 5-41 of the RI Report).
- Cu shoreline surface sediment concentrations ranges are generally consistent with (or are higher than) other surface sediment data in East Branch. However, shoreline sediment sample results are both higher and lower than nearby surface sediment data in localized areas (Figure 5-42 of the RI Report).

The RI Report did not evaluate bank erosion (above the OHWM), and COC data from bank soils located above the OHWM were not readily available, as they were located outside the Study Area. As such, data collected within or near shorelines below the OHWM were used to estimate COC loadings from bank erosion as part of the LTE evaluation, as described in Section 3.2.2.

[6] TPAH (17), TPCB, and Cu were used for the evaluations of sources, fate and transport, and the quantitative aspects of the conceptual site model in the RI Report, so these COCs are presented here.

Information from shoreline surveys conducted during the RI was used to categorize the potential for bank erosion (above the OHWM) to impact East Branch. The results of that evaluation are included in Table B2-1 and summarized as follows:

- The bank erosion pathway is incomplete (i.e., not occurring) at Grand Street Bridge, Metropolitan Avenue, Natmi Truck Terminals, and Pebble Lane Associates
- Bank erosion may be occurring above OHWM in isolated locations at Maspeth Concrete Loading Corp., LDT Enterprises/B&H Equipment Rental, and Department of Small Business – 47th Street
- Potential for isolated, small areas of bank erosion exists at Amboy Bus Co., MTA – New York City Transit, and Mione Transit Mix/Atlantic Hoist and Scaffolding
- Medium or high potential for bank erosion to occur due to deteriorated and/or collapsed bulkheads exists at Western Beef Properties and Feldman Metropolitan

3.2.2 LTE Bank Erosion Evaluation

Bank erosion above the OHWM was quantified in the LTE model, as described in Section 3.1.3.3 of the LTE Report (Anchor QEA 2024). Two percent of the shoreline in East Branch was identified as containing potentially erodible banks.[7] Western Beef Properties and Feldman Metropolitan have the highest potential for erosion (see Figure B3-4). Bank erosion information from the LTE evaluation for each upland site along East Branch is documented in Table B2-1.

The LTE evaluation (Anchor QEA 2024) demonstrated that bank erosion was a relatively small contributor to the overall current LTE concentrations in East Branch. Figure B3-3 shows the relative contributions to the overall estimated interim LTE concentrations for TPAH (34), TPCB, Cu, D/F TEQ, and C19-C36 from each individual ongoing external input included in the calculations, including bank erosion.

3.2.3 Bank Erosion Pathway Conclusion

The shoreline and bank erosion pathway evaluations documented in the RI Report (discussed in Section 3.2.1) and the evaluation of bank erosion from the LTE modeling (discussed in Section 3.2.2) were used to evaluate whether currently uncharacterized potentially erodible banks adjacent to East Branch would be expected to affect remedy design, implementation, and performance.

Bank erosion is a relatively small COC contributor to overall estimated interim LTE concentrations in East Branch, so this pathway is not likely to be an important consideration in understanding post-remedy concentrations in East Branch. Importantly, the LTE evaluation used data collected in and near potentially erodible shorelines because there are no data available from potentially erodible banks outside the Study Area. Nevertheless, the overall conclusion of the bank erosion pathway is that it should not adversely impact remedy design, implementation, or performance for the following reasons: 1) There are eight

[7] A bank was identified as potentially erodible in the LTE Report (Anchor QEA 2024) if it had a medium or high erosion potential and the bank or bulkhead was deteriorated.

bank areas at six sites with a medium or high potential of bank erosion in East Branch, but only two of those areas have deteriorated bulkheads or shorelines that could cause potential erosion concern; and 2) the contributions from bank erosion to LTE concentrations are relatively low.

3.3 Native Material Groundwater

Native material groundwater refers to discharge of groundwater to the base of the Study Area (i.e., from native material into subsurface sediment). This pathway was well characterized in the RI in terms of both flow and COC concentration, although there is some uncertainty in the data collected relative to its use for RD.

3.3.1 Information from the RI on Native Material Groundwater Discharge

Chemical loads associated with groundwater discharge to the base of the Study Area were quantitatively evaluated for 56 segments along the Study Area as part of the RI, with 10 segments and 8 groundwater sample locations in East Branch (see Figure 6-1c of the RI Report). The estimated annual loads of TPAH (17), TPCB, and Cu[8] via groundwater discharge from the native material to subsurface sediment in the Study Area are shown in Figures 5-26a through 5-28 of the RI Report. Information on these calculations and the results are described in Section 5.2.2 and Appendix F of the RI Report.

3.3.2 LTE Native Material Groundwater Evaluation

Groundwater contamination, where present, is an ongoing source of dissolved COCs from the native material to subsurface sediment, where it can affect sediment concentrations via transport through the interstitial spaces (as porewater) and sorption onto the solid matrix. Groundwater contamination is attenuated within the subsurface sediment as it moves upward as porewater[9] into the surface sediment. The annual COC load from porewater advection vertically entering the surface sediment from the subsurface sediment is a fraction of the COC load entering subsurface sediment from native groundwater (due to attenuation) and was based on the groundwater seepage rates (see Section 5.2.1 of the RI Report) and the measured porewater COC concentrations just below the surface sediment. The COC loads from porewater advection were quantified in Section 6.4 of the RI Report (Anchor QEA 2023a) and Section 3.1.3.5 of the LTE Report (Anchor QEA 2024).

It was assumed for the purposes of the LTE evaluation that the entire footprint of East Branch would be remediated (e.g., through some combination of technologies such as capping and/or dredging) such that contaminant loads from porewater advection to the post-remedy surface sediment would be effectively zero. Therefore, porewater advection loads were set to zero in the LTE calculation.

[8] TPAH (17), TPCB, and Cu were used for the evaluations of sources, fate and transport, and the quantitative aspects of the conceptual site model in the RI Report, so these COCs are presented here.
[9] Once groundwater from the native material enters the subsurface sediment, it is referred to as porewater.

3.3.3 East Branch Focused Feasibility Study Capping Evaluation and Native Groundwater

As further documented in Appendix C of the FFS, modeling was performed to evaluate the feasibility of capping in East Branch. This modeling included a scenario for removal down to the native material surface (e.g., Alternative EB-F) to evaluate the need for an amended cap to address COCs in groundwater beneath the Study Area sediment. A sensitivity analysis was conducted to identify threshold groundwater COC concentrations above which an amended cap may be needed if placed directly on native material. Based on the modeling results detailed in Section 3.1.4.2 of Appendix C of the FFS, areas of East Branch with native groundwater concentrations greater than estimated thresholds of 12 nanograms per liter (ng/L) TPCB and/or 65 micrograms per liter (µg/L) TPAH (34) would need an amended cap if sediment was removed down to the native material contact. This information for TPAH (34) and TPCB is depicted in Figures B3-5 and B3-6. As discussed in Sections 5.2.4, 5.2.5, and 5.2.6 of the FFS, Alternatives EB-D, EB-E and EB-F conservatively include an amended cap (rather than a sand backfill layer) in these areas after removal down to native material. The remaining COCs (D/F TEQ, C19-C36, Cu, and Pb) exhibit lower mobility and/or concentrations such that they would not require an amended cap. There are uncertainties in this analysis, so it is considered conceptual and would be further refined during RD if a remedy that includes sediment removal down to the native material interface is selected anywhere in East Branch.

3.3.4 Native Material Groundwater Pathway Conclusion

The evaluation of the native material groundwater pathway takes into account groundwater present in the portion of native material beneath upland sites that ultimately discharges to the Study Area sediment using the following information: 1) upland site native material groundwater COC concentration data (as available, but none was available in East Branch); 2) groundwater seepage rates and COC concentrations measured in native material groundwater below the Study Area collected during the RI (discussed in Section 3.3.1); and 3) the East Branch FFS capping evaluation (summarized in Section 3.3.3).

The overall conclusion of the native material groundwater pathway is that the in-creek remedy will account for this pathway, and it should not adversely impact remedy success; however, it is a pathway that will need to be further evaluated as part of RD. The reason for this is that based on the FFS capping evaluation results, areas of East Branch with threshold concentrations greater than 12 ng/L TPCB and/or 65 µg/L TPAH (34) in native groundwater may require an amended cap if the full thickness of overlying sediment is removed. This information for TPAH (34) and TPCB is depicted in Figures B3-5 and B3-6. As discussed in Sections 5.2.5 and 5.2.6 of the FFS, Alternatives EB-D, EB-E, and EB-F include an amended cap (rather than a sand backfill layer) in these areas after removal down to native material. Sites adjacent to areas with native groundwater concentrations greater than these threshold concentrations may be contributing to the elevated COC concentrations observed in native groundwater.

3.4 Lateral Groundwater and Seeps

As discussed in Section 1.1, lateral groundwater discharge is defined as groundwater within the upland Fill Unit that directly discharges into the water column at submerged vertical permeable shorelines. Lateral groundwater may contribute COCs to surface water, which could then sorb to suspended solids, a portion of which deposits onto the sediment bed, and thereby can serve as an ongoing source of COCs to the Study Area.

Seeps can occur within the Study Area as shoreline seeps, which are defined as fluid emerging from the shoreline, or bulkhead seeps, which are defined as fluid observed flowing out from bulkheads around joints, bolts, cracks, or holes. These two localized discharges of fluids are collectively referred to as "seeps" hereinafter. Seeps also represent potential ongoing COC sources to the Study Area, particularly if indications of contamination (such as visual signs of sheen, nonaqueous phase liquid [NAPL], or discoloration of surface water) are associated with a seep. Seeps may be due to a localized area of discharge of shallow groundwater, bank storage,[10] or NAPL, or a combination of these fluids. Seeps in which the fluid is NAPL are of interest due to their potential as a contaminant source, but seeps without observations of NAPL (referred to hereafter as aqueous seeps) have also been identified in surveys conducted to date and may also be a source of dissolved phase COCs to the surface water. An aqueous seep may merely be a localized area where lateral groundwater discharge is readily observable or flowing at a relatively higher rate due to heterogeneity in the geological properties of the bank or shoreline materials. Aqueous seeps observed at low tide conditions may result from bank storage or lateral groundwater discharge, or a combination of both.

The subsections that follow summarize the available data and evaluations of lateral groundwater and seeps as sources of COCs to the East Branch, with a focus on the extent to which they may impact the Early Action remedy. The RI Report evaluated lateral groundwater and seeps separately. However, this upland sources evaluation evaluates them collectively, given that the LTE evaluation considered these two inputs together, and given that aqueous seeps may represent localized areas of observable lateral groundwater discharge, as mentioned previously.

3.4.1 Information from RI/FS Studies on Lateral Groundwater and Seeps

3.4.1.1 Lateral Groundwater Discharge

3.4.1.1.1 RI Report

The RI groundwater evaluation included estimation of groundwater discharge associated with shallow lateral groundwater flow through vertical permeable shorelines. These discharge rates were added to the discharge from the base of sediment within corresponding segments to estimate total

[10] Seeps due to bank storage occur when creek water that inundates fill materials, natural soils, gaps, or voids behind bulkheads during high tide drains back to the creek via gravity when the tide recedes.

groundwater discharge in the RI. Cross-sectional flow modeling was conducted to identify the representative magnitude of lateral groundwater discharge through vertical permeable shorelines. Groundwater discharges in portions of the Study Area bordered by other permeable shorelines or barrier shorelines were characterized via in-creek seepage meter measurements, as well as paired hydraulic gradient and hydraulic conductivity measurements. The primary shoreline type in East Branch is vertical permeable shorelines, through which lateral groundwater could flow. Shoreline types are shown in Figures B3-5 and B3-6.

In the RI, the manifestation of potential COC loadings from lateral groundwater flow was evaluated by examining if there were changes in surface water quality data that would indicate a lateral source of loading from segments that may have a notable lateral flow component. The RI Report presented a qualitative assessment of surface water quality in areas interpreted to have relatively high lateral groundwater discharge (see Section 6.4 of Appendix F of the RI Report). Lateral groundwater discharges were evaluated as part of the RI and found to have little to no overall impact on surface water quality, although it is noted that USEPA is performing a sampling program to further evaluate this pathway (see Section 3.4.1.1.2).

3.4.1.1.2 USEPA Lateral Groundwater Investigation

USEPA is implementing a field program with the objective of improving the understanding of and better quantifying shallow lateral groundwater discharge to the Study Area, including East Branch (CDM Smith 2022). This program includes the following components:

- Reviewing existing information to select locations for installing a network of monitoring wells and tide gauges
- Performing long-term water level monitoring, slug and specific capacity testing, and groundwater velocity measurements
- Collecting groundwater samples from monitoring wells to characterize contaminant concentrations in shallow groundwater[11]
- Performing a seep survey and collecting aqueous and NAPL seep samples, if observed, to characterize contaminant concentrations[11]

Four locations within East Branch are included in the USEPA study. These locations are situated within the Western Beef Properties, Maspeth Concrete Loading Corp., MTA-New York City Transit, and Natmi Truck Terminals sites. USEPA is currently implementing the field program and anticipates that the last set of results from this sampling program will be available in June 2024.

[11] Samples are being analyzed for TPAH (34), semivolatile organic compounds (SVOCs), extractable petroleum hydrocarbons, volatile petroleum hydrocarbons, TPCB, dioxin/furan (D/F), metals, total dissolved solids, total suspended solids (TSS), total organic carbon, dissolved organic carbon, fluoride, and chloride.

The resulting data from USEPA's study are intended to be used to further understand lateral groundwater COC loads in the FS and be incorporated into the LTE model.

3.4.1.2 Seeps

3.4.1.2.1 RI Report

During the RI and FS field activities in East Branch, seeps were neither observed nor were there any visual indications of contamination (such as visual signs of sheen, NAPL, or discoloration of surface water) documented. As such, there were no seep samples collected from East Branch as part of the RI and FS studies; however, there were seep samples collected from other portions of the Study Area. With a few exceptions (not in East Branch), opportunistic seep samples collected as part of the FS Part 1 field program had measured TPAH (17), TPCB, and Cu[12] concentrations that were generally within the range of (or lower than) concentrations of dry weather surface water samples from the RI Phase 1 and Phase 2 field activities. This, along with review of chloride concentrations, suggests that most of the FS opportunistic seep samples from the Study Area likely represent bank storage. A few of the samples had relatively low chloride concentrations, which suggests those samples contain a volumetric component from seeps and/or lateral groundwater.

Because there were no East Branch-specific seep data collected as part of the RI or FS field activities, the data from the rest of the Study Area were used to support the LTE evaluation of seeps, as discussed in Section 3.4.3.

3.4.1.2.2 USEPA Lateral Groundwater Investigation

As part of the lateral groundwater field program being implemented by USEPA, Schmidt (2023) provided a preliminary summary of the shoreline reconnaissance and opportunistic seep samples that were collected in May 2023. A total of nine aqueous seep samples were collected in the Study Area during these efforts. Samples were analyzed for a range of analytes that included the FS COCs. NAPL was not observed at any of the seep locations. One aqueous seep was observed and sampled in East Branch.

The samples from this USEPA survey will be incorporated into future evaluations, as appropriate, once the data are available. USEPA has indicated more extensive data will be provided in a forthcoming data summary report.

[12] TPAH (17), TPCB, and Cu were used for the evaluations of sources, fate and transport, and the quantitative aspects of the conceptual site model in the RI Report so are presented here.

3.4.2 *Information Collected Outside the RI/FS*

3.4.2.1 Available Groundwater Data from Upland Sites

Additional groundwater data available from the NYSDEC Brownfield Cleanup Program were reviewed for the following three East Branch sites: Mione Transit Mix/Atlantic Hoist and Scaffolding; Amboy Bus Co.; and Pebble Lane Associates. Groundwater samples at these sites were collected from soil direct-push locations in the fill material or temporary well points with screened intervals in the fill/native contact area. Samples were analyzed for total semivolatile organic compounds (SVOCs) and metals. No polychlorinated biphenyl (PCB) analysis was performed. Available groundwater data for these sites are summarized in Table B2-1. Because it is not clear whether these data represent groundwater in the fill material (which could characterize COC concentrations of lateral discharge) or a combination of groundwater from the fill and native material, they were not evaluated further.

3.4.2.2 NYCDEP NAPL Seep Surveys

From September to December 2016, NYCDEP conducted a series of surveys during low spring tides (when there is the greatest difference between high- and low-tide elevations)[13] to identify sites where NAPL seeps were occurring. During these surveys, observers documented, photographed, and video-recorded NAPL seeps throughout the OU1 Study Area. A sampling program was then conducted during five sampling events in fall 2017 to obtain data on chemical concentrations of NAPL samples collected. NYCDEP summarized the field activities and presented the findings of these surveys and sampling events in the *2017 Upland NAPL Seep Sampling Data Summary Report* (NYCDEP 2020).

A total of 44 NAPL samples and field quality control samples were collected using a glass jar or a sheen net from NAPL seeps at 11 upland sites and from in-creek structures located in the main stem of Newtown Creek, East Branch, and English Kills. Samples were collected only from those properties and structures where NAPL seeps were documented during the sampling period. NAPL samples were analyzed for a range of analytes that included the FS COCs except for metals. The sample results were reported on a mass of analyte per unit mass of NAPL basis and therefore represent a compositional analysis of the NAPL. These sample results are not comparable with the seep measurements from the RI/FS programs (see Section 3.4.1.2), during which direct samples of aqueous seeps were collected (i.e., with results reported on a mass of analyte per volume of water basis).

In East Branch specifically, NAPL seeps were sampled at four upland properties (Feldman Metropolitan, Amboy Bus Co., Western Beef, and the East Branch Bridge).[14] Additional details and the

[13] The greatest difference between high- and low-tide elevations during spring low tides only occurs for several hours a day for a few days out of each month (twice each lunar month).

[14] Based on locations labeled as "Potential NAPL Seep" on Figure 2-1 of the NYCDEP *2017 Upland NAPL Seep Sampling Data Summary Report*, NAPL seeps may have been observed but not sampled at two other properties (Department of Small Business – 47th Street and Maspeth Concrete Loading). However, the text does not explicitly state whether NAPL seeps were actually observed at these "Potential NAPL Seep" locations.

results of the 2017 NYCDEP seep survey and sampling are provided in the *2017 Upland NAPL Seep Sampling Data Summary Report* (NYCDEP 2020). These data were not collected under a USEPA-approved work plan, so they are not part of the RI/FS dataset.

3.4.2.3 NYSDEC Upland Seep Surveys

As part of an evaluation of upland properties, NYSDEC conducted visual seep surveys and sampling over the course of three field events (August and September 2021, September 2022, and October 2022). Each visual survey was conducted during a spring low tide. This timing was correlated to a low tide when more of the shoreline area is exposed to better identify potential groundwater seeps flowing into the Study Area. Seeps that appeared to be emanating from the shoreline or from behind a shoreline structure (e.g., bulkheads) were documented and photographed so that additional observations could be attempted during a separate tide cycle. NAPL observations associated with a seep location were also documented. Text from the *Upland Site Characterization Report* (HRP 2023) indicates that aqueous seeps (with no visual observation of NAPL) were observed on multiple occasions at 42 locations within the OU1 Study Area, and NAPL seeps were observed on multiple occasions at 8 locations in 2021 and 2 locations in 2022. A total of 48 to 56 (the exact number is unclear in the report) aqueous samples of seeps (with or without visual observations of NAPL) were collected from locations where seeps were observed a second time. Samples were analyzed for a range of analytes that included the FS COCs.[15] These aqueous samples (for seep locations with or without visual observations of NAPL) were collected either from the seep fluid itself or from surface water near the seep, using a series of methods that were changed and refined with each sampling iteration. In addition, several surface water samples (referred to as background) were collected away from the shorelines and seep locations (e.g., mid-channel) to quantify existing surface water concentrations. The results of the NYSDEC study are provided in the *Upland Site Characterization Report* (HRP 2023), and a summary of observations and samples collected specifically in East Branch is as follows:

- In 2021, sheens with potential NAPL were observed on the water surface (but not sampled) adjacent to three sites in East Branch without corresponding seep observations: Department of Small Business – 47th Street (observed once), Western Beef Properties (observed twice), and Feldman Metropolitan (observed twice).
- In 2021, a seep was observed twice, and surface water near the seep was sampled adjacent to the MTA-New York City Transit site. Potential NAPL was not observed at this location. Sheen was observed approximately 10 feet away from the shoreline.

[15] The *Upland Site Characterization Report* (HRP 2023) does not present a clear summary of which of the observed seeps were sampled or the total number of samples. Therefore, the number of seep samples within the OU1 Study Area is presented as a range based on evaluating the text, tables, and figures presented in the *Upland Site Characterization Report* (HRP 2023). In addition, it is not clear which sample media were collected for chemical analysis in the case of the observed NAPL seeps (e.g., was only aqueous seep water targeted for collection, or was the observed NAPL targeted to be collected in the sample container?).

- Two seeps were observed twice and sampled (seep and surface water) in 2022 adjacent to Mione Transit Mix/Atlantic Hoist and Scaffolding[16] and Pebble Lane Associates.[17] Potential NAPL was not observed at these locations.
- Background surface water samples were also collected in East Branch during this study at one location in 2021 and two locations in 2022. NAPL was not observed at these background locations.

A summary of the NYSDEC observations and results is presented in Table B2-1. However, these data were considered only qualitatively in this evaluation because the data collection methods make it difficult to compare to RI surface water data and FS seep samples, so there is no means to perform quantitative evaluations. The 2021 NYSDEC sampling included mostly surface water samples collected immediately adjacent to seeps and reported increased turbidity and elevated total suspended solids (TSS) concentrations, suggesting the sampling methodology used likely entrained solids in the samples. The 2022 NYSDEC sampling methods were modified to reduce the potential for entrainment of solids, and NYSDEC reported, "*with each round of sampling, entrained solids and turbidity was reduced, resulting in generally lower concentrations of analytes in samples collected*" (HRP 2023). However, elevated solids were still observed in some samples (especially those taken in the September 2022 sampling event). The sampling methods used for the October 2022 survey are planned to be used in 2023 according to NYSDEC's work plan (HRP 2023). Additionally, NYSDEC encountered significant laboratory data quality issues with all the 2022 samples, which resulted in data validators rejecting all results for alkylated polycyclic aromatic hydrocarbons (PAHs), C9-C40 aliphatics, TPH, n-alkanes, and isoprenoids.

Additional information and the results of the NYSDEC surveys are provided in the *Seep Investigation Data Summary Report* (HRP 2022) and *Upland Site Characterization Report* (HRP 2023). These data were not collected as part of the RI/FS process under the oversight of USEPA; the focus of the seep surveys was on screening upland sites rather than understanding the potential influence of seeps on Newtown Creek surface water and sediments. NYSDEC indicated it was conducting an additional survey during late August 2023; no results from that survey have been provided to date.

3.4.3 LTE Lateral Groundwater and Seeps Evaluation

The annual COC loads from the combination of lateral groundwater and seeps were estimated for the current LTE calculation based on the FS Part 1 opportunistic seep data samples (see Section 5.7 of the RI Report) and reach-specific lateral groundwater discharge rates estimated in the RI groundwater investigation (see Section 5.2 and Appendix F of the RI Report). The LTE evaluation demonstrated that the estimated loads for lateral groundwater/seeps based on this information

[16] This property is identified as 1301 Metropolitan Ave Property #260 in the *Upland Site Characterization Report* (HRP 2023).
[17] This seep observation is located just downstream of the confluence of East Branch with Newtown Creek and is included for completeness.

contributed relatively low percentages to the predicted total LTE concentrations. Figure B3-3 shows the relative contributions to the overall estimated interim LTE concentrations for TPAH (34), TPCB, Cu, D/F TEQ, and C19-C36 from each individual ongoing external input included in the calculations, including lateral groundwater/seeps. Given that the flow rates used in these loads reflect estimates for lateral groundwater and that the COC concentrations are based on seeps that are aqueous and may also represent a contribution from lateral groundwater (see Section 3.4.1.2.1), they are considered representative of preliminary estimates of lateral groundwater and aqueous seeps; effects from NAPL seeps were evaluated separately, as discussed in Section 3.4.4. In future stages of the project, COC loads from lateral groundwater discharge will be further evaluated (including updating estimated LTE concentrations) based on the results of the USEPA shallow lateral groundwater discharge study (see Section 3.4.1.1.2) once the data become available.

3.4.4 Bounding Evaluation of NAPL Seep Impacts in East Branch

The NCG developed a report in September 2023 (Anchor QEA 2023b) to present a quantitative approach to bound the mass loading of NAPL seeps to support remedial planning for the East Branch EA using existing data and the LTE model.

Bounding calculations using data collected during RI/FS field activities and from the NYCDEP and NYSDEC surveys collected outside of the RI/FS process (see Sections 3.4.1 and 3.4.1.2) indicate that NAPL seeps, although observed within the Study Area, represent a comparatively minor source of COCs to sediment in East Branch. Although quantitative calculations of NAPL seep loads are not possible given the lack of measured volumetric discharge rates, multiple lines of evidence support the conclusion that NAPL seeps are a relatively minor source to East Branch that do not represent a significant recontamination potential that might affect remedial decision-making, including the following:

- TPAH (34) concentrations for most sampled seeps (i.e., from the FS Part 1 and NYSDEC studies), which are aqueous seeps that did not contain NAPL, are within the range of current surface water TPAH (34) concentrations.
- Chloride and conductivity measurements of sampled aqueous seeps indicate that approximately half of the sampled seeps likely consist of brackish creek water discharging almost entirely as bank storage, with the remainder of the sampled seeps representing a mix of bank storage and shallow lateral discharge of groundwater.
- A quantitative bounding analysis was performed with the LTE model to calculate the hypothetical magnitude of NAPL seeps in East Branch that would be needed to affect remedial decision-making. The resulting hypothetical TPAH (34) loads, NAPL volumetric flow rates, surface area of NAPL sheen in East Branch, and aqueous seep flow rates that would need to be present to affect remedial decision-making would have to be much higher than other existing and well documented/characterized loads and flow rates, which is implausible. Hence, the probability for seeps to significantly alter predicted LTE concentrations is also remote.

3.4.5 Lateral Groundwater and Seeps Pathway Conclusion

The evaluation of the lateral groundwater and seeps pathway is based on information from the RI/FS (summarized in Section 3.4.1), information collected outside the RI (summarized in Section 3.4.2), shoreline types (discussed in Section 3.4.1.1.1), the LTE evaluation (summarized in Section 3.4.3), and the mass loading bounding evaluation of NAPL seeps (summarized in Section 3.4.4). The seep sampling performed by NYCDEP (discussed in Section 3.4.2.2) and NYSDEC (discussed in Section 3.4.2.3) was considered in this evaluation, recognizing that these data were not collected as part of the RI/FS process under the oversight of USEPA and that there are limitations in that the data collection methods do not provide a means with which to perform quantitative loading evaluations, and significant data quality issues were identified during the NYSDEC sampling and laboratory analysis that resulted in rejected data. Limited groundwater data available from upland sites were also not evaluated because it was not clear which stratigraphic unit the data represented.

The overall conclusions for the lateral groundwater/seep pathway is that, based on available data and evaluations to date, it should not adversely impact remedy design, implementation, or performance for the following reasons: 1) there is little overall influence from lateral groundwater on surface water chemical concentrations (as discussed in Section 3.4.1.1.1); 2) the estimated contributions from lateral groundwater and seeps to LTE concentrations are relatively low (as discussed in Section 3.4.3); and 3) bounding calculations (as discussed in Section 3.4.4) indicate that NAPL seeps, although observed within the Study Area, represent a comparatively minor source of COCs to sediment in East Branch. However, the study USEPA is performing to further characterize shallow lateral groundwater discharge along the shoreline of Newtown Creek (see Section 3.4.1.1.2), along with opportunistic seep sampling (see Section 3.4.1.2.2), will generate data that are intended to be used to further understand lateral groundwater loads and seeps in the OU1 FS. It should be noted that there could possibly be a very localized sediment impact associated with a NAPL seep that might need to be considered during remedy design or implementation, but on a reach-wide basis the contribution is considered to be negligible.

4 References

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Table

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants[1,3,9,10,12,14,15]	Potential Pathway Contaminants[1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
Department of Small Business – 47th Street	Department of Small Business – 47th Street	Bank of New York	--	58-26 47th Street, Queens, New York 11378	QN-2601-25	0.04	Point sources and overland transport	The site appears to be vacant and primarily pervious. Site topography slopes toward EB. Point Sources: NCQ-514 (direct discharge) and NCQ-633 (MS4 [31 MG/year]). Outfall NCQ-633 is listed as an MS4 outfall on the Newtown Creek WPCP SPDES Permit No. NY0026204. NCQ-633 is shown adjacent to the storm sewer discharging to Newtown Creek that appears to collect drainage from the property between 47th Street and 49th Place north of Grand Avenue in both sets of drainage maps provided by NYC in April and September 2013. Based on these maps, the drainage area is similar in size to the other MS4 outfalls included in the NYCDEP 2015 geo-neutral point source model. Outfall NCQ-633 was recommended as a Phase 2 sampling location in the SSAM due to its relatively large flow contribution to the creek. During planning for Phase 2, the drainage basin for Outfall NCB-631 was identified as a potential point sources sampling location, but it was ultimately not selected for sampling because (according to information provided by NYCDEP) only a small portion of the drainage basin would be captured due to tidal inundation in the drainage infrastructure. On December 19, 2014, NYCDEP provided Anchor QEA and USEPA with modified drainage basin information because the NCQ-633 sampling location captured only approximately 6 acres of a 37-acre drainage basin. Sampling location NCB-631 replaced NCQ-633 in the Phase 2 point sources sampling program. Sampling location NCQ-633 was sampled once before being removed from the sampling program.	PAHs, PCBs, Cu, D/F, C19-C36	PAHs, PCBs, Cu, D/F, C19-C36	Unknown	Aeration system blower building	No	No
							Bank erosion	The bank is composed of pile-supported concrete bulkhead and riprap and concrete debris armoring in good condition. Low erosion potential above OHWM. Surface sediment sample results from the RI adjacent to the site were PCBs: 7.3 mg/kg; TPAH (34): 260 mg/kg; Cu: 1,200 mg/kg.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in a nearby in-creek groundwater sample (EB046GW) is 100 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	A sheen of potential NAPL was observed on the water surface once in 2021 during the NYSDEC seep investigation (EB-01). No seep observations have been made or samples collected.		Unknown				
LDT Enterprises/ B&H Equipment Rental	LDT Enterprises	LBA OR Core-Company IV, LLC	--	58-38 47th Street, Queens, New York 11378	QN-2601-40	0.1	Point sources and overland transport	The site appears to be near 100% impervious surface (building and paved surfaces). Site topography slopes toward EB. Several small runoff areas were observed flowing through cracks in the upland concrete wall and then over and down the concrete bulkhead during wet-weather surveys on 03/12/2013 and 06/07/2013. Staining of the concrete bulkhead in the areas of overland flow was also observed. Point source: O-158 (direct discharge).	Unknown	Unknown	Heavy equipment staging or storing	Vacant	No	No
							Bank erosion	The bank is protected by a pile-supported timber and concrete bulkhead in good condition. Low erosion potential above OHWM.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in a nearby in-creek groundwater sample (EB046GW) is 100 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected.		Unknown				

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants[1,3,9,10,12,14,15]	Potential Pathway Contaminants[1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
Grand Street Bridge	N/A	NYCDOT	--	--	--	0.2	Point sources and overland transport	Two MS4 outfalls: NCQ-632 and NCQ-346. Outfall NCQ-632 is listed as an MS4 54-inch outfall on the Newtown Creek WPCP SPDES Permit No. NY0026204. Additionally, this outfall is listed in the 2008 NYCDEP shoreline survey with a 600-series outfall ID, which is classified in the shoreline survey reports as storm drains. NYC personnel have indicated that 600-series outfalls are owned by NYC. NCQ-632 is shown adjacent to the storm sewer in Grand Avenue discharging to the East Branch in both sets of drainage maps provided by NYC in April and September 2013. Outfall NCQ-632 is adjacent to a separate drainage basin. The NYCDEP 2015 geo-neutral point source model estimates that this outfall contributes approximately 7% (68 MG/year) of total stormwater input to the creek. This outfall was recommended as a Phase 2 sampling location in the SSAM due to its relatively large flow contribution to the creek. Targeted Category 3A Outfall NCQ-632 is located next to Outfall NCQ-346, and it is also adjacent to this drainage basin. During sampling, USEPA requested that the manhole downstream of the junction of Grand Avenue and Page Place (NCQ632B) replace the original sampling manhole (NCQ632). According to NYCDEP drainage maps, sampling at the NCQ632B location captures approximately 64 acres of the 80-acre NCQ-632 drainage basin. Sampling location NCQ632 was sampled once before being removed from the sampling program.	PAHs, PCBs, Cu, D/F, C19-C36	PAHs, PCBs, Cu, D/F, C19-C36	Concrete bridge abutment	Concrete bridge abutment	No	No
							Bank erosion	Vertical concrete and bridge foundation in good condition. The bank is in stable condition, and this pathway is incomplete for this site.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, concentrations in native groundwater adjacent to the site are not elevated.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected.		Unknown				
Western Beef Properties	Western Beef Properties	Cactus 47-05 Metropolitan LLC	212	47-03/47-05 Metropolitan Avenue, Ridgewood, New York 11385	QN-2611-93 QN-2611-480	0.16	Point sources and overland transport	The site appears to be completely paved and occupied by buildings and parking lots. Site topography appears to slope toward shoreline or on-site drains. Site drainage infrastructure is unknown. Outfalls NCQ-445, NCQ-345, NCQ-344, NCQ-343, NCQ-511, NCQ-342, and NCQ-444 have been identified by NYCDEP shoreline surveys adjacent to the site. Anchor QEA has identified Outfalls NCQ-344 and NCQ-511 during the Phase 1 shoreline assessment. Anchor QEA identified an additional outfall, O-64, on the site's shoreline during the Phase 1 shoreline assessment; Outfall NCQ-511 was observed by Anchor QEA during wet-weather surveys. Association of these outfalls with the site is not known.	Unknown	Unknown	NYSDEC spills; lumber storage operations; brick yard; printing operations; school bus parking	Tractor trailer parking; 5,000-gallon No. 2 fuel oil AST (PBS No. 2-609052)	Yes, two existing wells that are usable; installation of one deep well	No
							Bank erosion	There is a sheet pile wall in good condition, which was installed in the last 5 years (as of January 2023). The remainder of the property is protected by a wooden bulkhead in poor condition with vegetation above OHWM, so there is low erosion potential. A 20-foot section of the wooden bulkhead has collapsed and has a high erosion potential; due to this, this area was categorized as a Potentially Erodible Bank in the LTE Evaluation. Surface sediment sample results from the RI adjacent to the site were PCBs: 1.1–16 mg/kg; TPAH (34): 100–320 mg/kg; Cu: 850–2,000 mg/kg. The bank erosion pathway is incomplete.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB and TPAH (34) in nearby native groundwater are elevated. Concentrations in the nearest in-creek groundwater sample (EB050GW) are 65 µg/L TPAH (34) and 710 ng/L TPCB.		Unknown				
							Lateral groundwater/ shoreline seeps	A sheen of potential NAPL was observed on the water surface twice in 2021 during the NYSDEC seep investigation (EB-02). No seep observations have been made or samples collected.		Unknown				

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants[1,3,9,10,12,14,15]	Potential Pathway Contaminants[1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
Amboy Bus Co.	Amboy Bus Co.	269 Triple J Metro, LLC	211	46-81 Metropolitan Avenue, Ridgewood, New York 11385	QN-2611-71	0.16	Point sources and overland transport	The site appears completely paved and occupied by a warehouse and bus parking. Site topography slopes toward on-site drains. One outfall, NCQ-443, was identified by NYCDEP shoreline surveys, and two outfalls (O-79 and O-78) have been identified by Anchor QEA adjacent to the site; association with the site is not known.	SVOCs, PAHs, Cu	Unknown	Lumber storage operations; warehousing; bus storage; tractor-trailer storage; automotive repair operations; gas station; NYSDEC spills; total of 21 USTs removed from site; one 2,200 gallon gasoline UST (closed-in place in 1995); 6,050-gallon diesel UST (closed-in place in 1995)	Petroleum-impacted soil and groundwater, including LNAPL; FedEx depot; three waste oil ASTs (PBS No. 2-350761)	No	Yes, C2421260; agreement executed 2/23/2022
							Bank erosion	The bank consists of riprap and a vegetated slope in poor condition with a high erosion potential, but given the size of the areas and bank condition, there is low potential that these areas would impact East Branch. NYSDEC (2023) identified this area as a potentially erodible bulkhead/shoreline.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB and TPAH (34) in nearby native groundwater are elevated. Concentrations in the nearest in-creek groundwater sample (EB050GW) are 65 µg/L TPAH (34) and 710 ng/L TPCB.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected. Lateral GW: 2021 Subsurface Investigation under BCP included groundwater samples screened in the fill/native area and nearest to the creek (30 to 54 feet to bulkhead): total SVOCs: 1.59 to 4.71 µg/L and total Cu: 7.16 to 27.3 µg/L. No PCB analysis was performed.		SVOCs, PAHs, Cu				
Maspeth Concrete Loading Corp.	Maspeth Concrete Loading Corp. - Metropolitan Avenue	PCM Development, LLC	210	46-73 Metropolitan Avenue, Ridgewood, New York 11385	QN-2611-35	0.18	Point sources and overland transport	The site appears to be nearly 100% impervious surface. Site topography appears to slope toward on-site drains. Envirofacts ICIS information indicates a current SPDES general permit (ID NYR00D669), with discharge via Outfall 001. The location of this outfall is currently unknown. Five outfalls (NCQ-832, NCQ-529, NCQ-527, NCQ-341, and NCQ-442) have been identified by NYCDEP shoreline surveys adjacent to the site, and Anchor QEA has observed three of these outfalls (NCQ-832, NCQ-341, and NCQ-442) during the Phase 1 shoreline assessment. It is not known whether these outfalls are associated with the site. Outfall NCQ-422 was targeted for sampling due to site uses that indicate the potential for unique point source discharges and recent compliance issues associated with the MSGP and wet-weather survey observations. Three samples were collected from Outfall NCQ-442 (Station ID MCL001).	PAHs, PCBs, Cu, D/F, C19-C36	PAHs, PCBs, Cu, D/F, C19-C36	Received petroleum by barge; NYSDEC spill; one 200,000-gallon No. 6 fuel oil UST (administratively closed in 1995); six 110,000-gallon ASTs (1950 to 2006 Sanborn maps); one 360,000-gallon AST (1936 to 2006 Sanborn maps); one 400,000-gallon AST (1936 to 2006 Sanborn maps); in 1987 an unknown quantity of No. 6 fuel oil was discharged to surface water (DAR addendum)	Concrete mixing facility; aggregate storage; heavy equipment parking; seven No. 2 fuel oil ASTs (active PBS 2-016160)	Yes; no existing wells; installation of two shallow wells	No
							Bank erosion	A portion of the bank is protected by a wooden bulkhead with a flat vegetated area above OHWM. The bulkhead is in poor condition from a structural standpoint but is sufficient from an erosional standpoint. The other portion of the wooden bulkhead is failing but appears to be holding back upland soils from entering the creek. Therefore, this site has low erosion potential above OHWM.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater are elevated. The TPCB concentration in a nearby in-creek groundwater sample (EB051GW) is 24 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected.		Unknown				

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants[1,3,9,10,12,14,15]	Potential Pathway Contaminants[1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
MTA - New York City Transit	MTA - New York City Transit	New York Industrial City Development Agency	209	46-25 Metropolitan Avenue, Ridgewood, New York 11385	QN-2611-1	0.34	Point sources and overland transport	The site appears to be completely paved and occupied by a large building and parking lot. Site topography slopes toward EB or on-site drains. Curbing along the shoreline appears to act as perimeter stormwater control. Several catch basins are visible in aerial photography. Current site drainage infrastructure is unknown. Four outfalls (NCQ-510, NCQ-339, NCQ-338, and NCQ-526) have been identified by NYCDEP shoreline surveys adjacent to the site, and two of these outfalls (NCQ-510 and NCQ-526) have been observed by Anchor QEA during the shoreline assessment; NCQ- 510 was observed during wet-weather surveys. It is not known whether these outfalls are associated with the site.	Unknown	Unknown	18,500-gallon diesel USTs (closed—removed in 1992); lumber storage operations; scrap metal processing and storage operations	Office building; one 8,000-gallon diesel UST; one 15,000-gallon No. 2 fuel oil UST; fueling area; vehicle parking areas; NYSDEC spill	Yes; no existing wells; installation of two shallow wells	No
							Bank erosion	A portion of the bank is protected by riprap with concrete debris in poor condition but appears stable despite not being engineered. A portion of the bank is grassed with visible undercutting. High erosion potential in both areas, but given the size of the areas and bank condition, there is low potential that these areas would impact East Branch. NYSDEC (2023) identified this area as a potentially erodible bulkhead/shoreline.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in the nearby in-creek groundwater sample (EB052GW) is 92 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	A seep was observed twice (potential NAPL was not observed) in 2021 during the NYSDEC seep investigation (EB-03), and adjacent surface water was sampled.		Unknown				
Metropolitan Ave. (Head of East Branch)	N/A	NYCDOT	--	--	--	0.4	Point sources and overland transport	CSOs: NCB-019 (3.1 MG/year) and NCB-083 (980 MG/year). Outfall NCB-083 is located at the terminus of the East Branch. Annual discharge from this outfall is approximately 980 MG, making it the largest Category 2 discharge and the single largest point source discharge to Newtown Creek. During large storm events, a regulator structure (St. Nicholas weir) limits the amount of combined flows entering the Morgan Avenue interceptor (and potentially discharging from NCB-015) by diverting excess flow to NCB-083. This outfall was targeted for sampling due to large discharge volume and location in EB. Three samples were collected from NCB-083.	PAHs, PCBs, Cu, D/F, C19-C36	PAHs, PCBs, Cu, D/F, C19-C36	Roadway	Roadway	No	No
							Bank erosion	The bank is protected by a steel sheet pile wall with a concrete pile cap. Poor from a structural standpoint but sufficient from an erosional standpoint. Therefore, the bank erosion pathway is incomplete at this site. NYSDEC (2023) identified this area as a potentially erodible bulkhead/shoreline.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, concentrations in native groundwater adjacent to the site are not elevated.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected.		Unknown				

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants [1,3,9,10,12,14,15]	Potential Pathway Contaminants [1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
Mione Transit Mix/Atlantic Hoist and Scaffolding	Mione Transit Mix	BCB Community Bank	34	1301 Metropolitan Avenue, Brooklyn, New York 11237	BK-2948-85	0.34	Point sources and overland transport	The site appears to be almost entirely impervious. The site topography slopes toward EB. A concrete block wall along the southeast portion of the site appears to be a stormwater perimeter control. Direct discharge outfalls: NCB-335, NCB-560, NCB-561, NCQ-336, and NCQ-337.	PCBs, PAHs, Cu, SVOCs	Unknown	Coal storage; Lumber storage yard; asphalt; trucking; large oil ASTs and gasoline USTs; grease pit	Miscellaneous storage—equipment and trucks. NYSDEC spills (most recent spill No. 2102352 was assigned in 2021); petroleum contamination in soil and groundwater	No	Yes; site code: C224344; executed 6/1/2022; RI/FS Phase
							Bank erosion	The bank is partially exposed earth and partially sheet pile wall. The earthen bank could erode from overland flow. The steel sheet pile is in poor but stable condition. This bank has a medium erosion potential, but given the size of the areas and bank or bulkhead condition, there is low potential that these areas would impact East Branch. Shoreline sample results from the RI adjacent to the site were PCBs: 0.26 mg/kg; TPAH (34): 9 mg/kg; Cu: 58 mg/kg.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in the nearby in-creek groundwater sample (EB052GW) is 92 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	A seep was observed twice (potential NAPL was not observed) and sampled (seep and surface water) in 2022 during the NYSDEC seep investigation (22-EB-03 and 22-EB-03-R). The seep was documented as entering the creek below the concrete bulkhead. TPCB: 101 ng/L, TPAH (34): 3,969 ng/L, Cu: 12.7 µg/L. Lateral GW: 2021 Subsurface Investigation under BCP included samples from the fill, nearest to the creek, are non-detect to 3.8 µg/L for total SVOCs. No PCB or Cu analysis was performed.		PCBs, PAHs, Cu, SVOCs				
Feldman Metropolitan	Feldman Metropolitan	Investors Bank	217	1356 Grand Street, Brooklyn, New York 11211	BK-2948-13	0.28	Point sources and overland transport	The site appears to be completely paved and mostly occupied by lumber storage. Site topography slopes toward on-site drains. Localized overland flow was observed through roots and debris at the southeast end of the site during wet-weather surveys on 12/17/2012 and 02/11/2013. Two outfalls (NCB-525 and NCQ-335) have been identified by NYCDEP shoreline surveys adjacent to the site, and one additional outfall, O-997, has been observed by Anchor QEA during the shoreline assessment and wet-weather surveys; association of these outfalls with the site is not known. An opportunistic water sample was collected during Phase 1 from Outfall O-997 and did not show elevated chemical concentrations compared to other samples. Information provided by NYC indicates that O-997 may drain a portion of Grand Avenue and may not be associated with the site. NCB-199 is also shown adjacent to the site.	Unknown	Unknown	Coal storage areas; spills and leaks from auto repair and storage; equipment for scrap iron; lumber yard and lumber hauling trucks: NYSDEC spills	Lumber storage yard	No	No
							Bank erosion	The bank is composed of steel sheet pile, concrete, wood, and exposed soils (unvegetated). A portion of the steel sheet pile is in good condition, and a portion is in poor condition. There is a precast concrete block bulkhead in fair condition. Conditions are unstable due to concrete blocks that have fallen into the creek. The wooded bulkhead with concrete pile cap is in good condition. The structure appears stable, despite evidence of occasional cracking throughout and wood facing failed in multiple places. Overall, the erosion potential is low to medium. However, there is an 80-foot section of deteriorated bulkhead that has exposed soil with a high erosion potential; due to this, this area was categorized as a Potentially Erodible Bank in the LTE Evaluation. Shoreline sample results from the RI adjacent to the site were PCBs: 0.11 mg/kg; TPAH (34): 9 mg/kg; Cu: 81 mg/kg. The nearest in-creek surface sediment sample results from the RI were PCBs: 0.93; TPAH (34): 305; Cu: 6,300. The maximum Cu surface sediment concentration in or near a potentially erodible bank in East Branch was measured in a sample collected near Feldman Metropolitan. NYSDEC (2023) identified areas of the site as a potentially erodible bulkhead/shoreline.		Unknown				
							Native groundwater	Upland native groundwater data is not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater are elevated. The TPCB concentrations in nearby in-creek groundwater samples (EB051GW and EB052GW) are 24 and 92 ng/L, respectively.		Unknown				
							Lateral groundwater/ shoreline seeps	A sheen with potential NAPL was observed on the water surface twice in 2021 during the NYSDEC seep investigation (EB-05). No seep observations have been made or samples collected.		Unknown				

Table B2-1
Upland Sources Summary – East Branch

Common Name of Property	DAR Name[1,2,3]	Current Site Name/ Owner[4]	DAR No.	Address[1,2,3]	Tax Parcel (Borough Block Lot)[1,2]	East Branch Creek Mile[2]	Potential Contaminant Migration Pathway	Pathway Descriptions[1,5,6,7,8,9,10,11,12,13,14]	Potential Contaminants[1,3,9,10,12,14,15]	Potential Pathway Contaminants[1,8,9,10,14]	Historical Potential Upland and Overwater Sources[1,2,3,5,12,14]	Current Potential Upland and Overwater Sources[2,8,14]	USEPA Lateral Groundwater Sampling Location[16]	Brownfield Cleanup Program[14]
Natmi Truck Terminals	Natmi Truck Terminals	YRC Inc.	207	1313 Grand Street, Brooklyn, New York 11211	BK-2930-90	0.05	Point sources and overland transport	The site appears completely paved and occupied by a large building and parking lot. Site topography slopes toward on-site drains. Overland flow was noted between concrete blocks during a snow wet-weather survey event on 02/11/2013, which appears to be from snowmelt. This runoff was not observed during other survey events. There are several catch basins visible in aerial photography. Current site drainage infrastructure is unknown. Three outfalls (NCB-434, NCB-454, and NCB-334) have been identified by NYCDEP shoreline surveys adjacent to the site but have not been observed by Anchor QEA; association with the site is not known.	Unknown	Unknown	NYSDEC spills; 17 550-gallon diesel USTs (installed 1959, closed prior to 1991); one 2,000-gallon diesel UST (closed—removed in 1998); two 4,000-gallon diesel USTs (closed—removed in 1998); truck parking areas; lumber storage areas In September 1998 and February to March 2011, contaminated soil was excavated and/or removed in response to spills. Phase 2 ESA and groundwater investigation in 2009.	Truck terminal; one 1,000-gallon No. 2 fuel oil UST; NYSDEC spills	Yes; no known existing wells; installation of two shallow wells	No
							Bank erosion	Bank is armored with large riprap up the extent of the bank. The bank is in stable condition, and the bank erosion pathway is incomplete for this site.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in a nearby in-creek groundwater sample (EB046GW) is 100 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	No seep observations have been made or samples collected.		Unknown				
Pebble Lane Associates	Pebble Lane Associates	57-00 Maspeth Avenue, LLC	134	57-00 47th Street, Maspeth, New York 11378 (58-20 47th Street)	QN-2601-1 QN-2601-6	0.0	Point sources and overland transport	Aerial photographs indicate that the western portion of the site is not paved. According to historical records, there are no outfalls from the site, but a portion of the site may have surface water that drains to the creek through overland flow. Outfalls O-152, O-153, O-154, O-155, and O-156 were identified by Anchor QEA during Phase 1 shoreline assessment adjacent to the site; these outfalls were not observed during the wet-weather surveys; association with the site is not known.	PCBs, PAHs, Cu	Unknown	Construction and demolition debris tipping, sorting, crushing, and stockpiling; transportation equipment and auto repair; fertilizer works; and used oil and motor oil AST (PBS No. 2-318744). An oil/water separator and UST graves were identified on the eastern and southern part of Lot 6, respectively (Langan 2021 Phase 2 investigation report). USTs were removed in February 2022 (Langan 2022 UST closure letter). Historical sheet flow documented; NYSDEC spills; in 2007, NOV was issued for placement of fill on the bank without a permit.	Vacant; VOCs, SVOCs, and metals in soil, groundwater, and/or soil vapor; visual evidence of petroleum impacts	No	Yes; C241267 RI/FS Phase
							Bank erosion	The portion of the bank adjacent to EB is in good, stable condition and this pathway is incomplete for this portion of the site. Part of the bank is in poor condition with exposed soils and vegetation with high erosion potential (but this portion of the site is downstream of the EB study area). The nearest in-creek sample to the site: 28 feet; maximum local surface sediment concentration (mg/kg): PCBs: 7.35; PAHs: 784; Cu: 2,900. NYSDEC (2023) identified this area as a potentially erodible bulkhead/shoreline.		Unknown				
							Native groundwater	Upland native groundwater data are not available for this site. Based on the East Branch FFS capping evaluation, TPCB in nearby native groundwater is elevated. The TPCB concentration in the nearest in-creek groundwater sample within EB (EB051GW) is 100 ng/L.		Unknown				
							Lateral groundwater/ shoreline seeps	A seep was observed twice (potential NAPL was not observed) and sampled (seep and surface water) in 2022 during the NYSDEC seep investigations (22-EB-101). The seep was documented as flowing in to the creek from under a large boulder near the downstream border of the EB Study Area. Lateral GW: 2021 Subsurface Investigation under BCP included one groundwater sample location screened in the fill/native area and 42 feet from the bulkhead was within the EB Study Area. The total SVOC and total Cu concentrations were 988.6 and 240 µg/L, respectively.		PCBs, PAHs, Cu				

Table B2-1

Upland Sources Summary – East Branch

Notes:

Potential contaminant is a chemical that could be present at the site, as determined by historical and current site use and operations.

1. Information obtained from: draft DAR site summaries or Table 5-3 of Anchor QEA, 2012. Draft *Data Applicability Report.* Remedial Investigation/Feasibility Study, Newtown Creek. May 2012.
2. Information obtained from: Google Maps and/or Anchor QEA Silverlight GIS Map
3. Information obtained from: 2010 and/or 2012 EDR
4. Information obtained from: combination of MapPluto and NYC digital tax parcels
5. Information obtained from: November 2011 Shoreline Assessment and panoramic shoreline photographs and/or wet-weather surveys (December 2012 to June 2013)
6. Information obtained from: high-resolution aerial photographs for bank erosion: Aerometric, 2012. High Resolution Orthoimagery of Newtown Creek. March 2012.
7. Information obtained from: March 2012 LiDAR contours
8. Information obtained from: USEPA, 2012. USEPA Envirofacts Database. Date accessed: September 2012. Updated January 2023. Available at: https://enviro.epa.gov/.
9. Information obtained from: Sanborn Maps
10. Seep information obtained from NYSDEC Upland Site Characterization Report (April 28, 2023).
11. Information updated from: Anchor QEA, 2014. *Sources Sampling Approach Memorandum.* Remedial Investigation/Feasibility Study, Newtown Creek. November 2014.
12. Information updated from: Anchor QEA, 2023. *Remedial Investigation Report.* Remedial Investigation/Feasibility Study, Newtown Creek. March 2023.
13. Bank erosion information obtained from: LTE evaluation
14. Information obtained from: NYSDEC Environmental Remediation, Spills, and Bulk Storage Databases. Date accessed: September 2012. Updated January 2023. Available at: http://www.dec.ny.gov/cfmx/extapps/derexternal/haz/results.cfm?pageid=3.
15. Only if data have been collected directly from the source has a potential pathway contaminant been added. Potential contaminants in column L included all potential pathway contaminants in column M.
16. USEPA groundwater sites obtained from: CDM Smith, 2022. *Remedial Acquisition Framework: Design and Engineering Services. Final Technical Approach Plan.* Newtown Creek Site, Operable Unit 1, Supplemental Characterization of Shallow Groundwater Discharge. April 1, 2022.

Abbreviations:

--: not applicable
μg/kg: microgram per kilogram
μg/L: microgram per liter
AST: aboveground storage tank
BCP: Brownfield Cleanup Program
C19-C36: C19-C36 aliphatic petroleum hydrocarbons
COC: contaminant of concern
CSO: combined sewer overflow
Cu: copper
DAR: *Data Applicability Report*
D/F: dioxin/furan
EB: East Branch
EDR: Environmental Data Resources, Inc.
ESA: Environmental Site Assessment
FFS: Focused Feasibility Study
ft: foot
GW: groundwater
ICIS: Integrated Compliance Information System
LiDAR: Light Detection and Ranging
LNAPL: light nonaqueous phase liquid
LTE: long-term equilibrium
M: metals
MG: million gallons
mg/kg: milligram per kilogram
MG/year: million gallons per year
MS4: municipal separate storm sewer system
MSGP: multisector general permit
MTBE: methyl tertiary butyl ether
N/A: not applicable
NAPL: nonaqueous phase liquid
NFA: no further action
ng/L: nanogram per liter
NOV: Notice of Violation
NPDES: National Pollutant Discharge Elimination System
NYC: New York City
NYCDEP: New York City Department of Environmental Protection
NYCDOT: New York City Department of Transportation
NYSDEC: New York State Department of Environmental Conservation
OHWM: ordinary high water mark
PAH: polycyclic aromatic hydrocarbon
PBS: petroleum bulk storage
PCB: polychlorinated biphenyl
PCE: tetrachloroethene
RI: Remedial Investigation
SPDES: State Pollutant Discharge Elimination System
SSAM: *Sources Sampling Approach Memorandum*
SVOC: semivolatile organic compound
TBD: to be determined
TCE: trichloroethene
TPAH (34): total polycyclic aromatic hydrocarbon (34)
TPCB: total polychlorinated biphenyl
TSS: total suspended solids
USEPA: U.S. Environmental Protection Agency
UST: underground storage tank
VOC: volatile organic compound
WPCP: Water Pollution Control Plant

Figures

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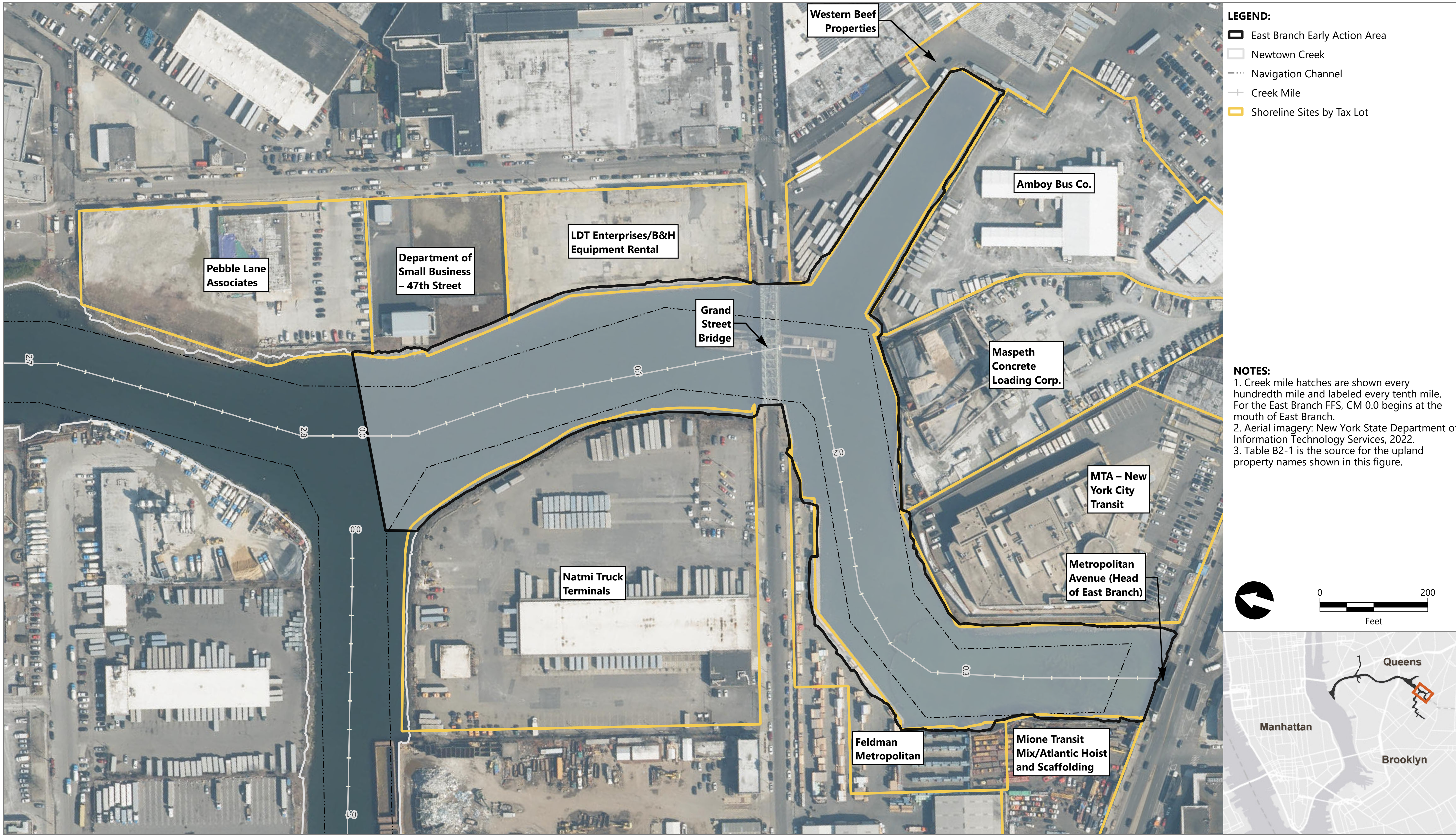

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Table B2-1 is the source for the upland property names shown in this figure.

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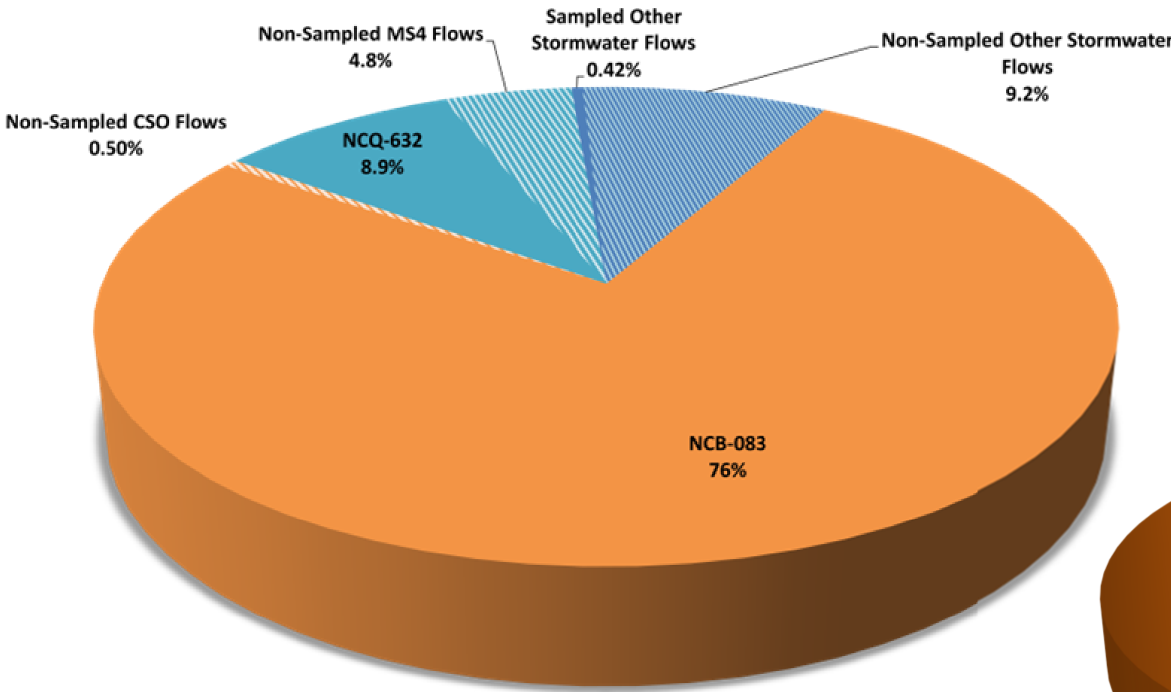
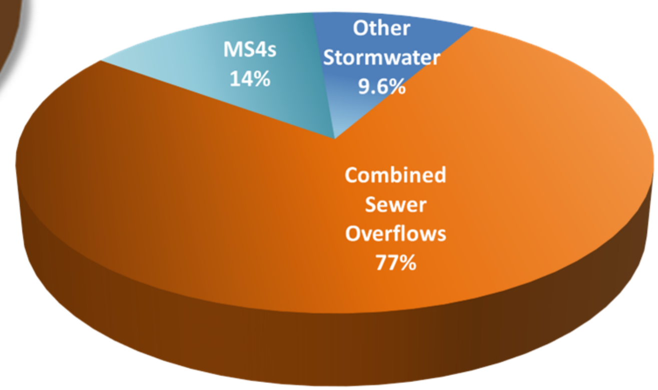
Figure B3-1
Upland Sites Adjacent to East Branch
Upland Sources Evaluation
Newtown Creek RI/FS



Detailed Relative Contribution of Annual Discharge Volumes



Relative Contribution of Annual Discharge Volumes

Sources:
NYCDEP 2015 geo-neutral point source model; U.S. Environmental Protection Agency (USEPA) Enforcement and Compliance History Online (ECHO) Database; Discharge Monitoring Reports (DMRs) for State Pollutant Discharge Elimination System (SPDES) Permit No. NY0267724, January 2008 through December 2012; and January 31, 2013, e-mail from New York City Department of Environmental Protection (NYCDEP) to USEPA regarding Anchor QEA, LLC, Data Requests

Notes:
1. Combined sewer overflow (CSO) and stormwater flows are estimated as the arithmetic average of the annual flows for 2008 through 2012 predicted by the NYCDEP 2015 geo-neutral point source model.
2. Hatching indicates discharges not sampled during the Phase 2 field sampling event.
3. Percentages may not sum precisely to 100 due to rounding.
4. Flow from NCQ-633 is not included in sampled stormwater flows. NCQ-633 was sampled once during the Phase 2 sampling program before being removed from the sampling program so is not included in the percentage of sampled discharges.

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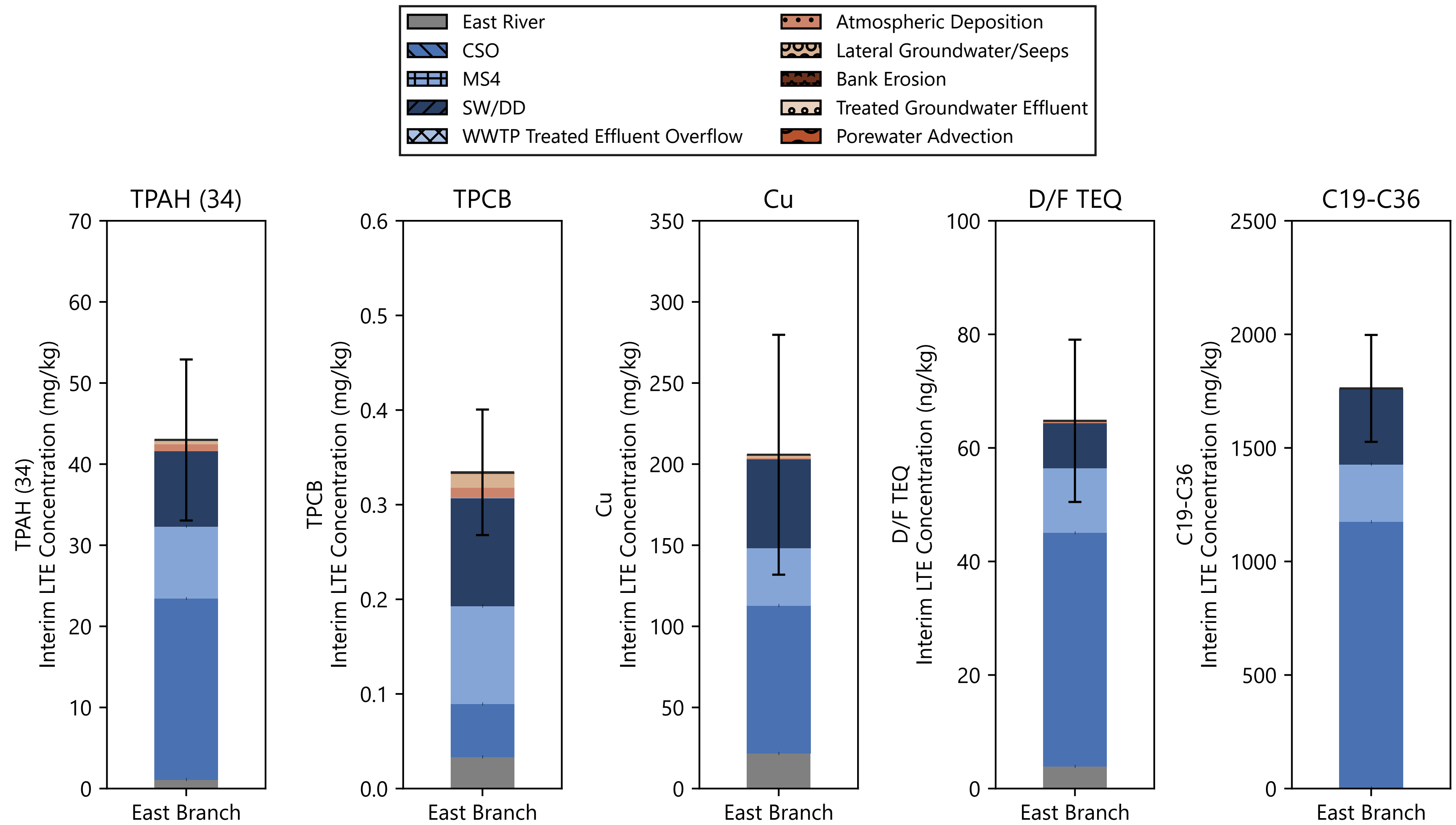

Notes: The range on each bar indicates the calculated long-term equilibrium concentrations with upper- and lower-bound ranges, while the bar itself shows the base case scenario.
WWTP treated effluent overflow and treated groundwater effluent are sources that originate outside of East Branch. Their contribution to long-term equilibrium in East Branch is a result of tidal transport.
CSO: combined sewer overflow; MS4: municipal separate storm sewer system; SW/DD: stormwater and direct drainage; WWTP: wastewater treatment plant
TPAH (34): total polycyclic aromatic hydrocarbon (34); TPCB: total polychlorinated biphenyl; Cu: copper; D/F TEQ: total dioxin/furan toxic equivalence quotient (mammal);
C19-C36: C19-C36 aliphatic petroleum hydrocarbons

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Figure B3-3
Contribution of External Inputs to Calculated Interim Long-Term Equilibrium Concentrations for TPAH (34), TPCB, Cu, D/F TEQ, and C19-C36

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Figure B3-4
Bank Erosion Evaluation
Upland Sources Evaluation
Newtown Creek RI/FS

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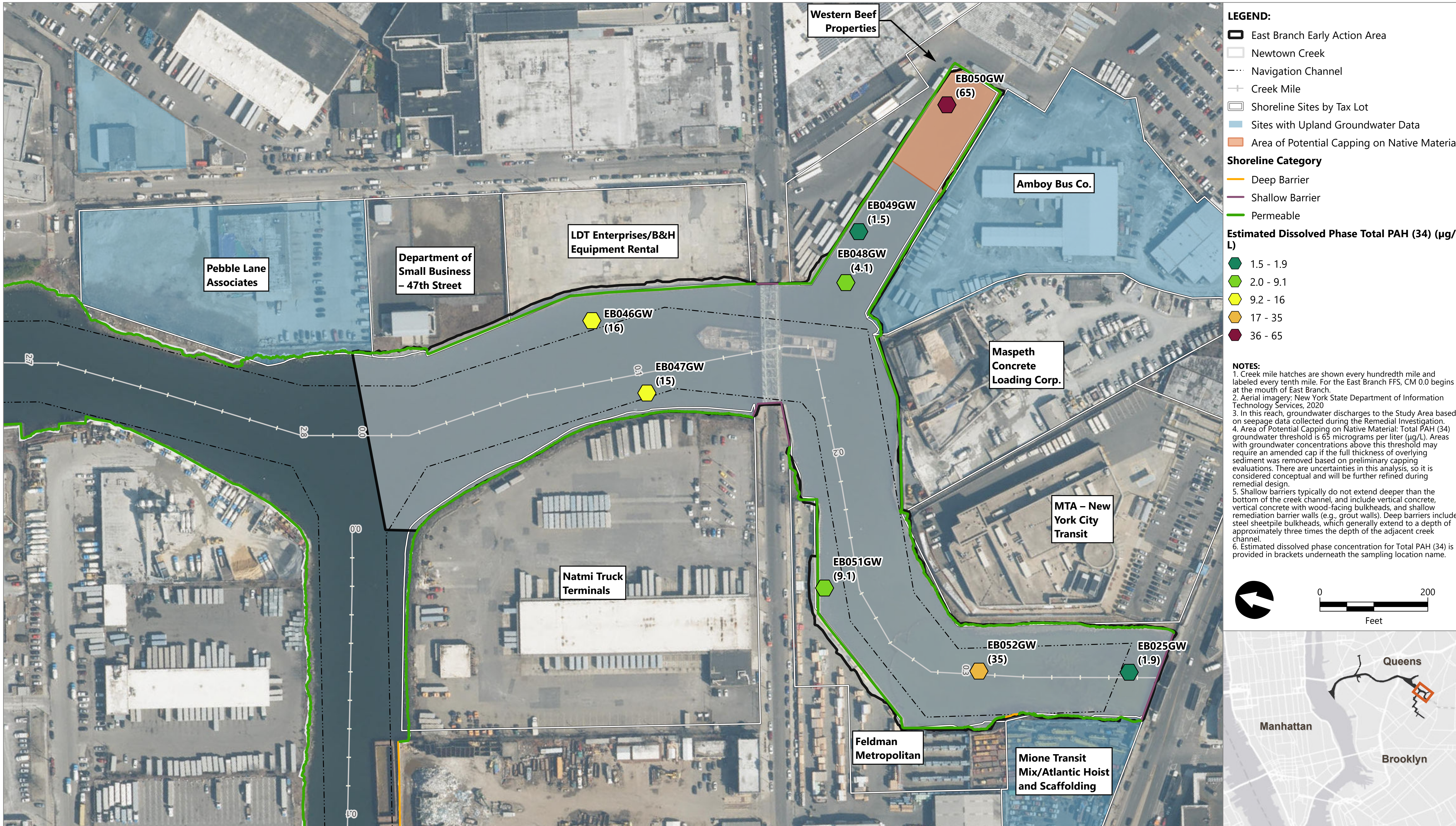

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2020
3. In this reach, groundwater discharges to the Study Area based on seepage data collected during the Remedial Investigation.
4. Area of Potential Capping on Native Material: Total PAH (34) groundwater threshold is 65 micrograms per liter (µg/L). Areas with groundwater concentrations above this threshold may require an amended cap if the full thickness of overlying sediment was removed based on preliminary capping evaluations. There are uncertainties in this analysis, so it is considered conceptual and will be further refined during remedial design.
5. Shallow barriers typically do not extend deeper than the bottom of the creek channel, and include vertical concrete, vertical concrete with wood-facing bulkheads, and shallow remediation barrier walls (e.g., grout walls). Deep barriers include steel sheetpile bulkheads, which generally extend to a depth of approximately three times the depth of the adjacent creek channel.
6. Estimated dissolved phase concentration for Total PAH (34) is provided in brackets underneath the sampling location name.

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Figure B3-5
Native Groundwater Sources Evaluation - Total PAH (34)

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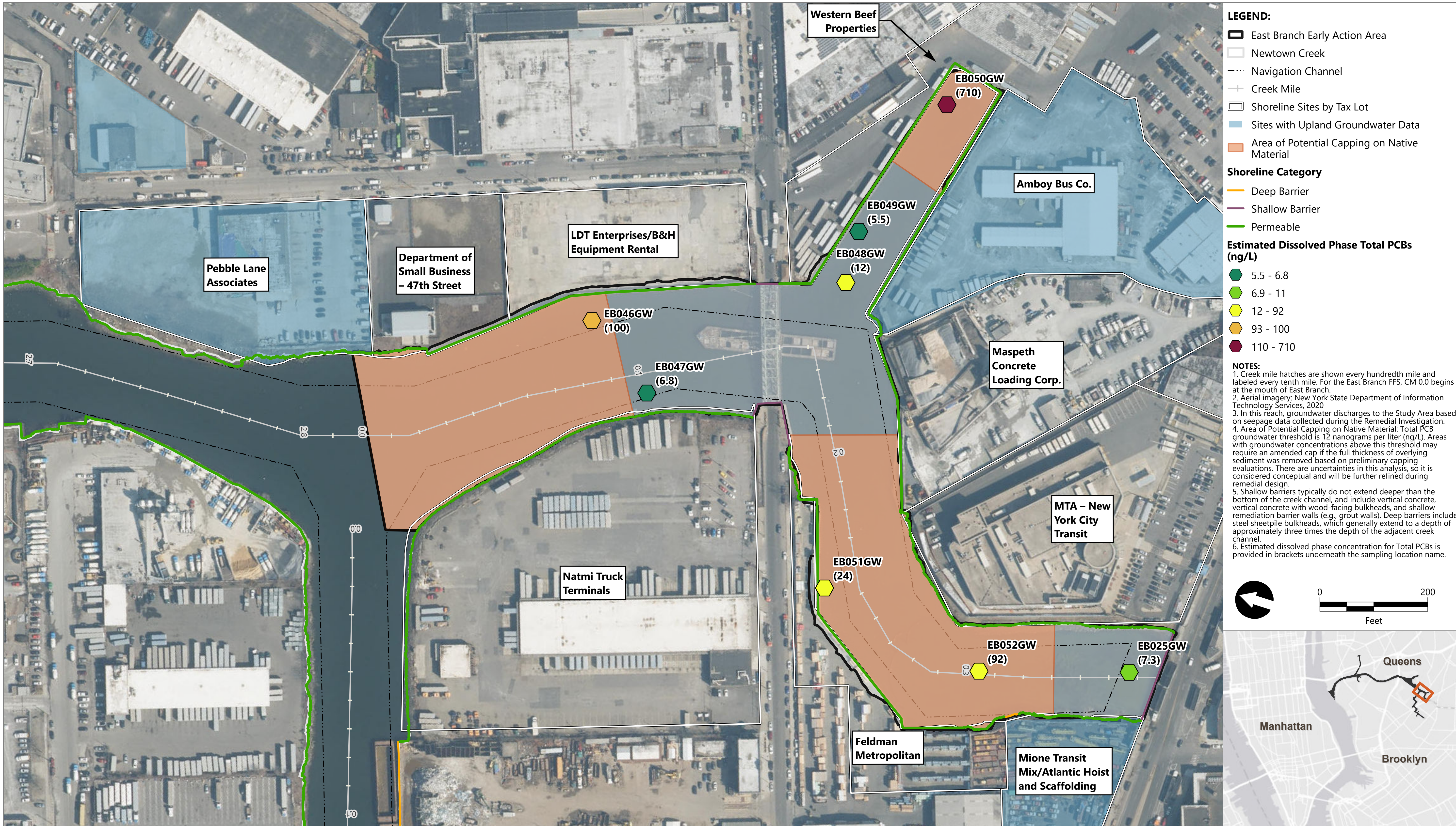

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Figure B3-6
Native Groundwater Sources Evaluation - Total PCBs
Upland Sources Evaluation
Newtown Creek RI/FS

Appendix C
Capping Evaluations

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

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Capping Evaluations
East Branch Early Action Focused Feasibility Study

Prepared for the Newtown Creek Group

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Capping Evaluations
East Branch Early Action Focused Feasibility Study

Prepared for
The Newtown Creek Group

Prepared by
Anchor QEA
123 Tice Boulevard, Suite 205
Woodcliff Lake, New Jersey 07677

Project Number: E41037-01.01
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TABLES

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FIGURES

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ABBREVIATIONS

µg/L	microgram per liter
%Pv	percent of pore volume
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
AC	activated carbon
ACES	Automated Coastal Engineering System
ADCP	acoustic Doppler current profiler
AFDD	Accumulated Freezing Degree Days
AIS	Automatic Identification Systems
ARCS	Assessment and Remediation of Contaminated Sediments
ARCS Program Guidance	*Assessment and Remediation of Contaminated Sediments (ARCS) Program: Guidance for In-Situ Subaqueous Capping of Contaminated Sediments*
BAZ	biologically active zone
C19-C36	C19-C36 aliphatic petroleum hydrocarbons
CEDAS	Coastal Engineering Design and Analysis System
cfs	cubic foot per second
CFT model	chemical fate and transport model
CFT Modeling Report	*Chemical Fate and Transport Model Development and Calibration Report*
cm	centimeter
cm/day	centimeter per day
cm/yr	centimeter per year
cm^2/s	centimeter squared per second
COC	contaminant of concern
CSO	combined sewer overflow
Cu	copper
D	outfall diameter
D/F	dioxin/furan
D/F TEQ	total dioxin/furan toxic equivalence quotient 2005 (mammal)
D_{50}	median particle size
DOC	dissolved organic carbon
FDD	Freezing Degree Day
feet/sec	foot per second
FFS	Focused Feasibility Study
FFS Report	*East Branch Early Action Focused Feasibility Study*
FMRM	*Final Modeling Results Memorandum*

f_{OC}	fraction organic carbon
FS	Feasibility Study
FS Gas Ebullition DER	*Feasibility Study Gas Ebullition Data Evaluation Report*
FS NAPL Mobility DER	*Feasibility Study Nonaqueous Phase Liquid Mobility Data Evaluation Report*
g/cm^3	gram per cubic centimeter
H:V	horizontal to vertical (ratio)
HEC-14	*Hydraulic Design of Energy Dissipators for Culverts and Channels*
in	inch
ISS	in situ stabilization/solidification
ITRC	Interstate Technology and Regulatory Council
K_d	partition coefficient
K_{DOC}	dissolved organic carbon partition coefficient
kg/m^2/year	kilogram per square meter per year
kg/year	kilogram per year
K_{OC}	organic carbon partition coefficient
K_{OW}	octanol/water partition coefficient
L/kg	liter per kilogram
LTE	long-term equilibrium
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
MLLW	mean lower low water
mph	mile per hour
MS4	municipal separated storm sewer system
N/A	not applicable
NAPL	nonaqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NCDC	National Climatic Data Center
NCG	Newtown Creek Group
ng/kg	nanogram per kilogram
ng/L	nanogram per liter
NOAA	National Oceanic and Atmospheric Administration
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
OPA	oil particle aggregate
PAH	polycyclic aromatic hydrocarbon

Pb	lead
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
propwash	propeller wash
RD	remedial design
RI	Remedial Investigation
RI Report	*Remedial Investigation Report*
SWAC	surface weighted average concentration
TPAH (34)	total polycyclic aromatic hydrocarbon (34)
TPCB	total polychlorinated biphenyl
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
yr^{-1}	per year

1 Introduction

As part of the Focused Feasibility Study (FFS) for East Branch of Newtown Creek, six remedial alternatives are being evaluated, including a no action alternative and five active remedial alternatives that involve some combination of sediment removal to various depths and placement of caps or a backfill layer to manage post-dredge residuals. The East Branch Early Action Area includes all areas within East Branch along shoreline stations 253+10 to 304+03. This appendix documents the analyses conducted to develop a preliminary design for a multilayer engineered cap (including chemical isolation and erosion protection layers) in East Branch; the results of these evaluations and the constructability of the preliminary cap design(s) are used as a means of evaluating feasibility of capping as part of the remedial alternatives. Additional analyses and refinements may be appropriate during the remedial design (RD) phase if an alternative that includes capping is selected.

The capping evaluations documented herein were performed in accordance with the U.S. Environmental Protection Agency's (USEPA's) *Assessment and Remediation of Contaminated Sediments (ARCS) Program: Guidance for In-Situ Subaqueous Capping of Contaminated Sediments* (ARCS Program Guidance; Palermo et al. 1998) and other technical guidance documents referenced where appropriate. The capping evaluations include two components:

1. Erosion protection (to address erosive forces from vessel- and wind-generated waves, propeller wash [propwash], ice, hydrodynamic flows, and outfall discharges; see Section 2)
2. Chemical isolation (to address flux of dissolved phase contaminants and flux of nonaqueous phase liquid [NAPL], where present; see Section 3).

In addition, a no-rise evaluation was performed to evaluate the potential for water surface elevations to increase as a result of cap placement (see Section 4).

1.1 Appendix Organization

This appendix is organized as follows:

- Section 2: Erosion Protection Layer Evaluations
- Section 3: Chemical Isolation Layer Evaluations
- Section 4: No-rise Evaluation
- Section 5: Capping Evaluations Summary
- Section 6: Climate Change Impacts and Resilience
- Section 7: References

2 Erosion Protection Layer Evaluations

This section documents the analyses conducted to determine the material size and thickness of the erosion protection component of capping alternatives in East Branch, including the evaluation of potential erosive forces that may affect the proposed cap areas and the computed median stable particle sizes for the erosion protection layer material in the five active alternatives being evaluated. The erosion protection layer of an engineered cap requires particle sizes large enough to be able to withstand potential erosive forces to allow the underlying cap chemical isolation layer(s) to remain in place to provide long-term protection of human health and the environment. An evaluation was performed to estimate likely erosive forces in the proposed cap areas and to calculate the median stable particle sizes that would adequately resist those forces.

Among the mechanisms that may affect the stability of engineered caps within East Branch are wind-generated waves; vessel-generated effects, including waves and propwash; ice; hydrodynamic flows; and discharges from outfalls. This section presents the methodology and results of the cap erosion protection layer preliminary design evaluations for use in the FFS. Other preliminary design elements, including layer thicknesses and filter layer considerations, are presented as well. If capping is included in the selected remedial alternative, additional analyses would be performed as part of the RD phase.

2.1 Design and Performance Criteria

Setting performance standards is a necessary first step in evaluating the erosion protection layer requirements for a cap. The ARCS Program Guidance (Palermo et al. 1998) provides the following description of the functions of a cap erosion protection layer:

> *"The cap component for stabilization/erosion protection has a dual function. On the one hand, this component of the cap is intended to stabilize the contaminated sediments being capped, and prevent them from being resuspended and transported offsite. The other function of this component is to make the cap itself resistant to erosion. These functions may be accomplished by a single component, or may require two separate components in an in-situ cap."*

Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005) provides the following guidance about cap design:

> *"[T]he design of the erosion protection features of an in-situ cap (i.e., armor layers) should be based on the magnitude and probability of occurrence of relatively extreme erosive forces estimated at the capping site. Generally, in-situ caps should be designed to withstand forces with a probability of 0.01 per year, for example, the 100-year storm."*

The erosion protection layer for the East Branch FFS was evaluated using methods published by USEPA specifically for in situ caps: Appendix A "Design of Armor Layers," to the ARCS Program Guidance (Palermo et al. 1998). Consistent with USEPA guidance and based on project requirements, the design and performance criteria for the erosion protection layer include being physically stable under the conditions predicted to occur during a 100-year storm and other reasonably anticipated future conditions.

2.2 Erosion Protection Layer Evaluations

This section describes the analyses performed to evaluate the erosion protection component of capping alternatives in East Branch, for the purposes of the FFS.

2.2.1 Wind-Generated Waves

Wind-generated waves were evaluated using a detailed analysis of the historical wind record dataset from the LaGuardia Airport meteorological station and provided by the National Climatic Data Center (NCDC; NCEI 2023). LaGuardia Airport station is located approximately 5 miles to the northeast of East Branch. Data from 10 meters above the ground elevation were compiled into a single set for analysis using the methodology outlined in the Part 2, Chapter 2-2 of the USACE *Coastal Engineering Manual* (USACE 2002). Figure C2-1a illustrates a wind rose of the combined dataset. Although wind data representative of site conditions have been downloaded from the weather station at Central Park, as documented in the Section 4.4.7 of the *Final Modeling Results Memorandum* (FMRM; Anchor QEA 2022a), data from LaGuardia showed higher wind speeds than at Central Park, so these data were used to more conservatively estimate wind-generated wave heights for the purposes of the FFS.

The NCDC historical wind gauge data were compiled into eight directional bins based on the wind rose, each encompassing a 45° range relative to north (0°): north (337.5°N to 22.5°N), northeast (22.5°N to 67.5°N), east (67.5°N to 112.5°N), southeast (112.5°N to 157.5°N), south (157.5°N to 202.5°N), southwest (202.5°N to 247.5°N), west (247.5°N to 292.5°N), and northwest (292.5°N to 337.5°N). For each directional bin, the annual maximum wind speed for each year from 1948 to 2023 was identified. A statistical analysis of the maximum annual wind speed for each directional bin was performed by applying five candidate probability distribution functions. The five functions were as follows:

- Fisher-Tippet Type I: this distribution is applicable to areas where weather systems dominate wind development.
- Four different Weibull distributions: these distributions are widely accepted as fitting functions for wind speed distribution (Hennessey 1977); four different exponent k values of 0.75, 1.0, 1.4, and 2.0 were evaluated. The k values specify the shape of the distribution of the data (i.e., the variability in growth of wind speeds). Numerous reports have studied the sensitivity

of the Weibull function to the shape factor, k; however, Früh suggested that the typical ranges of k for many mid-latitude locations is 1.7 to 2 (Früh 2015).

Each of the five distribution functions were fitted to the maximum yearly wind speed data (for the 1948–2023 time period) in each directional bin, and the best fit distribution over the range of wind frequencies was identified, as shown in Figures C2-1b through C2-1i.

For each of the five distribution functions (either Fisher-Tippet Type I or one of the four Weibull functions), the coefficient of determination (r-squared) was calculated for each directional bin to fit the data against the distribution function, and the distribution function with the coefficient of determination (r-squared) closest to 1.0 (i.e., that has the lowest residual sum of squares) for each directional bin was selected as the best fit distribution. Figures C2-1b through C2-1i represent the various distribution functions that were used to estimate the 1-year, 2-year, 10-year, 20-year, 50-year, and 100-year return interval storm event wind speeds. The five distribution functions each individually estimate these storm events based on a statistical analysis of the complete wind data set. The appropriate distribution was chosen to define the return period storm events for analysis based on the coefficient of determination closest to 1.0 (i.e., most accurately representing the wind data). Figures C2-1j and C2-1k represent the distribution function that was selected to estimate the 100-year return period wind speed for each of the eight directional bins. This 100-year design wind speed for each directional bin was then used to predict the 100-year wave height and period based on the fetch distances.

Because of the location, orientation, and geometry of East Branch, the winds and waves that affect East Branch come primarily from the northwest and the northeast. The statistical analysis determined that the speeds of the 100-year return interval winds (i.e., the maximum wind speed estimated for the 100-year return interval storm) are 64.5 miles per hour (mph) from the northwest (292.5- to 337.5-degree directional bin) and 62.5 mph from the northeast (22.5- to 67.5-degree directional bin). Table C2-1 summarizes the 100-year storm wind speeds and associated fetch lengths.

Table C2-1
100-Year Return Interval Wind Speeds

Wind Direction	Maximum Fetch (feet)	100-Year Windspeed (mph)
Northeast (22.5 to 67.5 degrees)	900	62.5
Northwest (292.5 to 337.5 degrees)	4,250	64.5

The Coastal Engineering Design and Analysis System (CEDAS) Automated Coastal Engineering System (ACES) was used to predict the 100-year wave height. ACES is an interactive design software developed by USACE (1992) used for coastal engineering evaluations. The software incorporates several design applications based on coastal engineering theory, empirical expressions, and numerical algorithms. The 100-year storm wave heights and periods were estimated based on the return interval wind speed, duration of the applied wind, fetch length, and local water depth. Wave growth was modeled with the restricted shallow water option in ACES due to the narrow confining shorelines within East Branch; an average water depth of 15 feet was assumed for analysis. A sensitivity analysis was performed to evaluate the effect of wind duration on wave growth. Wave growth was modeled for 2-minute, 5-minute, 10-minute, 15-minute, 30-minute, and 60-minute wind durations. A 15-minute wind duration was used to calculate wave growth since the results of the sensitivity analysis indicated the wave growth slowed significantly after 15-minute wind durations and growth was negligible thereafter, likely due to the restricted fetches and water depths preventing full wave growth. Fetch distances aligning with the northwest and northeast dominant wind directions at East Branch are 4,250 feet and 900 feet, respectively, as shown in Figure C2-2, and were used in the modeling. Table C2-2 summarizes the wind-generated wave heights for each fetch length in Table C2-1. The maximum of the predicted 100-year wave heights is approximately 1.4 feet, with a period of approximately 2.0 seconds for both the northwest and northeast dominant wind directions. Although the fetch length in the northwest directional bin is significantly longer than in the northeast wind direction, the restricted shallow water option in ACES accounts for impacts due to fetch shapes and geometries that can limit wave growth, resulting in smaller wave heights than one might expect over a similar fetch in an unconfined geometry (i.e., deeper, open water). Given the confining geometry of East Branch, specifically the long and narrow waterway channels bordered by multistory buildings and fences, and limited fetch distances, it is expected that regularly occurring wind-generated waves within Newtown Creek would be smaller in magnitude than those calculated along the longest fetch lengths. As a result, wind-generated waves are not likely to be the dominant driver for the cap armoring in East Branch.

Table C2-2
Significant Wave Heights and Associated Wave Period for 100-Year Return Period Storm

Wind Direction	Maximum Fetch (feet)	100-Year Windspeed (mph)	100-Year Wave Height (feet)	100-Year Wave Period (seconds)
Northeast	900	62.5	1.3	1.9
Northwest	4,250	64.5	1.4	2.0

2.2.2 Propeller Wash

As a motorized vessel moves through the water, its propeller produces an underwater "jet" of water, known as propwash. If this jet reaches the bottom of the waterbody, it can impart erosive forces on the material there. The magnitude of those forces depends on water depth and vessel operation conditions. This section presents an analysis performed to calculate the median stable particle diameter to resist erosive forces due to propwash from transiting and maneuvering vessels. Median stable particle diameters resulting from this propeller wash analysis are summarized based on the bed elevation (using MLLW to compute water depth for the calculations). Summarizing the results based on various bed elevations allows the results to be broadly applicable and not dependent on a specific bathymetry data set or any one remedy. The results of the analyses presented in this section are intended to support the FFS evaluations; additional analyses and refinements may be appropriate during the RD phase if an alternative that includes capping is selected.

2.2.2.1 Methodology

A review of the Automatic Identification Systems (AIS) data for vessels within East Branch was conducted for the 5-year period between 2016 and 2020. The evaluation yielded a list of representative vessels based on the vessels identified in East Branch from the AIS database. Vessel characteristic information (such as the horsepower, number of propellers, ship draft, and propeller diameter) were collected from online sources or estimated based on other available characteristics if online data were not available. Longitudinal and lateral transects of possible vessel paths in the navigation channel and nearshore areas were developed for evaluating propwash over a range of water depths and locations. Using the transects and vessel characteristics, the near-bed velocities and corresponding stable particle diameters were computed using the propwash model for maneuvering and transiting vessels as described in Appendix A of the ARCS Program Guidance (Palermo et al. 1998) for a range of vessel speeds and applied power. Vessels were assumed to not be transiting or maneuvering with barges because the AIS data show the larger vessels (tugs) use East Branch to turn around without any barge in tow.

Although propwash effects on sediment transport were included in the OU1 Study Area[1]-wide sediment transport modeling (Anchor QEA 2022a), the analysis described here has a different goal. The Study Area-wide modeling was focused on long-term net effects of transiting vessels on sediment resuspension and subsequent transport. Although vessels typically move through the water at a given speed, which acts to reduce the duration and magnitude of the propeller wash acting on the mudline at a given point in space, this analysis focuses on the more conservative potential propwash impacts from stationary or slowly moving and/or maneuvering vessels and the associated median stable particle diameter that would be needed to protect a cap placed as part of the remedial alternatives. Even though the analyses are similar, different methods were used to evaluate propwash in this study and in the sediment transport modeling.

2.2.2.2 Automatic Identification Systems Data Analysis

The AIS data identified 29 vessels that operated downstream of the Grand Street Bridge and six vessels that operated upstream of the bridge during 2016 through 2020. Vessel types included tugs,

[1] The term "Study Area" in this FFS refers to the OU1 Newtown Creek Study Area.

recreational vessels, port tenders, and other vessels (i.e., vessel type not identified in the AIS database). None of the vessels were barges. Based on available characteristics, three representative vessels were identified for use in the propwash model: the tug Emily Ann that operated downstream of the Grand Street Bridge, the tug TJ Miller that operated upstream and downstream of the Grand Street Bridge, and the New York City Department of Environmental Protection (NYCDEP) sampling vessel Tide Runner that also operated upstream and downstream of the bridge. These vessels were deemed representative of those operating in East Branch for the purposes of the FFS because they span a wide range in size, horsepower, and location of transit within East Branch. The Emily Ann was the highest horsepower vessel in the evaluated AIS data in East Branch, and the TJ Miller was the only tug in the evaluated AIS data that operated upstream of the Grand Street Bridge. The Tide Runner is a smaller vessel but operated over a larger area of East Branch than the larger tugs. Table C2-3 provides a summary of the vessel characteristics. Figure C2-3 shows photographs of these representative vessels. Figure C2-4 shows a map of activity of the three vessels within East Branch (along with sediment bed elevations from the most recent 2022 bathymetric survey), and Figure C2-5 shows a map of the vessel speeds.

Table C2-3
Summary of Representative Vessel Characteristics

Vessel Name	Applicable Analysis Transects[a]	Draft (feet)	Engine Power (horsepower)	Propeller Diameter (feet)
Emily Ann	1 and 2 only	5.6	3,000	7.83
TJ Miller	1 through 8	6.0	300	2.0[b]
Tide Runner	1 through 12	3.0[c]	500	1.3[c]

Notes:
a. See Figure C2-6 for location of transects used in the propwash analysis.
b. TJ Miller propeller diameter estimated from engine horsepower
c. Tide Runner draft and propeller diameter estimated from photographs and online information

Observations from these data show the following:

- The tugboat Emily Ann does not travel very far upstream into East Branch when turning around (approximately 200 feet upstream of the confluence with English Kills).
- There is no evidence of commercial traffic in the Western Beef Slip or the upstream portion of East Branch during the 5-year evaluation period, although vessels without AIS tracking may use these areas, or could reasonably do so in the future.
- The average speed of transiting vessels was 4 knots downstream of the Grand Street Bridge and 2 knots upstream of the bridge.

2.2.2.3 Calculation of the Near-Bed Velocity and Stone Size

Appendix A of the ARCS Program Guidance (Palermo et al. 1998) provides empirical equations used in the calculation of near-bed velocities generated from vessel propellers originally developed by

Blaauw and van de Kaa (1978). The equations calculate the maximum near-bed velocities and median stable particle diameter at the centerline of a propeller as a function of the distance away from the propeller. The equations are a function of the propeller diameter, distance from propeller shaft to channel bottom, water depth, ship draft, number of propellers, vessel speed, and applied engine power. The jet velocity exiting a propeller (U_o) is calculated as shown in Equation C2-1 (Appendix A of ARCS Program Guidance [Palermo et al. 1998]), with propellers assumed to be non-ducted.

Equation C2-1

$$U_o = C_2 \left(\frac{P_d}{{D_p}^2}\right)^{\frac{1}{3}}$$

where:

U_o	=	jet velocity exiting propeller (feet/sec)
C_2	=	constant (9.72 for non-ducted propellers)
P_d	=	applied engine power (horsepower)
D_p	=	propeller diameter (feet)

The velocity ($V_{x,y}$) in the longitudinal direction and vertical direction relative to the propeller is a function of the jet velocity exiting the propeller (U_o, as calculated from Equation C2-1) and propeller diameter (D_p). The velocity field ($V_{x,z}$) was calculated as shown in Equation C2-2 as a function of the horizontal distance from the propeller and the radial distance between the propeller and the sediment bed.

Equation C2-2

$$\frac{V_{x,z}}{U_o} = 2.78\frac{D_o}{x}exp\left(-15.43\left(\frac{z}{x}\right)^2\right)$$

where:

$V_{x,y}$	=	velocity at coordinates x and y (feet/sec)
U_o	=	jet velocity exiting propeller (feet/sec)
D_o	=	constant (0.71 D_p for non-ducted propellers)
D_p	=	propeller diameter (feet)
x	=	horizontal distance from propeller (feet)
z	=	radial distance from axis of propeller (feet)

To calculate the 2D velocity ($V_{x,y}$), a 1-foot grid spacing was used in the horizontal and vertical directions. The velocities in the grid cells immediately above the bed were used to determine the maximum predicted near-bed velocity, V_b(max), along each cross section. The empirical equations do not specifically address vessel speeds. The jet velocity exiting the propeller is proportional to the applied power as seen in Equation C2-1. The amount of applied power for a given vessel will be dependent on the specific mode of operation. For instance, greater applied power is usually needed to get a vessel moving from a stationary condition, and less applied power is needed to continue vessel movement. In addition, smaller vessels (e.g., recreational vessels) typically have a very quick response time between the application of power and the start of vessel movement, whereas larger, heavier vessels may remain nearly stationary for a period of time (i.e., several seconds to minutes, depending on the vessel and the conditions) after the application of power; this stationary or near-stationary condition is sometimes referred to as a "maneuvering" condition for the purposes of evaluating propwash. In the maneuvering mode of operation, the propeller jet, with higher applied power, results in a larger magnitude and duration of erosive forces on the bottom sediments as compared to a moving vessel. The empirical equations for computing propeller-induced near-bed velocities are based on a stationary vessel and do not specifically address vessel speeds. Maynord (1990) describes that the propeller jet and resulting near-bed velocity is different behind stationary (vessel speed equals zero) versus moving vessels and that the near-bed velocity is lower behind moving vessels than stationary vessels, with all else being equal. Therefore, for this evaluation, the net bed velocity was calculated as the propwash near-bed velocity (V_b) minus the vessel speed over ground, consistent with similar propwash analyses performed for other sites (e.g., CHE 2007). For example, a vessel moving at 5 feet/sec with a propwash near-bed velocity of 8 feet/sec will result in a net bed velocity of 3 feet/sec.

To determine the median particle diameter to resist erosive forces, Blaauw et al. (1984) give the following Equation C2-3:

Equation C2-3

$$V_b(max) = C_3(g * \Delta * D_{50})^{\frac{1}{2}}$$

where:

V_b	=	near-bed velocity (feet/sec)
C_3	=	coefficient (0.7 for small transport)
g	=	acceleration due to gravity (32.2 feet/sec^2)
D_{50}	=	median particle diameter to resist erosive forces (feet)
Δ	=	$(\gamma_S - \gamma_W)/\gamma_W$
γ_S	=	unit weight of stone (165 pounds per cubic foot)
γ_W	=	unit weight of water[2] (64.0 pounds per cubic foot)

Water depth along each cross section was a function of the bed elevation and assumed water surface elevation. The bed elevations used for this analysis were based on a bathymetric survey of East Branch completed in 2022. The tidal water levels were determined based on hourly data from the National Oceanic and Atmospheric Administration (NOAA) gauge at The Battery (8518750) for the 23-year period between 1992 and 2014. The data were transformed using amplitude and phase corrections to the Hunter's Point location near Newtown Creek using the amplitude and time adjustments provided by NOAA (8517673, Hunters Point, Newtown Creek, New York), as shown in Table C2-4. A 23-year period was used so that the analysis was based on a timescale that is longer than a complete 19-year tidal epoch and is long enough to give realistic estimates of tidal low- and high-water levels.

Table C2-4
NOAA Astronomical Tide Conversion Factors: The Battery to Hunter's Point

Amplitude Multiplication Factor (feet MLLW)	Phase Shift (minutes)
High tide: 0.89	High tide: 82
Low tide: 0.90	Low tide: 56

[2] East Branch is a brackish water environment. For the purposes of this analysis, the unit weight of salt water was used, which is the more conservative value when calculating the median particle diameter to resist erosive forces (i.e., results in a larger median particle diameter than if fresh water was assumed); this assumption may be refined for future analyses.

For this study, the conservative low tide value of -2.56 feet North American Vertical Datum of 1988 (NAVD88; 0.05 foot mean lower low water [MLLW]) was used for the East Branch study area. Predicted near-bed velocities are higher (and median particle diameter to resist erosive forces will be larger) with the assumption of low tide water levels because the propeller is closer to the bed during low-water conditions. This assumption is especially conservative in portions of East Branch where water depths at low tide would limit vessel operations outside of small, narrow sections of slightly deeper water. Uncertainties in vessel speeds and applied power meant that a range of values were assessed, including 0 to 1 knots for the vessel speeds and 5% to 20% for the applied power, depending on the vessel type.

No barges were observed in the AIS data in East Branch, so it was assumed the tugs operating in East Branch are turning around and are not maneuvering barges. In previous conversations with vessel captains during development of the hydrodynamic and sediment transport model in the FMRM (Anchor QEA 2022a), the captains would only indicate that they applied enough power to maintain steerage for safety. Thus, it was assumed the tugs in East Branch are unladen and traveling slowly, suggesting the applied power is relatively low. The smaller Tide Runner may be operating under higher power in the deeper water areas, but in the deeper water the propeller-induced velocity on the bed is low. In shallower water, the vessel would be traveling slower, under lower applied power, for safety reasons. It was also assumed the Tide Runner could "nose-up" to a bulkhead for sampling or another task, thus remaining stationary with an applied power. However, even under these conditions, the vessel would need to remain at relatively low power to maintain safety. Assumptions on applied vessel power could be reevaluated during RD if additional information from vessel captains can be obtained.

Longitudinal and lateral transects were created for the propwash model to represent vessel operations in various locations in East Branch. Figure C2-6 shows a map of the numbered transects. Transects parallel to the channel represent vessels transiting along the navigation channel or along the shoreline areas. Transects perpendicular to the channel represent vessels that are maneuvering. For the perpendicular transects, the assumption is that tugs are going into East Branch and turning around. For these transects, analyses were completed with the vessel positioned at both ends of the transect to represent the point where the vessel would be in the shallowest water. In each case, for the perpendicular transects, the stern of the vessel was directed toward the center of the channel, assuming that the vessel was midway through its turning operation, before completing its turnaround and returning toward the center of the channel. Other vessel positions and operating procedures may be simulated during the RD phase. Table C2-3 shows the transects evaluated for each vessel. Longitudinal transects represent transiting vessel operations in either the deep parts of East Branch, such as the navigation channel (1 and 4), along the shallow nearshore areas (9 through 12), or in the shallow slip areas (6 and 8). Lateral transects (2, 3, 5, and 7) represent maneuvering vessel operations in the shallow parts of East Branch, such as the nearshore areas or slip areas. The tug Emily Ann, which only operated downstream of the Grand Street Bridge, was evaluated only for Transects 1 and 2, whereas the other vessels were evaluated for transects both downstream and upstream of the bridge. Transects 5 through 8 represent areas of limited vessel use, with no observed use in the 5-year evaluation period (2016 to 2020) based on AIS data.

Given the narrow confines of East Branch and the vessel speed data from the AIS, the propwash analyses assumed that all vessels would operate at relatively low engine power. For the purposes of these FFS analyses, 20% of the total engine power was assumed for each of the three vessels evaluated. A vessel speed of 1 knot was assumed for the two tugboats evaluated, representing a slowly moving vessel, with the recognition that higher vessel speeds would result in lower near-bed velocities. For the Tide Runner sampling vessel, analyses were conducted assuming both a transiting operation at 1-knot speed and a stationary operation at 0 knot where the vessel would "nose-up" to push on the shoreline to maintain position for sampling, maintenance, or inspection. During this stationary operation, lower applied powers of 5% and 10% were used.

2.2.2.4 Results

This section describes the results of the propwash analysis. For each combination of vessel and transect, the maximum near-bed propwash-induced velocity and median particle diameter were calculated. Example output from the propwash model is shown in Figure C2-7 for the tug Emily Ann, operating along longitudinal Transect 1 in the navigation channel. The top panel shows the 2-dimensional velocity field along the centerline of the propeller. The middle panel shows the predicted near-bed velocity, and the bottom panel shows the predicted stable median particle diameter to resist erosive forces. For the purposes of evaluating the results, East Branch was divided into four main regions: Area 1 downstream of the Grand Street Bridge, Area 2 upstream of the Grand Street Bridge, and Areas 3 and 4 as the limited use areas, defined by the Western Beef Slip (Transects 6 and 7) and upstream of the NYCDEP boom (Transects 5 and 8), respectively (see Figure C2-6). There is no evidence of vessel use in the limited use areas from AIS data, but recreational vessels not tracked by AIS could access the Western Beef Slip and could potentially access upstream of the NYCDEP boom in the future, if the boom were to be removed. The areas were further subdivided into deep and shallow areas representing the navigation channel and nearshore areas, with a cutoff elevation of -13.5 feet MLLW (approximately -16 feet NAVD88). The cutoff elevation between deep and shallow areas, for the purposes of the erosion protection layer design, was determined by simulating a set of constant bed elevation scenarios from -20 feet NAVD88 to -10 feet NAVD88, using the vessel characteristics for Emily Ann, because it is the largest and most powerful of the three vessels that operate in deep water, and assuming vessel operations using 20% applied power and vessel speed of 1 knot. The cutoff elevation separating deep and shallow water was selected as the elevation below which the maximum D_{50} would be about 0.2 inch, the breakpoint between sand and gravel.

Table C2-5 shows the results for Area 1.

Table C2-5
Predicted D_{50} for Propwash in Area 1: Downstream of the Grand Street Bridge

Vessel Name	Region	Transects	Speed (knots)	Applied Power (%)	D_{50} (inches)
Emily Ann	Deep Water[1]	1	1	20	0.14 to 0.2
Tide Runner/TJ Miller	Shallow Water[2]	2	1	20	<0.1 or 2.7
Tide Runner	Shallow Water[3]	9 or 10	0 or 1	20	<0.1 or 2.0

Notes:
1. The Emily Ann was selected as the design vessel for the deep-water region because it is the largest and most powerful of the three vessels that operate in this area. Simulations along Transect 1 resulted in a stable particle size of 0.14 inch, whereas a sensitivity analysis simulating the Emily Ann operating over a flat bottom with varying water depths resulted in a stable particle size of about 0.2 inch at -13.5 feet MLLW, resulting in a range of D_{50}.
2. Both the Tide Runner and TJ Miller were simulated in a "turnaround" operation in the shallow water region represented by Transect 2. A range of D_{50} is provided based on the two vessels.
3. It is assumed that only the shallow draft of the Tide Runner can operate parallel to shore in the shallow water region, although the AIS data do not indicate that any of the design vessels have operated in the shallow water portions of Area 1; they have only operated in the deep-water portions. A range of D_{50} is provided based on considering two transects.

For the deep-water region in Area 1, the tug Emily Ann produced the highest propwash velocity with a predicted stable particle diameter at longitudinal Transect 1 of 0.2 inch (i.e., coarse sand/fine gravel). In shallow water in Area 1, the Tide Runner, transiting along Transects 9 and 10 or maneuvering along Transect 2, produced the highest propwash velocity with a corresponding predicted stable particle diameter of 2.7 inches (i.e., cobbles).

Table C2-6 shows the results for Area 2, where the tug TJ Miller and NYCDEP sampling vessel Tide Runner operate.

Table C2-6
Predicted D_{50} for Propwash in Area 2: Upstream of the Grand Street Bridge

Vessel Name[1]	Region	Transects	Speed (knots)	Applied Power (%)	D_{50} (inches)[2]
TJ Miller	Deep Water[3]	1	1	20	<0.1
Tide Runner	Deep Water[3]	1	1	20	<0.1
TJ Miller	Shallow Water	3 or 4	1	20	<0.1
Tide Runner	Shallow Water	3 or 4	0	5 or 10	2.4 or 3.9 [4]
Tide Runner	Shallow Water	3 or 4	1	20	1.7
Tide Runner	Shallow Water	11 or 12	0 or 1	20	0.12 or 2.3

Notes:
1. Tug Emily Ann was not evaluated because this vessel does not travel upstream of the Grand Street Bridge.
2. A range of D_{50} is provided for some cases analyzed based on a range of speed, applied power, or transects.

3. Transect 4 spans both shallow and deep water, so results for deep water are based on Transect 1, which has similar water depths to the deeper portions of Transect 4.
4. The upper end of the predicted range of D_{50} is considered overly conservative based on the nature of the assumptions for this evaluation. Therefore, an average of approximately 3 inches (i.e., cobbles) is recommended.

For the deeper water region in Area 2, the maximum predicted stable particle diameter is <0.1 inch (i.e., sand) for both the TJ Miller and the Tide Runner. For the shallow water portions of Area 2, the maximum predicted stable particle diameter is 2.4 (i.e., gravel) or 3.9 inches (i.e., cobbles), depending on the assumed applied engine power based on the Tide Runner operating in a stationary position (0-knot speed) on Transect 4. However, as discussed in Note 4 for Table C2-6, given the conservative nature of the assumptions for this evaluation, an average of approximately 3 inches (i.e., cobbles) is recommended.

Table C2-7 shows the results for Areas 3 and 4 (the Limited Use Areas).

Table C2-7
Predicted D_{50} for Propwash in Areas 3 and 4: Limited Use Areas

Vessel Name	Region	Transects	Speed (knots)	Applied Power (%)	D_{50}[2] (inches)
Tide Runner	Area 3: Deep and Shallow Water[1]	6 or 7	1	20	<0.1 or 1.9
Tide Runner	Area 4: Deep and Shallow Water[1]	5 or 8	1	20	2.2 or 3.4 [3]

Notes:
1. The Western Beef Slip (Transects 6 and 7) is defined as Area 3, and upstream of the NYCDEP boom (Transects 5 and 8) is defined as Area 4. There is no evidence of vessel use in this area from AIS data, but recreational vessels not tracked by AIS could access the Western Beef Slip and could potentially access upstream of the boom in the future if the boom is removed.
2. A range of D_{50} is provided based on considering multiple transects.
3. The upper end of the predicted range of D_{50} is considered overly conservative based on the nature of the assumptions for this evaluation. Therefore, an average of approximately 3 inches (i.e., cobbles) is recommended.

Area 3 is defined as the Western Beef Slip (Transects 6 and 7), and Area 4 is defined as upstream of the NYCDEP boom (Transects 5 and 8), but not including the area extending 200 feet from the discharge of the combined sewer overflow (CSO) at the head of East Branch because this area will have a separate outfall scour protection, as described in Section 2.2.7. The maximum predicted stable particle diameter to resist erosive forces in Area 3 is 1.9 inches (i.e., coarse gravel) and in Area 4 is 3.4 inches (i.e., cobbles) for both deep and shallow water, based on the Tide Runner operating on Transects 6 and 5, respectively. However, this result is considered especially conservative given the very shallow water that exists in this area at low tide (the assumed water level for the FFS propwash analysis) and the corresponding low probability that boats will be operating in Area 4 during these low tides. Therefore, a stable particle diameter of approximately 3 inches (i.e., cobbles) is recommended for the deep and shallow water in Area 4.

In summary, the recommended erosion protection material types for the four main areas of East Branch are shown in Table C2-8.

Table C2-8
Summary of Erosion Protection Layer Propwash Evaluations

Region	Stable Particle Type	
	Deep Water[1]	Shallow Water
Area 1 (Downstream of the Grand Street Bridge)	Coarse Sand	Cobbles
Area 2 (Upstream of the Grand Street Bridge)	Sand	Cobbles
Area 3 (Limited Use Area)	Coarse Gravel	Coarse Gravel
Area 4 (Limited Use Area)	Cobbles	Cobbles

Note:
1. For this evaluation, "deep water" is defined as deeper than -13.5 feet MLLW.

2.2.3 Vessel-Generated Waves

Vessel-generated waves (also known as vessel wakes) form as the hull of a moving vessel displaces water. AIS data as described in previous sections were again used to determine representative vessels to evaluate vessel wakes. The same three representative vessels used for the propwash evaluation (see Section 2.2.2), consisting of two tugs and a NYCDEP sampling vessel, were used to evaluate vessel-generated waves within East Branch. The analysis used the Bhowmik et al. (1991) methodology to calculate wake heights for recreational vessels (Equation C2-4) and the Sorensen and Weggel (1984) methodology to evaluate tugboats and large commercial vessels (Equation C2-5). The Bhowmik method involves several input parameters including vessel speed, vessel length and draft, and the distance away from the sailing line (i.e., the centerline of the vessel path); vessel wakes are calculated using the following equation:

Equation C2-4

$$H_m = 0.573 * V^{-0.346} * x^{-0.345} * {L_v}^{0.56} * D^{0.355}$$

where:

H_m	=	vessel wake height (feet)
V	=	vessel sailing velocity (feet/sec)
x	=	distance to sailing line (feet)
L_v	=	vessel length (feet)
D	=	vessel draft (feet)

The Sorensen and Weggel method of calculating vessel wake heights relies on the displacement of the passing vessel and is defined by nondimensional water depth and distance from sailing line. Both are achieved by dividing each parameter by the volume of water displaced by the vessel hull expressed in feet (i.e., the third root of displacement in cubic yards). The nondimensional wake height was calculated using the following equation:

Equation C2-5

$$H^* = a * x^{*^n}$$

where:

H^*	=	dimensionless wake height ($H_m = H^* * W^{\frac{1}{3}}$)
H_m	=	wake height (feet)
W	=	vessel displacement (cubic feet)
a	=	coefficient; -0.6 divided by the vessel Froude number
x^*	=	dimensionless distance from the sailing line ($x = x^* * W^{\frac{1}{3}}$)
n	=	exponent calculated from coefficients β and δ ($n = \beta * (d^*)^{\delta}$)
d^*	=	dimensionless water depth ($d = d^* * W^{\frac{1}{3}}$)
β	=	coefficient $\beta = -0.225 * F^{-0.699}\ for\ 0.2 \le F \le 0.55$ $\beta = -0.342\ for\ 0.55 \le F \le 0.8$
δ	=	coefficient $\delta = -0.118 * F^{-0.356}\ for\ 0.2 \le F \le 0.55$ $\delta = -0.146\ for\ 0.55 \le F \le 0.8$
F	=	Froude Number $F = \frac{d}{\sqrt{g * V}}$ $g = gravitational\ constant\ (32.2\ feet\ per\ second\ squared)$ $V = Vessel\ velocity\ (feet/sec)$

AIS data indicated that large commercial vessels (i.e., the Emily Ann-sized tugs) travelled between 1 and 4 knots, which is not fast enough to generate significant wake heights (i.e., <0.1 foot). Estimated wake heights for the other vessels in this analysis (i.e., TJ Miller and Tide Runner) ranged from 0.17 to 1.3 feet with a period of 0.9 to 1.6 seconds (Table C2-9). Due to the confined geometry and armored or bulkheaded shorelines along East Branch, vessels wakes may reflect off armored shorelines or structures and become superimposed. For the FFS evaluation, full reflection and superposition of the vessel wakes were conservatively assumed for the nearshore areas. Therefore, stable particle sizing for vessel wakes was determined using a maximum wave height of 2.6 feet, as described further in this section.

ACES (USACE 1992) was used to estimate the stable particle size to resist erosive forces based on predicted vessel wave heights. The rubble-mound revetment module within ACES, which uses stone sizing methods presented by USACE (2004a) was used to compute the stable median particle size (D_{50}) resistant to the predicted wake height based on the slope of the cap. A 3 to 1 horizontal to vertical (3H:1V) slope was used in this computation to represent reasonable post construction shoreline slopes within East Branch; however, the slope may be further refined during the RD phase. Table C2-9 summarizes the wave heights and wave periods and corresponding median (D_{50}) stable particle sizes in the nearshore (i.e., wake zone). In general, the wake zone begins where the depth of the water is approximately equal to the breaking wave depth. The width of the wake zone depends on the wave conditions and water level. For a 2.6-foot-high wave, the depth of the water where the wave breaks is approximately 4 feet below low tide. Based on the tidal range in East Branch, the wake zone for this analysis was determined to be between elevation -4 feet MLLW and approximately +9 feet MLLW. This range encompasses the water depths that compose the wake zone at both low and high tide conditions.

Based on the analyses for vessel-generated waves, the stable armor material diameter was estimated at a D_{50} of 7 inches (cobble size range), as summarized in Table C2-9.

Table C2-9
Vessel-Generated Waves

Vessel Name	Vessel Type	Wave Period (seconds)	Maximum Vessel Wave Height (feet)	Maximum Combined Wave Height[2] (feet)	Median D_{50} (inches)
Emily Ann[1]	Tug	N/A	N/A	N/A	N/A
TJ Miller	Tug	1.2	0.17	0.34	1.32
Tide Runner	Recreational	1.6	1.3	2.6	7.0

Notes:
1. Wave height, wave period, and resultant median stone size are not applicable to the Emily Ann vessel as it does not travel at speeds high enough to generate significant vessel wakes.
2. The combined wave height was computed as twice the maximum vessel wave height to account for reflection off shorelines and superposition of the waves.

N/A: not applicable

2.2.4 Ice

Due to the cold temperatures that occur in New York City in the winter months, East Branch occasionally freezes over in the winter. As a result, the potential effects of ice (e.g., displacement due to forces of ice crushing by thermal expansion, shear drag stresses, and impact of drifting ice) on the sediment cap in shallow waters and against the shoreline were evaluated as part of the erosion protection layer design. This section provides a summary of the analysis of icing conditions at East Branch.

Estimated ice thickness on East Branch was calculated based on the degree-day method, in which ice thickness is estimated based on the Accumulated Freezing Degree Days (AFDD). Ice thickness is calculated by multiplying the Stefan ice cover coefficient by the square root of AFDDs that occur over an entire season as shown in the following Stefan equation, C2-6 (USACE 2004b):

Equation C2-6

$$\text{Thickness} = c * \sqrt{\text{AFDD}}$$

where:

Thickness	=	ice thickness (inches)
c	=	ice cover coefficient (0.21 to 0.41 for sheltered small rivers)
AFDD	=	Accumulated Freezing Degree Days (calculated as the sum of Freezing Degree Days [FDDs] over the season)

where:

FDD	=	32°F$-T_{daily\ mean}$
T	=	temperature (°F)

An ice cover coefficient of 0.41 is more conservative for sheltered small rivers, so a c value of 0.41 was used to calculate ice thickness for this FFS analysis. AFDDs are calculated as the sum of Freezing Degree Days (FDDs) over the season. FDDs represent the temperature difference from freezing and are calculated by subtracting the daily mean temperature from the freezing temperature (32°F) for each day over the freezing season. For days when the average daily temperature does not exceed the freezing temperature, the FDD will be positive; conversely, for days when the average daily temperature does exceed freezing, the FDD will be negative. Ice forms when there are consecutive days when the FDD is positive (i.e., consecutive days when the average daily temperature does not exceed the freezing temperature). The AFDD is calculated by summing together the positive FDDs for each season. A large AFDD suggests that the average daily temperature for each positive FDD was very low (i.e., cold), and a small AFDD suggests that the average daily temperature for the positive FDDs were close to the freezing temperature. Historical temperature record data were obtained from the LaGuardia Airport meteorological station and provided by the NCDC (NCEI 2023). The LaGuardia Airport station is located approximately 5 miles to the northeast of East Branch. Daily low, high, and average temperature data from 1975 through 2023 were compiled into a single set for analysis. AFDDS calculated between 1975 and 2023 for each season ranged from 1.5 to 388.5, although in several years over that span, the temperature did not fall below freezing in enough consecutive days to allow ice to form based on the degree-day method; those seasons are reported as zero ice thickness.

Daly et al. (2008) found that for armor material of similar diameter that were selectively placed (i.e., engineered placement as opposed to loosely placed material), the average particle size could be reduced to approximately equal the ice thickness without experiencing damage. The estimated ice thickness at East Branch calculated by the degree-day method has ranged on average from 1.3 to 2.5 inches since 1975. Because ice thickness is not expected to be deep enough to affect in-water capping, ice thickness evaluations are confined to areas of the shoreline and very shallow water.

Thus, cap areas along the shoreline of East Branch would require a coarse gravel material with a minimum D_{50} of 2.5 inches to resist potential erosive forces from ice.

USACE suggests that where large moving ice floes are anticipated, a maximum stone size (D_{100}) for shallow slopes (3H:1V) should be twice the maximum expected ice thickness (USACE 2005). The criteria defined by Daly et al. (2008) would meet this design criteria with the appropriate selection of material. However, large moving ice floes (which may occur in a freshwater riverine environment) are not anticipated in East Branch because it is a tidally driven saltwater system with low hydrodynamic flows; as discussed in Section 2.2.5, this criterion would be overly conservative for protection against potential erosive forces from ice.

2.2.5 Hydrodynamic Flows

The stable particle diameter to resist the velocity resulting from water flow in East Branch was estimated using Appendix A of ARCS Program Guidance (Palermo et al. 1998) method. The method presented in Appendix A of Palermo (1998) and shown in Equation C2-7 is based on the USACE's Hydraulic Design of Flood Control Channels (USACE 1994). This method uses depth-averaged velocity and water depth to determine the stable D_{50}. The following equation and assumptions were used:

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Equation C2-7

$$D_{50} = S_f C_S C_V C_T C_G d \left[\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{0.5} \frac{V}{\sqrt{K_1 g d}} \right]^{2.5}$$

where:

D_{50}	=	median particle diameter (in feet) to resist erosion from the velocity of the water flow
S_f	=	safety factor = 1.5
C_S	=	stability coefficient for incipient failure = 0.375 for rounded rock (from page A-5 of Appendix A to Palermo et al. 1998)
C_V	=	velocity distribution coefficient = 1.0 for straight channels, inside of bends (from page A-5 of Appendix A to Palermo et al. 1998)
C_T	=	blanket thickness coefficient = 1.0 for flood flows (from page A-5 of Appendix A to Palermo et al. 1998)
C_G	=	gradation coefficient = $(D_{85}/D_{15})^{1/3}$
D_{85}/D_{15}	=	gradation uniformity coefficient = 3.5 (typical range = 1.8 to 3.5 from page A-5 of Appendix A to Palermo et al. 1998)
d	=	water depth (feet)
γ_s	=	unit weight of stone = 165 pounds per cubic foot
γ_w	=	unit weight of water = 64.0 pounds per cubic foot
V	=	maximum depth-averaged velocity (feet/sec)
K_1	=	side slope correction factor = 0.9 for a slope of 2H:1V (Plate B-39)
g	=	acceleration due to gravity = 32.2 feet/sec^2

The depth-averaged current velocity used in this evaluation for East Branch was based on 10-minute current measurements collected from an acoustic Doppler current profiler (ADCP) at station EB044 within East Branch during the Phase 2 field study. Velocities were measured from July 4, 2014, to January 6, 2015, and again from April 2, 2015, to May 5, 2015. The average depth-averaged velocity was 0.042 feet/sec (Table G4-2 of Anchor QEA 2022a). The maximum velocity during flood and ebb tide were 0.28 and 0.39 feet/sec, respectively. Using the higher depth-averaged velocity (i.e., 0.39 feet/sec) and a range of water depths between 5 and 30 feet, the largest calculated median stable particle diameter is 0.00046 foot (or 0.0055 inch).

A calibrated hydrodynamic model was used to evaluate how representative the velocity at the location of the ADCP is to velocity throughout East Branch. The hydrodynamic model used for this evaluation was that which is documented in the FMRM (Anchor QEA 2022a), with the velocity analysis spanning the same date range as the ADCP data. The maximum depth-averaged velocities from the hydrodynamic model were evaluated at the ADCP location and at seven other grid cells in

East Branch (Figure C2-8). The modeled maximum depth-averaged velocity at the ADCP location was 0.16 feet/sec and the maximum depth-averaged velocity at the other seven locations ranged from 0.01 to 0.44 feet/sec. The depth-averaged velocity at the ADCP location is similar in magnitude to other locations in East Branch, in that all the tidal and wind-driven, depth-averaged velocities in East Branch are relatively low. Spatial differences in tidal and wind-driven velocities throughout East Branch are not large enough to affect the selection of a median stable particle diameter for the cap given the much larger median stable particle diameters that result from other processes (e.g., propwash or vessel generated waves).

2.2.6 Outfall Scour

Scour protection is required to protect the cap placed in areas surrounding outfalls, including the CSOs that discharge into East Branch. There are approximately 39 total private and municipal outfalls[3] within East Branch, as shown in Figure C2-9. This includes approximately 34 individual direct discharge outfall structures (including one classified as a highway drain); two CSOs, both located at the head of East Branch along Metropolitan Avenue; two municipal separated storm sewer systems (MS4s; NCQ-633 and NCQ-632) located near the Grand Street Bridge and on the downstream reach of East Branch; and one major stormwater discharge (NCQ-346) beneath the Grand Street Bridge. The outfalls not categorized as CSOs/MS4s/major stormwater discharge points range in width/diameter from 4 to 36 inches, whereas the two CSOs are composed of one circular CSO, with a diameter of 3 feet (NCB-019); and one arched CSO, measuring approximately 17 feet wide by 13 feet tall (NCB-083). The MS4s and other major stormwater discharge points are 60 inches in diameter (NCQ-633), 54 inches in diameter (NCQ-632), and 48 inches in diameter (NCQ-346).

NYCDEP developed and calibrated a model to estimate the freshwater discharges from CSO outfalls, MS4s, and overland flow. The 2015 geo-neutral point source model predicts freshwater inflows from CSOs, large stormwater outfalls, and direct drainage to Newtown Creek during precipitation events. The mean peak flow rate and maximum peak flow rate for the CSOs and MS4s calculated for the 14-year period (1999–2012) that was used for model calibration are summarized in Table C2-10. The major stormwater discharge, NCQ-346, which is beneath the Grand Street Bridge, was not included in the modeling study performed in 2015, so no available flow data for that outfall were available to include in this evaluation.

[3] Outfall information is based the point source inventory process completed during the RI as documented in Section 2.1.2 of Appendix E of the RI Report (Anchor QEA 2023a). Some outfalls may be abandoned or no longer in use.

Table C2-10
14-Year Period (1999–2012) Absolute Maximum Flow Rates of CSOs and MS4s

Outfall	Absolute Maximum Flow Rate (cfs)	Average Maximum Flow Rate (cfs)
NCB-019	42.3	5.3
NCB-083	2,619	173.1
NCQ-633	105.6	5.4
NCQ-632	190.0	9.2

The *Hydraulic Design of Energy Dissipators for Culverts and Channels* (HEC-14; Thompson and Kilgore 2006) provides guidance for the design of scour protection at outfall structures based on outfall diameter, discharge rates, and water depth. The HEC-14 guidance indicates that the most common protection for outlet structures sized 60 inches in diameter or smaller is a riprap apron. The guidance provides a drawing detail, Figure C2-10, with recommended scour protection design in plan and section views taken from the Federal Lands Division of the Federal Highway Administration. Based on the HEC-14 guidance, aprons are sized by calculating a minimum required median stone size using outfall dimensions and flow data and then calculating dimensions of the protective apron accordingly.

The required median stone armor size for each outfall is calculated using the following equation, which appears as equation 10.4 in HEC-14:

Equation C2-8

$$D_{50} = 0.2 * D * \left(\frac{Q}{\sqrt{g} * D^{2.5}}\right)^{\frac{4}{3}} * \frac{D}{TW}$$

where:

D_{50}	=	median stone size (feet) to provide erosion protection
D	=	outfall diameter (feet)
Q	=	outfall discharge (cubic feet/sec)
g	=	gravitational acceleration (32.2 feet/sec^2)
TW	=	tailwater depth at outfall (feet)

Using flow data obtained from the 2015 geo-neutral model for CSOs and MS4s, the median stone sizes were calculated. In the absence of flow data for all other outfall types, the stone sizes calculated for CSOs and MS4s are assumed to also be representative for all other outfalls within East Branch with smaller diameters and discharge volumes. Calculated median stone sizes using equation C2-8 ranged from 5 to 15 inches. The tailwater depth (the depth of water at the downstream end of the culvert) was conservatively assumed to be one-half the diameter of the CSOs and MS4, except for NCB-083, which was assumed to have a tailwater depth equal to the outfall height as it is fully submerged. Because the tailwater depth will result in a partially submerged outfall, less available cross-sectional area will be available for outfall flow, effectively reducing the discharge rates. A tailwater depth of one-half the outfall diameter was assumed for this level of calculation because most outfalls are either partially or fully submerged. Following determination of the required median stone size for erosion protection, Table C2-11 provides the calculations for apron dimensions based on D_{50} diameter. Table C2-12 summarizes the maximum dimensions for outfall scour protection pads based on the calculated stone sizes.

Table C2-11
Example Riprap Classes and Apron Dimensions

Riprap Class	Median Stone Size (inches)	Apron Length	Apron Thickness
1	5 to 6	4*D	3.5*D_{50}
2	6 to 10	4*D	3.3*D_{50}
3	10 to 14	5*D	2.4*D_{50}
4	14 to 20	6*D	2.2*D_{50}
5	20 to 22	7*D	2.0*D_{50}
6	22+	8*D	2.0*D_{50}

Table C2-12
Outlet Scour Protection

Outfall	Outfall Size (feet)	Median Stone Size (inches)	Apron Width at Outfall (feet)	Maximum Apron Length (feet)	Maximum Apron Thickness (feet)
NCB-019	3	5.4	9	12	1.56
NCB-083	17	15.0	51	85	2.75
NCQ-633	4	9.4	12	16	2.57
NCQ-632	5	12	15	25	2.40

As part of this FFS evaluation, the scour protection at the discharge point of the CSO was based on the design for CSO scour protection on the Gowanus Canal (USACE 2014). This includes installation of a manufactured erosion control mattress (e.g., articulated concrete block). Therefore, this FFS assumes the placement of an articulated concrete block mattress at the discharge of the two CSOs at the head of East Branch.

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2.2.7 *Erosion Protection Layer Summary*

Table C2-13 provides a summary of the stable particle sizes recommended to protect against each erosive force evaluated in this analysis.

Table C2-13
Erosive Force Protection Summary

Erosive Force	Stable Median Particle Size	Area of Applicability
Wind-Generated Waves	N/A	N/A
Vessel-Generated Waves	Cobble (7 inches)	Wake Zone (above -4 feet MLLW)
Propwash	Deep Water (<-13.5 feet MLLW): Sand (0.2 inch) Shallow Water (>-13.5 feet MLLW): Cobble (2.7 inches)	Area 1 (downstream of Grand Street Bridge)
	Deep Water (<-13.5 feet MLLW): Sand (<0.1 inch) Shallow Water (>-13.5 feet MLLW): Cobble (3.9 inches[1])	Area 2 (downstream of Grand Street Bridge)
	1.9 inches	Area 3 (limited use area)
	3.4 inches[1]	Area 4 (limited use area)
Ice	2.5 inches	Very shallow water (above -4 feet MLLW)
Hydrodynamic Flows	<0.01 inch	All areas
Outfalls	Riprap (up to 12 inches)	Outfalls and MS4s
	Articulated concrete block mattress	CSOs

Note:
1. As noted in Tables C2-6 and C2-7, the upper end of the predicted range of D_{50} for the Tide Runner in shallow water is considered overly conservative based on the nature of the assumptions for this evaluation. Therefore, an average of approximately 3 inches (i.e., cobbles) is recommended for erosion protection in shallow water in Areas 2 and 4.

In the most nearshore areas (i.e., the wake zone; shallower than -4 feet MLLW), caps would be subject to ice forces and vessel-generated waves. The dominant force in the wake zone is vessel-generated waves, which require cobble-sized armoring with a D_{50} of 7 inches in diameter. In the shallow water areas away from the wake zone (between -13.5 and -4 feet MLLW), propwash is the dominant erosive force requiring gravel- or cobble-sized armoring, depending on the location.[4] Within the deep-water portions of East Branch (deeper than -13.5 feet MLLW), the dominant erosive force is propwash, but the bed velocities are relatively low compared to shallow water and would only require a sand-sized erosion protection layer.

The ARCS Program Guidance (Palermo et al. 1998) recommends that an erosion protection layer be twice as thick as the median particle diameter ($2 \times D_{50}$) or 1.5 times the maximum particle diameter

[4] Additional analyses will be completed during the RD phase if capping is selected as a component of remedial alternatives.

($1.5 \times D_{100}$), whichever is greater. Based on this methodology, within the wake zone, the erosion protection layer should be a minimum of 14 inches thick cobble. Within the shallow water areas beyond the wake zone, the erosion protection layer should be a minimum of approximately 6-inch-thick cobble and a minimum of less than an inch of sand in the deep-water areas. However, these minimum thicknesses do not account for constructability considerations; therefore, a minimum layer thickness of at least 6 inches was assumed for all materials, regardless of the calculated median particle size.

2.3 Filter Layer Considerations

A filter layer is often required when larger diameter material is used for the erosion protection layer of an engineered cap. The filter layer provides an interface between the larger sized erosion protection layer and the smaller sized material beneath it (a chemical isolation layer in this case) and is an essential element for protecting contaminated sediments (Palermo et al. 1998). As described in the USACE engineering manual *Design of Coastal Revetments, Seawalls, and Bulkheads* (USACE 1995), a filter layer is a transitional layer of gravel, small stone, or geotextile fabric placed between the underlying sediment and the structure. The filter prevents migration of one granular material through another (often referred to as "piping"), distributes the weight of the armor units to provide more uniform settlement, and permits relief of hydrostatic pressures in the underlying sediment.

The filter layer must satisfy requirements pertaining to both the armor-to-filter relation as well as filter-to-underlying material (i.e., chemical isolation layer) relation. The need for a filter layer was assessed for each erosion protection layer material presented in Table C2-13 based on the D_{50} required in each area. The Terzaghi-Vicksburg criteria (1943) are often used as guidelines in the design of a filter layer, as described in Mohan et al. (2000). The minimum filter criteria suggest that five times the D_{85} (85% passing by weight sieve size) size of the underlying material should be greater than the D_{15} (15% passing by weight sieve size) of the overlying material, as shown in Equation C2-9:

Equation C2-9

$$D_{15(\text{armor})} < 5 * D_{85(\text{filter})}$$

where:

$D_{15(\text{armor})}$ = the 15% passing sieve size of the overlying armor material by weight

$D_{85(\text{filter})}$ = the 85% passing sieve size of the underlying material by weight

However, research has shown that the standard Terzaghi filter criteria are overly conservative and that the threshold for the ratio of D_{15} to D_{85} in Equation C5-1 should be 12 to 14 (rather than 5, as recommended by Terzaghi), especially in the absence of a strong vertical hydraulic gradient (Gibson et al. 2010).

Based on the range of armor stone sizes determined from the erosion analysis for the different areas, it is anticipated that a separate filter layer, approximately 6 inches thick, will be needed between the erosion protection layer and the chemical isolation layer where the erosion protection layer is coarse gravel or larger. A filter layer will likely not be required for smaller gravel or sand-sized erosion protection materials.

A more detailed filter layer evaluation, including the gradation of the filter layer and compatibility with the erosion protection layer and the underlying chemical isolation layer of the engineered cap, will be performed as part of subsequent design phases of the project. The design filter layer material gradation will be generally based on the Engineering Manual 1110 2 2300 equations (USACE 2004a). The filter material will be designed as a well-graded granular layer with intermediate particle sizes between the armor material particle sizes and the underlying sediment or chemical isolation cap layer particle sizes.

2.4 Summary

A preliminary design analysis was performed for the cap erosion protection layer to evaluate potential erosive forces that may affect the proposed cap areas and to estimate median stable particle sizes and other design elements, including layer thicknesses and filter layer considerations, to resist potential erosive forces. The evaluation determined that vessel-generated waves are the governing potential erosive force in shallow areas and within the wake zone (i.e., water depths less than 4 feet). Outside of the wake zone and the nearshore areas, propwash forces were determined to be the governing potential erosive force. Table C2-14 presents a summary of the preliminary erosion protection layer design for East Branch considering the range of erosive forces and constructability along with filter layer considerations and implementability. The range of erosion protection layers resulting from this analysis are considered constructable in East Branch and are feasible for inclusion as part of the remedial alternatives that include capping as a technology for the East Branch FFS.

Table C2-14
Erosion Protection Layer Design Summary

Area	Elevation Range (MLLW)	Median Particle Type and Size	Minimum Erosion Protection Layer Thickness	Filter Layer Required Below Erosion Protection Layer?	Minimum Filter Layer Thickness
Wake Zone	Shallower than -4 feet MLLW	Cobble (7 inches)	14 inches	Yes	1.4 feet
Shallow Water/ Nearshore	-13.5 feet to -4 feet MLLW	Area 1: Cobble (2.7 inches) Area 2: Cobble (3.9 inches)[1] Area 3: Coarse Gravel (1.9 inches) Area 4: Cobbles (3.4 inches)[1]	Area 1: 6 inches Area 2: 6 inches[2] Area 3: 6 inches Area 4: 6 inches[2]	Possibly	6 inches
Deep Water	Deeper than -13.5 feet MLLW	Sand (0.2 inch)	1 inch	No	--

Notes:
1. As noted in Tables C2-6 and C2-7, the upper end of the predicted range of D_{50} for the Tide Runner in shallow water is considered overly conservative based on the nature of the assumptions for this evaluation. Therefore, an average of approximately 3 inches (i.e., cobbles) is recommended in the shallow water/nearshore areas of Areas 2 and 4.
2. Note that the erosion protection layer thickness for Area 2 and Area 4 is designated as 6 inches, which is slightly less than that recommended by the ARCS Program Guidance (Palermo et al. 1998) (e.g., $2\times D_{50}$) based on the calculated D_{50}. However, as discussed in Note 1, the calculated D_{50} for the Tide Runner is considered overly conservative and a D_{50} of 3 inches is recommend, which correlates to a layer thickness of 6 inches. This assumption will be refined during the RD phase.

--: alternative values not developed

3 Chemical Isolation Layer Evaluations

This section documents the analyses conducted in support of a preliminary design of the chemical isolation component of capping in East Branch. Four of the remedial alternatives being evaluated in this FFS (Alternatives EB-B through EB-E) involve placement of caps on top of sediment (with sediment removal prior to capping in some cases). Another alternative (Alternative EB-F) involves removal of all sediment, down to the native material interface, followed by placement of a residuals cover or a cap (as needed). The specific sediment removal depths and capping locations vary by alternative, but in general these alternatives can be simplified to two scenarios for the purposes of evaluating chemical isolation capping in this section: capping on sediment and capping on native material. Each of the five active remedial alternatives also includes the use of in situ stabilization/solidification (ISS) in one or more locations within East Branch. Treatability studies would be necessary to assess the potential diffusive flux from the post-ISS monolith and evaluate the need for a post-ISS cap. Due to the uncertainties of the need for a post-ISS cap at this FFS stage, preliminary cap modeling was not performed for the post-ISS cap.

The chemical isolation component of caps being considered for use in the East Branch FFS includes separate layers to address dissolved phase flux of contaminants of concern (COCs) and NAPL flux. As shown in Figure C3-1, dissolved phase chemical isolation was evaluated for both the cap-on-sediment and cap-on-native-material scenarios. NAPL is not present in native material within East Branch, so the NAPL sorption layer is not applicable to the cap-on-native-material scenario. The remainder of this section describes the evaluations performed to evaluate the feasibility of capping to address dissolved phase transport of COCs (Section 3.1) and NAPL mass flux (Section 3.2) in East Branch.

3.1 Dissolved Phase Contaminant Flux Evaluation

This section describes modeling evaluations performed to evaluate the feasibility of capping to address dissolved phase transport of COCs.

3.1.1 Dissolved Phase Modeling Approach

The primary purpose of this evaluation, which was based on numerical modeling, was to simulate the dissolved phase transport of COCs within a cap to identify the cap configuration needed to meet RD targets, which are defined in Section 3.1.1.4. The dissolved phase analyses documented in this appendix were performed in accordance with industry standard cap design guidance, including those set forth by USEPA (Palermo et al. 1998), the Interstate Technology and Regulatory Council (ITRC; 2014), and the ITRC Sediment Cap Chemical Isolation Guidance Document (ITRC 2023).

3.1.1.1 Contaminants of Concern

The COCs included in this evaluation are those that have been established for the FFS based on the outcomes of the previously completed Operable Unit 1 risk assessments and are the following:

- Total polycyclic aromatic hydrocarbon (34) (TPAH [34])
- Total polychlorinated biphenyl (TPCB)
- Total dioxin/furan toxic equivalence quotient (mammal) (D/F TEQ)
- C19-C36 aliphatic petroleum hydrocarbons (C19-C36)
- Copper (Cu)
- Lead (Pb)

For TPAH (34), model simulations were performed at the individual compound level to represent the range of chemical mobility associated with the TPAH (34) constituents. Likewise, model simulations were performed at the polychlorinated biphenyl (PCB) homolog level to represent the range of chemical mobility associated with the congeners that make up TPCB. The remaining COCs were simulated as single constituents, using conservatively representative properties for groups of chemicals in the cases of D/F TEQ and C19-C36. For example, conservatively, D/F TEQ was simulated using the chemical properties of the more mobile 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD).[5] The chemical properties used to represent C19-C36 were conservatively selected from the low-molecular weight end of the range reported for the compounds within this class of chemicals.

3.1.1.2 Model Framework

CapSim (version 3.8)[6], a one-dimensional model of chemical transport in sediment and cap systems, was used for this evaluation. This model simulates the time variable fate and transport of chemicals (dissolved and sorbed phases, including partitioning between these phases) under the processes of advection, diffusion and dispersion, biodegradation, bioturbation and bioirrigation, and exchange with the overlying surface water (Shen et al. 2018; Go et al. 2009; Lampert and Reible 2009). This industry standard model and its predecessors have been used to support the evaluation and design of sediment caps at numerous sites around the United States and internationally. Details on the model structure and underlying theory and equations are provided in the model's associated literature (Shen et al. 2018; Go et al. 2009; Lampert and Reible 2009).

[5] Of the 17 D/F congeners that make up D/F TEQ, 2,3,7,8-TCDD has the highest mobility, with the exception of 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF). 2,3,7,8-TCDD contributes ten times more to the D/F TEQ than 2,3,7,8-TCDF. Thus, the use of 2,3,7,8-TCDD chemical properties to represent D/F TEQ is conservative.

[6] Although CapSim version 4.1 was available at the time these evaluations were performed, the updates made to CapSim version 4.1 were not relevant to the evaluations documented herein (i.e., the changes made to the model between versions 3.8 and 4.1 do not affect the results for any of the model simulations performed for this effort). In January 2023, the anticipated release of CapSim version 5.0 was announced. This or a newer version of the model would be used during RD.

3.1.1.3 Model Domain and Layers

As described in the Section 3 lead-in, the model evaluations were conducted in support of a preliminary design of the chemical isolation component of a cap for two capping scenarios: 1) placement of a cap on sediment (with or without prior removal); and 2) placement of a cap on native material (following removal of sediment down to the native material interface). Feasibility was assessed by simulating a cap configuration's ability to maintain COC concentrations at the cap surface below design target values for more than 100 years. The model was initially set up to simulate COC transport through a 1-foot sand chemical isolation layer overlain by an erosion protection layer material. Erosion protection evaluations are presented in Section 2. Conservatively, the chemical isolation cap was set up to simulate only 6 inches of the erosion protection material; the layer is anticipated to be at least that thick (and thicker in some areas), as described in Section 2. A schematic showing the cap layers represented in the model and the processes simulated by the model is provided in Figure C3-2.

The underlying sediment was not included as part of the model domain in this preliminary modeling (i.e., the sediment was not simulated explicitly); rather, the porewater or groundwater concentrations beneath the cap were conservatively represented as an infinite source (i.e., constant concentration boundary condition) immediately beneath the cap. This approach is conservative because it assumes no attenuation or loss of COC mass occurs in the sediments or native material beneath the cap over time. This approach may be revisited during RD if an alternative involving capping is selected for the East Branch Early Action.

3.1.1.4 Design Targets

The chemical isolation layer is designed to meet target concentrations within a specified depth interval of the cap over a specified time frame. Collectively, these are referred to as design targets. Design targets for the purposes of the East Branch FFS were defined as maintaining model-predicted vertically averaged sorbed phase COC concentrations within the top 15 centimeters (cm) of the cap (i.e., within the top 15 cm of the erosion protection layer), where benthic organisms live and feed (referred to hereinafter as the biologically active zone [BAZ]; see Section 6.4.4.1 of the *Remedial Investigation Report* [RI Report]), to levels less than the risk-based preliminary remedial goals (PRGs) established for the project, for a simulation period of 100 years or more. The use of a vertical average within the BAZ is consistent with how exposure was evaluated during the Study Area risk assessments. Nonetheless, a sensitivity analysis was performed as well to evaluate whether the model results would be affected by use of a point-based concentration from the bottom of the BAZ for comparison to the risk-based PRGs. A similar assessment of point-based concentrations at the bottom of the BAZ that are set to risk-based PRGs may be used during design. An unknown amount of contamination from ongoing inputs may settle on the top of any cap, directly impacting the benthic organisms residing within the BAZ and ultimately affecting any type of BAZ averaging approach. In this evaluation, the BAZ is within the erosion protection layer, as described in Section 3.1.1.3 and shown in Figure C3-2. Risk-based PRGs are listed by COC in Table C3-1.

Table C3-1
Contaminants of Concern and Design Targets

COC Group	Surface Sediment Risk-based PRG (design target)
TPAH (34)	100 mg/kg (point-by-point)
TPCB	0.3 mg/kg (SWAC)
D/F TEQ	18 ng/kg (SWAC)
C19-C36	200 mg/kg (point-by-point)
Cu	490 mg/kg (point-by-point)
Pb	340 mg/kg (SWAC in intertidal zone*)

Note:
* Figure 3-6 in the FFS shows the spatial extent of the intertidal zone in East Branch.

It must be recognized that over the long term, a cap successfully designed and constructed to meet these risk-based PRGs may have different (and possibly higher) concentrations within its surface (i.e., top 6 inches of the erosion protection layer) due to the presence of ongoing external contaminant sources within the Study Area. In recognition of such sources, long-term equilibrium (LTE) modeling evaluations are being conducted to estimate surface sediment concentrations that are expected to be established within Newtown Creek post-remedy. The most recent modeling to evaluate LTE was documented in a draft report from the Newtown Creek Group (NCG; Anchor QEA 2024); LTE modeling is an ongoing effort for both the NCG and USEPA. The current working ranges of LTE concentrations indicate that regardless of the sediment remedy selected, surface COC concentrations are expected to equilibrate to background concentrations due to ongoing external inputs of contaminants; in some cases, this means attainment of the risk-based PRGs for surface sediments may not be sustainable over the longer term due to these ongoing inputs.

3.1.2 Model Inputs

The model uses several input parameters that describe chemical-specific properties, cap and sediment material properties, and chemical mass transfer rates. These input parameters were developed based on site-specific data, information from literature, and experience with cap design at other similar sites. Many of the model input parameters used in the chemical isolation cap modeling are also used in the draft Newtown Creek chemical fate and transport model (CFT model) documented in the draft *Chemical Fate and Transport Model Development and Calibration Report* (CFT Modeling Report; Anchor QEA 2022b); in these cases, the values developed for the draft CFT model were used because they are considered representative site-specific values for Newtown Creek.[7] A listing of model input parameters, the values used for this modeling evaluation, and the source(s) from which they were derived are provided in Table C3-2. More details describing certain key model inputs (i.e., those to which the model is most sensitive) are provided in Sections 3.1.2.1 through 3.1.2.3.

Table C3-2
Input Parameter Values for the Chemical Isolation Cap Model

Model Input Parameter and Units	Input Value	Data Source
Chemical-specific Properties		
Porewater concentration (µg/L)	See Table C3-3	Source term used for cap-on-sediment scenario. Values based on measured porewater concentrations from East Branch as well as sediment sample concentrations converted to porewater concentrations using site-specific partition coefficients (as available). See Section 3.1.2.1.1 for details.
Groundwater concentration (µg/L)	See Table C3-4	Source term used for cap-on-native-material scenario. Values based on measured groundwater concentrations from East Branch as well as native material concentrations converted to groundwater concentrations using literature-based partition coefficients. See Section 3.1.2.1.2 for details.
Partition coefficient Log K_d (log L/kg)	See Tables C3-5 and C3-6	Site-specific values used, consistent with the inputs developed for the draft CFT model for applicable COCs. See Section 3.1.2.2 for details.
Organic carbon partition coefficient Log K_{OC} (log L/kg)	See Tables C3-5 and C3-6	Literature-based values. See Section 3.1.2.2 for details.
DOC partition coefficient Log K_{DOC} (Log L/kg)	See Tables C3-5 and C3-6	Calculated using relationship with octanol-water partition coefficient (K_{OW}), consistent with the RI Report evaluations and inputs developed for the draft CFT model. See Section 3.1.2.2 for details.

[7] In May 2024, USEPA determined that the CFT model is not necessary for further project decision-making or actions based on review of the project schedule and consideration of the successful development of the LTE model. As such, further development and finalization of the CFT model was discontinued (Ketu 2024). Although the site-specific CFT model will no longer move forward, many of the site-specific model input parameters documented in the draft CFT Modeling Report are still relevant and applicable for use in the chemical isolation cap modeling, given that they were discussed in detail and reviewed by USEPA and in many cases concurrence was reached with USEPA on specific values or approaches, as documented in the draft CFT Modeling Report.

Model Input Parameter and Units	Input Value	Data Source
Molecular diffusivity (cm^2/s)	PAH compounds: 4.9E-06 to 8.6E-06 PCB homologs: 2.9E-06 to 4.2E-06 D/F TEQ: 4.5E-06 C19-C36: 4.9E-06 Cu: 4.2E-05 Pb: 2.4E-05	Consistent with the inputs developed for the draft CFT model (for applicable COCs). PAH, D/F TEQ, and C19-C36 values were specified using a literature-based correlation with molecular weight (Schwarzenbach et al. 1993), and values for PCBs, Cu, and Pb were specified using a literature-based correlation with molar volume (Hayduk and Laudie 1974). The model calculates an effective diffusion coefficient using this chemical-specific input value for the molecular diffusivity and an empirical equation based on the material porosity using the approach developed by Millington and Quirk (1961) for granular materials. Note that calculated molecular diffusivity values are rounded to two significant figures.
Boundary layer mass transfer coefficient (cm/day)	PAH compounds: 0.1 to 1.5 PCB homologs: 3 D/F TEQ: 3 C19-C36: 3 Cu: 3 Pb: 3	Based on the calibrated values from the draft CFT model for PAHs, PCBs, and Cu. Values for other COCs specified based on values from the draft CFT model for chemicals with similar mobility (based on K_d or K_{OC}). 0.1 cm/day: 1-methylnaphthalene, acenaphthylene, naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, C2-naphthalenes, anthracene, phenanthrene, C1-fluorenes, C3-naphthalenes 0.3 cm/day: C1-phenanthrenes/anthracenes, C2-fluorenes, C4-naphthalenes 0.5 cm/day: pyrene, fluoranthene, C1-fluoranthenes/pyrenes, C2-phenanthrenes/anthracenes, C3-fluorenes, C3-phenanthrenes/anthracenes 0.8 cm/day: benzo(a)anthracene, chrysene, C1-benzo(a)anthracenes/chrysenes, C4-phenanthrenes/anthracenes 1 cm/day: benzo(a)pyrene, benzo(e)pyrene, perylene, benzo(j,k)fluoranthene, C2-benzo(a)anthracenes/chrysenes 1.5 cm/day: benzo(g,h,i)perylene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, C3-benzo(a)anthracenes/chrysenes, C4-benzo(a)anthracenes/chrysenes 3 cm/day: PCB homologs, D/F TEQ, C19-C36, Cu, and Pb.
First-order chemical biodegradation rate (yr^{-1})	0	Assumed no biodegradation, which is conservative for some PAH compounds given they have been shown to degrade in sediments over the time scales of the simulation (i.e., years to decades or longer).

Model Input Parameter and Units	Input Value	Data Source
Erosion Protection Layer Properties		
Erosion protection layer thickness (cm)	15	Conservatively represented as a 15-cm (6-inch) layer for the purposes of the feasibility evaluation, as discussed in Section 3.1.1.3.
Total porosity (unitless)	0.35	Typical value for range of sand- to gravel-sized materials (e.g., Domenico and Schwartz 1990), which is considered representative of armor layer (and filter layer if needed), recognizing that the armor (and filter) materials often have a gradation that includes sand-sized materials, and armor stone with no cover will be subject to infilling of interstitial spaces from new sediment deposition.
Dry bulk density (g/cm^3)	1.69	Calculated based on typical particle density of 2.6 g/cm^3 for inorganic minerals and representative total porosity (see previous row).
Fraction organic carbon f_{OC} (unitless)	0.10	A value of 0.10 (i.e., 10% by weight) was selected to represent the future order of magnitude f_{OC} in the BAZ (top 15 cm) based on the assumption that over time, the materials in the BAZ will be consistent with the f_{OC} of depositing solids. The value of 10% is based on a weighted average of the f_{OC} values reported in the RI Report (Anchor QEA 2023a) for sources of depositing solids within East Branch, which, based on sediment transport modeling, were taken to be 20% of solids from the East River, 40% from CSO solids, and 40% from stormwater solids. Due to uncertainties in the future f_{OC} at the surface of the cap, a sensitivity analysis was performed to see how model results could be affected by use of different f_{OC} values (a nominal value of 0.1% and a value of 4% [which represents the f_{OC} of East River solids] were evaluated in the sensitivity analysis).
DOC (mg/L)	10 mg/L for cap-on-sediment scenario 1 mg/L for cap-on-native-material scenario	Based on average DOC concentrations summarized in the RI Report (Anchor QEA 2023a) for porewater samples (cap-on-sediment scenario) and groundwater samples (cap-on-native-material scenario) samples, respectively
Initial porewater concentrations within erosion protection layer (µg/L)	0	For this initial modeling, the porewater concentrations in the cap were set to zero. In reality, immediately following cap placement, the water in the pore spaces of the cap will likely be equal to the surface water COC concentrations, so the initial porewater concentration in the cap will be equal to surface water concentrations. During RD, the modeling will be updated to include a non-zero surface water concentration as an initial condition for cap porewater concentrations.
Benthic boundary layer concentration (µg/L)	0	For this initial modeling, the benthic boundary layer concentrations were set to zero. During RD, the modeling will be updated to include a non-zero surface water concentration as the benthic boundary layer concentration.

Model Input Parameter and Units	Input Value	Data Source
Chemical Isolation Layer Properties		
Chemical isolation layer thickness (cm)	Design variable	Started with a 12-inch-thick chemical isolation layer and, if necessary, iteratively increased thickness to meet the preliminary design targets (see Section 3.1.1.4).
Total porosity (unitless)	0.4	Typical value for sand (e.g., Domenico and Schwartz 1990).
Dry bulk density (g/cm^3)	1.56	Calculated based on typical particle density of 2.6 g/cm^3 for inorganic minerals and representative total porosity (see previous row).
f_{OC} (unitless)	Design variable	This input was used to represent sorptive amendment addition for organic chemicals (PAHs, PCBs, D/F TEQ, and C19-C36). Started with sand only (f_{OC} of 0.001 [i.e., 0.1% by weight]) and iteratively increased f_{OC} as necessary to meet the preliminary design targets.
DOC (mg/L)	10 mg/L for cap-on-sediment scenario 1 mg/L for cap-on-native-material scenario	Based on average DOC concentrations summarized in the RI Report (Anchor QEA 2023a) for porewater samples (cap-on-sediment scenario) and groundwater samples (cap-on-native-material scenario) samples, respectively
Initial porewater concentrations within chemical isolation layer (µg/L)	0	For this initial modeling, the porewater concentrations in the cap were set to zero. In reality, immediately following cap placement, the water in the pore spaces of the cap will likely be equal to the surface water COC concentrations, so the initial porewater concentration in the cap will be equal to surface water concentrations. During RD, the modeling will be updated to include a non-zero surface water concentration as an initial condition for cap porewater concentrations.
Chemical-independent Mass Transport Properties		
Net groundwater seepage rate (cm/day)	1.0	Value from the upper end of averaged measured groundwater seepage rates. See Section 3.1.2.3 for details.
Dispersion length (cm)	Variable based on domain length	Set to 10% of the model domain length. See Section 3.1.2.3 for details.
Net sedimentation rate (cm/yr)	0	Conservatively assumed no net sedimentation on top of the cap for the purposes of this FFS modeling evaluation. This assumption may be revisited during future design evaluations given the net depositional nature of East Branch.
Bioturbation depth (cm)	15	Consistent with inputs developed for the draft CFT model (Anchor QEA 2022b).
Particle biodiffusion coefficient (cm^2/yr)	32	Parameter represents bioturbation rate applied to sorbed (particle) phase. Value is consistent with inputs developed for the draft CFT model (Anchor QEA 2022b).

Model Input Parameter and Units	Input Value	Data Source
Porewater biodiffusion coefficient (cm^2/yr)	3,200	Parameter represents bioturbation rate applied to dissolved phase. Value is typically approximated as 100 times the particle biodiffusion coefficient (Reible 2012; Thibodeaux and Mackay 2011).
Consolidation thickness (cm) and time (years) to reach 90% consolidation for underlying sediment	None	For this FFS, the effects of consolidation, which may result in an additional upward flux of porewater, were excluded.

3.1.2.1 Source Term

The source term in the model defines the COC concentrations in porewater or groundwater in the sediments or native material beneath the cap, respectively.

For the cap-on-sediment scenario, porewater COC concentrations within the sediment beneath the cap represent the source term in the cap design model. For the cap-on-native-material scenario, groundwater COC concentrations within the native material beneath the cap represent the source term in the cap design model. Porewater, groundwater, sediment, and native material were sampled within East Branch as part of the Remedial Investigation (RI; and as part of the East Branch Treatability Study for some media), and the resulting data were used to develop input values for the model. COC concentrations measured in porewater and groundwater samples were used, and COC concentrations measured in sediment and native material samples were converted to porewater and groundwater concentrations, respectively, using equilibrium partitioning formulae, as described in Section 3.1.2.2, to provide larger datasets. All porewater and groundwater concentrations were input to CapSim as freely dissolved concentrations; the model internally calculates the dissolved organic carbon (DOC)-bound component (as well as the transport of both the freely dissolved and DOC-bound components up through the cap). As such, depending on sampling methods, some of the measured concentrations required conversion of a total dissolved concentration (i.e., freely dissolved and DOC-bound fractions combined) to a freely dissolved concentration. The development of these inputs is described in the following subsections.

3.1.2.1.1 Porewater Concentrations

The modeling was conservatively conducted with the assumption that the sediment beneath the cap would represent an infinite source of chemicals, so the underlying freely dissolved porewater concentrations specified in the model input were held constant over the duration of the long-term simulations.

Porewater and sediment samples were collected and analyzed for COCs in East Branch. As described previously, the source term defines the COC porewater concentrations in the sediment beneath the cap. If removal of sediments occurs prior to dredging, the source term reflects the concentrations in subsurface sediment remaining following (partial) removal (i.e., from sediment samples collected from depths below the dredge depth). For flexibility during the FFS phase, the specific removal scenarios across the various remedial alternatives were not explicitly evaluated, meaning the source term was not defined based on the specific depths of sediments remaining for each dredging scenario identified in this FFS. Rather, to conservatively cover the range of possible dredge scenarios, the sediment data collected from all depths, porewater data collected during the RI from shallow sediment,[8] and porewater data collected during the Treatability Study from all depths were used in the evaluation.

Porewater data were collected using passive sampling methods that quantify the freely dissolved concentrations for the analytes measured, which included polycyclic aromatic hydrocarbons (PAHs), PCBs, Cu, and Pb (see Section 4.8.1 of the RI Report [Anchor QEA 2023a]). This porewater dataset was supplemented with COC concentration data from sediment samples that were converted to freely dissolved porewater concentrations using equilibrium partitioning theory based on the equations presented in Section 3.1.2.2 (which are the same as those used for similar purposes in the RI Report; see Section 3.7 of Appendix F of Anchor QEA 2023a).

The measured porewater and sediment-derived porewater freely dissolved concentrations are shown in Figures C3-3 through C3-8. For TPAH (34) (Figure C3-3) and TPCB (Figure C3-4), the distributions of the measured porewater and sediment-derived porewater datasets are similar, with similar median concentrations. Sediment-derived D/F TEQ and C19-C36 freely dissolved porewater concentrations are shown in Figures C3-5 and C3-6, respectively (porewater samples were not analyzed for these COCs). For Cu (Figure C3-7), the measured porewater concentrations are within the range of sediment-derived porewater concentrations, although the median and maximum values for the measured porewater concentrations are lower than the corresponding sediment-derived values (derived using equilibrium partitioning). For Pb (Figure C3-8), the measured porewater concentrations are within the range of porewater concentrations calculated from sediment (using equilibrium partitioning).

As described in Section 3.1.1.1, for TPAH (34) and TPCB, the individual PAH compounds and PCB homolog groups that make up the respective totals were simulated by the model. Conservatively, the maximum freely dissolved porewater concentration—either measured porewater or sediment converted to porewater—was selected for each individual chemical or homolog group[9] for input to the model. Selecting the maximum concentration for each chemical is somewhat more conservative than selecting the individual PAH or PCB homolog concentrations from the sample having the highest TPAH (34) or TPCB concentration, but it ensures that the highest concentrations for the most

[8] Shallow sediment refers to 0- to 15-cm and 15- to 30-cm depths from RI data; only very limited porewater data were collected from deeper depths.

[9] For homolog groups, the concentration represents a total, which is the sum of the congener concentrations within a homolog group.

mobile compounds are evaluated. For D/F TEQ, C19-C36, Pb, and Cu, the maximum values were those derived from sediment samples (using equilibrium partitioning) and were used to represent the source term for these chemicals. Given that the risk-based PRGs for TPCB, D/F TEQ, and Pb apply on a surface weighted average concentration (SWAC) basis, the approach of selecting the maximum concentration for these COCs is an additional level of conservatism. The freely dissolved input porewater concentrations used in the model are listed in Table C3-3.

Table C3-3
Freely Dissolved Porewater Concentrations in Sediment Beneath Cap

Chemical Group and Concentration Units	Individual Chemical, Chemical Group or Homolog Group Name	Porewater Concentration
TPAH (34) (µg/L)	1-Methylnaphthalene	19
	2-Methylnaphthalene	8.0
	Acenaphthene	39
	Acenaphthylene	5.8
	Anthracene	11
	Benzo(a)anthracene	0.34
	Benzo(a)pyrene	0.062
	Benzo(b)fluoranthene	0.033
	Benzo(e)pyrene	0.036
	Benzo(g,h,i)perylene	7.8E-03
	Benzo(j,k)fluoranthene	0.020
	C1-Benzo(a)anthracenes/Chrysenes	0.15
	C1-Fluoranthenes/Pyrenes	4.0
	C1-Fluorenes	8.7
	C1-PhenanthrenesAnthracenes	13
	C2-Benzo(a)anthracenes/Chrysenes	0.049
	C2-Fluorenes	3.2
	C2-Naphthalenes	29
	C2-Phenanthrenes/Anthracenes	3.6
	C3-Benzo(a)anthracenes/Chrysenes	0.028
	C3-Fluorenes	0.62
	C3-Naphthalenes	22
	C3-Phenanthrenes/Anthracenes	0.59
	C4-Benzo(a)anthracenes/Chrysenes	6.9E-03
	C4-Naphthalenes	5.5
	C4-Phenanthrenes/Anthracenes	0.12
	Chrysene	0.29
	Dibenzo(a,h)anthracene	1.5

Chemical Group and Concentration Units	Individual Chemical, Chemical Group or Homolog Group Name	Porewater Concentration
	Fluoranthene	2.7
	Fluorene	11
	Indeno(1,2,3-c,d)pyrene	5.0E-03
	Naphthalene	23
	Perylene	4.5E-03
	Phenanthrene	6.2
	Pyrene	4.7
	TPAH (34)*	220
TPCB (ng/L)	PCB-mono	88
	PCB-di	140
	PCB-tri	200
	PCB-tetra	54
	PCB-penta	20
	PCB-hexa	4.1
	PCB-hepta	0.59
	PCB-octa	0.080
	PCB-nona	4.9E-03
	PCB-deca	3.2E-03
	TPCB*	510
D/F TEQ (ng/L)	D/F TEQ	3.7E-04
C19-C36 (µg/L)	C19-C36	6.7E-04
Cu (µg/L)	Copper	54
Pb (µg/L)	Lead	13.4

Notes:
Values rounded to two significant figures.
* TPAH (34) and TPCB were not explicitly simulated by the model (individual constituents were simulated and results summed to compute the model-predicted totals); values are included here for informational purposes.

3.1.2.1.2 Groundwater Concentrations

The contaminant concentrations in the native material groundwater beneath the cap define the source term in the model for the scenario in which a cap is placed directly on the native material (i.e., removal of the full thickness of overlying sediment). The modeling was conducted with the conservative assumption that the native layer beneath the cap would represent an infinite source of COCs, so the underlying freely dissolved groundwater concentrations specified in the model input were held constant over the duration of the long-term simulations.

Groundwater and native material samples were collected and analyzed for COCs in East Branch as part of the RI. Whole water groundwater samples were collected for organic chemicals, and filtered groundwater samples were collected for metals. As noted previously, freely dissolved groundwater concentrations were input to CapSim and the model was configured to internally calculate the DOC-bound fraction based on the input freely dissolved values and the DOC concentration and K_{DOC} values input to the model. The freely dissolved groundwater concentrations were calculated in accordance with the partitioning calculations discussed in Section 3.1.2.2 (Equation C3-2).

The RI groundwater sample data were supplemented with native material COC concentration data that were converted to freely dissolved groundwater concentrations using the partitioning equations presented in Section 3.1.2.2 and literature-based K_{OC} values.

The freely dissolved groundwater concentrations (based both on groundwater samples and native material-derived calculations) are shown in Figures C3-9 through C3-14. These concentration distributions are described as follows:

- As shown in Figure C3-9, the TPAH (34) distributions for the two datasets are similar, although the highest native material-derived groundwater TPAH (34) concentration (using equilibrium partitioning) is almost an order of magnitude greater than the highest groundwater sample TPAH (34) concentration.
- The freely dissolved TPCB groundwater sample concentrations are greater than the native material-derived groundwater concentrations (using equilibrium partitioning); median and maximum concentrations from groundwater sample data are more than an order of magnitude greater than the native material-derived TPCB concentrations (Figure C3-10). These distributions illustrate the uncertainty in the concentrations due to the lack of site-specific K_{OC} values and use of literature values for the conversion of native material sample concentrations to freely dissolved groundwater concentrations; there is also uncertainty in the groundwater sample data due to dissolved phase estimations that were made to remove the effects of elevated solids and turbidity in the groundwater samples, as discussed in the RI Report (see Appendix F, Section 3.7 of Anchor QEA 2023a).
- The TPCB concentrations at the lower end of the freely dissolved groundwater concentration range are similar to the concentrations at the upper end of the native material converted to groundwater distribution. These distributions further illustrate the uncertainty in the groundwater concentrations as noted in the previous bullet.
- Groundwater samples were not analyzed for dioxins and furans, so the native material-derived groundwater data (using equilibrium partitioning) were used to define the source term in the model (Figure C3-11) for D/F TEQ.
- As shown in Figure C3-12, C19-C36 detected concentrations from the groundwater dataset are greater than the native material-derived groundwater detected concentrations. The concentrations at the lower end of the groundwater sample dataset are greater than the concentrations at the upper end of the native material-derived groundwater distribution;

maximum detected C19-C36 groundwater sample concentrations are over two orders of magnitude greater than the native material-derived groundwater detected concentrations (using equilibrium partitioning). Most of the C19-C36 concentrations were not detected; in fact, the maximum C19-C36 value shown in Figure C3-12 was not detected; the result is reported at the method detection limit, which underscores the uncertainty in these values.

- The measured Cu groundwater detected concentrations are greater than the Cu native material-derived groundwater concentration (Figure C3-13). The maximum groundwater concentration is approximately one order of magnitude higher than the maximum native material-derived groundwater concentrations (Figure C3-13). The high number of non-detect sample concentrations (shown as open circles) and the lack of site-specific K_d for native material serve as sources of uncertainty.
- The three detected concentrations for Pb from the groundwater sample data are more than one order of magnitude greater than the range of native material-derived freely dissolved groundwater concentrations (Figure C3-14). The high number of non-detect sample concentrations (shown as open circles) and the lack of site-specific K_d for native material serve as sources of uncertainty.

Conservatively, the maximum freely dissolved groundwater concentration—either based on groundwater samples or native material converted to groundwater (using equilibrium partitioning)—was identified for each individual chemical (or homolog group for PCBs) and used as input source concentration for the model simulations of the cap-on-native-material scenario. Due to the uncertainty in the groundwater concentrations (i.e., differences between groundwater sample concentrations and native material-derived values, as shown on the cumulative frequency distributions, which are related at least in part to uncertainty in the groundwater sample dissolved phase estimation process, and lack of site-specific K_{OC} values for native material as discussed previously), an alternate set of groundwater concentrations for input to the model was also developed for the driving chemicals (i.e., PAHs and PCBs) to allow for a sensitivity analysis. For PAHs, the maximum freely dissolved groundwater concentrations from the measured groundwater sample dataset were used as the alternate source term concentrations (i.e., excluding the more uncertain values derived from native material samples and literature-based K_{OC} values using equilibrium partitioning). For PCBs, the maximum freely dissolved groundwater concentrations from the native material-derived values (using equilibrium partitioning) were used as the alternate source term input, which is less conservative than the measured groundwater concentrations. The risk-based PRG for total PCB and D/F TEQ applies on a SWAC basis, so the approach of selecting the maximum concentration for these COCs is conservative. Groundwater concentrations used in the model are listed in Table C3-4.

Table C3-4
Freely Dissolved Groundwater Concentrations in Native Material Beneath Cap

Chemical Group and Concentration Units	Individual Chemical, Chemical Group or Homolog Group Name	Maximum Groundwater Concentration	Alternate Groundwater Concentration
TPAH (34) (µg/L)	1-Methylnaphthalene	27	2.9
	2-Methylnaphthalene	30	3.9
	Acenaphthene	22	1.5
	Acenaphthylene	45	0.66
	Anthracene	8.8	1.5
	Benzo(a)anthracene	0.62	0.45
	Benzo(a)pyrene	0.20	0.14
	Benzo(b)fluoranthene	0.085	0.085
	Benzo(e)pyrene	0.11	0.097
	Benzo(g,h,i)perylene	0.035	0.033
	Benzo(j,k)fluoranthene	0.080	0.065
	C1-Benzo(a)anthracenes/Chrysenes	0.23	0.20
	C1-Fluoranthenes/Pyrenes	4.1	2.0
	C1-Fluorenes	3.3	1.9
	C1-Phenanthrenes/Anthracenes	9.4	6.2
	C2-Benzo(a)anthracenes/Chrysenes	0.095	0.095
	C2-Fluorenes	2.8	2.8
	C2-Naphthalenes	24	8.6
	C2-Phenanthrenes/Anthracenes	3.7	3.7
	C3-Benzo(a)anthracenes/Chrysenes	0.025	0.025
	C3-Fluorenes	1.1	1.1
	C3-Naphthalenes	13	11
	C3-Phenanthrenes/Anthracenes	0.81	0.81
	C4-Benzo(a)anthracenes/Chrysenes	6.1E-03	6.1E-03
	C4-Naphthalenes	4.4	4.4
	C4-Phenanthrenes/Anthracenes	0.18	0.18
	Chrysene	0.56	0.45
	Dibenzo(a,h)anthracene	6.6E-03	5.8E-03
	Fluoranthene	4.2	2.4
	Fluorene	5.2	0.77
	Indeno(1,2,3-c,d)pyrene	0.018	0.016
	Naphthalene	140	9.5
	Perylene	0.043	0.020
	Phenanthrene	13	4.9

Chemical Group and Concentration Units	Individual Chemical, Chemical Group or Homolog Group Name	Maximum Groundwater Concentration	Alternate Groundwater Concentration
	Pyrene	8.5	3.4
	TPAH (34)*	370	75
TPCB (ng/L)	PCB-mono	77	3.7
	PCB-di	130	4.7
	PCB-tri	290	5.5
	PCB-tetra	120	3.2
	PCB-penta	50	2.3
	PCB-hexa	12	0.30
	PCB-hepta	1.6	0.028
	PCB-octa	0.11	2.5E-03
	PCB-nona	6.8E-03	2.3E-04
	PCB-deca	1.4E-03	4.0E-05
	TPCB*	680	20
D/F TEQ (ng/L)	D/F TEQ	4.8E-05	--
C19-C36 (µg/L)	C19-C36	8.6E-01	--
Cu (µg/L)	Cu	19	--
Pb (µg/L)	Pb	14	--

Notes:
Values rounded to two significant figures.
* TPAH (34) and TPCB were not explicitly simulated by the model (individual constituents were simulated and results summed to compute the model-predicted totals); values are included here for informational purposes.
--: alternative values not developed

3.1.2.2 Partition Coefficients

Partitioning of chemicals between the dissolved and sorbed phases is described in CapSim by the chemical-specific equilibrium partition coefficient (K_d). K_d values are used in the modeling to represent partitioning of Cu and Pb in all media. Partitioning of PAHs and PCBs in sediment were based on site-specific K_d values developed in the RI Report and draft CFT Modeling Report. For C19-C36 and D/F in all media and PAHs and PCBs in native material, K_d values were calculated from literature-based K_{OC} values and the corresponding solid phase f_{OC}. For PCBs, average values by homolog group were used for the literature-based PCB partition coefficients. For C19-C36, K_{OC} values were conservatively selected from the more mobile low molecular weight end of the range reported for the compounds within this class of chemicals. The K_{OC} for D/F TEQ was based on the more mobile 2,3,7,8-TCDD.

Partitioning coefficients (i.e., K_d or K_{OC}) were used in two ways in the modeling: 1) to calculate the source concentrations (freely dissolved phase COC concentrations beneath the cap) input to the model based on COC concentrations measured in the sediment or native material (as discussed in Section 3.1.2.1); and 2) to simulate partitioning of COCs to the cap materials in the model's calculations. These uses are summarized in Table C3-5 and described as follows:

- Define the source term in the model (i.e., freely dissolved phase concentrations beneath the cap)
  - **Porewater (cap-on-sediment scenario):** Porewater concentrations were calculated from bulk sediment data to specify the underlying source term in the model for the cap-on-sediment scenario using K_d values and Equation C3-1a for PAHs, PCBs, Cu, and Pb.[10] Site-specific log K_d values from the draft CFT model or RI Report evaluations were used for these COCs. For C19-C36 and D/F TEQ, porewater concentrations were calculated from bulk sediment using Equation C3-1b and a literature-based log K_{OC} value in conjunction with the sample-specific sediment f_{OC} (based on RI data and Treatability Study data), literature-based K_{DOC}, and an average porewater DOC concentration of 10 milligrams per liter (mg/L; based on RI data).[11]

[10] K_d values for PCBs and PAHs were developed from paired sediment and porewater sampling, in which the porewater concentrations were measured via SPME. SPME measures the COCs freely dissolved in porewater (see Section 4.8.1 of the RI Report). Thus, the site-specific K_d values can be used directly to calculate freely dissolved porewater concentration.

[11] For D/F TEQ and C19-C36, a K_{OC} and f_{OC} were used, because porewater samples were not analyzed for these COCs in the RI. The literature-based K_{OC} in this case, does not incorporate the DOC fraction, so the conversion of D/F TEQ and C19-C36 sediment concentrations to freely dissolved porewater concentration required three phase partitioning to account for the DOC fraction.

Equation C3-1a

$$C_{dpw} = \frac{C_s}{K_d} \text{ (For PAHs, PCBs, Cu, and Pb)}$$

Equation C3-1b

$$C_{dpw} = \frac{C_s}{K_{OC} \cdot f_{OC} \cdot (1 + m_{DOC} \cdot K_{DOC})} \text{ (For D/F TEQ and C19-C36)}$$

where:

C_{dpw}	=	calculated freely dissolved porewater concentration (µg/L)
C_S	=	bulk sediment concentration (µg/kg)
K_d	=	equilibrium partition coefficient (L/kg; site-specific)
K_{OC}	=	organic carbon partition coefficient (L/kg; literature-based)
f_{OC}	=	fraction organic carbon in sediment (unitless)
m_{DOC}	=	DOC concentration in porewater (mg/L); specified to be 10 mg/L based on average of East Branch porewater DOC samples
K_{DOC}	=	DOC coefficient (L/kg)

- **Groundwater (cap-on-native-material scenario):** As described in Appendix F of the RI Report (Anchor QEA 2023a), for organic chemicals, total dissolved groundwater concentrations were estimated from whole water sample COC concentrations, total suspended solids, particulate organic carbon, and DOC measurements using equilibrium partitioning calculations due to the presence of elevated solids and turbidity in the raw whole water samples. Using the same fundamental equations presented in Appendix F of the RI Report (Anchor QEA 2023a), the DOC-bound fraction was removed from the total to estimate the freely dissolved groundwater concentrations for use in the cap model, as shown in Equation C3-2.

Equation C3-2

$$C_{dgw} = \frac{C_t}{(1 + m_{DOC} * K_{DOC})}$$

where:

$C_{dgw.}$	=	freely dissolved groundwater concentration (µg/L)
C_t	=	total dissolved groundwater concentration (µg/L)
m_{DOC}	=	DOC concentration in the groundwater (mg/L); specified to be 1 mg/L based on average of Study Area groundwater DOC samples
K_{DOC}	=	dissolved organic carbon partition coefficient (L/kg)

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Groundwater concentrations calculated from native material data were also used to specify the underlying source term in the model for the cap-on-native-material scenario. For organic chemicals, native material data were converted to groundwater concentrations using literature-based log K_{OC} values in conjunction with native material f_{OC}, literature-based K_{DOC}, and an average DOC of 1 mg/L (based on RI groundwater data), as shown in Equation C3-3a.[12] For metals, native material data were converted to groundwater concentrations using the site-specific log K_d values, as shown in Equation C3-3b.

Equation C3-3a

$$C_{dgw} = \frac{C_N}{K_{OC} \cdot f_{OC} \cdot (1 + m_{DOC} * K_{DOC})} \text{ (For organic COCs)}$$

Equation C3-3b

$$C_{dgw} = \frac{C_N}{K_d} \text{ (For metals)}$$

where:

C_{dgw}	=	freely dissolved groundwater concentration (µg/L)
C_N	=	native material concentration (µg/kg)
K_{OC}	=	organic carbon partition coefficient (L/kg)
f_{OC}	=	fraction of organic carbon of native material (unitless)[13]
m_{DOC}	=	DOC concentration in groundwater (mg/L); assumed 1 mg/L based on average of groundwater DOC
K_{DOC}	=	dissolved organic carbon coefficient (L/kg)
K_d	=	equilibrium partition coefficient (L/kg)

- Represent partitioning of COCs within the cap
  - Partitioning of COCs onto the materials within the cap's BAZ, where depositing solids are expected to mix with the erosion protection layer materials (as shown in Figure C3-2), was simulated in the model using site-specific K_d values (as available). These depositing solids are expected to exhibit partitioning behavior similar to the Study Area surface sediments (because K_d values measured in Study Area point source solids samples were similar to K_d values from Study Area surface sediment; see Section 6.4.1.3 of the

[12] Because the anthropogenic factors that affect the partitioning relationship of organic chemicals in Study Area sediment are not necessarily present in the native material, the site-specific Kd values for sediment may not be applicable to native material; see Section 4.9 of the RI Report (Anchor QEA 2023a).

[13] For total organic carbon (TOC) below 0.2% by weight, other factors, including particle size and sorption to nonorganic mineral fractions, become more important; therefore, TOC measurements less than 0.2% by weight were set to 0.2% by weight to reflect a small degree of sorption to the mineral surfaces that occurs in sediment with low TOC (Karickhoff 1984; USEPA 2000).

RI Report; Anchor QEA 2023a). Therefore, as available (i.e., for PAHs, PCBs, Cu, and Pb), the site-specific log K_d values were used to represent partitioning within this portion of the cap. For organic COCs in which site-specific log K_d values were not available (i.e., D/F TEQ and C19-C36), K_d values were calculated in the model (using equilibrium partitioning) using log K_{OC} values based on literature values and the expected f_{OC} within the upper portion of the cap (based on f_{OC} of depositing solids; see Table C3-2) to represent partitioning within the cap's BAZ.

- Because the anthropogenic factors that affect the partitioning relationships in Study Area sediment are not anticipated to influence the cap material beneath the BAZ, log K_{OC} values based on literature and an f_{OC} value consistent with the cap material (including sorptive amendment, if applicable) were used to represent partitioning to cap material beneath the BAZ in the model. This portion of the cap below the BAZ is shown as the chemical isolation layer in Figure C3-2.
- Because the source term in the model is on a freely dissolved basis, the model explicitly simulates partitioning onto DOC, as represented by the input values for DOC concentration and K_{DOC}.

Table C3-5 summarizes the partition coefficient approaches, their sources, and how they were used in the evaluation. Table C3-6 lists the partition coefficient values used.

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Table C3-5
Summary of Partition Coefficient Approaches, Sources and Uses

Partition Coefficient Approach	Source	COCs	Calculate Source Term			Simulate Partitioning within Cap	
			Sediment to Porewater	Native to Groundwater	Convert Groundwater Sample to Freely Dissolved Groundwater	Within BAZ	Cap Beneath BAZ
Site-specific K_d Calculated based on paired Study Area sediment and shallow porewater data as documented in the RI Report (Anchor QEA 2023a) and draft CFT Modeling Report (Anchor QEA 2022b).	East Branch-specific value for PAHs, PCBs, and Cu. Due to limited East Branch-specific data, Study Area average K_d value was used for Pb.	PAHs PCBs	●			●	
		Cu Pb	●	●		●	●
Literature-based K_{OC} Derived from literature	USEPA (2003). Values are consistent with those discussed in the RI Report (Anchor QEA 2023a).	PAHs		●			●
	Calculated from K_{OW} values[1] per DiToro (1985). Values are consistent with those discussed in the RI Report (Anchor QEA 2023a).	PCBs		●			●
	Calculated from the K_{OW} value for 2,3,7,8-TCDD published by Aberg et al. (2008) per DiToro (1985).	D/F TEQ	●	●		●	●
	Based on the low molecular weight end of the range reported for this class of compounds as reported by Gustafson et al (1997); this value is consistent with that discussed in the RI Report (Anchor QEA 2023a).	C19-C36	●	●		●	●

Partition Coefficient Approach	Source	COCs	Calculate Source Term: Sediment to Porewater	Calculate Source Term: Native to Groundwater	Calculate Source Term: Convert Groundwater Sample to Freely Dissolved Groundwater	Simulate Partitioning within Cap: Within BAZ	Simulate Partitioning within Cap: Cap Beneath BAZ
K_{DOC} Based on relationships with K_{OW}: $K_{DOC} = (0.05*K_{OW})$ Consistent with the RI Report (Anchor QEA 2023a) and draft CFT Modeling Report (Anchor QEA 2022b)	Literature-based K_{OW} for PAHs (USEPA 2003) consistent with inputs developed for the draft CFT model.	PAHs	●	●	●	●	●
	Literature-based K_{OW} for PCBs based on Hawker and Connell 1988 and de Bruijn et al. (1989).[1]	PCBs	●	●	●	●	●
	Literature-based K_{OW} for D/F TEQ (represented by 2,3,7,8-TCDD) based on Aberg et al. (2008).	D/F TEQ	●	●	●	●	●
	Literature-based K_{OW} for C19-C36 back-calculated from K_{OC} based on the DiToro (1985) relationship.	C19-C36	●	●	●	●	●

Note:

1. Average log K_{OW} values for PCBs were developed by arithmetically averaging results from individual congeners within each homolog group. Log K_{OW} values for PCBs as cited by Hawker and Connell (1988) are widely used, though they were measured by a generator column. Log K_{OW} values measured by the "slow-stirring" method are considered more accurate. Therefore, the Hawker and Connell PCB log K_{OW} values were adjusted based on a correlation with log K_{OW} values measured by de Bruijn et al. (1989) using the "slow-stirring" method (de Bruijn's log K_{OW} values were not used directly because that study only measured 20 PCB congeners).

Table C3-6
Chemical-Specific Properties – Partition Coefficients and Boundary Layer Mass Transfer Coefficients

Chemical Group/Homolog Group/ Chemical Name	Partition Coefficients			
	log K_{OC} (log L/Kg)	log K_d (log L/Kg)	log K_{OW} (log L/kg)	log K_{DOC} (log L/kg)
PAHs (Individual Chemicals)				
1-Methylnaphthalene	3.8	3.7	3.8	2.5
2-Methylnaphthalene	3.8	4.2	3.9	2.6
Acenaphthene	3.9	3.5	4.0	2.7
Acenaphthylene	3.2	3.9	3.2	1.9
Anthracene	4.5	4.3	4.5	3.2
Benzo(a)anthracene	5.6	5.8	5.7	4.4
Benzo(a)pyrene	6.0	6.5	6.1	4.8
Benzo(e)pyrene	6.0	6.4	6.1	4.8
Benzo(g,h,i)perylene	6.4	7.0	6.5	5.2
Benzo(j,k)fluoranthene	6.2	6.6	6.3	5.0
C1-Benzo(a)anthracenes/Chrysenes	6.0	6.1	6.1	4.8
C1-Fluoranthenes/Pyrenes	5.2	5.1	5.3	4.0
C1-Fluorenes	4.6	4.1	4.7	3.4
C1-Phenanthrenes/Anthracenes	5.0	4.7	5.0	3.7
C2-Benzo(a)anthracenes/Chrysenes	6.3	6.3	6.4	5.1
C2-Fluorenes	5.1	4.5	5.2	3.9
C2-Naphthalenes	4.2	3.9	4.3	3.0
C2-Phenanthrenes/Anthracenes	5.4	5.0	5.5	4.2
C3-Benzo(a)anthracenes/Chrysenes	6.8	6.3	6.9	5.6
C3-Fluorenes	5.6	5.1	5.7	4.4
C3-Naphthalenes	4.7	4.0	4.8	3.5
C3-Phenanthrenes/Anthracenes	5.8	5.4	5.9	4.6
C4-Benzo(a)anthracenes/Chrysenes	7.2	6.5	7.4	6.1
C4-Naphthalenes	5.2	4.4	5.3	4.0
C4-Phenanthrenes/Anthracenes	6.2	5.7	6.3	5.0
Chrysene	5.6	5.9	5.7	4.4
Dibenzo(a,h)anthracene	6.6	4.3	6.7	5.4
Fluoranthene	5.0	5.1	5.1	3.8
Fluorene	4.1	4.1	4.2	2.9
Indeno(1,2,3-c,d)pyrene	6.6	7.2	6.7	5.4
Naphthalene	3.3	4.0	3.4	2.1
Perylene	6.0	6.8	6.1	4.8

Chemical Group/Homolog Group/ Chemical Name	Partition Coefficients			
	log K_{OC} (log L/Kg)	log K_d (log L/Kg)	log K_{OW} (log L/kg)	log K_{DOC} (log L/kg)
Phenanthrene	4.5	5.0	4.6	3.3
Pyrene	4.8	5.0	4.9	3.6
PCBs (Homolog Group)				
PCB-mono	4.9	4.2	5.0	3.7
PCB-di	5.4	4.6	5.5	4.2
PCB-tri	5.8	5.0	5.9	4.6
PCB-tetra	6.3	5.6	6.4	5.1
PCB-penta	6.7	6.0	6.8	5.5
PCB-hexa	7.1	6.5	7.2	5.9
PCB-hepta	7.4	6.9	7.6	6.3
PCB-octa	7.8	7.3	7.9	6.6
PCB-nona	8.1	7.8	8.2	6.9
PCB-deca	8.4	8.0	8.6	7.3
D/F TEQ[1] (Chemical Group)	6.8	--	6.9	5.6
C19-C36 (Chemical Group)	8.6	--	8.8	7.5
Cu	--	5.1	--	--
Pb	--	5.3	--	--

Notes:
All values are rounded to two significant figures.
1. Partition coefficients for D/F TEQ based on values for 2,3,7,8-TCDD.
--: not relevant

3.1.2.3 Seepage Rate and Dispersion Coefficient

Seepage rates were measured at three locations within East Branch during the RI, with average rates from the sediment into the surface water of 0.3 centimeters per day (cm/day), 0.7 cm/day, and 1.0 cm/day (Anchor QEA 2023a). During the East Branch Treatability Study, seepage rates were calculated from vertical hydraulic gradient and vertical hydraulic conductivity values measured at six locations within the Western Beef Slip portion of East Branch. The average seepage rate from those data (based on pairing maximum values for vertical hydraulic conductivity and vertical hydraulic gradient) was 0.5 cm/day (NRT 2020). For the purposes of assessing feasibility of capping in East Branch, the upper-bound average seepage rate value of 1 cm/day from the existing data was used for the chemical isolation cap modeling evaluations. Because the cap modeling represents long-term conditions, it is appropriate to use an upper-bound average value to represent a long-term condition, rather than an instantaneous maximum (note, simulating a maximum instantaneous value would be equivalent to simulating low tide all day, every day, for 100 years, which is not realistic).

Newtown Creek is a tidally influenced system, experiencing two tidal cycles per day.[14] The seepage meter data collected during the RI indicated that measured seepage rates exhibit tidal oscillations (to varying degrees) at many Study Area locations. As such, dissolved phase transport within a cap may also be influenced by these tidal dynamics. Representing tidal oscillations in porous media flow velocity as a dispersion process is a common approach in modeling of long-term contaminant transport in groundwater systems (e.g., La Licata et al. 2011) because high-frequency variations in pore velocity have been shown to behave as a dispersive process over the long term (e.g., de Dreuzy et al. 2012). Thus, the approach taken here was to represent groundwater seepage in the cap model based on the average rates from the high-frequency seepage meter measurements (as described in the previous paragraph, using the conservative upper-end value of 1 cm/day) and to represent tidal oscillations as a dispersion process using an input value for dispersivity (which is dependent on the spatial scale or domain length of a model and has units of length). Dispersivity values for flow in porous media over relatively short distances (such as those of a sediment cap) are typically in the range of 1% of the domain length (consistent with typical values used in cap modeling [Reible 2012]), whereas those associated with large scale groundwater plumes are on the order of 10% (Gelhar et al. 1992; Neuman 1990). To represent the seepage variations and reversals from tidal fluctuations as an additional dispersion process, an upper-end hydrodynamic dispersivity of 10% of the domain length, which includes a 6-inch erosion protection layer and minimum 12-inch-thick chemical isolation layer (as shown in Figure C3-2) was selected to be conservative.

3.1.3 Model Simulation Approach

The model was used to simulate the transport of PAH compounds, PCB homologs, D/F TEQ, C19-C36, Pb, and Cu within the cap layers discussed in Section 3.1.1.3. Due to differences in chemical properties (i.e., mobility), the 35 individual PAH compounds[15] and 10 individual PCB homolog groups that compose TPAH (34) and TPCB, respectively, were simulated separately and the respective total concentrations were calculated based on the sum of the model results of the corresponding individual compounds or groups of compounds. As discussed in Section 3.1.1.4, model simulations were conducted to assess the performance of the cap over a 100-year period. Model performance was evaluated by comparing model-predicted solid phase concentrations for each chemical group from the top 15 cm of the cap (i.e., within the BAZ; expressed as a vertical average) to the risk-based PRGs (Section 3.1.1.4). In addition, a sensitivity analysis was performed, in which model-predicted solid phase concentrations for each chemical group from a depth of 15 cm below the cap surface

[14] For the remedial alternatives that involve placement of caps, the cap would be installed either at or below 0 foot MLLW (e.g., for Alternative EB-B) or at or below the pre-construction mudline elevations (for all other active remediation alternatives); see Section 5 of the FFS for details. As a result of this removal, the remaining contaminated sediment below the caps would generally be below 0 foot MLLW for all alternatives, thereby maintaining saturation of the contaminated sediment and preventing desiccation, which could potentially result in otherwise unexpected contaminant releases.

[15] Thirty-five individual PAHs were simulated instead of 34 because two PAHs (1-methylnaphthalene and 2-methylnaphthalene) were simulated in place of C1-naphthalenes.

(i.e., single point) were compared to the risk-based PRGs as well, to evaluate whether this approach produced different results (Section 3.1.5.3). Two scenarios were evaluated with the model: cap on sediment and cap on native material. For the cap-on-native-material scenario, two sub-scenarios were evaluated to bound the uncertainty in the source term groundwater concentrations, as discussed in Section 3.3.

The model was initially set up to simulate COC transport through a 1-foot sand chemical isolation layer overlain by 6-inches of erosion protection material. If sand alone was not sufficient to meet the design targets for more than 100 years, the total organic carbon (TOC) was increased iteratively (in 5% increments) until the design targets were predicted to be met. The use of TOC to represent the sorptive amendment to the cap in the model allows for flexibility in the selection of a specific sorptive amendment material during design. In this case, the TOC content for the chemical isolation layer was assumed to be achieved through the addition of activated carbon (AC). AC has been shown to be at least 10 to 100 times more sorbent than TOC for PAHs and PCBs (e.g., Jonker and Koelmans 2002; Hale and Werner 2010). For the capping evaluations in this appendix, AC was assumed to be 10 times more sorbent than TOC; for example, 1.0% by weight AC could provide similar sorption as 10% by weight TOC. There are several commercially available AC-based cap products, and AC can be blended with sand to produce a suitable amended cap material as well. If needed, selection of the AC, including selection of granular AC or powdered AC, would be made during design.

3.1.4 Dissolved Phase Chemical Isolation Model Results

Model results for the cap-on-sediment and cap-on-native-material scenarios are discussed in the following subsections, respectively.

3.1.4.1 Cap-on-Sediment Scenario

Model results for the cap-on-sediment scenario indicated that for D/F TEQ, C19-C36, Cu, and Pb, a 12-inch-thick sand layer without amendment would be sufficient to achieve the respective design targets. For TPAH (34) and TPCB, model-predicted concentrations exceeded the respective design targets in fewer than 100 years, indicating that an amendment would be needed (see Table C3-7). Therefore, the model was run iteratively, by increasing the specified TOC of the chemical isolation layer in 5% increments, to identify the sorptive amendment content in the sand chemical isolation layer necessary to meet the design targets. The model results, shown in Table C3-7, suggest a 12-inch-thick layer of sand with 5% by weight TOC (equivalent to 0.5% by weight AC) would be needed to meet the design target for TPCB for more than 100 years, and 10% by weight TOC (equivalent to 1% by weight AC) would be needed to meet the TPAH (34) design target. Figures C3-15a through C3-15f show the sorbed phase COC concentrations in the top 15 cm of the cap predicted by the model over time for a sand-only cap. As shown in these figures, the design targets are predicted to be exceeded in less than 40 years for TPAH (34) and in less than 10 years for TPCB with no amendment. A small amount of AC

(1% by weight) is predicted to be sufficient to sorb and attenuate PAHs (Figure C3-16a) and PCBs (Figure C3-16b) such that concentrations of TPAH (34) and TPCB within the top 15 cm of the cap are predicted to remain less than the respective design targets for more than 100 years. Model-predicted D/F TEQ and C19-C36 remain at zero with the addition of 1% by weight AC (Figures C3-16c and C-16d, respectively). This thickness and AC amendment content are well within the range of cap configurations that have been successfully constructed at other sites. As such, these results indicate capping would be feasible to address dissolved phase transport of COCs from sediment and porewater for the East Branch Early Action remedial alternatives.

Table C3-7
Model Results – Cap on Sediment

Chemical or Chemical Group	Design Target	Units	Model-predicted Concentration in Top 15 cm of Cap at Time of 100 Years[1]		
			Sand Only	**0.5% AC**	**1% AC**
TPAH (34)	100	mg/kg	290	120	71
TPCB	0.3	mg/kg	14	0.010[2]	1.5E-05[3]
D/F TEQ	18	ng/kg	0.47[3]	1.1 E-23[3]	1.3E-31[3]
C19-C36	200	mg/kg	0.034	1.8E-26[3]	1.6E-34[3]
Cu	490	mg/kg	1.3E-27[2]	1.3E-27[3]	1.3E-27[3]
Pb	340	mg/kg	1.7E-35[2]	1.7E-35[3]	1.7E-35[3]

Notes:
1. Values rounded to two significant figures.
2. Model-predicted values reported are within the range of MDLs from East Branch sediment/native material data.
3. Model-predicted values reported are less than the MDLs from East Branch sediment/native material data.

3.1.4.2 Cap-on-Native Material Scenario

Model results for the sand-only cap-on-native-material scenario are shown in Table C3-8. Figures C3-17a through C3-17f show the model-predicted sorbed phase COC concentrations in the top 15 cm of the cap over time for a sand-only cap on top of native material and are summarized as follows:

- The model results indicated that for D/F TEQ, C19-C36, Cu, and Pb, a 12-inch-thick sand layer without amendment would be sufficient to meet design targets (Table C3-8 and Figures C3-17c through C3-17f).
- TPAH (34) concentrations in the BAZ were predicted to exceed the design target in approximately 20 years when using the maximum groundwater concentration input value, indicating an amendment would be needed (Figure C3-17a). However, sand alone was predicted to be sufficient to meet the TPAH (34) design target when using the alternate groundwater concentration input value (Figure C3-18a).
- TPCB concentrations in the BAZ were predicted to exceed the design target in less than 100 years when assuming both the alternate and maximum groundwater concentration input

values (Table C3-8; Figure C3-17b and C3-18b). However, for the alternate groundwater concentration input value, the predicted concentration (0.44 milligram per kilogram [mg/kg]) was very close to the design target (0.3 mg/kg) and could possibly meet the target given the various conservative assumptions/parameters used in this analysis.

Based on these results, the model was run iteratively to identify the sorptive amendment content required to meet the design targets for both TPAH (34) and TPCB. Modeling indicated that 5% to 45% TOC (equivalent to 0.5% to 4.5% by weight AC) would be needed to meet the design targets for more than 100 years (see Table C3-8). Figures C3-19a through C3-19d show the model-predicted sorbed phase COC concentrations in the top 15 cm of the cap over time for a cap with 4.5% by weight AC on top of native material when using the maximum groundwater concentration input values. Figures C3-20a through C3-20b show the model-predicted sorbed phase COC concentrations in the top 15 cm of the cap over time for a cap with 0.5% by weight AC on top of native material when using the alternate groundwater concentration input values.

The modeling was conservative for PCBs because the input values were based on upper-end individual sample results rather than an average, which is more consistent with the SWAC basis on which the TPCB risk-based PRG is applied. Thus, the need for an amendment is uncertain in the cap-on-native-material scenario; these results suggest that if needed, an amended cap would only be needed in portions of East Branch for this scenario. Because the need for an amendment is uncertain, an additional sensitivity analysis was performed, as discussed in Section 3.1.5.1. This uncertainty would need to be addressed through additional data collection during design if capping on native material was the selected remedy in East Branch. Nonetheless, these results indicate capping would be feasible to address dissolved phase transport of COCs from native material and groundwater for the East Branch Early Action remedial alternatives.

Table C3-8
Model Results – Cap on Native Material

Chemical or Chemical Group	Design Target	Units	Model-predicted Concentration in Top 15 cm of Cap at Time of 100 Years[1,2]	
			Sand Only	With AC[3]
TPAH (34)	100	mg/kg	96–490	26–90
TPCB	0.3	mg/kg	0.44–11	3.1E-04[4]–6.4E-18[5]
D/F TEQ	18	ng/kg	7.7E-05[5]	7.3E-67[5]
C19-C36	200	mg/kg	1.7E-08[5]	2.5E-79[5]
Cu	490	mg/kg	4.7E-28[5]	4.7E-28[5]
Pb	340	mg/kg	1.8E-35[5]	1.8E-35[5]

Notes:
1. The range of model-predicted concentrations at time of 100 years is based on alternate and maximum PAH and PCB concentrations.
2. Values rounded to two significant figures.
3. The AC amendment dose ranges from 0.5 to 4.5%.
4. Model-predicted values reported are within the range of MDLs from East Branch sediment/native material data
5. Model-predicted values reported are less than the MDLs from East Branch sediment/native material data.

3.1.5 Model Sensitivity Analyses

3.1.5.1 Cap-on-Native-Material Groundwater Concentration Sensitivity Analysis

For the cap-on-native-material scenario, TPAH (34) and TPCB were the COCs predicted to be driving the need for an amended cap (at least in some portions of East Branch), depending on the input groundwater concentrations. Due to the uncertainty in those concentrations and the differing results between the two alternate concentration scenarios discussed in Section 3.1.4.2, a sensitivity analysis was conducted to identify the maximum TPAH (34) and TPCB concentrations that could be present in the groundwater and capped with an unamended (i.e., sand) cap. To perform this evaluation, the cap-on-native-material scenario simulations were repeated for a range of values.

Model results indicated that total dissolved groundwater TPAH (34) concentration of 81 micrograms per liter (µg/L) exceeds the design target, and 65 µg/L meets the design target. For TPCB, a concentration of 14 nanograms per liter (ng/L) exceeds the design target, and 12 ng/L TPCB meets the design target. Therefore, for the purposes of this FFS, total dissolved groundwater concentrations of 65 µg/L TPAH (34) or less and 12 ng/L TPCB or less in the native material could be addressed with a sand-only cap (or backfill/residuals cover). An amendment would be needed when capping on native material in areas of East Branch where measured groundwater concentrations are higher than these threshold values.

3.1.5.2 Bioturbation Zone f_{OC} Sensitivity Analysis

Base case modeling assumed that an f_{OC} value of 0.1 (i.e., 10% by weight) would be representative of a future order of magnitude f_{OC} in the BAZ based on the assumption that, over time, the materials in the BAZ will be consistent with the f_{OC} of depositing solids from point sources and the East River. To address the uncertainty in the future f_{OC} within the BAZ, a sensitivity analysis was conducted by using lower f_{OC} values in the BAZ—a nominal value of 0.001 (i.e., 0.1% by weight) to represent the armor material and a value of 0.04 (i.e., 4% by weight), which represents East River solids, were evaluated. As discussed in Section 3.1.2.2 and shown in Table C3-5, K_d values are used in the modeling to represent partitioning of PAHs, PCBs, Cu, and Pb in the BAZ. Therefore, only simulations of D/F and C19-C36 are affected by the change in the assumed f_{OC} in the BAZ, so this sensitivity analysis only evaluated these two COCs. Model simulations were conducted for a sand-only cap for the scenarios of cap-on-sediment and cap-on-native-material. Model results are shown in Table C3-9. For these less mobile chemicals, the results indicate that model results are not sensitive to the use of these alternate assumed f_{OC} values (note predicted chemical concentrations for the two alternate f_{OC} values are all equal to or slightly lower than those for the base case, indicating that the base case assumption is conservative).

Table C3-9
Bioturbation Zone f_{OC} Model Sensitivity Analysis Results – Cap on Sediment or Native Material Scenarios

Scenario	Chemical Group	Design Target	Units	Model-predicted Concentration in Top 15 cm of Cap at Time of 100 Years[1]		
				BAZ f_{OC} of 0.001 (Sensitivity Analysis)	BAZ f_{OC} of 0.04 (Sensitivity Analysis)	BAZ f_{OC} of 0.1 (Base Case)
Sand Cap on Sediment	D/F TEQ	18	ng/kg	0.29[2]	0.46[2]	0.47[2]
	C19-C36	200	mg/kg	0.024	0.034	0.034
Sand Cap on Native Material	D/F TEQ	18	ng/kg	6.3E-05[3]	7.7E-05[3]	7.7E-05[3]
	C19-C36	200	mg/kg	1.6E-08[3]	1.7E-08[3]	1.7E-08[3]

Notes:
1. Values rounded to two significant figures.
2. Model-predicted values reported are within the range of MDLs from East Branch sediment/native material data.
3. Model-predicted values reported are less than the MDLs from East Branch sediment/native material data.

3.1.5.3 Risk-Based PRG Comparison Depth Sensitivity Analysis

As discussed in Section 3.1.1.4, compliance with design targets was assessed using a vertical average over the 15 cm BAZ, which is appropriate given that is the depth over which the risk assessments were performed and therefore the depth over which risk-based PRGs apply. However, a sensitivity analysis was performed to compare the model-predicted concentrations at the bottom of the BAZ to the vertical averages and the target concentrations to evaluate how use of this alternate comparison depth might affect model results. This sensitivity analysis was conducted for both the cap-on-sediment and cap-on-native-material scenarios.

Model results for these sensitivity analyses indicate that model-predicted concentrations at a depth of 15 cm at 100 years are only slightly greater than the vertically averaged model-predicted concentrations within the top 15 cm (see Tables C3-10 and C3-11 for the cap-on-sediment and cap-on-native-material scenarios, respectively). Thus, the conclusions from the modeling would not be affected if comparison of model results to the risk-based PRGs was based on this single point at a depth of 15 cm versus the 15-cm vertical average.

Table C3-10
Evaluation Depth Sensitivity Analysis Model Results – Cap on Sediment Scenario

Amendment	Chemical Group	Design Target	Units	Model-predicted Concentration at Time of 100 Years[1]	
				Bottom of 15 cm Bioturbation Zone (Sensitivity Analysis)	Vertical Average Over 15 cm Bioturbation Zone (Base Case)
Sand Only	TPAH (34)	100	mg/kg	300	290
	TPCB	0.3	mg/kg	14	14
	D/F TEQ	18	ng/kg	0.50[3]	0.47[3]
	C19-C36	200	mg/kg	0.037	0.034
	Cu	490	mg/kg	2.1E-27[2]	1.3E-27[2]
	Pb	340	mg/kg	2.7E-35[2]	1.7E-35[2]
0.5% AC	TPAH (34)	100	mg/kg	120	120
	TPCB	0.3	mg/kg	0.013[3]	0.010[3]
	D/F TEQ	18	ng/kg	1.8E-23[2]	1.1E-23[2]
	C19-C36	200	mg/kg	2.9E-26[2]	1.8E-26[2]
	Cu	490	mg/kg	2.1E-27[2]	1.3E-27[2]
	Pb	340	mg/kg	2.7E-35[2]	1.7E-35[2]
1% AC	TPAH (34)	100	mg/kg	75	71
	TPCB	0.3	mg/kg	2.0E-05[2]	1.5E-05[2]
	D/F TEQ	18	ng/kg	2.0E-31[2]	1.3E-31[2]
	C19-C36	200	mg/kg	2.6E-34[2]	1.6E-34[2]
	Cu	490	mg/kg	2.1E-27[2]	1.3E-27[2]
	Pb	340	mg/kg	2.7E-35[2]	1.7E-35[2]

Notes:
1. Values rounded to two significant figures.
2. Model-predicted values reported are less than the MDLs from East Branch sediment/native material data.
3. Model-predicted values reported are within the range of MDLs from East Branch sediment/native material data.

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Table C3-11
Evaluation Depth Sensitivity Analysis Model Results – Cap on Native Material Scenario

Amendment	Chemical Group	Design Target	Units	Model-predicted Concentration at Time of 100 Years[1,2]	
				Bottom of 15 cm Bioturbation Zone (Sensitivity Analysis)	Vertical Average Over 15 cm Bioturbation Zone (Base Case)
Sand Only	TPAH (34)	100	mg/kg	98–500	96–490
	TPCB	0.3	mg/kg	0.46–11	0.44–11
	D/F TEQ	18	ng/kg	9.2E-05[5]	7.7E-05[5]
	C19-C36	200	mg/kg	2.4E-08[5]	1.7E-08[5]
	Cu	490	mg/kg	7.6E-28[5]	4.7E-28[5]
	Pb	340	mg/kg	2.9E-35[5]	1.8E-35[5]
With AC[3]	TPAH (34)	100	mg/kg	27–95	26–90
	TPCB	0.3	mg/kg	3.7E-04[4]–9.8E-18[5]	3.1E-04[4]–6.4E-18[5]
	D/F TEQ	18	ng/kg	1.2E-66[5]	7.3E-67[5]
	C19-C36	200	mg/kg	4.2E-79[5]	2.5E-79[5]
	Cu	490	mg/kg	7.6E-28[5]	4.7E-28[5]
	Pb	340	mg/kg	2.9E-35[5]	1.8E-35[5]

Notes:
1. The range of model-predicted concentrations at time of 100 years is based on alternate and maximum PAH and PCB concentrations.
2. Values rounded to two significant figures.
3. The AC amendment dose ranges from 0.5 to 4.5%.
4. Model-predicted values reported are within the range of MDLs from East Branch sediment/native material data.
5. Model-predicted values reported are less than the MDLs from East Branch sediment/native material data.

3.2 Nonaqueous Phase Liquid Flux Evaluation

The distribution of sheen and NAPL in Study Area sediment and native material was evaluated and delineated in Appendix C of the RI Report (Anchor QEA 2023a), and the results of that work for East Branch are summarized in Section 2.3.4 of the FFS. In East Branch, NAPL blebs were observed only in subsurface sediment (not in surface sediment or native material) at a limited number of locations (see Figure A2-9b in Appendix A of the FFS), whereas sheen was observed in more than half of the surface sediment samples and at various depths for most subsurface sampling locations (see Figures A2-9a and A2-9b in Appendix A of the FFS). Based on the results of the RI NAPL evaluation and delineation, additional data were collected during the Feasibility Study (FS) to assess the extent to which NAPL, where present, may migrate from subsurface sediment to surface water. The results of the fate and transport evaluation for NAPL in East Branch are summarized in Section 2.5 of the FFS Report. This section of the appendix evaluates the amount of absorptive material (e.g., organoclay or similar) that would be required in a cap layer to address NAPL flux in East Branch for the following three potential NAPL migration mechanisms:

- NAPL advection (i.e., flow) as a continuous fluid phase within the sediment pore spaces under ambient conditions
- Gas ebullition-facilitated NAPL transport
- NAPL advection due to sediment consolidation (squeezing) following cap placement

The potential NAPL mass flux for each of the three potential NAPL migration mechanisms was calculated, as discussed in Sections 3.2.1. through 3.2.3. These mass fluxes were then used to support a preliminary, conceptual-level design for a NAPL absorption cap layer, including thickness and amendment content, as discussed in Section 3.2.4. The NAPL absorption layer was evaluated independently from the dissolved phase chemical isolation layer. However, the amendment that would be used to sequester NAPL (assumed to be organoclay for the purposes of this evaluation) would also have sorptive capacity for dissolved phase mass if the sorptive capacity of the medium is not fully consumed by absorbing NAPL.

3.2.1 Advection Nonaqueous Phase Liquid Flux (Ambient Conditions)

The *Feasibility Study Nonaqueous Phase Liquid Mobility Data Evaluation Report* (FS NAPL Mobility DER; Anchor QEA 2022c) evaluated and interpreted NAPL mobility (i.e., whether NAPL can migrate via advective flow through the pore spaces of sediment or native materials due to hydraulic and gravitational forces). Based on extensive laboratory testing during the FS field programs, the evaluation concluded that NAPL in East Branch under ambient field conditions is immobile (i.e., cannot migrate via advection).

The FS NAPL mobility test samples were selected from specific depths containing the most notable NAPL presence based on high-resolution core photography under white and ultraviolet (UV) light, so they represent relatively higher NAPL saturation values at the sampling locations. NAPL mobility tests were conducted by centrifuging the selected sediment or native material test samples with hydraulic gradients orders of magnitude stronger than the in situ forces, so the laboratory test is considered a highly conservative test of NAPL mobility. Any test sample that did not express NAPL indicates that the NAPL contained in that sample was immobile (i.e., it cannot flow under the laboratory test condition nor the smaller driving forces that exist in situ). NAPL was not expressed from any of the four sediment centrifuge test samples collected in East Branch (see FS NAPL Mobility DER Figures 4-1 and 4-2; Anchor QEA 2022c). These results indicate that NAPL in East Branch is immobile via advection. NAPL saturation values for the NAPL mobility test samples ranged from 4.2% to 5.6% of pore volume (%Pv; FS NAPL Mobility DER Table 4-2).

The NAPL mobility laboratory test results are consistent with the visual observations of NAPL in East Branch sediments. In core photographs from East Branch, UV fluorescence (interpreted to be associated with NAPL) was observed at various depths in sediment as minute, discrete, isolated specks in a non-fluorescing matrix. This general pattern of dispersed fluorescence may represent deposited oil particle aggregates (OPAs).[16] The East Branch core photography was consistent with the intermittent visual observations of sheen and blebs in sediment and shake tests using core samples collected in this area. NAPL was not observed in East Branch native material in either sediment cores or NAPL mobility core photographs, and sheen was observed in native material at only one location; therefore, NAPL mobility testing of native materials was not performed.

Based on the results of the FS NAPL Mobility DER, NAPL loading to the cap due to advection under ambient field conditions is expected to be zero, and any evaluation is purely precautionary in nature.

3.2.2 Gas Ebullition-Facilitated Nonaqueous Phase Liquid Transport Flux

The *Feasibility Study Gas Ebullition Data Evaluation Report* (FS Gas Ebullition DER [Anchor QEA 2022d]) evaluated the potential for NAPL to migrate upward via gas ebullition. Gas ebullition-facilitated NAPL transport was evaluated using the following lines of evidence:

- Quantitative flux chamber measurements of NAPL that migrated from the sediment to the water column via gas ebullition (described in Section 4.1 of the FS Gas Ebullition DER)
- Visual assessment of sheen production (i.e., field survey observations, described in Section 3.2.3 of the FS Gas Ebullition DER)

NAPL fluxes were measured at seven flux chamber sampling locations in East Branch (see FS Gas Ebullition DER Figure 3-1c [Anchor QEA 2022d]). These data were used to calculate the annual NAPL load to East Branch due to gas ebullition-facilitated NAPL transport. The flux chambers were located to capture a range of fluxes with a bias toward areas with expected higher potential for gas ebullition, based on previous visual gas ebullition surveys (e.g., two low-, two moderate-, and three high-potential NAPL flux chamber locations; see Section 3.1 of the FS Gas Ebullition DER). The daily flux measured at these locations was used to represent fluxes in areas without flux chamber data, where sheen blossoms were observed at lower rates during previous surveys, providing a conservative estimate of daily flux. Contaminant fluxes (including NAPL flux) were measured during two periods of the year, during periods when gas ebullition activity is expected to be higher, based on sediment temperatures (July and October) and lower water depths (i.e., spring tides).

An annual gas ebullition-facilitated NAPL load was derived by estimating the following:

- A daily NAPL flux based on quantitative flux chamber measurements
- The area over which this transport occurs based on the extent of field observations of sheen production

[16] An OPA is an aggregation of a suspended oil droplet with particulate matter adhering to it (USGS 2015). When enough suspended particulate matter adheres to an oil droplet, the aggregate becomes denser than water, sinks within the water column, and settles onto the sediment bed, becoming incorporated into depositing sediments over time.

- The number of days per year this transport is estimated to occur based on seasonal sediment temperatures

See Section 5 of the FS Gas Ebullition DER (Anchor QEA 2022d) for a detailed discussion of how the annual gas ebullition-facilitated NAPL load was developed.

A lower- and upper-bound annual NAPL load was calculated, reflecting differences in daily NAPL flux measurements and the area over which the gas ebullition-facilitated transport occurs. Both the lower- and upper-bound calculations assumed spring tide conditions throughout the year, with corresponding upper-bound gas ebullition rates. For this reason, the annual load calculations represent a conservative measure of gas ebullition-facilitated NAPL transport. The annual NAPL load to East Branch associated with gas ebullition ranges from 28 to 130 kilograms per year (kg/year; FS Gas Ebullition DER Table 5-5 [Anchor QEA 2022d]).

To develop an amended cap layer to address NAPL transport from gas ebullition, the annual NAPL load (kg/year) was converted to an annual NAPL flux (kilogram per square meter per year [kg/m^2/year]) by dividing the NAPL load (FS Gas Ebullition DER Table 5-5 [Anchor QEA 2022d]) by the spatial footprint over which gas ebullition was observed (FS Gas Ebullition DER Table 5-3). The annual NAPL flux to East Branch associated with gas ebullition ranges from 0.004 to 0.0098 kg/m^2/year. For the purpose of the FFS, the NAPL cap design evaluation was conservatively developed to address the upper-bound annual gas ebullition-facilitated NAPL flux of 0.0098 kg/m^2/year. Assessment of the gas ebullition-facilitated transport will be re-evaluated during the RD phase, and the cap design may be refined, as appropriate.

3.2.3 Nonaqueous Phase Liquid Loading to Cap from Sediment Consolidation

In addition to NAPL movement from gas ebullition, NAPL could potentially move via advection due to post-capping sediment consolidation. As discussed in Section 3.2.1, the NAPL in East Branch sediment is interpreted to be immobile (unable to migrate via advection) under ambient conditions. The added weight of a cap placed on sediment, however, would effectively squeeze porewater (and potentially NAPL) out of the underlying sediment as the sediment pore space (i.e., porosity) decreases. The extensive test results from the FS NAPL Mobility Evaluation indicated that with NAPL saturation values of 16.5 %Pv or less in sediment, the NAPL is immobile via advection. As discussed in Section 3.2.1, NAPL saturation values for the four NAPL mobility test samples from East Branch (which were selected from discrete depths with the most notable visible NAPL presence) ranged from 4.2 to 5.6 %Pv (FS NAPL Mobility DER Table 4-2 [Anchor QEA 2022c]). However, with decreasing pore space, the NAPL saturation values would increase. Calculations were performed to evaluate whether NAPL saturation values could increase to a value greater than 16.5 %Pv due to consolidation, in which case NAPL could potentially become mobile.

The reduction in sediment porosity was calculated for the following two potential capping scenarios:

- Placement of a 3-foot-thick cap[17] directly on the existing sediment. This scenario represents remedial Alternative EB-B in deeper water areas where no dredging prior to cap placement would be required.
- Placement of a 3-foot-thick cap following removal of 3 feet of sediment via dredging. This scenario represents remedial Alternatives EB-C and EB-D based on the preliminary cap thickness for the deep-water portion of East Branch.

Alternatives with additional dredging (e.g., Alternatives EB-E and EB-F as well as portions of Alternative EB-D) are not expected to result in a net increase in load post-remedy (i.e., the dredging will remove more load than added through capping), so this would not result in consolidation and porosity reduction in the sediment below the cap, and NAPL would not be mobilized as a result of post-capping sediment consolidation.

The total porosity of East Branch sediments was measured in the four previously discussed NAPL mobility test samples collected from East Branch sediment (see FS NAPL Mobility DER Table 4-2 [Anchor QEA 2022c]). In addition, the sediment porosity was computed from 12 samples collected for consolidation testing as part of the Treatability Study (NRT 2020). The post-remedy porosity of the sediments was calculated as a function of depth below the sediment surface for both capping scenarios outlined previously using traditional consolidation theory (Terzaghi et al. 1996). The magnitude of consolidation (and corresponding decrease in porosity) is greatest in the near-surface sediments and then decreases with depth because the percent increase in effective stress associated with cap placement is inversely proportional to the depth below the cap.

Based on this evaluation, placement of the cap without prior dredging (representing Alternative EB-B) may reduce the underlying sediment porosity by approximately 40% on average in the top 2 feet of sediment, by approximately 17% at 5 feet deep, and by less than 10% below 10 feet deep. For the dredge-and-cap scenario representing Alternatives EB-C and EB-D, the porosity may be reduced by approximately 30% on average in the top 2 feet of sediment and by less than 10% below 5 feet deep. To be conservative, the consolidation in the top 2 feet of sediment assuming capping with no prior dredging was used to calculate potential post-consolidation NAPL saturation values.

Placement of a 3-foot-thick cap directly on the existing sediment would reduce sediment porosity by approximately 40% in the top 2 feet of the underlying sediment. This change represents a reduction factor of 1.67 [i.e., 1/(1-0.4)] for porosity, which would produce an equivalent factor of increase

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[17] The cap thickness and dredge depth used in this analysis were based on initial assumptions, which were subsequently refined as part of the FFS process for the shoreline portions of East Branch. Therefore, the actual dredge elevations/depths and cap thickness as part of Alternatives EB-B, EB-C, and EB-D may vary from that assumed in this analysis but are not expected to substantively affect the conclusions of this analysis; see Section 5 for a summary of the preliminary cap designs based on the FFS analyses presented in this appendix.

(i.e., 1.67 times) in NAPL saturation in sediment. Therefore, using the maximum measured initial NAPL saturation value of 5.6 %Pv, the maximum factor of sediment porosity reduction (i.e., a porosity reduction of 40%) due to consolidation would result in a maximum post-consolidation NAPL saturation value of 9.3 %Pv, which remains in the range of immobile NAPL (i.e., less than 16.5 %Pv) after post-cap consolidation.

These sediment consolidation NAPL loading calculations are based on conservatively high initial NAPL saturation values measured in materials containing the most notable NAPL presence. Furthermore, this evaluation assumes conservatively high consolidation, which was calculated for sediments immediately underlying the cap (i.e., the 0- to 2-foot interval) but was assumed to apply to all sediment depths containing NAPL. The calculations also assumed the more conservative remedial alternative—placement of a 3-foot-thick cap directly on the existing sediment—which had the higher predicted porosity reduction. Therefore, the conclusion that NAPL would remain immobile via advection following post-cap consolidation is conservative.

3.2.4 Amended Cap Layer to Address Nonaqueous Phase Liquid Transport

The NAPL flux that influences NAPL absorption layer design is the sum of NAPL fluxes due to advection, gas ebullition, and post-cap consolidation. The NAPL flux due to each of the NAPL transport mechanisms can be summarized as follows:

- **Advection:** 0 kg/m^2/year
- **Gas Ebullition:** Up to 0.0098 kg/m^2/year
- **Consolidation:** 0 kg/m^2/year

Rounded to two significant figures, the total NAPL flux associated with all three transport mechanisms is estimated as being up to 0.0098 kg/m^2/year in the areas with gas ebullition-based NAPL flux.

The layer thickness of NAPL absorption amendment (assumed to be organoclay for the purposes of this FFS) can be conservatively calculated using Equation C3-4 to design a cap that will address the maximum calculated NAPL flux over an assumed, hypothetical, 100-year service life.

Equation C3-4

$$L_c = \frac{T_{cap} \times L_{NAPL} \times 3.28\frac{ft}{m}}{\rho_{OC} \times C_{absorption}}$$

where:

L_C	=	organoclay layer thickness assuming 100% organoclay layer (feet)
T_{cap}	=	organoclay layer service life (100 years)
L_{NAPL}	=	NAPL flux (0.0098 kg/m^2/year)
ρ_{OC}	=	density of organoclay (865 kg/m^3; Cetco 2020)
$C_{absorption}$	=	absorptive capacity of organoclay (0.5 kg-NAPL/kg-organoclay; Cetco 2012)

In areas with gas ebullition-facilitated NAPL flux (conservatively estimated as up to 0.0098 kg/m^2/year), the NAPL flux for 100 years could be addressed with a 0.007-foot- (0.09-inch)-thick layer of organoclay. Other cap configurations with the same mass of organoclay per unit area of cap (for example, a 6-inch-thick layer with 98.5% sand and 1.5% organoclay by volume), would also be effective. However, it would be impracticable to evenly distribute this small of a percentage of organoclay in the cap materials. Accounting for uncertainty and constructability considerations, the FFS NAPL sorption layer will be assumed to consist of a 6-inch-thick layer with 95% sand and 5% organoclay by volume. This assumption may be revisited during the RD phase with consideration of a thinner NAPL sorption layer (e.g., 3-inch-thick layer with 10% organoclay by volume).

This assumed FFS NAPL sorption layer conservatively contains more than 3 times the mass of organoclay needed to manage the maximum estimated NAPL flux over 100 years. The assumed 100-year cap service life is conservative because it does not account for the depletion of NAPL from the sediment over time, which will reduce the remaining NAPL mass that could be transported via gas ebullition. Due to NAPL depletion, the upward NAPL flux into the cap is expected to decline over time. To be conservative, the future decline in NAPL flux is not included in these cap loading calculations (i.e., the NAPL flux is kept constant for the 100-year period). Lastly, a NAPL adsorption layer of this type (6 inches of sand blended with a small fraction of organoclay) is readily constructable, so capping to address NAPL flux is feasible.

3.3 Summary

Numerical modeling was conducted to evaluate the dissolved phase transport of COCs through the chemical isolation layer of a cap and identify a preliminary range of design thicknesses and compositions (amendment contents) for the chemical isolation layer. The modeling was conducted based on design targets defined as meeting risk-based PRGs within the top 15 cm of the cap (BAZ) for more than 100 years. With conservative assumptions, the preliminary model results indicated that a chemical isolation layer consisting of 1 foot of sand amended with AC would be sufficient to meet the design targets. Preliminary chemical isolation layer configurations to meet design targets are as follows:

- **Cap on Sediment:** 1% by weight AC is needed to meet design targets; TPAH [34] and TPCB were the driving chemicals.
- **Cap on Native Material:** Depending on the source term assumption, varying amounts of AC by weight is needed to meet design targets; 0.5% by weight AC or less is needed to meet the design targets (TPCB was the driving chemical) when assuming the less conservative source term based on the native material-derived groundwater concentrations. Up to 4.5% by weight AC is needed to meet design targets (TPAH [34] and TPCB were the driving chemicals) when assuming a source term based on the measured groundwater concentrations. In some areas of East Branch, depending on groundwater concentrations, a sand-only cap (representative of backfill to manage dredge residuals) would be sufficient for this scenario; additional data collection during the RD phase would be needed to refine delineation of such areas if an alternative including removal down to native material were selected.

In addition, an analysis was performed to quantify the potential NAPL flux from the sediment due to the combination of NAPL advection (under ambient conditions), gas ebullition, and NAPL advection due to post-cap consolidation processes. This evaluation determined that gas ebullition is the only process by which NAPL may migrate upward in East Branch, and a 6-inch-thick chemical isolation layer for NAPL sorption containing 5% organoclay by volume would conservatively address gas ebullition-facilitated NAPL flux for 100 years.

Together, these evaluations indicate that chemical isolation capping is feasible for the remedial alternatives that include that technology for the East Branch FFS.

4 No-Rise Evaluation

A no-rise analysis was performed using the final calibrated hydrodynamic model presented in the FMRM (Anchor QEA 2022a) to evaluate the potential for water surface elevations during a storm surge event to increase because of capping. Alternative EB-B would result in water depths within East Branch that are shallower on average than current depths due to placement of a cap on grade. The remaining active alternatives would result in no change (Alternative EB-C) or deeper water on average than current depths due to dredging that would occur prior to capping (Alternatives EB-D through EB-F) and would be unlikely to produce an increase in water surface elevation. Therefore, only Alternative EB-B was considered in this no-rise evaluation.

No-rise evaluations are typically performed to evaluate whether a project would cause a rise in peak water surface elevations during an extreme event such as the 100-year flood. This usually pertains to river systems where, during a 100-year flood, there is a large increase in flow entering the project area from upstream compared to normal flow conditions, but it also applies to tidal systems at risk for flooding during storm surge. Newtown Creek is a dead-end, tidally influenced tributary to the East River. The primary freshwater inflows to the creek are from point source discharges such as CSOs and stormwater/direct drainage. The natural hydrodynamics of Newtown Creek, including East Branch, are dominated by twice-daily tidal exchange with the East River and by rainfall-related inflows from point sources and overland flow. Because the water surface elevations in Newtown Creek are primarily driven by tides propagating in from the East River and not by a source of upland flow, it is not expected that a relatively small decrease in water depth due to placement of a cap would produce a measurable change in water surface elevations because the water surface elevations are largely forced by the tidal elevations in the East River. Nonetheless, a no-rise evaluation was performed to evaluate whether placement of a cap on grade has the potential to increase water surface elevations during periods of storm surge.

4.1 Model Setup and Results

The bathymetry in the calibrated hydrodynamic model (Figure C4-1) was modified to evaluate placement of a cap on top of the existing sediment in East Branch based on Alternative EB-B. The thickness of the cap and thus the change in bathymetry varied spatially in East Branch based on the following three areas delineated by the post-remedy elevation: the wake zone, shallow water/nearshore, and deep water. The thicknesses of the cap were taken from Table C5-1 for each of the three areas. The total cap thicknesses were 53 inches (4.4 feet) for areas shallower than -4 feet MLLW (i.e., the wake zone), 45 inches (3.8 feet) for areas with bed elevations of -4 feet MLLW to -13.5 feet MLLW (i.e., the shallow water/nearshore zone), and 36 inches (3 feet) for areas deeper than -13.5 feet MLLW (i.e., the deep zone). The elevation of the bed of the hydrodynamic model in East Branch was increased by these amounts, depending on the starting bed elevation of the model grid cell (Figure C4-1), to account for a cap, essentially making the water depth shallower after cap placement (Figure C4-2). Figure C4-3 shows the model grid cells in East Branch where the sediment bed elevation was increased and the amount of elevation increase. Alternative EB-B assumes placement of an armored/amended cap entirely at (or below) 0 foot MLLW. As such, any increase in the sediment bed elevation that would result in an elevation above 0 foot MLLW was truncated so the resulting sediment bed elevation was 0 foot MLLW. This assumes some dredging would be conducted such that the cap does not extend above 0 foot MLLW. Six point source discharges are included in the hydrodynamic model in East Branch, including two CSOs, three stormwater outfalls, and one direct drainage input. The model was verified so that the sediment surface around the outfall locations remained wet during discharge events after the elevation changes to represent the cap were applied.

The roughness of the bed in the hydrodynamic model was also adjusted to account for larger sized material being placed on the bed to protect the amended cap from erosive forces (i.e., the erosion protection layer as discussed in Section 2). The effective bed roughness used in the calibrated hydrodynamic model was 1 cm throughout Newtown Creek (Anchor QEA 2022a). The median stable particle diameter of the erosion protection layer was used to estimate effective bed roughness values for the no-net-rise simulation with the cap in place. The effective bed roughness (Ks) of the median stable particle diameters was estimated using Equation C4-1 (Warner et al. 2008):

Equation C4-1

$$K_s = 30 * \mathrm{D}_{50}/12$$

where:

D_{50}	=	median stable particle diameter (cm)
Ks	=	effective bed roughness (cm)

The resulting effective bed roughness values (Ks) were 45 cm for shallower than -4 feet MLLW, 25 cm for -4 feet MLLW to -13.5 feet MLLW, and 1.3 cm for deeper than -13.5 feet MLLW. The effective bed roughness values for the no-net-rise simulation were specified based on the bed elevation of the hydrodynamic model grid cells.

A period with storm surge and elevated water surface elevation in East Branch was simulated using the bathymetry from the calibrated hydrodynamic model (based on the 2012 bathymetric survey, as discussed in the FMRM [Anchor QEA 2022a]) and the revised post-cap bathymetry. The period for the storm surge event was selected by identifying the highest water surface elevation at the boundary of the hydrodynamic model in the long-term 20-year simulation spanning 1996 to 2015. The maximum water surface elevation occurred at the end of October 2012 coincident with a storm surge event. This storm surge event resulted from Hurricane Sandy, which caused a peak water surface elevation above the Federal Emergency Management Agency 100-year base flood elevation around New York City. However, the regional model boundary conditions available for the simulation of the event peaked at about 6 feet NAVD88 at The Battery, 5 feet lower than the observed peak water level (i.e., about 11 feet NAVD88). Notwithstanding this limitation in the regional model boundary condition, this event represents a storm surge of about 4 feet above the tidal water surface elevations. This event is also the highest water surface elevation and largest storm surge in the available hydrodynamic model boundary conditions. A 10-day period from October 24 to November 3, 2012, was simulated to capture this storm surge event.

A comparison of the difference in the peak water surface elevation was made at locations within East Branch downstream and upstream of the Grand Street Bridge, as well as two locations in Newtown Creek downstream of East Branch: at creek miles 0.4 and 2.6. Figures C4-4 and C4-5 show comparisons of the predicted water surface elevations with and without the simulated cap placement for these locations. At each of the four locations, the difference in the predicted maximum water surface elevation did not exceed 0.005 foot. Thus, implementation of a remedy that includes placement of a cap and shallowing of the bathymetry did not affect the simulated peak water surface elevations during the storm surge event. In the shallower areas of East Branch, the shallowing of the bathymetry to 0-foot MLLW resulted in areas that dry during low tides that were not dry in the Base Case simulation. In the hydrodynamic model, the grid cells become dry when the water depth is less than 10 cm (0.33 foot). In East Branch during the no-net-rise simulation, the cells become dry when the predicted water surface elevation is below 0.33 foot MLLW, representing a very shallow depth. This results in some differences in water surface elevation during the lowest tides between the Base Case and the no-net-rise simulation (Figure C4-5). However, these additional dry areas at low tide do not affect the probability of flooding or the maximum water surface elevation.

4.2 Summary

The results of the no-rise evaluation presented in this appendix indicate that for Alternative EB-B, which would result in average water depths that are shallower in East Branch compared to current conditions, there would be negligible change in peak water surface elevations during storm surge events. The remaining active alternatives would result in deeper water depths on average and are therefore unlikely to result in an increase in peak water surface elevations during storm surge events. If Alternative EB-B is selected for the East Branch Early Action remedy, the no-rise evaluation would be revised based on more detailed cross sections of the cap design and potentially the most recent bathymetric data.

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5 Capping Evaluations Summary and Remedial Design Considerations

As part of the FFS for East Branch of Newtown Creek, a no action alternative and five active remedial alternatives that involve some combination of sediment removal to various depths and placement of caps or a backfill layer to manage residuals are being evaluated. Preliminary design evaluations were conducted to demonstrate that placement of a multilayer engineered cap (including erosion protection and chemical isolation layers) is feasible in East Branch. Based on the evaluations presented in this appendix, the preliminary cap designs are summarized in Table C5-1. Figures C5-1 and C5-2 present the preliminary cap configuration for capping on sediment and capping on native material, respectively.

Table C5-1
Summary of Preliminary Cap Designs for East Branch FFS

Capping Scenario	Area	Elevation Range (feet MLLW)	Erosion Protection Layer[1,2]	Filter Layer[1]	Chemical Isolation Layer[1]	
					Dissolved Phase	NAPL Sorption
Cap on Sediment	Wake Zone	Shallower than -4 feet MLLW	20-inch-thick layer of cobbles (D_{50} = 7 inches)	9-inch-thick layer of gravel	15-inch-thick sand with AC[5]	9-inch-thick sand with organoclay
	Shallow Water/ Nearshore	-13.5 feet to -4 feet MLLW	12-inch-thick layer of coarse gravel (D_{50} = 1.9 to 2.7 inches) or cobbles (D_{50} = 3.4 to 3.9 inches)[4]	Possible 9-inch-thick layer of gravel		
	Deep Water	Deeper than -13.5 feet MLLW	12-inch-thick sand	N/A		
Cap on Native Material	Wake Zone	Shallower than -4 feet MLLW	20-inch-thick layer of cobbles (D_{50} = 7 inches)	9-inch-thick layer of gravel		N/A
	Shallow Water/ Nearshore	-13.5 feet to -4 feet MLLW	12-inch-thick layer of coarse gravel (D_{50} = 1.9 to 2.7 inches) or cobbles (D_{50} = 3.4 to 3.9 inches)[4]	Possible 9-inch-thick layer of gravel		
	Deep Water	Deeper than -13.5 feet MLLW	12-inch-thick sand	N/A		
Cap over ISS[3]	Not modeled but assumed to be the same as the Cap on Native Material					

Notes:
1. All thicknesses include overplacement tolerance, assumed to be 3 inches for sand and gravel material and 6 inches for cobble materials.
2. The erosion protection layer material varies based on area (see Table C2-14).
3. As discussed in Section 3, the need for a post-ISS cap would be based on treatability studies. Due to the uncertainties at this FFS stage, preliminary cap modeling was not performed for the post-ISS cap, but a preliminary design consisting of a chemical isolation layer amended with AC overlain by an erosion protection layer was assumed for the purposes of the FFS. It is assumed that the ISS process will eliminate the potential for gas ebullition-facilitated transport of NAPL; therefore, a separate NAPL sorption layer is not assumed for the post-ISS cap. The need for a post-ISS cap, including whether cap amendments are needed, would be determined during the RD phase.

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4. As noted in Tables C2-6 and C2-7, the upper end of the predicted range of D_{50} for the Tide Runner in shallow water is considered overly conservative based on the nature of the assumptions for this evaluation. Therefore, an average of approximately 3 inches (i.e., cobbles) is recommended in shallow water/nearshore areas of Areas 2 and 4.
5. In some areas of East Branch, depending on groundwater concentrations, a sand-only cap (representative of backfill to manage dredge residuals) would be sufficient for the cap-on-native-material scenario.

N/A: not applicable

The following summarizes several preliminary evaluations and considerations related to cap placement and performance:

- Although the sediments in Newtown Creek are soft, as discussed in the *Feasibility Study Geotechnical Data Evaluation Report* (Anchor QEA 2020a), they are similar to other sediment sites where caps have successfully been placed. Based on the experience at other sites, it is expected that cap placement in East Branch is feasible.
- The preliminary cap designs included in the FFS are composed of granular material that will mimic the contours of the creek bottom. Therefore, the caps, including the treatment layer(s), should not be sensitive to differential settlement, which are not expected to be drastic at this site (i.e., abrupt changes in settlement over short distances are not expected).
- Although the surface sediment (i.e., top 15 cm [6 inches] of sediment) is generally soft and exhibits high moisture content and high organic content, each of the alternatives except EB-B include dredging at least 3 feet of sediment prior to capping. Subsurface sediment (i.e., from 15 cm [6 inches] below the sediment surface to the native material interface) tends to be medium stiff, with lower moisture content compared to surface sediment. The periodic passage of gas bubbles through the sediment is not expected to alter its strength.

Additional analyses and refinements may be appropriate during the RD phase if an alternative that includes capping is selected. As discussed in Section 5.3.9 of the FFS, additional chemical and geotechnical data will be collected to support the cap design. During the RD phase, several additional detailed evaluations for the caps would be performed based on data collected as part of the Feasibility Study Field Program (Anchor QEA 2020b), the *Treatability Study Pre-Design Investigation Data Summary Report* (NRT 2020), and future Pre-Design Investigation, including the following:

- Cap-induced settlement of the underlying sediment would be assessed to determine the anticipated rate and magnitude of consolidation, including potential impacts on expressed porewater and contaminant mobility. This would include consideration of any dredging prior to capping.
- Geotechnical stability of the caps placed on the existing sediment would be assessed to determine if restrictions on the means and methods (e.g., equipment used to place the cap material or layer thickness) would be warranted. While gas migration through the sediment and cap is not expected to impact the stability of overlying caps, it will be reassessed during the design phase.

- There is only one location in East Branch where a sheen was observed in native; a cap has already been planned for that location due to relatively high COC flux from groundwater. If additional sheens are observed within native material during the Pre-Design Investigation, they would be further evaluated along with the flux of COCs from groundwater (see Section 3.1.4.2 of Appendix C). If appropriate, a cap may be designed to address flux of COCs resulting from sheen and/or groundwater discharge.

6 Climate Change Impacts and Resilience

While not quantitatively considered in this FFS, both climate change impacts and resilience will be evaluated and incorporated, as deemed necessary by USEPA, into RDs for actions at both the East Branch and OU1. Data and predictions on climate change for the New York City region (e.g., FEMA 2023; NOAA 2023; NYSDEC 2018; Rockefeller Foundation 2013; USACE et al. 2022; and USGCRP 2023) will be considered during design.

The New York State Department of Environmental Conservation (NYSDEC) advises that three significant hazards are expected to affect New York State this century: increased temperatures, rising sea level, and changing precipitation patterns (NYSDEC 2018). Consistent with USEPA's guidance titled *Consideration of Climate Resilience in the Superfund Cleanup Process for Non-Federal National Priorities List Sites* (USEPA 2021), resiliency measures for the following potential climate hazards will be considered during design:

- Intensity, frequency, or duration of extreme weather events
- Sea level rise
- Seasonal changes in precipitation or temperatures
- Increasing risk of floods
- Increasing intensity and frequency of wildfires

6.1 Rising Temperatures

Average temperatures in New York state have been steadily increasing, and since 1970 the increase in average temperatures in New York state has surpassed both national and global average temperature increases over that same time, with the winter season most significantly affected (NYSDEC 2018). It is predicted that the average annual temperatures for New York will increase as much as 11°F by 2100, leading to as many days with temperatures of at least 90°F as South Carolina experiences at present.

The rise in annual average temperatures may result in increased heat waves and frequency of short-term drought. During the summer, heat waves will become more frequent, intense, and longer, occurring up to two to three times as often and lasting 25% to 50% longer (NYSDEC 2018). In the winter, less snow and less rainfall will increase droughts. These longer, drier periods with higher temperatures create conditions for more frequent and intense wildfires posing a threat to habitat features and infrastructure.

With increased temperatures, capped areas and riverbanks impacted by ice generation in East Branch would likely experience thinner ice buildup in the future, reducing the hazards associated with ice forces. Droughts associated with rising temperatures are not likely to affect hydrodynamics of the tidally driven East Branch. Therefore, the predicted rising temperatures are not expected to significantly affect the performance of the East Branch remedial action.

6.2 Sea Level Rise and Changing Precipitation Patterns

Sea level rise can be caused by a variety of factors including thermal expansion and ice melt. Sea level within the lower Hudson River has risen 13 inches since 1900 and is projected to rise approximately 10 to 20 inches more by mid-century and as much as 50 inches above present water levels by 2100, though riverfront communities could be at risk of a water level rise up to 6 feet under worst case estimates (NYSDEC 2018). While patterns of precipitation indicate that rainfall has become more variable with more intermixed dry periods, precipitation events are expected to become more intense. It is projected that the number of days with total precipitation over 1 inch will increase by up to 7 days (from 10 days to 17 days) annually by 2080, and days with over 2 inches of total precipitation will increase by 4 days annually by 2100 (from 1 day to 5 days; NYSDEC 2018). The main risk associated with both sea level rise and increase in precipitation is flooding. NYSDEC projects that a 100-year storm will become up to 610% more likely by 2100, with a projected 1.5-inch to 3.3-inch increase in flood height during that same span (NYSDEC 2018).

An increase in mean sea level and flood elevations will correspond to an increase in design water levels; however, future sea level rise is not expected to increase the erosive forces within the East Branch remedial footprint or require larger cap armor stone to resist propwash or wind- and vessel-generated wave forces. As the water depths increase, it is anticipated that bottom velocities from propwash forces and wave orbitals will decrease for a given location, resulting in a decrease in stable particle size for the erosion protection layer at that location.

Increases in flooding and sea level may increase the erosive forces along shorelines as increased precipitation has been shown to occur as short but intense rain events, and this precipitation enters waterbodies as runoff or through outfalls, rather than by infiltration into the ground (ITRC 2023). Although surface runoff (i.e., overland flow) could result in increases in erosive forces on caps placed in very shallow water, previous evaluations presented in the RI Report of the impact from Hurricane Sandy provide empirical evidence that overland flow from street flooding was not a source of erosion to the creek sediments. The NCG performed a bathymetry survey in 2012 shortly following the storm, which involved significant street flooding, and compared that to 2011 pre-storm bathymetry data. The evaluation showed minimal change, if any, to the mudline elevations, indicating that forces generated by overland flow from street flooding were not great enough to affect the elevations of the sediment surface in the creek and along the shoreline.

These projections for increases in sea level and changing precipitation patterns are particularly notable for discharges through the MS4s, CSOs, and other outfalls located along East Branch, which may experience higher flows and greater inundation on a more frequent basis. Therefore, erosive forces from overland flow and outfall discharges would be further considered as part of the RD, if a remedy that includes capping along the shoreline is selected.

6.3 Design for Climate Impact Adaptability

As part of RD, an assessment will be performed to evaluate how long-term climate impacts would influence the remedy. The selected remedial alternative for East Branch will be designed such that it can accommodate or adapt to long-term climate change scenarios.

7 References

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Figures

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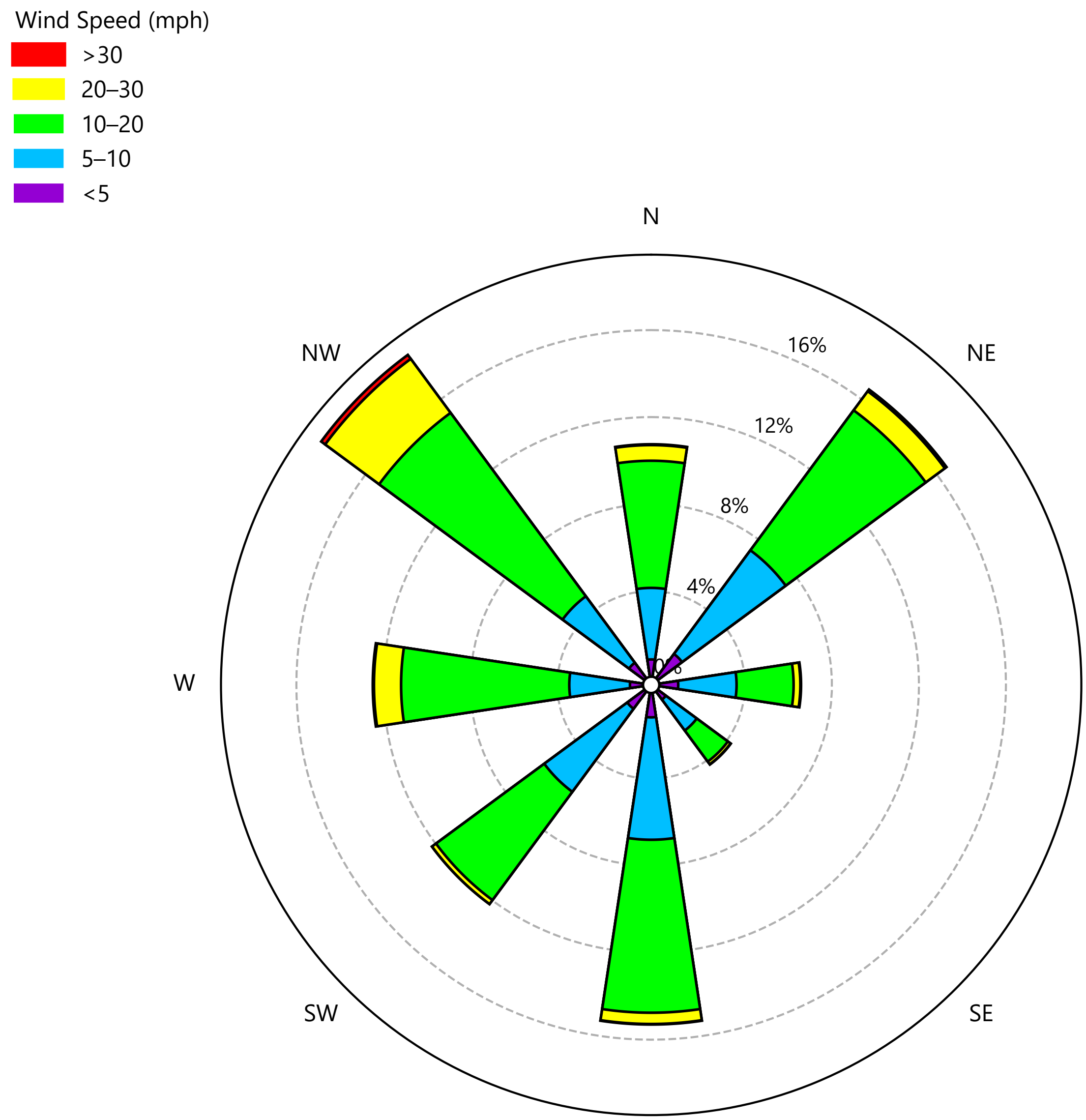

Notes:
1. Hourly wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023
2. Calm and variable winds: 2.5%
3. Maximum recorded wind speed: 71.4 mph
4. Wind data are presented as the "blowing from" direction.

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Figure C2-1a
Wind Rose for Queens, New York
Capping Evaluations
Newtown Creek RI/FS

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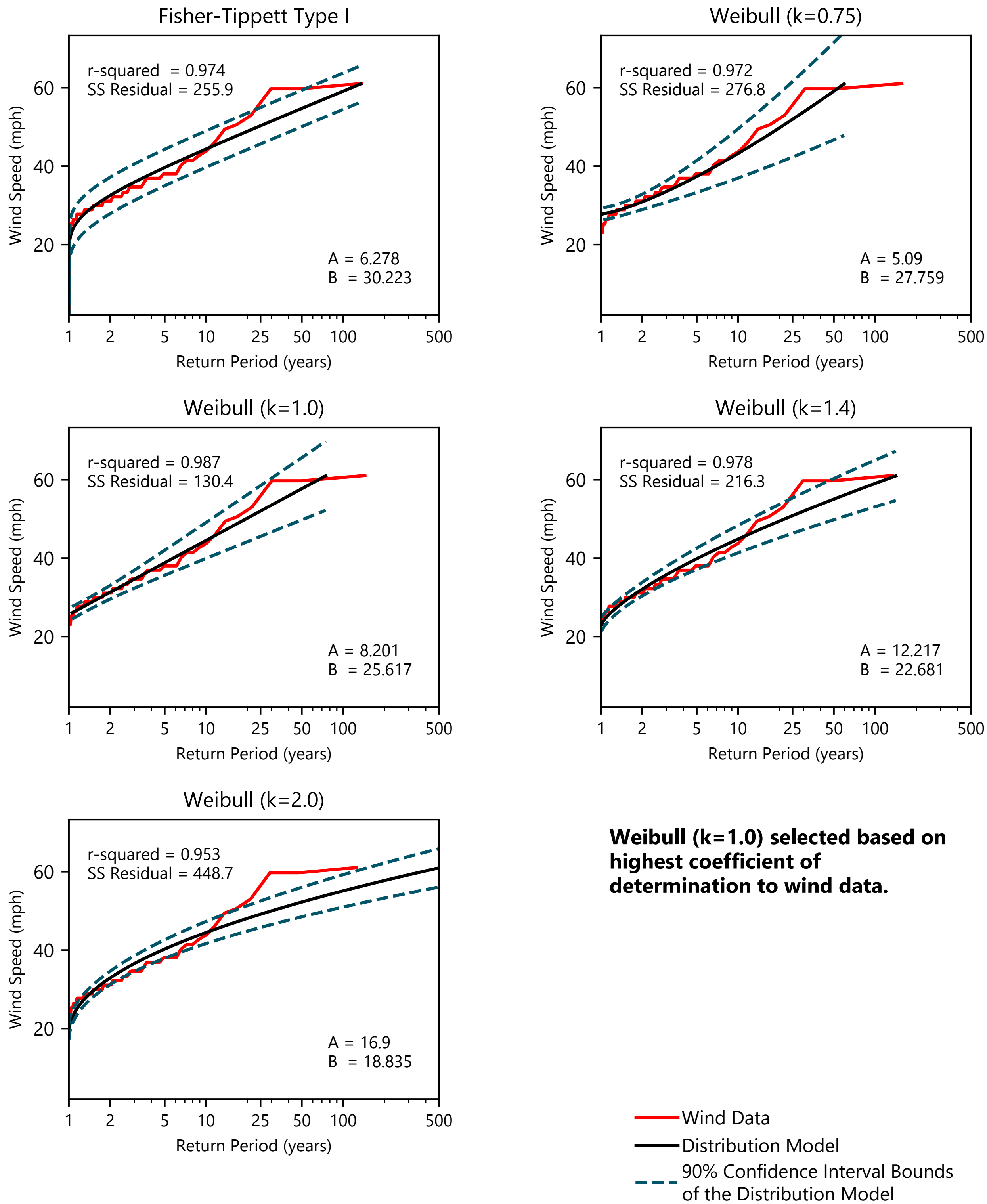

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Coefficients of determination (r-squared) are listed in each plot. Model selection criteria is the largest coefficient of determination (and lowest SS residual) for model distribution. "A" is the scale parameter and "B" is the location parameter for each distribution model.

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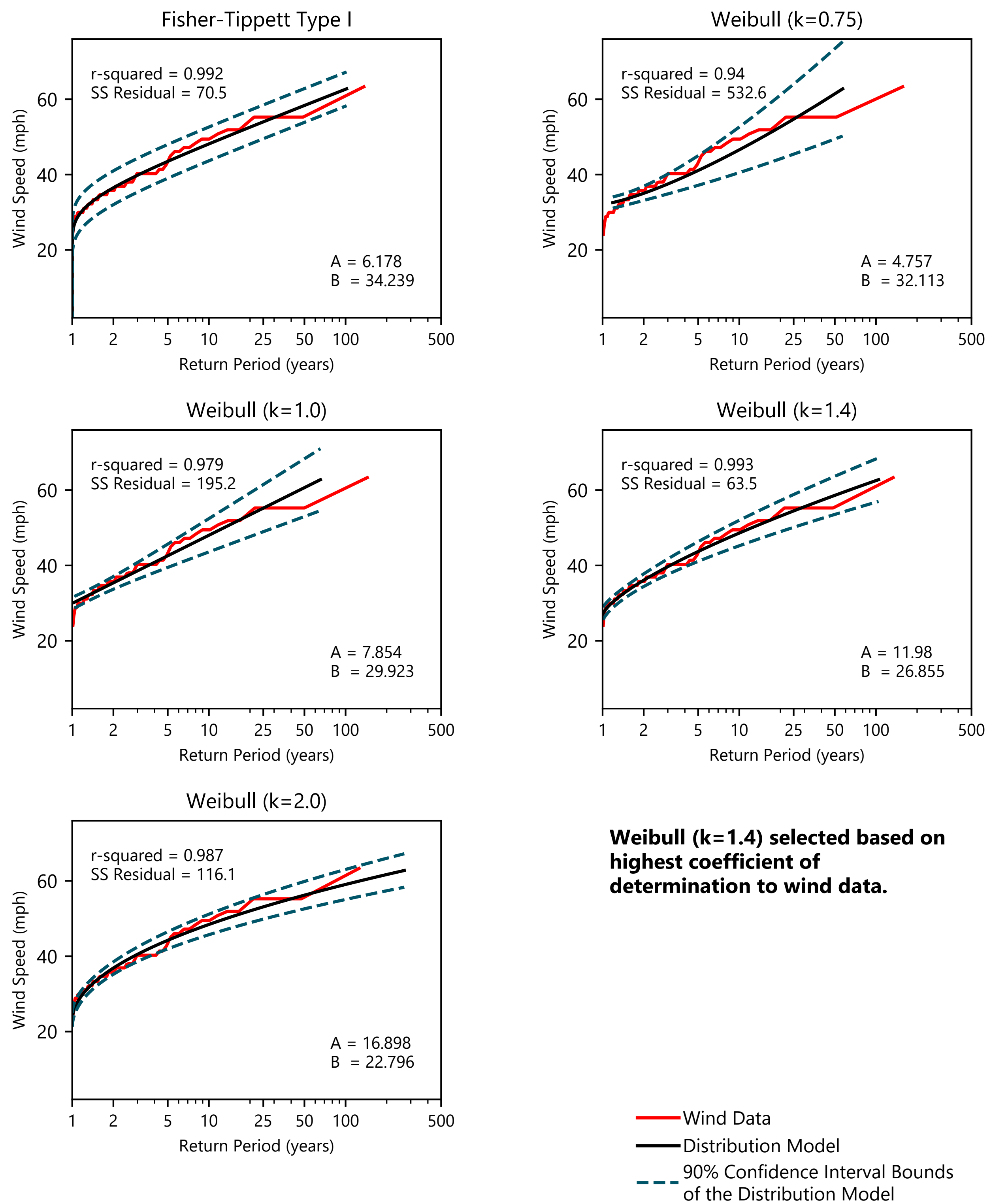

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Figure C2-1c
Extreme Value Distributions for Queens, New York
Directional Bin 22.5-67.5 Degrees

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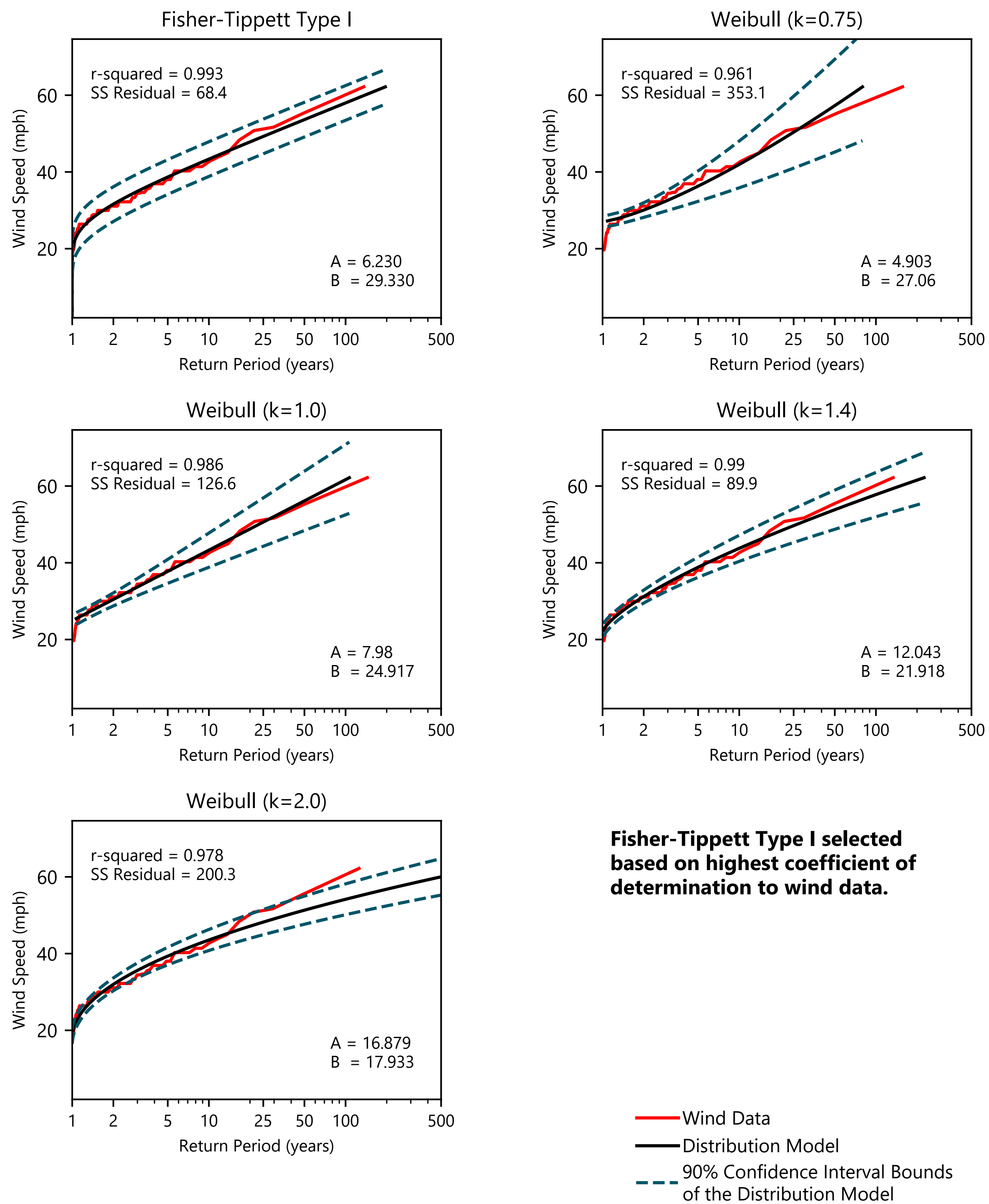

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Coefficients of determination (r-squared) are listed in each plot. Model selection criteria is the largest coefficient of determination (and lowest SS residual) for model distribution. "A" is the scale parameter and "B" is the location parameter for each distribution model.

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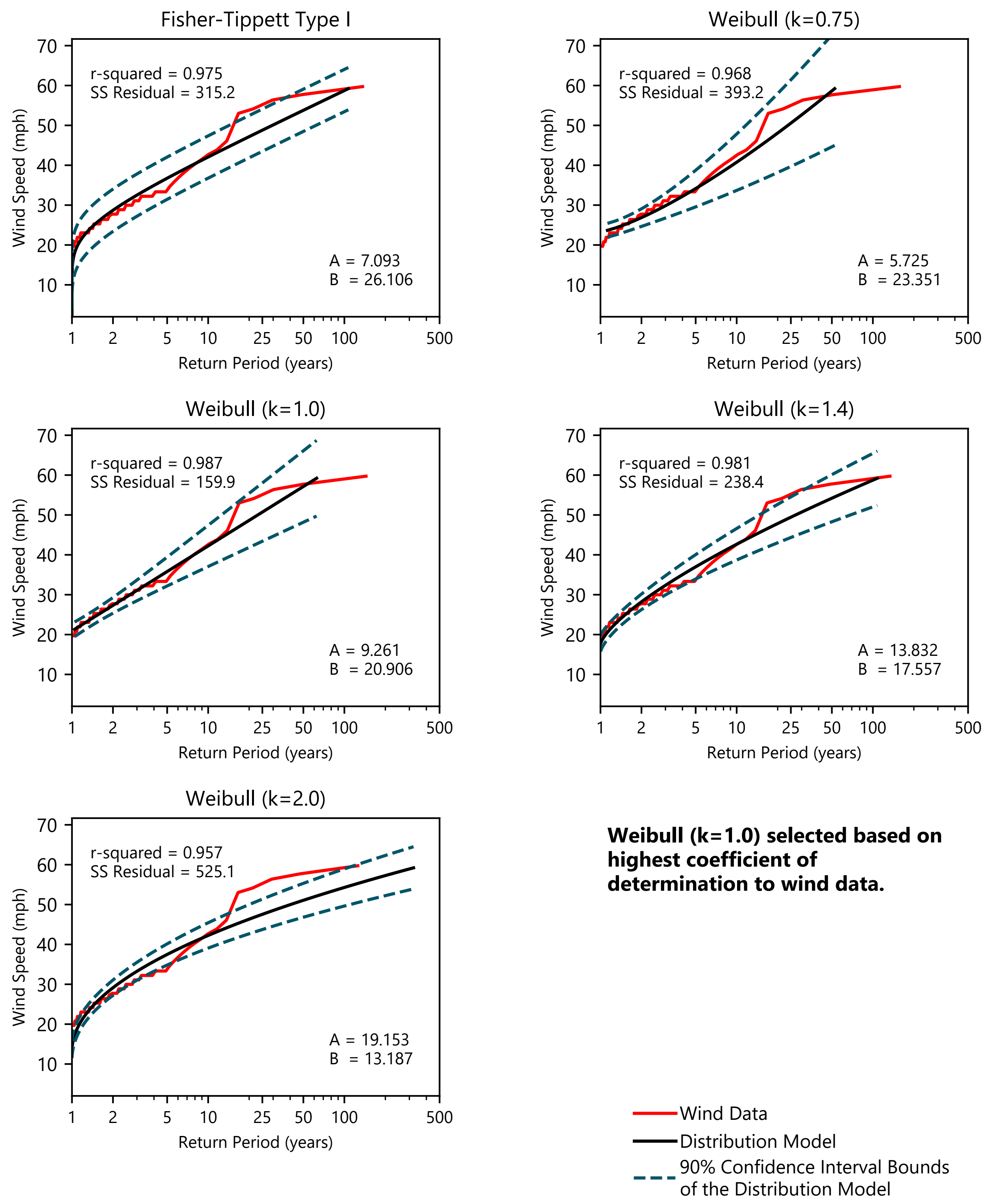

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Figure C2-1e
Extreme Value Distributions for Queens, New York
Directional Bin 112.5-157.5 Degrees

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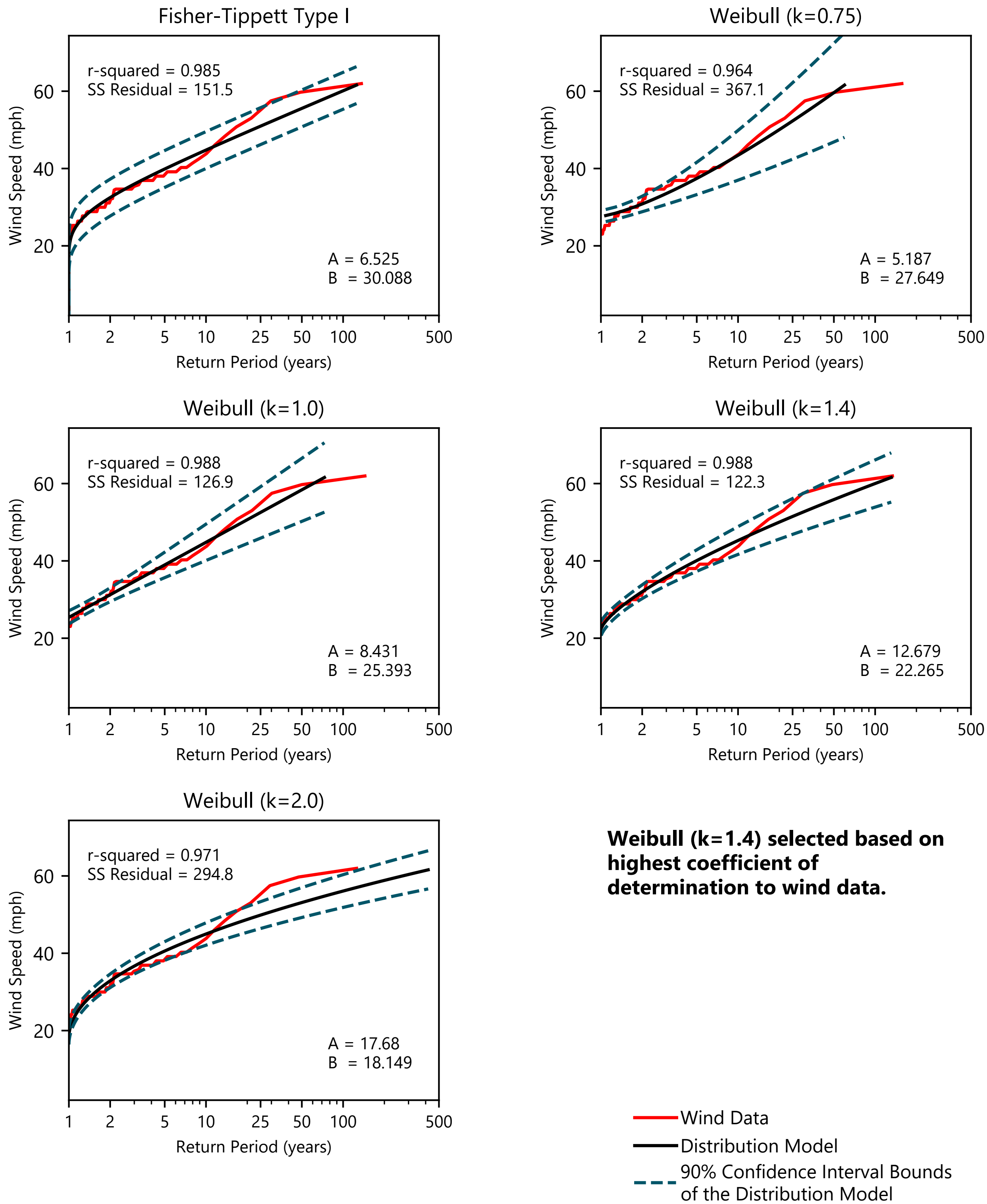

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Coefficients of determination (r-squared) are listed in each plot. Model selection criteria is the largest coefficient of determination (and lowest SS residual) for model distribution. "A" is the scale parameter and "B" is the location parameter for each distribution model.

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Figure C2-1f
Extreme Value Distributions for Queens, New York
Directional Bin 157.5-202.5 Degrees

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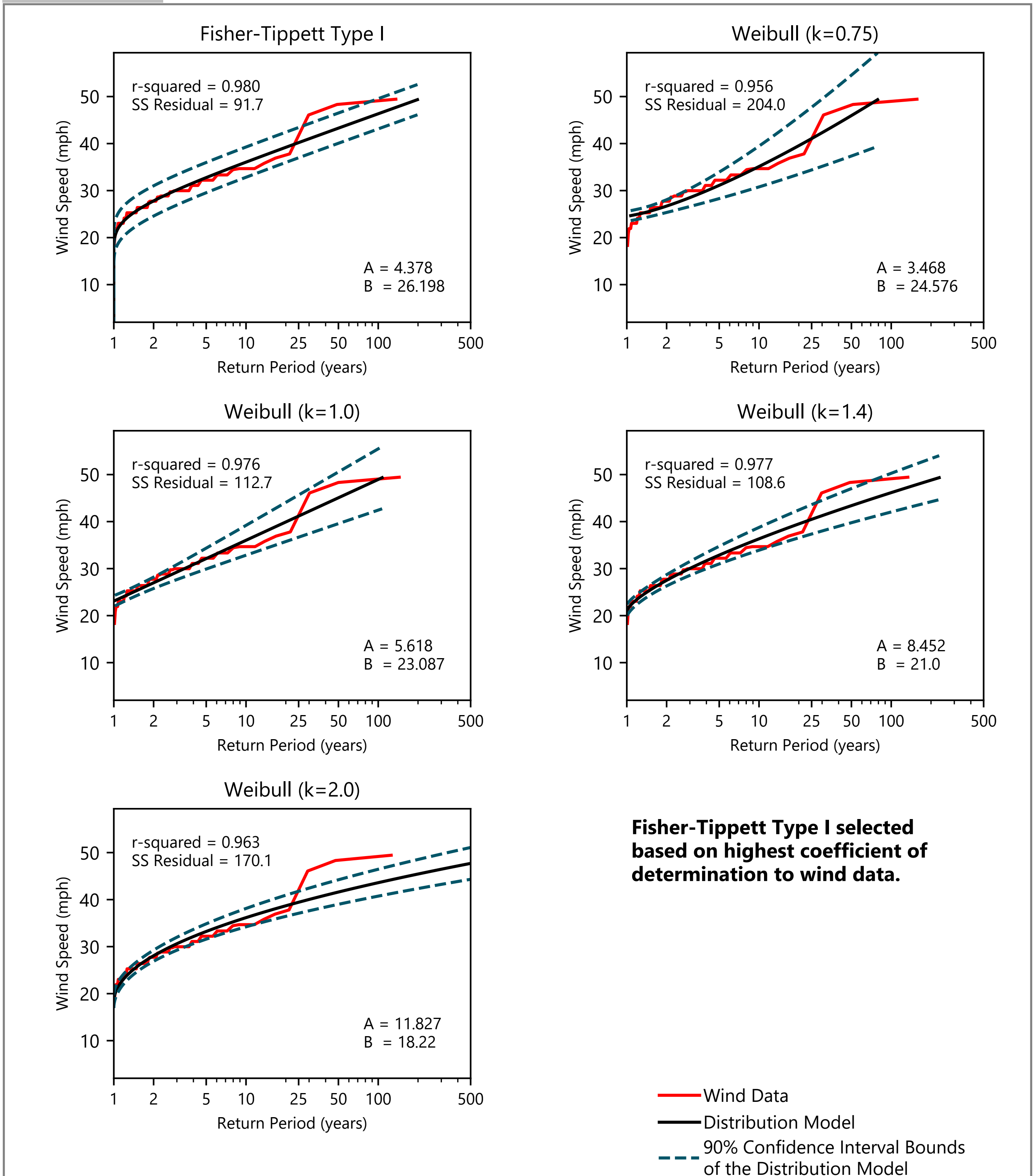

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Coefficients of determination (r-squared) are listed in each plot. Model selection criteria is the largest coefficient of determination (and lowest SS residual) for model distribution. "A" is the scale parameter and "B" is the location parameter for each distribution model.

Figure C2-1g
Extreme Value Distributions for Queens, New York
Directional Bin 202.5-247.5 Degrees

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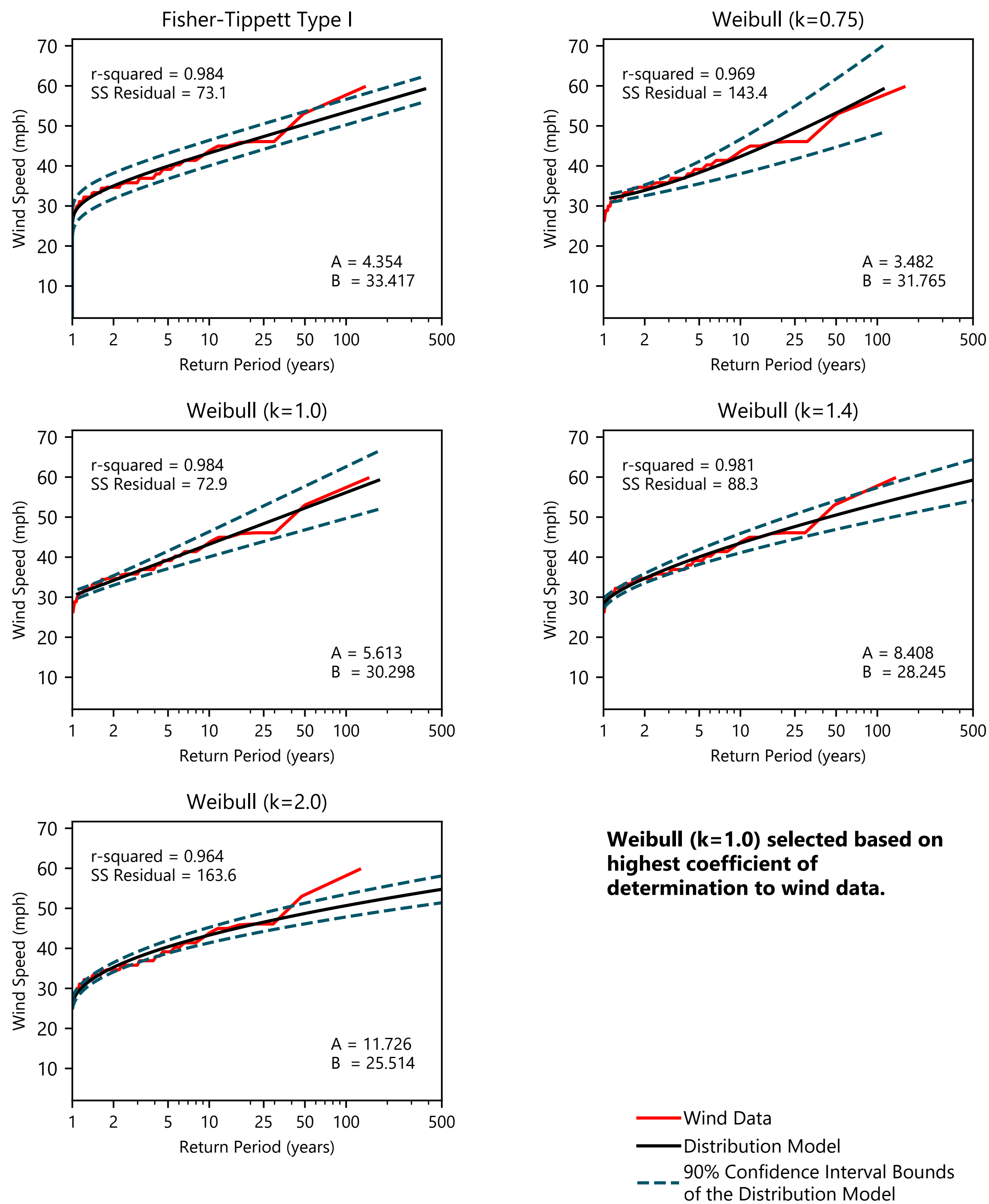

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Coefficients of determination (r-squared) are listed in each plot. Model selection criteria is the largest coefficient of determination (and lowest SS residual) for model distribution. "A" is the scale parameter and "B" is the location parameter for each distribution model.

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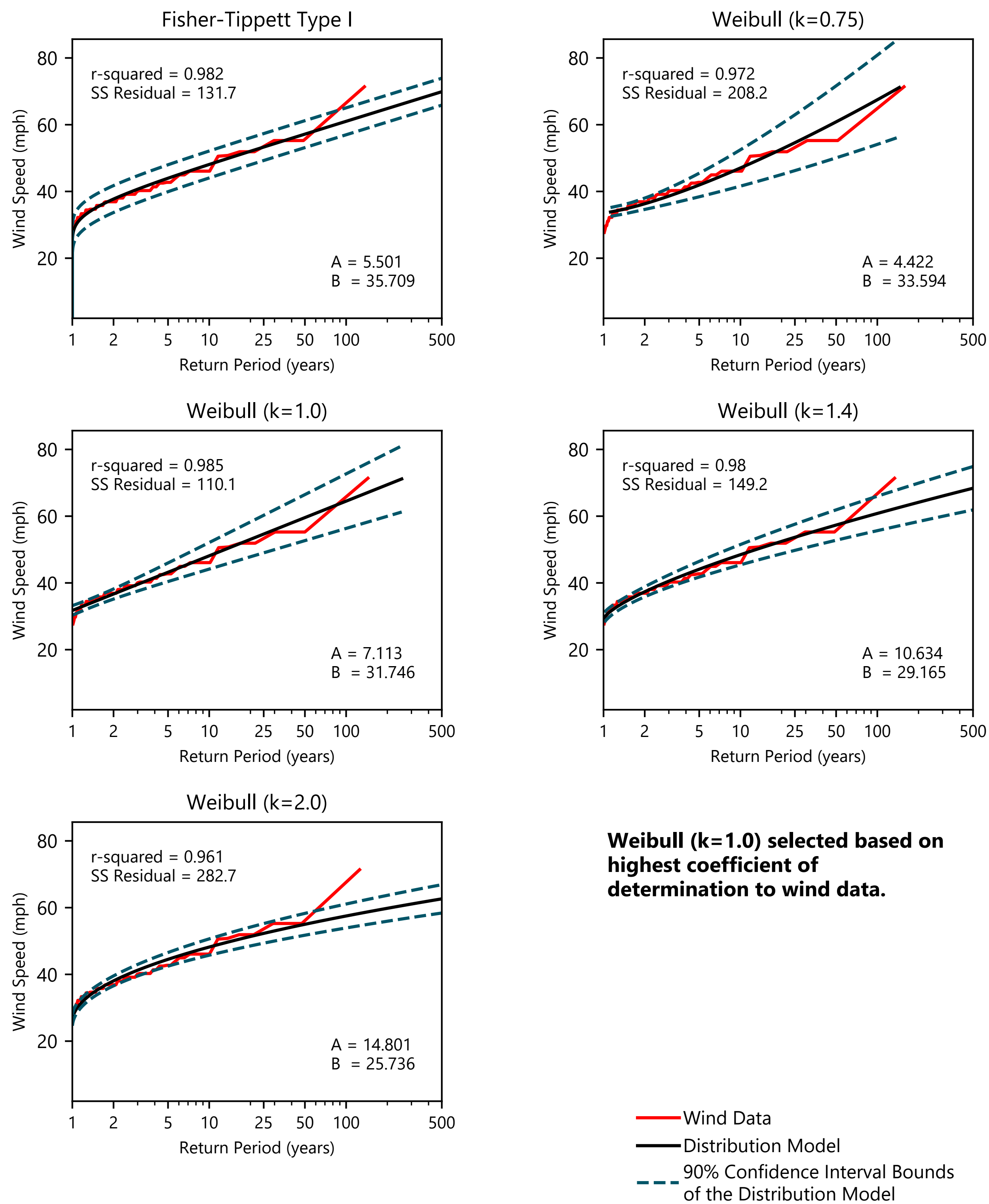

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Figure C2-1i
Extreme Value Distributions for Queens, New York
Directional Bin 292.5-337.5 Degrees

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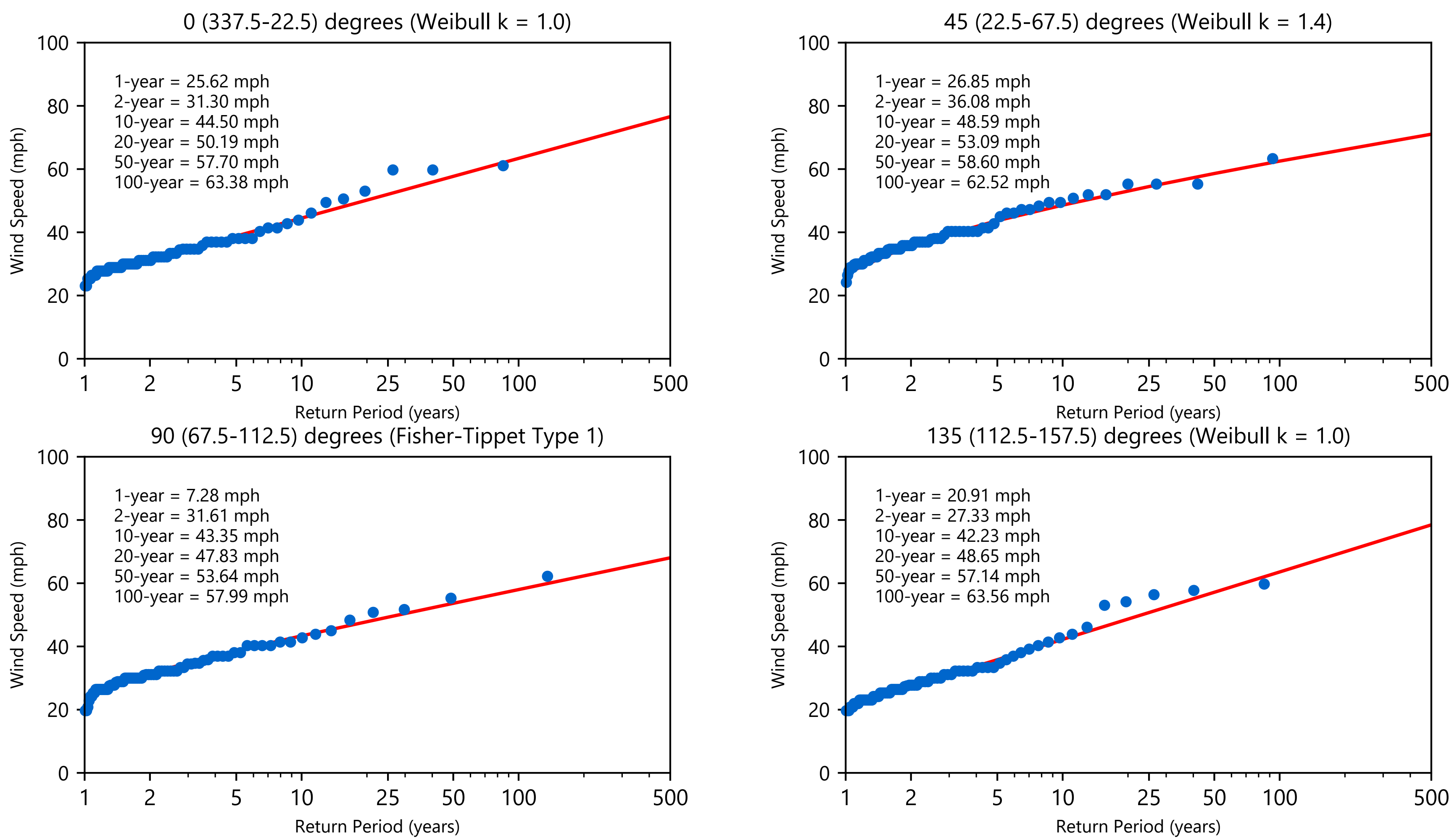

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Directional bin and selected model are listed in parenthesis above each plot.

● Annual Maximum Winds

— Selected Distribution Model

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Figure C2-1j
Return Interval Wind Speeds for Queens, New York
Wind Directions 0 to 135 Degrees
Capping Evaluations
Newtown Creek RI/FS

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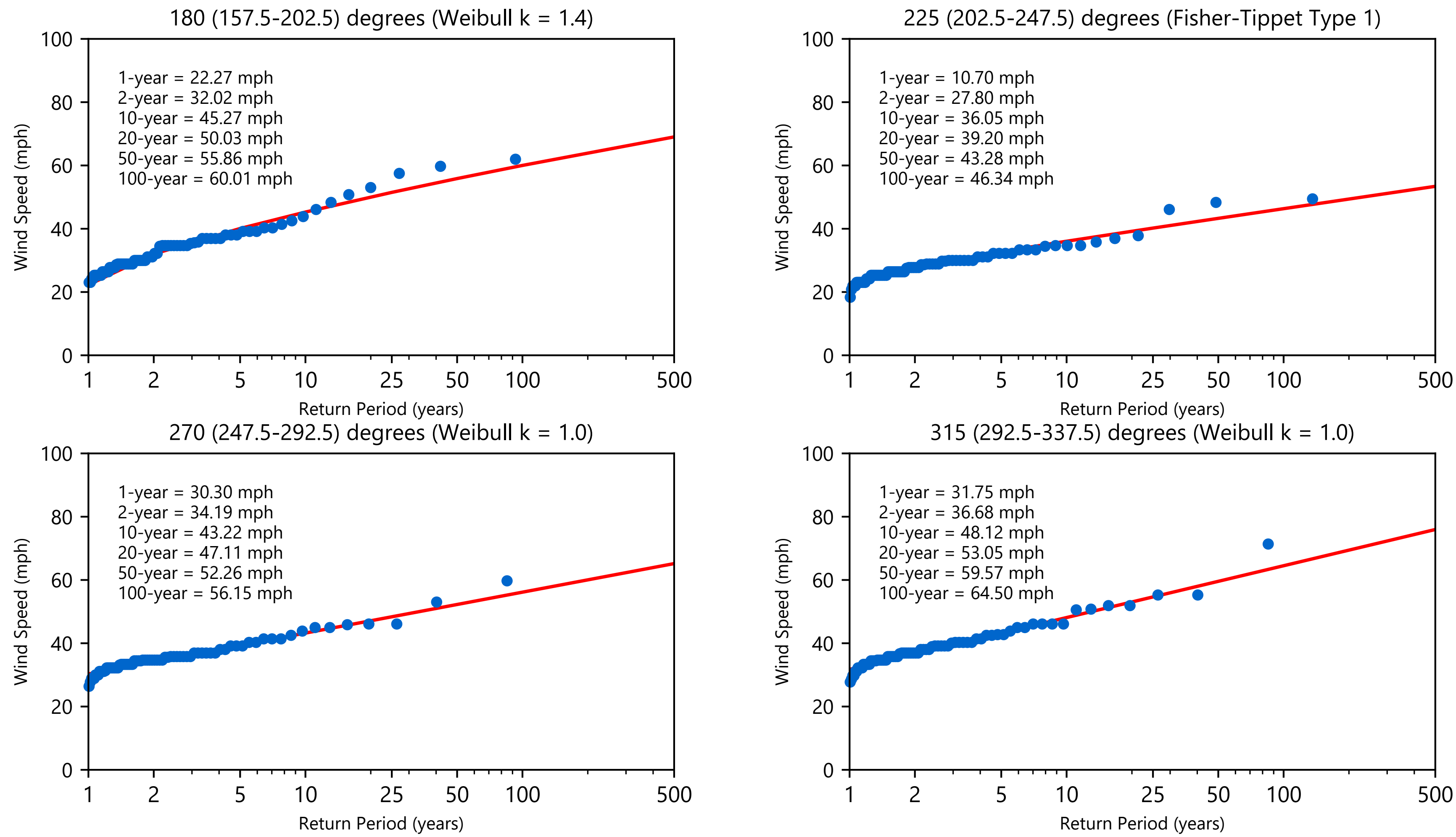

Notes: Wind data obtained from National Climatic Data Center (NCDC) and National Centers for Environmental Information (NCEI) for Queens, New York for years 1948 through 2023. Curve fitting performed using Fisher-Tippett Type I and Weibull Distribution Models. Directional bin and selected model are listed in parenthesis above each plot.

- Annual Maximum Winds
- Selected Distribution Model

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Figure C2-1k
Return Interval Wind Speeds for Queens, New York
Wind Directions 180 to 315 Degrees

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LEGEND:

- Wind directional bins and associated direction expressed in degrees relative to 0-degrees North
- Longest horizontal distance over which wind-generated waves travel within each dominant wind directional bin

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Figure C2-2
East Branch Fetch Distances
Capping Evaluations
Newtown Creek RI/FS

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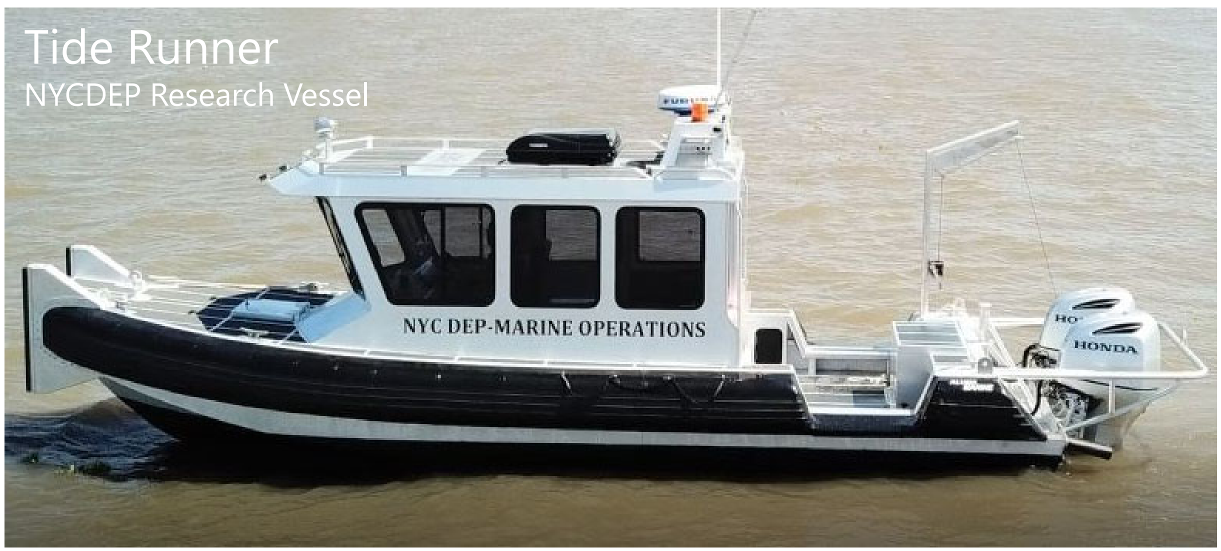

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Figure C2-3
Representative Vessels in East Branch
Capping Evaluations
Newtown Creek RI/FS

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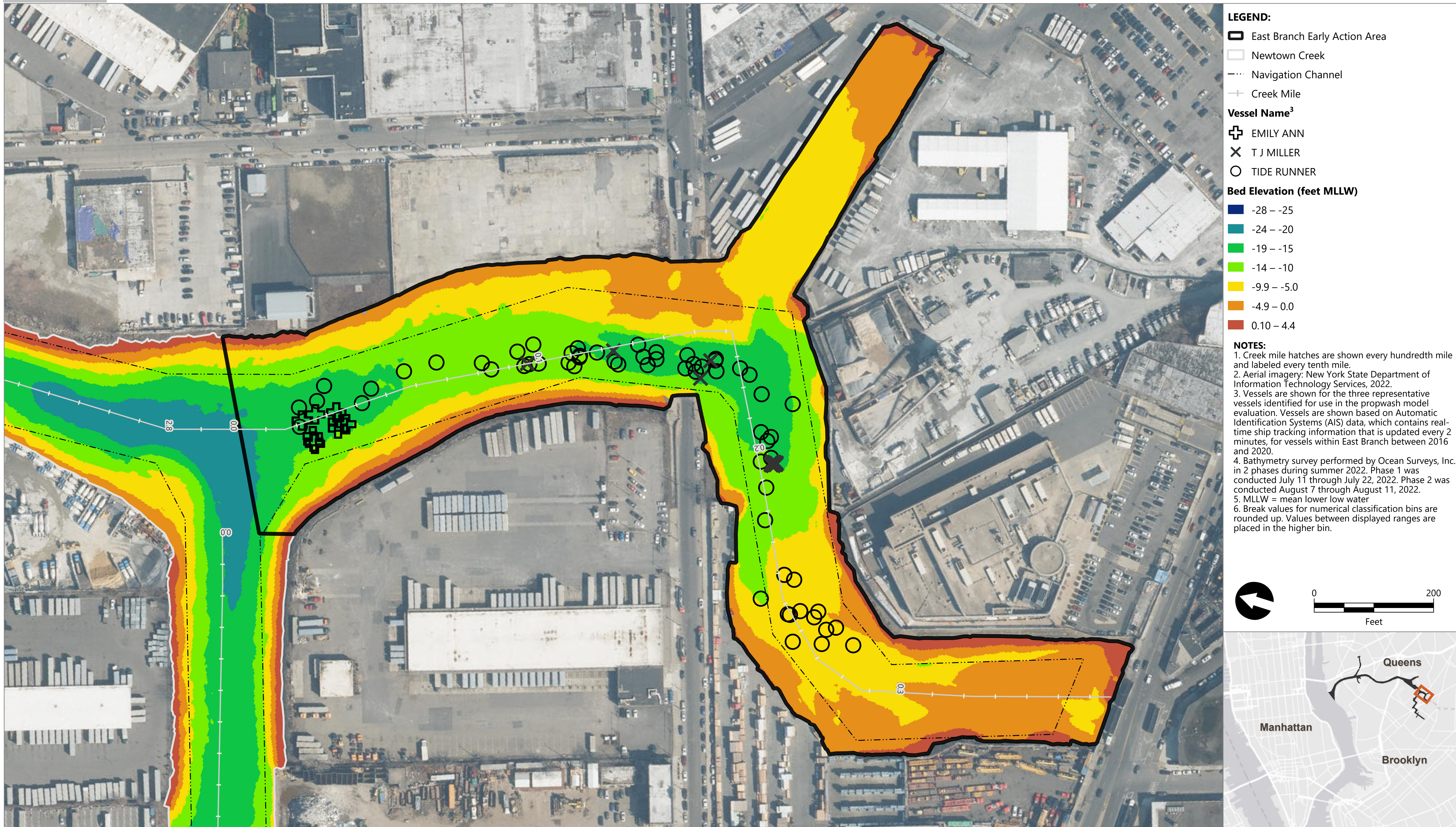

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Vessels are shown for the three representative vessels identified for use in the propwash model evaluation. Vessels are shown based on Automatic Identification Systems (AIS) data, which contains real-time ship tracking information that is updated every 2 minutes, for vessels within East Branch between 2016 and 2020.
4. Bathymetry survey performed by Ocean Surveys, Inc. in 2 phases during summer 2022. Phase 1 was conducted July 11 through July 22, 2022. Phase 2 was conducted August 7 through August 11, 2022.
5. MLLW = mean lower low water
6. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

Publish Date: 2024/02/19, 2:14 PM | User: alesueur
Filepath: \\orcas\gis\Jobs\NewtownCreek_1037\NewtownCreek_RIFS\Maps\FS\Reports\EastBranch_FFS\EastBranch_FFS_Report\EBFFS_Appendix_BtoE.aprx

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Figure C2-4
Vessel Activity in East Branch
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Vessels are shown for the three representative vessels identified for use in the propwash model evaluation. Vessels are shown based on Automatic Identification Systems (AIS) data, which contains real-time ship tracking information that is updated every 2 minutes, for vessels within East Branch between 2016 and 2020.

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Figure C2-5
Vessel Speeds in East Branch
Capping Evaluations
Newtown Creek RI/FS

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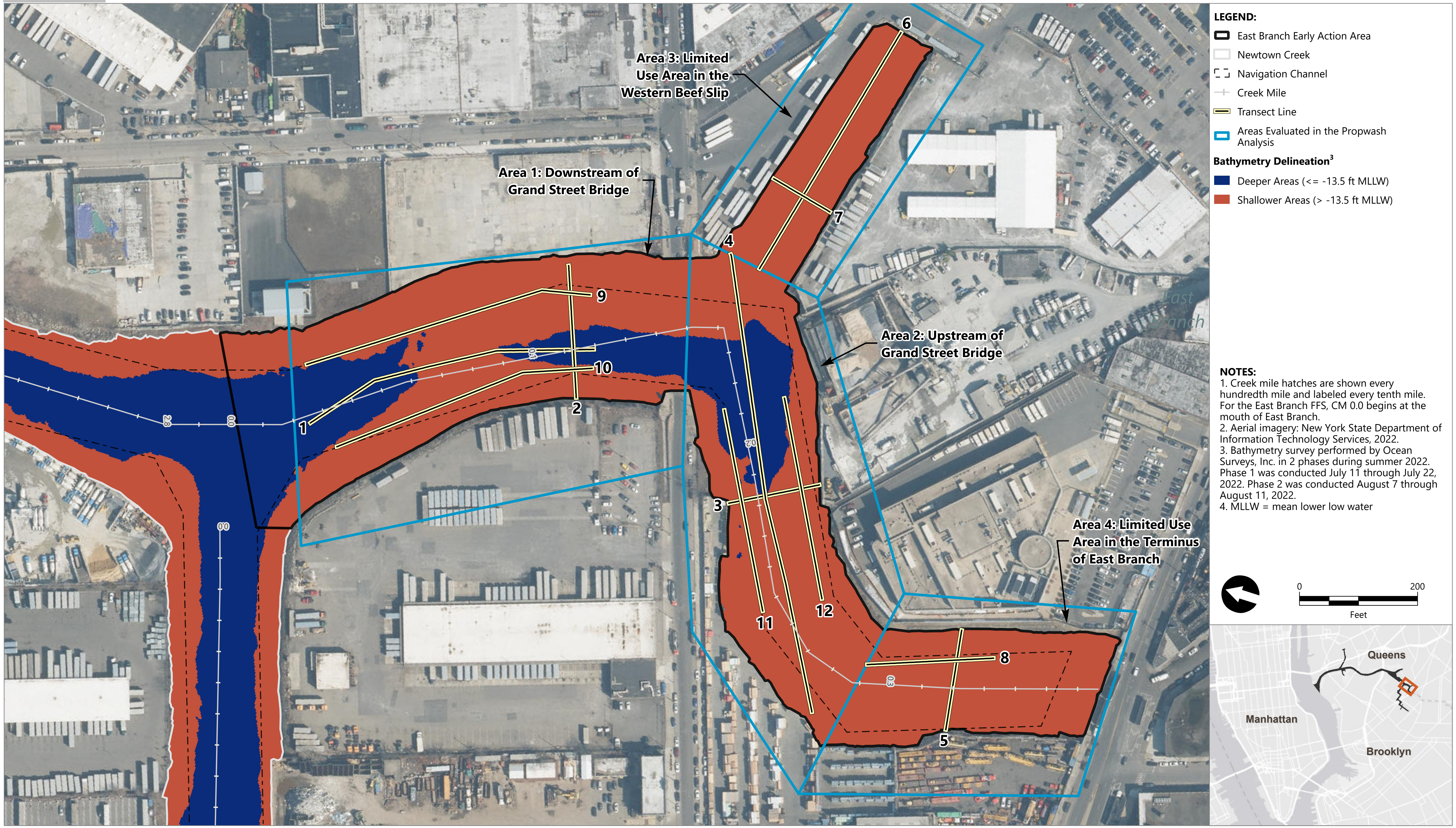

Publish Date: 2024/03/13, 9:28 AM | User: alesueur
Filepath: \\orcas\gis\Jobs\NewtownCreek_1037\NewtownCreek_RIFS\Maps\FS\Reports\EastBranch_FFS\EastBranch_FFS_Report\EBFFS_Appendix_BtoC.aprx

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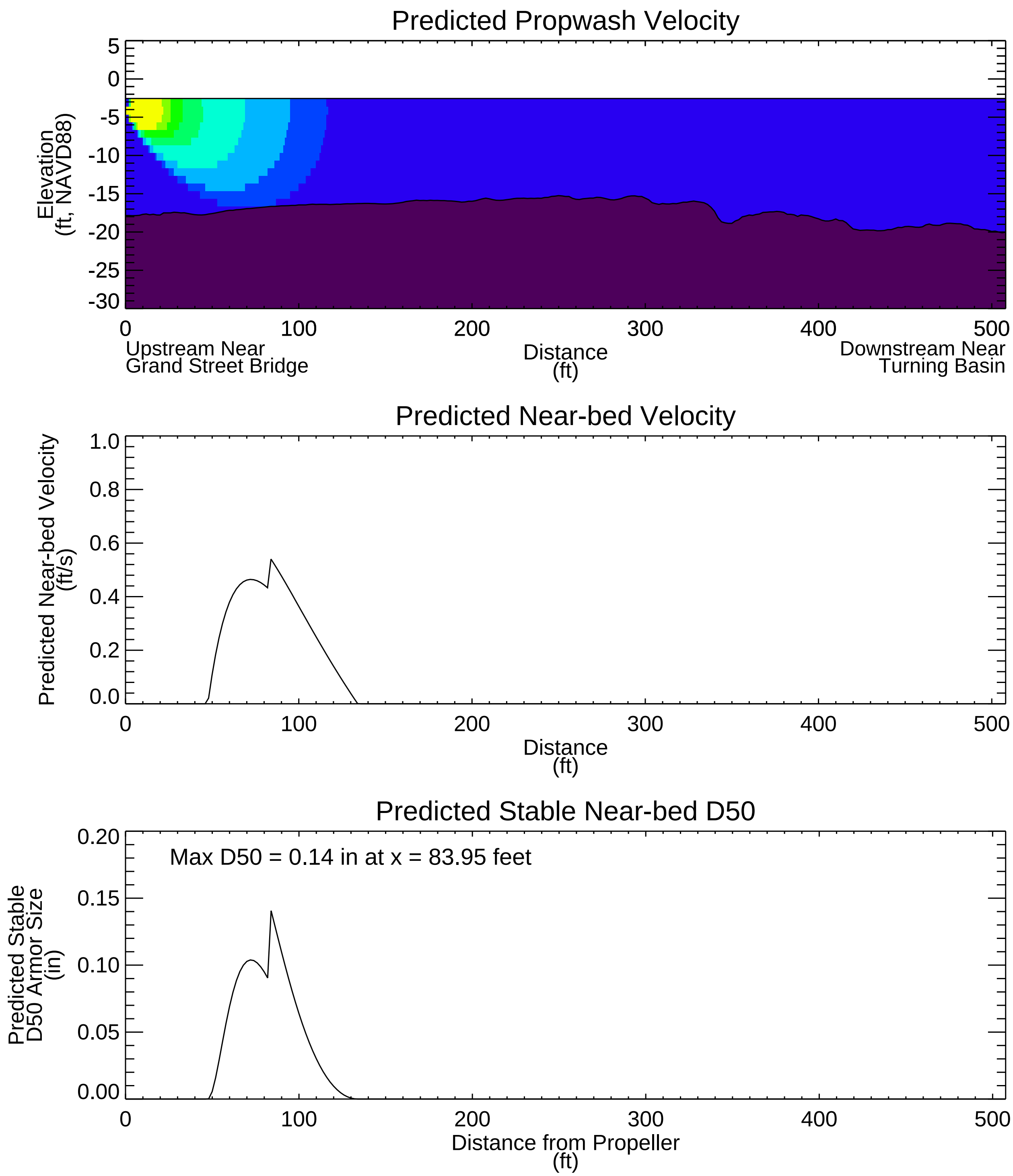
Figure C2-6
Propwash Model Transects
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



1. Transect 1; low tide. Vessel Emily Ann at 20.0% applied power and 1 knot vessel speed.
2. Grid spacing is 1.0 ft.
3. The propwash analysis is based on the Maynord 1998 capping methodology.

Predicted Propwash Velocities in Water Column (ft/s)

0-0.5 | 0.5-1 | 1-2 | 2-4 | 4-6 | 6-8 | 8-10 | 10-20 | >20

Sediment Bed

Publish Date: 07/24/2023 08:19 | User: DN
File Path: \\fuji\Anchor\Projects\Newtown_Creek\Deliverables\EB_FFS_Report\Working\Appendices\Appendix C_Cap Evaluations\03 IDL\ntc_ou3_blaaw_and_kaa_input_scenarios_20230130.pro

ANCHOR QEA

Figure C2-7

Predicted Near-bed Velocity and D50 for Emily Ann Along Transect 1

Capping Evaluations
Newtown Creek RI/FS

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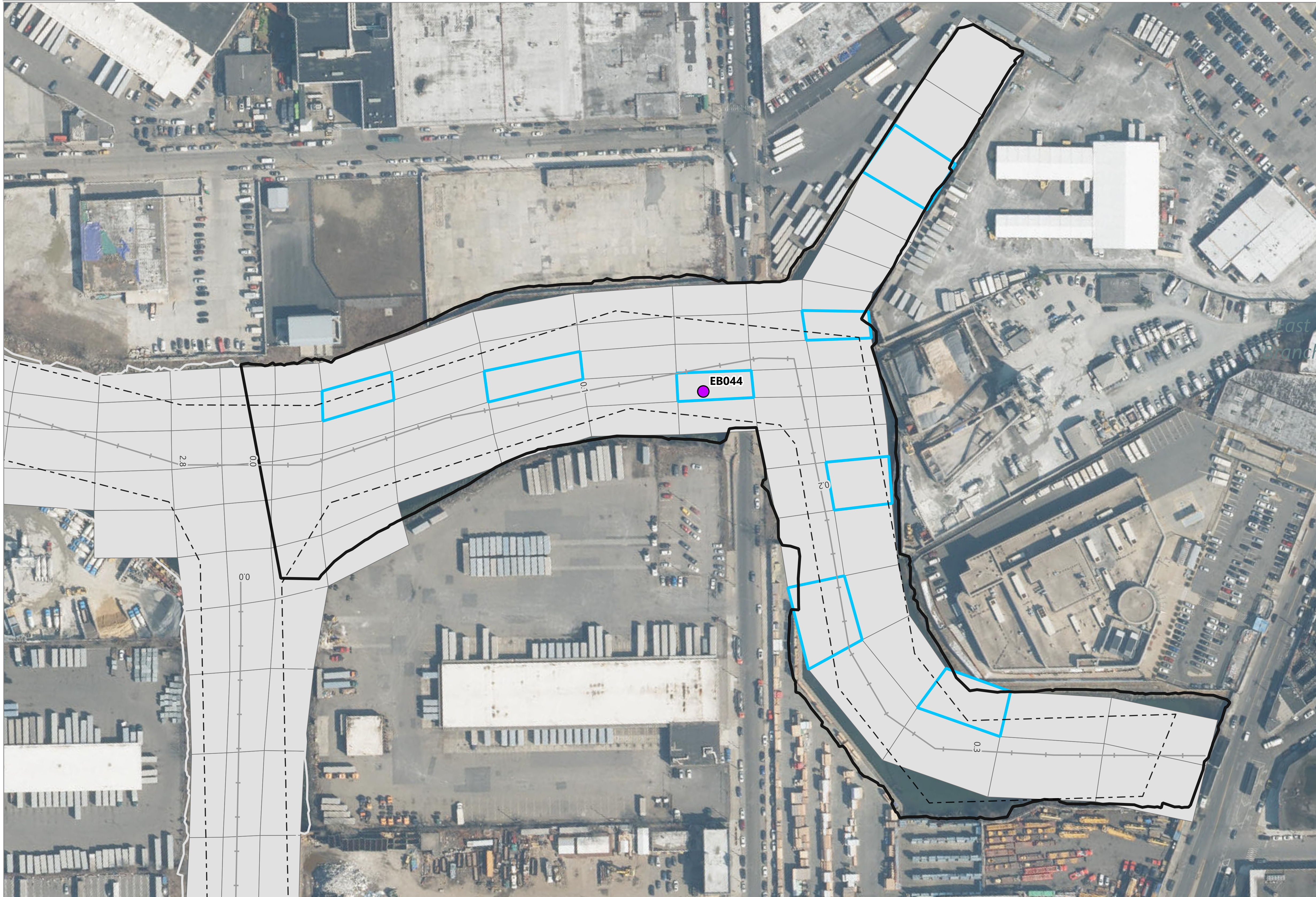
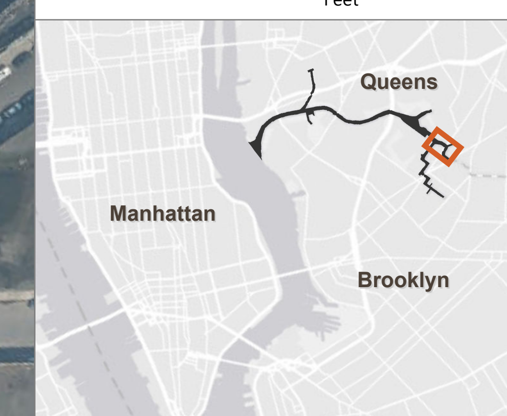


LEGEND:
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Phase 2 ADCP Location (July 2014 to April 2015)
- Predicted Depth-Averaged Current Velocity Locations
- Model Grid

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

0 200
Feet



Publish Date: 2024/02/19, 11:28 AM | User: alesueur
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Figure C2-8
Locations of Evaluated Modeled Depth-Averaged Current Speed
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL

LEGEND:

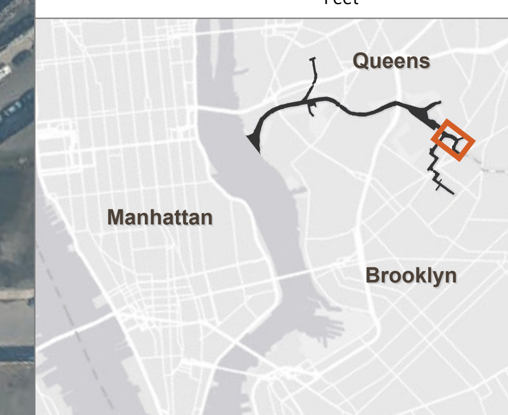
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile

Point Source Discharge

- Category 2A – Combined Sewer Overflows
- Category 3A – MS4 and Major Stormwater Discharges
- Category 3B – Highway Drains
- Category 3C – Direct Discharges from Individual Sites

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Outfall locations are approximate and based on best available information obtained during the Remedial Investigation.

0 200
Feet



Publish Date: 2024/02/19, 2:10 PM | User: alesueur
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Figure C2-9
East Branch Outfall and CSO Locations
Capping Evaluations
Newtown Creek RI/FS

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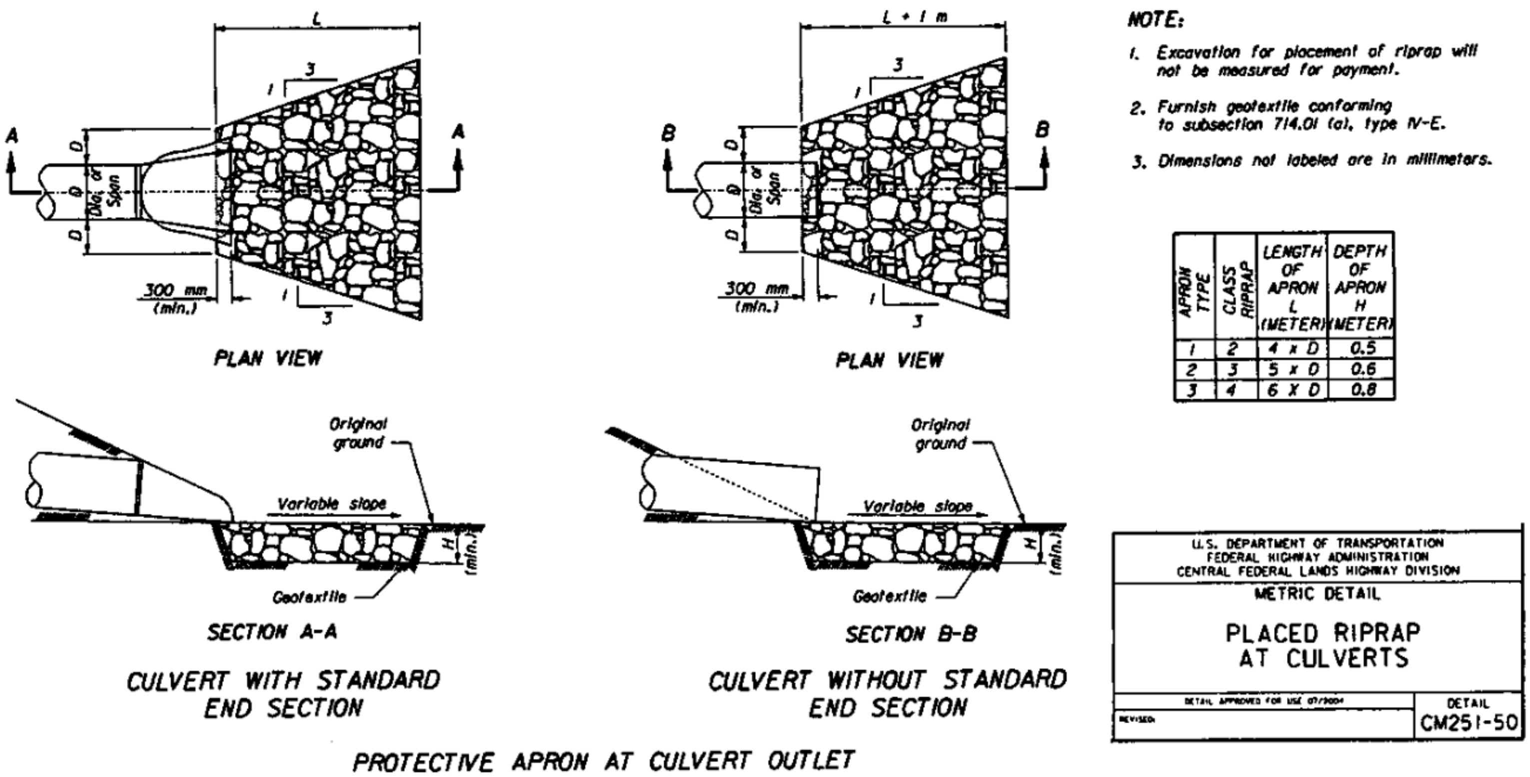
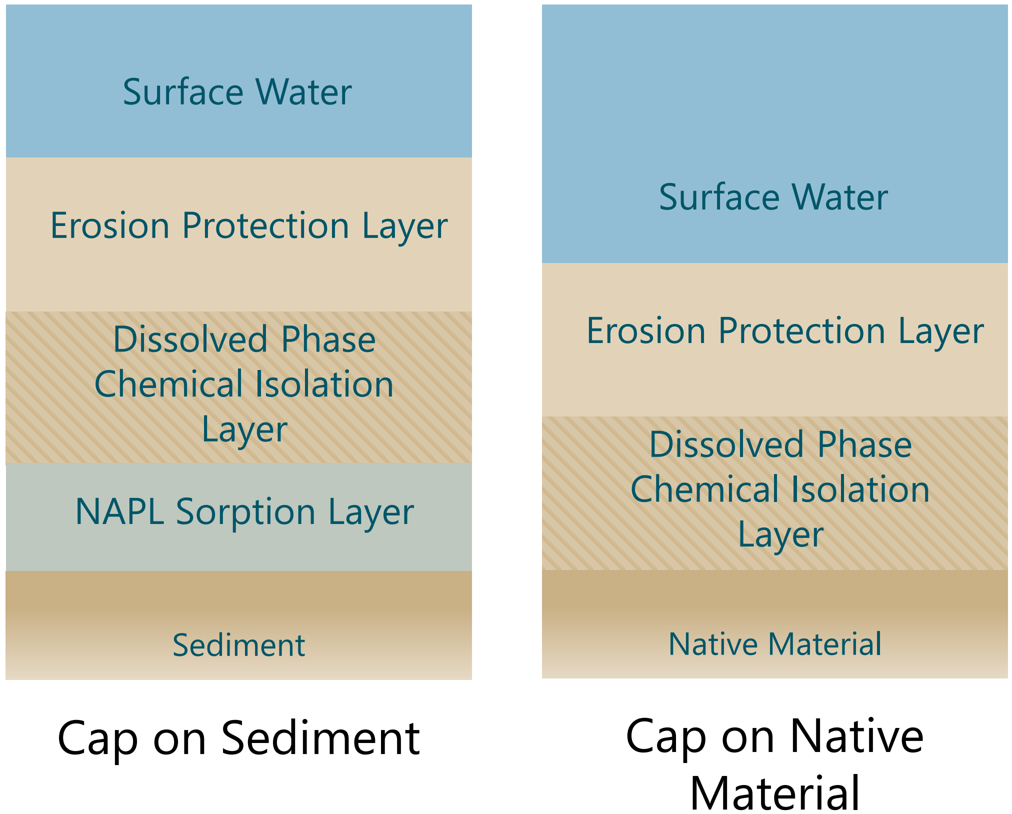


APRON TYPE	CLASS RIPRAP	LENGTH OF APRON L (METER)	DEPTH OF APRON H (METER)
1	2	4 x D	0.5
2	3	5 x D	0.6
3	4	6 X D	0.8

Source: Thompson and Kilgore 2006.

Filepath: \\fuji\anchor\Projects\Newtown_Creek\Deliverables\EB_FFS_Report\Working\Appendices\Appendix C_Cap Evaluations\02 Figures\sources\

Figure C2-10
HEC-14 Outfall Scour Apron Design Guidance



DRAFT FINAL

Filepath: \\fuji\anchor\Projects\Newtown_Creek\Deliverables\EB_FFS_Report\Working\Appendices\Appendix C_Cap Evaluations\02 Figures\Figure C3-1__CapConfiguration.pptx

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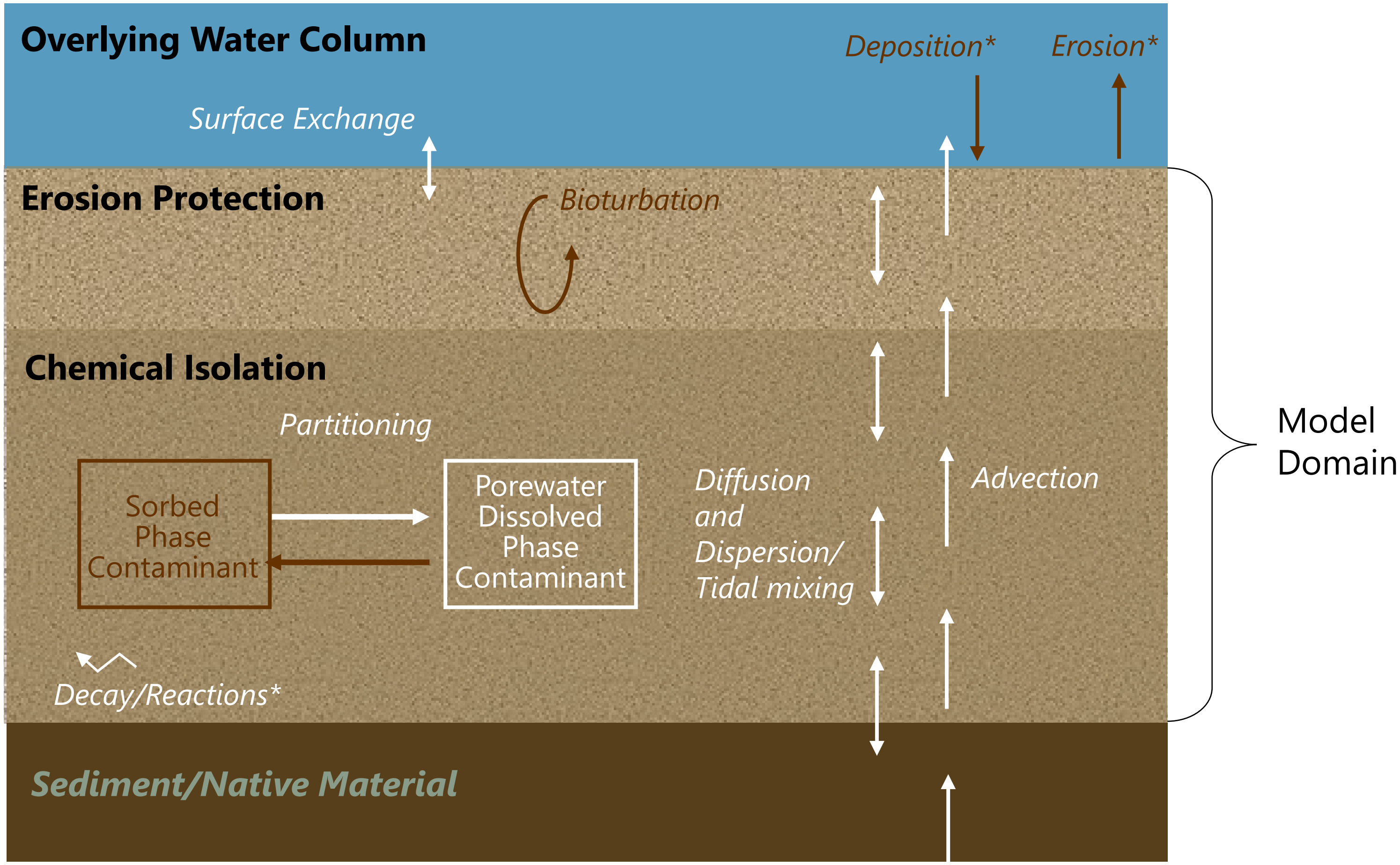
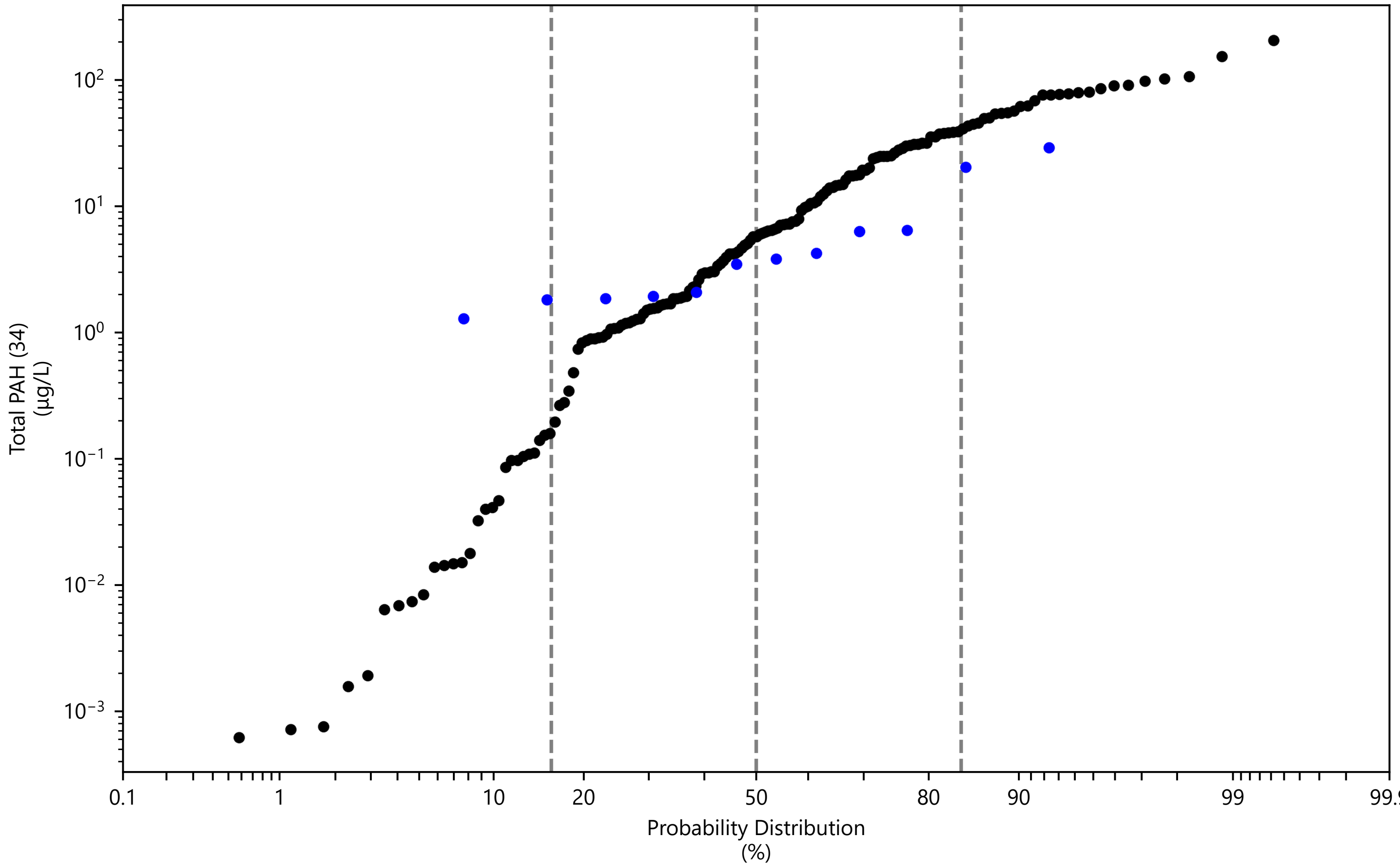
Figure C3-1
Example Cap Configuration for a Cap on Sediment and Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



* Deposition, erosion, and decay/reactions were not simulated for the East Branch FFS cap modeling.

DRAFT FINAL

Figure C3-2
Cap Configuration and Processes Simulated



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.

● Sediment Data Converted to Porewater Concentrations ● Porewater Data

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Publish Date: 03/19/2024 10:10 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_PAH_TOTAL_overlay_dissolved.py

ANCHOR QEA

Figure C3-3
Probability Distribution of Freely Dissolved Total PAH (34) in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS

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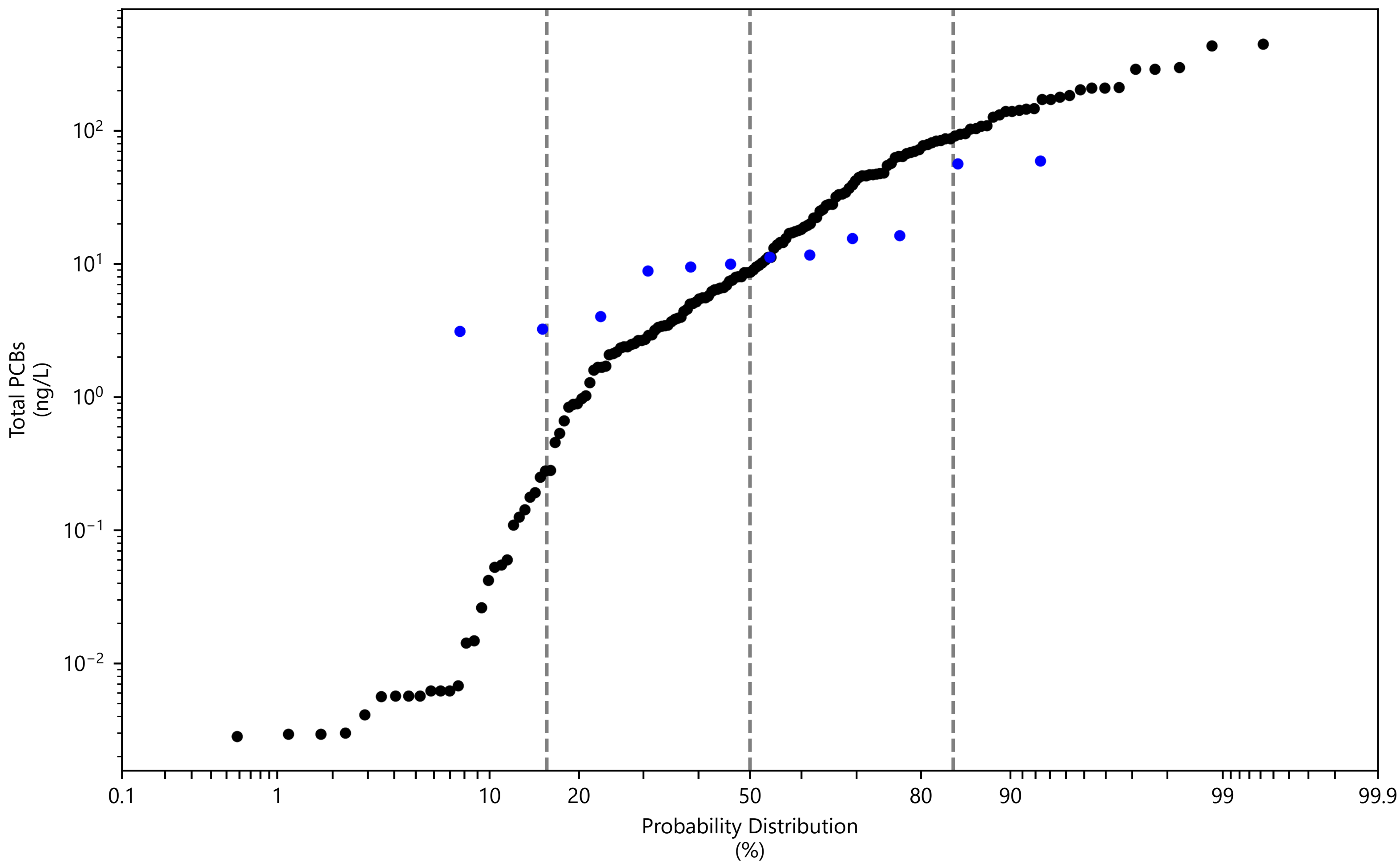
FINAL



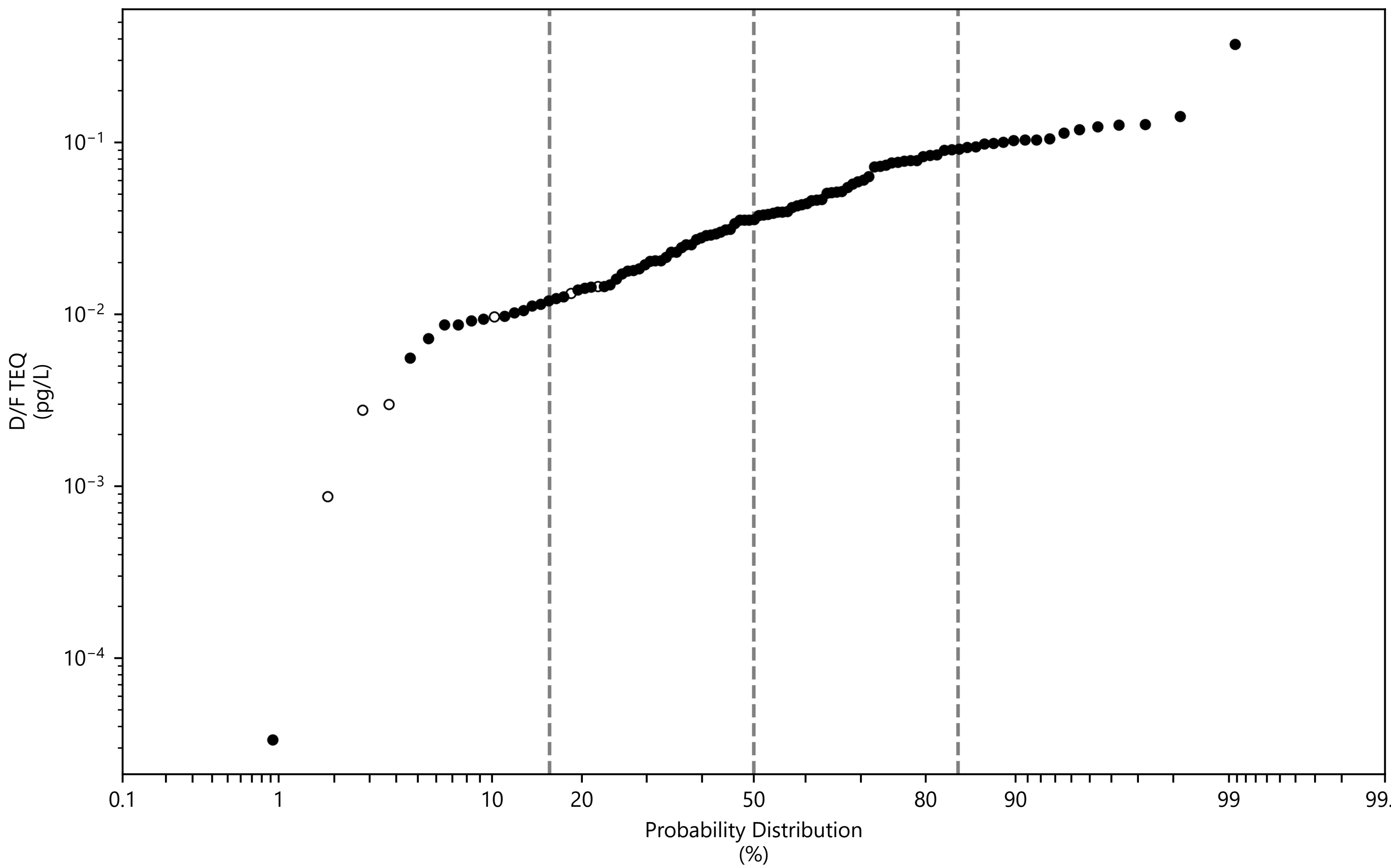
Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.

● Sediment Data Converted to Porewater Concentrations ● Porewater Data

Publish Date: 03/19/2024 10:13 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_PCB_TOTAL_overlay_dissolved.py

ANCHOR QEA

Figure C3-4
Probability Distribution of Freely Dissolved Total PCBs in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.
Open symbols represent non-detect sediment contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.

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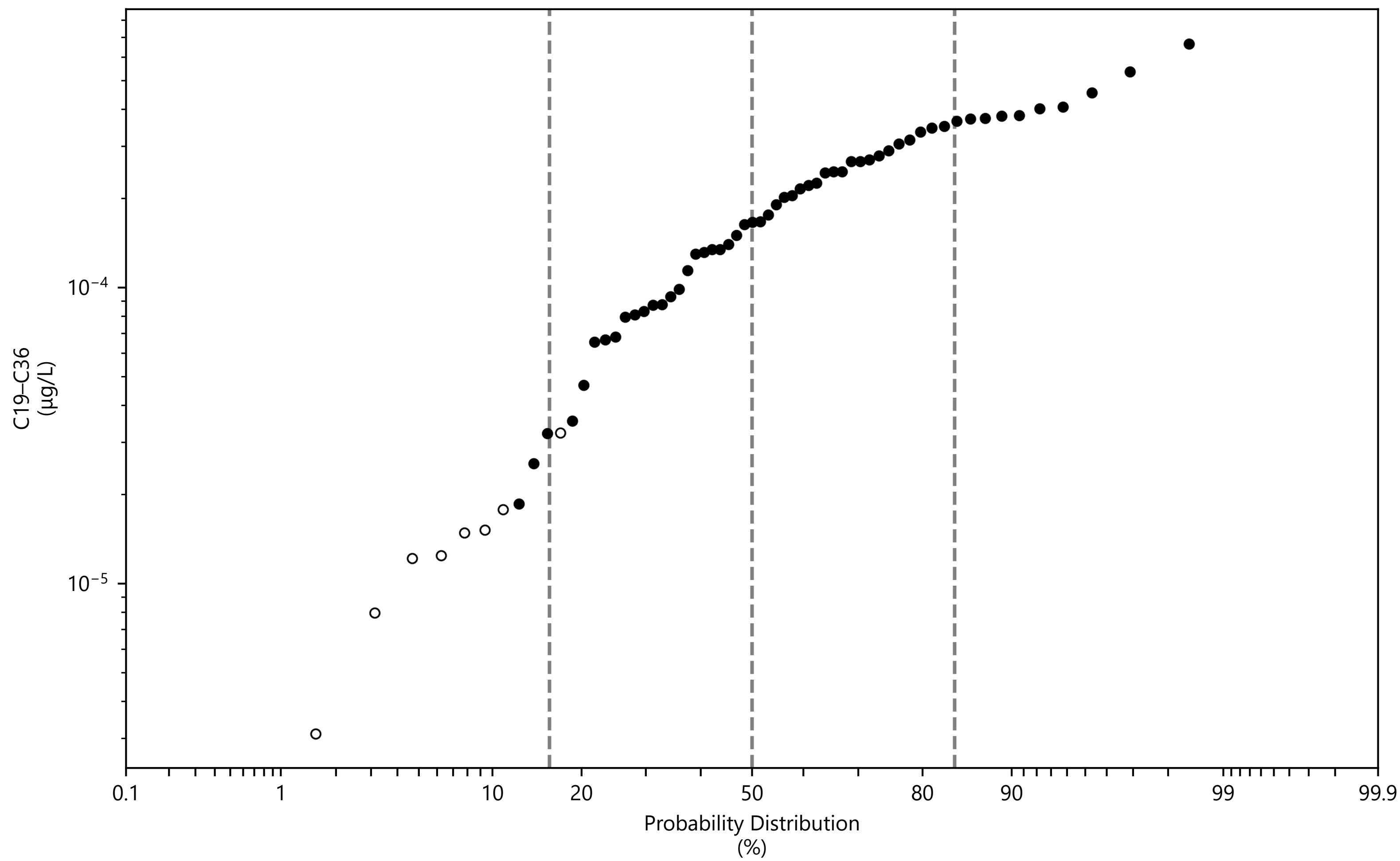
Publish Date: 03/19/2024 10:45 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_dioxin_furan_dissolved.py

ANCHOR QEA

Figure C3-5
Probability Distribution of Freely Dissolved D/F TEQ in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.
Open symbols represent non-detect sediment contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.

● Sediment Data Converted to Porewater Concentrations

Publish Date: 03/19/2024 10:24 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_Aliphatics_overlay_dissolved.py

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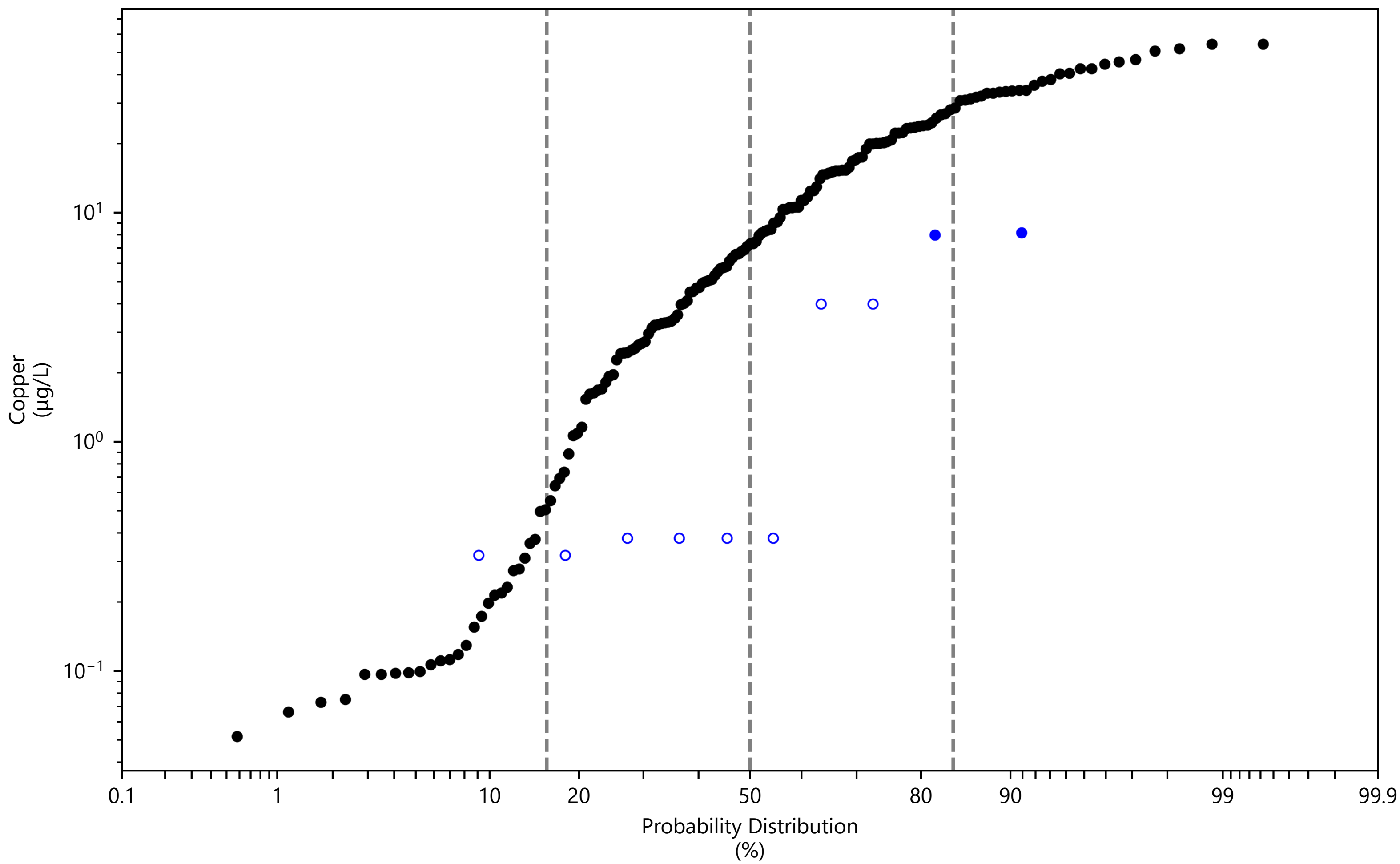
Figure C3-6
Probability Distribution of Freely Dissolved C19–C36 in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS



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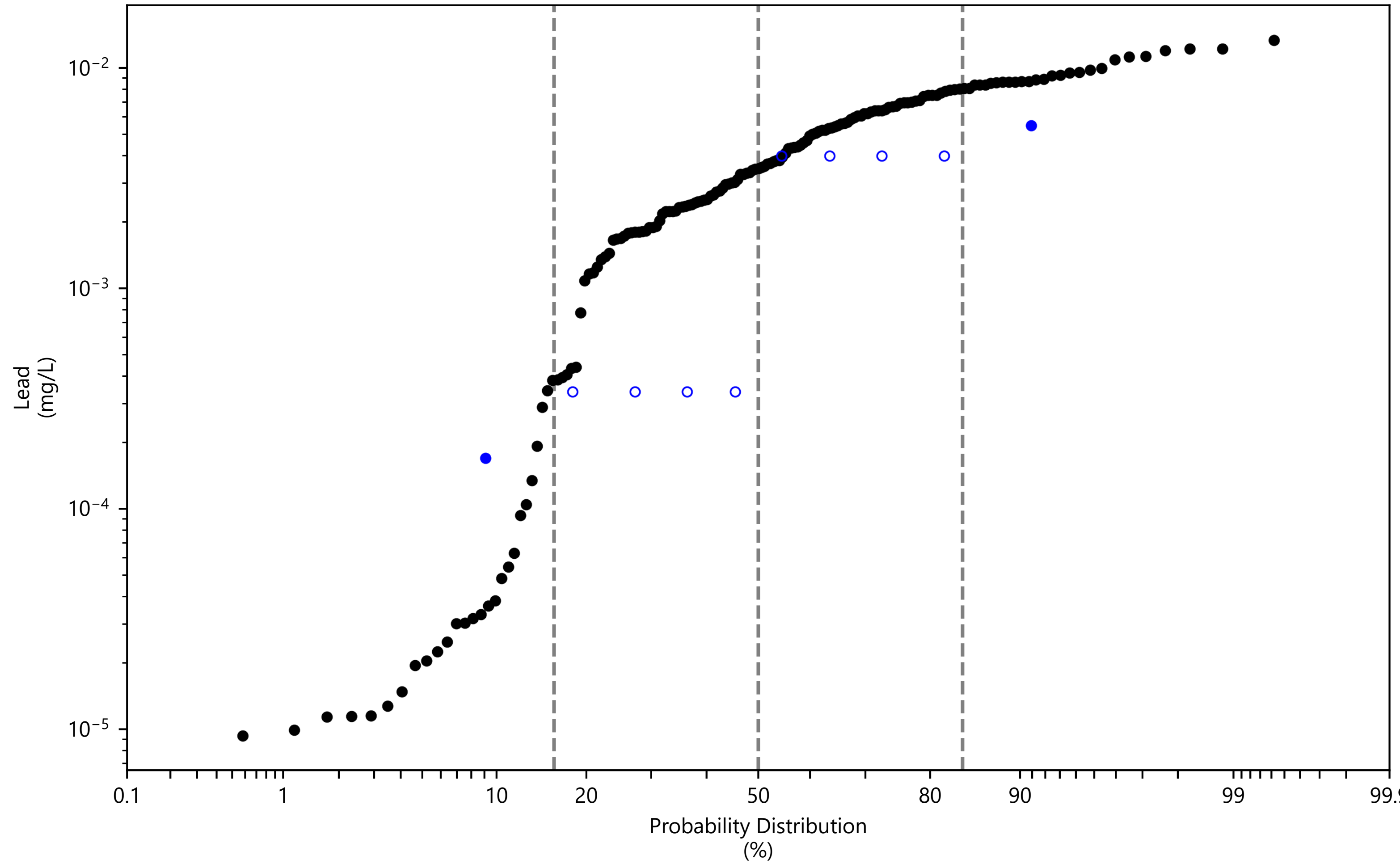
Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.
Non-detects plotted at MDL as blue open symbols.

● Sediment Data Converted to Porewater Concentrations ● Porewater Data

Publish Date: 03/19/2024 10:27 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_Copper_overlay_dissolved.py

ANCHOR QEA

Figure C3-7
Probability Distribution of Freely Dissolved Copper in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

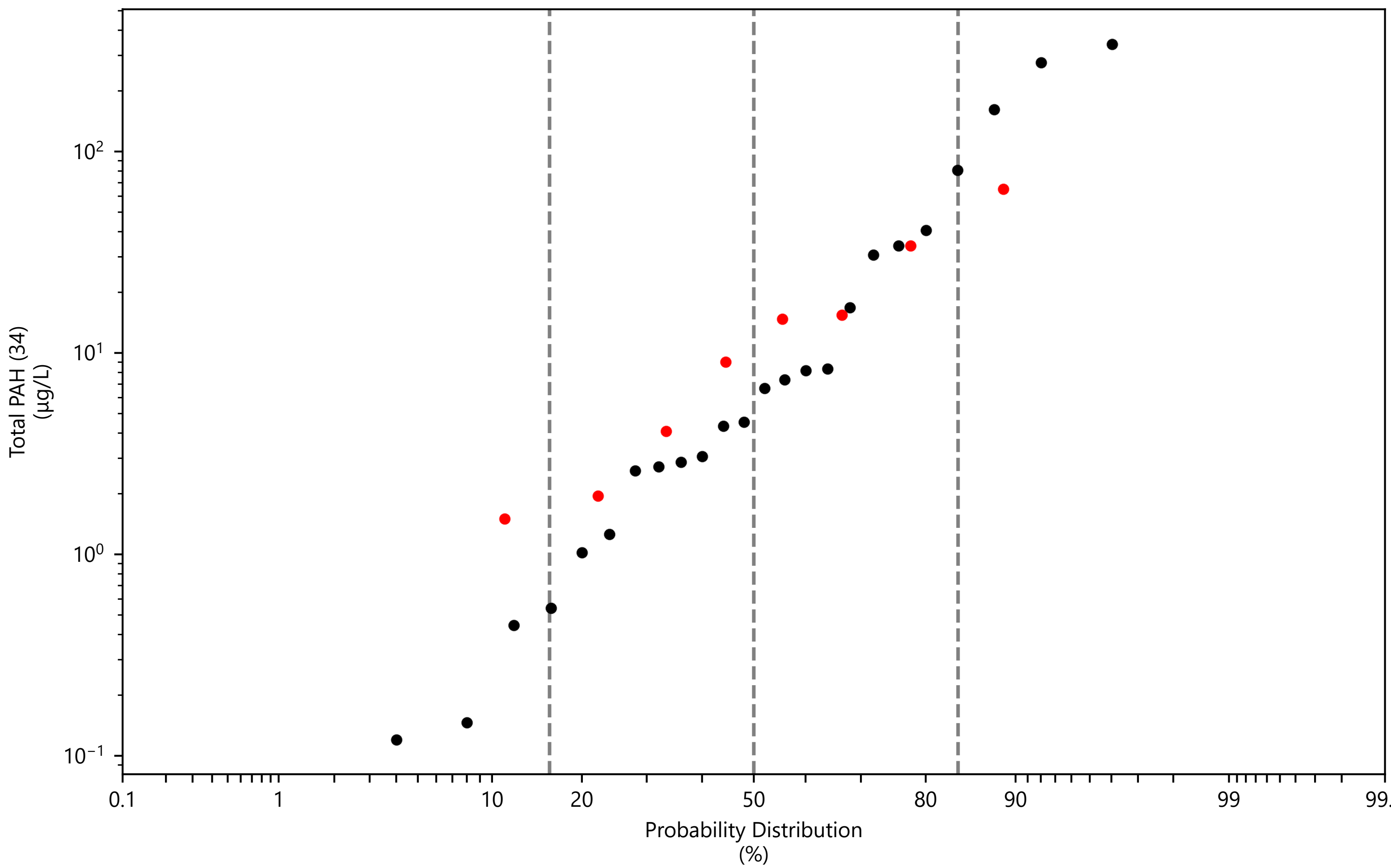
Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Sediment concentration data were converted to porewater concentrations using equilibrium partitioning.
Non-detects plotted at MDL as blue open symbols.

● Sediment Data Converted to Porewater Concentrations
● Porewater Data

Publish Date: 03/19/2024 10:30 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_lead_dissolved.py

ANCHOR QEA

Figure C3-8
Probability Distribution of Freely Dissolved Lead in East Branch Porewater
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

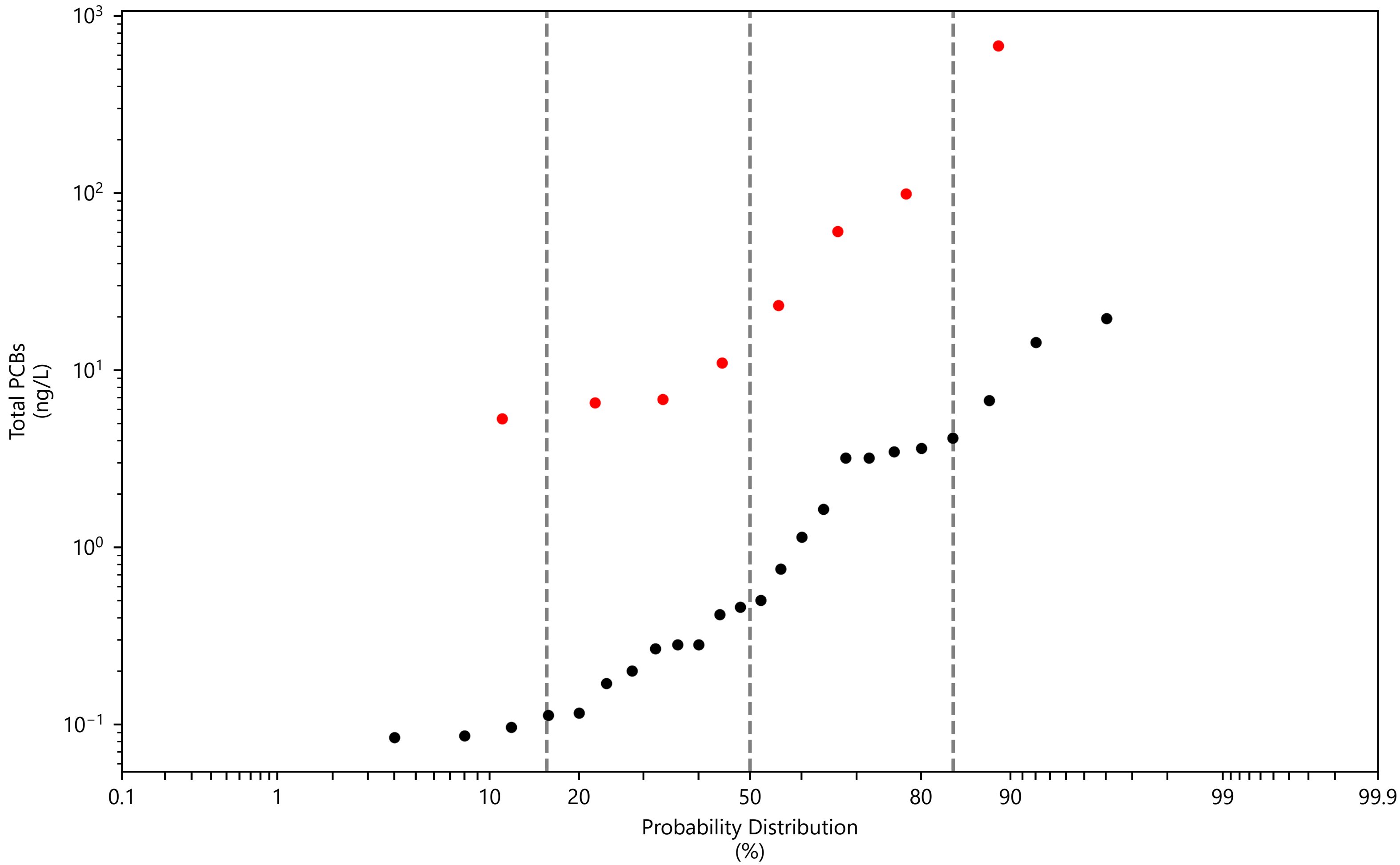
Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.

● Native Material Data Converted to Groundwater Concentrations ● Groundwater Data

Publish Date: 03/12/2024 23:00 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_PAH_TOTAL_overlay_dissolved.py

ANCHOR QEA

Figure C3-9
Probability Distribution of Freely Dissolved Total PAH (34) in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.

● Native Material Data Converted to Groundwater Concentrations ● Groundwater Data

Publish Date: 03/12/2024 23:03 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_PCB_TOTAL_overlay_dissolved.py

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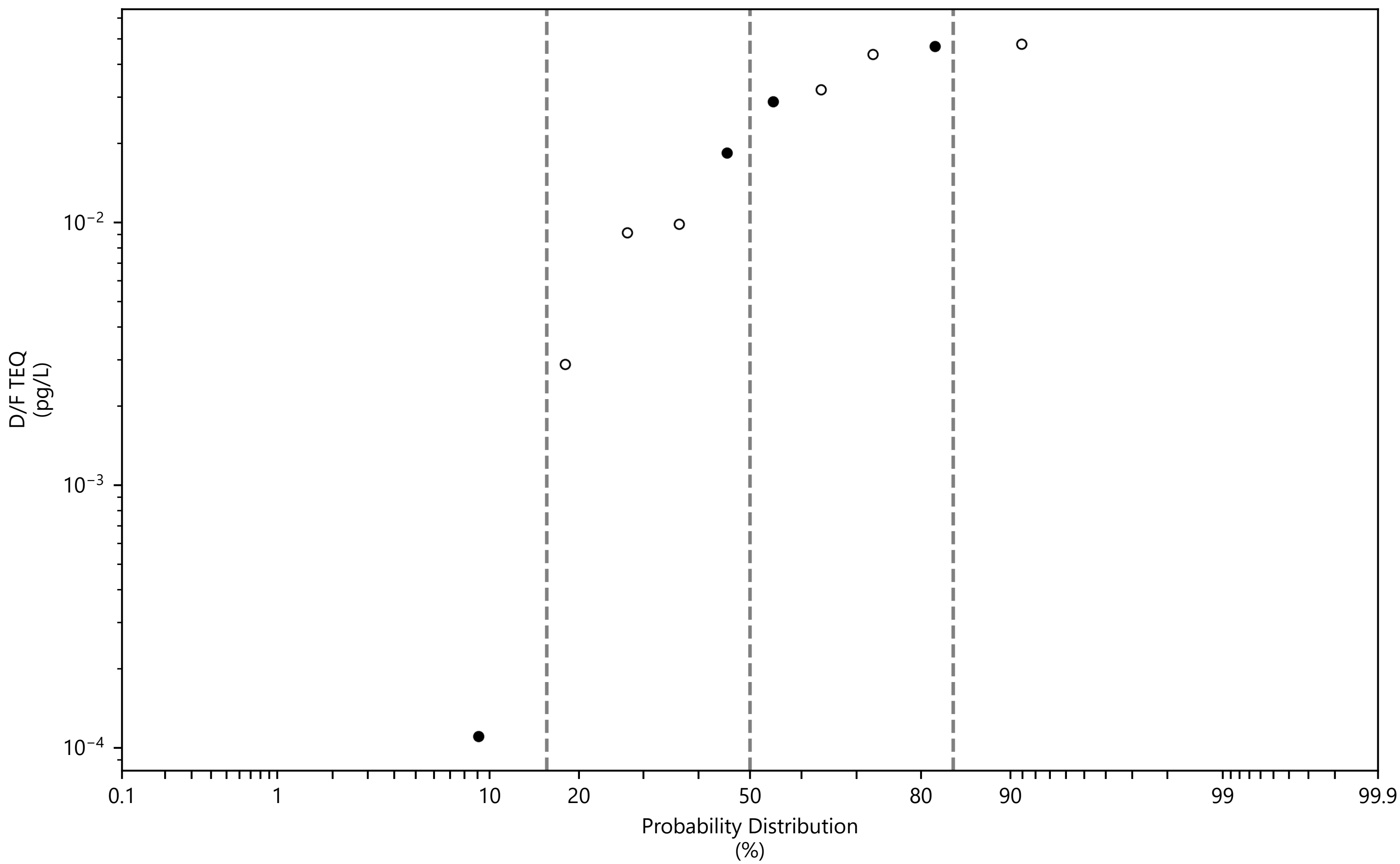
Figure C3-10
Probability Distribution of Freely Dissolved Total PCBs in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



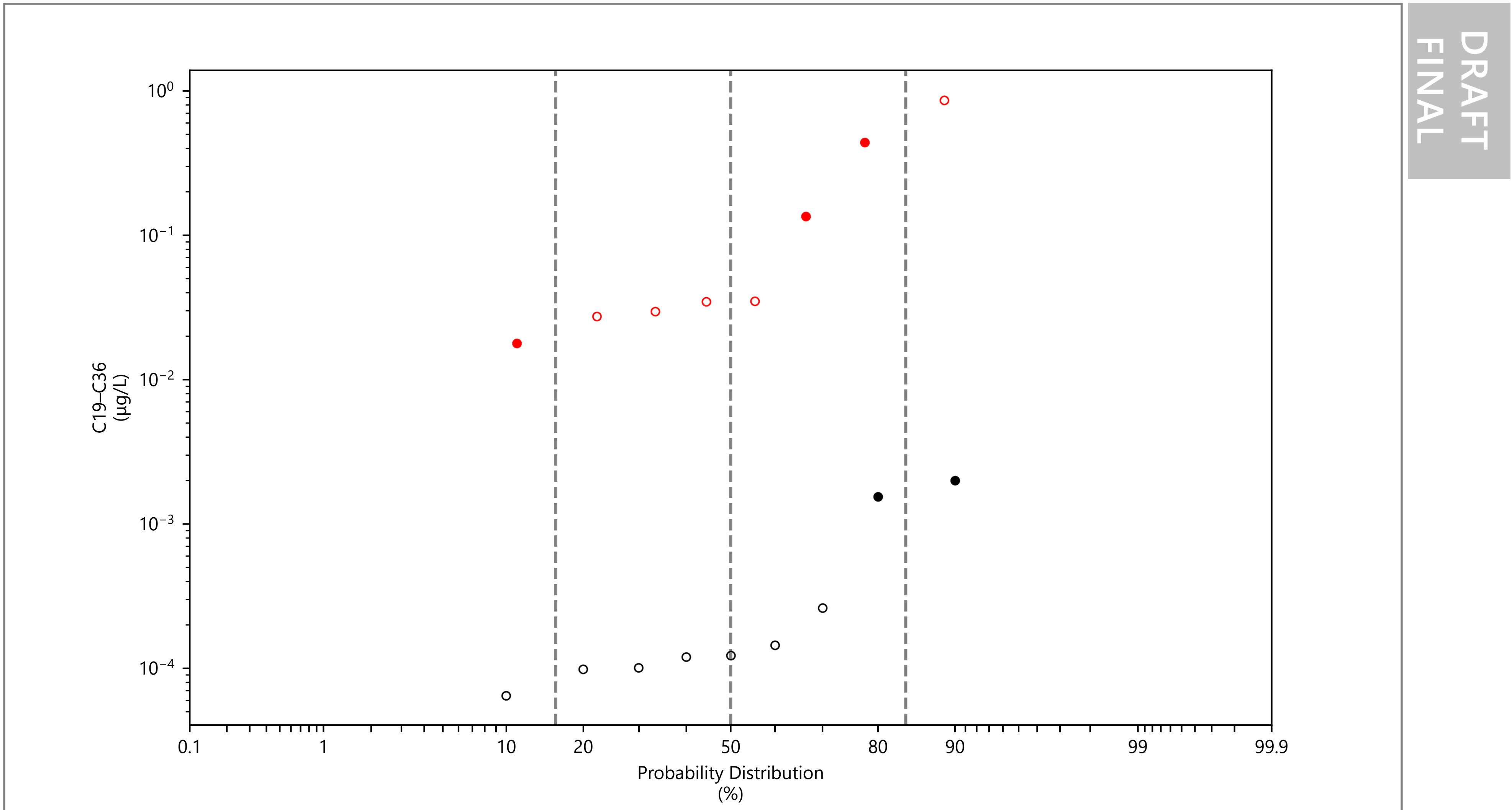
Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv.
Open symbols represent non-detect native material contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.

● Native Material Data Converted to Groundwater Concentrations

Publish Date: 03/19/2024 10:47 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_dioxin_furan_dissolved.py

ANCHOR QEA

Figure C3-11
Probability Distribution of Freely Dissolved D/F TEQ in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.
Black open symbols represent non-detect native material contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.
Red open symbols represent non-detect whole water groundwater contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.

● Native Material Data Converted to Groundwater Concentrations
● Groundwater Data

Publish Date: 03/12/2024 23:11 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_Aliphatics_overlay_dissolved.py

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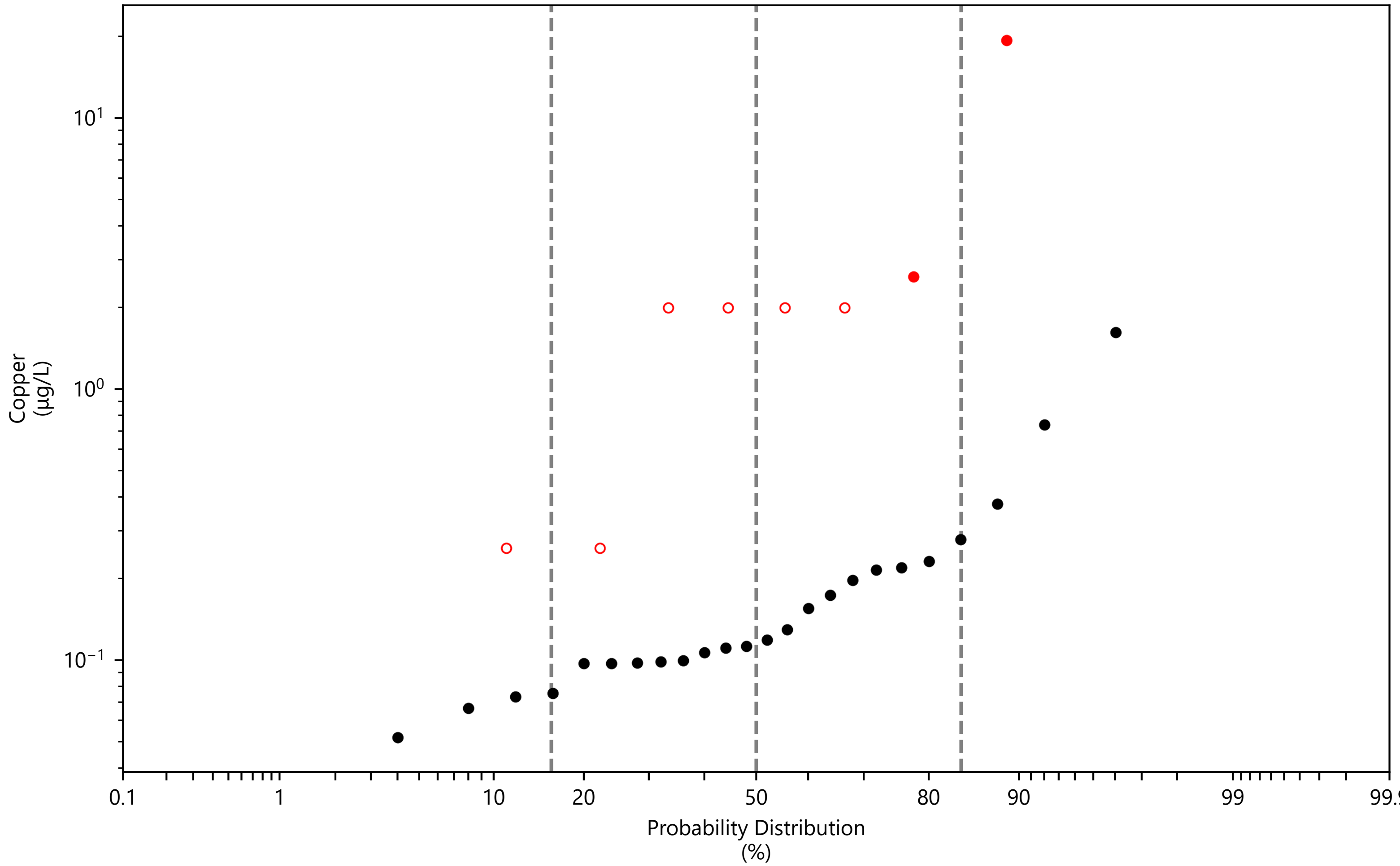
Figure C3-12
Probability Distribution of Freely Dissolved C19–C36 in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Red open symbols represent non-detect whole water groundwater contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.

● Native Material Data Converted to Groundwater Concentrations ● Groundwater Data

Publish Date: 03/12/2024 23:13 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_Copper_overlay_dissolved.py

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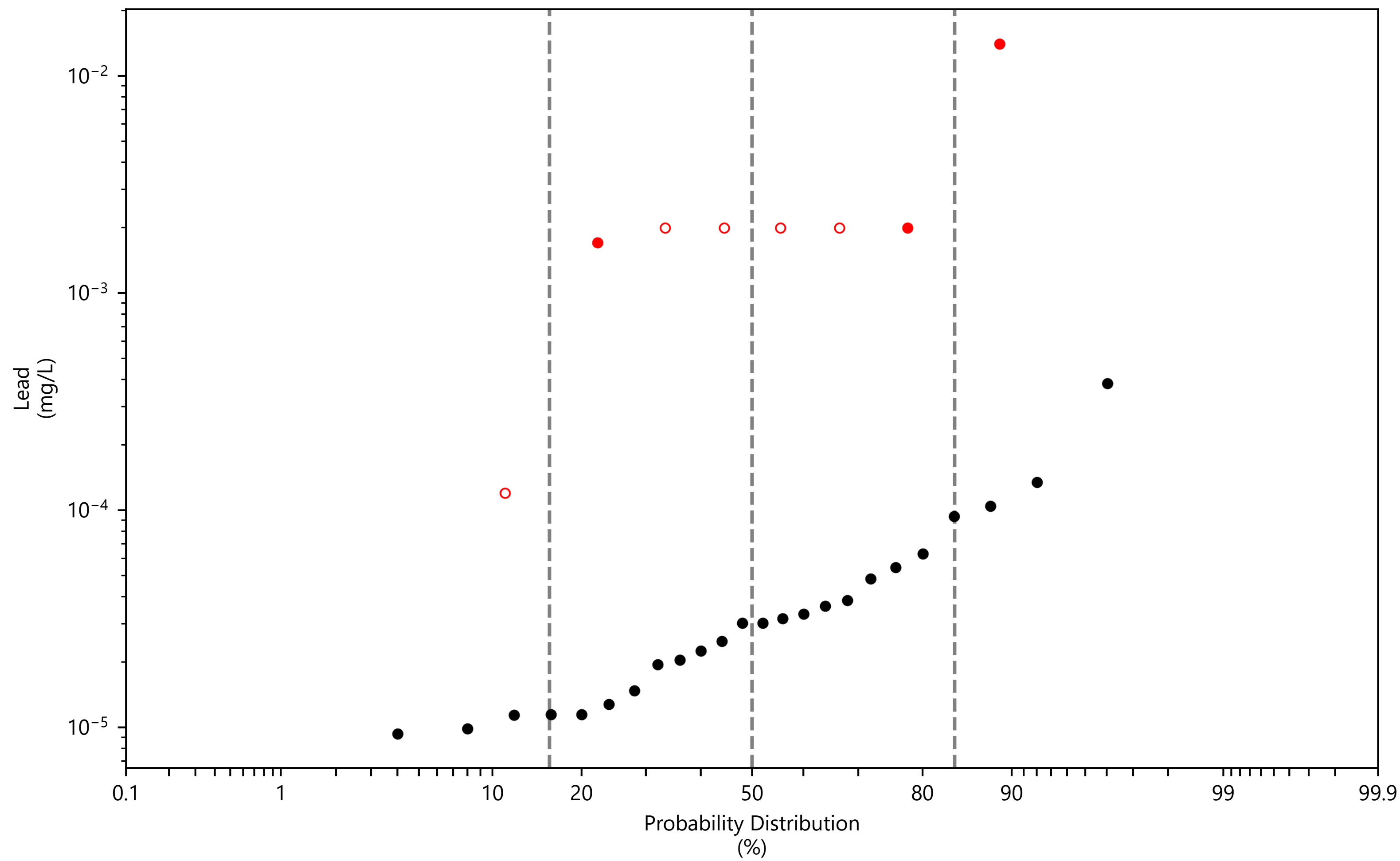
Figure C3-13
Probability Distribution of Freely Dissolved Copper in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



Notes:
Data source: sediment_query_dataset_East_Branch_20221216.csv, Porewater_Groundwater_20221227.xlsx.
Red open symbols represent non-detect whole water groundwater contaminant concentrations at the MDL converted to freely dissolved phase contaminant concentrations.
Native material concentration data were converted to groundwater concentrations using equilibrium partitioning.

● Native Material Data Converted to Groundwater Concentrations ● Groundwater Data

Publish Date: 03/12/2024 23:16 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\analysis\python\prob_plot_lead_dissolved.py

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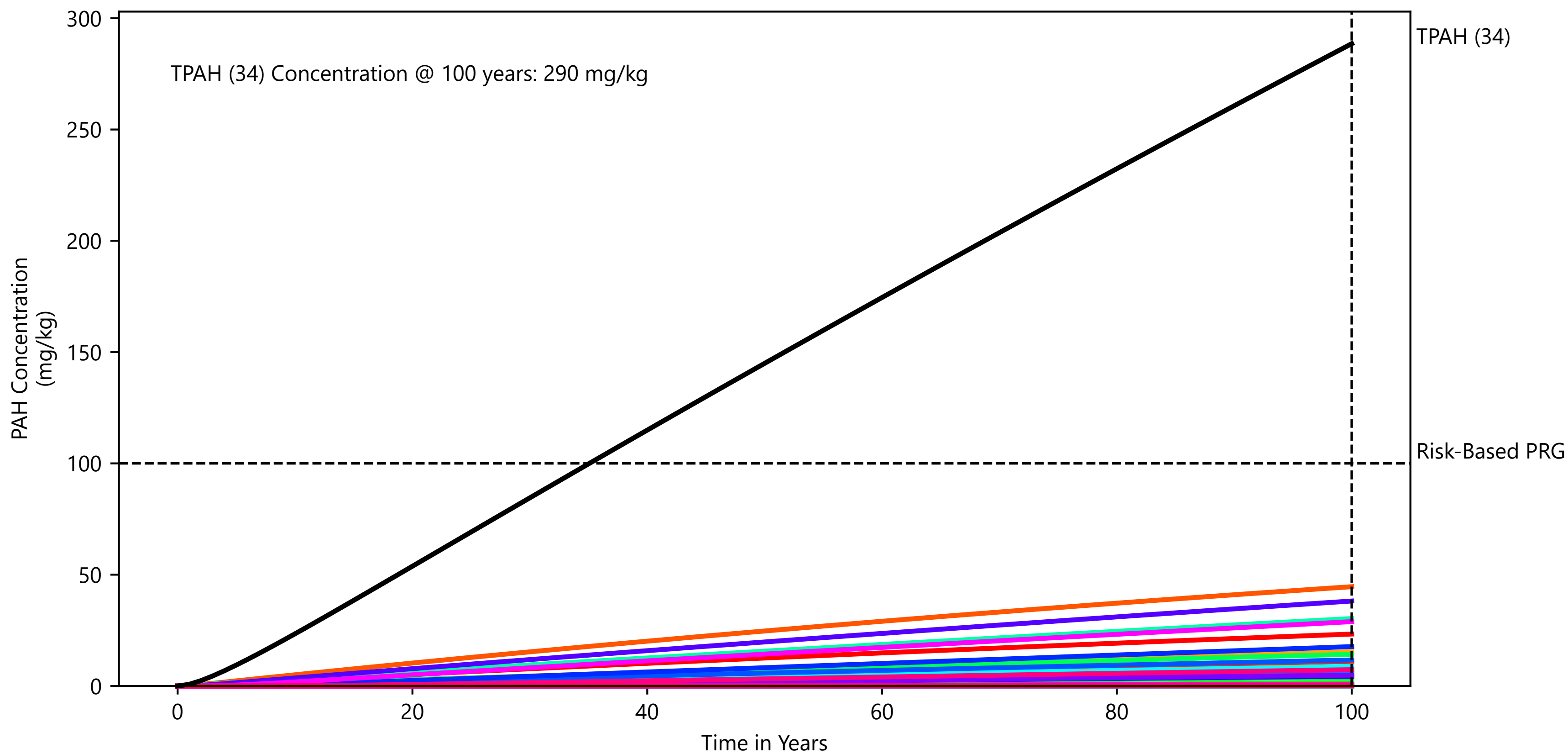
Figure C3-14
Probability Distribution of Freely Dissolved Lead in East Branch Groundwater
Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



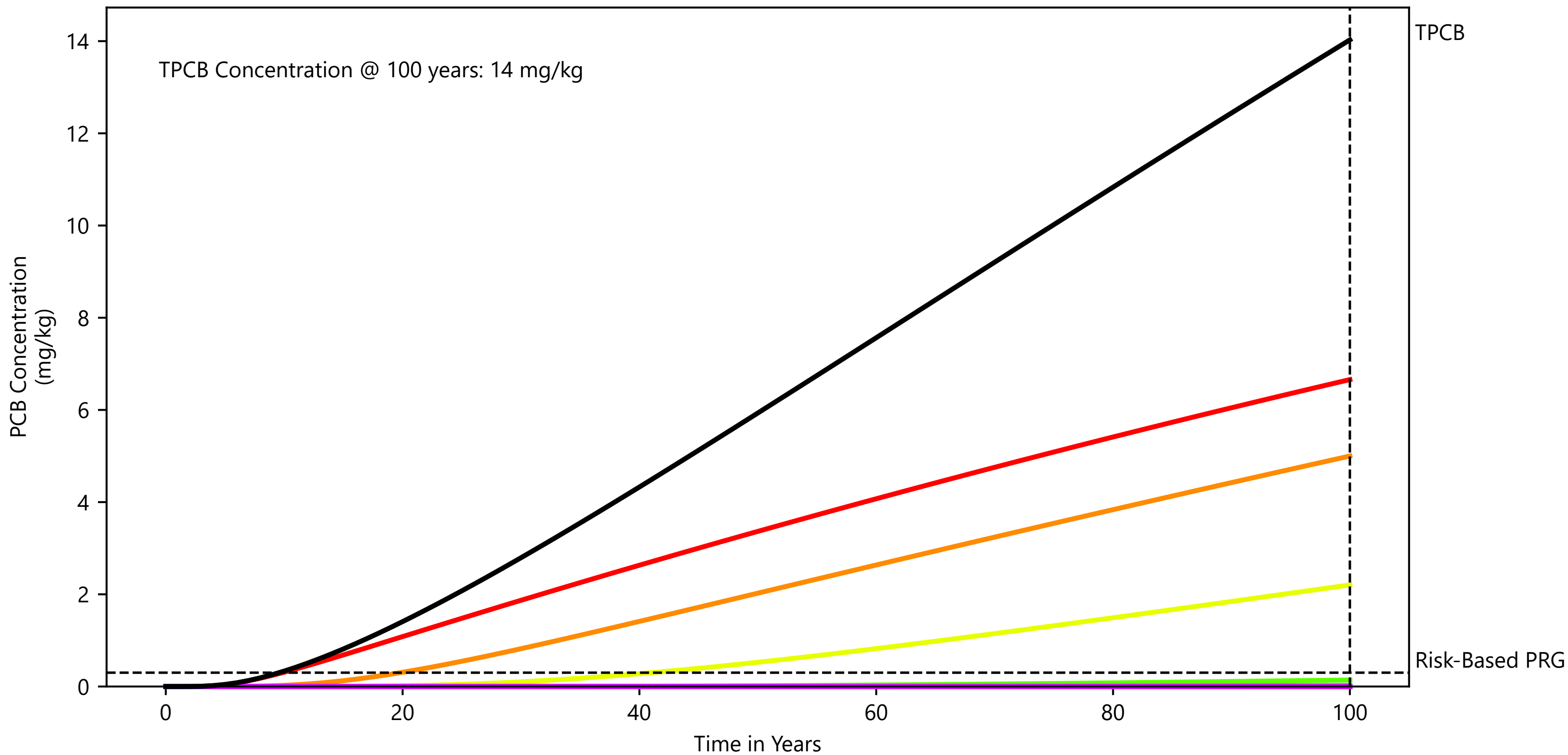
Notes:
Source: output_2302-01_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(j,k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
C1-Benzo(a)anthracenesChrysenes
C1-FluoranthenesPyrenes
C1-Fluorenes
C1-PhenanthrenesAnthracenes
C2-Benzo(a)anthracenesChrysenes
C2-Fluorenes
C2-Naphthalenes
C2-PhenanthrenesAnthracenes
C3-Benzo(a)anthracenesChrysenes
C3-Fluorenes
C3-Naphthalenes
C3-PhenanthrenesAnthracenes
C4-Benzo(a)anthracenesChrysenes
C4-Naphthalenes
C4-PhenanthrenesAnthracenes
TPAH (34)

Publish Date: 03/12/2024 22:21 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\Python\CapSim_Temporal_wContribution.py

ANCHOR QEA

Figure C3-15a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-69_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

Publish Date: 03/12/2024 22:21 PM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\Python\CapSim_Temporal_wContribution.py

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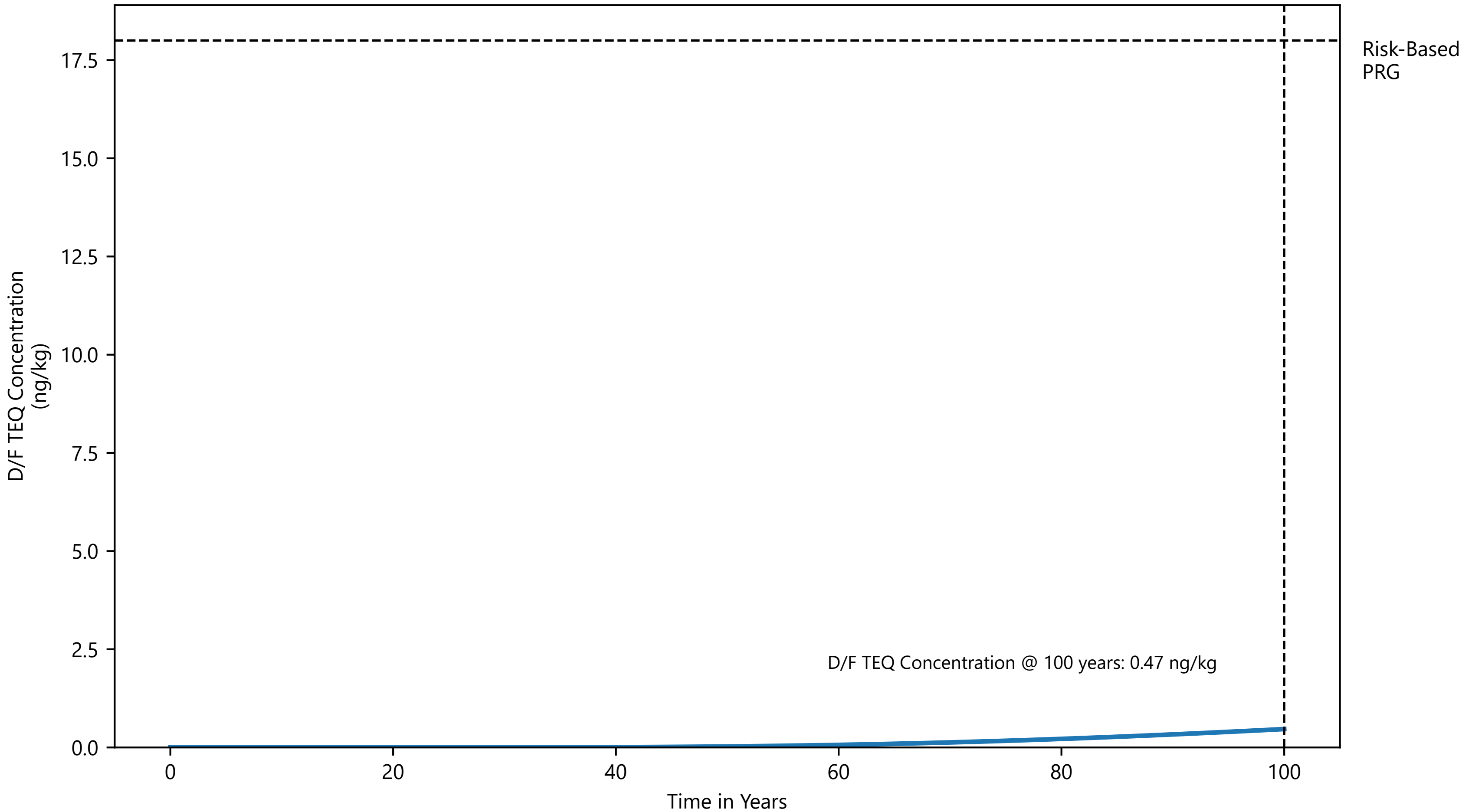
Figure C3-15b
Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS

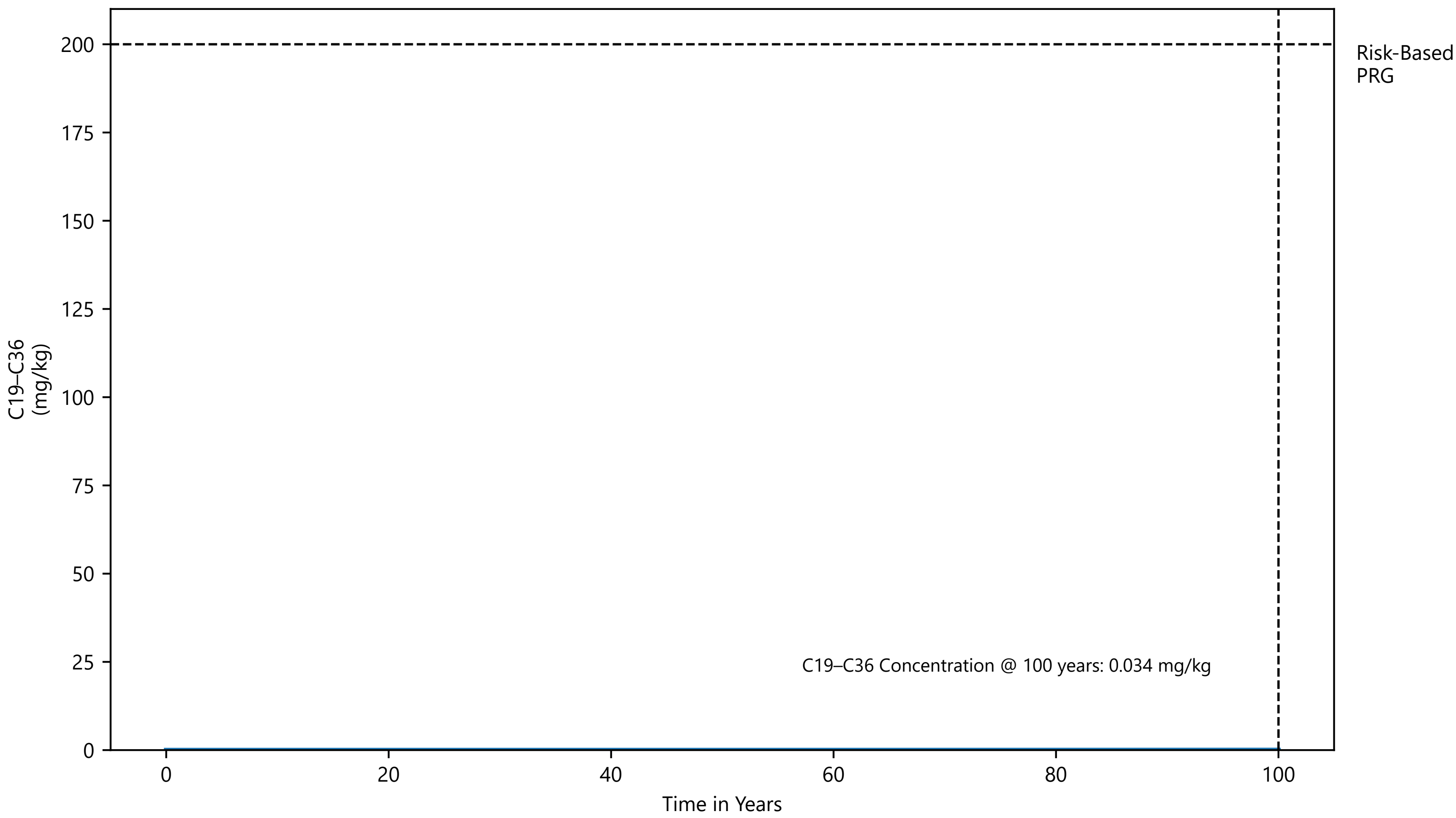


Notes:
Source: output_2302-72_DF-TEQ.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted D/F TEQ concentration at year 100 is within the range of MDLs reported in East Branch non-detect sediment/native material samples.

Publish Date: 03/19/2024 11:26 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\Python\CapSim_Temporal.py

ANCHOR QEA

Figure C3-15c
Temporal Profile of D/F TEQ in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-72_C19-C36.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted C19-C36 concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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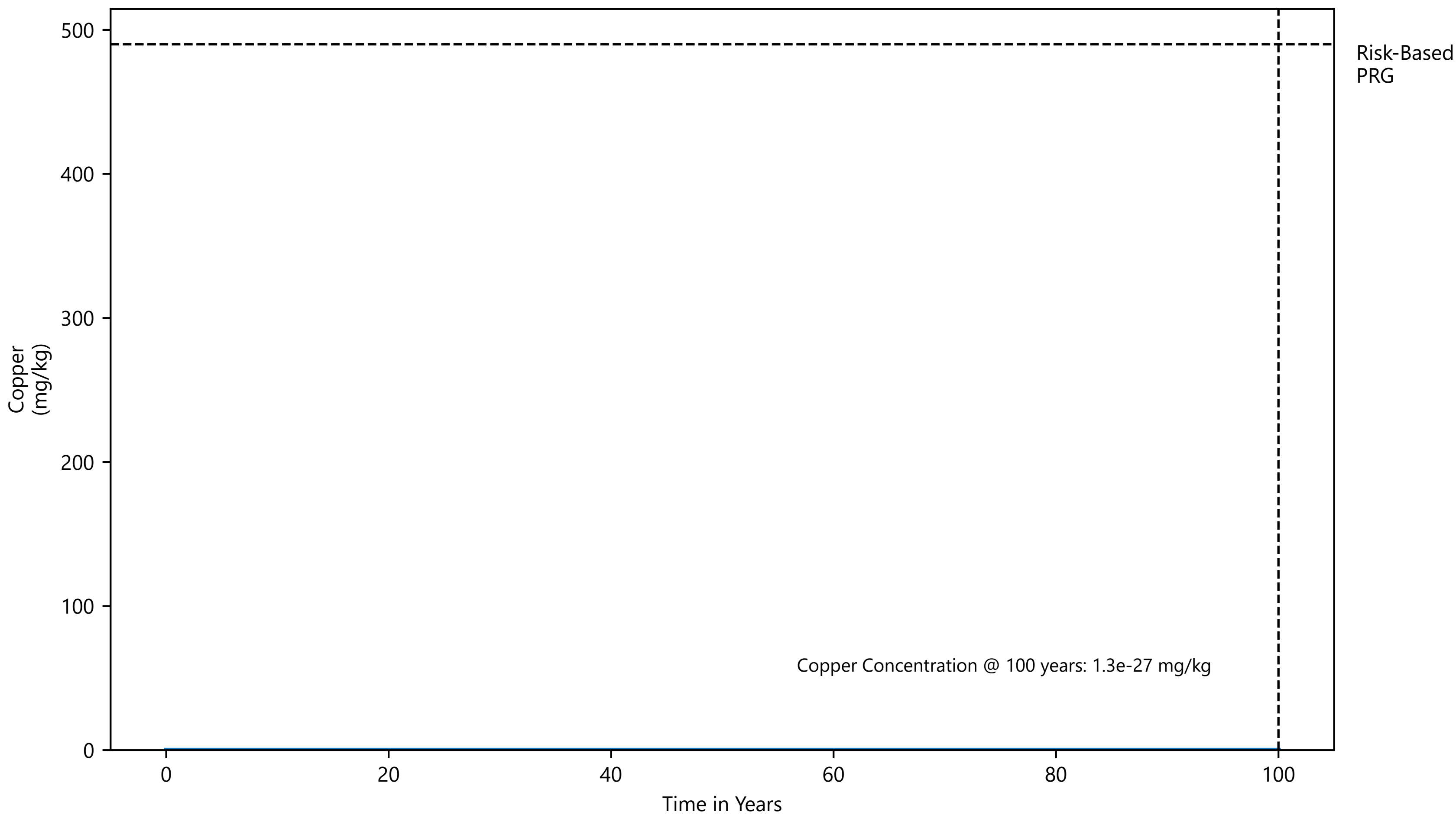
Figure C3-15d
Temporal Profile of C19–C36 Aliphatics in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment

DRAFT FINAL



Notes:
Source: output_2302-02_Copper.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted copper concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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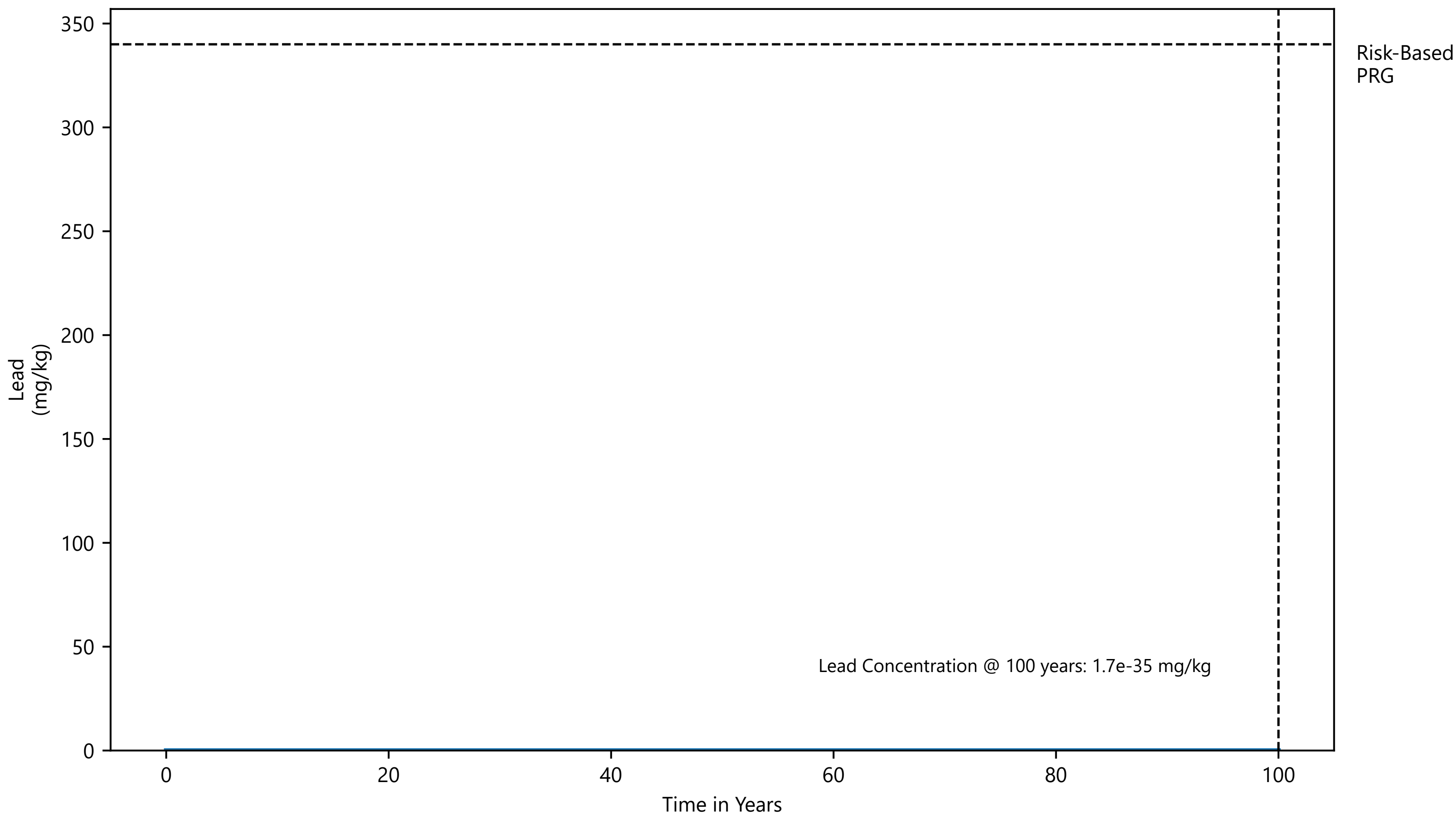
Figure C3-15e
Temporal Profile of Copper in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



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FINAL

Notes:
Source: output_2302-02_Lead.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted lead concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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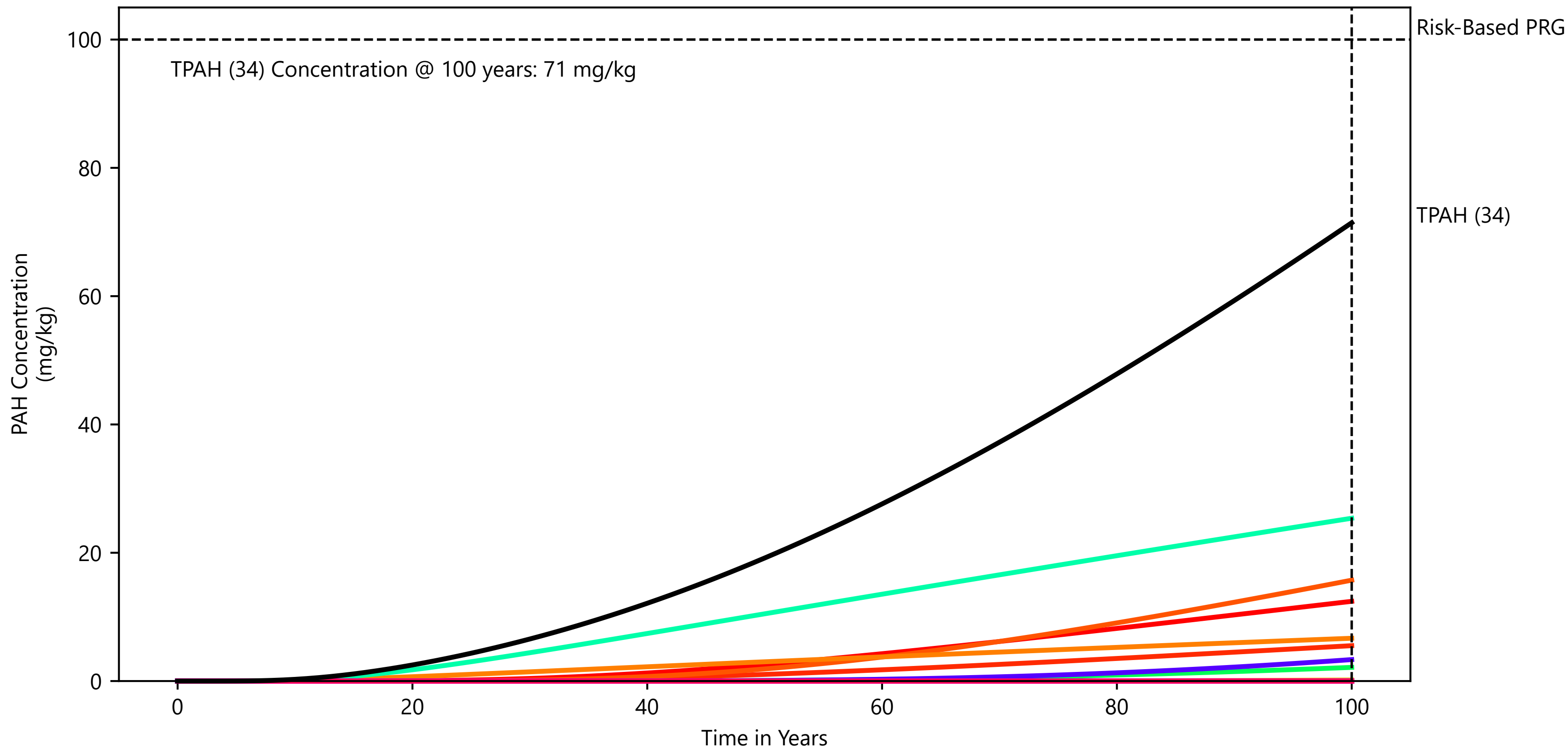
Figure C3-15f
Temporal Profile of Lead in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-04_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(j,k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
C1-Benzo(a)anthracenesChrysenes
C1-FluoranthenesPyrenes
C1-Fluorenes
C1-PhenanthrenesAnthracenes
C2-Benzo(a)anthracenesChrysenes
C2-Fluorenes
C2-Naphthalenes
C2-PhenanthrenesAnthracenes
C3-Benzo(a)anthracenesChrysenes
C3-Fluorenes
C3-Naphthalenes
C3-PhenanthrenesAnthracenes
C4-Benzo(a)anthracenesChrysenes
C4-Naphthalenes
C4-PhenanthrenesAnthracenes
TPAH (34)

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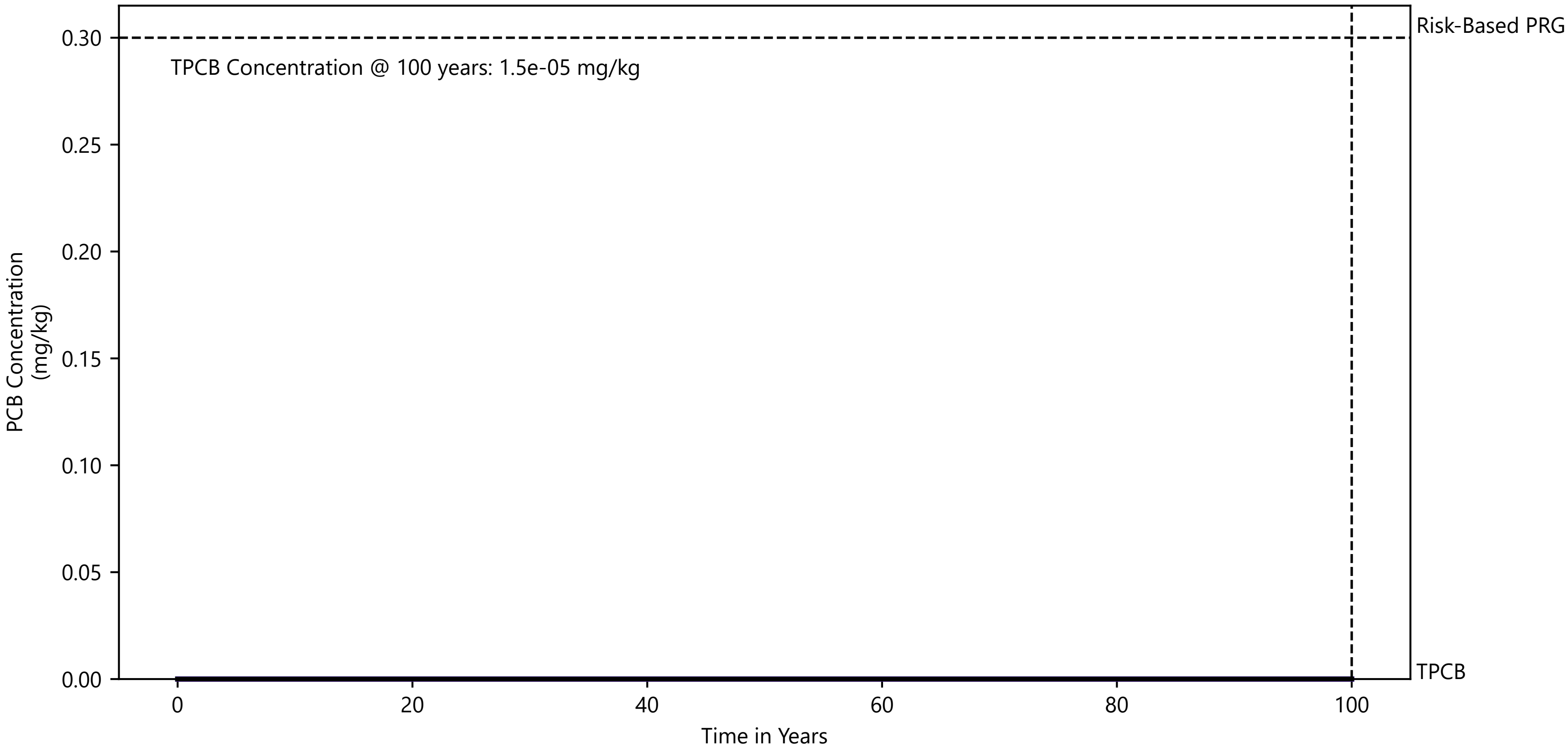
Figure C3-16a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (1% by Weight) Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-05_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted total PCB concentration at year 100 is less than MDLs reported in East Branch non-detect sediment/native material samples.

PCB-mono, PCB-di, PCB-tri, PCB-tetra, PCB-penta, PCB-hexa, PCB-hepta, PCB-octa, PCB-nona, PCB-deca, TPCB

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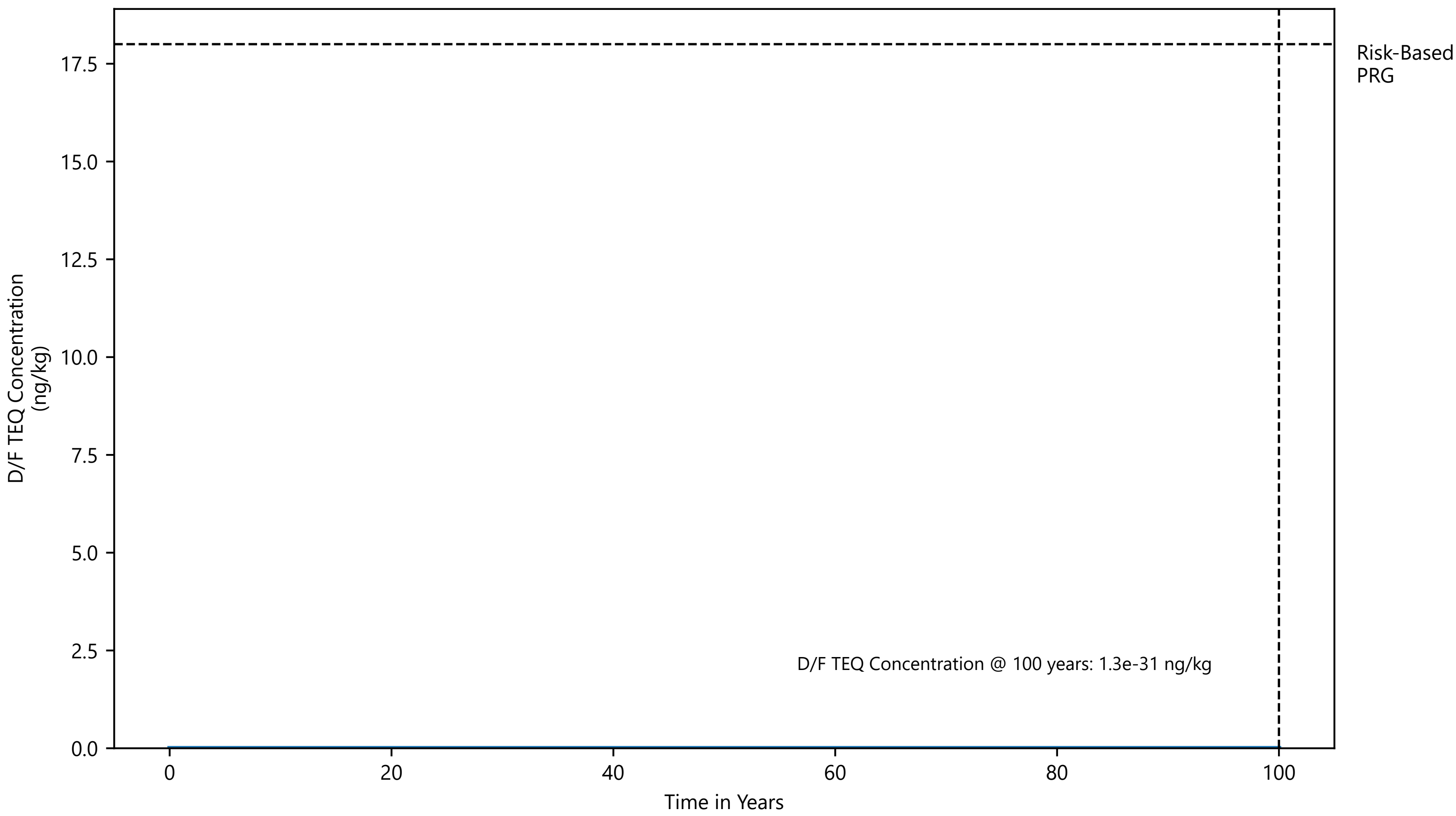
Figure C3-16b
Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (1% by Weight) Cap on Sediment
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-13_DF-TEQ.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted D/F TEQ concentration at year 100 is less than MDLs reported in East Branch non-detect sediment/native material samples.

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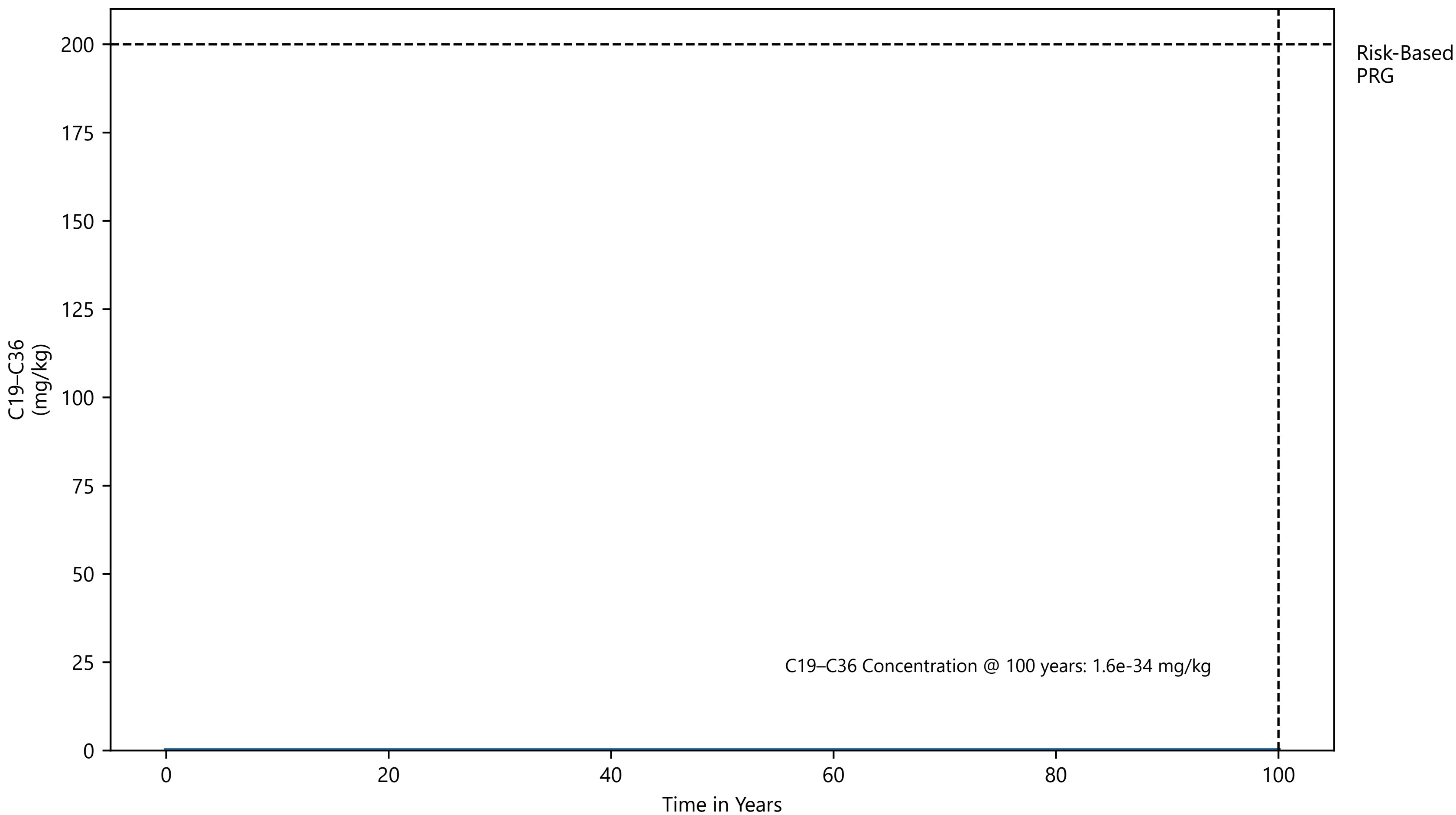
Figure C3-16c
Temporal Profile of D/F TEQ in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (1% by Weight) Cap on Sediment

Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-13_C19-C36.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted C19-C36 concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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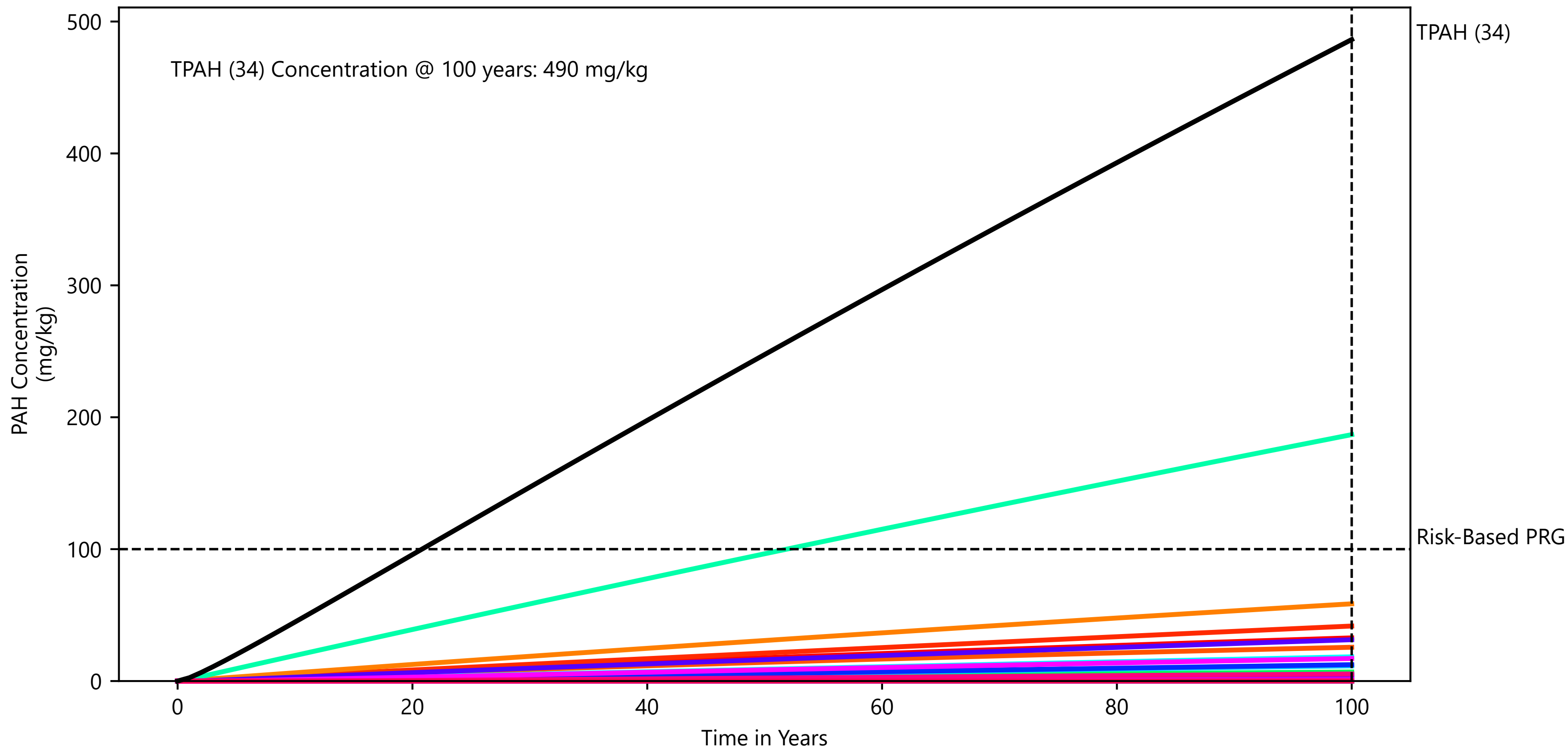
Figure C3-16d
Temporal Profile of C19–C36 Aliphatics in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (1% by Weight) Cap on Sediment

Capping Evaluations
Newtown Creek RI/FS

DRAFT FINAL



Notes:
Source: output_2302-17a_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(j,k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
C1-Benzo(a)anthracenesChrysenes
C1-FluoranthenesPyrenes
C1-Fluorenes
C1-PhenanthrenesAnthracenes
C2-Benzo(a)anthracenesChrysenes
C2-Fluorenes
C2-Naphthalenes
C2-PhenanthrenesAnthracenes
C3-Benzo(a)anthracenesChrysenes
C3-Fluorenes
C3-Naphthalenes
C3-PhenanthrenesAnthracenes
C4-Benzo(a)anthracenesChrysenes
C4-Naphthalenes
C4-PhenanthrenesAnthracenes
TPAH (34)

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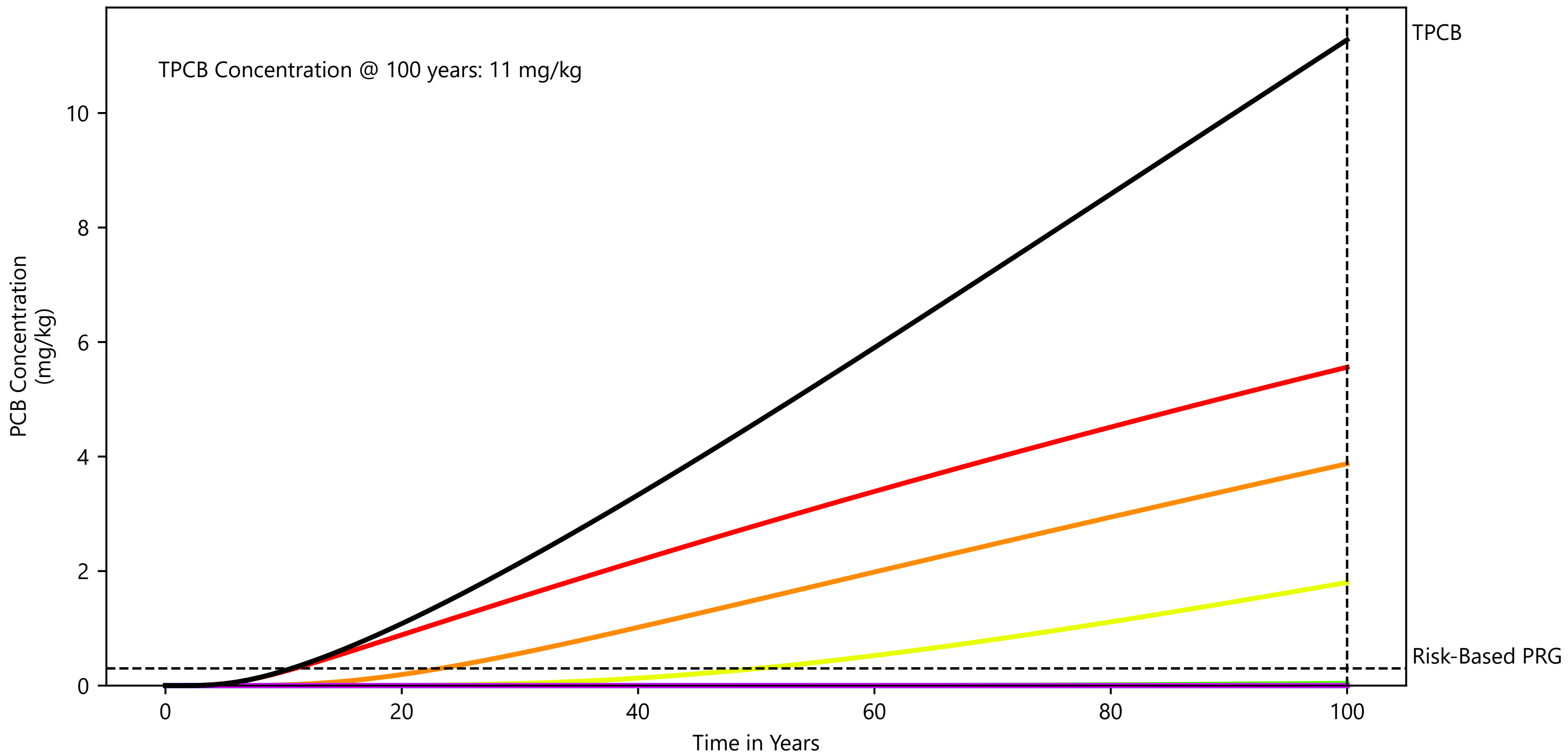
Figure C3-17a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



DRAFT FINAL

Notes:
Source: output_2302-42a_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

PCB-mono
PCB-di
PCB-tri
PCB-tetra
PCB-penta
PCB-hexa
PCB-hepta
PCB-octa
PCB-nona
PCB-deca
TPCB

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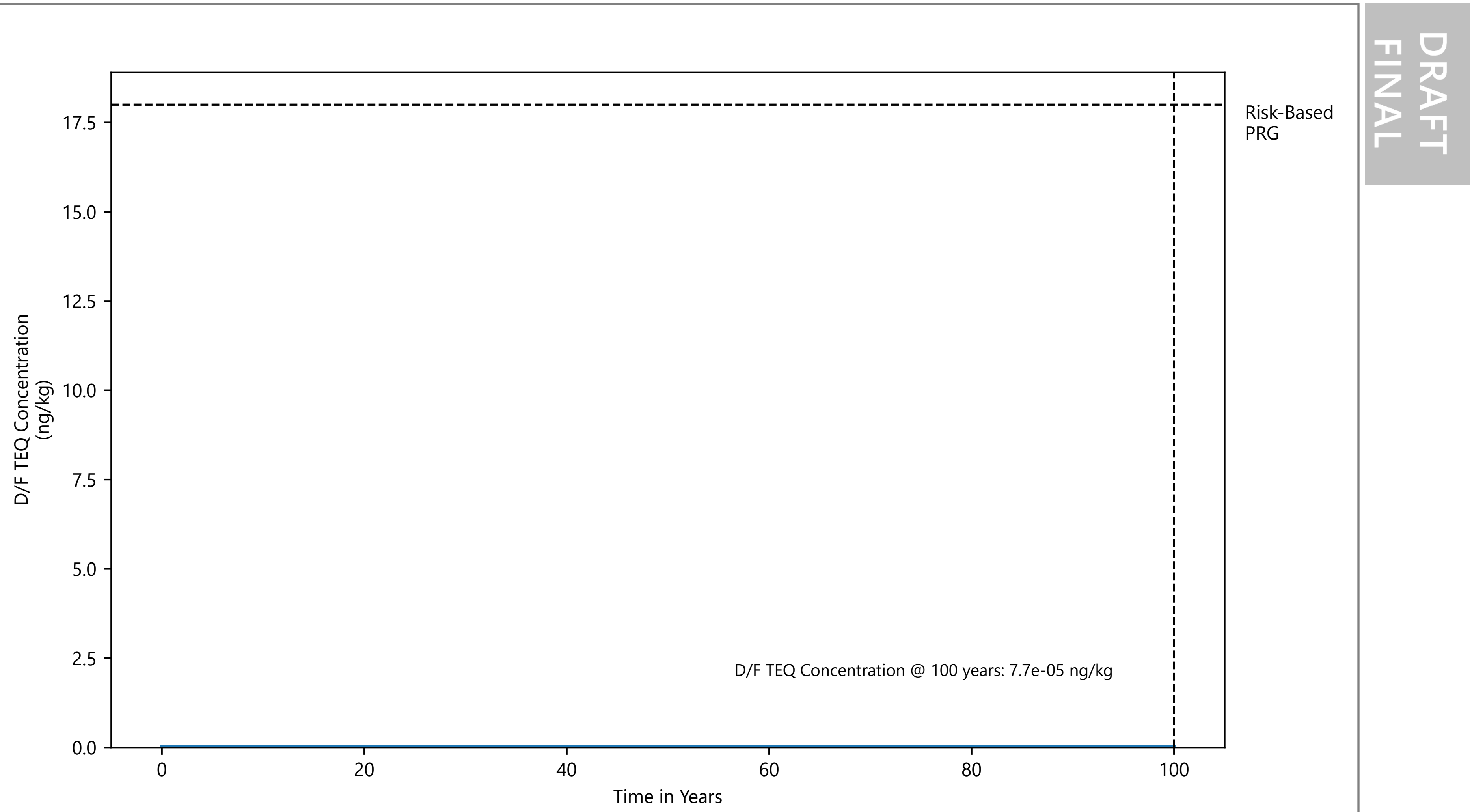
Figure C3-17b
Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



Notes:
Source: output_2302-44a_DF-TEQ.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted D/F TEQ concentration at year 100 is less than MDLs reported in East Branch non-detect sediment/native material samples.

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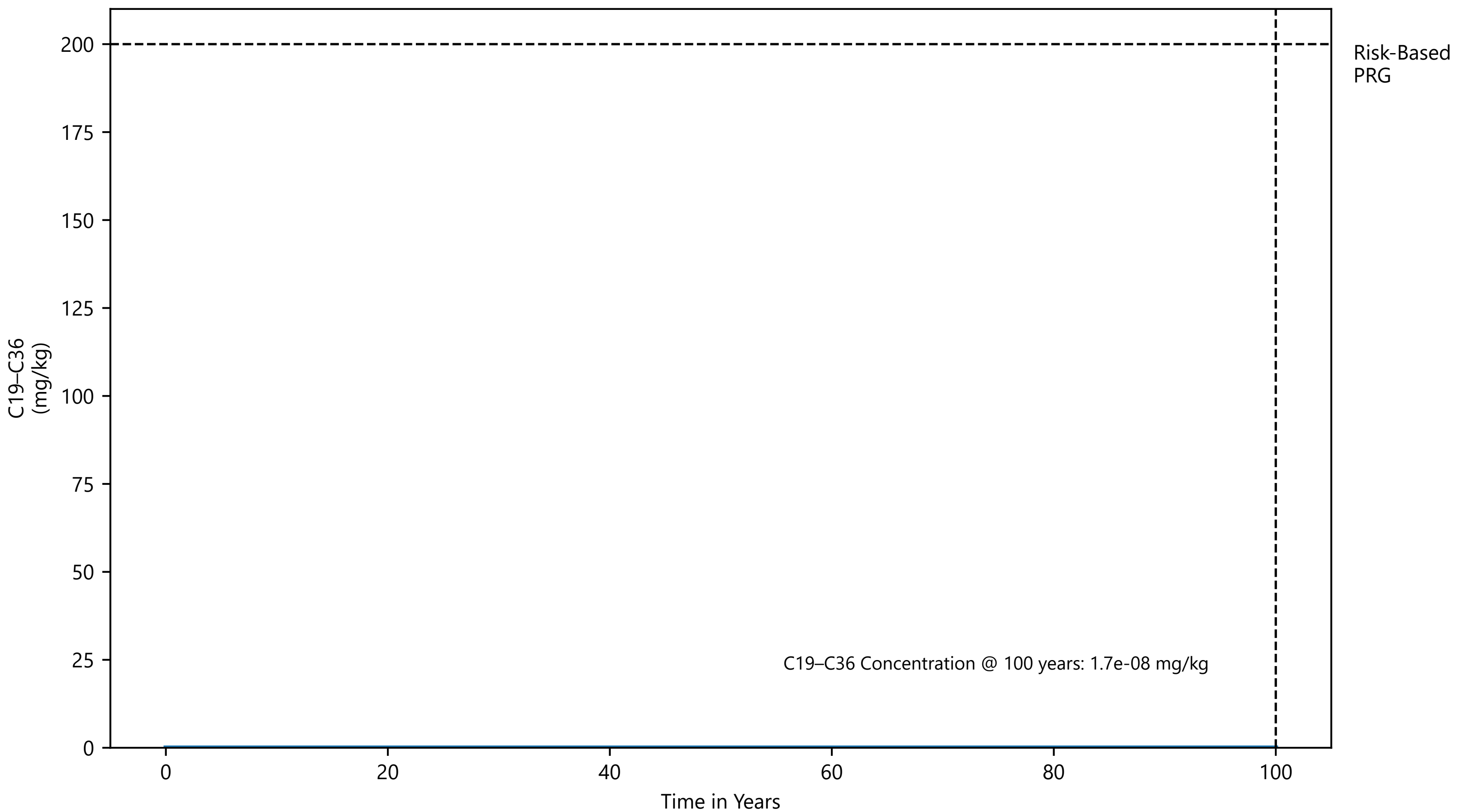
Figure C3-17c

Temporal Profile of D/F TEQ in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material

Capping Evaluations

Newtown Creek RI/FS



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Notes:
Source: output_2302-44a_C19-C36.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted C19-C36 concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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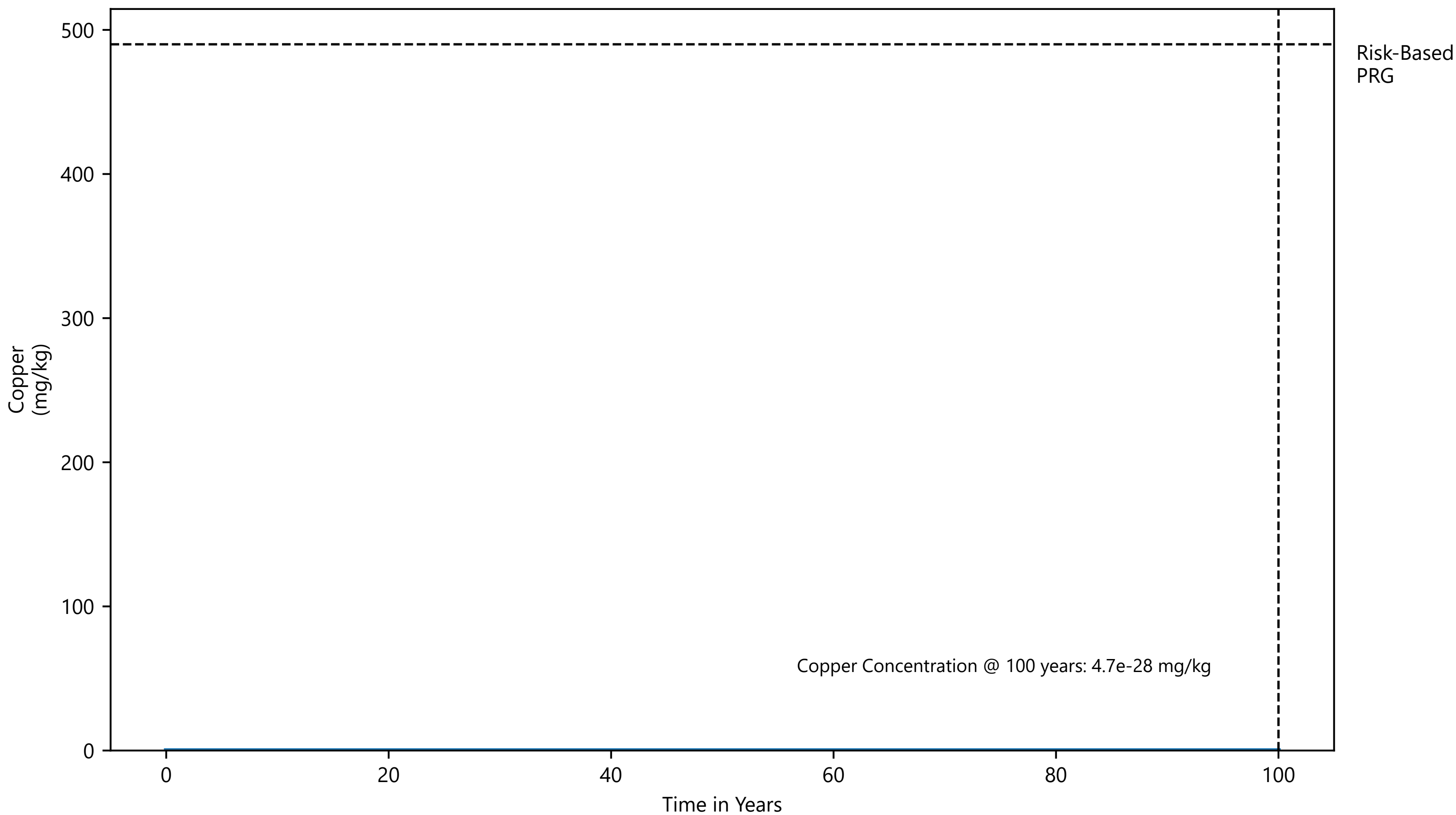
Figure C3-17d
Temporal Profile of C19–C36 Aliphatics in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material



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Notes:
Source: output_2302-18_Copper.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted copper concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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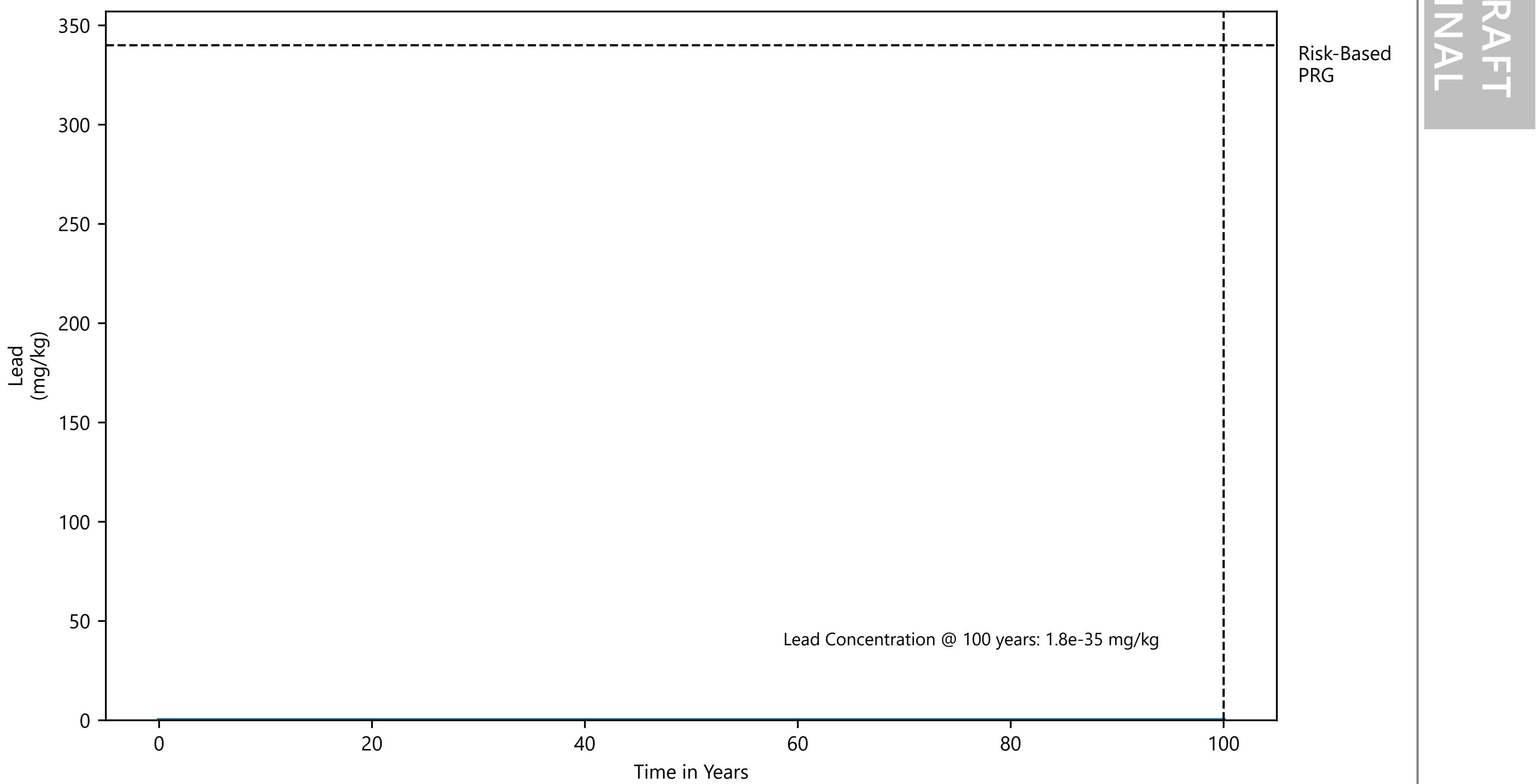
Figure C3-17e
Temporal Profile of Copper in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



Notes:
Source: output_2302-18_Lead.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted lead concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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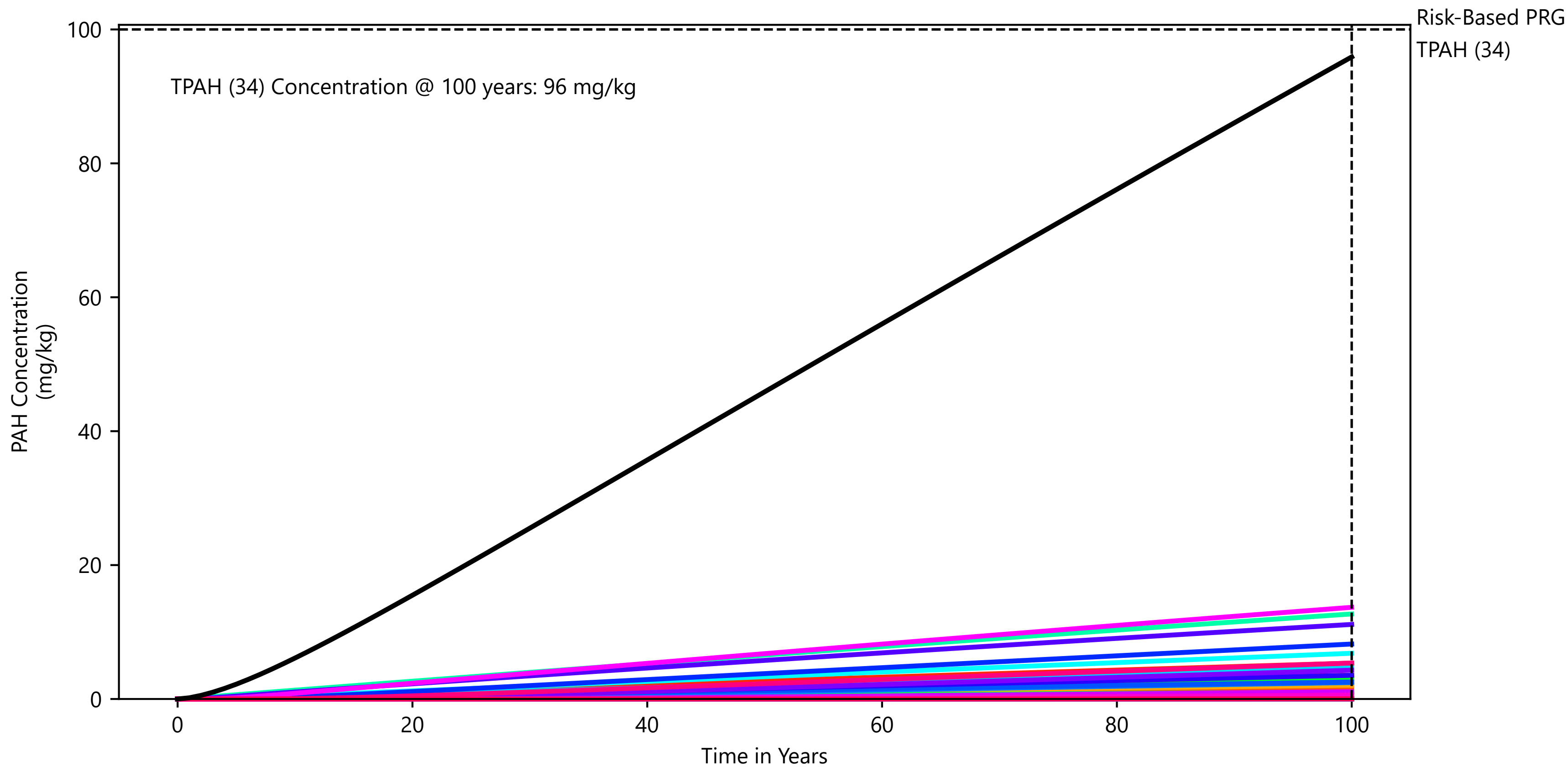
Figure C3-17f
Temporal Profile of Lead in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



Notes:
Source: output_2302-36a_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(e)pyrene, Benzo(g,h,i)perylene, Benzo(j,k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-c,d)pyrene, Naphthalene, Perylene, Phenanthrene, Pyrene, C1-Benzo(a)anthracenesChrysenes, C1-FluoranthenesPyrenes, C1-Fluorenes, C1-PhenanthrenesAnthracenes, C2-Benzo(a)anthracenesChrysenes, C2-Fluorenes, C2-Naphthalenes, C2-PhenanthrenesAnthracenes, C3-Benzo(a)anthracenesChrysenes, C3-Fluorenes, C3-Naphthalenes, C3-PhenanthrenesAnthracenes, C4-Benzo(a)anthracenesChrysenes, C4-Naphthalenes, C4-PhenanthrenesAnthracenes, TPAH (34)

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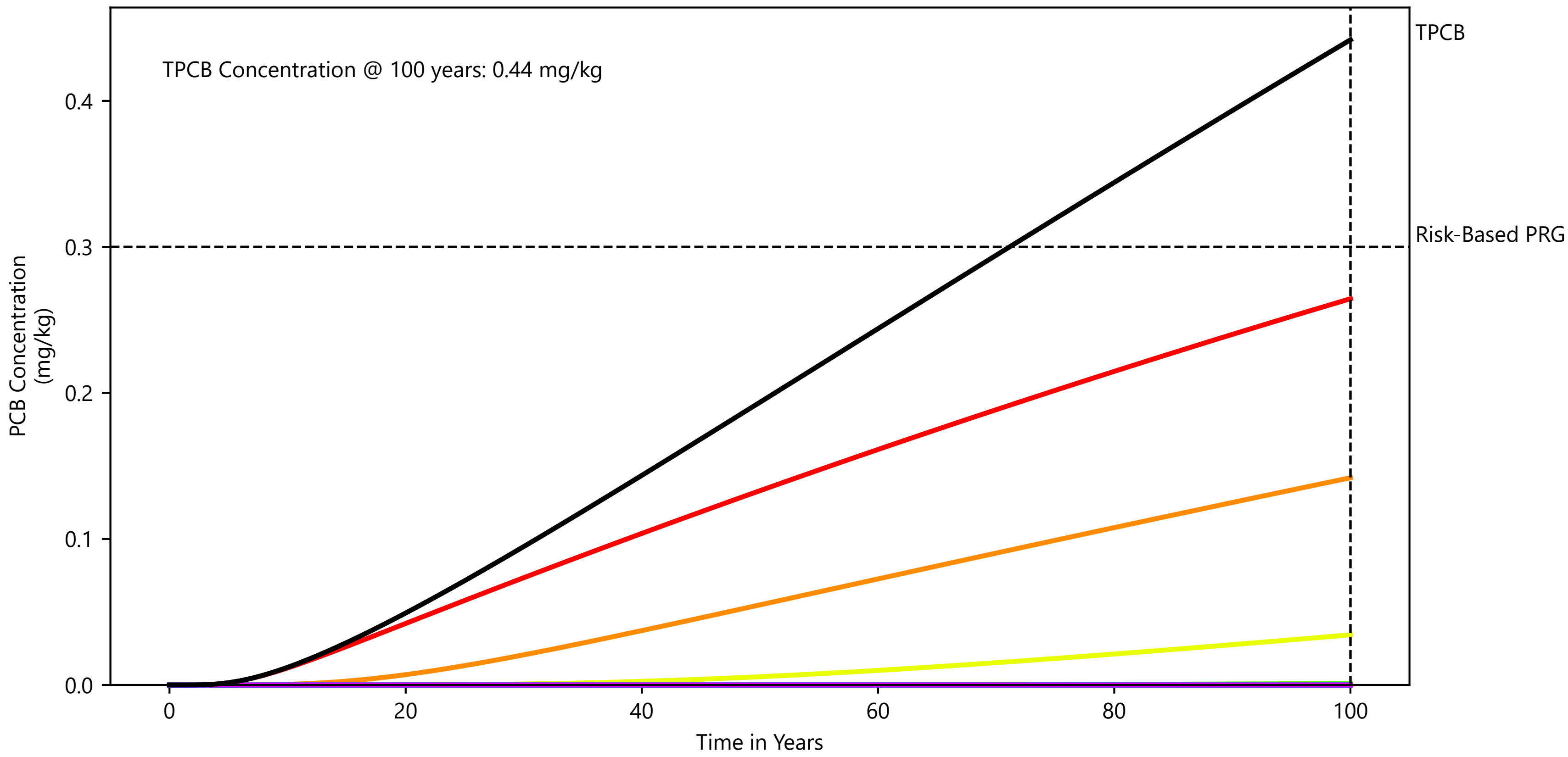
Figure C3-18a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material (Alternate Sample)



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Notes:
Source: output_2303-14_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

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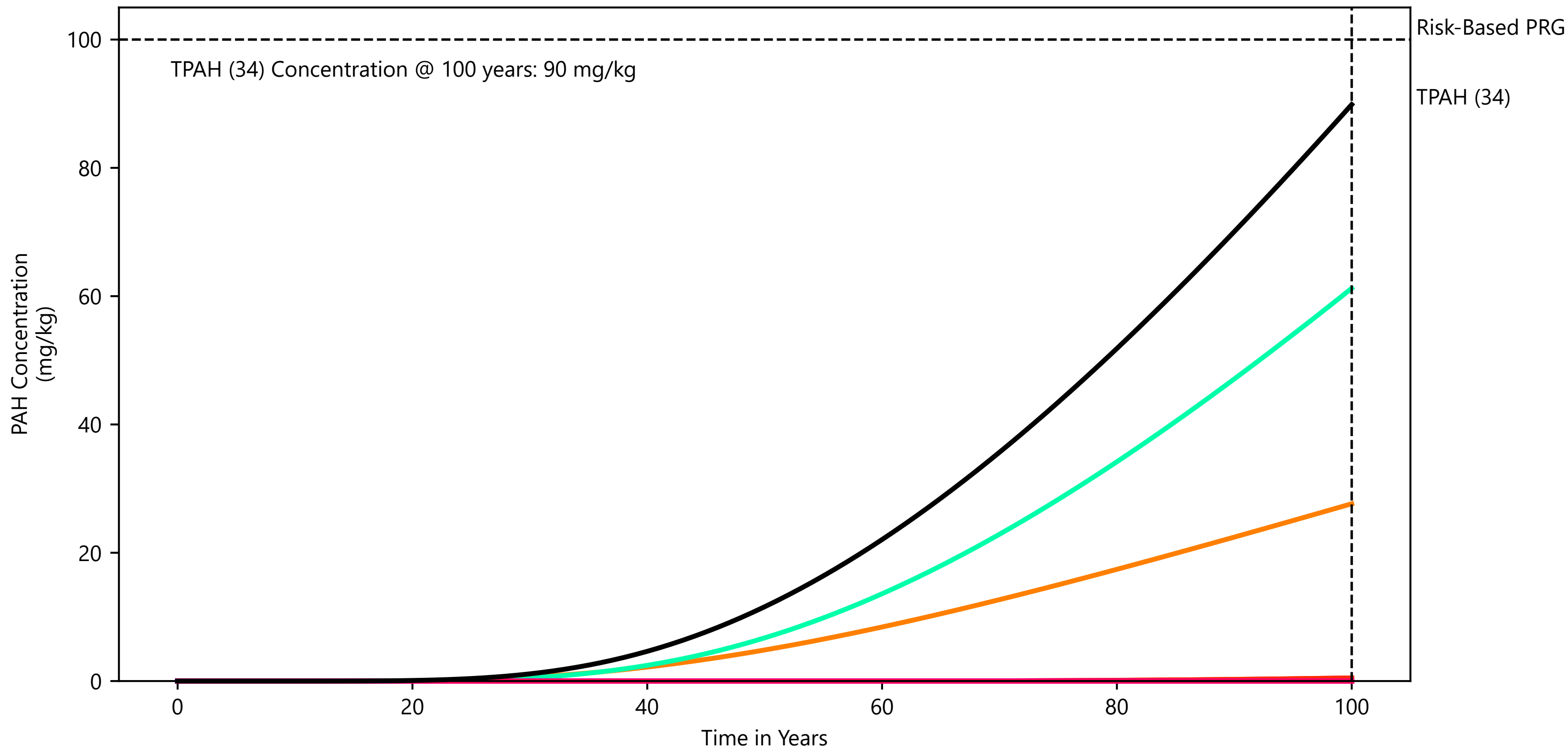
Figure C3-18b
Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand-Only Cap on Native Material (Alternate Sample)
Capping Evaluations
Newtown Creek RI/FS



Notes:
Source: output_2302-50a_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(e)pyrene, Benzo(g,h,i)perylene, Benzo(j,k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-c,d)pyrene, Naphthalene, Perylene, Phenanthrene, Pyrene, C1-Benzo(a)anthracenesChrysenes, C1-FluoranthenesPyrenes, C1-Fluorenes, C1-PhenanthrenesAnthracenes, C2-Benzo(a)anthracenesChrysenes, C2-Fluorenes, C2-Naphthalenes, C2-PhenanthrenesAnthracenes, C3-Benzo(a)anthracenesChrysenes, C3-Fluorenes, C3-Naphthalenes, C3-PhenanthrenesAnthracenes, C4-Benzo(a)anthracenesChrysenes, C4-Naphthalenes, C4-PhenanthrenesAnthracenes, TPAH (34)

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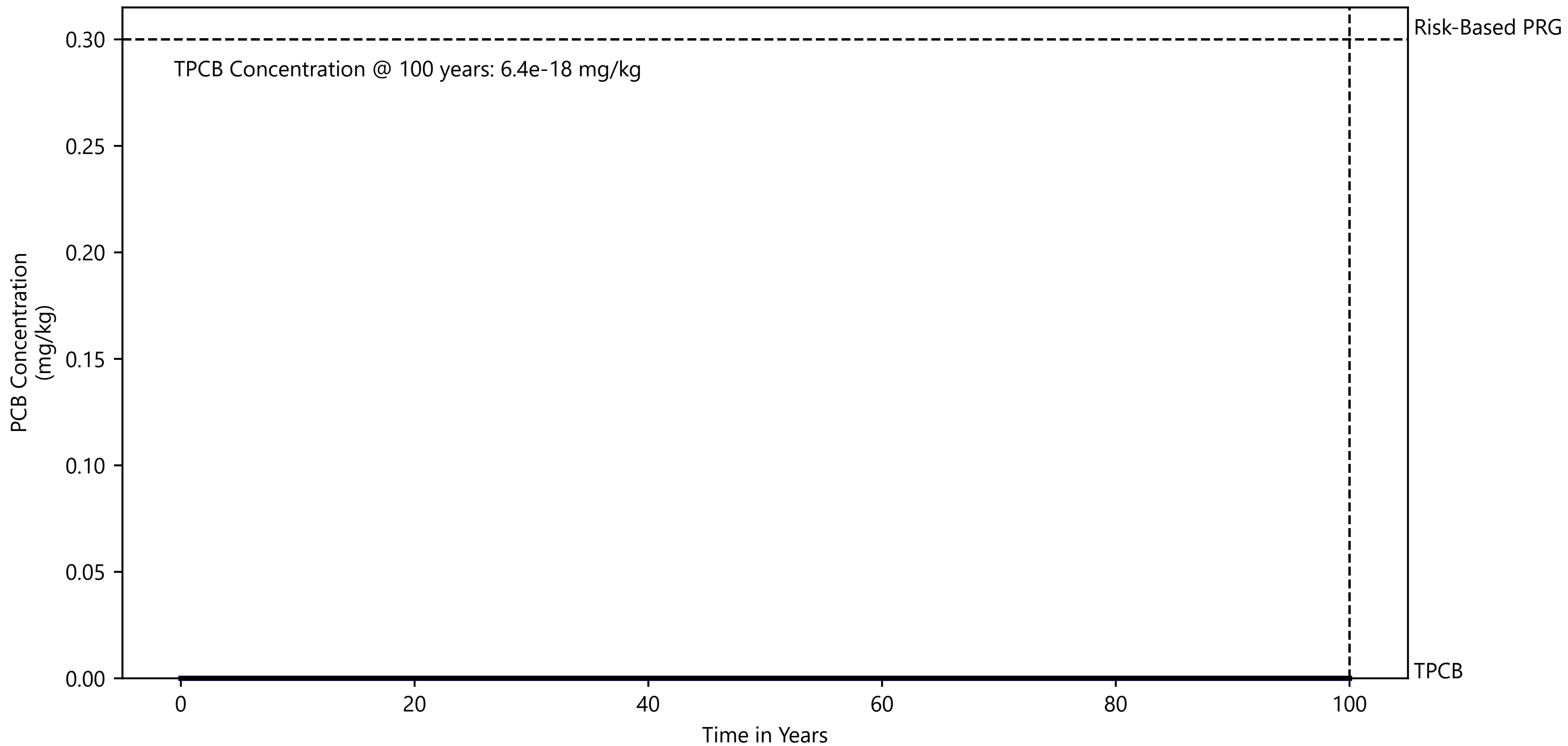
Figure C3-19a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (4.5% by Weight) Cap on Native Material
Capping Evaluations
Newtown Creek RI/FS



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Notes:
Source: output_2302-53a_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted total PCB concentration at year 100 is less than MDLs reported in East Branch non-detect sediment/native material samples.

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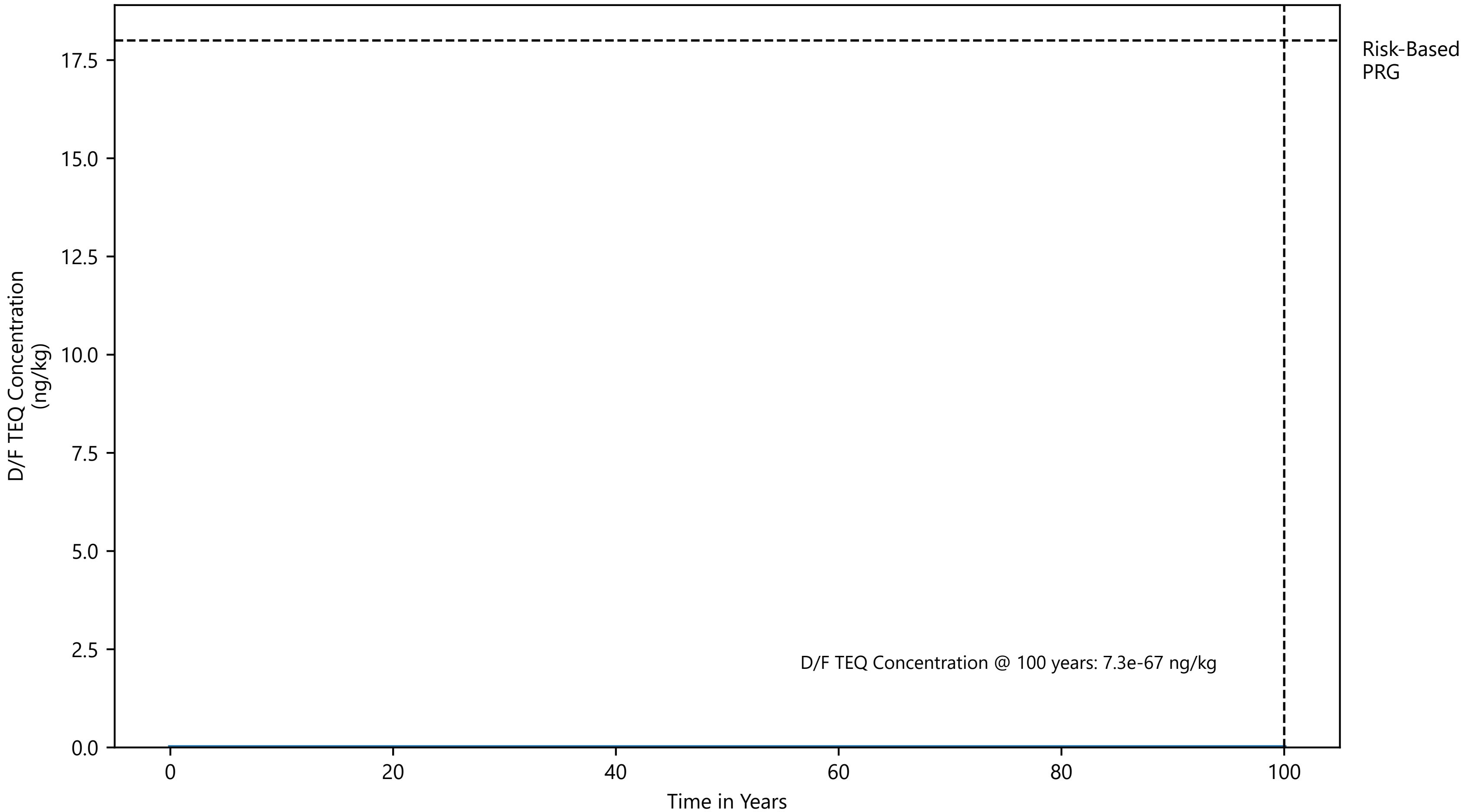
Figure C3-19b
Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (4.5% by Weight) Cap on Native Material



DRAFT FINAL

Notes:
Source: output_2304-01_DF-TEQ.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted D/F TEQ concentration at year 100 is less than MDLs reported in East Branch non-detect sediment/native material samples.

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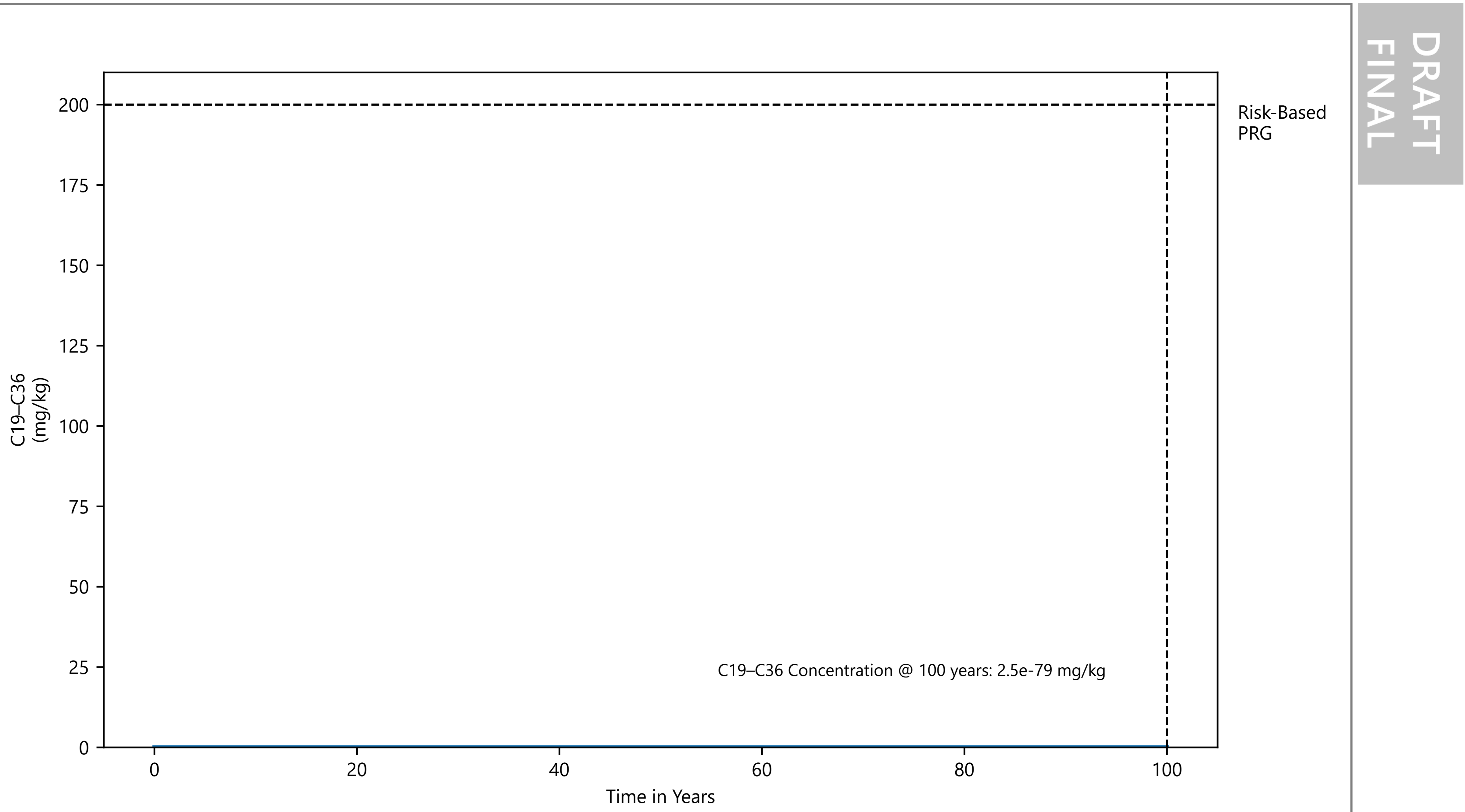
Figure C3-19c
Temporal Profile of D/F TEQ in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (4.5% by Weight) Cap on Native Material



Notes:
Source: output_2304-01_C19-C36.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted C19-C36 concentration at year 100 is less than MDLs reported in East Branch sediment/native material samples.

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Figure C3-19d
Temporal Profile of C19–C36 Aliphatics in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (4.5% by Weight) Cap on Native Material

Capping Evaluations
Newtown Creek RI/FS

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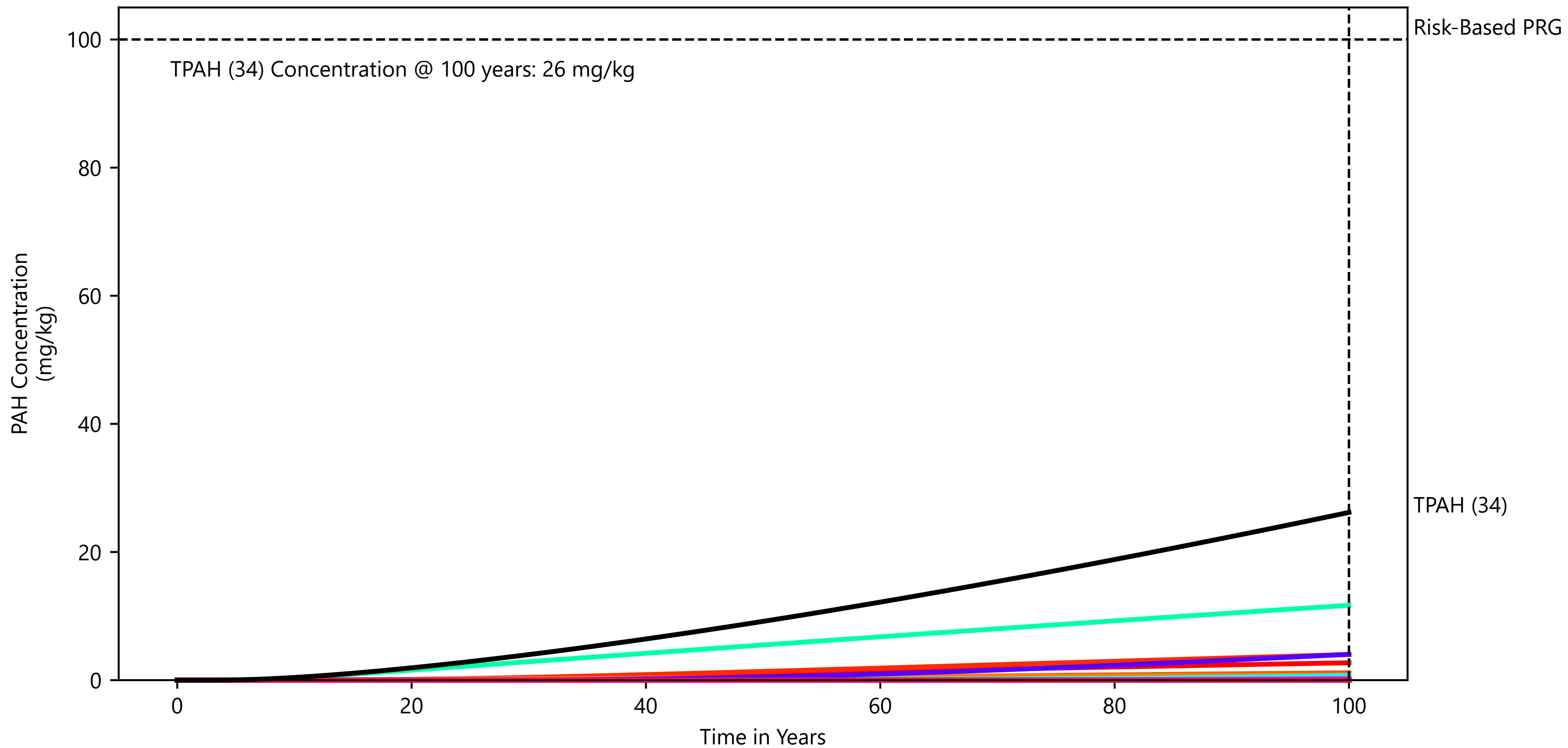

Notes:
Source: output_2302-37a_TPAH34.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.

1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(j,k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
C1-Benzo(a)anthracenesChrysenes
C1-FluoranthenesPyrenes
C1-Fluorenes
C1-PhenanthrenesAnthracenes
C2-Benzo(a)anthracenesChrysenes
C2-Fluorenes
C2-Naphthalenes
C2-PhenanthrenesAnthracenes
C3-Benzo(a)anthracenesChrysenes
C3-Fluorenes
C3-Naphthalenes
C3-PhenanthrenesAnthracenes
C4-Benzo(a)anthracenesChrysenes
C4-Naphthalenes
C4-PhenanthrenesAnthracenes
TPAH (34)

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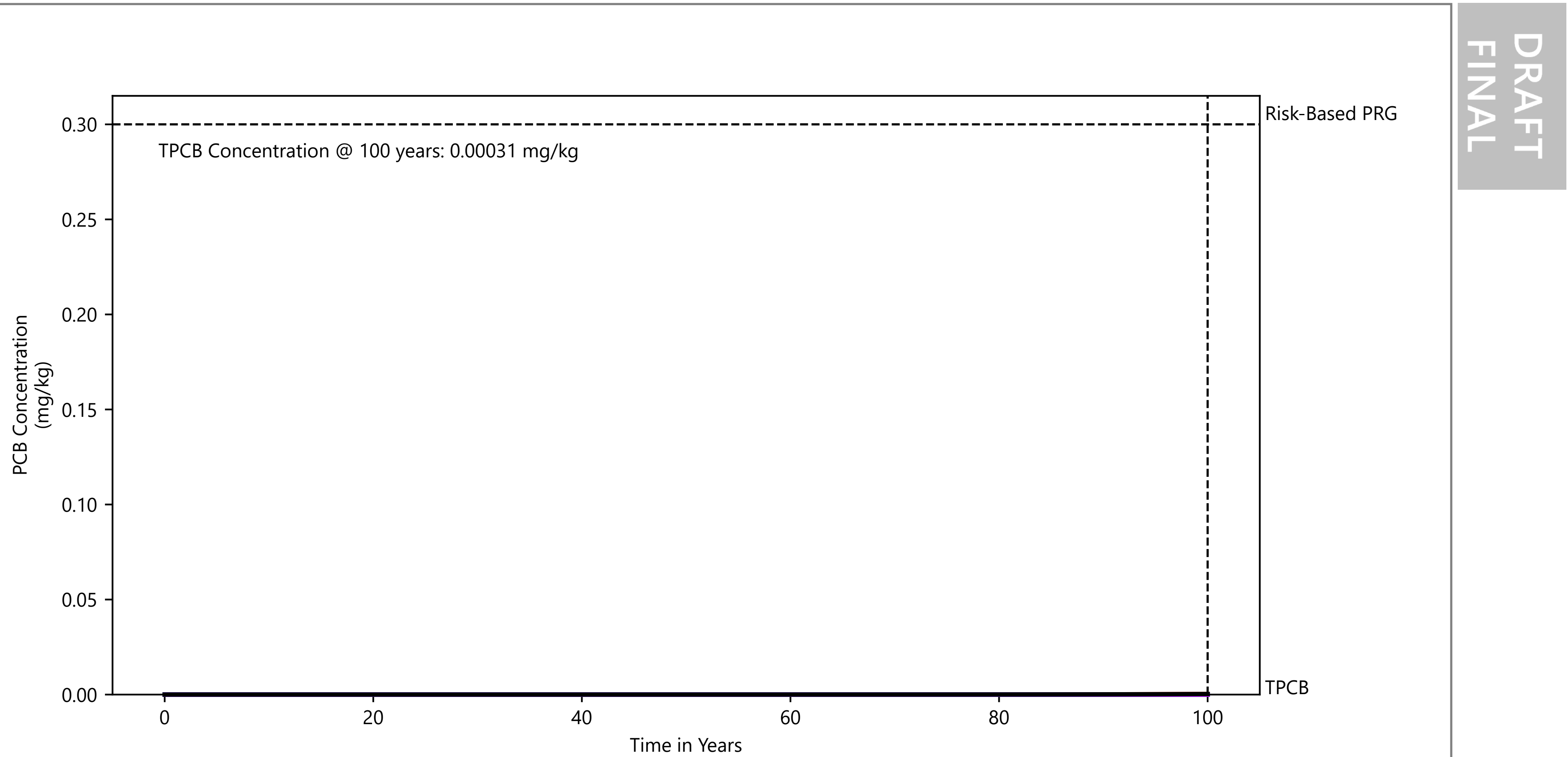
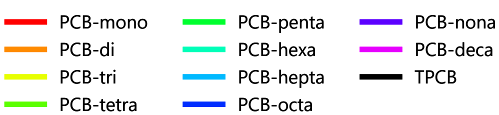
Figure C3-20a
Temporal Profile of Total PAH (34) in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (0.5% by Weight) Cap on Native Material (Alternate Sample)
Capping Evaluations
Newtown Creek RI/FS



Notes:
Source: output_2303-15_PCBs.csv.
The vertical dotted line at 100 years represents the length of time that protectiveness of the cap was evaluated.
Concentrations predicted by CapSim model.
The model-predicted total PCB concentration at year 100 is within the range of MDLs reported in East Branch non-detect sediment/native material samples.



Publish Date: 03/19/2024 11:49 AM | User: BAL-DGRA2
File Path: \\WCL-FS1\Syracuse\Projects\Newtown_Creek\MODEL\cap_model\East Branch 20221216\Python\CapSim_Temporal_wContribution.py

ANCHOR QEA

Figure C3-20b

Temporal Profile of Total PCBs in the Top 15 cm (Vertical Average) of a Sand and Activated Carbon (0.5% by Weight) Cap on Native Material (Alternate Sample)

Capping Evaluations
Newtown Creek RI/FS

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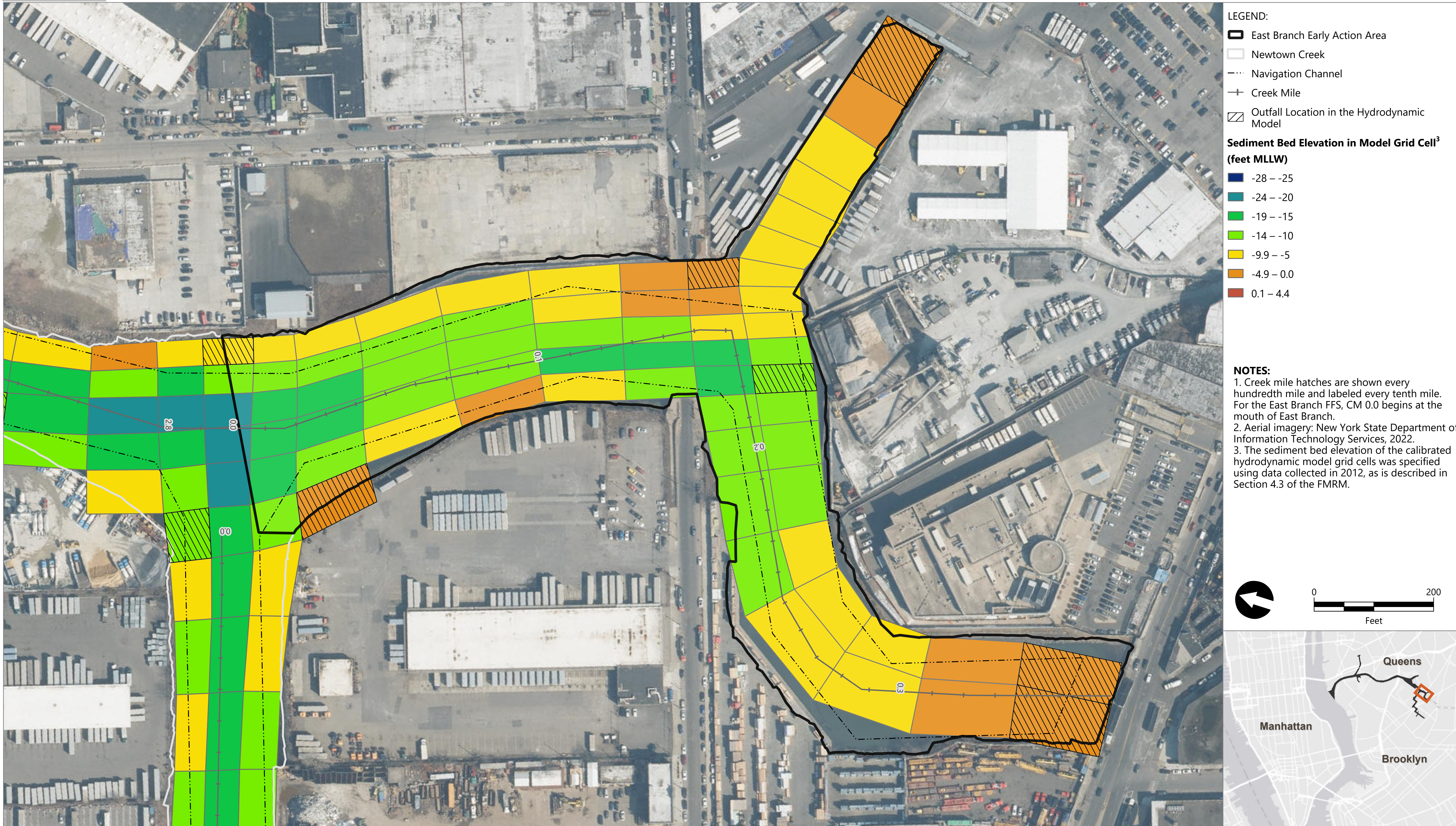

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. The sediment bed elevation of the calibrated hydrodynamic model grid cells was specified using data collected in 2012, as is described in Section 4.3 of the FMRM.

Publish Date: 2024/03/13, 9:27 AM | User: alesueur
Filepath: \\orcas\gis\Jobs\NewtownCreek_1037\NewtownCreek_RIFS\Maps\FS\Reports\EastBranch_FFS\EastBranch_FFS_Report\EBFFS_Appendix_BtoC.aprx

ANCHOR QEA

Figure C4-1
Sediment Bed Elevation in Each Hydrodynamic Model Grid Cell
Capping Evaluations
Newtown Creek RI/FS

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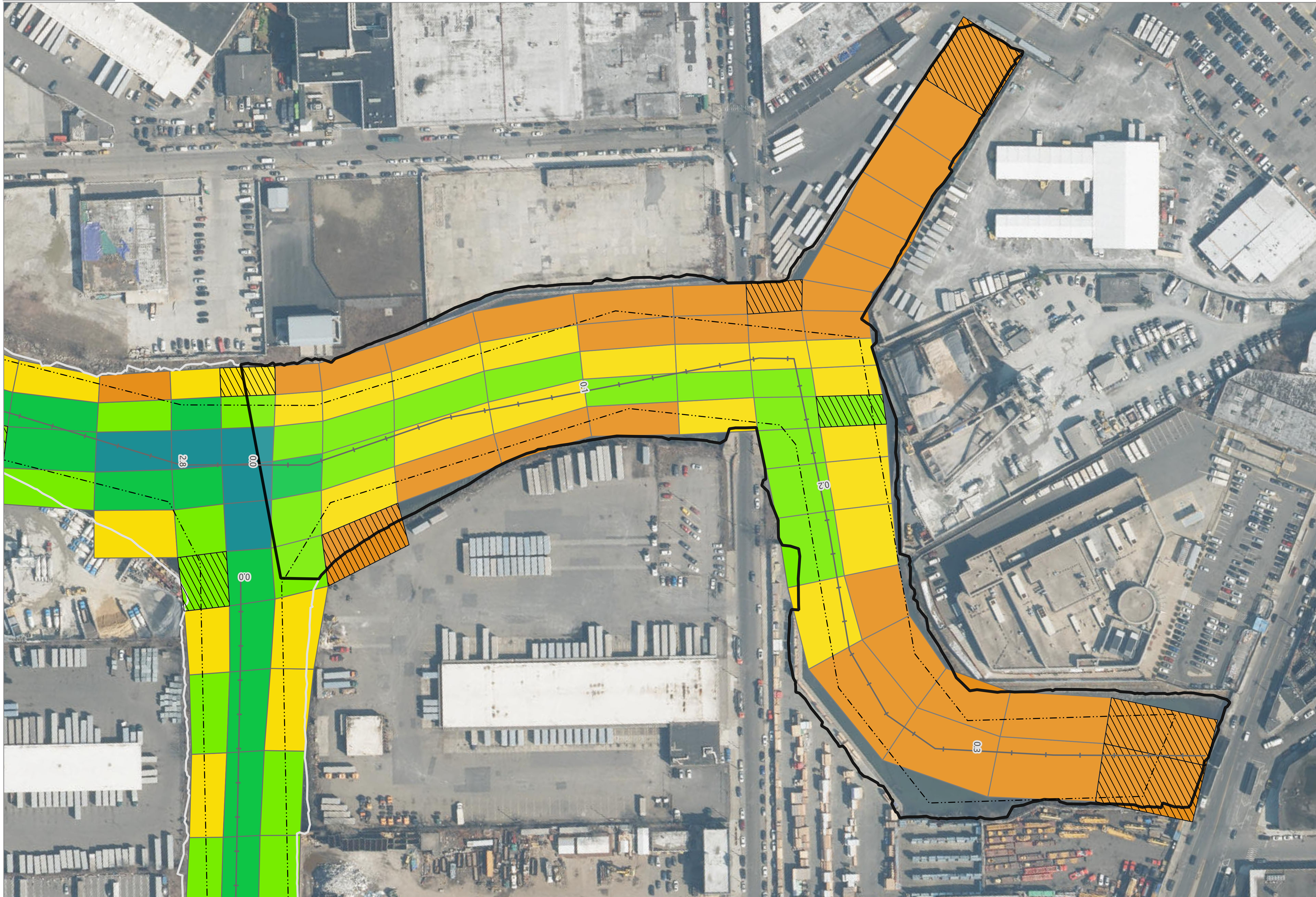

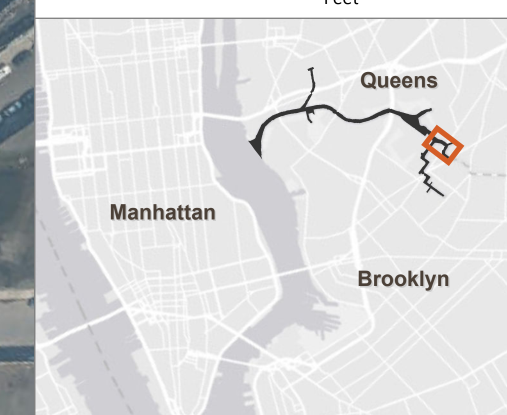

LEGEND:
- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Outfall Location in the Hydrodynamic Model

Revised Sediment Bed Elevation After Adjusting for Cap Thickness in Model Grid Cell[3]
(feet MLLW)
- -24 – -20
- -19 – -15
- -14 – -10
- -9.9 – -5
- -4.9 – 0.0

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. The revised sediment bed elevation represents the new bed elevation used in the hydrodynamic model following the installation of the cap.

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ANCHOR QEA

Figure C4-2
Sediment Bed Elevation After Adjusting for Cap Thickness
Capping Evaluations
Newtown Creek RI/FS

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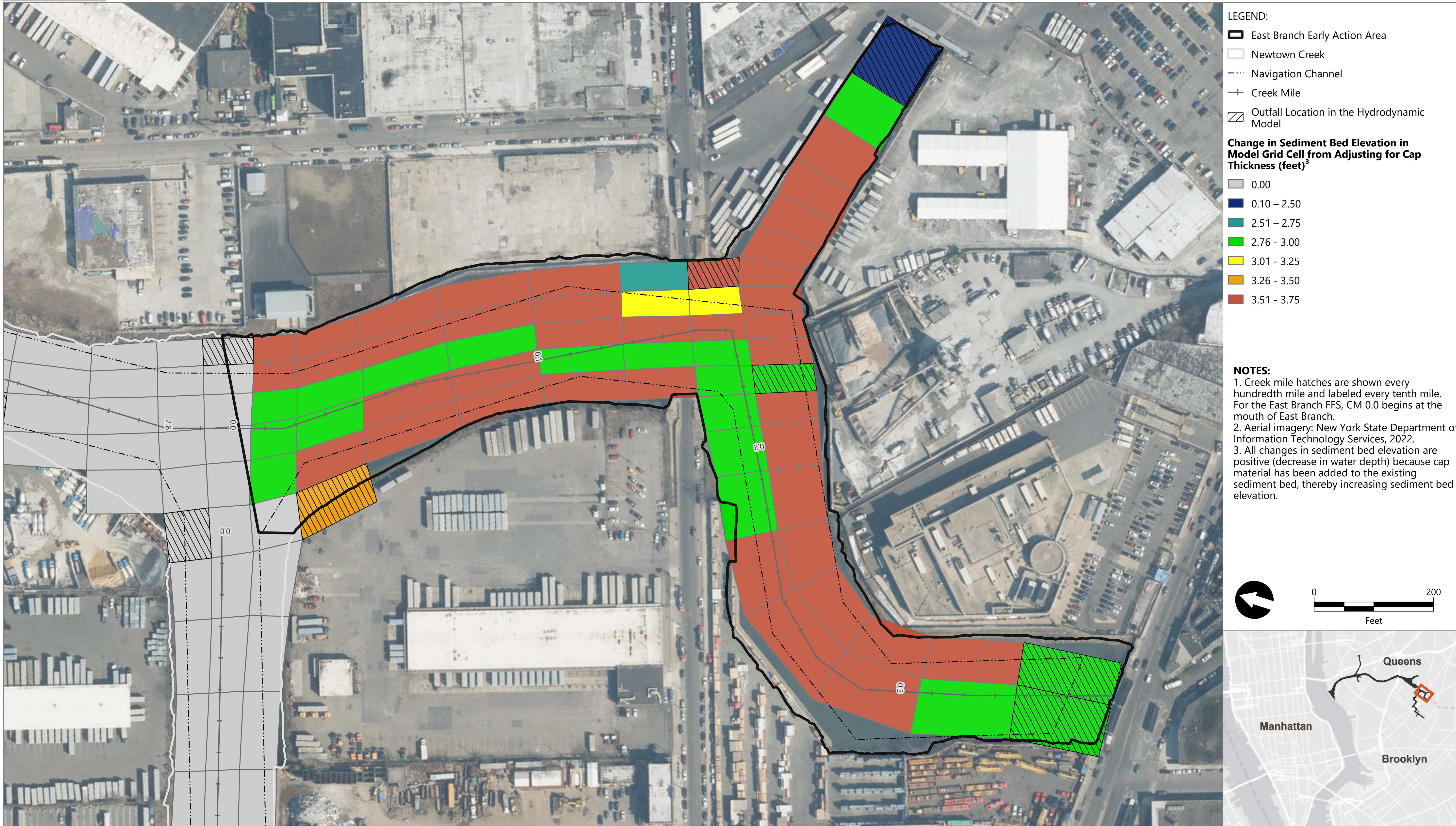

Publish Date: 2024/06/16, 3:17 PM | User: joliver
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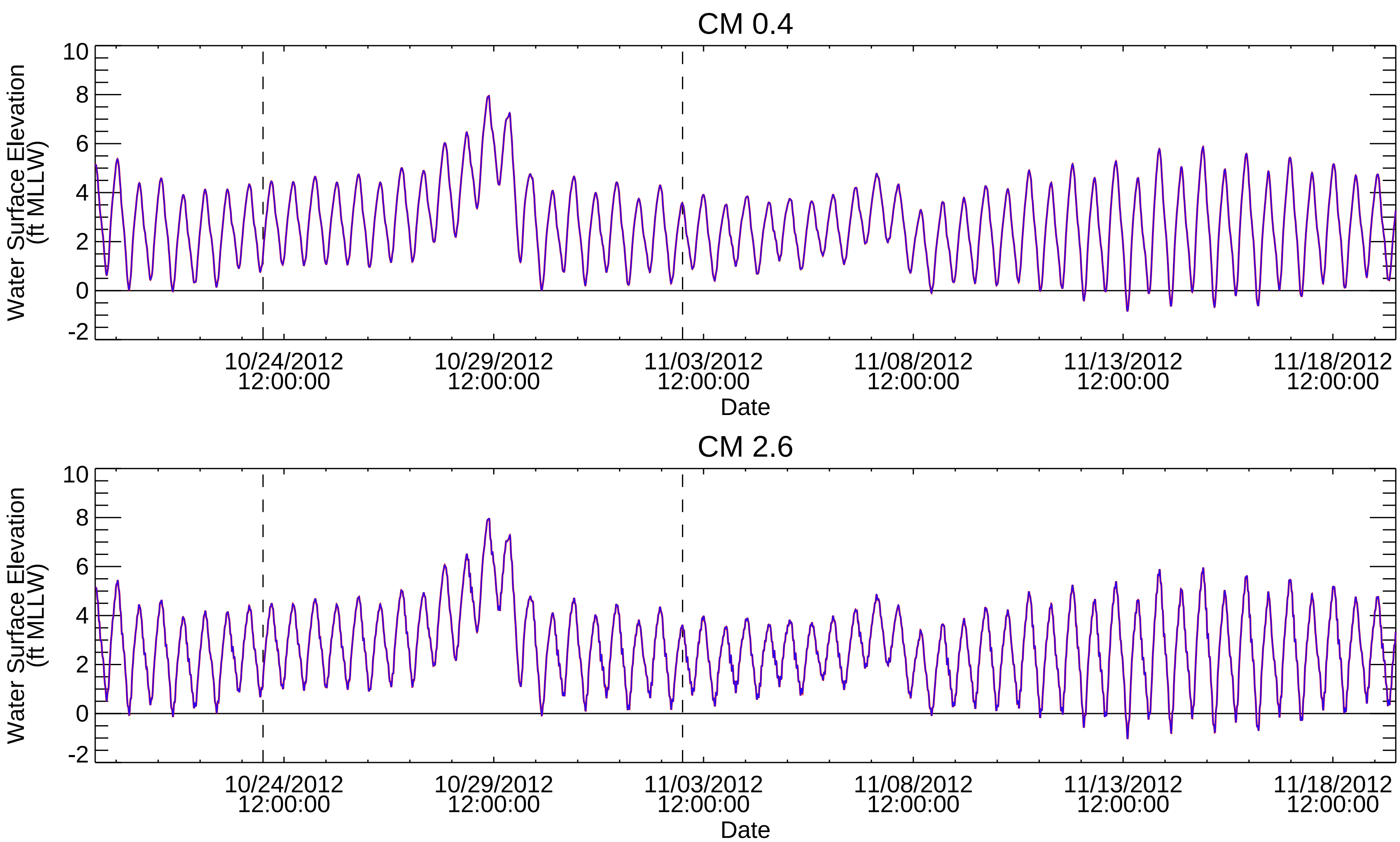
ANCHOR QEA

Figure C4-3
Change in Sediment Bed Elevation from Adjusting for Cap Thickness
Capping Evaluations
Newtown Creek RI/FS



Notes:
Vertical dashed lines represent query period.

Base Case Simulation
No-Rise Simulation (Alternative EB-B)

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ANCHOR QEA

Figure C4-4
Comparison of Predicted Water Surface Elevation at CM 0.4 and CM 2.6 During October 2012
Capping Evaluations
Newtown Creek RI/FS

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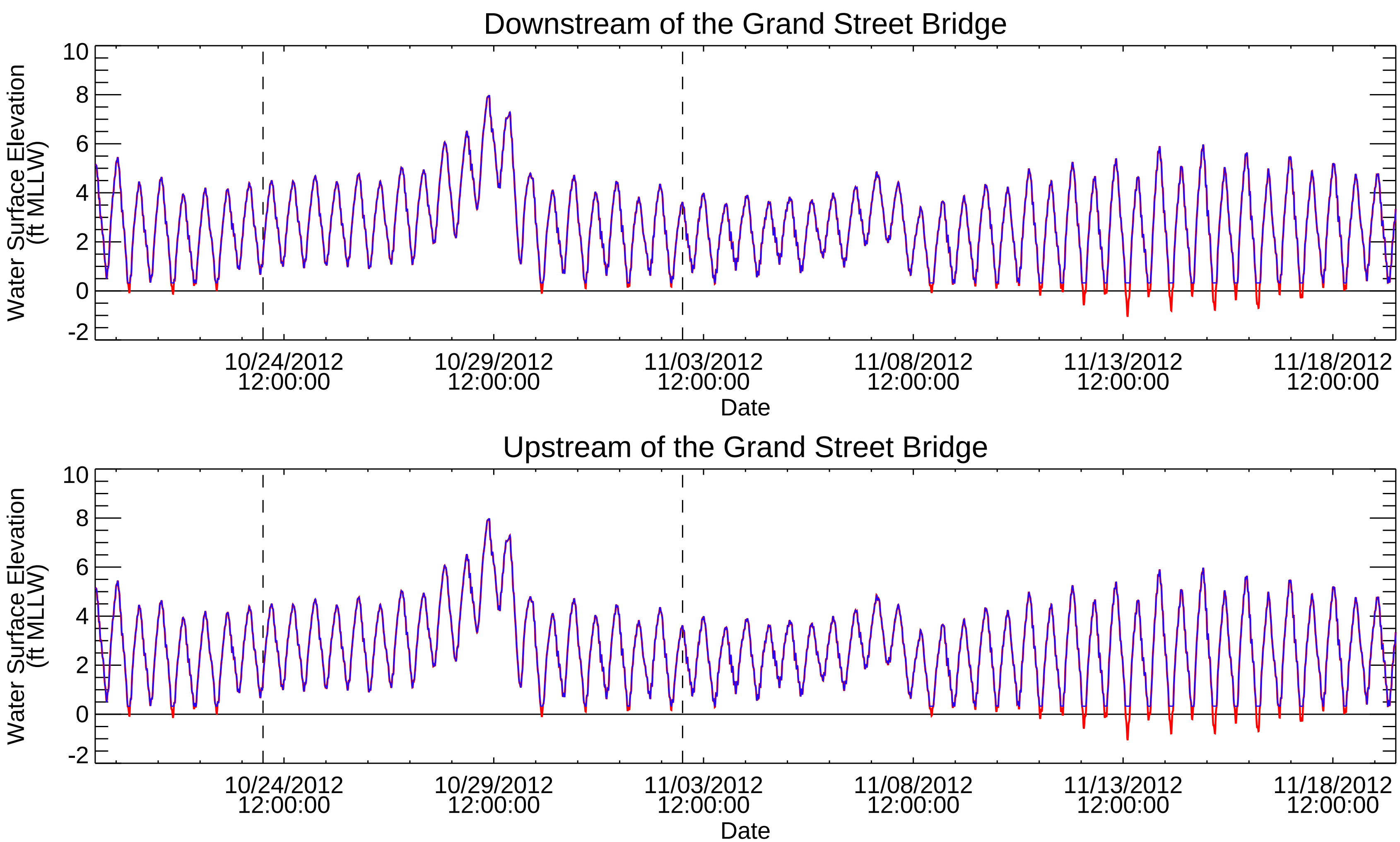

Notes:
Vertical dashed lines represent query period.

Base Case Simulation   No-Rise Simulation (Alternative EB-B)

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ANCHOR QEA

Figure C4-5
Comparison of Predicted Water Surface Elevation Downstream and Upstream of the Grand Street Bridge During October 2012

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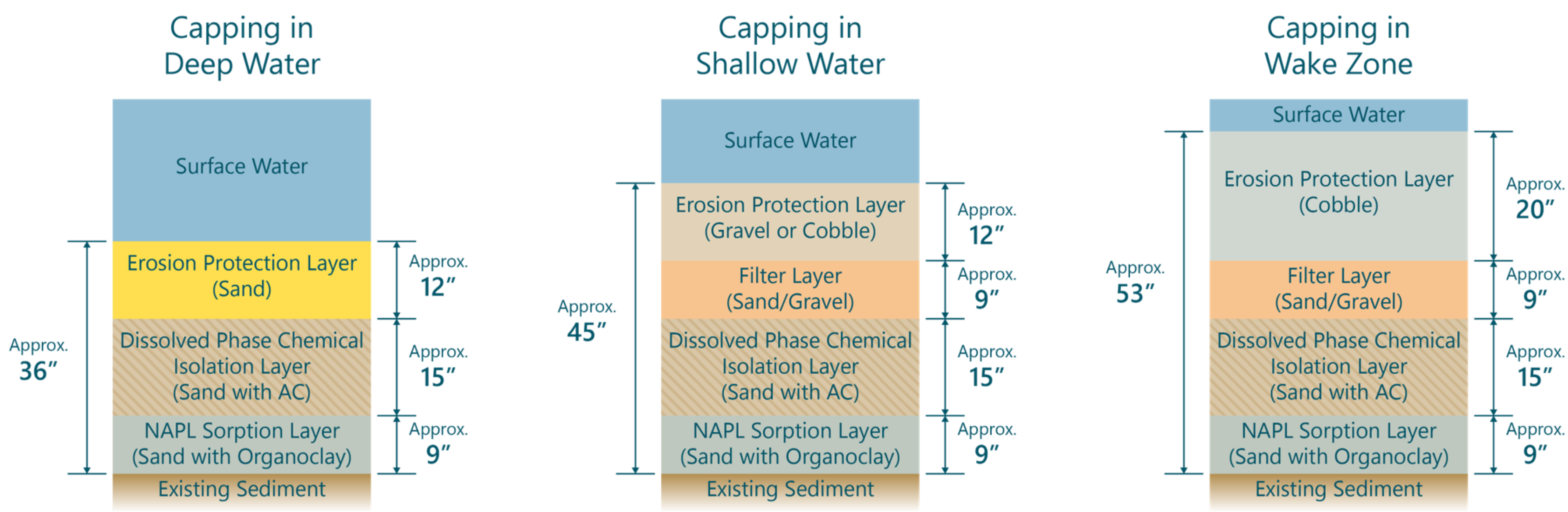

Note: The "capping in wake zone" erosion protection layer includes 6 inches of overplacement. All other layers include 3 inches of overplacement.
The need for a filter layer for "capping in shallow water" to be determined during the remedial design phase based on design material gradations.
AC: activated carbon
NAPL: nonaqueous phase liquid

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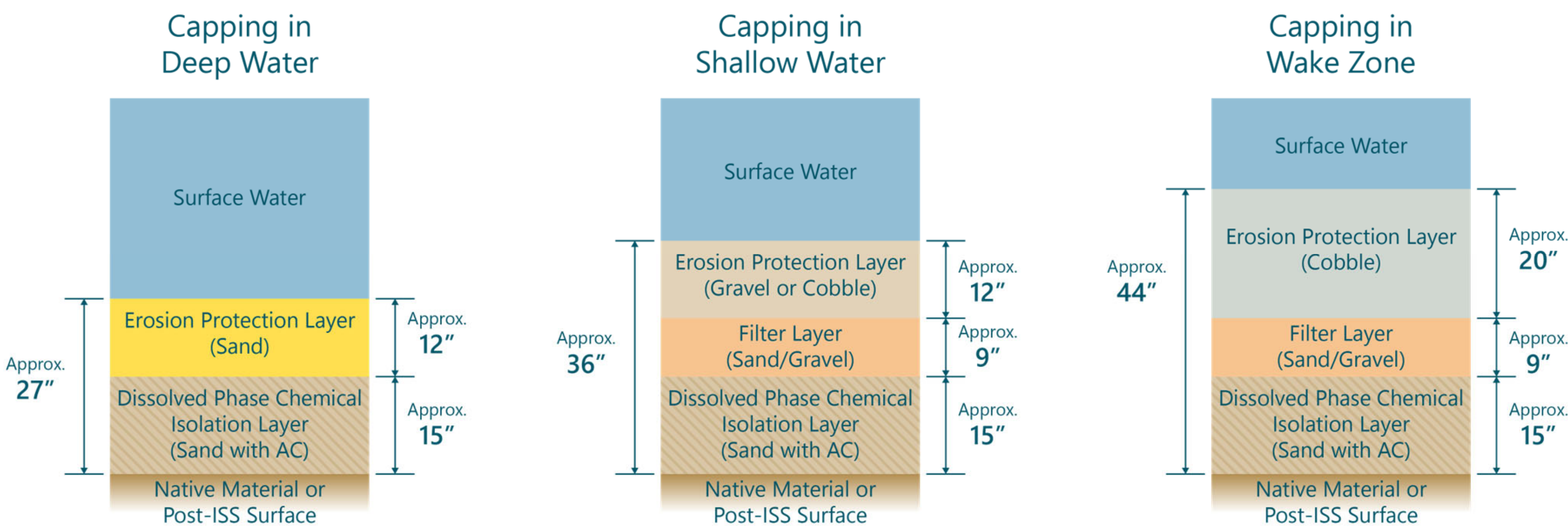
ANCHOR QEA

Figure C5-1
Preliminary Cap Configurations for Capping on Sediment



Notes: The "capping in wake zone" erosion protection layer includes 6 inches of overplacement. All other layers include 3 inches of overplacement.
The need for a filter layer for "capping in shallow water" to be determined during the remedial design phase based on design material gradations.
The need for a post-ISS cap would be based on treatability studies. Due to the uncertainties at this FFS stage, preliminary cap modeling was not performed for the post-ISS cap, but a preliminary design consisting of a chemical isolation layer amended with AC overlain by an erosion protection layer was assumed for the purposes of the FFS. It is assumed that the ISS process will eliminate the potential for ebullition-facilitated transport of NAPL; therefore, a separate NAPL sorption layer is not assumed for the post-ISS cap.
AC: activated carbon
ISS: in situ stabilization and solidification

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ANCHOR QEA

Figure C5-2
Preliminary Cap Configurations for Capping on Native Material and Capping on a Post-ISS Surface
Capping Evaluations
Newtown Creek RI/FS

Appendix D
Greenhouse Gas Emissions Evaluation

DRAFT FINAL


Photo by Bill Rhodes

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Greenhouse Gas Emissions Evaluation East Branch Early Action Focused Feasibility Study

Prepared for the Newtown Creek Group

DRAFT
FINAL

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Greenhouse Gas Emissions Evaluation East Branch Early Action Focused Feasibility Study

Prepared for
The Newtown Creek Group

Prepared by
Anchor QEA
123 Tice Boulevard, Suite 205
Woodcliff Lake, New Jersey 07677

Project Number: E41037-01.01
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ABBREVIATIONS

CAP	criteria air pollutant
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
EA	Early Action
EF	emission factor
FFS	Focused Feasibility Study
GAC	granular activated carbon
gal/hour	gallon per hour
GHG	greenhouse gas
HAP	hazardous air pollutant
ISS	in situ stabilization and solidification
kg	kilogram
MMBtu	million British thermal unit
MWh	megawatt hour
N_2O	nitrous oxide
NOx	oxides of nitrogen
NYC	New York City
PM_{10}	inhalable particulate matter
PTO	power takeoff
SEFA	Spreadsheets for Environmental Footprint Analysis
SOx	oxides of sulfur
ton	short ton (2,000 pounds)
tonne	metric ton (equivalent to 1.102 short tons and to 1,000 kilograms)
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1 Introduction

Six remedial alternatives to address sediments in the East Branch are being evaluated as part of the East Branch Early Action (EA) Focused Feasibility Study (FFS). One alternative is to take no action, and the other five alternatives include active remediation.[1] To support the EA FFS, greenhouse gas (GHG) emissions resulting from the implementation of the five active remedial alternatives were evaluated. Within the site remediation regulatory context, this evaluation is consistent with green remediation, defined by the U.S. Environmental Protection Agency (USEPA) as *"the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprint of cleanup actions"* (USEPA 2012). USEPA's "Consideration of Greener Cleanup Activities in the Superfund Cleanup Process" memorandum (USEPA 2016) and "Green Remediation Best Management Practices: An Overview" factsheet (USEPA 2022) were reviewed prior to developing this evaluation. The objective of this evaluation is to compare the GHG emissions of each remedial alternative to support evaluation of the alternatives and the ultimate selection by USEPA of a preferred alternative.

This appendix to the East Branch EA FFS describes the approach, methods, inputs, and calculations used to estimate GHG emissions for those components that are distinct to each of the five active remedial alternatives. This evaluation is not meant to represent a comprehensive account of emissions associated with implementing each remedial alternative; instead, the focus is only on the differences between the five active remedial alternatives under consideration.

In addition to the GHG emissions estimates presented in this appendix, USEPA's Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0 (USEPA 2019) were used to estimate metrics for other core elements of green remediation, including materials and waste, and water use, as well as criteria air pollutant (CAP) and hazardous air pollutant (HAP) emissions.

[1] GHG emissions were not estimated separately for the three nonaqueous phase liquid treatment options (i.e., in situ stabilization and solidification [ISS], amended capping, and dredging) within the 0.6-acre evaluation area in the Western Beef slip discussed in Section 5.1.1 of the FFS. Within the evaluation area, GHG emissions were estimated for the technologies presented for each remedial alternative in Section 5.2 of the FFS.

2 Approach and Methods

In general, a GHG emissions inventory is an account of GHGs emitted to (or removed from) the atmosphere during a specific period. GHG accounting is an important sustainability metric because emissions of carbon dioxide (CO_2) and other GHGs have been linked to climate change (USEPA 2012). This GHG assessment was conducted in general accordance with widely accepted international (WRI/WBCSD 2015; The Climate Registry 2019) and national (CCCL 2023) GHG accounting protocols and guidance. Emissions were calculated based on project-specific cost estimate-derived activity values and current USEPA GHG emission factors, when available.[2] Data sources and calculation methods are provided in Sections 3.2 through 3.4.

The primary fuel-consuming and emission-generating activities and sources anticipated to be distinct for each remedial alternative were reviewed in detail, as described in Section 3.

2.1 Operational Boundaries

Emissions accounting protocols (e.g., WRI/WBCSD 2015; CCCL 2023) specify establishing "operational boundaries" for the emission-generating entity under consideration (referred to as the reporting entity, which can be a country, company, or project). This process involves identifying emission sources associated with the "operations"—in this case, the anticipated activities associated with the implementation of each remedial alternative.

As discussed in Section 1, five active remedial alternatives are considered in this evaluation, and this emissions inventory focuses only on the differences between these alternatives and excludes emissions associated with components that are assumed to be similar between the five active remedial alternatives (i.e., site preparation, initial mobilization and final demobilization of equipment, and site restoration). The production of engineering controls (e.g., turbidity curtains) that may be used during in-water activities (e.g., dredging and in situ stabilization and solidification [ISS]) to comply with surface water-related regulations or project requirements outside of the work zone are also assumed to be approximately consistent among alternatives and are not included in these comparative GHG calculations. The operational boundaries for the five active remedial alternatives are best outlined in the detailed and comparative analysis included in Sections 6 and 7 of the FFS.

The emission-generating activities and sources identified for the five active remedial alternatives under consideration are described in Section 2.2. The inputs and calculations are described in Section 3.

[2] Alternative emissions factors were used for processes not covered by USEPA sources. These data sources are defined alongside relevant emissions calculations in Attachment D-A, as well as in Sections 3.2 through 3.4.

2.2 Emissions Categories

Emissions accounting protocols include identifying emission-generating activities and sources and categorizing these emissions as Scope 1 (direct emissions), Scope 2 (indirect emissions), or Scope 3 (other indirect emissions).

2.2.1 Scope 1: Direct Emissions

Scope 1 (direct) emissions are from sources that are owned or controlled by the reporting entity (e.g., stationary, mobile, and process-related emission sources). In the context of the remedial alternatives being evaluated in the EA FFS, direct emission sources include the transportation of materials and equipment to and from the site and construction activities related to bulkhead stabilization, installation, and replacement; ISS; dredging; and backfilling and capping with clean fill material, as described in Section 3.2.

2.2.2 Scope 2: Indirect Emissions

Scope 2 (indirect) emissions are a consequence of activities by the reporting entity but occur at sources owned or controlled by another entity. Scope 2 emissions specifically result from the import or purchase of electricity, heating/cooling, or steam, and related transmission and distribution. For this assessment, Scope 2 emissions have been estimated for purchased electricity used to operate the water treatment system to treat supernatant water generated during sediment dewatering operations and from direct contact with stormwater in the sediment processing area, as described in Section 3.3.

2.2.3 Scope 3: Other Indirect Emissions

Scope 3 (other indirect) emissions are a consequence of the activities of the reporting entity but occur from sources not owned or controlled by that entity and are not part of that entity's direct or indirect emissions. Examples of Scope 3 emission sources might include extraction and production of purchased materials; extraction, production, and transportation of purchased fuels; use of sold products; or employee commuting (WRI/WBCSD 2015; CCCL 2023).

For this evaluation, the production of Portland cement, virgin granular activated carbon (GAC),[3] organophilic clay (organoclay), sand, gravel, armor, and steel are evaluated as Scope 3 emission sources, as described in Section 3.4, due to the energy-intensive manufacturing processes for these materials. The items listed above comprise nearly all materials used in the proposed project. No additional materials are expected to be used in quantities that would significantly impact the GHG assessment. For most materials, GHG emissions were calculated from the CO_2 equivalent (CO_2e)

[3] For this FFS, activated carbon is assumed as a capping amendment to achieve long-term protectiveness of the remedy. The selection of the type or form of activated carbon (i.e., GAC or powdered activated carbon) would be made during the remedial design phase. However, a specific type of activated carbon needed to be selected as an input to USEPA's SEFA; therefore, for the purposes of this GHG emissions inventory, virgin GAC was assumed.

global warming potential from Randall et al. (2016). This is also the source used by USEPA's SEFA Version 3.0 for quantifying the environmental footprint of remediation projects. CO_2e emission factors (EFs) for organoclay and steel are not provided in Randall et al. (2016); therefore, alternative CO_2e EFs for the manufacture of these materials were obtained from the organoclay manufacturer specification sheet (CETCO 2014) and the environmental product declaration for steel sheeting released by steel manufacturer SSAB (SSAB 2023). Long-term cap maintenance is assumed to require 5% of the original cap material volumes for each alternative based on our experience with projects of similar size and scope.

Alternate amendments for stabilization or alternate stabilization techniques (if found acceptable from a technical basis during the remedial design phase) could increase the sustainability aspects of the project. Other emissions of this type (e.g., emissions from refining the diesel fuel to be used in bulkhead/shoreline stabilization work, ISS, dredging, and backfill and capping activities) have not been included because they were considered beyond the scope of this evaluation.[4]

Due to differences in construction schedules associated with the five active remedial alternatives, employee commute emissions were also evaluated as part of Scope 3. The total workforce for each project component was estimated as part of the engineering cost estimates (see Appendix F of the FFS), and workers were assumed to commute to and from the worksite each day for the duration of each project component. Transportation methods were assigned to workers based on the U.S. Census Bureau American Community Survey method of transportation data for construction workers in the New York City (NYC) metropolitan area (USCB 2021). Greenhouse gas EFs were assigned based on the weighted average of the individual modes of transit (USEPA 2023a).

Scope 3 emissions sources include transportation associated with purchased materials (Portland cement, backfill and cap material [sand, GAC, organoclay, gravel, and stone], and bulkhead steel sheeting) and disposal of post-stabilized dredged sediment. Although transportation of these materials may fall under the ownership of a contracted entity (e.g., a third-party vendor), the emissions resulting from these activities are included in the direct emissions category because they are considered significant components of the remedial alternatives.[5]

[4] If any alternate fuels (e.g., biodiesel) are deemed feasible and appropriate for use in transportation of materials, or for other activities, this will also increase the sustainability aspects of the project.

[5] Chapter 4 of *GHG Inventory Development Process and Guidance* (CCCL 2023) refers to the consolidation approach as an aid to determine whether some activities should be included in Scope 1 or 3. Because the reporting entity in this project controls the source, destination, and volume of materials transported, these activities were categorized as direct emissions.

3 Inputs and Calculations

Inputs are based on the specific design parameters associated with the five active remedial alternatives (e.g., material quantities and component activities) and are consistent with the engineering cost estimates (see Appendix F) prepared for the FFS (which, in turn, are based on experience from similar projects and professional judgment). EFs for CO_2, methane (CH_4), nitrous oxide (N_2O), and CO_2e are based on published information from USEPA and other literature sources, as needed, and are presented in Table D3-1. Section 3.1 provides a summary of the five active remedial alternatives. Details of the information and calculations used to estimate GHGs for each emissions category are provided in Sections 3.2 through 3.4.

3.1 Active Remedial Alternatives

A summary of the five active remedial alternatives (and Alternative EB-A, which was not evaluated in this appendix) is provided as follows and in Table D3-2:

- **Alternative EB-A:** No Action
- **Alternative EB-B:** Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW
- **Alternative EB-C:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths
- **Alternative EB-D:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging
- **Alternative EB-E:** Dredge All Within Navigation Channel, Cap Outside
- **Alternative EB-F:** Dredge All

Section 5 of the FFS discusses each of the remedial alternatives in detail.

3.2 Scope 1 Activities

Scope 1 sources are related to combustion of diesel fuel due to transportation of materials, operation of construction equipment used for bulkhead/shoreline stabilization work, ISS, dredging, backfilling and capping activities, long-term cap maintenance, and interim winterization and remobilization of construction equipment between construction seasons.

For sources related to the transportation of materials, GHG emissions were estimated based on material quantities (in tons), ton-mile-based EFs (USEPA 2023a) presented in Table D3-1, and the following input parameters:

- Distance traveled in miles (based on reasonable assumptions regarding the source and endpoint locations for these materials)
- The most feasible or appropriate transport method (truck, barge, or rail)

Assumptions related to material transport (distance and mode of transport) are summarized for all relevant components in Table D3-3.

For bulkhead/shoreline stabilization work, ISS, dredging, backfill, and capping activities, GHG emissions were estimated based on the CO_2, CH_4 and N_2O EFs for diesel fuel combustion in construction equipment, boats, and off-road trucks (USEPA 2023a) and the following input parameters:

- Assumed construction equipment type and quantity by project component
- Estimated fuel consumption rates for each type of equipment (gallons per hour [gal/hour])
- Estimated total equipment operating time (hours) using an assumed uptime of 60% for any particular piece of equipment[6]
- Estimated production rates based on professional experience on similar projects, with consideration of equipment specifications and best management practices

Construction equipment types and quantities required for each remedial alternative were determined based on professional experience on similar projects, and specifications (e.g., horsepower) were obtained from vendors and reliable equipment databases (e.g., EquipmentWatch[7]). Fuel consumption rates for each piece of equipment were derived using an equation in *Predicting Tractor Diesel Fuel Consumption* (Grisso et al. 2010), as shown in Equation 1:

Equation 1

$$Q_{AVG} = a^{`} * P_{PTO}$$

where:

Q_{AVG}	=	average diesel consumption (gal/hour)
P_{PTO}	=	rate power takeoff (PTO) power (horsepower)
a`	=	0.044 gallon per horsepower per hour

The calculated fuel consumption rate for each piece of equipment was then verified using manufacturer equipment documentation.

For interim winterization and remobilization, GHG emissions were calculated for the transportation of construction equipment to and from the site and for operation of a crane used for loading and off-loading of equipment onto trucks. Transportation-related emissions were calculated following the same method and assumptions presented above for the transportation of materials with an assumed round-trip distance of 200 miles for each interim winterization and remobilization event. Because a contractor has not been identified for the work, a one-way distance of 100 miles was

[6] Uptime estimates vary for production sites upstream and downstream of the Grand Street Bridge. The 60% uptime assumption used to estimate construction equipment GHG emissions is a simplifying assumption that represents an average of the specific uptime assumptions used in the engineering cost estimate for purposes of calculating dredge, backfill, and cap production rates. Additional information about uptime estimates is presented in Appendix F of the FFS.

[7] EquipmentWatch is available at: https://equipmentwatch.com/.

selected as a reasonable distance equipment may transit (e.g., to reach a maintenance facility or another construction site) to allow for comparison between remedial alternatives. In addition, miscellaneous equipment (e.g., light towers and field trailers) was assumed to be rented from regional vendors within 25 miles of the site. Emissions from crane operations were calculated following the same method and assumptions presented above for bulkhead work, ISS, dredging, backfill, and capping operations.

It is assumed that there would not be significant differences in monitoring and repair activities between the alternatives; this would also be the case for GHG emissions. Maintenance activity is expected to scale with the amount of capping material used during initial implementation. For this reason, GHG emissions for long-term maintenance are estimated based on a flat percentage (5.0%) of the initial cap material volume and on-site equipment activity for each alternative based on our experience with projects of similar size and scope.

Additional details regarding calculation inputs are provided in Attachment D-A.

3.3 Scope 2 Activities

For purchased electricity, relevant input parameters include power requirements for the water treatment system that will be used to treat the supernatant water generated during sediment dewatering operations and from direct contact with stormwater, as well as the most recent CO_2e emission rate (817.9 pounds per megawatt hour, year 2021) for the NYC/Westchester subregion[8] (USEPA 2023b).

3.4 Scope 3 Activities

As discussed in Section 2.2.3, the production of Portland cement, virgin GAC, organoclay, and steel has been estimated as a Scope 3 emission source because all are relatively energy-intensive components that represent a significant contribution to overall emissions. USEPA maintains (Randall et al. 2016; USEPA 2023c) several EFs for chemicals and construction materials, including Portland cement, sand, gravel, armor, and GAC (primary [i.e., virgin] and regenerated). Steel and organoclay are not analyzed in Randall et al. (2016), so alternative sources were utilized for these materials. A CO_2e emission factor for organoclay was obtained from a manufacturer carbon footprint analysis of the material (CETCO 2014). Finally, an EF for steel was obtained from the environmental product declaration for steel sheeting released by steel manufacturer SSAB (SSAB 2023). These EFs are reported as CO_2e normalized by global warming potential over a 100-year period.

[8] The Northeast Power Coordinating Council's NYC/Westchester subregion is defined by the North American Electric Reliability Corporation and USEPA's eGRID (USEPA 2023b).

To estimate these emissions associated with material production, the following CO_2e EFs were used (CETCO 2014; Randall et al. 2016; USEPA 2023c; SSAB 2023):

- Portland cement: 1.34 kilograms (kg) of CO_2e per kg of material
- Sand/gravel/armor: 0.0024 kg of CO_2e per kg of material
- Virgin GAC: 4.8 kg of CO_2e per kg of material
- Organoclay: 2.07 kg of CO_2e per kg of material
- Steel sheeting: 2.41 kg of CO_2e per kg of material

Worker commute emissions were estimated based on the total estimated workforce for each project component. Workers were assumed to commute to and from the worksite each day for the duration of each project component. Non-union[9] workers were assumed to stay in lodging relatively close to the site and would commute an average of 5 miles each way (10 miles round trip). Local union[10] workers were assumed to commute an average of 25 miles each way (50 miles round trip) from various localities within the New York/New Jersey metro region. A transportation method (e.g., public transit, carpool, or car/truck solo) distribution among workers was developed based on U.S. Census Bureau American Community Survey data on the method of transportation for construction workers in the NYC metropolitan area (USCB 2021). Greenhouse gas EFs for CO_2, CH_4, and N_2O were calculated based on the weighted average of the individual modes of transit (USEPA 2023a).

[9] Non-union workers were assumed to be housed in hotels near the site, so the commute distance was shortened to 5 miles. Union workers, who live locally, were assumed to be dispersed throughout the area, not concentrated around the site.

[10] Mode of transit is accounted for in the development of emissions factors, using U.S. Census Bureau American Community Survey data on commuter mode of transit by metro area and industry. Roughly 58% of construction workers in NYC travel by car, solo, for example, and this is reflected in the weighted average emissions factors. Public transit and carpooling are also considered in this way, based on their relative usage in the sector. Although there are not readily available data on average commute distance, commute time surveys indicate that NYC workers have one of the longest average commute times in the country. So, while the commute distance may be shorter, the overall time spent in a vehicle (for the 50+% who drive alone to work) is longer than other areas of the country. An assumption of 25 miles for one-way commute distance is common for construction projects.

4 Results

Attachment D-A presents the estimated GHG emissions associated with the five active remedial alternatives (see Attachment Tables D-A-1, D-A-2, D-A-3, D-A-4, and D-A-5) for the various emission-generating components discussed herein. All emissions are presented in tonnes (i.e., metric tons or 1,000 kg) of CO_2e. A summary of the total estimated CO_2e emissions is presented in Table D4-1 and Figure D4-1.

As this summary illustrates, Alternative EB-B has the least mass of overall CO_2e emissions of the active remedial alternatives. Alternative EB-C is expected to result in approximately 104% greater overall emissions than Alternative EB-B, Alternative EB-D is expected to result in approximately 9% greater overall emissions than Alternative EB-C (and 123% greater than Alternative EB-B), Alternative EB-E is expected to result in approximately 96% greater overall emissions than Alternative EB-D (and 337% greater than Alternative EB-B), and Alternative EB-F is expected to result in approximately 10% greater overall emissions than Alternative EB-E (and 381% greater than Alternative EB-B).

As Figures D4-1 and D4-2 show, the largest source of emissions for each alternative was production of raw materials (Scope 3). Scope 3 emissions made up a range from 55% (Alternative EB-B represents the low end of the range) to 61% (Alternatives EB-D and EB-E represent the high end of the range) of total GHG emissions for the alternatives. Of these materials, the Portland cement used in dewatering and ISS has the greatest impact, accounting for 65% (Alternative EB-B) to 97% (Alternative EB-F) of combined emissions from raw materials production. Emissions from materials for cap maintenance activities account for less than 1% (Alternatives EB-E and EB-F) up to 2% (Alternative EB-B) of combined emissions from raw materials production. For Scope 1 emissions, on-site construction equipment activity is the largest GHG emission activity, accounting for 17% (Alternative EB-E) to 26% (Alternative EB-B) of overall emissions. Emissions from electricity used (Scope 2) were comparatively negligible for all alternatives. Overall, total GHG impacts were most heavily affected by the amount of dredged material, with increasing impacts from Alternatives EB-B to EB-F due to the increases in the duration of the project, the volume of waste transported, and the quantity of Portland cement required.

4.1 Emission Equivalencies

To provide some context to the GHG emissions estimated for the five alternatives, several comparison equivalencies have been summarized in Table D4-2 using the USEPA GHG Equivalencies Calculator (USEPA 2023d). This table illustrates the magnitude of other activities that would result in CO_2e emissions estimated for each remedial alternative. Specifically, Table D4-2 shows the following comparisons for activities that would generate or sequester equivalent amounts of CO_2e:

- Number of passenger vehicles driven for 1 year
- Number of gallons of gasoline consumed

- Number of homes with CO_2e emissions generated from average annual energy usage
- Number of tree seedlings grown for 10 years to sequester equivalent CO_2 emissions

5 Green Sediment Remediation

This section is intended to provide discussion of the other core elements of USEPA's green sediment remediation. In addition to the GHG emissions described in Sections 1 through 3, these elements include CAP emissions (oxides of nitrogen [NOx], inhalable particulate matter [PM_{10}], and oxides of sulfur [SOx]) and HAP emissions (volatile organic compounds [VOCs]), water consumption (in gallons), total energy used (in million British thermal units [MMBtu]), non-hazardous waste landfill space required (in short tons), hazardous waste landfill space required (in short tons), and virgin fill required (in short tons). USEPA SEFA Version 3.0 (USEPA 2019) was used to estimate these metrics for Alternative EB-B using the data inventory presented herein to estimate GHG emissions. Alternatives EB-C through EB-F were not evaluated fully using SEFA, as most outputs were redundant to estimates already calculated in the development of this report and costs. Specifically, only total energy used was estimated for all alternatives using SEFA Version 3.0 methods. CAP and HAP emissions for Alternatives EB-C through EB-F were estimated by scaling Alternative E-B emissions according to total GHG emissions for each alternative (as reported in Table D4-1) relative to Alternative EB-B. Summary values for water consumption, landfill space, and fill volumes for all alternatives are included based on quantitative estimates developed for the cost estimate. Results, discussed in Section 5.1, are presented in Table D5-1, and SEFA spreadsheets for Alternative EB-B are included in Attachment D-B.

5.1 Green Remediation Metrics Comparison

The five core elements of green remediation include materials and waste, water, energy, air, and land and ecosystems. The results of the environmental footprint analysis for these five core elements are summarized in the following subsections.

5.1.1 Materials and Waste

The metrics associated with materials and waste, which are applicable to this project, involve on-site use of refined and unrefined materials, as well as the off-site disposal of volumes of hazardous and non-hazardous waste for each alternative. The percentage of recycled materials used was not evaluated because it was assumed to be zero for all alternatives.

Refined material volumes, including materials such as Portland cement, steel, GAC, and organoclay, were far smaller than the volumes of unrefined materials used in each alternative, but the environmental impact per ton is generally much higher for refined materials.

Refined material use was highest in Alternative EB-F (because of the large volume of Portland cement required to stabilize a large volume of dredged material) and lowest in Alternative EB-B (small volume of dredging to be stabilized with Portland cement). Conversely, Alternative EB-B had the highest use of unrefined materials (because of large quantities of sand, gravel, and armor needed to cover a larger acreage of capping) and lowest in Alternative EB-F (which has the smallest acreage of capping). Alternative EB-F featured the largest quantities of both hazardous and non-hazardous waste addressed by off-site disposal of all the alternatives, and Alternative EB-B resulted in the smallest quantities of each.

5.1.2 Water

Public water use was limited to water needed to mix grout for ISS and did not vary drastically between alternatives. Each alternative consumed between 0.3 million gallons (Alternative EB-F) and 1.4 million gallons (Alternative EB-B) over its respective duration. For context, the New York City Water Supply System provides 1 billion gallons of water to the City's 8.5 million residents every day.

5.1.3 Energy

Energy metrics relate to the amount of total on- and off-site energy used and to the total amount of on-site grid electricity used. Note that total energy used refers to the total amount of energy used by the remedy for on-site and off-site activities, including electricity generation, transportation, materials manufacturing, and other off-site activities that support the remedy. This total does not include electricity consumed on site.

The total energy used is the lowest for Alternative EB-B (496,000 MMBtu) and highest for Alternative EB-F (1,584,000 MMBtu). The largest driver for high energy use in Alternative EB-F is the production of refined materials, which is highest for this alternative. On-site diesel energy and material transport energy were also high contributors to the large total energy use.

On-site grid electricity use was also highest for Alternative EB-F (520 megawatt hours [MWh]) and lowest for Alternative EB-B (70 MWh). This relates to the amount of water treatment that would be required for a given alternative.

5.1.4 Air

Air emissions metrics evaluated by SEFA include CAP (i.e., NOx, SOx, and PM_{10}) emissions totals as well as HAP (VOC) emissions. Total emissions from all activities are reported, and on-site emissions are also specified. As noted in Section 5, air emissions were evaluated for Alternative EB-B, and those values were scaled according to the GHG totals presented in Table D4-1.

Alternative EB-B resulted in the lowest overall and on-site emissions for all pollutants (94 tons NOx, 62 tons SOx, 23 tons PM_{10}, and 1 ton of VOCs). The alternative with the highest emissions for all pollutants was Alternative EB-F, which resulted in totals of 450 tons NOx, 299 tons SOx, 110 tons PM_{10}, and 4 tons of VOCs over the entire construction period. The cumulative emissions totals for Alternative EB-F would be almost five times higher than for Alternative EB-B; however, the ambient air contaminant concentrations in the area for Alternative EB-F would not be that many times higher than for Alternative EB-B because the estimated construction period for Alternative EB-F is considerably longer, so the emissions would be spread out.

5.1.5 Land and Ecosystems

SEFA does not evaluate impacts to land and ecosystems. However, because each alternative is designed to cover the same geographical footprint, it was assumed that all alternatives will have similar green remediation strategies to address impacts to land and ecosystems.

6 References

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Tables

Table D3-1
Summary of Emission Factors

Source Type	Vehicle/Equipment Type	Unit	CO_2 Factor ($kg\ CO_2$ per unit)	CH_4 Factor ($g\ CO_2$ per unit)	N_2O Factor ($g\ CO_2$ per unit)	CO_2e Factor[9] ($kg\ CO_2e$ per unit)
Scope 1: Material Transport[1]	Medium- and heavy-duty trucks	Ton-mile	0.17	0.0016	0.0047	0.17
	Barge[2]	Ton-mile	0.044	0.025	0.0011	0.05
Scope 1: Dredging and Backfilling[1]	Heavy equipment	Gallons diesel fuel	10.21	1.01	0.94	10.50
	Watercraft	Gallons diesel fuel	10.21	6.41	0.17	10.45
	Off-road trucks	Gallons diesel fuel	10.21	0.91	0.56	10.39
Scope 1: Interim Winterization and Remobilization[1]	Medium- and heavy-duty trucks	Ton-mile	0.17	0.0016	0.0047	0.17
	SANY SCC1000	Gallons diesel fuel	10.21	1.01	0.94	10.50
Scope 2: Water Treatment[3]	Water treatment system	Megawatt hour	370.47	8.62	0.91	370.98
Scope 3: Raw Material Production[4,5,6]	Portland cement	Kg material	--	--	--	1.34
	Activated carbon	Kg material	--	--	--	4.82
	Sand/gravel/armor	Kg material	--	--	--	0.0024
	Organoclay	Kg material	--	--	--	2.07
	Steel sheeting	Kg material	--	--	--	2.41
Scope 3: Worker Commute[7]	Weighted average mode of transit[8]	Passenger-mile[1]	0.22	0.0083	0.0051	0.23

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023c
2. Barge emissions are calculated as emissions from tugboat transport using emission factors for waterborne craft from Table 8 of USEPA 2022.
3. Based on eGRID2021 (USEPA 2023a) Northeast Power Coordinating Council NYC/Westchester subregion
4. Randall et al. 2016; emission factors only available for CO_2e
5. CETCO 2014
6. SSAB 2023
7. USCB 2021
8. Mode of commute data (USCB 2021) was averaged based on the proportional use by construction workers in the NYC metro area.
9. 100-year global warming potentials from IPCC Sixth Assessment Report, 2021. CH_4: 29.8; N_2O: 273

Abbreviations:

CH_4: methane	kg: kilogram
CO_2: carbon dioxide	N_2O: nitrous oxide
CO_2e: carbon dioxide equivalent	NYC: New York City
g: gram	ton: short ton; 2,000 lb

Table D3-1
Summary of Emission Factors

References:

CETCO (Colloid Environmental Technologies Company), 2014. *Organoclay Carbon Footprint.* Technical Reference TR-859. 2014.

Randall et al. (Randall, P., D. Meyer, W. Ingwersen, D. Vineyard, M. Bergmann, S. Unger, and M. Gonzalez), 2016. *Life Cycle Inventory (LCI) Data-Treatment Chemicals, Construction Materials, Transportation, On-site Equipment, and other Processes for Use in Spreadsheets for Environmental Footprint Analysis (SEFA): Revised Addition.* U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/176.

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Table D3-2
Summary of Dredging, Backfill, and Capping Inputs

Description		Alternative EB-B	Alternative EB-C	Alternative EB-D	Alternative EB-E	Alternative EB-F
Dredging (Sediment and Debris)	Volume (cy)	34,100	98,400	114,600	246,300	268,000
	Duration (days)	77	233	268	507	523
	Weighted average daily production rate (cy/day)[3]	443	422	428	486	512
	Diesel fuel consumed (gallons)	90,400	30,200	323,700	623,100	661,300
	Amendment (Portland cement)	10% by sediment weight				
	Non-hazardous/hazardous waste disposal (percent by mass)	95%/5%				
Backfilling[1]	Volume (cy)	N/A	N/A	14,400	7,200	10,100
	Duration (days)	N/A	N/A	30	14	20
	Weighted average daily production rate (cy/day)[3]	N/A	N/A	480	514	505
Capping and Outfall Protection[2]	Volume (cy)	77,100	74,700	67,300	40,400	29,200
	Duration (days)	137	132	120	71	51
	Weighted average daily production rate (cy/day)[3]	563	566	561	569	573
	Diesel fuel consumed (capping and/or backfilling) (gallons)	161,600	157,000	173,500	113,600	100,700

Notes:
1. Includes sand
2. Includes sand, activated carbon, organoclay, gravel, and armor
3. Production rates were estimated based on professional experience on similar projects, with consideration of equipment specifications and best management practices.

Abbreviations:
cy: cubic yard
N/A: not applicable

Table D3-3
Transportation Assumptions

Description			Distance (miles)	Transport Method
Transportation of Portland cement to site for sediment stabilization			140	Truck
Transportation of dredged material from site to processing facility (sediment, debris, and water)			12	Barge[1]
Transportation of sand to site			75	Barge[1]
Transportation of activated carbon to site			585	Truck
Transportation of organoclay to site			2,500	Truck
Transportation of gravel to site			75	Barge[1]
Transportation of armor to site			75	Barge[1]
Off-site disposal	Non-hazardous waste disposal	From work site to regional processing facility	12	Barge[1]
		From processing facility to non-hazardous waste landfill	100	Truck
	Hazardous waste disposal	From work site to processing facility	25	Barge[1]
		From processing facility to hazardous waste landfill	250	Truck
Interim winterization and remobilization of contractor equipment[2]			9,525	Truck
Daily worker commute distance, one-way		Union	25[4]	Varied[5]
		Non-union[3]	5[4]	Varied[5]

Notes:

1. Barge emissions are calculated as emissions from tugboat transport.
2. The total distance per year required to winterize and remobilize all contractor equipment
3. Non-union workers are assumed to be in temporary lodging near the work site, rather than permanently housed in the NYC metro area as is assumed for union workers.
4. Assumes 5-mile one-way commute for non-union workers based in temporary lodging near the work site. Assumes 25-mile one-way commute for union workers based on average round-trip commute distance in New York of 49.73 miles (DeWitt 2022).
5. Mode of commute is based on USCB 2021, for construction workers in NYC metro area. Detailed commute assumptions are documented in Table D-A-6 of Attachment A.

References:

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Table D4-1
Summary of Total Estimated GHG Emissions (tonnes CO_2e)

Estimated Scopes	Description	Alternative EB-B	Alternative EB-C	Alternative EB-D	Alternative EB-E	Alternative EB-F
Estimated Scope 1 Emissions						
Transportation of Materials (non-disposal)	Transportation (via truck) of Portland cement for sediment stabilization	120	345	402	864	941
	Transportation of dredged material from site to processing facility (sediment, debris, and water)	26	74	87	186	203
	Transportation of sand to site (backfill)	0	0	75	37	53
	Transportation of sand to site (capping and outfall protection)	217	237	204	179	149
	Transportation of activated carbon to site	41	42	38	31	25
	Transportation of organoclay to site	217	225	194	46	0
	Transportation of gravel to site	76	65	63	15	4
	Transportation of armor to site	128	103	100	25	7
Transportation of Materials (disposal)	Transportation of post-stabilized dredged material (stabilized sediment, including Portland cement and debris) from processing facility to transload facility	25	71	74	179	195
	Transportation of non-hazardous material from transload facility to disposal landfill	784	2,239	2,349	5,675	6,181
	Transportation of hazardous material from work area to disposal landfill	100	287	301	726	791
Interim Winterization and Remobilization	Equipment and material transport	1,499	2,998	2,998	7,495	8,994
Construction Activities	Mobilization, including winterization and mobilization	21	36	36	36	36
	Shoreline stabilization work, including bulkhead stabilization, repair and installation, and ISS	1,603	1,951	1,951	4,505	6,172
	Dredging, including processing and water treatment	945	3,158	3,385	6,516	6,916
	Transportation and disposal	39	178	194	450	485
	Backfill and capping	1,776	1,725	1,908	1,249	1,106
	Environmental controls	18	53	54	93	117
	Total Scope 1 Emissions	**7,636**	**13,788**	**14,413**	**28,309**	**32,376**

Table D4-1
Summary of Total Estimated GHG Emissions (tonnes CO_2e)

Estimated Scopes		Description	Alternative EB-B	Alternative EB-C	Alternative EB-D	Alternative EB-E	Alternative EB-F
Estimated Scope 2 Emissions							
		Total Scope 2 Emissions: Purchased electricity for water treatment	**25**	**71**	**83**	**179**	**194**
Estimated Scope 3 Emissions							
		Production of raw materials	9,298	20,724	23,294	45,650	48,967
		Production of Portland cement	6,069	17,497	20,386	43,808	47,670
		Production of sand	140	153	180	140	130
		Production of organoclay	953	988	852	202	0
		Production of armor	83	66	65	16	5
		Production of gravel	49	42	40	10	3
		Production of steel sheeting	68	0	0	38	0
		Production of virgin GAC	1,789	1,832	1,639	1,355	1,103
		Combined maintenance materials	147	146	132	82	57
		Worker commute	59	107	113	208	250
		Total Scope 3 Emissions	**9,357**	**20,831**	**23,407**	**45,858**	**49,217**
		Total Estimated Emissions (rounded)	**17,000**	**34,700**	**37,900**	**74,300**	**81,800**

Note:

All values aside from the total are rounded to the nearest integer.

Abbreviations:

CO_2e: carbon dioxide equivalent

GAC: granular activated carbon

GHG: greenhouse gas

ISS: in situ stabilization and solidification

Table D4-2
Equivalencies of Total Estimated GHG Emissions (tonnes CO_2e)

Emissions Category	Alternative	Total Estimated CO_2e Emissions (tonnes)[8]	Equivalents to Alternative Emissions[1]				Social Cost of GHG Emissions (in 2020$)[6,7]
			Passenger Vehicles with Annual CO_2e Emissions[2]	Gallons of Gasoline Consumed Resulting in CO_2 Emissions[3]	Homes with CO_2 Emissions Due to Annual Energy Usage[4]	Urban Tree Seedlings Grown for 10 Years from Sequestered CO_2 Emissions[5]	
Scopes 1 and 2	Alternative EB-B	7,700	2,000	868,000	1,000	128,000	$1,435,000
	Alternative EB-C	13,900	3,000	1,567,000	2,000	232,000	$2,596,000
	Alternative EB-D	14,500	3,000	1,635,000	2,000	242,000	$2,715,000
	Alternative EB-E	28,500	6,000	3,213,000	4,000	475,000	$5,335,000
	Alternative EB-F	32,600	7,000	3,675,000	4,000	543,000	$6,100,000
Scope 3	Alternative EB-B	9,400	2,000	1,060,000	1,000	157,000	$1,750,000
	Alternative EB-C	20,800	5,000	2,345,000	3,000	347,000	$3,895,000
	Alternative EB-D	23,400	5,000	2,638,000	3,000	390,000	$4,377,000
	Alternative EB-E	45,900	10,000	5,175,000	6,000	765,000	$8,575,000
	Alternative EB-F	49,200	11,000	5,547,000	7,000	820,000	$9,204,000

Notes:

All equivalence values are rounded to the nearest thousand.

1. For more detailed information regarding how each calculation is derived, see USEPA 2023.
2. Emission factor utilized is 4.49 tonnes CO_2 per vehicle per year.
3. Emission factor utilized is 8.887×10^{-3} tonnes CO_2 per gallon of gasoline.
4. Emission factor utilized is 7.39 tonnes CO_2 per home per year.
5. Emission factor utilized is 0.060 tonnes CO_2 per urban tree seedling grown for 10 years.
6. Based on methodology presented in CEQ 2021, using discount rates for emissions year 2030.
7. A comparison of emissions based on the amount of contamination addressed was considered. Because all alternatives evaluated address the same amount of contamination, it was determined that this would not provide a meaningful comparison. A comparison to similar projects was also considered, but because the scope of included activities and methodology differs from one analysis to the next, making a direct comparison is problematic. Per recent National Environmental Policy Act guidance, the social cost of GHGs was evaluated and included as a standardized measure by which the GHG impacts can be better contextualized.
8. From scope totals reported in Table D4-1. Rounded to the nearest hundred.

Abbreviations:

CO_2: carbon

CO_2e: carbon dioxide equivalent

GHG: greenhouse gas

Table D4-2
Equivalencies of Total Estimated GHG Emissions (tonnes CO_2e)

References:

CEQ (Center for Environmental Quality), 2021. Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990, Interagency Working Group on Social Cost of Greenhouse Gases (IWG-SC), February 2021. Date accessed: May 2024. Available at: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf.

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Table D5-1
Green Remediation Metrics Summary

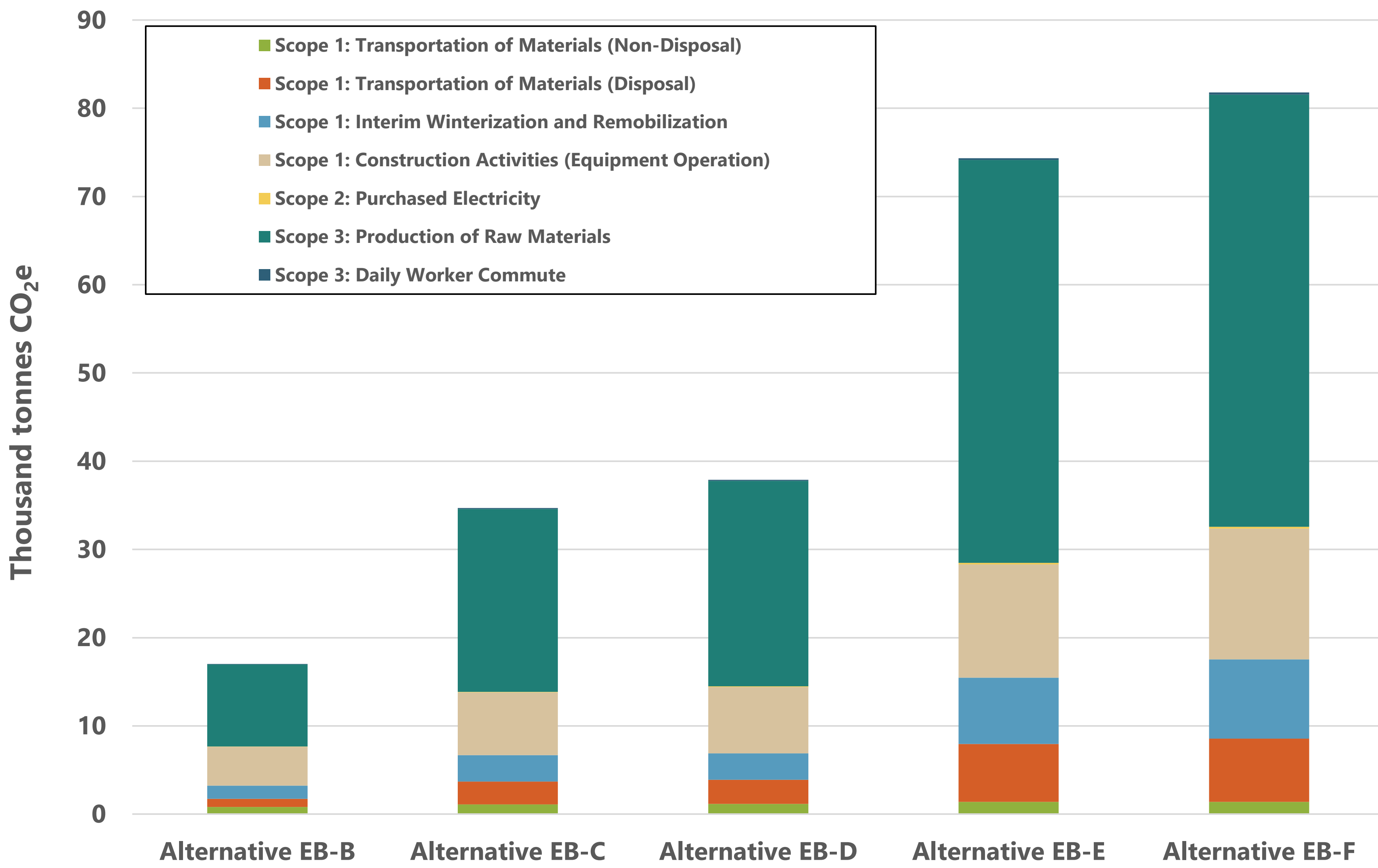
Core Element	Metric		Unit of Measure	EB-B Total	EB-C Total	EB-D Total	EB-E Total	EB-F Total
Materials and Waste	M&W-1	Refined materials used on site	Tons	13,000	18,000	20,000	41,000	41,000
	M&W-3	Unrefined materials used on site	Tons	125,000	120,000	131,000	76,000	63,000
	M&W-5	On-site hazardous waste disposed of off site	Tons	2,000	7,000	7,000	17,000	18,000
	M&W-6	On-site non-hazardous waste disposed of off site[2]	Tons	43,000	124,000	130,000	314,000	342,000
Water (used on site)	W-1	Public water use	MG	1.4	0.5	0.5	1.0	0.3
Energy	E-1	Total energy used (on and off site)	MMBtu	496,000	714,000	781,000	1,540,000	1,584,000
		On-site Diesel Energy	MMBtu	59,000	96,000	101,000	176,000	206,000
		Worker Commute Energy	MMBtu	1,300	2,300	2,500	4,600	5,500
		Transportation Energy (hauling)	MMBtu	40,000	83,000	85,000	190,000	215,000
		Material Production Energy[3]	MMBtu	396,000	533,000	592,000	1,170,000	1,157,000
	E-4	On-site grid electricity use	MWh	70	190	220	480	520
Air[1]	A-1	On-site NOx, SOx, and PM emissions	Pounds	60,000	123,000	134,000	264,000	290,000
	A-2	On-site HAP emissions	Pounds	21	43	46	91	100
	A-3	Total NOx, SOx, and PM emissions	Pounds	357,000	728,000	795,000	1,559,000	1,715,000
	A-3A	Total NOx emissions	Pounds	187,000	382,000	417,000	818,000	900,000
	A-3B	Total SOx emissions	Pounds	124,000	253,000	276,000	542,000	597,000
	A-3C	Total PM emissions	Pounds	46,000	93,000	101,000	199,000	219,000
	A-4	Total HAP emissions	Pounds	1,900	3,800	4,100	8,100	8,900
	Emissions scaling factor from GHG analysis[1]			100%	204%	221%	438%	482%
Land and Ecosystems	It is assumed that all alternatives will have similar green remediation strategies to address impacts to land and ecosystems.							

Notes:
This table was adapted from USEPA's SEFA Version 3.0 (USEPA 2019).
1. CAP and HAP emissions for Alternatives EB-C through EB-F are scaled from the Alternative EB-B emissions based on the ratio of GHG emissions per alternative calculated in the GHG analysis.
2. Engineering estimates developed for the cost estimate are reflected here because SEFA double-counted the quantities of non-hazardous waste based on entry of dual-mode transport (rail and barge).
3. The SEFA Portland cement footprint calculation is broken, so these were developed manually from energy factors in the tool.

Abbreviations:
CAP: criteria air pollutant
GHG: greenhouse gas
HAP: hazardous air pollutant
MG: millions of gallons
MMBtu: metric million British thermal units
MWh: megawatt hours (i.e., thousands of kilowatt-hours or millions of watt-hours)
NOx: oxides of nitrogen
PM: particulate matter
SEFA: Spreadsheets for Environmental Footprint Analysis
SOx: oxides of sulfur
ton: short ton (2,000 pounds)

Reference:
USEPA (U.S. Environmental Protection Agency), 2019. *Spreadsheets for Environmental Footprint Analysis,* Version 3.0. Released September 2019. Date accessed: May 2024. Available at: https://clu-in.org/greenremediation/SEFA/.

Figures



Notes:
Components "Purchased Electricity" and "Daily Worker Commute" make up less than 1% of GHG emissions and are not visible on the graphic.
CO_2e: carbon dioxide equivalent

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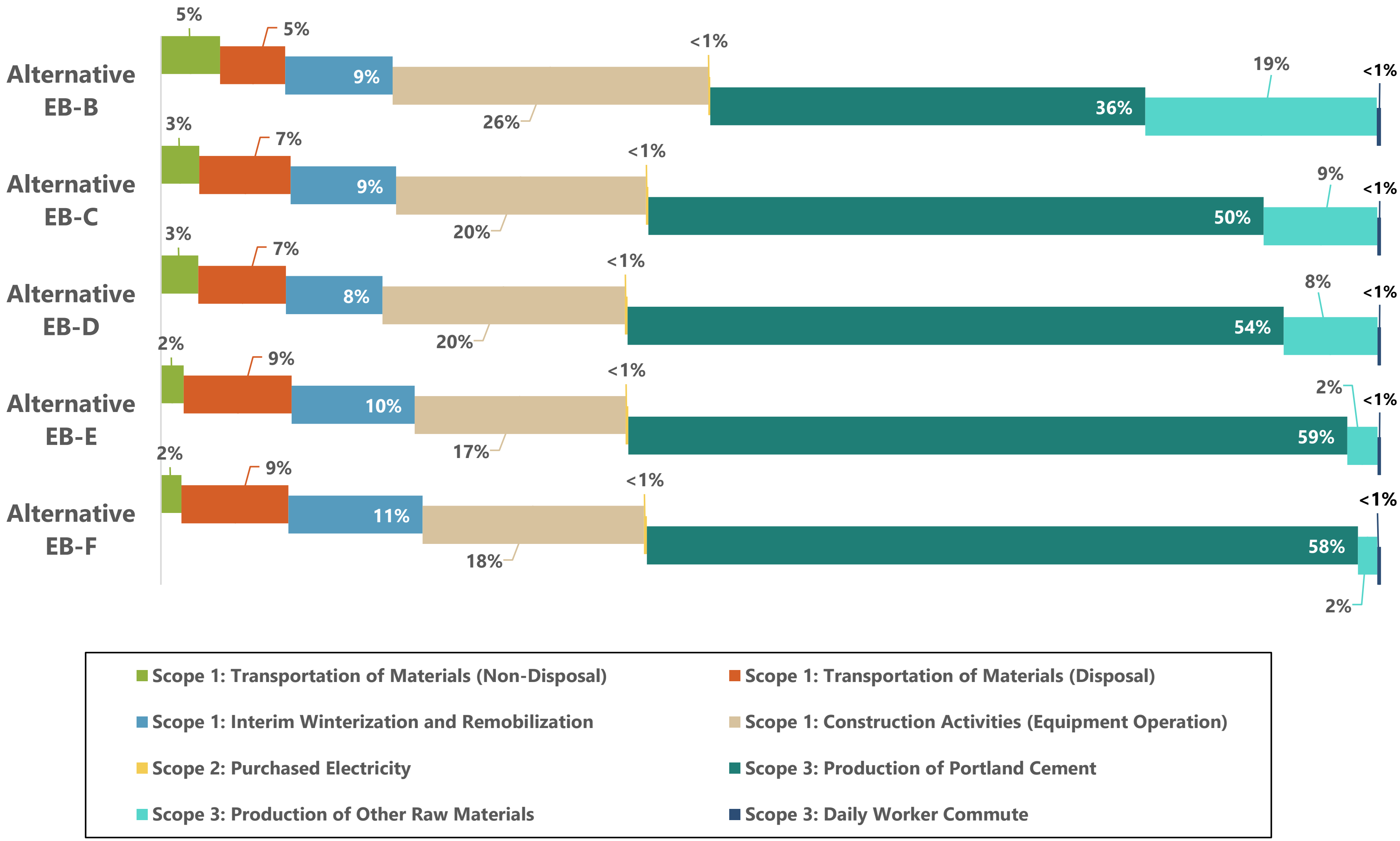
ANCHOR QEA

Figure D4-1
Estimated Greenhouse Gas Emissions by Category and Activity
Greenhouse Gas Emissions Evaluation
Newtown Creek RI/FS



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Note:
Percentages for each scope item are rounded; therefore, percentages may not sum to 100% for a given alternative.

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ANCHOR QEA

Figure D4-2
Percentage of GHG Emissions by Activity for Each Alternative
Greenhouse Gas Emissions Evaluation
Newtown Creek RI/FS

Attachment D-A
GHG Emissions Calculation Tables

Table D-A-1
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-B

Estimated Scope 1 GHG Emissions due to Transportation of Materials: Stabilization and Capping Materials, Waste Disposal, and Interim Winterization/Demobilization

Activity	Notes/Assumptions	Material Quantity (short tons)	Assumed Distance (miles)	Assumed Transport Mode	Emissions Factor[1] (kg CO_2 per ton-mile)	Emissions Factor[1] (kg CH_4 per ton-mile)	Emissions Factor[1] (kg N_2O per ton-mile)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Dredging-related Materials											
Transportation of Portland cement to site for sediment stabilization	From Earth Materials, LLC, in Vineland, New Jersey Assumes 1.27 ton/cy	4,992	140	Truck	0.170	1.60E-06	4.70E-06	119	0.00	0.003	120
Transportation of dredged material from site to processing facility (sediment, debris, and water)	Assumes 1.4 ton/cy	47,774	12	Barge[2]	0.044	2.54E-05	1.10E-06	25	0.01	0.001	26
							Total Emissions by Process	**144**	**0.02**	**0.004**	**146**
Backfill-related Materials											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	0	75	Barge[2]	0.044	2.54E-05	1.10E-06	0	0.00	0.000	0
							Total Emissions by Process	**0**	**0.00**	**0.000**	**0**
Capping and Outfall Protection-related Materials[3]											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	64,207	75	Barge[2]	0.044	2.54E-05	1.10E-06	212	0.12	0.005	217
Transportation of GAC to site	From Calgon production center in Huntington, West Virginia Assumes 0.45 ton/cy	409	585	Truck	0.170	1.60E-06	4.70E-06	41	0.00	0.001	41
Transportation of organoclay to site	From generic production facility (anecdotal; assumed somewhere in Western U.S. due to UT/WY/MT stronghold in bentonite production) Assumes 0.68 ton/cy	508	2,500	Truck	0.170	1.60E-06	4.70E-06	216	0.00	0.006	217
Transportation of gravel to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	22,383	75	Barge[2]	0.044	2.54E-05	1.10E-06	74	0.04	0.002	76
Transportation of armor to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	37,974	75	Barge[2]	0.044	2.54E-05	1.10E-06	125	0.07	0.003	128
							Total Emissions by Process	**668**	**0.24**	**0.017**	**679**
Waste Disposal											
Transportation of non-hazardous dredged material from work area to regional processing facility (stabilized sediment, including Portland cement and debris)	Transport of non-hazardous waste and debris from work area to regional facility for processing	45,755	12	Barge[2]	0.044	2.54E-05	1.10E-06	24	0.01	0.001	25
	Non-hazardous waste and debris from processing facility to landfill disposal	45,755	100	Truck	0.170	1.60E-06	4.70E-06	778	0.01	0.022	784
Transportation of post-stabilized dredged material from work area to disposal landfill (hazardous)	Transport of hazardous waste and debris from work area to regional facility for processing	2,283	25	Barge[2]	0.044	2.54E-05	1.10E-06	3	0.00	0.000	3
	Hazardous waste from processing facility to landfill disposal	2,283	250	Truck	0.170	1.60E-06	4.70E-06	97	0.00	0.003	98
							Total Emissions by Process	**902**	**0.02**	**0.025**	**909**

Estimated Scope 1 GHG Emissions due to Interim Winterization and Remobilization

Transportation of equipment to maintenance facility, rental facilities, and other project locations for winter, and remobilization back to site at the beginning of the following construction season	Maintenance facility or another project location assumed to be 100 miles away (200-mile round-trip distance). Rental facility assumed distance of 50 miles. Various rental facilities assumed distance of 25 miles.	919	9,525	Truck	0.170	1.60E-06	4.70E-06	1,487	0.01	0.041	1,499
							Total Emissions by Process	**1,487**	**0.01**	**0.041**	**1,499**

Table D-A-1
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-B

Estimated Scope 1 GHG Emissions due to Mobilization, Including Winterization and Mobilization

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
1B	SANY SCC1000	72	11.0	792	10.21	1.01	0.94	8	0.00	0.001	8
1B	Lowboy truck	72	17.6	1,267	10.21	0.91	0.56	13	0.00	0.001	13
							Total Emissions by Process	**21**	**0.00**	**0.001**	**21**

Estimated Scope 1 GHG Emissions due to Shoreline Work, Including Bulkheads and ISS

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
2A	BUCKET (3.0 CY)	0	0.0	0							0
2A	ORANGE PEEL GRAPPLE (1.25 CY)	252	0.0	0							0
2A	BARGE (80'X40')	756	0.0	0							0
2A	SCOW (225'X42'X12')	756	0.0	0							0
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	252	18.7	4,712	10.21	1.01	0.94	48	0.00	0.004	49
2A	BARGE (80'X40')	756	0.0	0							0
2A	VIBRATORY HAMMER (HPSI MODEL 300)	504	18.3	9,223	10.21	1.01	0.94	94	0.01	0.009	97
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	252	18.7	4,712	10.21	1.01	0.94	48	0.00	0.004	49
2A	TUG BOAT 1 - 380 HP	504	16.7	8,417	10.21	6.41	0.17	86	0.05	0.001	88
2A	TUG BOAT 2 - 700 HP	252	30.8	7,762	10.21	6.41	0.17	79	0.05	0.001	81
2A	WORK BOAT - 115 HP	504	5.1	2,570	10.21	6.41	0.17	26	0.02	0.000	27
2B	ISS OPERATION - DECK BARGE	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HORIZONTAL PIG (4,200 CF)	8,352	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SUCTION HOSE (4" X 20')	3,132	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - DISCHARGE HOSE (4" X 50')	4,176	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GODWIN PUMP (4")	8,352	0.7	5,846	10.21	1.01	0.94	60	0.01	0.005	61
2B	ISS OPERATION - FRAC TANK (18,000 GAL)	2,088	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HME SPUD BARGE	4,176	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GENERATOR (175 KW)	1,044	12.3	12,841	10.21	1.01	0.94	131	0.01	0.012	135
2B	ISS OPERATION - BATCH PLANT (45 CM/HR)	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - BAUER RG 22S DRILL RIG	1,044	45.0	46,980	10.21	1.01	0.94	480	0.05	0.044	493
2B	ISS OPERATION - HORIZONTAL SILO (1,200 CF)	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GAS WELDER	1,044	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - LIGHT PLANT	1,044	0.0	0				0	0.00	0.000	0
2B	TUG BOAT 2 - 700 HP	1,044	30.8	32,155	10.21	6.41	0.17	328	0.21	0.005	336
2B	WATER TRUCK (4,000 GAL)	1,044	13.2	13,781	10.21	0.91	0.56	141	0.01	0.008	143
							Total Emissions by Process	**1,563**	**0.43**	**0.099**	**1,603**

Table D-A-1
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-B

Estimated Scope 1 GHG Emissions due to Dredging, including Processing and Water Treatment

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
3A	CAT 375 L	583	18.8	10,960	10.21	1.01	0.94	112	0.01	0.010	115
3A	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3A	ORANGE PEEL GRAPPLE (1.25 CY)	583	0.0	0				0	0.00	0.000	0
3A	EXCAVATOR RAKE	583	0.0	0				0	0.00	0.000	0
3A	BARGE (80'X40')	1,166	0.0	0				0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	583	16.7	9,736	10.21	6.41	0.17	99	0.06	0.002	102
3A	SCOW (100 CY)	2,333	0.0	0				0	0.00	0.000	0
3A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	583	18.7	10,902	10.21	1.01	0.94	111	0.01	0.010	114
3A	BARGE (80'X40')	1,166	0.0	0				0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	583	16.7	9,736	10.21	6.41	0.17	99	0.06	0.002	102
3A	TUG BOAT 2 - 700 HP	583	30.8	17,956	10.21	6.41	0.17	183	0.12	0.003	188
3A	SCOW (225'X42'X12')	1,750	0.0	0				0	0.00	0.000	0
3A	WORK BOAT - 115 HP	2,333	5.1	11,898	10.21	6.41	0.17	121	0.08	0.002	124
3B	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3B	BARGE (80'X40')	1,166	0.0	0				0	0.00	0.000	0
3B	CAT 349 E	583	19.0	11,077	10.21	1.01	0.94	113	0.01	0.010	116
3B	WATER TRUCK (4,000 GAL)	583	13.2	7,696	10.21	0.91	0.56	79	0.01	0.004	80
3B	SILO	583	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	2,333	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	5,832	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	3,499	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	1,166	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	583	0.7	408	10.21	1.01	0.94	4	0.00	0.000	4
3C	WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	1,166	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	583	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	583	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	1,166	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	583	0.0	0				0	0.00	0.000	0
							Total Emissions by Process	**923**	**0.36**	**0.044**	**945**

Estimated Scope 1 GHG Emissions due to T&D

5	TUG BOAT 2 - 700 HP	122	30.8	3,758	10.21	1.01	0.94	38	0.00	0.004	39
							Total Emissions by Process	**38**	**0.00**	**0.004**	**39**

Estimated Scope 1 GHG Emissions due to Backfill and Capping

6	CAT 272 SKID STEER	986	4.2	4,141	10.21	1.01	0.94	42	0.00	0.004	43
6	CAT 910M FRONT LOADER	986	4.4	4,338	10.21	1.01	0.94	44	0.00	0.004	46
6	TELEBELT 130	986	17.8	17,551	10.21	1.01	0.94	179	0.02	0.016	184
6	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	986	18.7	18,438	10.21	1.01	0.94	188	0.02	0.017	194
6	BARGE (80'X40')	986	0.0	0				0	0.00	0.000	0
6	SCOW (225'X42'X12')	1,973	0.0	0				0	0.00	0.000	0
6	TUG BOAT 2 - 700 HP	1,267	30.8	39,024	10.21	6.41	0.17	398	0.25	0.007	408
6	SCOW (100 CY)	3,946	0.0	0				0	0.00	0.000	0
6	TUG BOAT 1 - 380 HP	2,534	16.7	42,318	10.21	6.41	0.17	432	0.27	0.007	442
6	BARGE (80'X40')	986	0.0	0				0	0.00	0.000	0
6	CAT 375 L	1,534	18.8	28,839	10.21	1.01	0.94	294	0.03	0.027	303
6	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
6	KAFKA 814 BLENDING HOPPER	0	0.0	0				0	0.00	0.000	0
6	WORK BOAT - 115 HP	1,348	5.1	6,875	10.21	6.41	0.17	70	0.04	0.001	72
							Long-term Maintenance (5% of capping)	82	0.03	0.004	85
							Total Emissions by Process	**1,732**	**0.67**	**0.088**	**1,776**

Table D-A-1
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-B

Estimated Scope 1 GHG Emissions due to Environmental Controls

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
7	WORK BOAT - 115 HP	338	5.1	1,724	10.21	6.41	0.17	18	0.01	0.000	18
							Total Emissions by Process	18	0.01	0.000	18
							Total Emissions from Equipment (tonnes)	**4,295**	**1.47**	**0.24**	**4,403**
							Estimated Scope 1 GHG Emissions	**7,495**	**1.77**	**0.32**	**7,636**

Estimated Scope 2 GHG Emissions due to Operation of Water Treatment System (Purchased Electricity)

Water Treatment System	Water Treatment Volume (gal)	Estimated Operation Time (hours)	Power Consumption of Water Treatment System (kW)	Estimated Total kWh for Water Treatment	eGrid2021 Emission Factor[5] (CO_2 in lb/MWh)	eGrid2021 Emission Factor[5] (CH_4 in lb/MWh)	eGrid2021 Emission Factor[5] (N_2O in lb/MWh)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Water treatment system capacity (75 gpm)	2,729,948	607	110	66,732	817	0.019	0.0020	25	0.00058	0.000061	25
							Total Emissions by Source	**25**	**0.00058**	**0.000061**	**25**

Estimated Scope 3 GHG Emissions due to Production of Raw Materials

Material	Material Quantity (short tons)	CO_2 Equivalency Factor[6] (kg CO_2e per kg material)	CO_2e Emissions (tonnes)
Portland cement	4,992	1.34	6,069
Sand	64,207	0.0024	140
Organoclay[7]	508	2.07	953
Armor	37,974	0.0024	83
Gravel	22,383	0.0024	49
Steel sheeting[8]	31	2.410	68
Virgin GAC	409	4.8	1,789
Combined Maintenance Materials	5% of capping quantity		147
		Total Emissions	**9,298**

Estimated Scope 3 GHG Emissions due to Worker Commute

Project Component	Workers On-Site by Project Component	Total Daily Commute (person-miles)	Emissions Factor[1], CO_2 kg per Daily Commuter-Mile[9]	Emissions Factor[1], CH_4 kg per Daily Commuter-Mile	Emissions Factor[1], N_2O kg per Daily Commuter-Mile	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Component A - Contractor's Team	9	28,800	0.22	8.32E-06	5.08E-06	6.5	0.00024	0.00015	6.5
Component B - Mobilization and Pre-Remediation Site Work	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component C - Winterization and Remobilization	5	2,500	0.22	8.32E-06	5.08E-06	0.6	0.00002	0.00001	0.6
Component D - Bulkheads	16	23,800	0.22	8.32E-06	5.08E-06	5.3	0.00020	0.00012	5.4
Component E - ISS	7	44,950	0.22	8.32E-06	5.08E-06	10.1	0.00037	0.00023	10.1
Component F - Dredging and Debris Removal	13	49,410	0.22	8.32E-06	5.08E-06	11.1	0.00041	0.00025	11.2
Component G - Sediment Dewatering/Stabilization	5	20,250	0.22	8.32E-06	5.08E-06	4.5	0.00017	0.00010	4.6
Component H - Water Treatment	5	17,010	0.22	8.32E-06	5.08E-06	3.8	0.00014	0.00009	3.8
Component I - T&D (does not include workers at facility)	2	2,200	0.22	8.32E-06	5.08E-06	0.5	0.00002	0.00001	0.5
Component J - Backfill, Capping, and Outfall Protection	7	54,560	0.22	8.32E-06	5.08E-06	12.2	0.00045	0.00028	12.3
Component K - Environmental Controls	4	4,700	0.22	8.32E-06	5.08E-06	1.1	0.00004	0.00002	1.1
Component L - Site Restoration	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component M - Demobilization	5	3,750	0.22	8.32E-06	5.08E-06	0.8	0.00003	0.00002	0.8
Total		**260,930**	--	--	--	**58.5**	**0.00217**	**0.00132**	**58.9**

Total Emissions by Category

Emissions Category	Estimated CO2 Emissions (tonnes)	Estimated CH4 Emissions (tonnes)	Estimated N2O Emissions (tonnes)	Estimated CO2e Emissions10 (tonnes)
Scope 1	7,495	1.8	0.3	7,636
Scope 2	25	5.8E-04	6.1E-05	25
Scope 3	58	2.2E-03	1.3E-03	9,357
Overall Total	**7,578**	**1.8**	**0.3**	**17,018**

Table D-A-1

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-B

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023a
2. Barge emissions are calculated as emissions from tugboat transport.
3. Transportation of materials includes import and export mileage only. Intrasite movement of GAC and organoclay between the upland site and placement locations are covered in the component-specific equipment emissions.
4. Equipment type and fuel usage rates specified based on professional judgment, experience on similar projects, and published information, including Equation 1 as reported in Appendix D. A fuel usage rate of "0" in this table indicates that the equipment is not self-powered and is dependent upon power from construction equipment, generators, or tug/towboats, the emissions of which are accounted for in other line items. Some water treatment equipment is powered by grid electricity, emissions from which are included in Scope 2. Fuel usage rates are rounded to the nearest tenth of a gallon per hour.
5. Based on eGRID2021 (USEPA 2023b) Northeast Power Coordinating Council NYC/Westchester subregion
6. Randall et al. 2016 is the source for all equivalency factors in this table except for organoclay and steel, as noted.
7. CETCO Technical Reference – Organoclay Carbon Footprint
8. SSAB 2023
9. USCB 2021. Daily Commuter-Mile emission factors are based on weighted average mode of transportation statistics for construction workers in the NYC metro area.
10. Scope 3 includes CO_2e emissions from raw materials production, where no individual GHG gas emissions were calculated.
11. Equipment operational duration includes 60% uptime assumption for all pieces of equipment.
12. Due to rounding in the displayed values, emissions totals shown may differ from the sum of the individual values.

Conversion Factors:
2.20462 lb per kg
1,000 kg per tonne

Abbreviations:
CH_4: methane
CO_2: carbon dioxide
CO_2e: carbon dioxide equivalent
cy: cubic yard
GAC: granular activated carbon
gal: gallon
GHG: greenhouse gas
gpm: gallons per minute
hp: horsepower
ISS: in situ stabilization and solidification
kg: kilogram
kW: kilowatt
kWh: kilowatt hour
lb: pound
lb/MWh: pounds per megawatt hour
N_2O: nitrous oxide
NYC: New York City
T&D: transportation and disposal
ton: short ton; 2,000 lb
tonne: metric ton (MT); 1,000 kg

References:

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Table D-A-2
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-C

Estimated Scope 1 GHG Emissions due to Transportation of Materials: Stabilization and Capping Materials, Waste Disposal, and Interim Winterization/Demobilization

Activity	Notes/Assumptions	Material Quantity (short tons)	Assumed Distance (miles)	Assumed Transport Mode	Emissions Factor[1] (kg CO_2 per ton-mile)	Emissions Factor[1] (kg CH_4 per ton-mile)	Emissions Factor[1] (kg N_2O per ton-mile)	CO_2 Emissions[1,2] (tonnes)	CH_4 Emissions[1,2] (tonnes)	N_2O Emissions[1,2] (tonnes)	CO_2e Emissions[1,2] (tonnes)
Dredging-related Materials											
Transportation of Portland cement to site for sediment stabilization	From Earth Materials, LLC, in Vineland, New Jersey Assumes 1.27 ton/cy	14,393	140	Truck	0.170	1.60E-06	4.70E-06	343	0.00	0.009	345
Transportation of dredged material from site to processing facility (sediment, debris, and water)	Assumes 1.4 ton/cy	137,733	12	Barge[2]	0.044	2.54E-05	1.10E-06	73	0.04	0.002	74
							Total Emissions by Process	**415**	**0.05**	**0.011**	**420**
Backfill-related Materials											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	0	75	Barge[2]	0.044	2.54E-05	1.10E-06	0	0.00	0.000	0
							Total Emissions by Process	**0**	**0.00**	**0.000**	**0**
Capping and Outfall Protection-related Materials[3]											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	70,108	75	Barge[2]	0.044	2.54E-05	1.10E-06	231	0.13	0.006	237
Transportation of GAC to site	From Calgon production center in Huntington, West Virginia Assumes 0.45 ton/cy	419	585	Truck	0.170	1.60E-06	4.70E-06	42	0.00	0.001	42
Transportation of Organoclay to site	From generic production facility (anecdotal; assumed somewhere in Western U.S. due to UT/WY/MT stronghold in bentonite production) Assumes 0.68 ton/cy	526	2,500	Truck	0.170	1.60E-06	4.70E-06	224	0.00	0.006	225
Transportation of gravel to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	19,248	75	Barge[2]	0.044	2.54E-05	1.10E-06	64	0.04	0.002	65
Transportation of armor to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	30,509	75	Barge[2]	0.044	2.54E-05	1.10E-06	101	0.06	0.003	103
							Total Emissions by Process	**661**	**0.23**	**0.017**	**672**
Waste Disposal											
Transportation of non-hazardous dredged material from work area to regional processing facility (stabilized sediment, including Portland cement and debris)	Transport of non-hazardous waste and debris from work area to regional facility for processing	130,705	12	Barge[2]	0.044	2.54E-05	1.10E-06	69	0.04	0.002	71
	Non-hazardous waste and debris from processing facility to landfill disposal	130,705	100	Truck	0.170	1.60E-06	4.70E-06	2,222	0.02	0.061	2,239
Transportation of post-stabilized dredged material from work area to disposal landfill (hazardous)	Transport of hazardous waste and debris from work area to regional facility for processing	6,521	25	Barge[2]	0.044	2.54E-05	1.10E-06	7	0.00	0.000	7
	Hazardous waste from processing facility to landfill disposal	6,521	250	Truck	0.170	1.60E-06	4.70E-06	277	0.00	0.008	279
							Total Emissions by Process	**2,575**	**0.07**	**0.071**	**2,597**

Estimated Scope 1 GHG Emissions due to Interim Winterization and Remobilization

Transportation of equipment to maintenance facility, rental facilities, and other project locations for winter, and remobilization back to site at the beginning of the following construction season.	Maintenance facility or another project location assumed to be 100 miles away (200-mile round-trip distance). Rental facility assumed distance of 50 miles. Various rental facilities assumed distance of 25 miles.	919	19,050	Truck	0.170	1.60E-06	4.70E-06	2,975	0.03	0.082	2,998
							Total Emissions by Process	**2,975**	**0.03**	**0.082**	**2,998**

Table D-A-2
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-C

Estimated Scope 1 GHG Emissions due to Mobilization, including Winterization and Mobilization

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
1B	SANY SCC1000	120	11.0	1,320	10.21	1.01	0.94	13	0.00	0.001	14
1B	Lowboy Truck	120	17.6	2,112	10.21	0.91	0.56	22	0.00	0.001	22
							Total Emissions by Process	**35**	**0.00**	**0.002**	**36**

Estimated Scope 1 GHG Emissions due to Shoreline Work, including Bulkheads and ISS

2A	BUCKET (3.0 CY)	0	0.0	0							0
2A	ORANGE PEEL GRAPPLE (1.25 CY)	734	0.0	0							0
2A	BARGE (80'X40')	2,203	0.0	0							0
2A	SCOW (225'X42'X12')	2,203	0.0	0							0
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	734	18.7	13,726	10.21	1.01	0.94	140	0.01	0.013	144
2A	BARGE (80'X40')	2,203	0.0	0							0
2A	VIBRATORY HAMMER (HPSI MODEL 300)	1,469	18.3	26,883	10.21	1.01	0.94	274	0.03	0.025	282
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	734	18.7	13,726	10.21	1.01	0.94	140	0.01	0.013	144
2A	TUG BOAT 1 - 380 HP	1,469	16.7	24,532	10.21	6.41	0.17	250	0.16	0.004	256
2A	TUG BOAT 2 - 700 HP	734	30.8	22,607	10.21	6.41	0.17	231	0.14	0.004	236
2A	WORK BOAT - 115 HP	1,469	5.1	7,492	10.21	6.41	0.17	76	0.05	0.001	78
2B	ISS OPERATION - DECK BARGE	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HORIZONTAL PIG (4,200 CF)	5,280	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SUCTION HOSE (4" X 20')	1,980	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - DISCHARGE HOSE (4" X 50')	2,640	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GODWIN PUMP (4")	5,280	0.7	3,696	10.21	1.01	0.94	38	0.00	0.003	39
2B	ISS OPERATION - FRAC TANK (18,000 GAL)	1,320	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HME SPUD BARGE	2,640	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GENERATOR (175 KW)	660	12.3	8,118	10.21	1.01	0.94	83	0.01	0.008	85
2B	ISS OPERATION - BATCH PLANT (45 CM/HR)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - BAUER RG 22S DRILL RIG	660	45.0	29,700	10.21	1.01	0.94	303	0.03	0.028	312
2B	ISS OPERATION - HORIZONTAL SILO (1,200 CF)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GAS WELDER	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - LIGHT PLANT	660	0.0	0				0	0.00	0.000	0
2B	TUG BOAT 2 - 700 HP	660	30.8	20,328	10.21	6.41	0.17	208	0.13	0.003	212
2B	WATER TRUCK (4,000 GAL)	660	13.2	8,712	10.21	0.91	0.56	89	0.01	0.005	91
							Total Emissions by Process	**1,903**	**0.59**	**0.113**	**1,951**

Table D-A-2
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-C

Estimated Scope 1 GHG Emissions due to Dredging, including Processing and Water Treatment

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
3A	CAT 375 L	1,706	18.8	32,073	10.21	1.01	0.94	327	0.03	0.030	337
3A	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3A	ORANGE PEEL GRAPPLE (1.25 CY)	1,706	0.0	0				0	0.00	0.000	0
3A	EXCAVATOR RAKE	1,706	0.0	0				0	0.00	0.000	0
3A	BARGE (80'X40')	3,413	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	1,706	16.7	28,490	10.21	6.41	0.17	291	0.18	0.005	298
3A	SCOW (100 CY)	6,826	0.0	0				0	0.00	0.000	0
3A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	1,706	18.7	31,902	10.21	1.01	0.94	326	0.03	0.030	335
3A	BARGE (80'X40')	3,413	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	1,706	16.7	28,490	10.21	6.41	0.17	291	0.18	0.005	298
3A	TUG BOAT 2 - 700 HP	1,706	30.8	52,545	10.21	6.41	0.17	536	0.34	0.009	549
3A	SCOW (225'X42'X12')	5,119	0.0	0				0	0.00	0.000	0
3A	WORK BOAT - 115 HP	6,826	5.1	34,813	10.21	6.41	0.17	355	0.22	0.006	364
3B	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3B	BARGE (80'X40')	5,688	0.0	0				0	0.00	0.000	0
3B	CAT 349 E	2,844	19.0	54,036	10.21	1.01	0.94	552	0.05	0.051	567
3B	WATER TRUCK (4,000 GAL)	2,844	13.2	37,541	10.21	0.91	0.56	383	0.03	0.021	390
3B	SILO	2,844	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	11,376	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	28,440	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	17,064	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	5,688	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	2,844	0.7	1,991	10.21	1.01	0.94	20	0.00	0.002	21
3C	WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	5,688	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	2,844	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	2,844	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	5,688	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	2,844	0.0	0				0	0.00	0.000	0
							Total Emissions by Process	**3,082**	**1.08**	**0.158**	**3,158**

Estimated Scope 1 GHG Emissions due to T&D

5	TUG BOAT 2 - 700 HP	552	30.8	17,002	10.21	1.01	0.94	174	0.02	0.016	178
							Total Emissions by Process	**174**	**0.02**	**0.016**	**178**

Estimated Scope 1 GHG Emissions due to Backfill and Capping

6	CAT 272 SKID STEER	950	4.2	3,990	10.21	1.01	0.94	41	0.00	0.004	42
6	CAT 910M FRONT LOADER	950	4.4	4,180	10.21	1.01	0.94	43	0.00	0.004	44
6	TELEBELT 130	950	17.8	16,910	10.21	1.01	0.94	173	0.02	0.016	177
6	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	950	18.7	17,765	10.21	1.01	0.94	181	0.02	0.017	186
6	BARGE (80'X40')	950	0.0	0				0	0.00	0.000	0
6	SCOW (225'X42'X12')	1,901	0.0	0				0	0.00	0.000	0
6	TUG BOAT 2 - 700 HP	1,231	30.8	37,915	10.21	6.41	0.17	387	0.24	0.006	396
6	SCOW (100 CY)	3,802	0.0	0				0	0.00	0.000	0
6	TUG BOAT 1 - 380 HP	2,462	16.7	41,115	10.21	6.41	0.17	420	0.26	0.007	430
6	BARGE (80'X40')	950	0.0	0				0	0.00	0.000	0
6	CAT 375 L	1,498	18.8	28,162	10.21	1.01	0.94	288	0.03	0.026	296
6	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
6	KAFKA 814 BLENDING HOPPER	0	0.0	0				0	0.00	0.000	0
6	WORK BOAT - 115 HP	1,348	5.1	6,875	10.21	6.41	0.17	70	0.04	0.001	72
							Long-term Maintenance (5% of capping)	80	0.03	0.004	82
							Total Emissions by Process	**1,682**	**0.65**	**0.085**	**1,725**

Table D-A-2

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-C

Estimated Scope 1 GHG Emissions due to Environmental Controls

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
7	WORK BOAT - 115 HP	996	5.1	5,080	10.21	6.41	0.17	52	0.03	0.001	53
							Total Emissions by Process	52	0.03	0.001	53
							Total Emissions from Equipment (tonnes)	**6,928**	**2.38**	**0.38**	**7,101**
							Estimated Scope 1 GHG Emissions	**13,554**	**2.75**	**0.56**	**13,788**

Estimated Scope 2 GHG Emissions due to Operation of Water Treatment System (Purchased Electricity)

Water Treatment System	Water Treatment Volume (gal)	Estimated Operation Time (hours)	Power Consumption of Water Treatment System (kW)	Estimated Total kWh for Water Treatment	eGrid2021 Emission Factor[5] (CO_2 in lb/MWh)	eGrid2021 Emission Factor[5] (CH_4 in lb/MWh)	eGrid2021 Emission Factor[5] (N_2O in lb/MWh)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Water treatment system capacity (75 gpm)	7,870,465	1,749	110	192,389	817	0.019	0.0020	71	0.00166	0.000175	71
							Total Emissions by Source	**71**	**0.00166**	**0.000175**	**71**

Estimated Scope 3 GHG Emissions due to Production of Raw Materials

Material	Material Quantity (short tons)	CO_2 Equivalency Factor[6] (kg CO_2e per kg material)	CO_2e Emissions (tonnes)
Portland cement	14,393	1.34	17,497
Sand	70,108	0.0024	153
Organoclay[7]	526	2.07	988
Armor	30,509	0.0024	66
Gravel	19,248	0.0024	42
Steel sheeting[8]	0	2.410	0
Virgin GAC	419	4.8	1,832
Combined Maintenance Materials	5% of capping quantity		146
		Total Emissions	**20,724**

Estimated Scope 3 GHG Emissions due to Worker Commute

Project Component	Workers On-Site by Project Component	Total Daily Commute (person-miles)	Emissions Factor[1], CO_2 kg per Daily Commuter-Mile[9]	Emissions Factor[1], CH_4 kg per Daily Commuter-Mile	Emissions Factor[1], N_2O kg per Daily Commuter-Mile	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Component A - Contractor's Team	9	49,320	0.22	8.32E-06	5.08E-06	11.1	0.00041	0.00025	11.1
Component B - Mobilization and Pre-Remediation Site Work	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component C - Winterization and Remobilization	5	5,000	0.22	8.32E-06	5.08E-06	1.1	0.00004	0.00003	1.1
Component D - Bulkheads	16	69,360	0.22	8.32E-06	5.08E-06	15.5	0.00058	0.00035	15.7
Component E - ISS	7	17,050	0.22	8.32E-06	5.08E-06	3.8	0.00014	0.00009	3.8
Component F - Dredging and Debris Removal	13	144,570	0.22	8.32E-06	5.08E-06	32.4	0.00120	0.00073	32.6
Component G - Sediment Dewatering/Stabilization	5	59,250	0.22	8.32E-06	5.08E-06	13.3	0.00049	0.00030	13.4
Component H - Water Treatment	5	49,770	0.22	8.32E-06	5.08E-06	11.2	0.00041	0.00025	11.2
Component I - T&D (Does Not Include Workers at Facility)	2	5,400	0.22	8.32E-06	5.08E-06	1.2	0.00004	0.00003	1.2
Component J - Backfill, Capping, and Outfall Protection	7	53,010	0.22	8.32E-06	5.08E-06	11.9	0.00044	0.00027	12.0
Component K - Environmental Controls	4	8,300	0.22	8.32E-06	5.08E-06	1.9	0.00007	0.00004	1.9
Component L - Site Restoration	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component M - Demobilization	5	3,750	0.22	8.32E-06	5.08E-06	0.8	0.00003	0.00002	0.8
Total		**473,780**	**--**	**--**	**--**	**106.2**	**0.00394**	**0.00241**	**107.0**

Total Emissions by Category

Emissions Category	Estimated CO2 Emissions (tonnes)	Estimated CH4 Emissions (tonnes)	Estimated N2O Emissions (tonnes)	Estimated CO2e Emissions10 (tonnes)
Scope 1	13,554	2.8	0.6	13,788
Scope 2	71	1.7E-03	1.7E-04	71
Scope 3	106	3.9E-03	2.4E-03	20,831
Overall Total	**13,731**	**2.8**	**0.6**	**34,690**

Table D-A-2

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-C

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023a
2. Barge emissions are calculated as emissions from tugboat transport.
3. Transportation of materials includes import and export mileage only. Intrasite movement of GAC and organoclay between the upland site and placement locations are covered in the component-specific equipment emissions.
4. Equipment type and fuel usage rates specified based on professional judgment, experience on similar projects, and published information, including Equation 1 as reported in Appendix D. A fuel usage rate of "0" in this table indicates that the equipment is not self-powered and is dependent upon power from construction equipment, generators, or tug/towboats, the emissions of which are accounted for in other line items. Some water treatment equipment is powered by grid electricity, emissions from which are included in Scope 2. Fuel usage rates are rounded to the nearest tenth of a gallon per hour.
5. Based on eGRID2021 (USEPA 2023b) Northeast Power Coordinating Council NYC/Westchester subregion
6. Randall et al. 2016 is the source for all equivalency factors in this table except for organoclay and steel, as noted.
7. CETCO Technical Reference – Organoclay Carbon Footprint
8. SSAB 2023
9. USCB 2021. Daily Commuter-Mile emission factors are based on weighted average mode of transportation statistics for construction workers in the NYC metro area.
10. Scope 3 includes CO_2e emissions from raw materials production, where no individual GHG gas emissions were calculated.
11. Equipment operational duration includes 60% uptime assumption for all pieces of equipment.
12. Due to rounding in the displayed values, emissions totals shown may differ from the sum of the individual values.

Conversion Factors:
2.20462 lb per kg
1,000 kg per tonne

Abbreviations:
CH_4: methane
CO_2: carbon dioxide
CO_2e: carbon dioxide equivalent
cy: cubic yard
GAC: granular activated carbon
gal: gallon
GHG: greenhouse gas
gpm: gallons per minute
hp: horsepower
ISS: in situ stabilization and solidification
kg: kilogram
kW: kilowatt
kWh: kilowatt hour
lb: pound
lb/MWh: pounds per megawatt hour
N_2O: nitrous oxide
NYC: New York City
T&D: transportation and disposal
ton: short ton; 2,000 lb
tonne: metric ton (MT); 1,000 kg

References:

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Table D-A-3
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-D

Estimated Scope 1 GHG Emissions due to Transportation of Materials: Stabilization and Capping Materials, Waste Disposal, and Interim Winterization/Demobilization

Activity	Notes/Assumptions	Material Quantity (short tons)	Assumed Distance (miles)	Assumed Transport Mode	Emissions Factor[1] (kg CO_2 per ton-mile)	Emissions Factor[1] (kg CH_4 per ton-mile)	Emissions Factor[1] (kg N_2O per ton-mile)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Dredging-related Materials											
Transportation of Portland cement to site for sediment stabilization	From Earth Materials, LLC, in Vineland, New Jersey Assumes 1.27 ton/cy	16,770	140	Truck	0.170	1.60E-06	4.70E-06	399	0.00	0.011	402
Transportation of dredged material from site to processing facility (sediment, debris, and water)	Assumes 1.4 ton/cy	160,477	12	Barge[2]	0.044	2.54E-05	1.10E-06	85	0.05	0.002	87
Backfill-related Materials							**Total Emissions by Process**	**484**	**0.05**	**0.013**	**489**
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	22,270	75	Barge[2]	0.044	2.54E-05	1.10E-06	73	0.04	0.002	75
Capping and Outfall Protection-related Materials[3]							**Total Emissions by Process**	**73**	**0.04**	**0.002**	**75**
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	60,289	75	Barge[2]	0.044	2.54E-05	1.10E-06	199	0.11	0.005	204
Transportation of GAC to site	From Calgon production center in Huntington, West Virginia Assumes 0.45 ton/cy	375	585	Truck	0.170	1.60E-06	4.70E-06	37	0.00	0.001	38
Transportation of Organoclay to site	From generic production facility (anecdotal; assumed somewhere in Western U.S. due to UT/WY/MT stronghold in bentonite production) Assumes 0.68 ton/cy	454	2,500	Truck	0.170	1.60E-06	4.70E-06	193	0.00	0.005	194
Transportation of gravel to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	18,599	75	Barge[2]	0.044	2.54E-05	1.10E-06	61	0.04	0.002	63
Transportation of armor to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	29,684	75	Barge[2]	0.044	2.54E-05	1.10E-06	98	0.06	0.002	100
Waste Disposal							**Total Emissions by Process**	**588**	**0.21**	**0.015**	**599**
Transportation of non-hazardous dredged material from work area to regional processing facility (stabilized sediment, including Portland cement and debris)	Transport of non-hazardous waste and debris from work area to regional facility for processing	137,102	12	Barge[2]	0.044	2.54E-05	1.10E-06	72	0.04	0.002	74
	Non-hazardous waste and debris from processing facility to landfill disposal	137,102	100	Truck	0.170	1.60E-06	4.70E-06	2,331	0.02	0.064	2,349
Transportation of post-stabilized dredged material from work area to disposal landfill (hazardous)	Transport of hazardous waste and debris from work area to regional facility for processing	6,841	25	Barge[2]	0.044	2.54E-05	1.10E-06	8	0.00	0.000	8
	Hazardous waste from processing facility to landfill disposal	6,841	250	Truck	0.170	1.60E-06	4.70E-06	291	0.00	0.008	293
							Total Emissions by Process	**2,701**	**0.07**	**0.074**	**2,724**

Estimated Scope 1 GHG Emissions due to Interim Winterization and Remobilization

Transportation of equipment to maintenance facility, rental facilities, and other project locations for winter, and remobilization back to site at the beginning of the following construction season.	Maintenance facility or another project location assumed to be 100 miles away (200-mile round-trip distance). Rental facility assumed distance of 50 miles. Various rental facilities assumed distance of 25 miles.	919	19,050	Truck	0.170	1.60E-06	4.70E-06	2,975	0.03	0.082	2,998
							Total Emissions by Process	**2,975**	**0.03**	**0.082**	**2,998**

Table D-A-3
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-D

Estimated Scope 1 GHG Emissions due to Mobilization, including Winterization and Mobilization

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
1B	SANY SCC1000	120	11.0	1,320	10.21	1.01	0.94	13	0.00	0.001	14
1B	Lowboy Truck	120	17.6	2,112	10.21	0.91	0.56	22	0.00	0.001	22
							Total Emissions by Process	**35**	**0.00**	**0.002**	**36**

Estimated Scope 1 GHG Emissions due to Shoreline Work, including Bulkheads and ISS

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
2A	BUCKET (3.0 CY)	0	0.0	0							0
2A	ORANGE PEEL GRAPPLE (1.25 CY)	734	0.0	0							0
2A	BARGE (80'X40')	2,203	0.0	0							0
2A	SCOW (225'X42'X12')	2,203	0.0	0							0
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	734	18.7	13,726	10.21	1.01	0.94	140	0.01	0.013	144
2A	BARGE (80'X40')	2,203	0.0	0							0
2A	VIBRATORY HAMMER (HPSI MODEL 300)	1,469	18.3	26,883	10.21	1.01	0.94	274	0.03	0.025	282
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	734	18.7	13,726	10.21	1.01	0.94	140	0.01	0.013	144
2A	TUG BOAT 1 - 380 HP	1,469	16.7	24,532	10.21	6.41	0.17	250	0.16	0.004	256
2A	TUG BOAT 2 - 700 HP	734	30.8	22,607	10.21	6.41	0.17	231	0.14	0.004	236
2A	WORK BOAT - 115 HP	1,469	5.1	7,492	10.21	6.41	0.17	76	0.05	0.001	78
2B	ISS OPERATION - DECK BARGE	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HORIZONTAL PIG (4,200 CF)	5,280	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SUCTION HOSE (4" X 20')	1,980	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - DISCHARGE HOSE (4" X 50')	2,640	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GODWIN PUMP (4")	5,280	0.7	3,696	10.21	1.01	0.94	38	0.00	0.003	39
2B	ISS OPERATION - FRAC TANK (18,000 GAL)	1,320	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HME SPUD BARGE	2,640	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GENERATOR (175 KW)	660	12.3	8,118	10.21	1.01	0.94	83	0.01	0.008	85
2B	ISS OPERATION - BATCH PLANT (45 CM/HR)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - BAUER RG 22S DRILL RIG	660	45.0	29,700	10.21	1.01	0.94	303	0.03	0.028	312
2B	ISS OPERATION - HORIZONTAL SILO (1,200 CF)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GAS WELDER	660	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - LIGHT PLANT	660	0.0	0				0	0.00	0.000	0
2B	TUG BOAT 2 - 700 HP	660	30.8	20,328	10.21	6.41	0.17	208	0.13	0.003	212
2B	WATER TRUCK (4,000 GAL)	660	13.2	8,712	10.21	0.91	0.56	89	0.01	0.005	91
							Total Emissions by Process	**1,903**	**0.59**	**0.113**	**1,951**

Table D-A-3
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-D

Estimated Scope 1 GHG Emissions due to Dredging, including Processing and Water Treatment

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
3A	CAT 375 L	1,829	18.8	34,385	10.21	1.01	0.94	351	0.03	0.032	361
3A	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3A	ORANGE PEEL GRAPPLE (1.25 CY)	1,829	0.0	0				0	0.00	0.000	0
3A	EXCAVATOR RAKE	1,829	0.0	0				0	0.00	0.000	0
3A	BARGE (80'X40')	3,658	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	1,829	16.7	30,544	10.21	6.41	0.17	312	0.20	0.005	319
3A	SCOW (100 CY)	7,315	0.0	0				0	0.00	0.000	0
3A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	1,829	18.7	34,202	10.21	1.01	0.94	349	0.03	0.032	359
3A	BARGE (80'X40')	3,658	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	1,829	16.7	30,544	10.21	6.41	0.17	312	0.20	0.005	319
3A	TUG BOAT 2 - 700 HP	1,829	30.8	56,333	10.21	6.41	0.17	575	0.36	0.010	589
3A	SCOW (225'X42'X12')	5,486	0.0	0				0	0.00	0.000	0
3A	WORK BOAT - 115 HP	7,315	5.1	37,307	10.21	6.41	0.17	381	0.24	0.006	390
3B	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3B	BARGE (80'X40')	6,096	0.0	0				0	0.00	0.000	0
3B	CAT 349 E	3,048	19.0	57,912	10.21	1.01	0.94	591	0.06	0.054	608
3B	WATER TRUCK (4,000 GAL)	3,048	13.2	40,234	10.21	0.91	0.56	411	0.04	0.023	418
3B	SILO	3,048	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	12,192	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	30,480	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	18,288	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	6,096	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	3,048	0.7	2,134	10.21	1.01	0.94	22	0.00	0.002	22
3C	WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	6,096	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	3,048	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	3,048	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	6,096	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	3,048	0.0	0				0	0.00	0.000	0
							Total Emissions by Process	**3,304**	**1.16**	**0.170**	**3,385**

Estimated Scope 1 GHG Emissions due to T&D

5	TUG BOAT 2 - 700 HP	600	30.8	18,480	10.21	1.01	0.94	189	0.02	0.017	194
							Total Emissions by Process	**189**	**0.02**	**0.017**	**194**

Estimated Scope 1 GHG Emissions due to Backfill and Capping

6	CAT 272 SKID STEER	1,080	4.2	4,536	10.21	1.01	0.94	46	0.00	0.004	48
6	CAT 910M FRONT LOADER	1,080	4.4	4,752	10.21	1.01	0.94	49	0.00	0.004	50
6	TELEBELT 130	1,080	17.8	19,224	10.21	1.01	0.94	196	0.02	0.018	202
6	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	1,080	18.7	20,196	10.21	1.01	0.94	206	0.02	0.019	212
6	BARGE (80'X40')	1,080	0.0	0				0	0.00	0.000	0
6	SCOW (225'X42'X12')	2,160	0.0	0				0	0.00	0.000	0
6	TUG BOAT 2 - 700 HP	1,361	30.8	41,919	10.21	6.41	0.17	428	0.27	0.007	438
6	SCOW (100 CY)	4,320	0.0	0				0	0.00	0.000	0
6	TUG BOAT 1 - 380 HP	2,722	16.7	45,457	10.21	6.41	0.17	464	0.29	0.008	475
6	BARGE (80'X40')	1,080	0.0	0				0	0.00	0.000	0
6	CAT 375 L	1,627	18.8	30,588	10.21	1.01	0.94	312	0.03	0.029	321
6	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
6	KAFKA 814 BLENDING HOPPER	0	0.0	0				0	0.00	0.000	0
6	WORK BOAT - 115 HP	1,348	5.1	6,875	10.21	6.41	0.17	70	0.04	0.001	72
							Long-term Maintenance (5% of capping)	89	0.03	0.005	91
							Total Emissions by Process	**1,861**	**0.72**	**0.095**	**1,908**

Table D-A-3
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-D

Estimated Scope 1 GHG Emissions due to Environmental Controls

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
7	WORK BOAT - 115 HP	1,008	5.1	5,141	10.21	6.41	0.17	52	0.03	0.001	54
							Total Emissions by Process	52	0.03	0.001	54
							Total Emissions from Equipment (tonnes)	**7,344**	**2.52**	**0.40**	**7,527**
							Estimated Scope 1 GHG Emissions	**14,166**	**2.93**	**0.59**	**14,413**

Estimated Scope 2 GHG Emissions due to Operation of Water Treatment System (Purchased Electricity)

Water Treatment System	Water Treatment Volume (gal)	Estimated Operation Time (hours)	Power Consumption of Water Treatment System (kW)	Estimated Total kWh for Water Treatment	eGrid2021 Emission Factor[5] (CO_2 in lb/MWh)	eGrid2021 Emission Factor[5] (CH_4 in lb/MWh)	eGrid2021 Emission Factor[5] (N_2O in lb/MWh)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Water treatment system capacity (75 gpm)	9,170,106	2,038	110	224,158	817	0.019	0.0020	83	0.00193	0.000203	83
							Total Emissions by Source	**83**	**0.00193**	**0.000203**	**83**

Estimated Scope 3 GHG Emissions due to Production of Raw Materials

Material	Material Quantity (short tons)	CO_2 Equivalency Factor[6] (kg CO_2e per kg material)	CO_2e Emissions (tonnes)
Portland cement	16,770	1.34	20,386
Sand	82,559	0.0024	180
Organoclay[7]	454	2.07	852
Armor	29,684	0.0024	65
Gravel	18,599	0.0024	40
Steel sheeting[8]	0	2.410	0
Virgin GAC	375	4.8	1,639
Combined Maintenance Materials	5% of capping quantity		132
		Total Emissions	**23,294**

Estimated Scope 3 GHG Emissions due to Worker Commute

Project Component	Workers On-Site by Project Component	Total Daily Commute (person-miles)	Emissions Factor[1], CO_2 kg per Daily Commuter-Mile[9]	Emissions Factor[1], CH_4 kg per Daily Commuter-Mile	Emissions Factor[1], N_2O kg per Daily Commuter-Mile	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Component A - Contractor's Team	9	49,770	0.22	8.32E-06	5.08E-06	11.2	0.00041	0.00025	11.2
Component B - Mobilization and Pre-Remediation Site Work	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component C - Winterization and Remobilization	5	5,000	0.22	8.32E-06	5.08E-06	1.1	0.00004	0.00003	1.1
Component D - Bulkheads	16	69,360	0.22	8.32E-06	5.08E-06	15.5	0.00058	0.00035	15.7
Component E - ISS	7	17,050	0.22	8.32E-06	5.08E-06	3.8	0.00014	0.00009	3.8
Component F - Dredging and Debris Removal	13	154,940	0.22	8.32E-06	5.08E-06	34.7	0.00129	0.00079	35.0
Component G - Sediment Dewatering/Stabilization	5	63,500	0.22	8.32E-06	5.08E-06	14.2	0.00053	0.00032	14.3
Component H - Water Treatment	5	53,340	0.22	8.32E-06	5.08E-06	12.0	0.00044	0.00027	12.0
Component I - T&D (Does Not Include Workers at Facility)	2	5,900	0.22	8.32E-06	5.08E-06	1.3	0.00005	0.00003	1.3
Component J - Backfill, Capping, and Outfall Protection	7	58,280	0.22	8.32E-06	5.08E-06	13.1	0.00048	0.00030	13.2
Component K - Environmental Controls	4	8,400	0.22	8.32E-06	5.08E-06	1.9	0.00007	0.00004	1.9
Component L - Site Restoration	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component M - Demobilization	5	3,750	0.22	8.32E-06	5.08E-06	0.8	0.00003	0.00002	0.8
Total		**498,290**	--	--	--	**111.7**	**0.00414**	**0.00253**	**112.5**

Total Emissions by Category

Emissions Category	Estimated CO2 Emissions (tonnes)	Estimated CH4 Emissions (tonnes)	Estimated N2O Emissions (tonnes)	Estimated CO2e Emissions10 (tonnes)
Scope 1	14,166	2.9	0.6	14,413
Scope 2	83	1.9E-03	2.0E-04	83
Scope 3	112	4.1E-03	2.5E-03	23,407
Overall Total	**14,361**	**2.9**	**0.6**	**37,903**

Table D-A-3

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-D

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023a
2. Barge emissions are calculated as emissions from tugboat transport.
3. Transportation of materials includes import and export mileage only. Intrasite movement of GAC and organoclay between the upland site and placement locations are covered in the component-specific equipment emissions.
4. Equipment type and fuel usage rates specified based on professional judgment, experience on similar projects, and published information, including Equation 1 as reported in Appendix D. A fuel usage rate of "0" in this table indicates that the equipment is not self-powered and is dependent upon power from construction equipment, generators, or tug/towboats, the emissions of which are
5. Based on eGRID2021 (USEPA 2023b) Northeast Power Coordinating Council NYC/Westchester subregion
6. Randall et al. 2016 is the source for all equivalency factors in this table except for organoclay and steel, as noted.
7. CETCO Technical Reference – Organoclay Carbon Footprint
8. SSAB 2023
9. USCB 2021. Daily Commuter-Mile emission factors are based on weighted average mode of transportation statistics for construction workers in the NYC metro area.
10. Scope 3 includes CO_2e emissions from raw materials production, where no individual GHG gas emissions were calculated.
11. Equipment operational duration includes 60% uptime assumption for all pieces of equipment.
12. Due to rounding in the displayed values, emissions totals shown may differ from the sum of the individual values.

Conversion Factors:
2.20462 lb per kg
1,000 kg per tonne

Abbreviations:
CH_4: methane
CO_2: carbon dioxide
CO_2e: carbon dioxide equivalent
cy: cubic yard
GAC: granular activated carbon
gal: gallon
GHG: greenhouse gas
gpm: gallons per minute
hp: horsepower
ISS: in situ stabilization and solidification
kg: kilogram
kW: kilowatt
kWh: kilowatt hour
lb: pound
lb/MWh: pounds per megawatt hour
N_2O: nitrous oxide
NYC: New York City
T&D: transportation and disposal
ton: short ton; 2,000 lb
tonne: metric ton (MT); 1,000 kg

References:
CETCO (Colloid Environmental Technologies Company), 2014. *Organoclay Carbon Footprint.* Technical Reference TR-859. 2014.
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Table D-A-4
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-E

Estimated Scope 1 GHG Emissions due to Transportation of Materials: Stabilization and Capping Materials, Waste Disposal, and Interim Winterization/Demobilization

Activity	Notes/Assumptions	Material Quantity (short tons)	Assumed Distance (miles)	Assumed Transport Mode	Emissions Factor[1] (kg CO_2 per ton-mile)	Emissions Factor[1] (kg CH_4 per ton-mile)	Emissions Factor[1] (kg N_2O per ton-mile)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Dredging-related Materials											
Transportation of Portland cement to site for sediment stabilization	From Earth Materials, LLC, in Vineland, New Jersey Assumes 1.27 ton/cy	36,037	140	Truck	0.170	1.60E-06	4.70E-06	858	0.01	0.024	864
Transportation of dredged material from site to processing facility (sediment, debris, and water)	Assumes 1.4 ton/cy	344,852	12	Barge[2]	0.044	2.54E-05	1.10E-06	182	0.11	0.005	186
							Total Emissions by Process	**1,040**	**0.11**	**0.028**	**1,051**
Backfill-related Materials											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	11,085	75	Barge[2]	0.044	2.54E-05	1.10E-06	37	0.02	0.001	37
							Total Emissions by Process	**37**	**0.02**	**0.001**	**37**
Capping and Outfall Protection-related Materials[3]											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	53,098	75	Barge[2]	0.044	2.54E-05	1.10E-06	175	0.10	0.004	179
Transportation of GAC to site	From Calgon production center in Huntington, West Virginia Assumes 0.45 ton/cy	310	585	Truck	0.170	1.60E-06	4.70E-06	31	0.00	0.001	31
Transportation of Organoclay to site	From generic production facility (anecdotal; assumed somewhere in Western U.S. due to UT/WY/MT stronghold in bentonite production) Assumes 0.68 ton/cy	108	2,500	Truck	0.170	1.60E-06	4.70E-06	46	0.00	0.001	46
Transportation of gravel to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	4,534	75	Barge[2]	0.044	2.54E-05	1.10E-06	15	0.01	0.000	15
Transportation of armor to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	7,256	75	Barge[2]	0.044	2.54E-05	1.10E-06	24	0.01	0.001	25
							Total Emissions by Process	**291**	**0.12**	**0.007**	**297**
Waste Disposal											
Transportation of non-hazardous dredged material from work area to regional processing facility (stabilized sediment, including Portland cement and debris)	Transport of non-hazardous waste and debris from work area to regional facility for processing	331,224	12	Barge[2]	0.044	2.54E-05	1.10E-06	175	0.10	0.004	179
	Non-hazardous waste and debris from processing facility to landfill disposal	331,224	100	Truck	0.170	1.60E-06	4.70E-06	5,631	0.05	0.156	5,675
Transportation of post-stabilized dredged material from work area to disposal landfill (hazardous)	Transport of hazardous waste and debris from work area to regional facility for processing	16,526	25	Barge[2]	0.044	2.54E-05	1.10E-06	18	0.01	0.000	19
	Hazardous waste from processing facility to landfill disposal	16,526	250	Truck	0.170	1.60E-06	4.70E-06	702	0.01	0.019	708
							Total Emissions by Process	**6,526**	**0.17**	**0.180**	**6,580**

Estimated Scope 1 GHG Emissions due to Interim Winterization and Remobilization

Transportation of equipment to maintenance facility, rental facilities, and other project locations for winter, and remobilization back to site at the beginning of the following construction season.	Maintenance facility or another project location assumed to be 100 miles away (200-mile round-trip distance). Rental facility assumed distance of 50 miles. Various rental facilities assumed distance of 25 miles.	919	47,625	Truck	0.170	1.60E-06	4.70E-06	7,437	0.07	0.206	7,495
							Total Emissions by Process	**7,437**	**0.07**	**0.206**	**7,495**

Table D-A-4
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-E

Estimated Scope 1 GHG Emissions due to Mobilization, including Winterization and Mobilization

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
1B	SANY SCC1000	120	11.0	1,320	10.21	1.01	0.94	13	0.00	0.001	14
1B	Lowboy Truck	120	17.6	2,112	10.21	0.91	0.56	22	0.00	0.001	22
							Total Emissions by Process	**35**	**0.00**	**0.002**	**36**

Estimated Scope 1 GHG Emissions due to Shoreline Work, including Bulkheads and ISS

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
2A	BUCKET (3.0 CY)	0	0.0	0							0
2A	ORANGE PEEL GRAPPLE (1.25 CY)	2,023	0.0	0							0
2A	BARGE (80'X40')	6,070	0.0	0							0
2A	SCOW (225'X42'X12')	6,070	0.0	0							0
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	2,023	18.7	37,830	10.21	1.01	0.94	386	0.04	0.036	397
2A	BARGE (80'X40')	6,070	0.0	0							0
2A	VIBRATORY HAMMER (HPSI MODEL 300)	4,046	18.3	74,042	10.21	1.01	0.94	756	0.07	0.070	777
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	2,023	18.7	37,830	10.21	1.01	0.94	386	0.04	0.036	397
2A	TUG BOAT 1 - 380 HP	4,046	16.7	67,568	10.21	6.41	0.17	690	0.43	0.011	706
2A	TUG BOAT 2 - 700 HP	2,023	30.8	62,308	10.21	6.41	0.17	636	0.40	0.011	651
2A	WORK BOAT - 115 HP	4,046	5.1	20,635	10.21	6.41	0.17	211	0.13	0.004	216
2B	ISS OPERATION - DECK BARGE	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HORIZONTAL PIG (4,200 CF)	9,216	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SUCTION HOSE (4" X 20')	3,456	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - DISCHARGE HOSE (4" X 50')	4,608	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GODWIN PUMP (4")	9,216	0.7	6,451	10.21	1.01	0.94	66	0.01	0.006	68
2B	ISS OPERATION - FRAC TANK (18,000 GAL)	2,304	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HME SPUD BARGE	4,608	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GENERATOR (175 KW)	1,152	12.3	14,170	10.21	1.01	0.94	145	0.01	0.013	149
2B	ISS OPERATION - BATCH PLANT (45 CM/HR)	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - BAUER RG 22S DRILL RIG	1,152	45.0	51,840	10.21	1.01	0.94	529	0.05	0.049	544
2B	ISS OPERATION - HORIZONTAL SILO (1,200 CF)	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GAS WELDER	1,152	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - LIGHT PLANT	1,152	0.0	0				0	0.00	0.000	0
2B	TUG BOAT 2 - 700 HP	1,152	30.8	35,482	10.21	6.41	0.17	362	0.23	0.006	371
2B	WATER TRUCK (4,000 GAL)	1,152	13.2	15,206	10.21	0.91	0.56	155	0.01	0.009	158
							Total Emissions by Process	**4,393**	**1.44**	**0.254**	**4,505**

Table D-A-4

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-E

Estimated Scope 1 GHG Emissions due to Dredging, including Processing and Water Treatment

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
3A	CAT 375 L	3,521	18.8	66,195	10.21	1.01	0.94	676	0.07	0.062	695
3A	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3A	ORANGE PEEL GRAPPLE (1.25 CY)	3,521	0.0	0				0	0.00	0.000	0
3A	EXCAVATOR RAKE	3,521	0.0	0				0	0.00	0.000	0
3A	BARGE (80'X40')	7,042	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	3,521	16.7	58,801	10.21	6.41	0.17	600	0.38	0.010	614
3A	SCOW (100 CY)	14,083	0.0	0				0	0.00	0.000	0
3A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	3,521	18.7	65,843	10.21	1.01	0.94	672	0.07	0.062	691
3A	BARGE (80'X40')	7,042	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	3,521	16.7	58,801	10.21	6.41	0.17	600	0.38	0.010	614
3A	TUG BOAT 2 - 700 HP	3,521	30.8	108,447	10.21	6.41	0.17	1,107	0.70	0.018	1,133
3A	SCOW (225'X42'X12')	10,562	0.0	0				0	0.00	0.000	0
3A	WORK BOAT - 115 HP	14,083	5.1	71,823	10.21	6.41	0.17	733	0.46	0.012	750
3B	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3B	BARGE (80'X40')	11,736	0.0	0				0	0.00	0.000	0
3B	CAT 349 E	5,868	19.0	111,492	10.21	1.01	0.94	1,138	0.11	0.105	1,170
3B	WATER TRUCK (4,000 GAL)	5,868	13.2	77,458	10.21	0.91	0.56	791	0.07	0.043	805
3B	SILO	5,868	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	23,472	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	58,680	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	35,208	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	11,736	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	5,868	0.7	4,108	10.21	1.01	0.94	42	0.00	0.004	43
3C	WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	11,736	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	5,868	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	5,868	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	11,736	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	5,868	0.0	0				0	0.00	0.000	0
							Total Emissions by Process	**6,360**	**2.23**	**0.327**	**6,516**

Estimated Scope 1 GHG Emissions due to T&D

5	TUG BOAT 2 - 700 HP	1,392	30.8	42,874	10.21	1.01	0.94	438	0.04	0.040	450
							Total Emissions by Process	**438**	**0.04**	**0.040**	**450**

Estimated Scope 1 GHG Emissions due to Backfill and Capping

6	CAT 272 SKID STEER	612	4.2	2,570	10.21	1.01	0.94	26	0.00	0.002	27
6	CAT 910M FRONT LOADER	612	4.4	2,693	10.21	1.01	0.94	27	0.00	0.003	28
6	TELEBELT 130	612	17.8	10,894	10.21	1.01	0.94	111	0.01	0.010	114
6	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	612	18.7	11,444	10.21	1.01	0.94	117	0.01	0.011	120
6	BARGE (80'X40')	612	0.0	0				0	0.00	0.000	0
6	SCOW (225'X42'X12')	1,224	0.0	0				0	0.00	0.000	0
6	TUG BOAT 2 - 700 HP	893	30.8	27,504	10.21	6.41	0.17	281	0.18	0.005	287
6	SCOW (100 CY)	2,448	0.0	0				0	0.00	0.000	0
6	TUG BOAT 1 - 380 HP	1,786	16.7	29,826	10.21	6.41	0.17	305	0.19	0.005	312
6	BARGE (80'X40')	612	0.0	0				0	0.00	0.000	0
6	CAT 375 L	1,159	18.8	21,789	10.21	1.01	0.94	222	0.02	0.020	229
6	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
6	KAFKA 814 BLENDING HOPPER	0	0.0	0				0	0.00	0.000	0
6	WORK BOAT - 115 HP	1,348	5.1	6,875	10.21	6.41	0.17	70	0.04	0.001	72
							Long-term Maintenance (5% of capping)	58	0.02	0.003	59
							Total Emissions by Process	**1,218**	**0.48**	**0.060**	**1,249**

Table D-A-4

Estimated Greenhouse Gas Emissions for Remedial Alternative EB-E

Estimated Scope 1 GHG Emissions due to Environmental Controls

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
7	WORK BOAT - 115 HP	1,740	5.1	8,874	10.21	6.41	0.17	91	0.06	0.002	93
							Total Emissions by Process	91	0.06	0.002	93
							Total Emissions from Equipment (tonnes)	**12,534**	**4.25**	**0.69**	**12,848**
							Estimated Scope 1 GHG Emissions	**27,865**	**4.75**	**1.11**	**28,309**

Estimated Scope 2 GHG Emissions due to Operation of Water Treatment System (Purchased Electricity)

Water Treatment System	Water Treatment Volume (gal)	Estimated Operation Time (hours)	Power Consumption of Water Treatment System (kW)	Estimated Total kWh for Water Treatment	eGrid2021 Emission Factor[5] (CO_2 in lb/MWh)	eGrid2021 Emission Factor[5] (CH_4 in lb/MWh)	eGrid2021 Emission Factor[5] (N_2O in lb/MWh)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Water treatment system capacity (75 gpm)	19,705,812	4,379	110	481,698	817	0.019	0.0020	178	0.00415	0.000437	179
							Total Emissions by Source	**178**	**0.00415**	**0.000437**	**179**

Estimated Scope 3 GHG Emissions due to Production of Raw Materials

Material	Material Quantity (short tons)	CO_2 Equivalency Factor[6] (kg CO_2e per kg material)	CO_2e Emissions (tonnes)
Portland cement	36,037	1.34	43,808
Sand	64,183	0.0024	140
Organoclay[7]	108	2.07	202
Armor	7,256	0.0024	16
Gravel	4,534	0.0024	10
Steel sheeting[8]	17	2.410	38
Virgin GAC	310	4.8	1,355
Combined Maintenance Materials	5% of capping quantity		82
		Total Emissions	**45,650**

Estimated Scope 3 GHG Emissions due to Worker Commute

Project Component	Workers On-Site by Project Component	Total Daily Commute (person-miles)	Emissions Factor[1], CO_2 kg per Daily Commuter-Mile[9]	Emissions Factor[1], CH_4 kg per Daily Commuter-Mile	Emissions Factor[1], N_2O kg per Daily Commuter-Mile	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Component A - Contractor's Team	9	85,320	0.22	8.32E-06	5.08E-06	19.1	0.00071	0.00043	19.3
Component B - Mobilization and Pre-Remediation Site Work	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component C - Winterization and Remobilization	5	12,500	0.22	8.32E-06	5.08E-06	2.8	0.00010	0.00006	2.8
Component D - Bulkheads	16	191,080	0.22	8.32E-06	5.08E-06	42.8	0.00159	0.00097	43.1
Component E - ISS	7	29,760	0.22	8.32E-06	5.08E-06	6.7	0.00025	0.00015	6.7
Component F - Dredging and Debris Removal	13	298,290	0.22	8.32E-06	5.08E-06	66.9	0.00248	0.00151	67.3
Component G - Sediment Dewatering/Stabilization	5	122,250	0.22	8.32E-06	5.08E-06	27.4	0.00102	0.00062	27.6
Component H - Water Treatment	5	102,690	0.22	8.32E-06	5.08E-06	23.0	0.00085	0.00052	23.2
Component I - T&D (Does Not Include Workers at Facility)	2	13,200	0.22	8.32E-06	5.08E-06	3.0	0.00011	0.00007	3.0
Component J - Backfill, Capping, and Outfall Protection	7	38,440	0.22	8.32E-06	5.08E-06	8.6	0.00032	0.00020	8.7
Component K - Environmental Controls	4	14,500	0.22	8.32E-06	5.08E-06	3.3	0.00012	0.00007	3.3
Component L - Site Restoration	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component M - Demobilization	5	3,750	0.22	8.32E-06	5.08E-06	0.8	0.00003	0.00002	0.8
Total		**920,780**	**--**	**--**	**--**	**206.4**	**0.00766**	**0.00468**	**207.9**

Total Emissions by Category

Emissions Category	Estimated CO2 Emissions (tonnes)	Estimated CH4 Emissions (tonnes)	Estimated N2O Emissions (tonnes)	Estimated CO2e Emissions10 (tonnes)
Scope 1	27,865	4.8	1.1	28,309
Scope 2	178	4.2E-03	4.4E-04	179
Scope 3	206	7.7E-03	4.7E-03	45,858
Overall Total	**28,249**	**4.8**	**1.1**	**74,346**

Table D-A-4
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-E

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023a
2. Barge emissions are calculated as emissions from tugboat transport.
3. Transportation of materials includes import and export mileage only. Intrasite movement of GAC and organoclay between the upland site and placement locations are covered in the component-specific equipment emissions.
4. Equipment type and fuel usage rates specified based on professional judgment, experience on similar projects, and published information, including Equation 1 as reported in Appendix D. A fuel usage rate of "0" in this table indicates that the equipment is not self-powered and is dependent upon power from construction equipment, generators, or tug/towboats, the emissions of which are
5. Based on eGRID2021 (USEPA 2023b) Northeast Power Coordinating Council NYC/Westchester subregion
6. Randall et al. 2016 is the source for all equivalency factors in this table except for organoclay and steel, as noted.
7. CETCO Technical Reference – Organoclay Carbon Footprint
8. SSAB 2023
9. USCB 2021. Daily Commuter-Mile emission factors are based on weighted average mode of transportation statistics for construction workers in the NYC metro area.
10. Scope 3 includes CO_2e emissions from raw materials production, where no individual GHG gas emissions were calculated.
11. Equipment operational duration includes 60% uptime assumption for all pieces of equipment.
12. Due to rounding in the displayed values, emissions totals shown may differ from the sum of the individual values.

Conversion Factors:
2.20462 lb per kg
1,000 kg per tonne

Abbreviations:
CH_4: methane
CO_2: carbon dioxide
CO_2e: carbon dioxide equivalent
cy: cubic yard
GAC: granular activated carbon
gal: gallon
GHG: greenhouse gas
gpm: gallons per minute
hp: horsepower
ISS: in situ stabilization and solidification
kg: kilogram
kW: kilowatt
kWh: kilowatt hour
lb: pound
lb/MWh: pounds per megawatt hour
N_2O: nitrous oxide
NYC: New York City
T&D: transportation and disposal
ton: short ton; 2,000 lb
tonne: metric ton (MT); 1,000 kg

References:

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Table D-A-5
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-F

Estimated Scope 1 GHG Emissions due to Transportation of Materials: Stabilization and Capping Materials, Waste Disposal, and Interim Winterization/Demobilization

Activity	Notes/Assumptions	Material Quantity (short tons)	Assumed Distance (miles)	Assumed Transport Mode	Emissions Factor[1] (kg CO_2 per ton-mile)	Emissions Factor[1] (kg CH_4 per ton-mile)	Emissions Factor[1] (kg N_2O per ton-mile)	CO_2 Emissions[1,2] (tonnes)	CH_4 Emissions[1,2] (tonnes)	N_2O Emissions[1,2] (tonnes)	CO_2e Emissions[1,2] (tonnes)
Dredging-related Materials											
Transportation of Portland cement to site for sediment stabilization	From Earth Materials, LLC, in Vineland, New Jersey Assumes 1.27 ton/cy	39,214	140	Truck	0.170	1.60E-06	4.70E-06	933	0.01	0.026	941
Transportation of dredged material from site to processing facility (sediment, debris, and water)	Assumes 1.4 ton/cy	375,254	12	Barge[2]	0.044	2.54E-05	1.10E-06	198	0.11	0.005	203
							Total Emissions by Process	**1,131**	**0.12**	**0.031**	**1,143**
Backfill-related Materials											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	15,636	75	Barge[2]	0.044	2.54E-05	1.10E-06	52	0.03	0.001	53
							Total Emissions by Process	**52**	**0.03**	**0.001**	**53**
Capping and Outfall Protection-related Materials[3]											
Transportation of sand to site	From Tilcon quarry in Clinton Point, New York Assumes 1.55 ton/cy	43,999	75	Barge[2]	0.044	2.54E-05	1.10E-06	145	0.08	0.004	149
Transportation of GAC to site	From Calgon production center in Huntington, West Virginia Assumes 0.45 ton/cy	252	585	Truck	0.170	1.60E-06	4.70E-06	25	0.00	0.001	25
Transportation of Organoclay to site	From generic production facility (anecdotal; assumed somewhere in Western U.S. due to UT/WY/MT stronghold in bentonite production) Assumes 0.68 ton/cy	0	2,500	Truck	0.170	1.60E-06	4.70E-06	0	0.00	0.000	0
Transportation of gravel to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	1,152	75	Barge[2]	0.044	2.54E-05	1.10E-06	4	0.00	0.000	4
Transportation of armor to site	From Tilcon quarry in Clinton Point, New York Assumes 1.69 ton/cy	2,171	75	Barge[2]	0.044	2.54E-05	1.10E-06	7	0.00	0.000	7
							Total Emissions by Process	**181**	**0.09**	**0.005**	**185**
Waste Disposal											
Transportation of non-hazardous dredged material from work area to regional processing facility (stabilized sediment, including Portland cement and debris)	Transport of non-hazardous waste and debris from work area to regional facility for processing	360,781	12	Barge[2]	0.044	2.54E-05	1.10E-06	190	0.11	0.005	195
	Non-hazardous waste and debris from processing facility to landfill disposal	360,781	100	Truck	0.170	1.60E-06	4.70E-06	6,133	0.06	0.170	6,181
Transportation of post-stabilized dredged material from work area to disposal landfill (hazardous)	Transport of hazardous waste and debris from work area to regional facility for processing	18,001	25	Barge[2]	0.044	2.54E-05	1.10E-06	20	0.01	0.000	20
	Hazardous waste from processing facility to landfill disposal	18,001	250	Truck	0.170	1.60E-06	4.70E-06	765	0.01	0.021	771
							Total Emissions by Process	**7,109**	**0.19**	**0.196**	**7,168**

Estimated Scope 1 GHG Emissions due to Interim Winterization and Remobilization

Transportation of equipment to maintenance facility, rental facilities, and other project locations for winter, and remobilization back to site at the beginning of the following construction season.	Maintenance facility or another project location assumed to be 100 miles away (200-mile round-trip distance). Rental facility assumed distance of 50 miles. Various rental facilities assumed distance of 25 miles.	919	57,150	Truck	0.170	1.60E-06	4.70E-06	8,925	0.08	0.247	8,994
							Total Emissions by Process	**8,925**	**0.08**	**0.247**	**8,994**

Table D-A-5
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-F

Estimated Scope 1 GHG Emissions due to Mobilization, including Winterization and Mobilization

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
1B	SANY SCC1000	120	11.0	1,320	10.21	1.01	0.94	13	0.00	0.001	14
1B	Lowboy Truck	120	17.6	2,112	10.21	0.91	0.56	22	0.00	0.001	22
							Total Emissions by Process	**35**	**0.00**	**0.002**	**36**

Estimated Scope 1 GHG Emissions due to Shoreline Work, including Bulkheads and ISS

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
2A	BUCKET (3.0 CY)	0	0.0	0							0
2A	ORANGE PEEL GRAPPLE (1.25 CY)	3,614	0.0	0							0
2A	BARGE (80'X40')	10,843	0.0	0							0
2A	SCOW (225'X42'X12')	10,843	0.0	0							0
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	3,614	18.7	67,582	10.21	1.01	0.94	690	0.07	0.064	709
2A	BARGE (80'X40')	10,843	0.0	0							0
2A	VIBRATORY HAMMER (HPSI MODEL 300)	7,229	18.3	132,291	10.21	1.01	0.94	1,351	0.13	0.124	1,389
2A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	3,614	18.7	67,582	10.21	1.01	0.94	690	0.07	0.064	709
2A	TUG BOAT 1 - 380 HP	7,229	16.7	120,724	10.21	6.41	0.17	1,233	0.77	0.021	1,261
2A	TUG BOAT 2 - 700 HP	3,614	30.8	111,311	10.21	6.41	0.17	1,136	0.71	0.019	1,163
2A	WORK BOAT - 115 HP	7,229	5.1	36,868	10.21	6.41	0.17	376	0.24	0.006	385
2B	ISS OPERATION - DECK BARGE	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HORIZONTAL PIG (4,200 CF)	3,456	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SUCTION HOSE (4" X 20')	1,296	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - DISCHARGE HOSE (4" X 50')	1,728	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GODWIN PUMP (4")	3,456	0.7	2,419	10.21	1.01	0.94	25	0.00	0.002	25
2B	ISS OPERATION - FRAC TANK (18,000 GAL)	864	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - HME SPUD BARGE	1,728	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GENERATOR (175 KW)	432	12.3	5,314	10.21	1.01	0.94	54	0.01	0.005	56
2B	ISS OPERATION - BATCH PLANT (45 CM/HR)	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - BAUER RG 22S DRILL RIG	432	45.0	19,440	10.21	1.01	0.94	198	0.02	0.018	204
2B	ISS OPERATION - HORIZONTAL SILO (1,200 CF)	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - GAS WELDER	432	0.0	0				0	0.00	0.000	0
2B	ISS OPERATION - LIGHT PLANT	432	0.0	0				0	0.00	0.000	0
2B	TUG BOAT 2 - 700 HP	432	30.8	13,306	10.21	6.41	0.17	136	0.09	0.002	139
2B	WATER TRUCK (4,000 GAL)	432	13.2	5,702	10.21	0.91	0.56	58	0.01	0.003	59
							Total Emissions by Process	**6,018**	**2.12**	**0.333**	**6,172**

Table D-A-5
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-F

Estimated Scope 1 GHG Emissions due to Dredging, including Processing and Water Treatment

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
3A	CAT 375 L	3,737	18.8	70,256	10.21	1.01	0.94	717	0.07	0.066	737
3A	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3A	ORANGE PEEL GRAPPLE (1.25 CY)	3,737	0.0	0				0	0.00	0.000	0
3A	EXCAVATOR RAKE	3,737	0.0	0				0	0.00	0.000	0
3A	BARGE (80'X40')	7,474	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	3,737	16.7	62,408	10.21	6.41	0.17	637	0.40	0.011	652
3A	SCOW (100 CY)	14,947	0.0	0				0	0.00	0.000	0
3A	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	3,737	18.7	69,882	10.21	1.01	0.94	713	0.07	0.066	734
3A	BARGE (80'X40')	7,474	0.0	0	10.21	6.41	0.17	0	0.00	0.000	0
3A	TUG BOAT 1 - 380 HP	3,737	16.7	62,408	10.21	6.41	0.17	637	0.40	0.011	652
3A	TUG BOAT 2 - 700 HP	3,737	30.8	115,100	10.21	6.41	0.17	1,175	0.74	0.020	1,202
3A	SCOW (225'X42'X12')	11,210	0.0	0				0	0.00	0.000	0
3A	WORK BOAT - 115 HP	14,947	5.1	76,230	10.21	6.41	0.17	778	0.49	0.013	796
3B	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
3B	BARGE (80'X40')	12,456	0.0	0				0	0.00	0.000	0
3B	CAT 349 E	6,228	19.0	118,332	10.21	1.01	0.94	1,208	0.12	0.111	1,242
3B	WATER TRUCK (4,000 GAL)	6,228	13.2	82,210	10.21	0.91	0.56	839	0.07	0.046	854
3B	SILO	6,228	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	24,912	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	62,280	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	37,368	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	12,456	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	6,228	0.7	4,360	10.21	1.01	0.94	45	0.00	0.004	46
3C	WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	12,456	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	6,228	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	6,228	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	12,456	0.0	0				0	0.00	0.000	0
3C	WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	6,228	0.0	0				0	0.00	0.000	0
							Total Emissions by Process	**6,751**	**2.37**	**0.347**	**6,916**

Estimated Scope 1 GHG Emissions due to T&D

5	TUG BOAT 2 - 700 HP	1,500	30.8	46,200	10.21	1.01	0.94	472	0.05	0.043	485
							Total Emissions by Process	**472**	**0.05**	**0.043**	**485**

Estimated Scope 1 GHG Emissions due to Backfill and Capping

6	CAT 272 SKID STEER	511	4.2	2,146	10.21	1.01	0.94	22	0.00	0.002	23
6	CAT 910M FRONT LOADER	511	4.4	2,248	10.21	1.01	0.94	23	0.00	0.002	24
6	TELEBELT 130	511	17.8	9,096	10.21	1.01	0.94	93	0.01	0.009	95
6	SENNEBOGAN 870 MH W/ HYD. CLAMSHELL	511	18.7	9,556	10.21	1.01	0.94	98	0.01	0.009	100
6	BARGE (80'X40')	511	0.0	0				0	0.00	0.000	0
6	SCOW (225'X42'X12')	1,022	0.0	0				0	0.00	0.000	0
6	TUG BOAT 2 - 700 HP	792	30.8	24,394	10.21	6.41	0.17	249	0.16	0.004	255
6	SCOW (100 CY)	2,045	0.0	0				0	0.00	0.000	0
6	TUG BOAT 1 - 380 HP	1,584	16.7	26,453	10.21	6.41	0.17	270	0.17	0.004	276
6	BARGE (80'X40')	511	0.0	0				0	0.00	0.000	0
6	CAT 375 L	1,058	18.8	19,890	10.21	1.01	0.94	203	0.02	0.019	209
6	BUCKET (3.0 CY)	0	0.0	0				0	0.00	0.000	0
6	KAFKA 814 BLENDING HOPPER	0	0.0	0				0	0.00	0.000	0
6	WORK BOAT - 115 HP	1,348	5.1	6,875	10.21	6.41	0.17	70	0.04	0.001	72
							Long-term Maintenance (5% of capping)	51	0.02	0.003	53
							Total Emissions by Process	**1,079**	**0.43**	**0.053**	**1,106**

Table D-A-5
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-F

Estimated Scope 1 GHG Emissions due to Environmental Controls

Project Component	Equipment Type	Total Duration of Equipment Operation (hours)[11]	Assumed Fuel Usage Rate[4] (gal diesel per hour)	Total Quantity of Diesel Fuel Used (gal)	Emissions Factor[1] (kg CO_2 per gal diesel fuel)	Emissions Factor[1] (g CH_4 per gal diesel fuel)	Emissions Factor[1] (g N_2O per gal diesel fuel)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
7	WORK BOAT - 115 HP	2,196	5.1	11,200	10.21	6.41	0.17	114	0.07	0.002	117
							Total Emissions by Process	114	0.07	0.002	117
							Total Emissions from Equipment (tonnes)	**14,469**	**5.04**	**0.78**	**14,832**
							Estimated Scope 1 GHG Emissions	**31,866**	**5.55**	**1.26**	**32,376**

Estimated Scope 2 GHG Emissions due to Operation of Water Treatment System (Purchased Electricity)

Water Treatment System	Water Treatment Volume (gal)	Estimated Operation Time (hours)	Power Consumption of Water Treatment System (kW)	Estimated Total kWh for Water Treatment	eGrid2021 Emission Factor[5] (CO_2 in lb/MWh)	eGrid2021 Emission Factor[5] (CH_4 in lb/MWh)	eGrid2021 Emission Factor[5] (N_2O in lb/MWh)	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Water treatment system capacity (75 gpm)	21,443,062	4,765	110	524,164	817	0.019	0.0020	194	0.00452	0.000476	194
							Total Emissions by Source	**194**	**0.00452**	**0.000476**	**194**

Estimated Scope 3 GHG Emissions due to Production of Raw Materials

Material	Material Quantity (short tons)	CO_2 Equivalency Factor[6] (kg CO_2e per kg material)	CO_2e Emissions (tonnes)
Portland cement	39,214	1.34	47,670
Sand	59,635	0.0024	130
Organoclay[7]	0	2.07	0
Armor	2,171	0.0024	5
Gravel	1,152	0.0024	3
Steel sheeting[8]	0	2.410	0
Virgin GAC	252	4.8	1,103
Combined Maintenance Materials	5% of capping quantity		57
		Total Emissions	**48,967**

Estimated Scope 3 GHG Emissions due to Worker Commute

Project Component	Workers On-Site by Project Component	Total Daily Commute (person-miles)	Emissions Factor[1], CO_2 kg per Daily Commuter-Mile[9]	Emissions Factor[1], CH_4 kg per Daily Commuter-Mile	Emissions Factor[1], N_2O kg per Daily Commuter-Mile	CO_2 Emissions[12] (tonnes)	CH_4 Emissions[12] (tonnes)	N_2O Emissions[12] (tonnes)	CO_2e Emissions[12] (tonnes)
Component A - Contractor's Team	9	107,010	0.22	8.32E-06	5.08E-06	24.0	0.00089	0.00054	24.2
Component B - Mobilization and Pre-Remediation Site Work	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component C - Winterization and Remobilization	5	15,000	0.22	8.32E-06	5.08E-06	3.4	0.00012	0.00008	3.4
Component D - Bulkheads	16	341,360	0.22	8.32E-06	5.08E-06	76.5	0.00284	0.00173	77.1
Component E - ISS	7	11,160	0.22	8.32E-06	5.08E-06	2.5	0.00009	0.00006	2.5
Component F - Dredging and Debris Removal	13	316,590	0.22	8.32E-06	5.08E-06	71.0	0.00263	0.00161	71.5
Component G - Sediment Dewatering/Stabilization	5	129,750	0.22	8.32E-06	5.08E-06	29.1	0.00108	0.00066	29.3
Component H - Water Treatment	5	108,990	0.22	8.32E-06	5.08E-06	24.4	0.00091	0.00055	24.6
Component I - T&D (Does Not Include Workers at Facility)	2	14,300	0.22	8.32E-06	5.08E-06	3.2	0.00012	0.00007	3.2
Component J - Backfill, Capping, and Outfall Protection	7	34,100	0.22	8.32E-06	5.08E-06	7.6	0.00028	0.00017	7.7
Component K - Environmental Controls	4	18,300	0.22	8.32E-06	5.08E-06	4.1	0.00015	0.00009	4.1
Component L - Site Restoration	6	4,500	0.22	8.32E-06	5.08E-06	1.0	0.00004	0.00002	1.0
Component M - Demobilization	5	3,750	0.22	8.32E-06	5.08E-06	0.8	0.00003	0.00002	0.8
Total		**1,109,310**	**--**	**--**	**--**	**248.6**	**0.00922**	**0.00563**	**250.5**

Total Emissions by Category

Emissions Category	Estimated CO2 Emissions (tonnes)	Estimated CH4 Emissions (tonnes)	Estimated N2O Emissions (tonnes)	Estimated CO2e Emissions10 (tonnes)
Scope 1	31,866	5.6	1.3	32,376
Scope 2	194	4.5E-03	4.8E-04	194
Scope 3	249	9.2E-03	5.6E-03	49,217
Overall Total	**32,309**	**5.6**	**1.3**	**81,787**

Table D-A-5
Estimated Greenhouse Gas Emissions for Remedial Alternative EB-F

Notes:
--: Indicates there is no information that is appropriate or applicable
1. USEPA 2023a
2. Barge emissions are calculated as emissions from tugboat transport.
3. Transportation of materials includes import and export mileage only. Intrasite movement of GAC and organoclay between the upland site and placement locations are covered in the component-specific equipment emissions.
4. Equipment type and fuel usage rates specified based on professional judgment, experience on similar projects, and published information, including Equation 1 as reported in Appendix D. A fuel usage rate of "0" in this table indicates that the equipment is not self-powered and is dependent upon power from construction equipment, generators, or tug/towboats, the emissions of which are accounted for in other line items. Some water treatment equipment is powered by grid electricity, emissions from which are included in Scope 2. Fuel usage rates are rounded to the nearest tenth of a gallon per hour.
5. Based on eGRID2021 (USEPA 2023b) Northeast Power Coordinating Council NYC/Westchester subregion
6. Randall et al. 2016 is the source for all equivalency factors in this table except for organoclay and steel, as noted.
7. CETCO Technical Reference – Organoclay Carbon Footprint
8. SSAB 2023
9. USCB 2021. Daily Commuter-Mile emission factors are based on weighted average mode of transportation statistics for construction workers in the NYC metro area.
10. Scope 3 includes CO_2e emissions from raw materials production, where no individual GHG gas emissions were calculated.
11. Equipment operational duration includes 60% uptime assumption for all pieces of equipment.
12. Due to rounding in the displayed values, emissions totals shown may differ from the sum of the individual values.

Conversion Factors:
2.20462 lb per kg
1,000 kg per tonne

Abbreviations:
CH_4: methane
CO_2: carbon dioxide
CO_2e: carbon dioxide equivalent
cy: cubic yard
GAC: granular activated carbon
gal: gallon
GHG: greenhouse gas
gpm: gallons per minute
hp: horsepower
ISS: in situ stabilization and solidification
kg: kilogram
kW: kilowatt
kWh: kilowatt hour
lb: pound
lb/MWh: pounds per megawatt hour
N_2O: nitrous oxide
NYC: New York City
T&D: transportation and disposal
ton: short ton; 2,000 lb
tonne: metric ton (MT); 1,000 kg

References:
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SSAB (Svenskt Stål AB), 2023. Environmental Product Declaration, S-P-01920 - Cold rolled steel sheets and coils. Published March 31, 2020. Revised September 25, 2023.
Randall et al. (Randall, P., D. Meyer, W. Ingwersen, D. Vineyard, M. Bergmann, S. Unger, and M. Gonzalez), 2016. *Life Cycle Inventory (LCI) Data-Treatment Chemicals, Construction Materials, Transportation, On-site Equipment, and other Processes for Use in Spreadsheets for Environmental Footprint Analysis (SEFA): Revised Addition.* U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-16/176.
USCB (U.S. Census Bureau), 2021. American Communities Survey 2021, Table B08126. Date accessed: May 2024. Available at: https://data.census.gov/table?q=B08126:+MEANS+OF+TRANSPORTATION+TO+WORK+BY+INDUSTRY&g=310XX00US35620&tid=ACSDT1Y2021.B08126&tp=false.
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USEPA, 2023b. Emissions & Generation Resource Integrated Database (eGRID): eGRID2021. Released: January 30, 2023; date accessed: May 2023. Available at: https://www.epa.gov/egrid.
USEPA, 2023c. Supply Chain Greenhouse Gas Emission Factors v1.2 by NAICS-6. Last revised April 12, 2023; date accessed: May 25, 2023. Available at: https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=https%3A//doi.org/10.23719/1528686.

Table D-A-6

Worker Labor and Commute Assumptions for Remedial Alternatives EB-B through EB-E

Labor Assumptions

Worker	Type	Quantity (each)	Round-Trip Commute (miles)[1]	Work Days					Total Project Miles				
				Alt EB-B	Alt EB-C	Alt EB-D	Alt EB-E	Alt EB-F	Alt EB-B	Alt EB-C	Alt EB-D	Alt EB-E	Alt EB-F
Component A - Contractor's Team													
HEALTH AND SAFETY OFFICER	Non-Union	1	10	320	548	553	948	1,189	3,200	5,480	5,530	9,480	11,890
PROJECT ENGINEER	Non-Union	1	10	320	548	553	948	1,189	3,200	5,480	5,530	9,480	11,890
FIELD ENGINEER	Non-Union	2	10	320	548	553	948	1,189	6,400	10,960	11,060	18,960	23,780
PROJECT MANAGER	Non-Union	1	10	320	548	553	948	1,189	3,200	5,480	5,530	9,480	11,890
QA/QC MANAGER	Non-Union	1	10	320	548	553	948	1,189	3,200	5,480	5,530	9,480	11,890
SUPERINTENDENT	Non-Union	3	10	320	548	553	948	1,189	9,600	16,440	16,590	28,440	35,670
Component B - Mobilization and Pre-Remediation Site Work													
UNION OPERATOR 1	Union	1	50	15	15	15	15	15	750	750	750	750	750
UNION OPERATOR 2	Union	2	50	15	15	15	15	15	1,500	1,500	1,500	1,500	1,500
UNION LABORER	Union	3	50	15	15	15	15	15	2,250	2,250	2,250	2,250	2,250
Component C - Winterization and Remobilization													
UNION OPERATOR	Union	1	50	10	20	20	50	60	500	1,000	1,000	2,500	3,000
UNION TRUCK DRIVER	Union	1	50	10	20	20	50	60	500	1,000	1,000	2,500	3,000
UNION LABORER	Union	3	50	10	20	20	50	60	1,500	3,000	3,000	7,500	9,000
Component D - Bulkheads													
NON-UNION OPERATOR 1	Non-Union	3	10	35	102	102	281	502	1,050	3,060	3,060	8,430	15,060
UNION TUG OPERATOR	Union	3	50	35	102	102	281	502	5,250	15,300	15,300	42,150	75,300
UNION LABORER	Union	2	50	35	102	102	281	502	3,500	10,200	10,200	28,100	50,200
UNION DECKHAND	Union	8	50	35	102	102	281	502	14,000	40,800	40,800	112,400	200,800
Component E - ISS													
NON-UNION FOREMAN	Non-Union	1	10	145	55	55	96	36	1,450	550	550	960	360
UNION OPERATOR 1	Union	3	50	145	55	55	96	36	21,750	8,250	8,250	14,400	5,400
UNION DECKHAND	Union	2	50	145	55	55	96	36	14,500	5,500	5,500	9,600	3,600
UNION TUG OPERATOR	Union	1	50	145	55	55	96	36	7,250	2,750	2,750	4,800	1,800
Component F - Dredging and Debris Removal													
NON-UNION OPERATOR 1	Non-Union	1	10	81	237	254	489	519	810	2,370	2,540	4,890	5,190
UNION TUG OPERATOR	Union	3	50	81	237	254	489	519	12,150	35,550	38,100	73,350	77,850
UNION OPERATOR 1	Union	1	50	81	237	254	489	519	4,050	11,850	12,700	24,450	25,950
UNION LABORER	Union	2	50	81	237	254	489	519	8,100	23,700	25,400	48,900	51,900
UNION DECKHAND	Union	6	50	81	237	254	489	519	24,300	71,100	76,200	146,700	155,700
Component G - Sediment Dewatering/Stabilization													
UNION OPERATOR 1	Union	2	50	81	237	254	489	519	8,100	23,700	25,400	48,900	51,900
UNION LABORER	Union	3	50	81	237	254	489	519	12,150	35,550	38,100	73,350	77,850

Table D-A-6
Worker Labor and Commute Assumptions for Remedial Alternatives EB-B through EB-E

Labor Assumptions

Worker	Type	Quantity (each)	Round-Trip Commute (miles)[1]	Work Days					Total Project Miles				
				Alt EB-B	Alt EB-C	Alt EB-D	Alt EB-E	Alt EB-F	Alt EB-B	Alt EB-C	Alt EB-D	Alt EB-E	Alt EB-F
Component H - Water Treatment													
WATER TREATMENT OPERATOR	Non-Union	1	10	81	237	254	489	519	810	2,370	2,540	4,890	5,190
UNION DECKHAND	Union	2	50	81	237	254	489	519	8,100	23,700	25,400	48,900	51,900
UNION LABORER	Union	2	50	81	237	254	489	519	8,100	23,700	25,400	48,900	51,900
Component I - T&D (Does Not Include Workers at Facility)													
UNION TUG OPERATOR	Union	1	50	22	54	59	132	143	1,100	2,700	2,950	6,600	7,150
UNION DECKHAND	Union	1	50	22	54	59	132	143	1,100	2,700	2,950	6,600	7,150
Component J - Backfill, Capping, and Outfall Protection													
NON-UNION OPERATOR 1	Non-Union	1	10	176	171	188	124	110	1,760	1,710	1,880	1,240	1,100
UNION OPERATOR 1	Union	2	50	176	171	188	124	110	17,600	17,100	18,800	12,400	11,000
UNION OPERATOR 2	Union	1	50	176	171	188	124	110	8,800	8,550	9,400	6,200	5,500
UNION TUG OPERATOR	Union	3	50	176	171	188	124	110	26,400	25,650	28,200	18,600	16,500
Component K - Environmental Controls													
UNION DECKHAND	Union	4	50	24	42	42	73	92	4,700	8,300	8,400	14,500	18,300
Component L - Site Restoration													
UNION OPERATOR 1	Union	1	50	15	15	15	15	15	750	750	750	750	750
UNION OPERATOR 2	Union	2	50	15	15	15	15	15	1,500	1,500	1,500	1,500	1,500
UNION LABORER	Union	3	50	15	15	15	15	15	2,250	2,250	2,250	2,250	2,250
Component M - Demobilization													
UNION OPERATOR	Union	1	50	15	15	15	15	15	750	750	750	750	750
UNION TRUCK DRIVER	Union	1	50	15	15	15	15	15	750	750	750	750	750
UNION LABORER	Union	3	50	15	15	15	15	15	2,250	2,250	2,250	2,250	2,250
	Total Workers	90						**Total Miles**	260,930	473,780	498,290	920,780	1,109,310

Table D-A-6
Worker Labor and Commute Assumptions for Remedial Alternatives EB-B through EB-E

Commute Assumptions

Mode of Transit[2,3]	Workers	Percentage Commuters	CO_2 Factor (kg/unit)	CH_4 Factor (g/unit)	N_2O Factor (g/unit)	Units
Car, truck, van: solo	279,803	58.1%	0.31	0.0080	0.0070	commuter-mile
Car, truck, van: carpool	57,450	11.9%	0.16	0.0040	0.0035	commuter-mile
Public transit (excluding taxi)	109,157	22.7%	0.076	0.0072	0.0011	commuter-mile
Walking	16,049	3.3%	--	--	--	commuter-mile
Taxi, motorcycle, bicycle, other	19,043	4.0%	0.16	0.040	0.0087	commuter-mile
Total commuters	481,502	--	--	--	--	--
Weighted average emission factors			0.22	0.0083	0.0051	commuter-mile

Notes:

--: Indicates there is no information that is appropriate or applicable

1. Assumes 5-mile one-way commute for non-union workers based in temporary lodging near the work site. Assumes 25-mile one-way commute for union workers based on average round-trip commute distance in New York of 49.73 miles (DeWitt 2022).
2. Mode of commute is based on USCB 2021, for construction workers in NYC metro area.
3. Work-from-home excluded in determining percentage of transit mode utilization for on-site workers.
4. Emission factors source: USEPA 2023. Some vehicle emission factors were aggregated for agreement with USCB data.

Abbreviations:

CH_4: methane
CO_2: carbon dioxide
g: gram
ISS: in situ stabilization and solidification
kg: kilogram
N_2O: nitrous oxide
T&D: transmission and distribution

References:

DeWitt, Hannah, 2022. "Which States Have the Longest Commutes?" *Jerry.* Last modified April 27, 2022; date accessed: January 24, 2024. Available at: https://getjerry.com/insights/which-states-have-longest-commutes.

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Attachment D-B
Spreadsheets for Environmental Footprint Analysis

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
Main Workbook

Site Name	***Netwon Creek - East Branch FFS***
Remedy	***Alternative EB-B***
	Identify the site name and remedy name in the spaces above. These names will be populated on all of the worksheets for the project.

	Enter the path name (if not saved in same directory) and file name of the "Calculations" workbook for the project.
Path Name:	
Calculations File Name:	SEFA_calculations_EB FFS.xlsx

Component	Remedy Component Names*
Component 1	Mobilization
Component 2	Shoreline Work (Bulkheads, ISS, etc.)
Component 3	Dredging (incl. Processing and Water Treatment)
Component 4	Backfill, Capping, and Outfall Protection
Component 5	Restoration and Demobilization
Component 6	
	***Fill in unique names for Remedy Components (optional). These names will be populated on all of the worksheets for the project.**

The following color coding applies to cells in the worksheets in this workbook.

(green)	Green cells indicate notes or instructions
(yellow)	Yellow cells are for manual data input
(blue)	Blue cells are calculated cells that are protected
(gray)	Gray cells are not available and/or not applicable for data entry
(orange)	Orange cells are calculated metrics that are forwarded to the "Summary" tab

Overview

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation

Introduction to SEFA

Purpose: SEFA is a set of workbooks designed to assist EPA in conducting environmental footprint analyses for site cleanups, as described in EPA's supporting Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002). SEFA is intended for estimating footprints during key phases of a cleanup project, such as evaluation of alternative remedies, development of remedy designs, and optimization of remedies but may also be applied to other phases. Although originally developed for EPA's internal use, EPA is making SEFA available to the public for the benefit of others wishing to estimate the environmental footprint of site cleanups. *The SEFA workbooks do not individually or collectively represent EPA guidance or requirements nor is their use required by EPA.*

Structure: SEFA is comprised of three interlinked Excel workbooks (files) to be saved by users in a single directory. Each workbook contains multiple worksheets (tabs) as described in the sections below. The tabs in each workbook are categorized with the following color-coding:
Yellow: tab contains required or optional user data entry
Green: tab contains notes, instructions, or explanations
Blue: tab provides outputs
Gray: tab not set up for user data entry

Instructions: SEFA is equipped with full instructions and notes located in designated tabs in each workbook. Also, abbreviated instructions and notes regarding certain key aspects of data entry are located throughout the other tabs in SEFA. For a full description of assumptions in SEFA and the approach for conducting a footprint analysis, see the supporting methodology.

"Main" Workbook: Starting and end points of analysis. No data entry by user, except for minimal (and optional) input on "General" and "Summary" tabs.

Intro to SEFA *:* Purpose, structure, and logistics of using SEFA

General : Site information and custom names for remedy components (data input by user to this tab is optional)

Instructions *:* General instructions pertaining to linkage of the three workbooks and overall approach to SEFA input

Summary : Overall results of analysis in tabular format (data input by user to this tab is optional)

Totals by Scope and Component : Auto-filled column and pie charts that graphically organize results by remedy component and by scope for energy and air emissions footprints

Energy & Air 1 - 6 and ***All Energy & Air (7 worksheets)*** *:* Energy and air results imported automatically from the "Calculations" workbook

"Input" Workbook: Data entry by user for all remedy activities, including input for energy consumption, materials usage, waste generation, personnel transport, and operation of equipment. Tabs for user data entry are indicated below.

General : Auto fills site, remedy, and component names from the "Main" workbook

Input Instructions *:* Instructions for setting up data entry tabs in the "Input" workbook, and notes on features in the "Input" workbook that provide flexibility for the footprint analysis

Detailed Notes and Explanations *:* Notes and explanations for each table in the "Input Template" tab

Input Summary : Overall summary of input information is compiled automatically from the "Input" tabs and exported to the "Calculations" workbook

Input Template *:* The majority of user data entry in SEFA occurs in this tab, including data entry for energy, materials, waste, transportation, and equipment. A blank template worksheet is provided. Multiple copies of the "Input Template" tab can be created by the user as needed. See the "Input" workbook for specific notes and instructions on setting up input tabs and entering data.

Grid Electricity : Optional user input for fuel mix for local grid electricity

User Defined Factors : Optional user input on footprint conversion factors for user-specified materials and activities

Well Material Calculator : An optional tool for estimating the amount of materials required to construct a well of specified type, material, and size

Lookup : Reference tables on typical rates of energy consumption and material conversion factors that are used in the "Input Template" tab

"Calculations" Workbook: Automatically applies footprint conversion factors for energy use and air emissions for individual remedy components, and summarizes results. No data entry by user, but supplemental calculations can be made by the user in some of the tabs.

General : Auto fills site, remedy, and component names from the "Main" workbook

Notes : Notes on the features in the "Calculations" workbook

Components 1 - 6 (6 worksheets) : Calculations made automatically for energy and air emissions based on results from the "Input" workbook, with useful subtotals at the bottom of each worksheet

All Components : Total energy use and air emissions (i.e., summation of values in the individual "Component" tabs), with useful subtotals at the bottom of the worksheet

Default Conversions : Built-in footprint conversion factors used to calculate energy and air emissions associated with common remediation materials and activities

Grid Electricity Conversions : Footprint conversion factors for grid electricity are calculated automatically based on fuel mix in the "Grid Electricity" tab in the "Input" workbook

Explanation of Grid Electricity : Explains how electricity conversion factors are developed and provides an example

Transfer 1 - 3 (3 worksheets) : Intermediate data exchange

Programming Details of SEFA

Data Exchange **:** All (three) workbooks must be open simultaneously to enable automated data exchanges. SEFA will generally process inputs faster if running off a hard drive rather than a server.

Color Coding : The "General" tab of each workbook provides a legend for cell color coding used to distinguish functions such as manual input, imported/exported data, and automated calculations.

Locks : Data cells with formulas (or data to be exported to other workbooks) are equipped with "hard locks."

Data Sources **:** Origination of values in cells with imported data (whether previously populated or calculated) can be identified by clicking on the cell of interest.

SEFA Version History

SEFA was originally released in April 2012, with minor corrections in January 2013. In August 2014, SEFA was updated with improvements for ease of use and flexibility of application, and with corrections and adjustments affecting footprint results. This November 2018 update (Version 3.0) provides updated footprint conversion factors for materials processing, fuel consumption, and laboratory analysis. Any future updates will be posted at www.cluin.org/greenremediation/SEFA, where Version 3.0 is available for dowloading.

Technical Assistance

EPA technical support in using SEFA is available only within the Agency. Individuals or organizations outside EPA who are interested in using SEFA may wish to obtain technical assistance from qualified environmental, engineering, or other suitable professionals. Selected examples of footprint analyses conducted using SEFA and the supporting methodology are posted at www.cluin.org/greenremediation/footprintassessment. Suggestions for SEFA enhancements may be forwarded to Carlos Pachon, EPA Office of Superfund Remediation and Technology Innovation (pachon.carlos@epa.gov).

Original development of SEFA was funded by EPA OSRTI under Contract No. EP-W-07-078 to Tetra Tech. Technical lead was provided by Karen Scheuermann of EPA Region 9. Appreciation is extended to Doug Sutton, Rob Greenwald, Mike Pavarini, and Nikolaos Fytilis for significant contributions in developing and updating the spreadsheets. For related information on green remediation, visit www.cluin.org/greenremediation or contact Carlos Pachon at pachon.carlos@epa.gov.

EPA United States Environmental Protection Agency

EPA is making SEFA available to the public as a means of disseminating useful information about environmental footprint analysis. The Agency is not responsible for adaptation of this workbook model by other organizations or associated analytical results.

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation

Instructions

1) Setting Up the Workbooks

SEFA consists of the "Main", "Input", and "Calculations" workbooks (.xlsx files). All three files must be open at the same time while working in SEFA. This allows the workbooks to communicate and calculate footprints.

For simplest use, the three workbooks should all be saved in the same directory, in which case the "Path Name" can be left blank in the "General" tab of each workbook. Alternatively, if you would like to save the workbooks in different directories, you must fill in the "Path Name" on the "General" tab of each workbook using the following format: *DriveLetter*:*FolderName**FolderName*\\ Be sure to include final backslash.

On the "General" tab of each workbook, you must enter the "File Name" of one of the other workbooks (as indicated in each workbook) using the following format: *WorkbookName .FileExtension*

The file extension is ".xlsx" for all three workbooks.

You may want to change the file names for the "Main", "Input", and "Calculations" workbooks to reflect the site, remedy, and date. For example, the new name for the "Main" workbook may be "main_SiteName_Nov2018.xlsx". If you change the names of the workbooks, you must update the file names on the "General" tabs in each workbook in order for the workbooks to exchange data. Note that the file names may be changed unintentionally when the files are copied or downloaded, and should be readjusted for proper functioning of the SEFA workbooks.

2) Setting Up Site and Remedy Names

In the "General" tab in the "Main" workbook, you may replace default labels with site-specific labels for site name and remedy name. These will be automatically updated in all the workbooks. You may also provide a narrative overview of the site and remedy at the bottom of the "General" tab in the "Main" workbook.

3) Setting Up Remedy Components

On the "General" tab in the "Main" workbook, you have the option of customizing the names of the six "Remedy Components", and those customized names will automatically be updated in all the workbooks. If not customized, the default names <Component 1> to <Component 6> will be used by SEFA. Note that the names of the six "Remedy Components" may not fit the legend in the charts on the "Totals by Scope and Component" tab in the "Main" workbook, even if the names fit in the data entry cells on the "General" tab in the "Main" workbook.

Customizing the Remedy Components allows you to reflect any delineation that will be relevant to the site and remedy. For example, the Remedy Components may be spatial in nature, representing different geographical areas of the cleanup site (e.g., North Quadrant, South Quadrant, West Quadrant). Or the Remedy Components may be functional in nature, representing different operations or activities at the site (e.g., Site Investigation, Excavation, Waste Hauling, Backfilling, Long-term Monitoring). As another example, the Remedy Components may be temporal in nature, representing different time segments for the remedy (e.g., Year 1, Year 2, Year 3).

4) Entering Data

"Input" Workbook: The majority of site and remedy data is entered in the "Input" tabs in the "Input" workbook. See the "Input Instructions" tab in the "Input" workbook for specifics on this data entry. Additional data may be entered in the "Input Summary", "Grid Electricity", "User Defined Factors", and "Well Material Calculator" tabs. See the instructions on each of those tabs for specifics on the functions provided in the tabs.

"Main" Workbook: In the "Summary" tab in the "Main" workbook (Row 37), you may provide a qualitative description of activities at the site related to Land & Ecosystems.

"Calculations" Workbook: No data entry is required by the user in the "Calculations" workbook. However, space is provided in the tabs of this workbook for user-specific calculations and subtotals.

5) Processing Data and Accessing Outputs

Processing Data: The SEFA worksheets automatically process the data entered by the user, apply footprint conversion factors, and compile the results. You have access to all worksheets where the data processing and compilation occurs. However, those portions of the worksheets are "locked" so that the data links and formulas cannot be altered.

Accessing Outputs: The final outputs of the SEFA worksheets are located in the "Main" workbook. The outputs are available in tabular format in the "Summary" tab, and in chart format in the "Totals by Scope and Component" tab. All output presentations are populated automatically. The user may customize and format the charts on the "Totals by Scope and Component" tab in the "Main" workbook to accommodate longer "Remedy Component" names or to copy and paste individual charts.

Accessing Intermediate Results *:* The user has access to intermediate results throughout the SEFA workbooks. Intermediate results that may be of particular interest are located in the "Energy & Air" tabs in the "Main" workbook, the "Input Summary" tab in the "Input" workbook, and the "Component" tabs in the "Calculations" workbook.

6) Miscellaneous

General Formatting *:* Although you cannot alter cells in the worksheets that are used for processing data, some general formatting functions are available in all the worksheets. These include adjusting decimal places, adjusting width of columns or row, shading cells, etc. Most of the worksheets also contain blank spaces which are available for making notes or supporting calculations.

Naming, Adjusting, and Adding Tabs *:* You should not rename the original tabs in the SEFA workbooks, except for the "Input Template" tab in the "Input" workbook (as noted in the "Input Instructions" tab in the "Input" workbook). Renaming other tabs may disrupt the exchange of data among the workbooks. However, you may relocate tabs within each workbook. You may also add new tabs to the workbooks, for example to provide references and calculations in support of the data entry, or user-designed charts and tables for presenting the results.

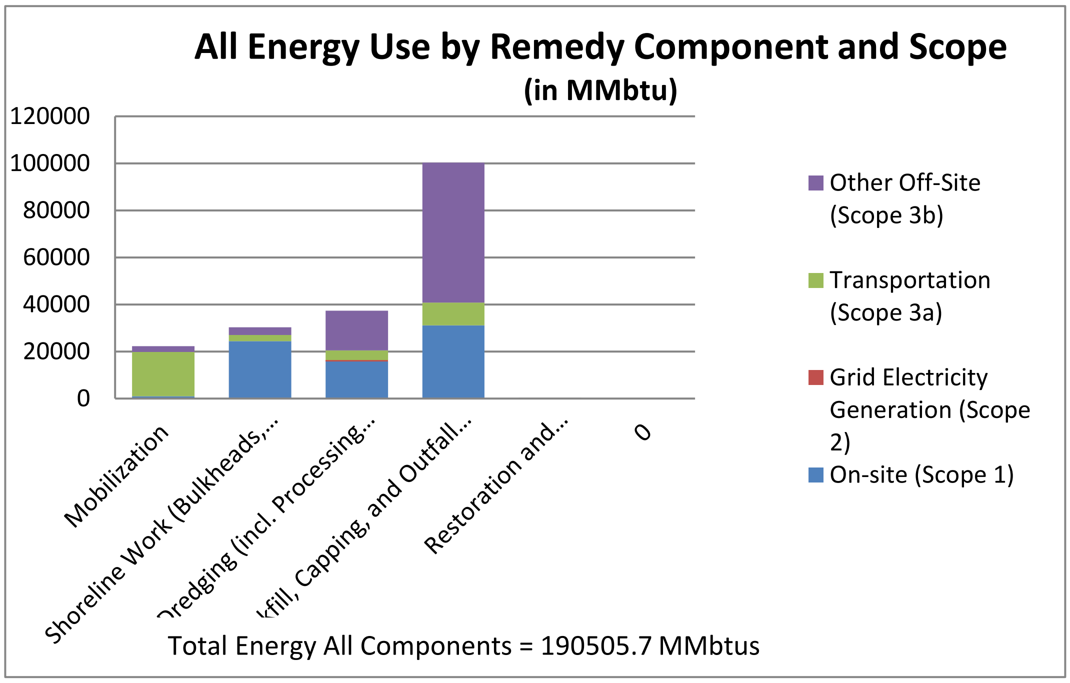
Environmental Footprint Summary

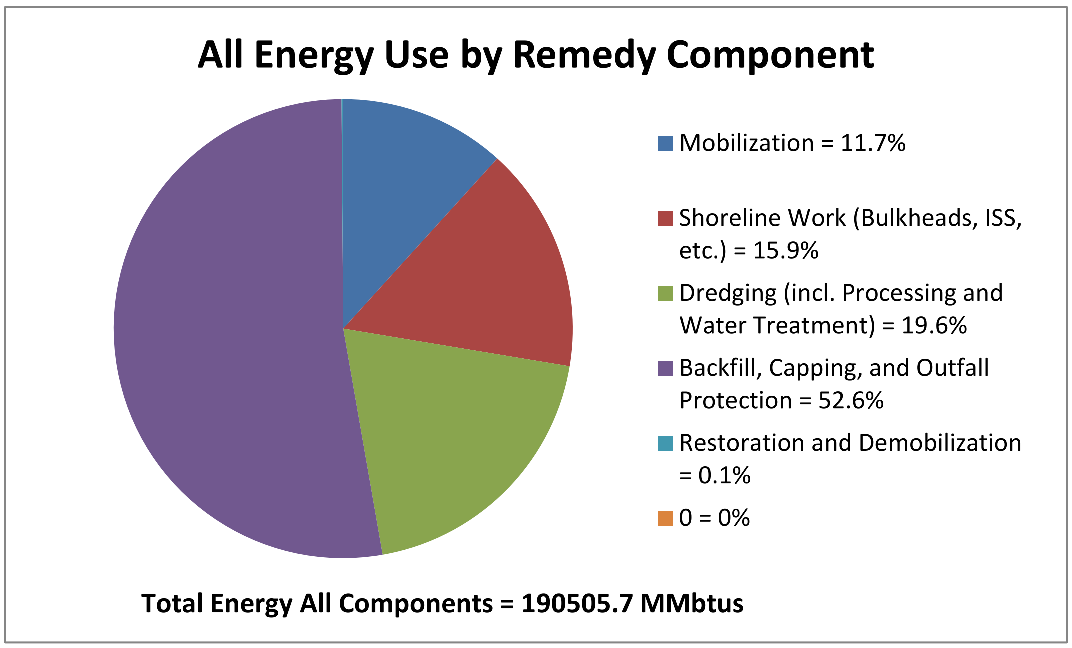
Core Element	Metric		Unit of Measure	Footprint: Mobilization	Shoreline Work (Bulkheads, ISS, etc.)	Dredging (incl. Processing and Water Treatment)	Backfill, Capping, and Outfall Protection	Restoration and Demobilization		Total
Materials & Waste	M&W-1	Refined materials used on-site	Tons	0.0	7,275.8	4,992.4	917.0	0.0	0.0	13,185.2
	M&W-2	% of refined materials from recycled or reused material	%		0.0%	0.0%	0.0%			0.0%
	M&W-3	Unrefined materials used on-site	Tons	0.000	0.000	0.000	124,564.000	0.000	0.000	124,564.0
	M&W-4	% of unrefined materials from recycled or reused material	%				0.0%			0.0%
	M&W-5	On-site hazardous waste disposed of off-site	Tons	0.0	0.0	2,283.0	0.0	0.0	0.0	2,283.0
	M&W-6	On-site non-hazardous waste disposed of off-site	Tons	0.0	0.0	86,752.0	0.0	0.0	0.0	86,752.0
	M&W-7	Recycled or reused waste	Tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	M&W-8	% of total potential waste recycled or reused	%			0.0%				0.0%
Water (used on-site)	W-1	Public water use	MG	0.0	1.4	0.0	0.0	0.0	0.0	1.4
	W-2	Groundwater use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-3	Surface water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-4	Reclaimed water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-5	Storm water use	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-6	User-defined water resource #1	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-7	User-defined water resource #2	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	W-8	Wastewater generated	MG	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy	E-1	Total energy used (on-site and off-site)	MMBtu	22,313.9	30,308.3	37,399.2	100,254.1	230.1	0.0	190,505.7
	E-2	Energy voluntarily derived from renewable resources								
	E-2A	On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-2B	Voluntary purchase of renewable electricity	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-3	Voluntary purchase of RECs	MWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E-4	On-site grid electricity use	MWh	0.000	0.000	66.732	0.000	0.000	0.000	66.7
Air	A-1	On-site NOx, SOx, and PM emissions	Pounds	824.0	21,641.2	12,476.5	25,265.8	141.8	0.0	60,349.2
	A-2	On-site HAP emissions	Pounds	0.3	7.0	4.5	9.0	0.1	0.0	20.9
	A-3	Total NOx, SOx, and PM emissions	Pounds	26,731.9	27,081.4	74,376.1	228,561.8	166.3	0.0	356,917.4
	A-3A	Total NOx emissions	Pounds	24,349.0	23,837.4	29,370.2	109,580.6	142.5	0.0	187,279.7
	A-3B	Total SOx emissions	Pounds	1,611.4	1,317.2	7,931.7	113,254.4	9.1	0.0	124,123.8
	A-3C	Total PM emissions	Pounds	771.5	1,926.7	37,074.3	5,726.8	14.6	0.0	45,513.9
	A-4	Total HAP emissions	Pounds	168.4	238.9	314.8	1,127.2	2.9	0.0	1,852.3
	A-5	Total greenhouse gas emissions	Tons CO2e*	1,821.8	2,454.2	2,935.4	7,058.3	18.4	0.0	14,288.1
Land & Ecosystems		Qualitative Description								

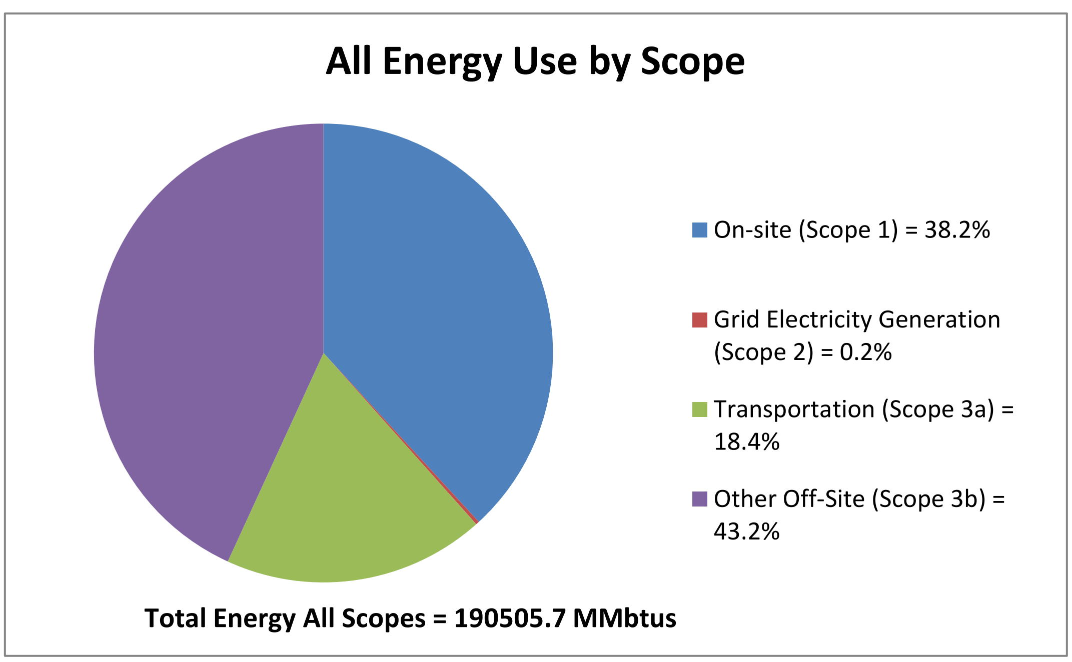
** Total greenhouse gases emissions (in CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.*
"MMBtu" = millions of Btus
"MG" = millions of gallons
"CO2e" = carbon dioxide equivalents of global warming potential
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)
"Tons" = short tons (2,000 pounds)

The above metrics are consistent with EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint (EPA 542-R-12-002), February 2012

Notes:


All Energy Use by Remedy Component and Scope
(in MMbtu)
120000
100000
80000
60000
40000
20000
0
Mobilization
Shoreline Work (Bulkheads,...
Dredging (incl. Processing...
kfill, Capping, and Outfall...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
Total Energy All Components = 190505.7 MMbtus


All Energy Use by Remedy Component
Mobilization = 11.7%
Shoreline Work (Bulkheads, ISS, etc.) = 15.9%
Dredging (incl. Processing and Water Treatment) = 19.6%
Backfill, Capping, and Outfall Protection = 52.6%
Restoration and Demobilization = 0.1%
0 = 0%
Total Energy All Components = 190505.7 MMbtus

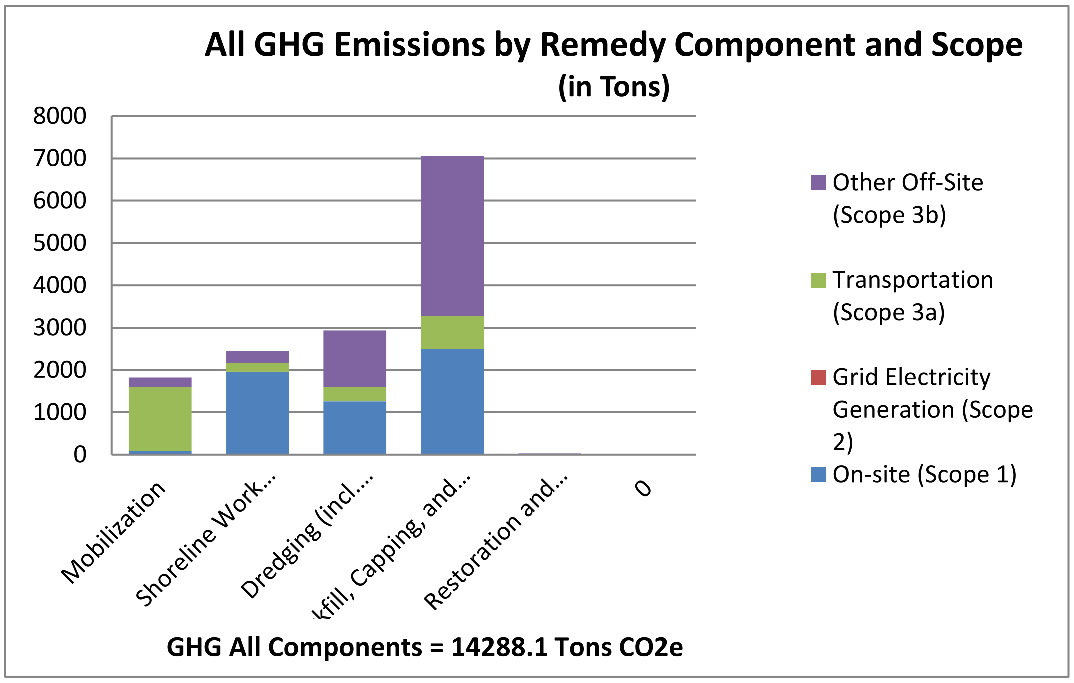

All Energy Use by Scope
On-site (Scope 1) = 38.2%
Grid Electricity Generation (Scope 2) = 0.2%
Transportation (Scope 3a) = 18.4%
Other Off-Site (Scope 3b) = 43.2%
Total Energy All Scopes = 190505.7 MMbtus

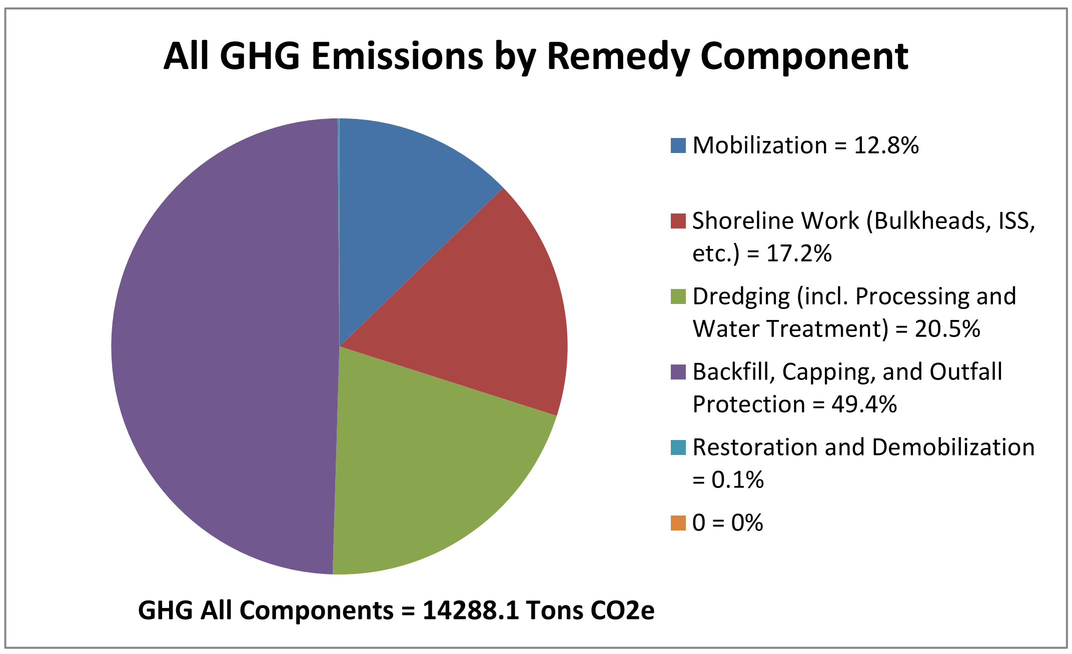
Total Energy MMbtus	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratior	0	Total	
On-site (Scope 1)	1,006.4	24,437.8	15,928.2	31,158.9	179.0	0.0	72,710.2	
' Generation (Scope 2)	0.0	0.0	462.4	0.0	0.0	0.0	462.4	d Electricity
ısportation (Scope 3a)	18,851.5	2,512.6	4,126.3	9,615.4	23.1	0.0	35,128.8	Trar
ıer Off-Site (Scope 3b)	2,456.0	3,358.0	16,882.4	59,479.9	28.0	0.0	82,204.3	Oth
Total	22,313.9	30,308.3	37,399.2	100,254.1	230.1	0.0	190,505.7	

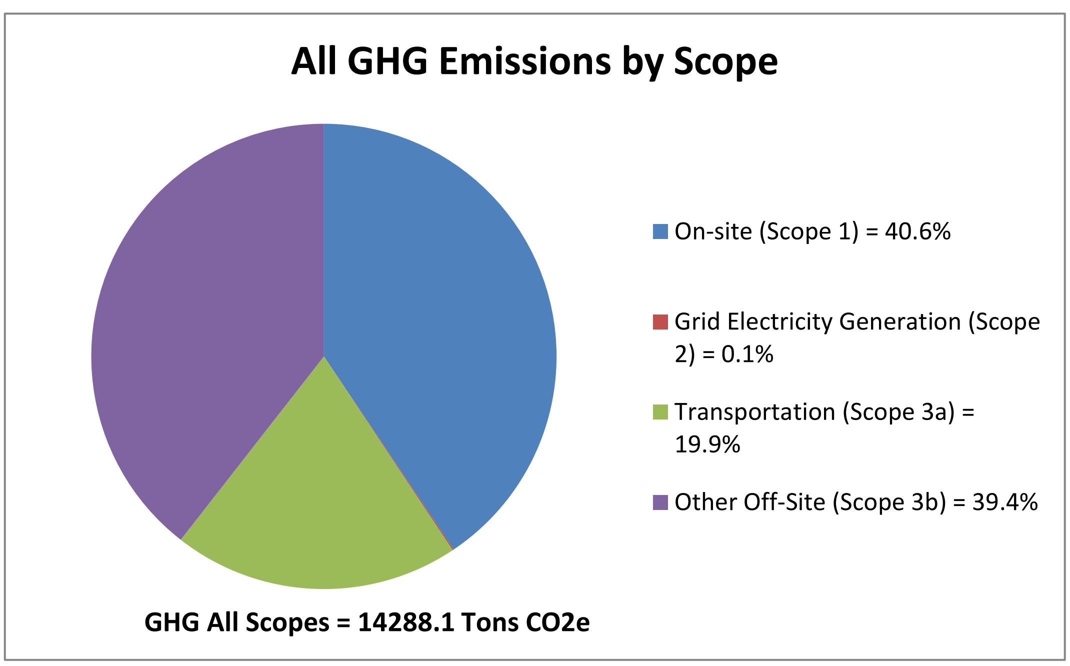
Mobilization = 11.7%
Shoreline Work (Bulkheads, ISS, etc.) = 15.9°
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 52
Restoration and Demobilization = 0.1%
0 = 0%

On-site (Scope 1) = 38.2%
Grid Electricity Generation (Scope 2) = 0.2%
Transportation (Scope 3a) = 18.4%
Other Off-Site (Scope 3b) = 43.2%

Total Energy All Components = 190505.7 MMbtus
Total Energy All Scopes = 190505.7 MMbtus


All GHG Emissions by Remedy Component and Scope
(in Tons)
8000
7000
6000
5000
4000
3000
2000
1000
0
Mobilization
Shoreline Work...
Dredging (incl....
kfill, Capping, and...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
GHG All Components = 14288.1 Tons CO2e


All GHG Emissions by Remedy Component
Mobilization = 12.8%
Shoreline Work (Bulkheads, ISS, etc.) = 17.2%
Dredging (incl. Processing and Water Treatment) = 20.5%
Backfill, Capping, and Outfall Protection = 49.4%
Restoration and Demobilization = 0.1%
0 = 0%
GHG All Components = 14288.1 Tons CO2e

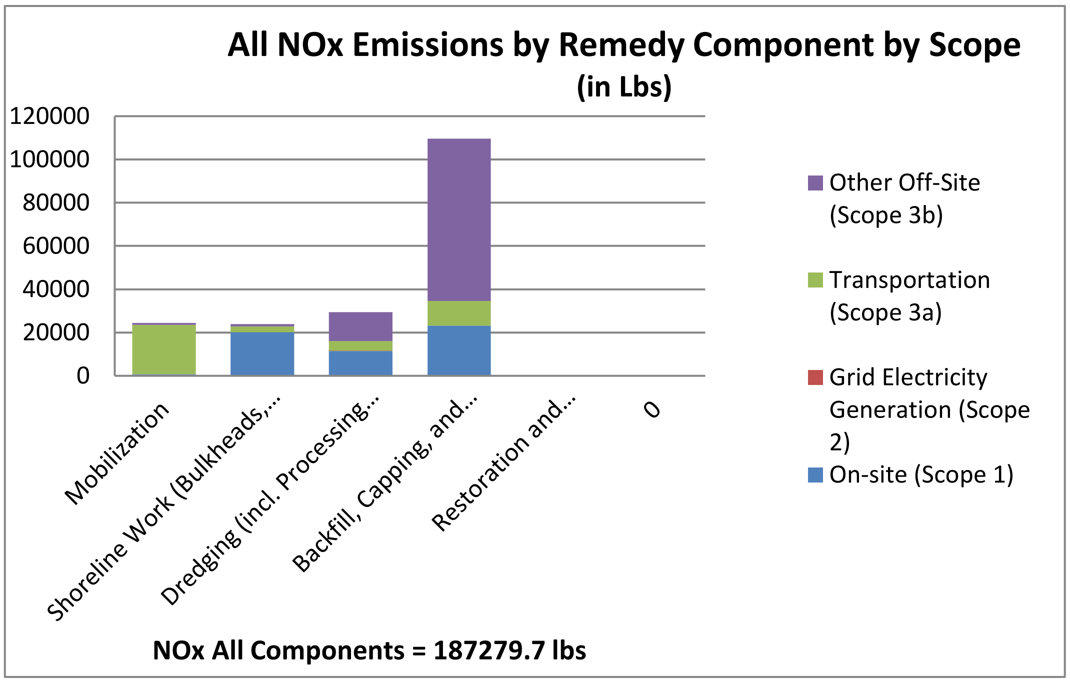

All GHG Emissions by Scope
On-site (Scope 1) = 40.6%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 19.9%
Other Off-Site (Scope 3b) = 39.4%
GHG All Scopes = 14288.1 Tons CO2e

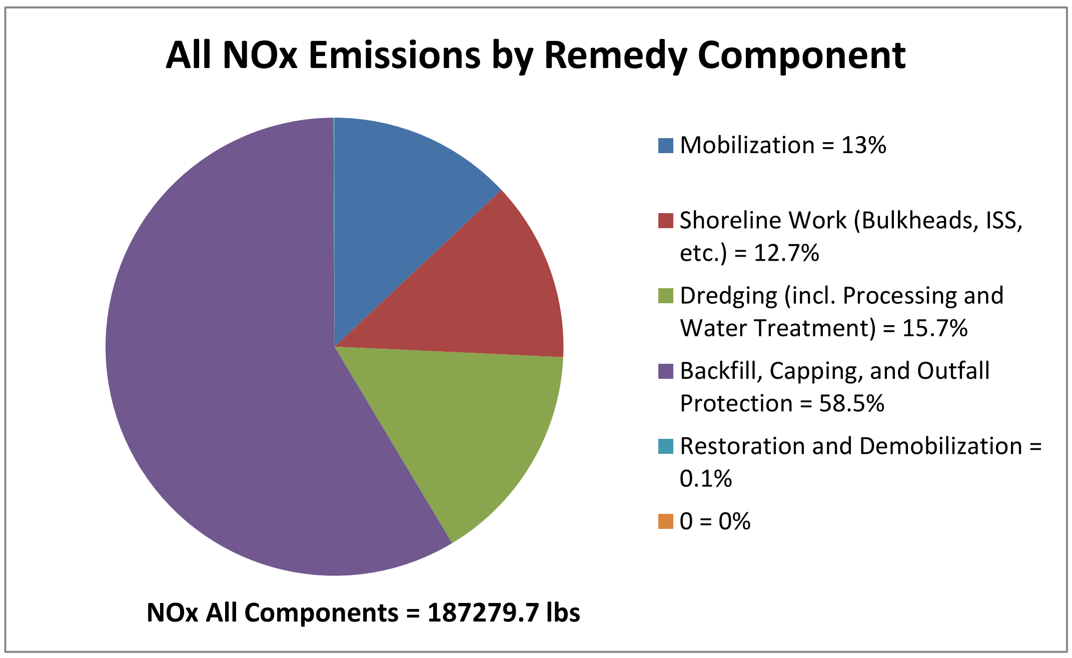
GHG Tons CO2e	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratioı	0	Total	
On-site (Scope 1)	80.5	1,954.9	1,256.0	2,492.6	14.3	0.0	5,798.3	
' Generation (Scope 2)	0.0	0.0	11.7	0.0	0.0	0.0	11.7	d Electricity
ısportation (Scope 3a)	1,525.5	202.9	333.4	777.9	1.8	0.0	2,841.6	Trar
ıer Off-Site (Scope 3b)	215.8	296.4	1,334.3	3,787.8	2.2	0.0	5,636.5	Oth
Total	1,821.8	2,454.2	2,935.4	7,058.3	18.4	0.0	14,288.1	

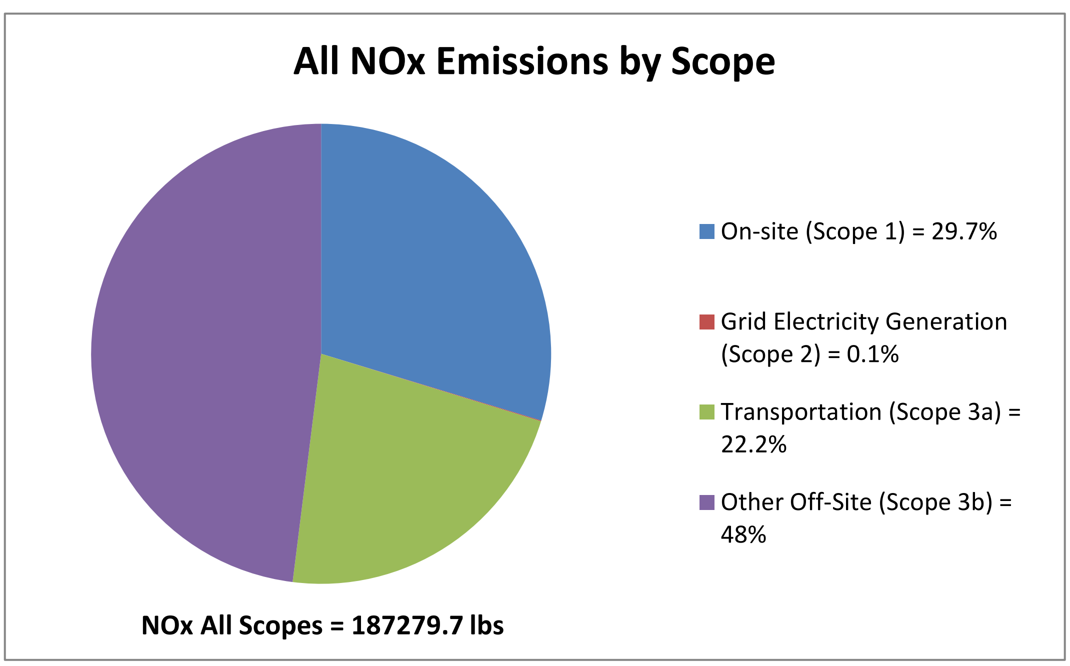
Mobilization = 12.8%
Shoreline Work (Bulkheads, ISS, etc.) = 17.2%
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 49
Restoration and Demobilization = 0.1%
0 = 0%

On-site (Scope 1) = 40.6%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 19.9%
Other Off-Site (Scope 3b) = 39.4%

GHG All Components = 14288.1 Tons CO2e
GHG All Scopes = 14288.1 Tons CO2e


All NOx Emissions by Remedy Component by Scope
(in Lbs)
120000
100000
80000
60000
40000
20000
0
Mobilization
Shoreline Work (Bulkheads,...
Dredging (incl. Processing...
Backfill, Capping, and...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
NOx All Components = 187279.7 lbs


All NOx Emissions by Remedy Component
Mobilization = 13%
Shoreline Work (Bulkheads, ISS, etc.) = 12.7%
Dredging (incl. Processing and Water Treatment) = 15.7%
Backfill, Capping, and Outfall Protection = 58.5%
Restoration and Demobilization = 0.1%
0 = 0%
NOx All Components = 187279.7 lbs

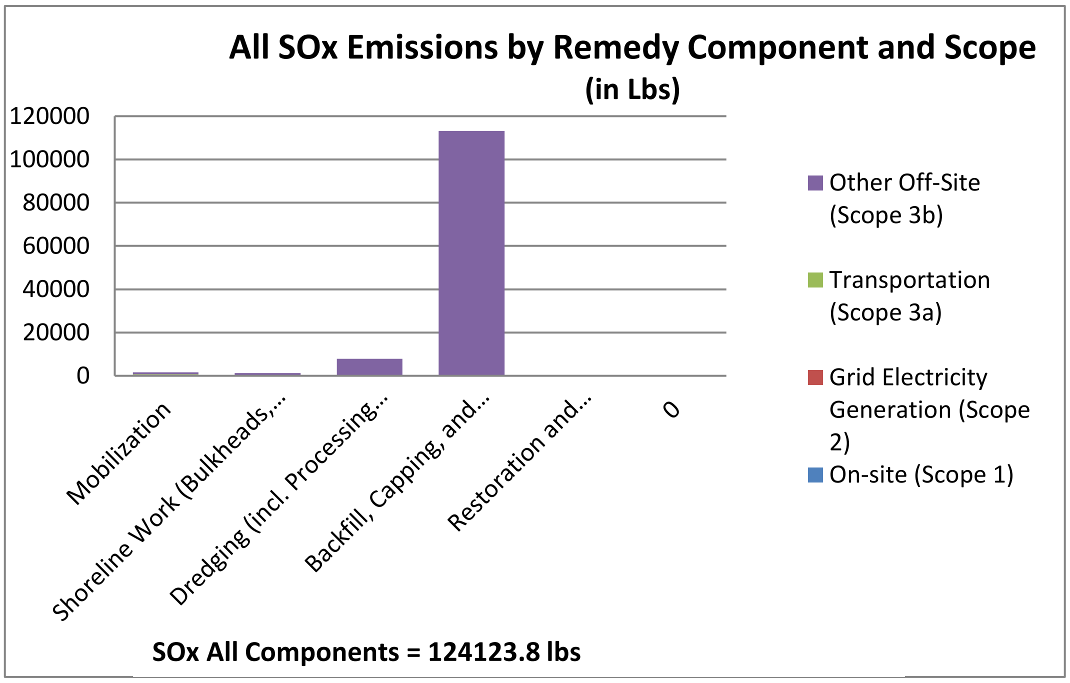

All NOx Emissions by Scope
On-site (Scope 1) = 29.7%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 22.2%
Other Off-Site (Scope 3b) = 48%
NOx All Scopes = 187279.7 lbs

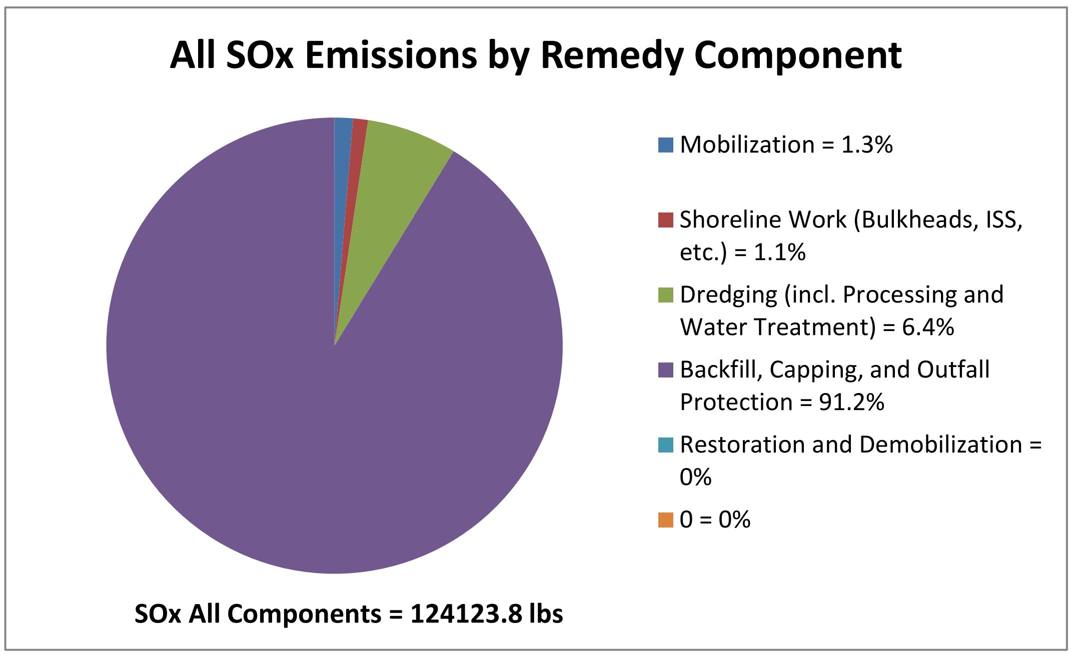
NOx lbs	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratioı	0	Total	
On-site (Scope 1)	755.5	20,104.8	11,441.9	23,166.8	130.1	0.0	55,599.0	
' Generation (Scope 2)	0.0	0.0	100.4	0.0	0.0	0.0	100.4	d Electricity
ısportation (Scope 3a)	22,864.9	2,730.2	4,583.2	11,463.8	5.0	0.0	41,647.1	Trar
ıer Off-Site (Scope 3b)	728.7	1,002.5	13,244.7	74,950.0	7.4	0.0	89,933.3	Otł
Total	24,349.0	23,837.4	29,370.2	109,580.6	142.5	0.0	187,279.7	

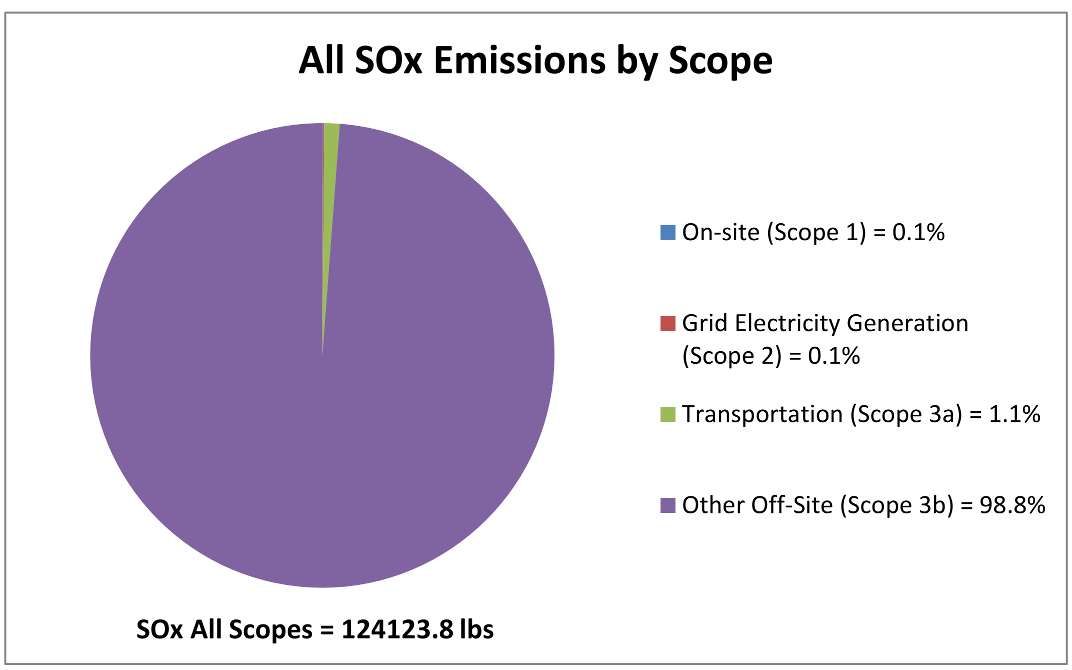
Mobilization = 13%
Shoreline Work (Bulkheads, ISS, etc.) = 12.7%
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 58
Restoration and Demobilization = 0.1%
0 = 0%

On-site (Scope 1) = 29.7%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 22.2%
Other Off-Site (Scope 3b) = 48%

NOx All Components = 187279.7 lbs
NOx All Scopes = 187279.7 lbs


All SOx Emissions by Remedy Component and Scope
(in Lbs)
120000
100000
80000
60000
40000
20000
0
Mobilization
Shoreline Work (Bulkheads,...
Dredging (incl. Processing...
Backfill, Capping, and...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
SOx All Components = 124123.8 lbs


All SOx Emissions by Remedy Component
Mobilization = 1.3%
Shoreline Work (Bulkheads, ISS, etc.) = 1.1%
Dredging (incl. Processing and Water Treatment) = 6.4%
Backfill, Capping, and Outfall Protection = 91.2%
Restoration and Demobilization = 0%
0 = 0%
SOx All Components = 124123.8 lbs

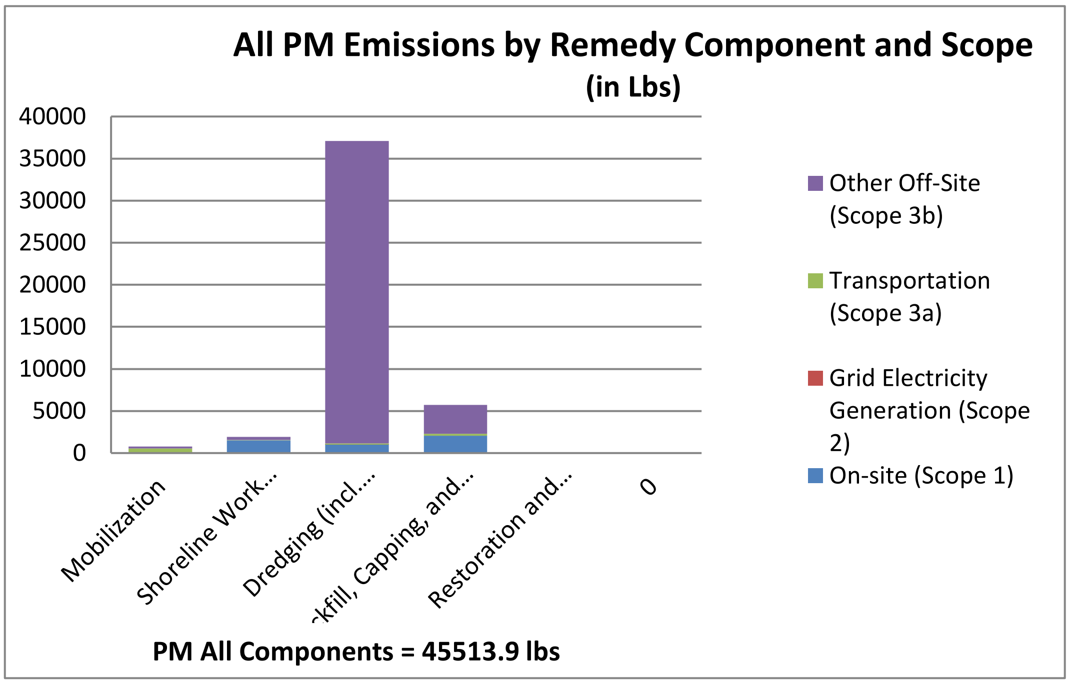

All SOx Emissions by Scope
On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 1.1%
Other Off-Site (Scope 3b) = 98.8%
SOx All Scopes = 124123.8 lbs

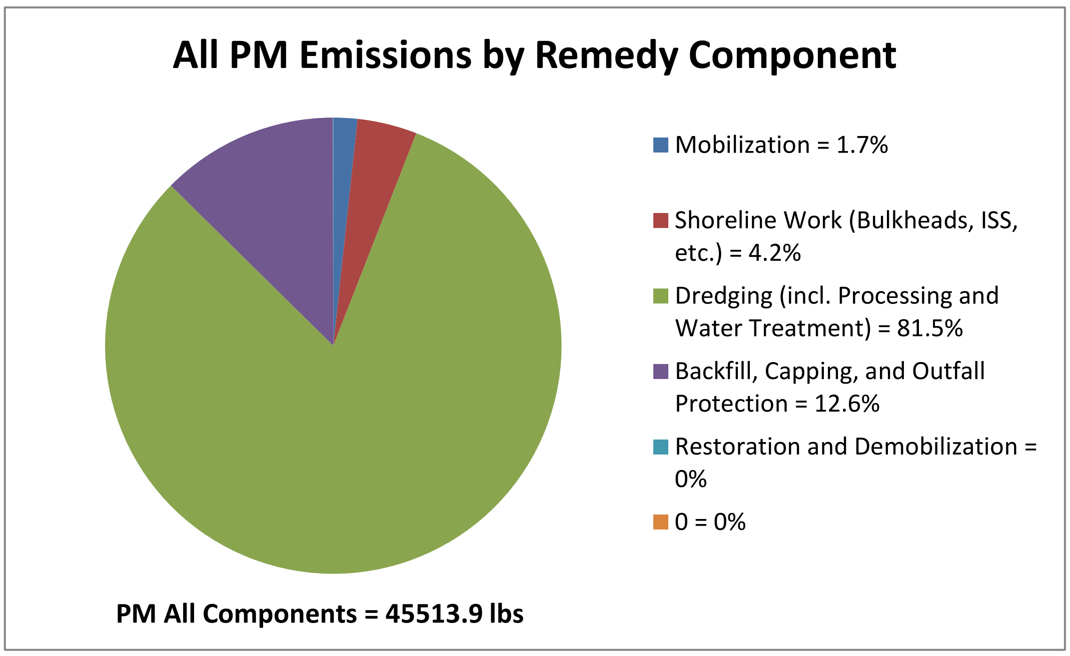
SOx lbs	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratio	0	Total	
On-site (Scope 1)	0.9	23.0	14.7	29.3	0.2	0.0	68.1	
' Generation (Scope 2)	0.0	0.0	98.1	0.0	0.0	0.0	98.1	d Electricity
ısportation (Scope 3a)	725.5	85.4	143.7	363.0	0.1	0.0	1,317.7	Trar
ıer Off-Site (Scope 3b)	884.9	1,208.9	7,675.2	112,862.1	8.9	0.0	122,640.0	Oth
Total	1,611.4	1,317.2	7,931.7	113,254.4	9.1	0.0	124,123.8	

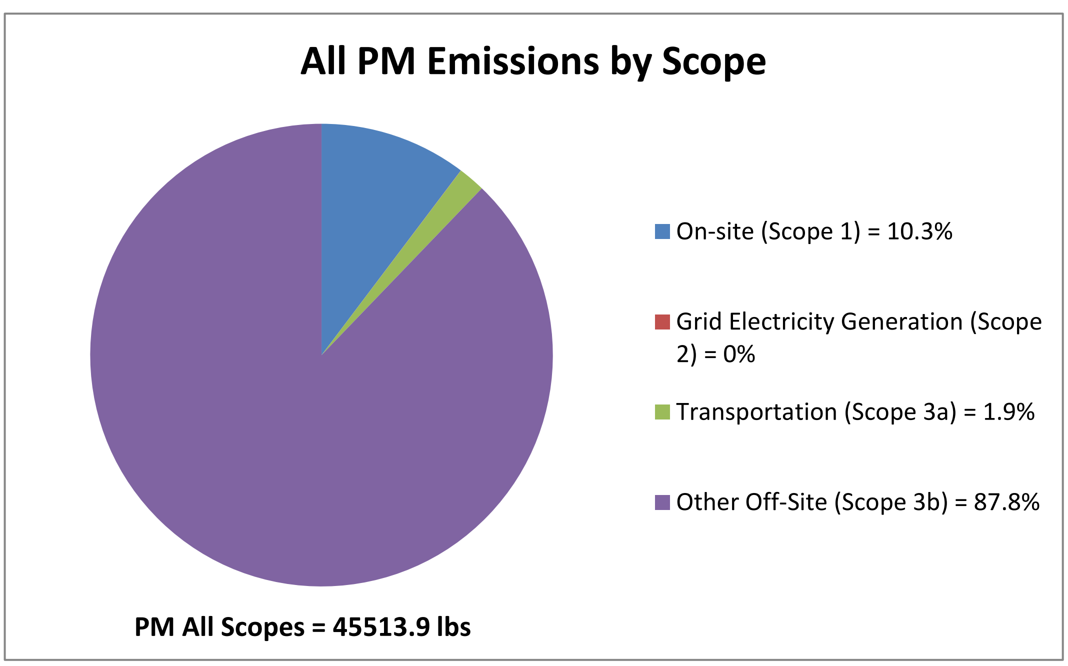
Mobilization = 1.3%
Shoreline Work (Bulkheads, ISS, etc.) = 1.1%
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 91
Restoration and Demobilization = 0%
0 = 0%

On-site (Scope 1) = 0.1%
Grid Electricity Generation (Scope 2) = 0.1%
Transportation (Scope 3a) = 1.1%
Other Off-Site (Scope 3b) = 98.8%

SOx All Components = 124123.8 lbs
SOx All Scopes = 124123.8 lbs


All PM Emissions by Remedy Component and Scope
(in Lbs)
40000
35000
30000
25000
20000
15000
10000
5000
0
Mobilization
Shoreline Work...
Dredging (incl....
-kfill, Capping, and...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
PM All Components = 45513.9 lbs


All PM Emissions by Remedy Component
Mobilization = 1.7%
Shoreline Work (Bulkheads, ISS, etc.) = 4.2%
Dredging (incl. Processing and Water Treatment) = 81.5%
Backfill, Capping, and Outfall Protection = 12.6%
Restoration and Demobilization = 0%
0 = 0%
PM All Components = 45513.9 lbs


All PM Emissions by Scope
On-site (Scope 1) = 10.3%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 1.9%
Other Off-Site (Scope 3b) = 87.8%
PM All Scopes = 45513.9 lbs

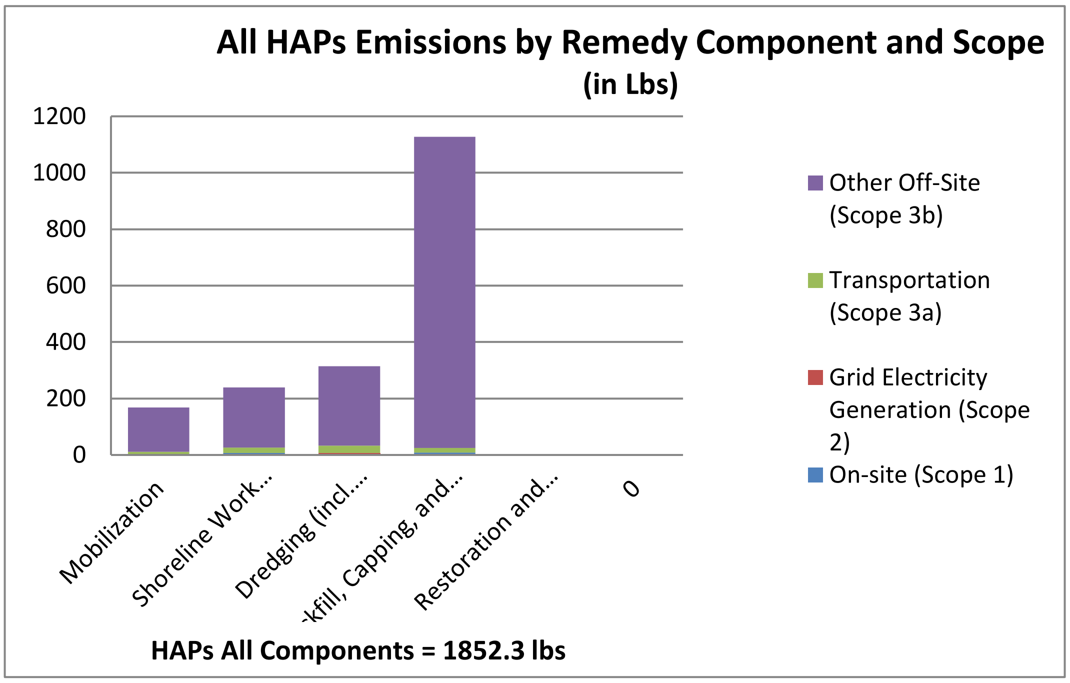
PM
lbs

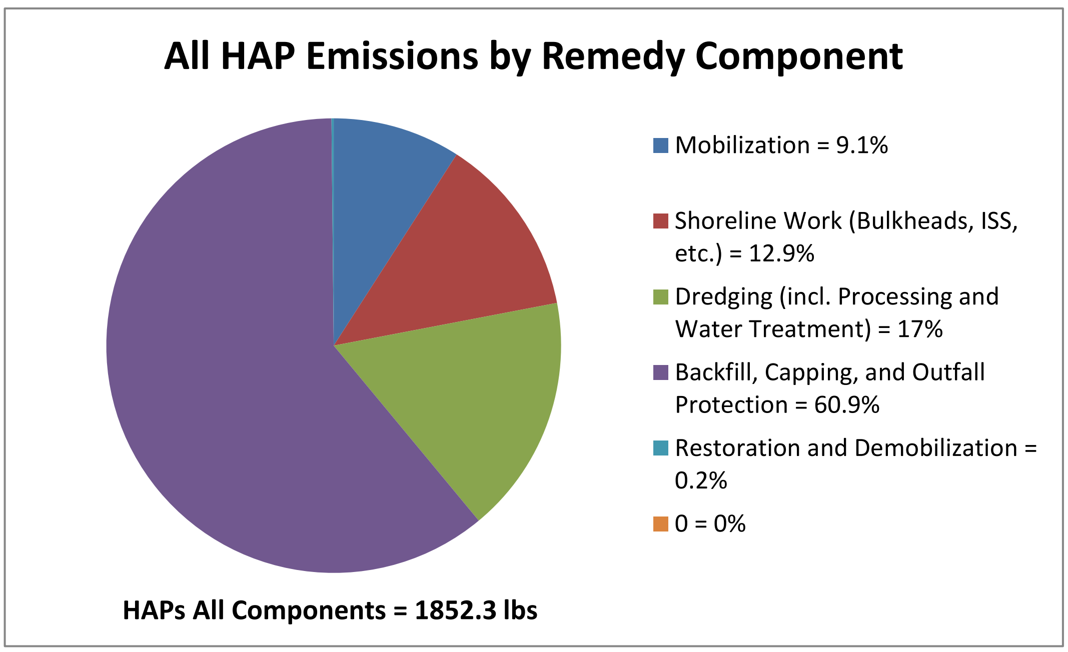
	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratioı	0	Total	
On-site (Scope 1)	67.6	1,513.4	1,019.9	2,069.6	11.6	0.0	4,682.1	
' Generation (Scope 2)	0.0	0.0	5.0	0.0	0.0	0.0	5.0	d Electricity
ısportation (Scope 3a)	461.1	61.4	100.8	235.1	0.6	0.0	858.9	Trar
ıer Off-Site (Scope 3b)	242.8	351.9	35,948.5	3,422.1	2.5	0.0	39,967.8	Oth
Total	771.5	1,926.7	37,074.3	5,726.8	14.6	0.0	45,513.9	

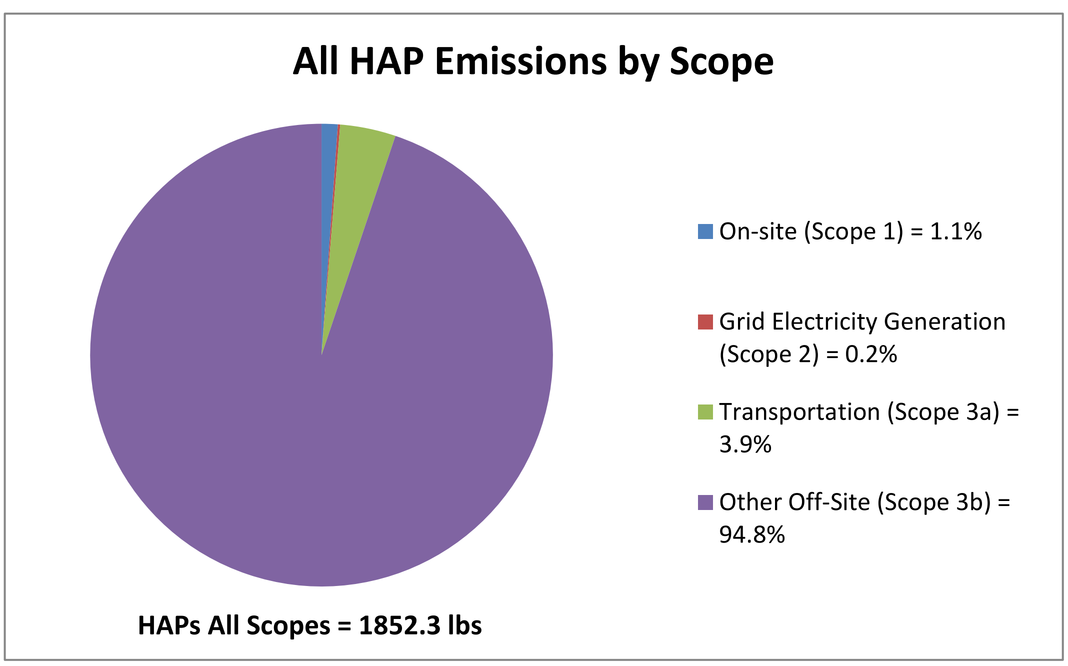
Mobilization = 1.7%
Shoreline Work (Bulkheads, ISS, etc.) = 4.2%
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 12
Restoration and Demobilization = 0%
0 = 0%

On-site (Scope 1) = 10.3%
Grid Electricity Generation (Scope 2) = 0%
Transportation (Scope 3a) = 1.9%
Other Off-Site (Scope 3b) = 87.8%

PM All Components = 45513.9 lbs
PM All Scopes = 45513.9 lbs


All HAPs Emissions by Remedy Component and Scope
(in Lbs)
1200
1000
800
600
400
200
0
Mobilization
Shoreline Work...
Dredging (incl....
-kfill, Capping, and...
Restoration and...
0
Other Off-Site (Scope 3b)
Transportation (Scope 3a)
Grid Electricity Generation (Scope 2)
On-site (Scope 1)
HAPs All Components = 1852.3 lbs


All HAP Emissions by Remedy Component
Mobilization = 9.1%
Shoreline Work (Bulkheads, ISS, etc.) = 12.9%
Dredging (incl. Processing and Water Treatment) = 17%
Backfill, Capping, and Outfall Protection = 60.9%
Restoration and Demobilization = 0.2%
0 = 0%
HAPs All Components = 1852.3 lbs


All HAP Emissions by Scope
On-site (Scope 1) = 1.1%
Grid Electricity Generation (Scope 2) = 0.2%
Transportation (Scope 3a) = 3.9%
Other Off-Site (Scope 3b) = 94.8%
HAPs All Scopes = 1852.3 lbs

HAPs
lbs

	Mobilizatic	Shoreline \	Dredging (i	Backfill, Ca	Restoratio	0	Total
On-site (Scope 1)	0.3	7.0	4.5	9.0	0.1	0.0	20.9
' Generation (Scope 2)	0.0	0.0	3.0	0.0	0.0	0.0	3.0
ısportation (Scope 3a)	11.0	18.5	25.0	16.3	1.2	0.0	72.0
ıer Off-Site (Scope 3b)	157.2	213.3	282.2	1,102.0	1.6	0.0	1,756.4
Total	168.4	238.9	314.8	1,127.2	2.9	0.0	1,852.3

Mobilization = 9.1%
Shoreline Work (Bulkheads, ISS, etc.) = 12.9%
Dredging (incl. Processing and Water Treatm
Backfill, Capping, and Outfall Protection = 60
Restoration and Demobilization = 0.2%
0 = 0%

On-site (Scope 1) = 1.1%
Grid Electricity Generation (Scope 2) = 0.2%
Transportation (Scope 3a) = 3.9%
Other Off-Site (Scope 3b) = 94.8%

HAPs All Components = 1852.3 lbs
HAPs All Scopes = 1852.3 lbs

Mobilization - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**1,006**	**161,013**	**755**	**1**	**68**	**824**	**0**
Grid Electricity Generation (Scope 2)	**0.000**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**18,852**	**3,051,043**	**22,865**	**726**	**461**	**24,051**	**11**
Other Off-Site (Scope 3b)	**2,456**	**431,608**	**729**	**885**	**243**	**1,856**	**157**
Remedy Totals	**22,314**	**3,643,664**	**24,349**	**1,611**	**771**	**26,732**	**168**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file: SEFA_calculations_EB FFS.xlsx

Shoreline Work (Bulkheads, ISS, etc.) - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**24,438**	**3,909,783**	**20,105**	**23**	**1,513**	**21,641**	**7**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**2,513**	**405,884**	**2,730**	**85**	**61**	**2,877**	**19**
Other Off-Site (Scope 3b)	**3,358**	**592,811**	**1,003**	**1,209**	**352**	**2,563**	**213**
Remedy Totals	**30,308**	**4,908,478**	**23,837**	**1,317**	**1,927**	**27,081**	**239**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity	
On-site renewable energy generation or use	MMBtu	**0**	
On-site biodiesel use	MMBtu	**0**	
Biodiesel and other renewable resource use for transportation	MMBtu	**0**	
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**	*(This value is the sum of the three rows above)*
Voluntary purchase of renewable electricity	MWh	**0**	
Voluntary purchase of RECs	MWh	**0**	

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_EB FFS.xlsx

Dredging (incl. Processing and Water Treatment) - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**15,928**	**2,512,045**	**11,442**	**15**	**1,020**	**12,476**	**5**
Grid Electricity Generation (Scope 2)	**462**	**23,490**	**100**	**98**	**5**	**203**	**3**
Transportation (Scope 3a)	**4,126**	**666,805**	**4,583**	**144**	**101**	**4,828**	**25**
Other Off-Site (Scope 3b)	**16,882**	**2,668,549**	**13,245**	**7,675**	**35,949**	**56,868**	**282**
Remedy Totals	**37,399**	**5,870,889**	**29,370**	**7,932**	**37,074**	**74,376**	**315**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file: SEFA_calculations_EB FFS.xlsx

Backfill, Capping, and Outfall Protection - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**31,159**	**4,985,139**	**23,167**	**29**	**2,070**	**25,266**	**9**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**9,615**	**1,555,725**	**11,464**	**363**	**235**	**12,062**	**16**
Other Off-Site (Scope 3b)	**59,480**	**7,575,645**	**74,950**	**112,862**	**3,422**	**191,234**	**1,102**
Remedy Totals	**100,254**	**14,116,509**	**109,581**	**113,254**	**5,727**	**228,562**	**1,127**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity
On-site renewable energy generation or use	MMBtu	**0**
On-site biodiesel use	MMBtu	**0**
Biodiesel and other renewable resource use for transportation	MMBtu	**0**
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**
Voluntary purchase of renewable electricity	MWh	**0**
Voluntary purchase of RECs	MWh	**0**

(This value is the sum of the three rows above)

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_EB FFS.xlsx

Restoration and Demobilization - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**179**	**28,638**	**130**	**0**	**12**	**142**	**0**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**23**	**3,677**	**5**	**0**	**1**	**6**	**1**
Other Off-Site (Scope 3b)	**28**	**4,410**	**7**	**9**	**2**	**19**	**2**
Remedy Totals	**230**	**36,725**	**143**	**9**	**15**	**166**	**3**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity	
On-site renewable energy generation or use	MMBtu	**0**	
On-site biodiesel use	MMBtu	**0**	
Biodiesel and other renewable resource use for transportation	MMBtu	**0**	
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**	*(This value is the sum of the three rows above)*
Voluntary purchase of renewable electricity	MWh	**0**	
Voluntary purchase of RECs	MWh	**0**	

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_EB FFS.xlsx

- Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Grid Electricity Generation (Scope 2)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Transportation (Scope 3a)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Other Off-Site (Scope 3b)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Remedy Totals	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity	
On-site renewable energy generation or use	MMBtu	**0**	
On-site biodiesel use	MMBtu	**0**	
Biodiesel and other renewable resource use for transportation	MMBtu	**0**	
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**	*(This value is the sum of the three rows above)*
Voluntary purchase of renewable electricity	MWh	**0**	
Voluntary purchase of RECs	MWh	**0**	

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file: SEFA_calculations_EB FFS.xlsx

All - Energy & Air Compiled Results

Category	Total Energy	GHG	NOx	SOx	PM	NOx + SOx + PM	HAPs
	MMbtus	lbs CO2e	lbs	lbs	lbs	lbs	lbs
On-site (Scope 1)	**72,710**	**11,596,618**	**55,599**	**68**	**4,682**	**60,349**	**21**
Grid Electricity Generation (Scope 2)	**462.386**	**23,490**	**100**	**98**	**5**	**203**	**3**
Transportation (Scope 3a)	**35,129**	**5,683,135**	**41,647**	**1,318**	**859**	**43,824**	**72**
Other Off-Site (Scope 3b)	**82,204**	**11,270,674**	**89,923**	**122,630**	**39,967**	**252,521**	**1,756**
Remedy Totals	**190,506**	**28,573,916**	**187,270**	**124,114**	**45,513**	**356,897**	**1,852**

Values that are forwarded to the "Summary" tab are indicated in orange.

Voluntary Renewable Energy Use	Unit	Quantity	
On-site renewable energy generation or use	MMBtu	**0**	
On-site biodiesel use	MMBtu	**0**	
Biodiesel and other renewable resource use for transportation	MMBtu	**0**	
On-site renewable energy generation or use + on-site biodiesel use + biodiesel and other renewable resource use for transportation	MMBtu	**0**	*(This value is the sum of the three rows above)*
Voluntary purchase of renewable electricity	MWh	**0**	
Voluntary purchase of RECs	MWh	**0**	

This worksheet is not intended for user input. Values on this worksheet are obtained from the following file:
SEFA_calculations_EB FFS.xlsx

Netwon Creek - East Branch FFS

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

Input Workbook

Alternative EB-B

	Enter the path name (if not saved in the same directory) and file name of the "Main" workbook for the project.
Path Name:	
Main File Name:	SEFA_main_EB FFS.xlsx

Component	**Remedy Component Names**
Component 1	*Mobilization*
Component 2	*Shoreline Work (Bulkheads, ISS, etc.)*
Component 3	*Dredging (incl. Processing and Water Treatment)*
Component 4	*Backfill, Capping, and Outfall Protection*
Component 5	*Restoration and Demobilization*
Component 6	*0*

Component names are autofilled from the "Main" workbook.

The following color coding applies to cells in the worksheets in this workbook.

(green)	Green cells indicate notes or instructions
(yellow)	Yellow cells are for manual data input
(red)	Red cells are for manual data input from a drop-down list of selections and are protected
(blue)	Blue cells are calculated cells that are protected
(gray)	Gray cells are not available and/or not applicable for data entry

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation

Input Instructions

1) Overview

The “Input” workbook is used for data entry of site and remedy information. The majority of this data is entered in the “Input” tabs. Additional information may be entered in the “Input Summary”, “Grid Electricity”, “User Defined Factors”, and “Well Material Calculator” tabs.

"Input" Tabs : The user enters information on transportation, materials, equipment, waste, and energy associated with the site and remedy on the "Input" tabs. The user may establish up to 14 "Input" tabs to reflect the site and remedy, and assigns each "Input" tab to one of the 6 Remedy Components. See the section “Adding and Aligning “Input” Tabs” below for information on setting up “Input” tabs, renaming the tabs, and assigning them to Remedy Components. See the “Detailed Notes and Explanations” tab for specifics on entering remedy data into the “Input” tabs.

"Input Summary" Tab : The column headings in the “Input Summary” tab (Row 6) must be updated by the user to reflect the tab names in the following situations: (a) if additional “Input” tabs are set up by the user (regardless of whether they are renamed); and (b) if “Input” tab names are customized or changed.

"Grid Electricity" Tab : If grid electricity is used at the site, the local fuel mix for the grid electricity should be added in this tab. See the instructions on the “Grid Electricity” tab for specifics on data entry for local fuel mix.

"User Defined Factors" Tab : If the remedy requires materials or off-site activities not provided in SEFA, you may add the materials or activities to SEFA. You should research and document the information, then enter it in the “User Defined Factors” tab. See the “User Defined Factors” tab for specifics on adding user defined factors.

"Well Material Calculator" Tab : Data entry is not required in this tab. The Well Material Calculator is provided as a convenience to the user. The Calculator uses a lookup table to calculate the amount of casing material, screen material, cement, and sand/gravel that would be required to build a well, based on specifications entered by the user. See the “Well Material Calculator” tab for specifics on the use of the Calculator.

2) Adding and Aligning "Input" Tabs

You may want to create additional “Input” tabs to help organize your data entry. When you create a new "Input" tab, you will typically want to align it with a Remedy Component. These steps are described below.

Creating Additional "Input" Tabs: To create a new “Input” tab, right-click the tab name of the "Input Template" tab, choose “move or copy”, check the box "create a copy" and then click "OK". You can leave the tab name alone after copying (such as “Input Template (2), Input Template (3)”, etc.), or you can rename each new “Input” tab by right-clicking on the tab, choosing “rename”, and typing the new name. If you rename an “Input” tab, you must also enter that new name on the “Input Summary” tab in the "Input" workbook, for the tab to be included in the footprint analysis. (See instructions below for the “Input Summary” tab for more information on this topic.)

Aligning the "Input" Tabs with the Remedy Components: Each “Input” tab can be considered a subcategory under one of the Remedy Components designated in the “General” tab of the “Main” workbook. In order for each “Input” tab to be included in the footprint analysis, the tab must be aligned with a Remedy Component. To align an “Input” tab, use the drop-down menu in Row 4 of the "Input" tab and choose the Remedy Component that the “Input” tab pertains to. You may select one of six Remedy Components or you may turn the selection "off" so that the tab is not aligned with a Remedy Component. The Remedy Component number will appear in Row 4 on the "Input Summary" tab. (If "off" is chosen, "0" will appear in Row 4.) An example of aligning “Input” tabs to the Remedy Components is illustrated in Item (7) below.

Additional Notes:

(a) You can create any number of “Input” tabs, but you may align a maximum of 14 “Input” tabs to the Remedy Components at any one time.
(b) You may group multiple “Input” tabs under the same Remedy Component.

(c) You may want to allow certain “Input” tabs to remain non-aligned with the Remedy Components in some cases. For example a non-aligned “Input” tab may be used for testing alternative designs or parameters for the remedy. The tab would be turned “off” when not included in the analysis, and would be re-aligned with a Remedy Component to be included in the analysis.

(d) You should reserve the unused (blank) “Input Template” tab, in the event that it becomes necessary to create additional “Input” tabs at a later time.
(e) You may delete an “Input” tab at any time by right-clicking on the tab and choosing “delete”. If an “Input” tab is deleted, you should also remove the name of that tab from the column headings in the “Input Summary” tab.

(f) You can reposition an “Input” tab by left-clicking on the tab and dragging it to the right or left. This will not affect the alignments made between the "Input" tabs and the Remedy Components.
(g) If you run out of space for entries in any of the tables in the "Input" tabs, you may create another "Input" tab to continue entries in the table. Be sure to align the new tab to the correct Remedy Component.

3) Setting Up the "Input Summary" Tab

The “Input Summary” tab displays a summary of 14 “Input” tabs (in Columns C - P) and 6 Remedy Components (in Columns Q - V). The grand total is displayed in Column W.

If you create a new “Input” tab or rename an existing “Input” tab, you must add the new name to the column headings in Row 6 of the “Input Summary” tab. This allows the “Input Summary” tab to collect data from the various “Input” tabs. For example, if you rename the “Input Template” tab, so that it is now called “Site Investigation”, you must also rename the corresponding column heading in Row 6 of the “Input Summary” tab. In this example, Cell C6 would be renamed “Site Investigation”. Additional notes:

(a) The Remedy Component Numbers in Row 4 of the “Input Summary” tab are automatically populated, based on the selections made in Row 4 of the “Input” tabs.

(b) Other than renaming the column headings with “Input” tab names (if necessary), no other data entry is required in the “Input Summary” tab.

(c) You may add the "Input" tab names in any order in Row 6 of the "Input Summary" tab. They need not reflect the order of the tabs in the "Input" workbook.

(d) Be sure to reflect the exact tab name in Row 6 of the "Input Summary" tab, in order for it to be recognized by SEFA.

4) Data Entry in the "Input Template" Tab

The “Input Template” tab contains a variety of data entry tables for flexibility to accommodate a wide range of remedy activities and configurations. You can by-pass any of the data entry tables, and use only those tables that are relevant to the site and remedy at hand. (See EPA's Methodology [www.cluin.org/greenremediation/methodology] for a protocol for screening out inputs that would make minimal contributions to the footprint totals.) Much of the data entry in the “Input Template” tab is self-explanatory. However, please see the “Detailed Notes and Explanations” tab in the "Input" workbook for specifics on the data entry tables in the “Input Template” tab.

5) Using the "Grid Electricity" Tab

On the “Grid Electricity” tab, you can define the fuel mix (mix of energy resources that is used to generate grid electricity) for grid electricity used at your site. SEFA uses this fuel mix to calculate the footprint from generation of the grid electricity. By default, the fuel mix in the “Grid Electricity” tab is set to the U.S. national average from 2016. You are strongly encouraged to change this to a regional or local fuel mix that is more representative of the grid electricity used by the remedy. Specifying the fuel mix from the local provider will often be important for accuracy of the footprint calculations, as the fuel mix can vary substantially at the national, regional, and local levels.

You can set a single fuel mix for all Remedy Components, or you can specify individual fuel mixes for each of the 6 Remedy Components. This allows for flexibility in the event that different grid electricity providers are used for different activities or areas at the site. Please see the “Grid Electricity” tab for specifics on how to set the fuel mix for your site.

6) Using the "User Defined Factors" Tab

SEFA is equipped with default footprint conversion factors for a variety of materials and activities. The conversion factors are used to estimate the amount of energy required for, and the amount of NOx, SOx, PM, HAPs, and greenhouse gas emissions related to, the off-site production of materials or activities. Additional conversion factors are used for energy and air emissions related to the combustion of fuels. These default conversion factors can be viewed in the “Default Conversions” tab of the “Calculations” workbook and are applied automatically in the “Calculations” workbooks.

In the “User Defined Factors” tab, SEFA provides flexibility in establishing conversion factors for materials and activities that are unique to the remedy or site. Unique conversion factors can be established for the following:

(a) Combustion of fuels (both renewable and “conventional”) for transportation and on-site equipment

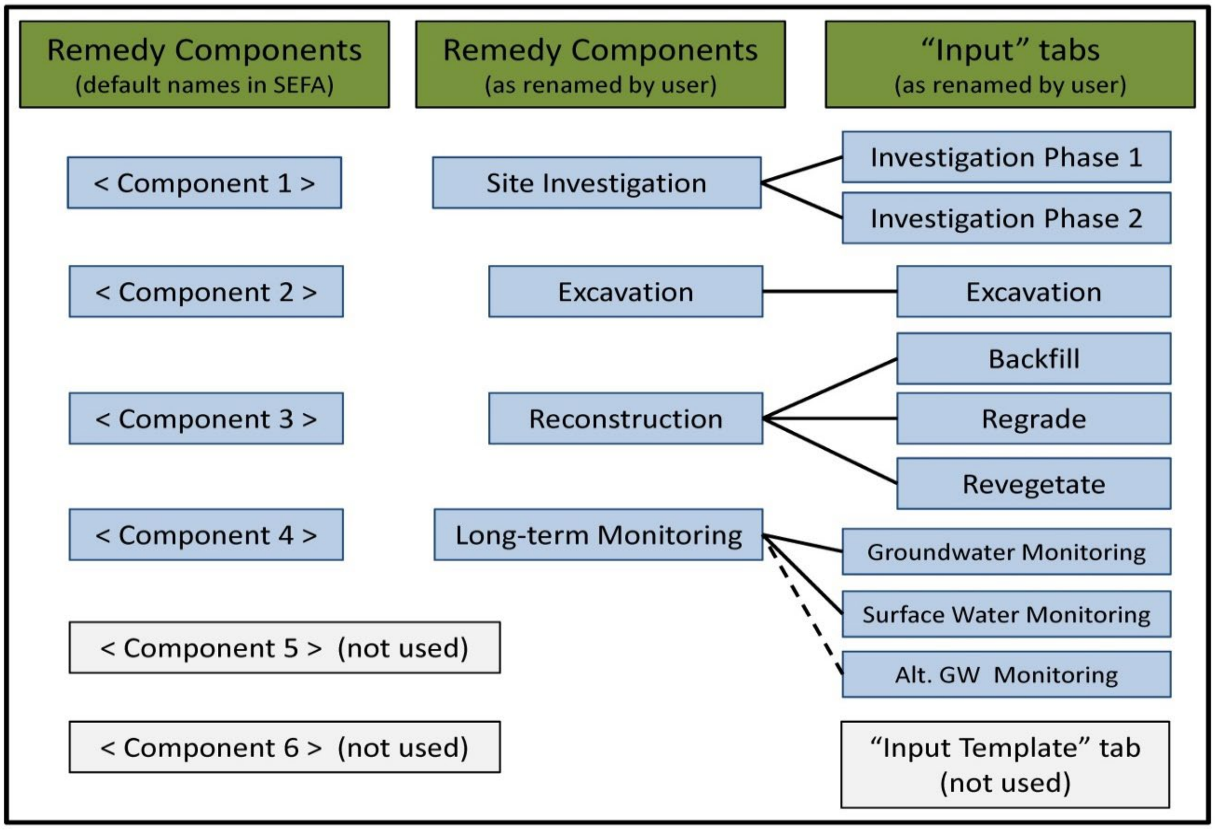
(b) Off-site manufacturing or processing of materials

(c) Off-site management and recycling of wastes

In establishing these unique conversion factors, you should research and document the data, and enter it into the “User Defined Factors” tab. Once entered, SEFA will automatically apply the conversion factors in the “Calculations” workbook. Please see the “User Defined Factors” tab for specifics on establishing unique conversion factors.

7) Example of Aligning "Input" Tabs to Remedy Components

The diagram below illustrates the alignment of “Input” tabs to Remedy Components for a hypothetical site and remedy. In this example, the user renames Remedy Components 1 - 4, according to the four main aspects of the remedy, but does not need Remedy Components 5 and 6. The user makes copies of the blank “Input Template” tab as needed, names them, and links them to the Remedy Components. The user keeps the original blank copy of the “Input Template” tab in reserve in the event that additional copies are needed. The notes below the diagram provide additional explanations for creating, naming, and aligning the “Input” tabs in this example.



<u>Notes:</u>

(a) The user is interested in distinguishing between Phases 1 and 2 during Site Investigation because the Phases will occur six months apart. Therefore, the user creates two copies of the “Input Template” tab, names the copies accordingly, and aligns them with the “Site Investigation” remedy component.

(b) The user views the excavation activities as a single discrete event, and so creates one copy of the “Input Template” tab, names it accordingly, and links it with the “Excavation” remedy component.

(c) The user would like to better understand the footprints for three aspects of Reconstruction to determine which aspects to focus on for footprint reduction measures. Therefore, the user creates three copies of the “Input Template” tab, names the copies accordingly, and aligns them with the “Reconstruction” remedy component.

(d) The user is interested in tracking Groundwater Monitoring and Surface Water Monitoring separately, and so creates two copies of the “Input Template” tab, names the copies accordingly, and aligns them with the “Long-term Monitoring” remedy component.

(e) The user would like to test the environmental footprint from two groundwater monitoring regimes (which are equally effective for monitoring the site). Therefore, the user creates a copy of the “Input Template” tab for the alternative regime, and names it “Alt. GW Monitoring”. The user does not align this tab with the “Long-term Monitoring” remedy component, but keeps the tab turned “off”. When testing the alternative, the user will align the “Alt. GW Monitoring” with the “Long-term Monitoring” remedy component and will turn the original “Groundwater Monitoring” tab “off”.

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation

Detailed Notes and Explanations for "Input Template" Tab

Topics Detailed in Sections 1-17 (below)

1) Headings (Rows 1 & 2 on the "Input Template" tab)

An identifier for the SEFA worksheets appears in Row 1. The site and remedy names appear automatically in Row 2, based on information entered in the “General” tab of the “Main” workbook. The name of the “Input” tab also appears automatically in Row 2, based on the name typed by the user on the tab at the bottom of the excel window. These headings are repeated at the top of subsequent pages of the “Input” tab.

2) Alignment with Remedy Components (Rows 4 & 5)

The drop-down menu in Cell E4 is used for alignment of the “Input” tab with a Remedy Component. Please see the “Input Instructions” tab in the “Input” workbook for instructions on aligning “Input” tabs.

3) Comment Space (Row 7)

Space is made available in Row 7 for narrative notes for General Scope, Examples of Items Eliminated through Screening Process, and Other Notes and References. In addition, spaces are left open in the following sections of the “Input Template” tab for notes, references, or supporting calculations:

(a) Selected cells between and among the tables in the main part of the worksheet

(b) All cells beginning in Column X and extending to the right

(c) All cells in Rows 178 - 212

(d) All cells in Rows 213 – 430 (Columns G - W) below the main worksheet

4) Personnel Transportation (Row 14)

Use this table to model personnel transportation to and from the site.

(a) Calculations for Fuel Used in Column K are based on the values or drop-down selections for Number of Roundtrips to Site, Roundtrip Distance to Site, Mode of Transportation, and Fuel Type in Columns C, D, E, and G, respectively. You must make entries or selections in all four columns (C, D, E, and G) in order for the Fuel Used to be calculated.

(b) You may select any combination for Mode of Transportation (Column E) and Fuel Type (Column G). However, SEFA provides Default Fuel Usage Rates (Column I) for only the most common combinations. For combinations for which SEFA does not provide a Default Fuel Usage Rate, the message “NO DATA” will appear in Column I.

(c) You may override the Default Fuel Usage Rate. If you have a specific Fuel Usage Rate for any transportation/fuel combination, you may enter it in Column J. This will override the default value in Column I. You may also use Column J to designate the Fuel Usage Rate when “NO DATA” appears in Column I.

(d) If “Airplane” is selected as Mode of Transportation in Column E, you should select “Diesel” as the Fuel Type in Column G. SEFA contains Default Fuel Usage Rates only for diesel when “Airplane” is selected, based on the assumption that diesel is similar to jet fuel.

(e) If “Electricity” is selected as Fuel Type in Column G, Fuel Used (Column K) will be in units of kilowatt hours (kWh). SEFA assumes that electricity for the vehicle is supplied on-site, so the result in Column K is transferred automatically to Cell G67 of the "On-Site Electricity Use" table. For vehicles which obtain electricity from an off-site source, you may still include that energy usage in the tables beginning on Row 147 of the “Input Template” tab. Please see below for instructions on the use of these tables.

(f) The units for Total Distance (Column H) are dependent on the mode of transportation selected in the drop-down menu in Column E. The units are:

(i) For car or truck, the units are miles.

(ii) For airplane/bus/train, the units are passenger-miles.

(iii) If “Vehicle (other)” is selected in the drop-down menu, the units should be determined by the user.

(g) The units for Default Fuel Usage Rate (Column I) are dependent on the transportation/fuel combination and are noted below. When specifying the Fuel Usage Rate in Column J, the same units must be used. The units are based on gallons for diesel/biodiesel/gasoline and ccf for natural gas. Although some of the combinations are unlikely, the units would be:

(i) For car or truck, the units are miles/gallon or miles/ccf.

(ii) For airplane/bus/train, the units are passenger-miles/gallon or passenger-miles/ccf.

(iii) If “Vehicle (other)” is selected in the drop-down menu, the units should be determined by the user.

(h) When the Fuel Type (Column G) is biodiesel, B20, diesel, or gasoline, the units for Fuel Used (Column K) are gallons. When the Fuel Type is natural gas, the units for Fuel Used are hundreds of cubic feet (ccf). When the Fuel Type is electricity, the units for Fuel Used are kilowatt hours (kWh).

(i) If you do not find the mode of transportation you are looking for in the drop-down menu in Column E, you may add a “User-defined Vehicle" to the drop-down menu. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

(j) If you are using a transportation fuel that is not provided in the drop-down menu in Column G, you may still include that fuel usage in the tables beginning on Row 147 of the “Input Template” tab. Please see below for instructions on the use of that table.

(k) Open cells are provided in Rows 25 and 26 to allow additional flexibility for transportation/fuel combinations. When using these rows, you must still select the Fuel Type from the drop-down menu in Column G, in order for the fuel usage to be summed in the SEFA worksheets.

5) On-Site Equipment Use and Transportation (Row 29)

Use this table to model on-site equipment that is powered by diesel, biodiesel, gasoline, compressed natural gas, or liquified petroleum gas, and to model the transport of that equipment to and from the site.

Equipment Use

(a) For equipment or processes powered by electricity, use the “On-Site Electricity Use” table beginning on Row 51. If you are using equipment or processes powered by a fuel that is not provided in the drop-down menu in Column E, or in the “On-Site Natural Gas Use” or “On-Site Electricity Use” tables, you may still include that fuel usage in the tables beginning on Row 147 of the “Input Template” tab. Please see below for instructions on the use of these tables.

(b) Calculations for Fuel Used for On-Site Equipment in Column H are based on the values or drop-down selections for Horsepower, Load Factor, Equipment Fuel Type, and Equipment Hours Operated in Columns C, D, E, and G, respectively. You must make entries or selections in all four columns (C, D, E, and G) in order for the Fuel Used for On-Site Equipment to be calculated.

(c) For Horsepower in Column C, you may enter the representative value noted in the drop-down menu (Column A), or a unique value, if known, for the equipment to be used on-site. The horsepower ratings noted in the drop-down menu in Column A are provided for convenience only, as generally representative values that can be used in the absence of more specific information. They are not recognized in the SEFA calculations unless entered in Column C.

(d) The Load Factor (Column D) for a piece of equipment is the ratio of the load that the motor actually draws when it is operating to the maximum load that it could draw. For example, for a motor of 100 HP that drives a constant 75 HP load whenever it is on, the load factor will be 75/100, or 75%. To represent a motor that is running fairly efficiently, it is recommended that a load factor of 75% be used absent other information.

Equipment Transportation

Fuel usage rates for equipment transportation are miles per gallon (mpg) or gallons per ton-mile (gptm). For selecting Mode of Transportation (Column M) and Transport Fuel Type (Column N), and for overriding the Default Fuel Usage Rate (Columns O and P) in the On-site Equipment Use and Transportation table, please see notes beginning on Row 109 below for Materials Transportation.

Other

(a) The use of equipment on-site may be modelled independently from transport of the equipment to the site. For example, if a piece of equipment is used on-site, but transport of the equipment is not applicable (e.g., the equipment is permanently fixed to the site or transport is screened out as a minimal contributor), then fill in Columns A - G, but not Columns I - P. Conversely, if a piece of equipment is being transported to the site, but once on-site is powered by fuel other than those provided in the drop-down menu in Column E, then you would fill in Columns I - P, but not Columns A - G.

(b) If you do not find the mode of transportation you are looking for in the drop-down menu in Column M, you may add a "User-defined Vehicle" to the drop-down menu. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(c) If you are using equipment or transportation fuel that is not provided in the drop-down menus in Columns E or N, you may still include that fuel usage in the tables beginning on Row 147 of the "Input Template" tab. Please see below for instructions on the use of these tables.

(d) Open cells are provided in Rows 39 and 40 to provide additional flexibility for equipment/fuel and transportation/fuel combinations. When using these rows, you must still select the Equipment Fuel Type and the Transport Fuel Type from the drop-down menus in Columns E and N, respectively, in order for the fuel usage to be summed in the SEFA worksheets.

6) On-Site Electricity Use (Row 51)

Use this table to model electricity usage on-site, whether the electricity is supplied through the grid, or generated on-site from renewable resources.

(a) You may represent electricity demand in three ways: (1) based on the horsepower rating of equipment in Rows 53 - 56; (2) based on kW rating in Rows 57 - 60; and (3) based on total kWh used in Rows 61 - 64. Please note that all cells shaded yellow must be filled in for each type of data entry selected.

(b) The Load Factor (Column C) for a piece of electrical equipment is the ratio of the load that the motor actually draws when it is operating to the maximum load that it could draw. For example, for a motor of 100 HP that drives a constant 75 HP load whenever it is on, the load factor will be 75/100, or 75%. To represent a motor that is running fairly efficiently, it is recommended that a load factor of 75% be used absent other information.

(c) The Efficiency (Column D) for a piece of electrical equipment is a measure of how well the equipment performs relative to its designed capacity. The lower the efficiency, the more electricity is required by the equipment to complete the task. For efficiency, use either (1) the percent that gets you closest to the expected Electrical Rating or (2) a value of 75% to represent a motor that is running fairly efficiently.

(d) Enter electricity generated on-site from renewable resources in Cell G66. Enter only renewable electricity for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the on-site electricity generation). This renewable energy is subtracted from the total energy demand to the grid. Note that if the amount of renewable energy generated on-site is greater than that used on-site, the total Grid Electricity Used in Cell G68 is negative. This represents excess electricity that may be sold to other users or sent back into the grid.

7) On-Site Natural Gas Use (Row 51)

Use this table for combustion of natural gas on-site. For example, natural gas may be used for heating buildings or treatment processes.

(a) If power rating is known, use Rows 53 and 54.

(b) If heat load is known instead of power rating, use Rows 53 and 54, and enter power rating as 125% of heat load and choose 80% for efficiency.

(c) If Energy Required is known, use Row 55.

(d) If Natural Gas Used is known, use Row 56.

(e) The following conversion is used for calculating Natural Gas Used in Column R: 1 ccf = 103,000 Btu.

8) Landfill Gas Combusted On-Site for Energy Use (Row 61)

Use this table for combustion of landfill gas on-site. For example, the landfill gas usage may be in turbines for electricity production, or may be for heating in buildings or treatment processes. If the landfill gas is being flared, you should model this in the "Other Energy Use and Air Emissions" table on Row 147 of the "Input Template" tab.

(a) The greenhouse gas calculations in SEFA account for the avoidance of emissions of landfill methane, in addition to the emissions of CO2e as a result of the combustion process.

(b) SEFA does not account for non-methane gases emitted from the landfill. You can account for these in the "Other Energy Use and Air Emissions" table beginning on Row 147 of the "Input Template" tab.

(c) SEFA accounts for landfill gas combustion for beneficial purposes as "On-site renewable energy use or generation" in the "Summary" tab in the "Main" workbook. However, some entities do not support the claim of landfill gas as a renewable resource. In this case, you may want to use the "Other Energy Use and Air Emissions" table on Row 147 of the "Input Template" tab to adjust the totals for renewable energy in the "Summary" tab.

(d) When landfill gas is used for electricity production, you may decide to characterize the electricity production to be from a "renewable resource". If you characterize the electricity as "renewable", and you retain the renewable energy rights, you should enter the amount of electricity generated in Cell G59 of the "On-Site Electricity Use" table in the "Input Template" tab. You should also use the "Other Energy Use and Air Emissions" table on Row 147 of the "Input Template" tab to avoid double counting for the renewable energy.

9) Materials Use and Transportation (Row 72)

Use this table to model the types and amounts of materials used for the remedy and to model the transport of the materials to the site.

<u>Materials Use</u>

(a) Calculations for the energy and air emissions footprint from off-site manufacturing of materials are based on the values or drop-down selections for Material Type and Quantity in Columns A and D. (The footprint calculations are made automatically in the "Component" tabs in the "Calculations" workbook.) You must make entries or selections in both Columns A and D, and you must select "Yes" in the drop-down menu in Column H, in order for the footprint calculations to be made. Additional notes:

(i) There may be instances in which you do not want the energy and air emissions footprint calculations to be performed on the material, in which case you should choose "No" in Column H. For example, the material may be from a "Reused" source, with no energy or air emissions footprint accruing to the cleanup site.

(ii) If you do not find the material you are looking for in the drop-down menu in Column A, you may add a "User-defined Material" to the drop-down menu. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(iii) If you are using a material that is in the drop-down menu in Column A, but you have documented unique footprint conversion factors for that material that are different from the default footprint conversion factors in SEFA, you may add the unique material to the drop-down menu, as a "User-defined Material". For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(iv) If you are using a material in an aqueous solution, the suggested approach in order to be consistent with EPA's Footprint Methodology (www.cluin.org/greenremediation/methodology) is to first enter the dry weight of the material without transportation and selecting "Yes" for footprint calculation and then enter the material in solution in a different line for transportation and selecting "No" for footprint calculation.

(b) Summation of total tons of refined and unrefined materials, and calculation of % materials from recycled or reused sources, are based on values or drop-down selections made in Columns D, F, and G. (The total tons and %'s are presented in Rows 7 - 10 of the "Summary" tab of the "Main" workbook.) You must make entries or selections in all three Columns (D, F, and G) in order for the materials to be included in the totals tons and %'s. Additional notes:

(i) The distinction between refined and unrefined material (Column F) is described in EPA's Footprint Methodology (www.cluin.org/greenremediation/methodology).

(ii) For background information on the selection in Column G between "Virgin", "Recycled", and "Reused" materials, see the discussion in Section 15 below.

(iii) The selections for "Recycled" and "Reused" materials in Column G are combined in the calculation for "% of (un)refined materials from recycled or reused material" in Rows 8 and 10 in the "Summary" table of the "Main" workbook. The distinction between "Recycled" and "Reused" is retained in the drop-down menu in Column G for the convenience of the user.

(iv) If a material is obtained partly from virgin sources and partly from reused or recycled sources, you may enter the appropriate portions of the material on two separate rows in the "Materials Use and Transportation" table, and identify one portion as "Virgin" and the other portion as "Reused" or "Recycled". For example, if your site uses 100,000 lbs of cement composed of 8% reused material (with no footprint accruing to the site from the reused portion) you may enter the information in Columns A, D, F, G, and H as follows.

First row (virgin source): cement, 92000 lbs, refined, virgin, yes
Second row (reused source): cement, 8000 lbs, refined, reused, no

(c) For materials identified as "Reused" or "Recycled", you will typically choose "No" in the drop-down menu in Column H to indicate that no energy or air emissions footprint accrues to the cleanup site from production of the material. If you would like to account for the footprint from a "Reused" or "Recycled" material, you may add it as a "User-defined Material" to the drop-down list in Column A. For instructions, please see the "User Defined Materials" tab in the "Input" workbook.

Materials Transportation

(a) Calculations for Fuel Used in Column R are based on the values or drop-down selections for Default One-way Distance, Number of One-way Trips, Mode of Transportation, and Fuel Type in Columns I, K, N, and O, respectively. You must make entries or selections in three of the columns (K, N, and O) in order for the Fuel Used to be calculated. You may override the Default One-way Distance by entering a site-specific One-way Distance in Column J. You may use the Yes/No drop-down menu in Column L to have SEFA automatically include an empty return trip in the fuel calculations. This function simply doubles the total distance transported in Column M, and uses the same one-way distance, number of one-way trips, mode of transportation, transport fuel type, and fuel usage rate (entered in Columns I, J, K, N, O, P, and Q) for the empty return trip as for loaded trip.

(b) You may select any combination for Mode of Transportation (Column N) and Fuel Type (Column O). However, SEFA provides Default Fuel Usage Rates (Column P) for only the most common combinations. For combinations for which SEFA does not provide a Default Fuel Usage Rate, the message "NO DATA" will appear in Column P.

(c) You may override the Default Fuel Usage Rate. If you have a specific Fuel Usage Rate for any transportation/fuel combination, you may enter it in Column Q. This will override the default value in Column P. You may also use Column Q to designate the Fuel Usage Rate when "NO DATA" appears in Column P. When overriding or designating the Fuel Usage Rate in Column Q, you must use the same units as noted in the drop-down menu in Column N.

(d) If "Aircraft" is selected as Mode of Transportation in Column N, you should select "Diesel" as the Fuel Type in Column O. SEFA contains Default Fuel Usage Rates only for diesel when "Aircraft" is selected, based on the assumption that diesel is similar to jet fuel.

(e) The option for electricity is not provided in Column O for materials transport. If electricity is used for transport, and the electricity is provided on-site, you may enter it separately in the "On-Site Electricity Use" table (Row 51). For vehicles which obtain electricity from an off-site source, you may still include that energy usage in the tables beginning on Row 147 of the "Input Template" tab. Please see below for instructions on the use of these tables.

(f) The units for Default Fuel Usage Rate in Column P depend on the Mode of Transportation selected in Column N. If "Truck (mpg)" is selected, the units are Miles per Gallon (mpg). For all other selections (Combination Truck, Truck Single Unit, Aircraft, Barge, and Train), the units are Gallons per Ton-Mile (gptm). For background information on the selection of "Truck (mpg)" vs "Combination Truck (gptm)" and "Truck Single Unit (gptm)", see the discussion in Section 16 below.

(g) When "Truck (mpg)" has been selected in Column N, you may want to account for empty return trips. When Combination Truck, Truck Single Unit, Aircraft, Barge, or Train have been selected you generally should not model an empty return trip. (For background information on modelling empty return trips, see the discussion in Section 16 below.) In order to account for empty return trips, you may use the Yes/No drop-down menu in Column L. If you prefer not to use the drop-down menu in Column L, or would like to modify the empty return trip (as compared to the loaded trip), you may want to use one of the following options:

(i) Double the Number of Trips in Column K.

(ii) Enter the empty return trips in a separate Row, leaving Columns D, F, G, and H blank. (You may select the material from the drop-down menu in Column A, if desired.) Fill in Columns K, N, and O, and be sure that there is an entry in either Column I or J (or both). Use the override function in Column Q if desired.

Other

(a) The use of materials on-site may be modelled independently from transport of the materials to the site. For example, if a material is used on-site, but transport of the material is not applicable (e.g., the material is transported with the same vehicle used for personnel transportation or transport is screened out as a minimal contributor), then fill in Columns A - H, but not Columns I - R. Conversely, if a material is being transported to the site, but the material is not to be included in any aspect of the footprint (e.g., total tons, % recycled, energy and air emissions footprints), then fill in Columns I - R, but not Columns A - H.

(b) If you do not find the mode of transportation you are looking for in the drop-down menu in Column N, you may add a "User-defined Vehicle" to the drop-down menu. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(c) If you are using a transportation fuel that is not provided in the drop-down menu in Column O, you may still include that fuel usage in the tables beginning on Row 147 of the "Input Template" tab. Please see below for instructions on the use of these tables.

(d) Open cells are provided in Rows 90 and 91, to allow additional flexibility for transportation/fuel combinations. When using these rows, you must still select the Fuel Type from the drop-down menu in Column O, in order for the fuel usage to be summed in the SEFA worksheets.

10) Waste Disposal and Transportation (Row 103)

Use this table to model types and amounts of wastes generated by the remedy and to model the transport of wastes from the site.

Waste Disposal

(a) Calculations for the energy and air emissions footprint from management of waste generated on-site are based on the values or drop-down selections for Waste Destination and Quantity in Columns A and D. (The footprint calculations are made automatically in the "Component" tabs in the "Calculations" workbook.) You must make entries or selections in both Columns A and D, in order for the footprint calculations to be made. Additional notes:

(i) SEFA assumes no energy or air emissions footprint from the "Recycled/Reused On-Site" and "Recycled/Reused Off-Site" selections in the drop-down menu in Column A. To include energy or air emissions footprints for recycled or reused waste in the footprint analysis, you may add a "User-defined" item to the drop-down menu. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(ii) Aside from reused or recycled wastes, if you do not find the off-site waste management destination or process that you are looking for in the drop-down menu in Column A, you may add a "User-defined" item to the drop-down menu. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(iii) If you are using a waste destination or process that is in the drop-down menu in Column A, but you have documented unique footprint conversion factors for that waste destination or process that are different from the default footprint conversion factors in SEFA, you may add the unique waste destination or process to the drop-down menu, as a "User-defined" item. For instructions, please see the "User Defined Factors" tab in the "Input" workbook.

(iv) In cases where waste, such as sludge, has been dewatered prior to transportation and disposal, enter the dry weight of the waste in Column D. If the waste has not been dewatered prior to transportation and disposal, then enter the wet weight in Column D. This ensures that the SEFA calculations will be based on the waste as transported and managed off-site.

(b) Summation of total tons of hazardous and non-hazardous wastes, and calculation of % of waste that is recycled or reused, are based values or drop-down selections made in Columns A and D. (The total tons and %'s are presented in Rows 11 - 14 of the "Summary" tab of the "Main" workbook.) You must make entries or selections in both Columns (A and D) in order for the materials to be included in the totals tons and %'s. Additional notes:

(i) The distinction between hazardous and non-hazardous waste (in the drop-down menu in Column A) may depend on state and local regulations for the location of the site and waste destination. You should make the selection in Column A that best fits the waste at hand.

(ii) For waste that is recycled/reused, no distinction is made in SEFA between hazardous and non-hazardous waste. This conforms with EPA's Footprint Methodology (www.cluin.org/greenremediation/methodology).

(c) Although wastewater sent to a POTW is not strictly speaking a "waste", that item has been included in the "Waste Disposal and Transportation" table (in the drop-down menu in Column A) for the user's convenience.

Waste Transportation

(a) Calculations for Fuel Used in Column O are based on the values or drop-down selections for Default One-way Distance, Number of One-way Trips, Mode of Transportation, and Fuel Type in Columns F, H, K, and L, respectively. You must make entries or selections in three of the columns (H, K, and L) in order for the Fuel Used to be calculated. You may override the Default One-way Distance by entering a site-specific One-way Distance in Column G. You may use the Yes/No drop-down menu in Column I to have SEFA automatically include an empty return trip in the fuel calculations. This function simply doubles the total distance transported in Column J, and uses the same one-way distance, number of one-way trips, mode of transportation, transport fuel type, and fuel usage rate (entered in Columns F, G, H, K, L, M, and N) for the empty return trip as for loaded trip.

(b) The use of Columns F - O in the "Waste Disposal and Transportation" table in Row 90 is parallel to the use of Columns I - R in the "Materials Use and Transportation" table in Row 65. Please see Section 9 above for notes and descriptions for use of this table.

(c) The default footprint conversion factors in SEFA for processing wastewater at a POTW include the typical footprint from transport of the wastewater through municipal lines. Therefore, you should leave Columns F - O blank when modelling “POTW” as a waste destination.

11) Water Use (Row 121)

Use this table to model the types and quantity of water used on-site by the remedy.

(a) To model water used on-site, select the source of water from the drop-down menu in Column A, and enter the quantity of water in Column D. Space for narrative remarks is provided in Columns F, J, N, and S for the convenience of the user. Entering information in Columns F, J, N, and S is optional. Additional notes:

(i) The items selected in the drop-down menu in Column A are summed according to source, and totals for each source are reported in Rows 15 - 21 in the “Summary” tab of the “Main” workbook.

(ii) Narrative remarks in Columns F, J, N, and S are not forwarded to the “Summary” tab in the “Main” workbook, and SEFA will not use information in these Columns for the footprint calculations.

(b) SEFA provides default footprint conversion factors for energy and air emissions only for “Public Water” in the drop-down menu in Column A. These footprint conversion factors include the typical footprint from transport of the public water through municipal lines.

(c) For all other selections in the drop-down menu (besides “Public Water”), SEFA assumes no energy or air emissions footprint. If there are any significant activities related to extracting, reclaiming, collecting, or diverting the other types of water, you may want to model those activities separately in other sections of the “Input Template” tab.

(d) No data entry options are provided in the “Water Use” table for transport of water from off-site suppliers. If water is transported to the site by truck or other vehicle, you may use the “Materials” table on Row 72 to model the transport, and use the notes section in Column S of that table to identify the entry.

(i) If “Truck (mpg)” is being used for transport of the water, leave Columns A - H of the “Materials” table blank, and enter the relevant transport information in Columns I - Q.

(ii) If transport based on gptm is being used for the water, leave Columns A and F - H of the “Materials” table blank. Enter the quantity of water (in tons) in Column D, and relevant transport information in Columns N, O, and Q.

(e) If you do not find the water source you are looking for in the drop-down menu in Column A, or if you are using a public water source that has footprint conversion factors that are different from the default footprint conversion factors in SEFA, you may add a “User-defined Water Resource” to the drop-down menu. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

12) Off-Site Laboratory Analysis (Row 147)

Use this table to model the types and number of analyses conducted at off-site laboratories.

(a) Select the type of analysis from the drop-down menu in Column M, and enter the number of samples undergoing the analysis in Column Q.

(b) The drop-down menu in Column M allows selection from 10 sample analyses typically found at cleanup sites. The selection "Off-site Laboratory Analysis - Other" from the drop-down menu uses footprint conversion factors based on an average of the other 10 analyses. If you do not find the sample analysis you are looking for in the drop-down menu, use a selection that most closely fits the analysis, and make a note in Column S to describe the analysis being represented.

(c) No data entry options are provided in the “Off-Site Laboratory Analysis” table for transport of samples to off-site laboratories. You may use the “Materials” table on Row 72 to model the transport, and use the notes section in Column S of that table to identify the entry.

13) Other Energy Use and Air Emissions (Row 147)

Use this table to model energy use and air emissions from on-site activities and transportation that have not been covered in any of the other tables in the “Input Template” tab. The “Other Energy Use and Air Emissions” table provides flexibility to include in the footprint analysis unique situations at your cleanup site. In all cases, you must perform your own estimates or calculations for the quantities to be entered in Column F of this table.

(a) Rows 151 and 152: If the remedy at your site uses a conventional (i.e., non-renewable) energy source on-site that is not represented elsewhere in the “Input Template” tab, you may add it as “User-defined on-site conventional energy use” in Rows 151 or 152. For example, you may have a boiler on-site that runs on fuel oil. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

(b) Row 152: If the remedy at your site results in emissions of on-site hazardous air pollutants (HAPs) that are not represented elsewhere in the “Input Template” tab, you may add them as “On-site HAP process emissions” in Row 152. For example, the treatment system at your site may release fugitive VOC emissions. Enter the quantity of the emissions in lbs in Cell F152, and use the notes space in Cell G152 to describe the source and type of emissions.

(c) Row 153: If the remedy at your site results in greenhouse gas (GHG) emissions that are not represented elsewhere in the “Input Template” tab, you may add them as “On-site GHG emissions” in Row 153. For example, the landfill gas collection system at your site may not be 100% efficient, resulting in fugitive emissions of methane. Enter the quantity of the emissions in lbs CO2e in Cell F153, and use the notes space in Cell G153 to describe the source and type of emissions.

(d) Row 154: If the remedy at your site results in carbon or greenhouse gas storage, you may add this as “On-site carbon storage” in Row 154. For example, you may have planted trees as part of your remedy, resulting in uptake of CO2. Enter the quantity of the carbon storage provided by the trees in lbs CO2e in Cell F154, and use the notes space in Cell G154 to describe the source and type of carbon storage. The quantity in Cell F154 must be entered as a negative number to represent storage.

(e) Row 155: If you are flaring landfill gas at your site, you may add this as “GHG avoided by flaring on-site landfill methane” in Row 155. Enter the quantity of methane flared in ccf CH4 in Cell F155, and use the notes space in Cell G155 to describe the source and type of GHG storage. Recall that landfill gas is not 100% methane and adjust the amount entered in Cell F155 accordingly. Use Row 155 only for landfill gas that is combusted but not used for energy production. For landfill gas used in energy production, use the “Landfill Gas Combusted On-Site for Energy Use” table on Row 61 of the “Input Template” tab. Additional notes:

(i) The greenhouse gas calculations in SEFA account for the avoidance of emissions of landfill methane, in addition to the emissions of CO2e as a result of the combustion process.

(ii) SEFA does not account for non-methane gases emitted from the landfill. You can account for these emissions on other rows in the "Other Energy Use and Air Emissions" table.

(f) Rows 156, 157, and 158: If the remedy at your site results in NOx, SOx, or PM emissions or reductions that are not represented elsewhere in the “Input Template” tab, you may add these as “Other on-site NOx/SOx/PM emissions or reductions” in Rows 156, 157, and 158. For example, NOx emissions may occur as a result of fertilizer application during reseeding of disturbed soils. As another example, PM reductions may be achieved through particulate filters on diesel equipment used on-site. Enter the quantity of NOx/SOx/PM emissions or reductions in lbs in Cells F156, F157, and F158, and use the notes spaces in Cells G156, G157, and G158 to describe the items. The quantities must be entered as positive numbers to represent emissions and negative numbers to represent reductions.

(g) Rows 161 and 162: If the remedy at your site uses a conventional (i.e., non-renewable) energy source for transportation that is not represented elsewhere in the “Input Template” tab, you may add it as “User-defined conventional energy transportation" in Rows 161 or 162. For example, you may want to more accurately model the fuel used in rail transport of materials to your site, instead of using the default assumption of diesel fuel. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

14) Other Voluntary Renewable Energy Use (Row 167)

Use this table to model renewable energy use from on-site activities and transportation that have not been covered in any of the other tables in the “Input Template” tab. The “Other Voluntary Renewable Energy Use” table provides flexibility to include in the footprint analysis unique situations at your cleanup site. In all cases, you must perform your own estimates or calculations for the quantities to be entered in Column F.

(a) Rows 169 and 170: If the remedy at your site uses a renewable energy source on-site that is not represented elsewhere in the “Input Template” tab, you may add it as “User-defined on-site renewable energy use” in Rows 169 or 170. For example, you may have a boiler on-site that runs on biomass. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

(b) Rows 171 and 172: If the remedy at your site uses a renewable energy source for transportation that is not represented elsewhere in the “Input Template” tab, you may add it as “User-defined renewable energy transportation" in Rows 171 or 172. For example, you may use vehicles that run on ethanol. For instructions, please see the “User Defined Factors” tab in the “Input” workbook.

(c) Rows 173 and 174: Use this space to document voluntary purchases of renewable electricity or Renewable Energy Certificates (RECs). Enter the quantity of the renewable purchases in MWh in Cells F173 and F174. Also fill out the tables beginning in Cells M167 and M171 of the “Input Template” tab with specifics on the renewable purchases. Consistent with the protocol described in EPA’s Methodology, SEFA does not include in the footprint analysis any emissions reductions (or “credits”) that may be associated with the renewable purchases. However, the MWh amounts for the renewable purchases are included in the “Summary” table of the “Main” workbook. Please refer to EPA’s Methodology (www.cluin.org/greenremediation/methodology) for a description of the difference between the two types of renewable purchases, and the reasoning behind the protocol.

15) Discussion for Selection of Virgin vs Recycled vs Reused Materials

For each material added in the "Materials Use and Transportation" table on Row 72, you should select the material source from three options (“Virgin”, “Recycled”, or “Reused”) in the drop-down menu in Column G.

(a) The first option, "Virgin”, describes a material that is being used for the first time, that has come directly from the manufacturer or supplier, and is made from raw materials, not recycled or repurposed sources. For this option, you must select "Yes" in Column H in order for the energy and air emissions footprint for the material to be calculated in SEFA.

(b) The second option, "Recycled”, describes a material that is created from sources that are being used for a second time or more. A recycled material usually has a smaller footprint than a material from virgin sources. There are several approaches for representing a recycled material in SEFA.

(i) You may select "No" in Column H if the item is assumed to have an insignificant energy and air emissions footprint or if the footprint does not accrue to the site. In this case no energy and air emissions footprint will be calculated for the material.

(ii) You may select "Yes" in Column H if the item is assumed to have an energy and air emissions footprint similar to the footprint of the virgin material. In this case the energy and air emissions footprint will be calculated using the default conversion factors in SEFA for the virgin material.

(iii) You may create a “User-defined Material” in the drop-down list in Column A for a material that has footprint conversion factors different from the default factors in SEFA. (The default conversion factors in SEFA can be found on the "Default Conversions" tab in the "Calculations" workbook. Instructions for creating a “User-defined Material" can be found on the “User Defined Materials” tab in the “Input” workbook.) If you create a “User-defined Material” to represent a recycled material, you must select "Yes" in Column H in order for the energy and air emissions footprint for the material to be calculated using the user-defined conversion factors.

(c) The third option, "Reused”, describes a material that is taken from another location and used essentially unchanged. Assuming that there is no energy or air emissions footprint associated with the "Reused" material, or that the footprint does not accrue to the site, you would select "No" in Column H. In this case no energy and air emissions footprint will be calculated for the material. If you find that the “Reused” material does have an energy and air emissions footprint, you may follow the approaches noted above for “Recycled” materials.

16) Discussion of Miles per Gallon (mpg) vs Gallons per Ton-Mile (gptm)

Options for equipment, materials, and waste transportation in the "Input Template" tab include “Truck (mpg)” which represents truck transport based on Miles per Gallon (mpg), and "Combination Truck (gptm)" and “Truck single unit (gptm)” which represent truck transport based on Gallons per Ton-Mile (gptm). The selection for mode of transportation is made in the drop-down menu in the "Equipment" table in Row 29 (Column M), in the “Materials” table in Row 72 (Column N), and in the “Waste” table in Row 103 (Column K). Rules of thumb are noted below for the two options for truck transport (mpg and gptm). However, each cleanup site and remedy is unique, and you should use the mode of transport that is most representative for the situation at hand.
Note that the other modes of transportation in the drop-down menu (aircraft, barge, and train) are based on gptm. The discussion below regarding "Combination Truck (gptm)" and “Truck single unit (gptm)” is also relevant to gptm transport by aircraft, barge, and train.

(a) Truck (mpg): Miles per Gallon is a unit of measure best used to describe the efficiency of a vehicle hauling a single load to a single location, and is determined by how many miles a vehicle can travel on one gallon of fuel. Additional notes:

(i) For mpg, fuel use is calculated based on the one-way distance between the site and supplier (or site and waste destination), number of one-way trips, and type of fuel selected. These items are found in Column I or J, Column L, and Column O, respectively, in the “Materials” table, and in corresponding Columns in the Equipment and Waste tables.

(ii) Typically, truck transport using mpg will most accurately represent short-haul scenarios. These scenarios may include dump trucks hauling clean fill from a nearby borrow site, or hauling waste to a nearby municipal waste landfill.

(iii) Truck transport using mpg often results in an empty return trip. If this is the case at your site, you should model the empty return trip. As an estimation, you may assume the same fuel usage rate (mpg) for the empty return trip, or if you know the fuel usage rate (mpg) is different, you may override it.

(b) Truck freight (gptm): Gallons per Ton-Mile is best used to describe the efficiency of hauling freight on a vehicle that may be carrying multiple loads to multiple locations, and is determined by how many gallons of fuel it takes to haul a ton of freight one mile. Additional notes:

(i) For gptm, fuel use is calculated based on the weight of material or waste being transported, one-way distance between the site and supplier, and type of fuel selected. These items are found in Column E, Column I or J, and Column O, respectively, in the “Materials” table, and in corresponding Columns in the Equipment and Waste tables.

(ii) Typically truck transport using gptm will most accurately represent long-haul scenarios. These scenarios may include transporting steel or treatment chemicals from the manufacturing location to a local distribution yard or to the site.

(iii) The fuel usage rate for truck transport using gptm includes return trips of transport vehicles, based on average transport activities. Therefore, you should not model empty return trips for this type of transport.

17) Additional Flexibility for Combustion of Fuels

SEFA provides additional flexibility for modeling combustion of biodiesel, diesel, gasoline, and natural gas used for on-site equipment and for transportation.

(a) If you are using biodiesel, diesel, gasoline, or natural gas for transportation that has a footprint for combustion that is different from the default footprint in SEFA, you may establish user-defined conversion factors for combustion of that fuel. (See the “Default Conversions” tab in the “Calculations” workbook for the default conversion factors in SEFA.) Note that any user-defined factors established for a fuel type will apply to all forms of transportation using that fuel type (i.e., all types of transportation selected in the "Personnel", "On-site Equipment Use", "Materials Use", and "Waste Disposal" tables in the "Input Template" tab). For instructions on establishing user-defined factors for biodiesel, diesel, gasoline, or natural gas used in transportation, please see the “User Defined Factors” tab in the “Input” workbook.

(b) Similar to the notes above, if you are using biodiesel, diesel, gasoline, or natural gas for on-site equipment that has a footprint for combustion that is different from the default footprint in SEFA, you may establish user-defined conversion factors for combustion of that fuel. (See the “Default Conversions” tab in the “Calculations” workbook for the default conversion factors in SEFA.) Note that any user-defined factors established for a fuel type will apply to all forms of on-site equipment using that fuel type (i.e., all types of equipment selected in Column A in the “On-Site Equipment Use and Transportation” table in the “Input Template” tab). For instructions on establishing user-defined factors for biodiesel, diesel, gasoline, or natural gas used in on-site equipment, please see the “User Defined Factors” tab in the “Input” workbook.

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Input Summary

Remedy Component Number →		1	2	3	4	5	6															
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)														Remedy Component Subtotals						
Item		Input Template	Input Template (2)	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
On-Site																						
On-site Renewable Energy																						
Renewable electricity generated on-site	MWh	0	0	0	0	0										0	0	0	0	0	0	0
Landfill gas combusted on-site for energy use	ccf CH_4	0	0	0	0	0										0	0	0	0	0	0	0
On-site biodiesel use	gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site biodiesel use - Other	gal	0	0	0	0	0										0	0	0	0	0	0	0
User-defined on-site renewable energy use #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
On-Site Conventional Energy																						
Grid electricity	MWh	0	0	66.732	0	0										0	0	66.732	0	0	0	66.732
On-site diesel use - Other	Gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site diesel use <75 hp	Gal	435.9633	8684.0367	606.38532	9481.233	0										435.9633	8684.0367	606.38532	9481.233	0	0	19207.618
On-site diesel use 75<hp<750	Gal	6804.3956	128254.95	112346.11	214683.47	1287.6923										6804.3956	128254.95	112346.11	214683.47	1287.6923	0	463376.62
On-site diesel use >750 hp	Gal	0	38872.34	0	0	0										0	38872.34	0	0	0	0	38872.34
On-site gasoline use - Other	Gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site gasoline use <25 hp	Gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site gasoline use >25 hp	Gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site natural gas use	ccf	0	0	0	0	0										0	0	0	0	0	0	0
On-site compressed natural gas use - Other	ccf	0	0	0	0	0										0	0	0	0	0	0	0
On-site compressed natural gas use	ccf	0	0	0	0	0										0	0	0	0	0	0	0
On-site liquified petroleum gas use - Other	gal	0	0	0	0	0										0	0	0	0	0	0	0
On-site liquified petroleum gas use	gal	0	0	0	0	0										0	0	0	0	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
Other On-site Emissions																						
On-site HAP process emissions	Lbs	0	0	0	0	0										0	0	0	0	0	0	0
On-site GHG emissions	Lbs CO2e	0	0	0	0	0										0	0	0	0	0	0	0
On-site carbon storage	Lbs CO2e	0	0	0	0	0										0	0	0	0	0	0	0
GHG avoided by flaring on-site landfill methane	ccf CH4	0	0	0	0	0										0	0	0	0	0	0	0
Other on-site NOx emissions or reductions	Lbs	0	0	0	0	0										0	0	0	0	0	0	0
Other on-site SOx emissions or reductions	Lbs	0	0	0	0	0										0	0	0	0	0	0	0
Other on-site PM emissions or reductions	Lbs	0	0	0	0	0										0	0	0	0	0	0	0
Electricity Generation																						
Grid electricity	MWh	0	0	66.732	0	0										0	0	66.732	0	0	0	66.732
Voluntary purchase of renewable electricity	MWh	0	0	0	0	0										0	0	0	0	0	0	0
Voluntary purchase of RECs	MWh	0	0	0	0	0										0	0	0	0	0	0	0
Transportation																						
Transportation Fuel Use Breakdown																						
Biodiesel use - Personnel Transport	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Personnel Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Equipment Transport	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Equipment Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Material Transport	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Material Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Waste Transport	gal	0	0	0	0	0										0	0	0	0	0	0	0
Biodiesel use - Waste Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Personnel Transport - other vehicles	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Personnel Transport - car	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Personnel Transport - passenger truck	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Personnel Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Equipment Transport	gal	134255.8	0	0	0	0										134255.8	0	0	0	0	0	134255.8
Diesel use - Equipment Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Material Transport	gal	0	15622.948	10719.861	67057.048	0										0	15622.948	10719.861	67057.048	0	0	93399.857
Diesel use - Material Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel use - Waste Transport	gal	0	0	15650.1	0	0										0	0	15650.1	0	0	0	15650.1
Diesel use - Waste Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Gasoline use - Personnel Transport - other vehicles	gal	0	0	0	0	0										0	0	0	0	0	0	0
Gasoline use - Personnel Transport - car	gal	1532	2750	3716.8	2374.4	186										1532	2750	3716.8	2374.4	186	0	10559.2
Gasoline use - Personnel Transport - passenger truck	gal	0	0	0	0	0										0	0	0	0	0	0	0
Gasoline use - Personnel Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Gasoline use - Equipment Transport	gal	0	0	0	0	0										0	0	0	0	0	0	0
Gasoline use - Equipment Transport - User Defined	gal	0	0	0	0	0										0	0	0	0	0	0	0
Natural Gas use - Personnel Transport	ccf	0	0	0	0	0										0	0	0	0	0	0	0
Natural Gas use - Personnel Transport - User Defined	ccf	0	0	0	0	0										0	0	0	0	0	0	0
Natural Gas use - Equipment Transport	ccf	0	0	0	0	0										0	0	0	0	0	0	0

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Input Summary

Remedy Component Number →		1	2	3	4	5	6									Remedy Component Subtotals						
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)																				
Item		Input Template	Input Template (2)	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Conventional Energy																						
Transportation diesel use	gal	134255.8	15622.948	26369.961	67057.048	0										134255.8	15622.948	26369.961	67057.048	0	0	243305.76
Transportation gasoline use	gal	1532	2750	3716.8	2374.4	186										1532	2750	3716.8	2374.4	186	0	10559.2
Transportation natural gas use	ccf	0	0	0	0	0										0	0	0	0	0	0	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	10										0	0	0	0	10	0	10
User-defined conventional energy transportation #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
Renewable Energy																						
Transportation biodiesel use	gal	0	0	0	0	0										0	0	0	0	0	0	0
User-defined renewable energy transportation #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined renewable energy transportation #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
Off-Site																						
Construction Materials																						
Aluminum, Rolled Sheet	lb	0	0	0	0	0										0	0	0	0	0	0	0
Asphalt, mastic	lb	0	0	0	0	0										0	0	0	0	0	0	0
Asphalt, paving-grade	lb	0	0	0	0	0										0	0	0	0	0	0	0
Ethanol, Corn, 95%	lb	0	0	0	0	0										0	0	0	0	0	0	0
Ethanol, Corn, 99.7%	lb	0	0	0	0	0										0	0	0	0	0	0	0
Ethanol, Petroleum, 99.7%	lb	0	0	0	0	0										0	0	0	0	0	0	0
Gravel/Sand Mix, 65% Gravel	lb	0	0	0	0	0										0	0	0	0	0	0	0
Gravel/sand/clay	lb	0	0	0	0	0										0	0	0	0	0	0	0
HDPE	lb	0	0	0	0	0										0	0	0	0	0	0	0
Photovoltaic system (installed)	W	0	0	0	0	0										0	0	0	0	0	0	0
PVC	lb	0	0	0	0	0										0	0	0	0	0	0	0
Portland cement, US average	lb	0	14551660	9984785	0	0																
Ready-mixed concrete, 20 MPa	ft3	0	0	0	0	0										0	0	0	0	0	0	0
Round Gravel	lb	0	0	0	120714000	0										0	0	0	120714000	0	0	120714000
Sand	lb	0	0	0	128414000	0										0	0	0	128414000	0	0	128414000
Stainless Steel	lb	0	0	0	0	0										0	0	0	0	0	0	0
Steel	lb	0	0	0	0	0										0	0	0	0	0	0	0
Other refined construction materials	lb	0	0	0	1016000	0										0	0	0	1016000	0	0	1016000
Other unrefined construction materials	lb	0	0	0	0	0										0	0	0	0	0	0	0
Treatment Materials & Chemicals																						
Cheese Whey	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Emulsified vegetable oil	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Granular activated carbon, primary	lbs	0	0	0	818000	0										0	0	0	818000	0	0	818000
Granular activated carbon, regenerated	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Iron (II) Sulfate	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Lime, Hydrated, Packed	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Molasses	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Phosphoric Acid, 70% in H2O	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Potassium Permanganate	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Sodium Hydroxide, 50% in H2O	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Other Treatment Chemicals & Materials	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Material Type																						
Total Virgin Refined Materials	tons	0	7275.83	4992.3925	917	0										0	7275.83	4992.3925	917	0	0	13185.223
Total Recycled Refined Materials	tons	0	0	0	0	0										0	0	0	0	0	0	0
Total Reused Refined Materials	tons	0	0	0	0	0										0	0	0	0	0	0	0
Total Refined Material	tons	0	7275.83	4992.3925	917	0										0	7275.83	4992.3925	917	0	0	13185.223
Total Virgin Unrefined Materials	tons	0	0	0	124564	0										0	0	0	124564	0	0	124564
Total Recycled Unrefined Materials	tons	0	0	0	0	0										0	0	0	0	0	0	0
Total Reused Unrefined Materials	tons	0	0	0	0	0										0	0	0	0	0	0	0
Total Unrefined Material	tons	0	0	0	124564	0										0	0	0	124564	0	0	124564
Fuel Processing																						
Biodiesel produced	gal	0	0	0	0	0										0	0	0	0	0	0	0
Diesel produced	gal	141496.16	191434.27	139322.46	291221.75	1287.6923										141496.16	191434.27	139322.46	291221.75	1287.6923	0	764762.33
Gasoline produced	gal	1532	2750	3716.8	2374.4	186										1532	2750	3716.8	2374.4	186	0	10559.2
Compressed natural gas produced	ccf	0	0	0	0	0										0	0	0	0	0	0	0
Liquified petroleum gas produced	gal	0	0	0	0	0										0	0	0	0	0	0	0
Natural gas produced	ccf	0	0	0	0	0										0	0	0	0	0	0	0
Water Use																						
Public Water Supply	gal x 1000	0	1395.9	0	0	0										0	1395.9	0	0	0	0	1395.9
Extracted Groundwater	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
Surface Water	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
Reclaimed Water	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
Collected/Diverted Storm Water	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
User-defined water resource #1	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0

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Input Summary

Remedy Component Number →		1	2	3	4	5	6									Remedy Component Subtotals						
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)																				
Item		Input Template	Input Template (2)	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Waste/Recycle Handling																						
Hazardous waste incineration	lbs	0	0	0	0	0										0	0	0	0	0	0	0
Off-site waste water treatment (POTW)	gal x 1000	0	0	0	0	0										0	0	0	0	0	0	0
Off-site non-hazardous waste landfill	tons	0	0	86752	0	0										0	0	86752	0	0	0	86752
Off-site hazardous waste landfill	tons	0	0	2283	0	0										0	0	2283	0	0	0	2283
Recycled/Reused On-Site	tons	0	0	0	0	0										0	0	0	0	0	0	0
Recycled/Reused Off-Site	tons	0	0	0	0	0										0	0	0	0	0	0	0
Solid Waste Totals																						
Total Non-Hazardous Waste	tons	0	0	86752	0	0										0	0	86752	0	0	0	86752
Total Hazardous Waste	tons	0	0	2283	0	0										0	0	2283	0	0	0	2283
Total Recycled/Reused	tons	0	0	0	0	0										0	0	0	0	0	0	0
Total Waste (all types)	tons	0	0	89035	0	0										0	0	89035	0	0	0	89035
Lab Services																						
Off-site Laboratory Analysis - Other	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Metals	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Mercury	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - Sulfate	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - PCBs	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - VOCs	sample	0	0	0	0	0										0	0	0	0	0	0	0
Off-site Laboratory Analysis - SVOCs	sample	0	0	0	0	0										0	0	0	0	0	0	0
Resource Extraction for Electricity																						
Coal extraction and processing	MWh	0	0	4.00392	0	0										0	0	4.00392	0	0	0	4.00392
Natural gas extraction and processing	MWh	0	0	6.6732	0	0										0	0	6.6732	0	0	0	6.6732
Nuclear fuel extraction and processing	MWh	0	0	1.33464	0	0										0	0	1.33464	0	0	0	1.33464
Oil extraction and processing	MWh	0	0	3.3366	0	0										0	0	3.3366	0	0	0	3.3366
Other fuel extraction and processing	MWh	0	0	0	0	0										0	0	0	0	0	0	0
Electricity Transmission																						
Transmission and distribution losses	MWh	0	0	66.732	0	0										0	0	66.732	0	0	0	66.732

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Input Summary

Remedy Component Number →		1	2	3	4	5	6									Remedy Component Subtotals						
		Column headings in Row 6 must match the name of "Input" tabs in this workbook for Columns C - P in this table to be populated ("0" in Row 4 means "Input" tab is turned Off and will not be grouped to a Remedy Component (Columns Q - V) or used in subsequent calculations)																				
Item		Input Template	Input Template (2)	Input Template (3)	Input Template (4)	Input Template (5)	Input Template (6)	Input Template (7)	Input Template (8)	Input Template (9)	Input Template (10)	Input Template (11)	Input Template (12)	Input Template (13)	Input Template (14)	1	2	3	4	5	6	Total
Other																						
User-defined material #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined Waste Destinations																						
User-defined recycled/reused on-site #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0										0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0										0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0										0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0										0	0	0	0	0	0	0

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Input Worksheet for Input Template

Please specify which Remedy Component this Input worksheet is part of: (Select "Off" to exclude this Input worksheet from calculations and results)	Component 1	Mobilization

General Scope

Includes: B - Interim Winterization and Mobilization

Example Items Eliminated through Screening Process

Mobilization Items Assumed Consistent Across All Alternatives (Equipment Operating Hours and Duration; DGA; HDPE Liner; Fencing; Spill Plates; Heavy-Duty Urethane Tarp; Associated Transport of Materials)

Other Notes and References

Personnel Transportation

Participant	Number of Roundtrips to Site	Roundtrip Distance to Site (miles)	Mode of Transportation*	Transport Fuel Type*	Total Distance Transported (miles)	Default Fuel Usage Rate**	Fuel Usage Rate Override**	Fuel Used for Personnel Transport**	Activity or Notes
Commute: Component A - Contractor's Team	2880	10	Car	Gasoline	28800	25		1152	
Commute: Component B - Mobilization and Pre-Remedia	90	50	Car	Gasoline	4500	25		180	
Commute: Component C - Winterization and Remobilizati	100	50	Car	Gasoline	5000	25		200	
			Car	Gasoline		25			

** See the "Detailed Notes and Explanations" tab for explanation of transport and fuel options.*

*** for biodiesel, B20, diesel, and gasoline, units are gallons for Fuel Used and miles/gallon for Fuel Usage Rate; for natural gas, units are hundreds of cubic feet (ccf) for Fuel Used and ccf/miles for Fuel Usage Rate; for electricity, units are miles/kWh for Fuel Usage Rate and the kWh (Fuel Used) are added to total grid electricity used (cell G69).*

On-Site Equipment Use and Transportation

Equipment Type*	HP*	Load Factor (%)*	Equipment Fuel Type**	Equipment Fuel Usage Rate	Equipment Hours Operated	Fuel Used for On-site Equipment	Equipment weight (tons)	Number of Equipment Roundtrips to Site	Roundtrip Distance to Site (miles)	Total Distance Transported (miles)	Mode of Transportation	Transport Fuel Type***	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Equipment Transport (gallons)	Activity or Notes
Loader (200 HP)	100	100%	Diesel between 75 and 750 hp	5.494505495	194.4	1068.131868	0	0	0							
Skid-steer - small (60 HP)	95	100%	Diesel between 75 and 750 hp	5.21978022	324	1691.208791	0	0	0							
Other - HP varies	22	100%	Diesel less than 75 hp	1.345565749	324	435.9633028	0	0	0							
Other - HP varies	249	100%	Diesel between 75 and 750 hp	13.68131868	108	1477.582418	0	0	0							
Other - HP varies	249	100%	Diesel between 75 and 750 hp	13.68131868	72	985.0549451	0	0	0							
Other - HP varies	400	100%	Diesel between 75 and 750 hp	21.97802198	72	1582.417582	0	0	0							
Other - HP varies	0	0%	Diesel	0	0	0	919	1	9525	9525	Combination Truck (gptm)	Diesel	0.015337423		134255.8	Single winterization and remobilization of all equipment

** HP and Load Factor must be entered by user in Columns C and D. Please see the "Detailed Notes and Explanations" tab for further explanation.*

*** For biodiesel, B20, diesel, gasoline, and liquified petroleum gas, units are gallons for Fuel Used for On-site Equipment and gallons/hr for Equipment Fuel Usage Rate; for compressed natural gas units are ccf (hundreds of cubic feet) for Fuel Used for On-site Equipment and ccf/hr for Equipment Fuel Usage Rate.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation and other aspects of data entry in Columns M, N, and P. Units are gallons for Fuel Used for Equipment Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 1	Mobilization

On-Site Electricity Use

Equipment Type	HP	Load Factor (%)	Efficiency (%)	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
Estimated Total Electricity Usage Based on Above						0	
Renewable Electricity Generated On-Site*							
Total Electricity Usage Based on Personnel Transportation						0	
Total Grid Electricity Used						0	

** Electricity generated on-site from renewable resources, for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the renewable energy generation).*

On-Site Natural Gas Use

Equipment Type	Power Rating (Btu/hr)	Efficiency (%)	Hours Used	Energy Required (Btu)	Natural Gas Used (ccf)	Notes
					0	
				0		
		Totals	0	0	0	

Landfill Gas Combusted On-Site for Energy Use

Equipment Type	Landfill Gas (ccf)	% Methane by volume	Used for electricity?	Landfill Gas Methane Used (ccf)	Notes
				0	
				0	
				0	
			Total	0	

Please see the "Detailed Notes and Explanations" tab for instructions on using the two tables above ("On-site Natural Gas Use" and "Landfill Gas Combusted On-Site for Energy Use"). In the two tables above, ccf = hundreds of cubic feet.

Materials Use and Transportation

Material Type*	Unit	Quantity	Tons	Is the Material Refined or Unrefined?**	Material Source: Virgin, Recycled, or Reused?**	Calculate Item Footprint?**	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation* **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Materials Transport (gallons)	Notes and Description of Materials

			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														

** Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined Materials" in the dropdown menu.*

*** Selections must be made in Columns F - H in order for the footprint calculations to be performed. Please see the "Detailed Notes and Explanations" tab for further information.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns L, N, O, and Q. Units are gallons for Fuel Used for Materials Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 1	Mobilization

Waste Disposal and Transportation

Waste Destination*	Unit	Quantity	Tons	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Waste Transport (gallons)	Notes and Description of Waste
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											

** No footprint is calculated for the Recycled/Reused On-Site and Off-Site selections. Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined" selections in the dropdown menu.*

*** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns I, K, L, and N. Units are gallons for Fuel Used for Waste Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Type of Water Used

Source of Water Used*	Unit	Quantity	Tons	Source Location/Aquifer (optional)	Quality of Water Used (optional)	Water Uses (optional)	Fate of Used Water (optional)
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				

** Only the "Public Water" selection has an associated footprint. No footprint is calculated for the other water source selections.*

Note: Information entered in Columns F - V (Source/Quality/Use/Fate) is not compiled or reported by SEFA.

Remedy Component that this Input worksheet is part of:	Component 1	Mobilization

Other Energy Use and Air Emissions

Item		Units	Quantity	Notes
On-Site				
User-defined on-site conventional energy use #1	*User-Defined	TBD		
User-defined on-site conventional energy use #2	*User-Defined	TBD		
On-site HAP process emissions**		lbs		
On-site GHG emissions**		lbs CO2e		
On-site carbon storage**		lbs CO2e		
Landfill gas flared on-site		ccf CH4		
Other on-site NOx emissions or reductions**		lbs		
Other on-site SOx emissions or reductions**		lbs		
Other on-site PM emissions or reductions**		lbs		

Off-Site Laboratory Analysis

Parameter and Notes	Number of Samples	Comments

Input Worksheet for Input Template

		Units	Quantity	Notes
Transportation		**Units**	**Quantity**	**Notes**
User-defined conventional energy transportation #1	*User-Defined	TBD		
User-defined conventional energy transportation #2	*User-Defined	TBD		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Enter a positive number for emissions and a negative number for reductions, avoidances, or storage***
See the "Detailed Notes and Explanations" tab for use of this table.

Totals	**0**	

Other Voluntary Renewable Energy Use

Item		Units	Quantity	Notes
User-defined on-site renewable energy use #1	*User-Defined	TBD		
User-defined on-site renewable energy use #2	*User-Defined	TBD		
User-defined renewable energy transportation #1	*User-Defined	TBD		
User-defined renewable energy transportation #2	*User-Defined	TBD		
Voluntary purchase of renewable electricity**		MWh		
Voluntary purchase of RECs**		MWh		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Complete information on provider in the table to the right. No footprint reductions are associated with the voluntary purchases.***
See the "Detailed Notes and Explanations" tab for use of this table

Description of purchased renewable electricity (green pricing product or green marketing product)	Provider:	
	Type of product:	
	Type of renewable energy source:	
	Date of renewable system installation:	
Description of purchased RECs	Provider:	
	Type of renewable energy source:	
	Date of renewable system installation:	
	Location of renewable system installation:	

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Input Worksheet for Input Template (2)

Please specify which Remedy Component this Input worksheet is part of: (Select "Off" to exclude this Input worksheet from calculations and results)	Component 2	Shoreline Work (Bulkheads, ISS, etc.)

General Scope

A - Bulkheads; B - ISS

Example Items Eliminated through Screening Process

Other Notes and References

Personnel Transportation

Participant	Number of Roundtrips to Site	Roundtrip Distance to Site (miles)	Mode of Transportation*	Transport Fuel Type*	Total Distance Transported (miles)	Default Fuel Usage Rate**	Fuel Usage Rate Override**	Fuel Used for Personnel Transport**	Activity or Notes
A: Non-union	105	10	Car	Gasoline	1050	25		42	
A: Union	455	50	Car	Gasoline	22750	25		910	
B: Non-union	145	10	Car	Gasoline	1450	25		58	
B: Union	870	50	Car	Gasoline	43500	25		1740	

** See the "Detailed Notes and Explanations" tab for explanation of transport and fuel options.*

*** for biodiesel, B20, diesel, and gasoline, units are gallons for Fuel Used and miles/gallon for Fuel Usage Rate; for natural gas, units are hundreds of cubic feet (ccf) for Fuel Used and ccf/miles for Fuel Usage Rate; for electricity, units are miles/kWh for Fuel Usage Rate and the kWh (Fuel Used) are added to total grid electricity used (cell G69).*

On-Site Equipment Use and Transportation

Equipment Type*	HP*	Load Factor (%)*	Equipment Fuel Type**	Equipment Fuel Usage Rate	Equipment Hours Operated	Fuel Used for On-site Equipment	Equipment weight (tons)	Number of Equipment Roundtrips to Site	Roundtrip Distance to Site (miles)	Total Distance Transported (miles)	Mode of Transportation	Transport Fuel Type***	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Equipment Transport (gallons)	Activity or Notes
Grout pump (20 HP)	17	100%	Diesel less than 75 hp	1.039755352	8352	8684.036697	0	0	0							
Generator - HP varies	279	100%	Diesel between 75 and 750 hp	15.32967033	1044	16004.17582	0	0	0							
Drilling - large rig (500 HP)	1023	100%	Diesel between 75 and 750 hp	56.20879121	1044	58681.97802	0	0	0							
Other - HP varies	700	100%	Diesel greater than 750 hp	37.23404255	1044	38872.34043	0	0	0							
Water truck (400 HP)	300	100%	Diesel between 75 and 750 hp	16.48351648	1044	17208.79121	0	0	0							
Other - HP varies	426	100%	Diesel between 75 and 750 hp	23.40659341	252	5898.461538	0	0	0							
Drilling - large rig (500 HP)	415	100%	Diesel between 75 and 750 hp	22.8021978	504	11492.30769	0	0	0							
Other - HP varies	380	100%	Diesel between 75 and 750 hp	20.87912088	504	10523.07692	0	0	0							
Other - HP varies	380	100%	Diesel between 75 and 750 hp	20.87912088	252	5261.538462	0	0	0							
Other - HP varies	115	100%	Diesel between 75 and 750 hp	6.318681319	504	3184.615385	0	0	0							

** HP and Load Factor must be entered by user in Columns C and D. Please see the "Detailed Notes and Explanations" tab for further explanation.*

*** For biodiesel, B20, diesel, gasoline, and liquified petroleum gas, units are gallons for Fuel Used for On-site Equipment and gallons/hr for Equipment Fuel Usage Rate; for compressed natural gas units are ccf (hundreds of cubic feet) for Fuel Used for On-site Equipment and ccf/hr for Equipment Fuel Usage Rate.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation and other aspects of data entry in Columns M, N, and P. Units are gallons for Fuel Used for Equipment Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 2	Shoreline Work (Bulkheads, ISS, etc.)

On-Site Electricity Use

Equipment Type	HP	Load Factor (%)	Efficiency (%)	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
					Estimated Total Electricity Usage Based on Above	0	
					Renewable Electricity Generated On-Site*		
					Total Electricity Usage Based on Personnel Transportation	0	
					Total Grid Electricity Used	0	

** Electricity generated on-site from renewable resources, for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the renewable energy generation).*

On-Site Natural Gas Use

Equipment Type	Power Rating (Btu/hr)	Efficiency (%)	Hours Used	Energy Required (Btu)	Natural Gas Used (ccf)	Notes
					0	
				0		
		Totals	0	0	0	

Landfill Gas Combusted On-Site for Energy Use

Equipment Type	Landfill Gas (ccf)	% Methane by volume	Used for electricity?	Landfill Gas Methane Used (ccf)	Notes
				0	
				0	
				0	
			Total	0	

Please see the "Detailed Notes and Explanations" tab for instructions on using the two tables above ("On-site Natural Gas Use" and "Landfill Gas Combusted On-Site for Energy Use"). In the two tables above, ccf = hundreds of cubic feet.

Materials Use and Transportation

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Netwon Creek - East Branch FFS - Alternative EB-B

Input Worksheet for Input Template (2)

Material Type*	Unit	Quantity	Tons	Is the Material Refined or Unrefined?**	Material Source: Virgin, Recycled, or Reused?**	Calculate Item Footprint?**	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation***	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Materials Transport (gallons)	Notes and Description of Materials
Portland cement, US average	lb	14551660	7275.83	Refined	Virgin	Yes	25	140	1	No	140	Combination	Diesel	0.015337423		15622.948	
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														

** Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined Materials" in the dropdown menu.*

*** Selections must be made in Columns F - H in order for the footprint calculations to be performed. Please see the "Detailed Notes and Explanations" tab for further information.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns L, N, O, and Q. Units are gallons for Fuel Used for Materials Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 2	Shoreline Work (Bulkheads, ISS, etc.)

Waste Disposal and Transportation

Waste Destination*	Unit	Quantity	Tons	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Waste Transport (gallons)	Notes and Description of Waste
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											

** No footprint is calculated for the Recycled/Reused On-Site and Off-Site selections. Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined" selections in the dropdown menu.*

*** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns I, K, L, and N. Units are gallons for Fuel Used for Waste Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Type of Water Used

Source of Water Used*	Unit	Quantity	Tons	Source Location/Aquifer (optional)	Quality of Water Used (optional)	Water Uses (optional)	Fate of Used Water (optional)
Public Water	gal x 1000	1395.9	5820.903				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				

** Only the "Public Water" selection has an associated footprint. No footprint is calculated for the other water source selections.*

Note: Information entered in Columns F - V (Source/Quality/Use/Fate) is not compiled or reported by SEFA.

Remedy Component that this Input worksheet is part of:	Component 2	Shoreline Work (Bulkheads, ISS, etc.)

Other Energy Use and Air Emissions

Item		Units	Quantity	Notes
On-Site				
User-defined on-site conventional energy use #1	*User-Defined	TBD		
User-defined on-site conventional energy use #2	*User-Defined	TBD		
On-site HAP process emissions**		lbs		
On-site GHG emissions**		lbs CO2e		

Off-Site Laboratory Analysis

Parameter and Notes	Number of Samples	Comments

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Input Worksheet for Input Template (2)

On-site carbon storage**		lbs CO2e		
Landfill gas flared on-site		ccf CH4		
Other on-site NOx emissions or reductions**		lbs		
Other on-site SOx emissions or reductions**		lbs		
Other on-site PM emissions or reductions**		lbs		
Transportation		**Units**	**Quantity**	**Notes**
User-defined conventional energy transportation #1	*User-Defined	TBD		
User-defined conventional energy transportation #2	*User-Defined	TBD		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Enter a positive number for emissions and a negative number for reductions, avoidances, or storage***
See the "Detailed Notes and Explanations" tab for use of this table.

Totals	**0**	

Other Voluntary Renewable Energy Use

Item		**Units**	**Quantity**	**Notes**
User-defined on-site renewable energy use #1	*User-Defined	TBD		
User-defined on-site renewable energy use #2	*User-Defined	TBD		
User-defined renewable energy transportation #1	*User-Defined	TBD		
User-defined renewable energy transportation #2	*User-Defined	TBD		
Voluntary purchase of renewable electricity**		MWh		
Voluntary purchase of RECs**		MWh		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Complete information on provider in the table to the right. No footprint reductions are associated with the voluntary purchases.***
See the "Detailed Notes and Explanations" tab for use of this table

Description of purchased renewable electricity (green pricing product or green marketing product)	Provider:	
	Type of product:	
	Type of renewable energy source:	
	Date of renewable system installation:	
Description of purchased RECs	Provider:	
	Type of renewable energy source:	
	Date of renewable system installation:	
	Location of renewable system installation:	

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
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Input Worksheet for Input Template (3)

Please specify which Remedy Component this Input worksheet is part of: (Select "Off" to exclude this Input worksheet from calculations and results)	Component 3	Dredging (incl. Processing and Water Treatment)

General Scope

A - Dredging; B - Materials; C - Transportation of Import Materials; D - Water Treatment; E- Transportation and Disposal; F - Transportation of Waste Materials

Example Items Eliminated through Screening Process

Other Notes and References

Personnel Transportation

Participant	Number of Roundtrips to Site	Roundtrip Distance to Site (miles)	Mode of Transportation*	Transport Fuel Type*	Total Distance Transported (miles)	Default Fuel Usage Rate**	Fuel Usage Rate Override**	Fuel Used for Personnel Transport**	Activity or Notes
F: Non-union	81	10	Car	Gasoline	810	25		32.4	
F: Union	972	50	Car	Gasoline	48600	25		1944	
G: Union	405	50	Car	Gasoline	20250	25		810	
H: Non-union	81	10	Car	Gasoline	810	25		32.4	
H: Union	405	50	Car	Gasoline	20250	25		810	
I: Union	44	50	Car	Gasoline	2200	25		88	

** See the "Detailed Notes and Explanations" tab for explanation of transport and fuel options.*

*** for biodiesel, B20, diesel, and gasoline, units are gallons for Fuel Used and miles/gallon for Fuel Usage Rate; for natural gas, units are hundreds of cubic feet (ccf) for Fuel Used and ccf/miles for Fuel Usage Rate; for electricity, units are miles/kWh for Fuel Usage Rate and the kWh (Fuel Used) are added to total grid electricity used (cell G69).*

On-Site Equipment Use and Transportation

Equipment Type*	HP*	Load Factor (%)*	Equipment Fuel Type**	Equipment Fuel Usage Rate	Equipment Hours Operated	Fuel Used for On-site Equipment	Equipment weight (tons)	Number of Equipment Roundtrips to Site	Roundtrip Distance to Site (miles)	Total Distance Transported (miles)	Mode of Transportation	Transport Fuel Type***	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Equipment Transport (gallons)	Activity or Notes
Excavator - large (250 HP)	428	100%	Diesel between 75 and 750 hp	23.51648352	583.2	13714.81319										
Other - HP varies	380	100%	Diesel between 75 and 750 hp	20.87912088	583.2	12176.7033										
Excavator - large (250 HP)	426	100%	Diesel between 75 and 750 hp	23.40659341	583.2	13650.72527										
Other - HP varies	380	100%	Diesel between 75 and 750 hp	20.87912088	583.2	12176.7033										
Other - HP varies	700	100%	Diesel between 75 and 750 hp	38.46153846	583.2	22430.76923										
Excavator - large (250 HP)	432	100%	Diesel between 75 and 750 hp	23.73626374	583.2	13842.98901										
Water truck (400 HP)	300	100%	Diesel between 75 and 750 hp	16.48351648	583.2	9613.186813										
Grout pump (20 HP)	17	100%	Diesel less than 75 hp	1.039755352	583.2	606.3853211										
Other - HP varies	115	100%	Diesel between 75 and 750 hp	6.318681319	2332.8	14740.21978										

** HP and Load Factor must be entered by user in Columns C and D. Please see the "Detailed Notes and Explanations" tab for further explanation.*

*** For biodiesel, B20, diesel, gasoline, and liquified petroleum gas, units are gallons for Fuel Used for On-site Equipment and gallons/hr for Equipment Fuel Usage Rate; for compressed natural gas units are ccf (hundreds of cubic feet) for Fuel Used for On-site Equipment and ccf/hr for Equipment Fuel Usage Rate.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation and other aspects of data entry in Columns M, N, and P. Units are gallons for Fuel Used for Equipment Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 3	Dredging (incl. Processing and Water Treatment)

On-Site Electricity Use

Equipment Type	HP	Load Factor (%)	Efficiency (%)	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known total Energy Used>						66732	Water Treatment
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
Estimated Total Electricity Usage Based on Above						66732	
Renewable Electricity Generated On-Site*							
Total Electricity Usage Based on Personnel Transportation						0	
Total Grid Electricity Used						66732	

** Electricity generated on-site from renewable resources, for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the renewable energy generation).*

On-Site Natural Gas Use

Equipment Type	Power Rating (Btu/hr)	Efficiency (%)	Hours Used	Energy Required (Btu)	Natural Gas Used (ccf)	Notes
						0	
				0		
		Totals	0	0	0	

Landfill Gas Combusted On-Site for Energy Use

Equipment Type	Landfill Gas (ccf)	% Methane by volume	Used for electricity?	Landfill Gas Methane Used (ccf)	Notes
				0	
				0	
				0	
			Total	0	

Please see the "Detailed Notes and Explanations" tab for instructions on using the two tables above ("On-site Natural Gas Use" and "Landfill Gas Combusted On-Site for Energy Use"). In the two tables above, ccf = hundreds of cubic feet.

Materials Use and Transportation

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019
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Input Worksheet for Input Template (3)

Material Type*	Unit	Quantity	Tons	Is the Material Refined or Unrefined?**	Material Source: Virgin, Recycled, or Reused?**	Calculate Item Footprint?**	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation***	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Materials Transport (gallons)	Notes and Description of Materials
Portland cement, US average	lb	9984785	4992.3925	Refined	Virgin	Yes	25	140	1	No	140	Combination	Diesel	0.015337423		10719.861	
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														

** Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined Materials" in the dropdown menu.*

*** Selections must be made in Columns F - H in order for the footprint calculations to be performed. Please see the "Detailed Notes and Explanations" tab for further information.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns L, N, O, and Q. Units are gallons for Fuel Used for Materials Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 3	Dredging (incl. Processing and Water Treatment)

Waste Disposal and Transportation

Waste Destination*	Unit	Quantity	Tons	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Waste Transport (gallons)	Notes and Description of Waste
Off-site non-hazardous waste landfill	tons	43376	43376	25		1		25	Barge (gptm)	Diesel	0.0047		5096.7	
Off-site hazardous waste landfill	tons		0	500		1		500						
Off-site non-hazardous waste landfill	tons	43376	43376	25	100	1	No	100	Train (gptm)	Diesel	0.002150075		9326.2	
Off-site hazardous waste landfill	tons	2283	2283	500	250	1	No	250	Train (gptm)	Diesel	0.002150075		1227.2	
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											

** No footprint is calculated for the Recycled/Reused On-Site and Off-Site selections. Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined" selections in the dropdown menu.*

*** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns I, K, L, and N. Units are gallons for Fuel Used for Waste Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Type of Water Used

Source of Water Used*	Unit	Quantity	Tons	Source Location/Aquifer (optional)	Quality of Water Used (optional)	Water Uses (optional)	Fate of Used Water (optional)
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				

** Only the "Public Water" selection has an associated footprint. No footprint is calculated for the other water source selections.*

Note: Information entered in Columns F - V (Source/Quality/Use/Fate) is not compiled or reported by SEFA.

Remedy Component that this Input worksheet is part of:	Component 3	Dredging (incl. Processing and Water Treatment)

Other Energy Use and Air Emissions

Item		Units	Quantity	Notes
On-Site				
User-defined on-site conventional energy use #1	*User-Defined	TBD		
User-defined on-site conventional energy use #2	*User-Defined	TBD		
On-site HAP process emissions**		lbs		
On-site GHG emissions**		lbs CO2e		

Off-Site Laboratory Analysis

Parameter and Notes	Number of Samples	Comments

Input Worksheet for Input Template (3)

On-site carbon storage**		lbs CO2e		
Landfill gas flared on-site		ccf CH4		
Other on-site NOx emissions or reductions**		lbs		
Other on-site SOx emissions or reductions**		lbs		
Other on-site PM emissions or reductions**		lbs		
Transportation		**Units**	**Quantity**	**Notes**
User-defined conventional energy transportation #1	*User-Defined	TBD		
User-defined conventional energy transportation #2	*User-Defined	TBD		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Enter a positive number for emissions and a negative number for reductions, avoidances, or storage***
See the "Detailed Notes and Explanations" tab for use of this table.

Totals	**0**	

Other Voluntary Renewable Energy Use

Item		Units	Quantity	Notes
User-defined on-site renewable energy use #1	*User-Defined	TBD		
User-defined on-site renewable energy use #2	*User-Defined	TBD		
User-defined renewable energy transportation #1	*User-Defined	TBD		
User-defined renewable energy transportation #2	*User-Defined	TBD		
Voluntary purchase of renewable electricity**		MWh		
Voluntary purchase of RECs**		MWh		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Complete information on provider in the table to the right. No footprint reductions are associated with the voluntary purchases.***
See the "Detailed Notes and Explanations" tab for use of this table

Description of purchased renewable electricity (green pricing product or green marketing product)	Provider:	
	Type of product:	
	Type of renewable energy source:	
	Date of renewable system installation:	
Description of purchased RECs	Provider:	
	Type of renewable energy source:	
	Date of renewable system installation:	
	Location of renewable system installation:	

Input Worksheet for Input Template (4)

Please specify which Remedy Component this Input worksheet is part of: (Select "Off" to exclude this Input worksheet from calculations and results)	Component 4	Backfill, Capping, and Outfall Protection

General Scope	*Example Items Eliminated through Screening Process*	*Other Notes and References*
Backfill/Materials/Materials Transportation, Capping and Outfall Protection/Materials/Materials Transportation		

Personnel Transportation

Participant	Number of Roundtrips to Site	Roundtrip Distance to Site (miles)	Mode of Transportation*	Transport Fuel Type*	Total Distance Transported (miles)	Default Fuel Usage Rate**	Fuel Usage Rate Override**	Fuel Used for Personnel Transport**	Activity or Notes
J: Non-union	176	10	Car	Gasoline	1760	25		70.4	
J: Union	1056	50	Car	Gasoline	52800	25		2112	
K: Union	96	50	Car	Gasoline	4800	25		192	

** See the "Detailed Notes and Explanations" tab for explanation of transport and fuel options.*

*** for biodiesel, B20, diesel, and gasoline, units are gallons for Fuel Used and miles/gallon for Fuel Usage Rate; for natural gas, units are hundreds of cubic feet (ccf) for Fuel Used and ccf/miles for Fuel Usage Rate; for electricity, units are miles/kWh for Fuel Usage Rate and the kWh (Fuel Used) are added to total grid electricity used (cell G69).*

On-Site Equipment Use and Transportation

Equipment Type*	HP*	Load Factor (%)*	Equipment Fuel Type**	Equipment Fuel Usage Rate	Equipment Hours Operated	Fuel Used for On-site Equipment	Equipment weight (tons)	Number of Equipment Roundtrips to Site	Roundtrip Distance to Site (miles)	Total Distance Transported (miles)	Mode of Transportation	Transport Fuel Type***	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Equipment Transport (gallons)	Activity or Notes
Skid-steer - small (60 HP)	95	100%	Diesel between 75 and 750 hp	5.21978022	986.4	5148.791209										
Loader (200 HP)	100	100%	Diesel between 75 and 750 hp	5.494505495	986.4	5419.78022										
Other - HP varies	405	100%	Diesel between 75 and 750 hp	22.25274725	986.4	21950.10989										
Other - HP varies	426	100%	Diesel between 75 and 750 hp	23.40659341	986.4	23088.26374										
Other - HP varies	700	100%	Diesel between 75 and 750 hp	38.46153846	1267.2	48738.46154										
Other - HP varies	380	100%	Diesel between 75 and 750 hp	20.87912088	2534.4	52916.04396										
Loader (200 HP)	428	100%	Diesel between 75 and 750 hp	23.51648352	1533.6	36064.87912										
Other - HP varies	115	100%	Diesel less than 75 hp	7.033639144	1347.984	9481.233028										
Work Boat	115	1000%	Diesel between 75 and 750 hp	63.18681319	338	21357.14286										

** HP and Load Factor must be entered by user in Columns C and D. Please see the "Detailed Notes and Explanations" tab for further explanation.*

*** For biodiesel, B20, diesel, gasoline, and liquified petroleum gas, units are gallons for Fuel Used for On-site Equipment and gallons/hr for Equipment Fuel Usage Rate; for compressed natural gas units are ccf (hundreds of cubic feet) for Fuel Used for On-site Equipment and ccf/hr for Equipment Fuel Usage Rate.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation and other aspects of data entry in Columns M, N, and P. Units are gallons for Fuel Used for Equipment Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 4	Backfill, Capping, and Outfall Protection

On-Site Electricity Use

Equipment Type	HP	Load Factor (%)	Efficiency (%)	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
Estimated Total Electricity Usage Based on Above						0	
Renewable Electricity Generated On-Site*							
Total Electricity Usage Based on Personnel Transportation						0	
Total Grid Electricity Used						0	

** Electricity generated on-site from renewable resources, for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the renewable energy generation).*

On-Site Natural Gas Use

Equipment Type	Power Rating (Btu/hr)	Efficiency (%)	Hours Used	Energy Required (Btu)	Natural Gas Used (ccf)	Notes
					0	
				0		
Totals			0	0	0	

Landfill Gas Combusted On-Site for Energy Use

Equipment Type	Landfill Gas (ccf)	% Methane by volume	Used for electricity?	Landfill Gas Methane Used (ccf)	Notes
				0	
				0	
				0	
Total				0	

Please see the "Detailed Notes and Explanations" tab for instructions on using the two tables above ("On-site Natural Gas Use" and "Landfill Gas Combusted On-Site for Energy Use"). In the two tables above, ccf = hundreds of cubic feet.

Materials Use and Transportation

Input Worksheet for Input Template (4)

Material Type*	Unit	Quantity	Tons	Is the Material Refined or Unrefined?**	Material Source: Virgin, Recycled, or Reused?**	Calculate Item Footprint?**	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation***	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Materials Transport (gallons)	Notes and Description of Materials
Sand	lb	128414000	64207	Unrefined	Virgin	Yes	25	75		No	75	Barge (gptm)	Diesel	0.0047		22632.968	
Granular activated carbon, primary	lb	818000	409	Refined	Virgin	Yes	500	585		No	585	Combination Truck (gptm)	Diesel	0.015337423		3669.709	
Other refined construction materials	lb	1016000	508	Refined	Virgin	Yes	500	2500		No	2500	Combination Truck (gptm)	Diesel	0.015337423		19478.528	Organoclay
Round Gravel	lb	44766000	22383	Unrefined	Virgin	Yes	25	75		No	75	Barge (gptm)	Diesel	0.0047		7890.008	
Round Gravel	lb	75948000	37974	Unrefined	Virgin	Yes	25	75		No	75	Barge (gptm)	Diesel	0.0047		13385.835	Armor
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														

** Please see the “Detailed Notes and Explanations” tab for instructions on specifying “User-Defined Materials” in the dropdown menu.*

*** Selections must be made in Columns F - H in order for the footprint calculations to be performed. Please see the “Detailed Notes and Explanations” tab for further information.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns L, N, O, and Q. Units are gallons for Fuel Used for Materials Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 4	Backfill, Capping, and Outfall Protection

Waste Disposal and Transportation

Waste Destination*	Unit	Quantity	Tons	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Waste Transport (gallons)	Notes and Description of Waste
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											

** No footprint is calculated for the Recycled/Reused On-Site and Off-Site selections. Please see the “Detailed Notes and Explanations” tab for instructions on specifying “User-Defined” selections in the dropdown menu.*

*** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns I, K, L, and N. Units are gallons for Fuel Used for Waste Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Type of Water Used

Source of Water Used*	Unit	Quantity	Tons	Source Location/Aquifer (optional)	Quality of Water Used (optional)	Water Uses (optional)	Fate of Used Water (optional)
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				

** Only the "Public Water" selection has an associated footprint. No footprint is calculated for the other water source selections.*

Note: Information entered in Columns F - V (Source/Quality/Use/Fate) is not compiled or reported by SEFA.

Remedy Component that this Input worksheet is part of:	Component 4	Backfill, Capping, and Outfall Protection

Other Energy Use and Air Emissions

Item		Units	Quantity	Notes
On-Site				
User-defined on-site conventional energy use #1	*User-Defined	TBD		
User-defined on-site conventional energy use #2	*User-Defined	TBD		

Off-Site Laboratory Analysis

Parameter and Notes	Number of Samples	Comments

Input Worksheet for Input Template (4)

On-site HAP process emissions**		lbs		
On-site GHG emissions**		lbs CO2e		
On-site carbon storage**		lbs CO2e		
Landfill gas flared on-site		ccf CH4		
Other on-site NOx emissions or reductions**		lbs		
Other on-site SOx emissions or reductions**		lbs		
Other on-site PM emissions or reductions**		lbs		
Transportation		**Units**	**Quantity**	**Notes**
User-defined conventional energy transportation #1	*User-Defined	TBD		
User-defined conventional energy transportation #2	*User-Defined	TBD		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Enter a positive number for emissions and a negative number for reductions, avoidances, or storage***
See the "Detailed Notes and Explanations" tab for use of this table.

Totals	**0**	

Other Voluntary Renewable Energy Use

Item		Units	Quantity	Notes
User-defined on-site renewable energy use #1	*User-Defined	TBD		
User-defined on-site renewable energy use #2	*User-Defined	TBD		
User-defined renewable energy transportation #1	*User-Defined	TBD		
User-defined renewable energy transportation #2	*User-Defined	TBD		
Voluntary purchase of renewable electricity**		MWh		
Voluntary purchase of RECs**		MWh		

**** Enter units and conversion factors on "User Defined Factors" tab***
***** Complete information on provider in the table to the right. No footprint reductions are associated with the voluntary purchases.***
See the "Detailed Notes and Explanations" tab for use of this table

Description of purchased renewable electricity (green pricing product or green marketing product)	Provider:	
	Type of product:	
	Type of renewable energy source:	
	Date of renewable system installation:	
Description of purchased RECs	Provider:	
	Type of renewable energy source:	
	Date of renewable system installation:	
	Location of renewable system installation:	

Input Worksheet for Input Template (5)

Please specify which Remedy Component this Input worksheet is part of: (Select "Off" to exclude this Input worksheet from calculations and results)	Component 5	Restoration and Demobilization

General Scope	*Example Items Eliminated through Screening Process*	*Other Notes and References*
Site Restoration, Demobilization		

Personnel Transportation

Participant	Number of Roundtrips to Site	Roundtrip Distance to Site (miles)	Mode of Transportation*	Transport Fuel Type*	Total Distance Transported (miles)	Default Fuel Usage Rate**	Fuel Usage Rate Override**	Fuel Used for Personnel Transport**	Activity or Notes
L: Union	90	10	Car	Gasoline	900	25		36	
M: Union	75	50	Car	Gasoline	3750	25		150	

** See the "Detailed Notes and Explanations" tab for explanation of transport and fuel options.*

*** for biodiesel, B20, diesel, and gasoline, units are gallons for Fuel Used and miles/gallon for Fuel Usage Rate; for natural gas, units are hundreds of cubic feet (ccf) for Fuel Used and ccf/miles for Fuel Usage Rate; for electricity, units are miles/kWh for Fuel Usage Rate and the kWh (Fuel Used) are added to total grid electricity used (cell G69).*

On-Site Equipment Use and Transportation

Equipment Type*	HP*	Load Factor (%)*	Equipment Fuel Type**	Equipment Fuel Usage Rate	Equipment Hours Operated	Fuel Used for On-site Equipment	Equipment weight (tons)	Number of Equipment Roundtrips to Site	Roundtrip Distance to Site (miles)	Total Distance Transported (miles)	Mode of Transportation	Transport Fuel Type***	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Equipment Transport (gallons)	Activity or Notes
Loader - small (75 HP)	100	100%	Diesel between 75 and 750 hp	5.494505495	108	593.4065934										
Skid-steer - small (60 HP)	95	100%	Diesel between 75 and 750 hp	5.21978022	108	563.7362637										
Roller (100 HP)	22	100%	Diesel between 75 and 750 hp	1.208791209	108	130.5494505										

** HP and Load Factor must be entered by user in Columns C and D. Please see the "Detailed Notes and Explanations" tab for further explanation.*

*** For biodiesel, B20, diesel, gasoline, and liquified petroleum gas, units are gallons for Fuel Used for On-site Equipment and gallons/hr for Equipment Fuel Usage Rate; for compressed natural gas units are ccf (hundreds of cubic feet) for Fuel Used for On-site Equipment and ccf/hr for Equipment Fuel Usage Rate.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation and other aspects of data entry in Columns M, N, and P. Units are gallons for Fuel Used for Equipment Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 5	Restoration and Demobilization

On-Site Electricity Use

Equipment Type	HP	Load Factor (%)	Efficiency (%)	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with HP, Efficiency, and Hours>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known kW rating>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
<Equip. with known total Energy Used>							
Estimated Total Electricity Usage Based on Above						0	
Renewable Electricity Generated On-Site*							
Total Electricity Usage Based on Personnel Transportation						0	
Total Grid Electricity Used						0	

** Electricity generated on-site from renewable resources, for which the facility retains the rights to the renewable energy (i.e., does not sell renewable energy certificates associated with the renewable energy generation).*

On-Site Natural Gas Use

Equipment Type	Power Rating (Btu/hr)	Efficiency (%)	Hours Used	Energy Required (Btu)	Natural Gas Used (ccf)	Notes
					0	
				0		
		Totals	0	0	0	

Landfill Gas Combusted On-Site for Energy Use

Equipment Type	Landfill Gas (ccf)	% Methane by volume	Used for electricity?	Landfill Gas Methane Used (ccf)	Notes
				0	
				0	
				0	
			Total	0	

Please see the "Detailed Notes and Explanations" tab for instructions on using the two tables above ("On-site Natural Gas Use" and "Landfill Gas Combusted On-Site for Energy Use"). In the two tables above, ccf = hundreds of cubic feet.

Materials Use and Transportation

Material Type*	Unit	Quantity	Tons	Is the Material Refined or Unrefined?**	Material Source: Virgin, Recycled, or Reused?**	Calculate Item Footprint?**	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation* **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Materials Transport (gallons)	Notes and Description of Materials
			0														
			0														
			0														Organoclay
			0														

Input Worksheet for Input Template (5)

			0														Armor
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														
			0														

** Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined Materials" in the dropdown menu.*

*** Selections must be made in Columns F - H in order for the footprint calculations to be performed. Please see the "Detailed Notes and Explanations" tab for further information.*

**** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns L, N, O, and Q. Units are gallons for Fuel Used for Materials Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Remedy Component that this Input worksheet is part of:	Component 5	Restoration and Demobilization

Waste Disposal and Transportation

Waste Destination*	Unit	Quantity	Tons	Default One-way Distance to Site (miles)	One-way Distance to Site Override (miles)	Number of One-way Trips to Site	Include Return Trip in Calculations?	Total Distance Transported (miles)	Mode of Transportation **	Transport Fuel Type	Default Transport Fuel Usage Rate (gptm or mpg)	Transport Fuel Usage Rate Override (gptm or mpg)	Fuel Used for Waste Transport (gallons)	Notes and Description of Waste
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											
			0											

** No footprint is calculated for the Recycled/Reused On-Site and Off-Site selections. Please see the "Detailed Notes and Explanations" tab for instructions on specifying "User-Defined" selections in the dropdown menu.*

*** Please see the "Detailed Notes and Explanations" tab for instructions on selecting mode of transportation, accounting for empty return trips, and other aspects of data entry in Columns I, K, L, and N. Units are gallons for Fuel Used for Waste Transport and miles/gallon (mpg) or gallons per ton-mile (gptm) for Transport Fuel Usage Rate.*

Type of Water Used

Source of Water Used*	Unit	Quantity	Tons	Source Location/Aquifer (optional)	Quality of Water Used (optional)	Water Uses (optional)	Fate of Used Water (optional)
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				
			0				

** Only the "Public Water" selection has an associated footprint. No footprint is calculated for the other water source selections.*

Note: Information entered in Columns F - V (Source/Quality/Use/Fate) is not compiled or reported by SEFA.

Remedy Component that this Input worksheet is part of:	Component 5	Restoration and Demobilization

Other Energy Use and Air Emissions

Item		Units	Quantity	Notes
On-Site				
User-defined on-site conventional energy use #1	*User-Defined	TBD		
User-defined on-site conventional energy use #2	*User-Defined	TBD		
On-site HAP process emissions**		lbs		
On-site GHG emissions**		lbs CO2e		
On-site carbon storage**		lbs CO2e		
Landfill gas flared on-site		ccf CH4		
Other on-site NOx emissions or reductions**		lbs		
Other on-site SOx emissions or reductions**		lbs		
Other on-site PM emissions or reductions**		lbs		
Transportation		Units	Quantity	Notes
User-defined conventional energy transportation #1	*User-Defined	TBD	10	
User-defined conventional energy transportation #2	*User-Defined	TBD		

Off-Site Laboratory Analysis

Parameter and Notes	Number of Samples	Comments

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Input Worksheet for Input Template (5)

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**** Enter units and conversion factors on "User Defined Factors" tab***

***** Enter a positive number for emissions and a negative number for reductions, avoidances, or storage***

See the "Detailed Notes and Explanations" tab for use of this table.

Totals	0	

Other Voluntary Renewable Energy Use

Item		Units	Quantity	Notes
User-defined on-site renewable energy use #1	*User-Defined	TBD		
User-defined on-site renewable energy use #2	*User-Defined	TBD		
User-defined renewable energy transportation #1	*User-Defined	TBD		
User-defined renewable energy transportation #2	*User-Defined	TBD		
Voluntary purchase of renewable electricity**		MWh		
Voluntary purchase of RECs**		MWh		

**** Enter units and conversion factors on "User Defined Factors" tab***

***** Complete information on provider in the table to the right. No footprint reductions are associated with the voluntary purchases.***

See the "Detailed Notes and Explanations" tab for use of this table

Description of purchased renewable electricity (green pricing product or green marketing product)	Provider:	
	Type of product:	
	Type of renewable energy source:	
	Date of renewable system installation:	
Description of purchased RECs	Provider:	
	Type of renewable energy source:	
	Date of renewable system installation:	
	Location of renewable system installation:	

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Fuel Mix for Grid Electricity

Please Select One Option for Fuel Mix --> | Use Different Fuel Mixes

Mix per Remedy Component	1	2	3	4	5	6	*Default Fuel Mix
Type of Fuel	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total	% of Total
Coal	30.5%	6.0%	6.0%	6.0%	6.0%	6.0%	30.5%
Natural Gas	33.9%	10.0%	10.0%	10.0%	10.0%	10.0%	33.9%
Oil	0.7%	5.0%	5.0%	5.0%	5.0%	5.0%	0.7%
Nuclear	19.8%	2.0%	2.0%	2.0%	2.0%	2.0%	19.8%
Biomass	1.7%	66.0%	66.0%	66.0%	66.0%	66.0%	1.7%
Geothermal	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%
Hydro	6.4%	11.0%	11.0%	11.0%	11.0%	11.0%	6.4%
Solar	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%
Wind	5.6%	0.0%	0.0%	0.0%	0.0%	0.0%	5.6%
Other (enter information in table below)	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	100%

U.S. national average fuel mix from 2016 is noted in Column N, and is populated as the default fuel mix in Column B.
For use of this worksheet, please see instructions at the end of the worksheet.
**** The Default Fuel Mix noted in Column N is a simplified representation of the U.S. national average fuel mix from 2016. Column B is also populated with the default fuel mix. The default fuel mix is taken from EPA's "eGRID2016 - Year 2016 Summary Tables", created February 2018.***

		User Defined Conversion Factors for "Other" Fuel Type in Fuel Mix table (above) Parameters Used, Extracted, Emitted, or Generated						
Item or Service Used	**Unit**	**Energy (MMBtu/MWh)**	**GHG (lbs CO2e/MWh)**	**NOx (lbs/MWh)**	**SOx (lbs/MWh)**	**PM (lbs/MWh)**	**Air Toxics (lbs/MWh)**	**Ref**
Electricity generation with "Other" fuel	MWh	#						
Fuel extraction & processing for "Other" fuel	MWh							

"MMBtu" = millions of Btus
"MWh" = megawatt hours (i.e., thousands of kilowatt-hours or millions of Watt-hours)

Please fill in all yellow cells in the User Defined Conversion Factors table above

Notes and References

Instructions for "Grid Electricity" tab

Overview of Grid Electricity

Use this worksheet to define the fuel mix for grid electricity used at your site. The fuel mix is the percentage of the various energy sources (natural gas, coal, nuclear, hydro, etc.) used to generate the grid electricity. SEFA uses this fuel mix to calculate the footprint from generation of the grid electricity. SEFA provides a default fuel mix for grid electricity in Rows 9 - 19 (Column B) of on this worksheet. This fuel mix is an average for the U.S. in 2016. The fuel mix for grid electricity can vary greatly from locale to locale. The fuel mix for the grid electricity at your site may have a footprint significantly larger or smaller than this average. If you have high electricity demand at your site, you should research the local grid supplier to determine its fuel mix. Fuel mixes for local grid electricity providers can often be found on the web pages of the providers. Once you determine the fuel mix of the local grid supplier, you may enter it in the table above. Be sure to document the source of information for the local grid mix in the space provided on Row 33.

Notes for Use of this Worksheet

(1) On the "Grid Electricity" tab of the "Input" workbook, you may either (a) enter one fuel mix and specify that it applies to all six of the Remedy Components, or (b) enter unique fuel mixes for each Remedy Component.

(a) To set a single fuel mix for all Remedy Components, choose “Use a Single Fuel Mix” from the drop-down menu in Cell L5, and enter the fuel mix in Column B. This fuel mix will be carried forward to all Remedy Components.

(b) To specify the fuel mix individually for each of 6 (or fewer) Remedy Components, choose “Use Different Fuel Mixes” from the drop-down menu in Cell L5, and enter the specific fuel mix for each of the Remedy Components in Columns B - L (depending on how many Remedy Components are used in the analysis).

(c) The entry for each fuel type must be less than 100% and the sum of all entries in each of the Columns B - L must add to 100%.

(d) Note that the default fuel mix (U.S. average in 2016) is also documented in Column N. This allows you to recover this information in the event that you override the default mix originally located in Column B.

(2) When specifying the fuel mix, you have the option to enter an "Other" type of fuel (Row 18 above). If “Other” fuel is specified, then the table on Row 23 above must be filled in to represent the footprint from electricity generation and resource extraction for the “Other” fuel. These entries would be based on research that you conduct. When the table on Row 23 is filled in, it will apply to "Other" fuel sources entered for all Remedy Components (Columns B - L). If the table on Row 23 is not filled in then the footprint from the “Other” portion of the fuel mix will be zero in the SEFA calculations.

(3) Based on the values entered in the tables above, SEFA automatically calculates the footprint conversion factors for the grid electricity (in the “Grid Electricity Conversions” tab in the “Calculations” workbook), and automatically applies the footprint conversion factors (in the “Components” tabs in the “Calculations” workbook). The footprint conversion factors are applied to the electricity usage that you enter in the “Input Template” tab of the “Input” workbook. Specifically, they are applied to the total grid electricity usage found in Cell G68 of the “Input Template” tab.

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For use of this worksheet, please see instructions at the end of the worksheet

User Defined Activity, Material, or Service	Unit	Tons per Unit*	User Defined Conversion Factors — Parameters Used, Extracted, Emitted, or Generated: Energy (MMBtu/unit)	GHG (lbs CO2e/unit)	NOx (lbs NOx/unit)	SOx (lbs SOx/unit)	PM (lbs PM/unit)	HAPs (lbs HAPs/unit)	Ref.	Use this row only for:
User-defined emissions for biodiesel on-site equipment	gal									User-defined emissions for biodiesel on-site equipment
User-defined emissions for diesel on-site equipment	gal									User-defined emissions for diesel on-site equipment
User-defined emissions for gasoline on-site equipment	gal									User-defined emissions for gasoline on-site equipment
User-defined emissions for compressed natural gas on-site eq	ccf									User-defined emissions for compressed natural gas on-site e
User-defined emissions for liquified petroleum gas on-site eq	gal									User-defined emissions for liquified petroleum gas on-site e
User-defined emissions for natural gas on-site equipment	ccf									User-defined emissions for natural gas on-site equipment
User-defined emissions for biodiesel transportation	gal									User-defined emissions for biodiesel transportation
User-defined emissions for diesel transportation	gal									User-defined emissions for diesel transportation
User-defined emissions for gasoline transportation	gal									User-defined emissions for gasoline transportation
User-defined emissions for natural gas transportation	ccf									User-defined emissions for natural gas transportation
Note: Entering user-defined emission conversion factors in Rows 7 - 16 will override default conversion factors for all emissions calculations of the same fuel/use throughout the SEFA workbooks.										
User-defined material #1	TBD	TBD								User-defined material #1
User-defined material #2	TBD	TBD								User-defined material #2
User-defined material #3	TBD	TBD								User-defined material #3
User-defined material #4	TBD	TBD								User-defined material #4
User-defined material #5	TBD	TBD								User-defined material #5
User-defined material #6	TBD	TBD								User-defined material #6
User-defined material #7	TBD	TBD								User-defined material #7
User-defined material #8	TBD	TBD								User-defined material #8
User-defined material #9	TBD	TBD								User-defined material #9
User-defined material #10	TBD	TBD								User-defined material #10
User-defined material #11	TBD	TBD								User-defined material #11
User-defined material #12	TBD	TBD								User-defined material #12
User-defined material #13	TBD	TBD								User-defined material #13
User-defined material #14	TBD	TBD								User-defined material #14
User-defined material #15	TBD	TBD								User-defined material #15
User-defined material #16	TBD	TBD								User-defined material #16
User-defined material #17	TBD	TBD								User-defined material #17
User-defined material #18	TBD	TBD								User-defined material #18
User-defined material #19	TBD	TBD								User-defined material #19
User-defined material #20	TBD	TBD								User-defined material #20

Item or Service Used	Unit	Tons per Unit*	Energy (MMBtu/unit)	GHG (lbs CO2e/unit)	NOx (lbs NOx/unit)	SOx (lbs SOx/unit)	PM (lbs PM/unit)	HAPs (lbs HAPs/unit)	Ref.	Use this row only for:
User-defined recycled/reused on-site #1	TBD	TBD								User-defined recycled/reused on-site #1
User-defined recycled/reused on-site #2	TBD	TBD								User-defined recycled/reused on-site #2
User-defined recycled/reused on-site #3	TBD	TBD								User-defined recycled/reused on-site #3
User-defined recycled/reused off-site #1	TBD	TBD								User-defined recycled/reused off-site #1
User-defined recycled/reused off-site #2	TBD	TBD								User-defined recycled/reused off-site #2
User-defined recycled/reused off-site #3	TBD	TBD								User-defined recycled/reused off-site #3
User-defined non-hazardous waste destination #1	tons	1								User-defined non-hazardous waste destination #1
User-defined non-hazardous waste destination #2	TBD	TBD								User-defined non-hazardous waste destination #2
User-defined non-hazardous waste destination #3	TBD	TBD								User-defined non-hazardous waste destination #3
User-defined hazardous waste destination #1	tons	1								User-defined hazardous waste destination #1
User-defined hazardous waste destination #2	TBD	TBD								User-defined hazardous waste destination #2
User-defined hazardous waste destination #3	TBD	TBD								User-defined hazardous waste destination #3

Item or Service Used	Unit	Tons per Unit*	Energy (MMBtu/unit)	GHG (lbs CO2e/unit)	NOx (lbs/unit)	SOx (lbs/unit)	PM (lbs/unit)	HAPs (lbs/unit)	Ref.	Use this row only for:
User-defined on-site conventional energy use #1	TBD									User-defined on-site conventional energy use #1
User-defined on-site conventional energy use #2	TBD									User-defined on-site conventional energy use #2
User-defined conventional energy transportation #1	TBD									User-defined conventional energy transportation #1
User-defined conventional energy transportation #2	TBD									User-defined conventional energy transportation #2
User-defined on-site renewable energy use #1	TBD									User-defined on-site renewable energy use #1
User-defined on-site renewable energy use #2	TBD									User-defined on-site renewable energy use #2
User-defined renewable energy transportation #1	TBD									User-defined renewable energy transportation #1
User-defined renewable energy transportation #2	TBD									User-defined renewable energy transportation #2
User-defined water resource #1	gal x 1000									User-defined water resource #1
User-defined water resource #2	gal x 1000									User-defined water resource #2

** "Tons per unit" refers to how many tons there are per unit of the material (e.g., 1 pound is 1/2000 of a ton or 0.0005 tons per unit)*

"MMBtu" = millions of Btus

User Defined Vehicles in Mode of Personnel Transportation	Fuel Usage Rate						Ref.	
	B20	Biodiesel	Diesel	Electricity	Gasoline	Natural Gas		
	mpg or pmpg	mpg or pmpg	mpg or pmpg	mpkWh	mpg	mpccf		
User Defined Vehicle #1								User Defined Vehicle #1
User Defined Vehicle #2								User Defined Vehicle #2
User Defined Vehicle #3								User Defined Vehicle #3
User Defined Vehicle #4								User Defined Vehicle #4
User Defined Vehicle #5								User Defined Vehicle #5

"mpg" = miles per gallon; "pmpg" = passenger miles per gallon; "mpkWh" = miles per kilowatt hour; "mpccf" = miles per 100 cubic feet"

User Defined Vehicles in Mode of Transportation for Equipment, Materials, and Waste	Fuel Usage Rate			Ref.	
	B20	Biodiesel	Diesel		
	mpg or gptm	mpg or gptm	mpg or gptm		
User Defined Vehicle #1					User Defined Vehicle #1
User Defined Vehicle #2					User Defined Vehicle #2
User Defined Vehicle #3					User Defined Vehicle #3
User Defined Vehicle #4					User Defined Vehicle #4
User Defined Vehicle #5					User Defined Vehicle #5

Instructions for "User Defined Factors" tab

Overview of User Defined Factors

Use this worksheet for user-defined footprint conversion factors for materials and activities that are unique to your site, and are not already provided in the "Input Template" tab of the "Input" workbook. Unique conversion factors can be established for the following:

(a) Combustion of fuels (both conventional and renewable) for transportation and on-site equipment

(b) Manufacturing or processing of materials

(c) Management and recycling of wastes

(d) Use of conventional and renewable energy

(e) Water resources

(f) Vehicles for personnel transportation

(g) Vehicles for equipment, materials, and waste transportation

In establishing these unique conversion factors, you must research and document the data, and enter it into the tables as follows:

(a) For the tables in Rows 4 - 71, enter the item name in Column A, the units you would like to use for the item in Column B, the factor for converting the specified units to tons in Column C. Enter the footprint conversion factors in Columns D - N.

(b) For the tables in Rows 75 - 89, enter the item name in Column A and fuel usage rates in Columns C - L. You need enter fuel usage rates only for those types of fuel that pertain to the vehicles entered in Column A. SEFA will apply default footprint conversion factors for combustion of fuels associated with user-defined vehicles in Rows 75 - 89.

After you have entered an item and its conversion factors or fuel usage rate, you may select (or view) the item in the corresponding table on the "Input Template" tabs in the "Input" workbook. Once you enter the quantity of the item in an "Input Template" tab, SEFA will include the item in the footprint analysis, and will automatically apply the conversion factors or fuel usage rates in the "Calculations" workbook.

For the tables in Rows 4 - 71, the conversion factors in Column D - N represent the amount of energy required for, and the amount of GHG, NOx, SOx, PM, and HAPs air emissions related to, the combustion of fuels, the off-site production of materials, the off-site management of waste, the use of energy, and the provision of water resources. Note that SEFA is equipped with default footprint conversion factors for a variety of materials and activities. These default conversion factors can be viewed in the "Default Conversions" tab of the "Calculations" workbook and are applied automatically in the "Calculations" workbook. You may want to view these default conversion factors before deciding whether to create a user-defined item with unique conversion factors.

How to Set Up User Defined Factors on This Worksheet

This section describes the general approach for setting up user defined factors. See the next four sections for specific examples for each type of user-defined factor.

(1) Column A: You are encouraged to enter descriptive names for the fuels, materials, waste processes, energy usage, water resources, or vehicles in Column A. Once entered, the new names will appear in the respective drop-down menus or data entry cell in the "Input" tab.

(2) Columns B and C: Entries in Columns B and C depend on the item being represented.

(a) For materials and wastes (Rows 18-37), you must enter the units for the item in Column B, and the conversion factor for tons in Column C.
Additional notes:

(i) Conversion to tons is necessary for summing of diverse materials or wastes (performed automatically in the SEFA workbooks) to arrive at the total materials usage or waste generation reported in the "Summary" tab in the "Main" workbook.

(ii) Conversion to tons is also necessary for calculations of fuel required for transport of materials or waste (performed automatically in the SEFA workbooks), when transport using units of "Gallons per Ton-Mile" is selected in the "Input Template" tab.

(b) For combustion of fuels (Rows 7 - 16), you must enter the units for the item in Column B, but you are not required to enter a conversion factor in Column C. The conversions for tons/gal and tons/ccf for these fuels are standard values set by default in SEFA.

(c) For energy (Rows 54 - 61), you must enter the units for the item in Column B, but you are not required to enter a conversion factor in Column C. The conversion for tons per unit is not needed in the SEFA calculations, because the items do not directly affect the amounts of materials or wastes, or the calculations of fuel used for transport.

(d) For water resources (Rows 62 & 63, units are "gallons x 1000" as shown in Column B. You are not required to enter a conversion factor in Column C.

(3) Column D: Entries in Column D depend on the item being represented.

(a) For materials, waste, energy usage, and water resources (Rows 18 - 63) enter in Column D the amount of energy (in Btus/unit), associated with the item.

(b) For combustion of fuels (Rows 7 - 16), you are not required to enter the amount of energy (in Btu/unit) in Column D. The energy content in Btu/gal and Btu/ccf for these fuels are standard values set by default in SEFA.

(4) Columns F - N: For fuels, materials, waste, energy usage, and water resources (Rows 7 - 63 fill in new row numbers), enter the footprint conversion factors for GHG, NOx, SOx, PM, and HAPs in Column F - N. These are footprint conversion factors that you have obtained through your own research. The conversion factors must be based on the units in Column B.

(5) Column O: Provide a reference number in Column O. (Reference numbers should be placed in Column N and Column H for vehicles in the tables beginning on Rows 68 and 77, respectively.) Full references for footprint conversion factors or fuel usage rates can be added in the open space below the table.

(6) Columns P - T: The entries in these columns reiterate the original text in Column A, to document the purpose of each of the rows. (The original entry in Column A disappears once you enter a unique item in that Column.) Do not use any row in this table for a purpose other than that described in Columns P - T. For example, do not enter a fuel combustion item in Rows 16 - 35 (designated for materials manufacturing) or Rows 38 - 49 (designated for waste management). (These entries are found in Columns N - P and Columns H - L for vehicles in the tables beginning on Rows 68 and 77, respectively.)

Examples for Rows 18 - 37 (Manufacturing or processing of materials)

You may want to add to the footprint analysis a material not found in SEFA. You should first check the drop-down menu in Column A of the “Materials Use and Transportation” table on Row 65 of the “Input Template” tab in the “Input” workbook. If the material is not already in the drop-down menu, you may add the material name and its footprint conversion factors in Rows 16 - 35 in the "User Defined Factors" tab (above). You may also want to add a user-defined material to provide unique (more accurate) footprint conversion factors for a material already included in the drop-down menu.

(1) For example, composite siding is not found in the drop-down menu. If composite siding is used on-site (e.g., for weatherproofing buildings), you may want to add it to the drop-down menu. To do this, enter “Composite siding” in Column A above. Column B might be “lbs” (of the siding) and Column C would be “0.0005”, the conversion factor from lbs to tons. The footprint conversion factors in Columns D - N would represent the energy required, and the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with the off-site manufacture of the composite siding. The entry in Column D would be in units of MMBtu/lb (that is, MMBtu energy required per lb composite siding manufactured), Column F would be in units of lbs CO2e/lb (that is, lbs CO2e emissions per lb composite siding manufactured), Column H would be lbs NOx/lb, etc.

(2) As another example, instead of using “Other treatment chemicals & materials” from the drop-down menu, you may want to add to the drop-down menu a unique treatment chemical used at your site. To do this, you would enter the name of the treatment chemical in Column A above. Column B might be “gallons” (of treatment chemical) and Column C might be 0.004 tons per gallons (depending on the density of the treatment chemical). The footprint conversion factors in Columns D - N would represent the energy required, and the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with the production of the treatment chemical. The entry in Column D would be in units of MMBtu/gallon (that is, MMBtu energy required per gallon treatment chemical produced), the entry in Column F would be in units of lbs CO2e/gallon (that is, lbs CO2e emissions per gallon treatment chemical produced), Column H would be lbs NOx/gallon, etc.

Once the user-defined material has been entered above, you may return to the “Materials Use and Transportation” table in the "Input Template" tab, select the newly added material from the drop-down menu in Column A, and enter the quantity of the material used at your site. All entries made in Rows 18 - 37 above are considered in SEFA as part of the off-site footprint.

Examples for Rows 39 - 51 (Management and recycling of wastes)

You may want to add to the footprint analysis a waste management or recycling process not found in SEFA. You should first check the drop-down menu in Column A of the “Waste Disposal and Transportation” table on Row 90 of the “Input Template” tab in the “Input” workbook. If the waste or recycling process is not already in the drop-down menu, you may add the process and its footprint conversion factors in Rows 39 - 51 in the "User Defined Factors" tab (above). You may also want to add a user-defined waste destination to provide unique (more accurate) footprint conversion factors for a waste destination or process already included in the drop-down menu.

(1) For example, anaerobic digestion is not found in the drop-down menu. If waste from your site is being sent to an off-site anaerobic digester, you may want to add it to the drop-down menu. To do this, enter “Anaerobic digester” in Column A above. Column B might be “tons” (of waste) and Column C would be “1”, the conversion factor from tons to tons. The footprint conversion factors in Columns D - N would represent the energy required, and the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with anaerobic digestion of the waste. The entry in Column D would be in units of MMBtu/ton (that is, MMBtu energy required per ton of waste undergoing anaerobic digestion), Column F would be in units of lbs CO2e/ton (that is, lbs CO2e emissions per ton of waste undergoing anaerobic digestion), Column H would be lbs NOx/ton, etc.

(2) As another example, instead of using “Non-hazardous waste landfill” from the drop-down menu, you may want to add to the drop-down menu a local landfill that uses energy-saving processes and equipment. To do this, you would enter the name of the landfill in Column A above. Column B might be “tons” (of waste) and Column C would be “1”, the conversion factor from tons to tons. The footprint conversion factors in Columns D - N would represent the energy required, and the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with the managing the waste at the landfill. The entry in Column D would be in units of MMBtu/ton (that is, MMBtu energy required per ton of waste managed), the entry in Column F would be in units of lbs CO2e/ton (that is, lbs CO2e emissions per ton of waste managed), Column H would be lbs NOx/ton, etc.

Once the user-defined waste destination has been entered above, you may return to the “Waste Disposal and Transportation” table in the "Input Template" tab, select the newly added waste destination or process from the drop-down menu in Column A, and enter the quantity of the waste sent to the waste disposal or recycling location. Entries made in Rows 40 - 42 above are considered in SEFA as part of the on-site footprint. Entries in Rows 43 - 51 are part of the off-site footprint.

Examples for Rows 54 - 61 (Use of conventional and renewable energy)

You may want to add to the footprint analysis an energy usage not found in SEFA. Inputs for energy usages are found in the tables in Rows 14 - 174 of the "Input Template" tab in the "Input" workbook. If an energy usage at your site is not available in these tables, you may add the name of the energy usage and its footprint conversion factors in Rows 54 - 61 above.

(1) For example, your site may burn fuel oil in a boiler (a conventional fuel used on-site). SEFA does not include this type of energy usage in Rows 14 - 174 of the "Input Template" tab. To model the energy usage of the boiler, use Row 54 or 55 in the table above. Enter the name of the activity in Column A, the units in Column B (for example, gallons of fuel oil), and the footprint conversion factors in Columns D - N. Once the fuel oil usage has been entered above, you may return to the "Input Template" tab, and find the new item represented in Row 150 or 151. Enter the quantity of fuel oil in Cell F150 of F151 of the "Input Template" tab. SEFA will automatically apply the new conversion factors to this item only.

(2) As another example, your site may use personnel transportation vehicles that run on bio-based ethanol (a renewable fuel used in transportation). SEFA does not include this type of energy usage in Rows 14 - 174 of the "Input Template" tab. To model the ethanol vehicles, use Row 60 or 61 in the table above. Enter the name of the activity in Column A, the units in Column B (for example, gallons of ethanol), and the footprint conversion factors in Columns D - N. Once the ethanol usage has been entered above, you may return to the "Input Template" tab, and find the new item represented in Row 171 or 172. Enter the quantity of ethanol in Cell F171 or F172 of the "Input Template" tab. SEFA will automatically apply the new conversion factors to this item only.

(3) In both the examples above, the footprint conversion factors in Columns D - N would represent the energy required, and the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with the combustion of the fuel (either fuel oil or bio-based ethanol). The entry in Column D would be in units of MMBtu/gallon (that is, MMBtu energy per gallon of fuel oil or ethanol combusted), Column F would be in units of lbs CO2e/gallon (that is, lbs CO2e emissions per gallon of fuel oil or ethanol combusted), Column H would be lbs NOx/gallon, etc.

(4) Entries made in Rows 54, 55, 58, and 59 above are considered in SEFA as part of the on-site footprint. Entries made in Rows 56, 57, 60, and 61 above are considered in SEFA as part of the transportation footprint.

(5) SEFA does not provide for separate modelling of the production (e.g., resource extraction or processing of fuel oil or ethanol) of a unique energy source that may be added in Rows 54 - 61 above. Instead, SEFA will use default footprint conversion factors for the fuel type.

Examples for Rows 7 - 16 (Combustion of fuels for transportation and on-site equipment)

You may want to add to the footprint analysis unique conversion factors for combustion of fuels already found in SEFA (such as gasoline, diesel, or biodiesel). This may be of interest if the default conversion factors in SEFA do not accurately represent emissions from equipment or vehicles in use at your site. Default conversion factors are found in the "Default Conversions" tab in the "Calculations" workbook. To include in the analysis unique footprint conversion factors for combustion of fuels (either conventional or renewable) for transportation and on-site equipment, you may add the name of the fuel name and its footprint conversion factors in Rows 7 - 14 above.

(1) For example, your site may use on-site diesel equipment that has been retrofitted with particulate filters.. To model the emissions from this equipment, use Row 8 in the table above. Enter the name of the fuel combustion situation in Column A, the units in Column B (for example, gallons of diesel), and the footprint conversion factors in Columns F - N. Once you enter unique conversion factors for this situation in the table above, the factors will override the default conversion factors in SEFA, and SEFA will automatically apply the new factors to all on-site diesel combustion. In this example, the unique footprint conversion factors will be applied to all on-site diesel equipment that you enter into the "Input Template" tab.

(2) As another example, your site may use ultra-low sulfur diesel fuel for transport of materials and waste. To model the emissions from this transportation fuel, use Row 12 in the table above. Enter the name of the fuel combustion situation in Column A, the units in Column B (for example, gallons of diesel), and the footprint conversion factors in Columns F - N. Once you enter unique conversion factors for this situation in the table above, the factors will override the default conversion factors in SEFA, and SEFA will automatically apply the new factors to all transportation diesel usage. In this example, the unique footprint conversion factors will be applied to all diesel transportation (personnel, equipment, materials, and waste) that you enter into the "Input Template" tab.

(3) In both examples above, the footprint conversion factors in Columns F - N would represent the GHG, NOx, SOx, PM, and HAPs emissions to air, associated with the combustion of the fuel. The entry in Column F would be in units of lbs CO2e/gallon (that is, lbs CO2e emissions per gallon diesel combusted), Column H would be lbs NOx/gallon, etc. If natural gas is used, the units would be lbs CO2e/ccf, lbs NOx/ccf, etc.

(4) Entries made in Rows 7 - 12 above are considered in SEFA as part of the on-site footprint. Entries made in Rows 13 - 16 above are considered in SEFA as part of the transportation footprint.

(5) SEFA does not provide for separate modelling of the production (e.g., resource extraction or processing of ultra-low sulfur diesel) of the unique fuel that may be added in Rows 7 - 16 above. Instead, SEFA will used default footprint conversion factors for the fuel type.

Well Material Calculator - 1

Use this tool to calculate the amount of material required for a well of specified type, depth, and diameter. This page is a calculator only and not linked to the "Input" tabs. The user must manually enter the results from the "Materials Required" table below into the appropriate "Input" tab.

Notes on Well Material Calculations - 1:

Well Details - 1	
Type of Well	
Well Casing Material	
Total Depth of Well in Feet (from ground surface to bottom of well, including screen)	
Screen Length in Feet	
Well Casing Diameter in Inches	
Stick-up Height in Feet (if applicable)	
Number of Wells	

Materials Required - 1		
Casing Material		Pounds
Screen Material		Pounds
Grout for Annulus (Cement)		Pounds
Water for Annulus (to mix cement)		Gallons
Sand Pack Material (Gravel/Sand)		Pounds
Soil Cuttings for Disposal		Pounds
Grout to Abandon Well(s)		Pounds
Water for Grout to Abandon Well(s)		Gallons

Well Construction Material Factors

	Pounds per Foot of Well Length								
Well Diameter	**SCH 40 PVC Casing**	**SCH 80 PVC Casing**	**SCH 40 Steel Casing**	**SCH 80 Steel Casing**	**USER DEFINED Casing**	**Grout for Annulus**	**Grout to Abandon Well**	**Sand for Annulus**	**Drill Cuttings for Disposal**
2-inch	0.69	0.94	3.65	5.02		13	2	19	22
4-inch	2.03	2.82	10.79	14.98		19	6	29	39
6-inch	3.58	5.38	18.97	28.57		25	14	39	61
8-inch	5.39	8.18	28.55	43.39		32	25	48	87
10-inch	7.64	12.1	40.48	64.43		38	40	58	119
12-inch	10.1	16.7	53.52	88.63		45	57	68	155

Source: Most of the information in the above table is from EPA's "Methodology for Understanding and Reducing a Project's Environmental Footprint," February 2012. Additional material weight factors for Schedule 80 PVC, Schedule 40 Steel, and Schedule 80 Steel, are from "Groundwater and Wells, Second Edition", by Johnson Filtration Systems Inc., 1986.

Note on User Defined Casing: *The "User Defined Casing" feature can be used to calculate the amount of material required for a well constructed of a material or size (schedule) other than the four options provided. To use this feature, select "User Defined Casing" in the "Well Casing Material" drop-down menu in the "Well Details" table, then add the appropriate "pounds per foot of well length" factor to the "User Defined Casing" column of the "Well Construction Materials Factors" table, in the row that corresponds to the well diameter. You must find or develop the unique "pounds per foot of well length" factor for the specific material, schedule, and diameter of pipe. The Well Material Calculator will use this factor to calculate Casing Material required and total Screen Material required. Note that if you select a material for the well casing that is not already included in the library of materials in SEFA, you must also develop emissions factors for the material's production and add these values to the "User Defined Factors" tab. (See the "User Defined Factors" tab for specifics.)*

Notes on Calculations:
- Calculation for screened pipe assumes that the weight of screened pipe is equal to weight of casing.
- Calculations for Grout Material, Sand Pack Material, and Soil Cuttings for Disposal assume annulus around casing has a diameter that is 4 inches larger than the casing.
- Grout values are for weight of unmixed cement, assuming 6 gallons of water is mixed with 94 pounds of neat cement with a blended density of 15 pounds per gallon (generally typical of engineering specifications).
- Drill cutting volume does not include drilling mud for mud rotary drilling.

Well Material Calculator - 2

Use this tool to calculate the amount of material required for a well of specified type, depth, and diameter. This page is a calculator only and not linked to the "Input" tabs. The user must manually enter the results from the "Materials Required" table below into the appropriate "Input" tab.

Notes on Well Material Calculations - 2:

Well Details - 2	
Type of Well	
Well Casing Material	
Total Depth of Well in Feet (from ground surface to bottom of well, including screen)	
Screen Length	
Well Casing Diameter in Inches	
Stick-up Height in Feet (if applicable)	
Number of Wells	

Materials Required - 2		
Casing Material		Pounds
Screen Material		Pounds
Grout for Annulus (Cement)		Pounds
Water for Annulus (to mix cement)		Gallons
Sand Pack Material (Gravel/Sand)		Pounds
Soil Cuttings for Disposal		Pounds
Grout to Abandon Well(s)		Pounds
Water for Grout to Abandon Well(s)		Gallons

Well Construction Material Factors

	Pounds per Foot of Well Length								
Well Diameter	**SCH 40 PVC Casing**	**SCH 80 PVC Casing**	**SCH 40 Steel Casing**	**SCH 80 Steel Casing**	**USER DEFINED Casing**	**Grout for Annulus**	**Grout to Abandon Well**	**Sand for Annulus**	**Drill Cuttings for Disposal**
2-inch	0.69	0.94	3.65	5.02		13	2	19	22
4-inch	2.03	2.82	10.79	14.98		19	6	29	39
6-inch	3.58	5.38	18.97	28.57		25	14	39	61
8-inch	5.39	8.18	28.55	43.39		32	25	48	87
10-inch	7.64	12.1	40.48	64.43		38	40	58	119
12-inch	10.1	16.7	53.52	88.63		45	57	68	155

Source: Most of the information in the above table is from EPA's "Methodology for Understanding and Reducing a Project's Environmental Footprint," February 2012. Additional material weight factors for Schedule 80 PVC, Schedule 40 Steel, and Schedule 80 Steel, are from "Groundwater and Wells, Second Edition", by Johnson Filtration Systems Inc., 1986.

Note on User Defined Casing: *The "User Defined Casing" feature can be used to calculate the amount of material required for a well constructed of a material or size (schedule) other than the four options provided. To use this feature, select "User Defined Casing" in the "Well Casing Material" drop-down menu in the "Well Details" table, then add the appropriate "pounds per foot of well length" factor to the "User Defined Casing" column of the "Well Construction Materials Factors" table, in the row that corresponds to the well diameter. You must find or develop the unique "pounds per foot of well length" factor for the specific material, schedule, and diameter of pipe. The Well Material Calculator will use this factor to calculate Casing Material required and total Screen Material required. Note that if you select a material for the well casing that is not already included in the library of materials in SEFA, you must also develop emissions factors for the material's production and add these values to the "User Defined Factors" tab. (See the "User Defined Factors" tab for specifics.)*

Notes on Calculations:
- Calculation for screened pipe assumes that the weight of screened pipe is equal to weight of casing.
- Calculations for Grout Material, Sand Pack Material, and Soil Cuttings for Disposal assume annulus around casing has a diameter that is 4 inches larger than the casing.
- Grout values are for weight of unmixed cement, assuming 6 gallons of water is mixed with 94 pounds of neat cement with a blended density of 15 pounds per gallon (generally typical of engineering specifications).
- Drill cutting volume does not include drilling mud for mud rotary drilling.

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Well Material Calculator - 3

Use this tool to calculate the amount of material required for a well of specified type, depth, and diameter. This page is a calculator only and not linked to the "Input" tabs. The user must manually enter the results from the "Materials Required" table below into the appropriate "Input" tab.

Notes on Well Material Calculations - 3:

Well Details - 3	
Type of Well	
Well Casing Material	
Total Depth of Well in Feet (from ground surface to bottom of well, including screen)	
Screen Length	
Well Casing Diameter in Inches	
Stick-up Height in Feet (if applicable)	
Number of Wells	

Materials Required - 3		
Casing Material		Pounds
Screen Material		Pounds
Grout for Annulus (Cement)		Pounds
Water for Annulus (to mix cement)		Gallons
Sand Pack Material (Gravel/Sand)		Pounds
Soil Cuttings for Disposal		Pounds
Grout to Abandon Well(s)		Pounds
Water for Grout to Abandon Well(s)		Gallons

Well Construction Material Factors

	Pounds per Foot of Well Length								
Well Diameter	**SCH 40 PVC Casing**	**SCH 80 PVC Casing**	**SCH 40 Steel Casing**	**SCH 80 Steel Casing**	**USER DEFINED Casing**	**Grout for Annulus**	**Grout to Abandon Well**	**Sand for Annulus**	**Drill Cuttings for Disposal**
2-inch	0.69	0.94	3.65	5.02		13	2	19	22
4-inch	2.03	2.82	10.79	14.98		19	6	29	39
6-inch	3.58	5.38	18.97	28.57		25	14	39	61
8-inch	5.39	8.18	28.55	43.39		32	25	48	87
10-inch	7.64	12.1	40.48	64.43		38	40	58	119
12-inch	10.1	16.7	53.52	88.63		45	57	68	155

Source: Most of the information in the above table is from EPA's "Methodology for Understanding and Reducing a Project's Environmental Footprint," February 2012. Additional material weight factors for Schedule 80 PVC, Schedule 40 Steel, and Schedule 80 Steel, are from "Groundwater and Wells, Second Edition", by Johnson Filtration Systems Inc., 1986.

Note on User Defined Casing: *The "User Defined Casing" feature can be used to calculate the amount of material required for a well constructed of a material or size (schedule) other than the four options provided. To use this feature, select "User Defined Casing" in the "Well Casing Material" drop-down menu in the "Well Details" table, then add the appropriate "pounds per foot of well length" factor to the "User Defined Casing" column of the "Well Construction Materials Factors" table, in the row that corresponds to the well diameter. You must find or develop the unique "pounds per foot of well length" factor for the specific material, schedule, and diameter of pipe. The Well Material Calculator will use this factor to calculate Casing Material required and total Screen Material required. Note that if you select a material for the well casing that is not already included in the library of materials in SEFA, you must also develop emissions factors for the material's production and add these values to the "User Defined Factors" tab. (See the "User Defined Factors" tab for specifics.)*

Notes on Calculations:
- Calculation for screened pipe assumes that the weight of screened pipe is equal to weight of casing.
- Calculations for Grout Material, Sand Pack Material, and Soil Cuttings for Disposal assume annulus around casing has a diameter that is 4 inches larger than the casing.
- Grout values are for weight of unmixed cement, assuming 6 gallons of water is mixed with 94 pounds of neat cement with a blended density of 15 pounds per gallon (generally typical of engineering specifications).
- Drill cutting volume does not include drilling mud for mud rotary drilling.

Lookup Table *Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019*

The "Lookup" worksheet is for reference only, and is not intended for user input.

Tables 1, 2, and 3 are provided to convert transportation and equipment use into fuel use. Data is obtained from Climate Leaders documents, US Department of Energy[1], and EPA's 2017 Life Cycle Inventory Report[2], and is consistent with the February 2012 EPA footprint methodology. Where fuel efficiencies are provided for biodiesel, B20, or natural gas, the following assumptions are made:

- diesel has a higher heating value of 0.139 MMBtu per gallon
- biodiesel has a higher heating value of 0.127 MMBtu per gallon
- natural gas has a higher heating value of 0.103 MMBtu per hundred cubic feet
- B20 is 20% biodiesel and 80% diesel
- fuel efficiencies scale approximately with higher heating value (e.g., biodiesel fuel efficiency in miles per gallon = 0.127/0.139 x diesel fuel efficiency).

Table 1. Mode of Transport. For Personnel	B20 mpg or pmpg	Biodiesel mpg or pmpg	Diesel mpg or pmpg	Electricity mpkWh	Gasoline mpg	Natural Gas mpccf
Airplane	NO DATA	NO DATA	45	NO DATA	NO DATA	NO DATA
Bus	94	88	96	NO DATA	NO DATA	71
Car	28	26	28.4	2.82	25	21
Heavy-Duty Truck	7.4	6.9	7.55	NO DATA	9.45	5.6
Light-Duty/Passenger Truck	15	14	15.1	NO DATA	18.9	11
Train	NO DATA	NO DATA	59	NO DATA	NO DATA	NO DATA
User Defined Vehicle #1	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #2	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #3	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #4	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #5	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA	ENTER DATA

- Fuel usage for buses, airplanes, and trains are for passenger miles per gallon (pmpg). Airplane/jet fuel calculated as diesel for simplicity and due to similarities between kerosene and diesel.
- Electric car efficiencies are from US Department of Energy [1] and take into account an estimated 96% charger-battery system efficiency, per ENERGY STAR information [3].
- Diesel airplane, bus, and train efficiencies from converting average CO2 emissions in Climate Leaders from Commuting, Business Travel and Product Transport to diesel usage assuming Climate Leaders value of 22.3 lbs of CO2 per gallon of diesel. Diesel and gasoline efficiencies for car and light-duty/passenger truck are from Table 20 of EPA's Life-Cycle Inventory Report [2].
- Gasoline mpg for heavy-duty truck is assumed to be 50% of a light-duty truck to represent a light-duty truck towing a trailer

Table 2. Fuel Type for Equip. Use	Units	Units per HP-hr
B20	gal	0.051
Biodiesel	gal	0.055
Compressed natural gas	ccf	0.0005
Diesel	gal	0.050
Diesel between 75 and 750 hp	gal	0.055
Diesel greater than 750 hp	gal	0.053
Diesel less than 75 hp	gal	0.061
Gasoline	gal	0.0002
Gasoline <25 hp	gal	0.1316
Gasoline >25 hp	gal	0.078
Liquified petroleum gas	gal	0.096

-Brake Specific Fuel Consumption (BSFC) values are consistent with 7,000 Btu/HP-hr (as used by EPA AP-42, Compilation of Air Pollutant Emission Factors, Chapter 3) and fuel higher heating values of 0.127 MMBtu for biodiesel (per February 2012 EPA footprint methodology). Diesel, gasoline, liquified petroleum gas, and compressed natural gas values are are from Table 20 of EPA's Life-Cycle Inventory Report [2]. 'Based on correspodence with ORD (authors of the Life-Cycle Inventory Report), tthe value for "Gasoline < 25 hp" was incorrect in Table 20 of the Report. It should be 7.6 hp-hr/gal and not 0.0002 hp-hr/gal. The entry for "Gasoline < 25 hp" in the table above reflects this correction.

Table 3. Equipment Type and Representative Horsepower
Asphalt paver (150 HP)
Backhoe (100 HP)
Concrete paving machine (200 HP)
Dozer - large (200 HP)
Dozer - small (100 HP)
Drilling - direct push (60 HP)
Drilling - large rig (500 HP)
Drilling - medium rig (150 HP)
Dump truck (400 HP)
Excavator - large (250 HP)
Excavator - medium (175 HP)
Excavator/hoe - small (75 HP)
Generator - HP varies
Grader (175 HP)
Grout pump (20 HP)
Hydroseeder (20 HP)
Integrated tool carrier (100 HP)
Loader (200 HP)
Loader - small (75 HP)
Mobile laboratory (25 HP)
Mowers (5 HP)
Other - HP varies
Riding trencher (55 HP)
Roller (100 HP)
Rotary-screw air compressor - 250 cfm (60 HP)
Skid-steer - small (60 HP)
Telescopic handler (60 HP)
Tractor mower (25 HP)
Water truck (400 HP)

Equipment types are available with various engine sizes. Specific equipment sizes should be used when available. The above "representative sizes" are provided as general guides in the absence of other information

Lookup Table (continued)

Table 4. Materials	Units	Conv. to tons	Default One-Way Distance from Source to Site (miles)*
Aluminum, Rolled Sheet	lb	0.0005	500
Asphalt, mastic	lb	0.0005	25
Asphalt, paving-grade	lb	0.0005	25
Ethanol, Corn, 95%	lb	0.0005	500
Ethanol, Corn, 99.7%	lb	0.0005	500
Ethanol, Petroleum, 99.7%	lb	0.0005	500
Gravel/Sand Mix, 65% Gravel	lb	0.0005	25
Gravel/sand/clay	lb	0.0005	25
HDPE	lb	0.0005	500
Photovoltaic system (installed)	W	0.000125	1000
PVC	lb	0.0005	500
Portland cement, US average	lb	0.0005	25
Ready-mixed concrete, 20 MPa	ft3	0.0375	25
Round Gravel	lb	0.0005	25
Sand	lb	0.0005	25
Stainless steel	lb	0.0005	500
Steel	lb	0.0005	500
Other refined construction materials	lb	0.0005	500
Other unrefined construction materials	lb	0.0005	25
Cheese Whey	lb	0.0005	1000
Emulsified vegetable oil	lb	0.0005	1000
Granular activated carbon, primary	lb	0.0005	500
Granular activated carbon, regenerated	lb	0.0005	500
Hydrogen Peroxide, 50% in H2O	lb	0.0005	500
Iron (II) Sulfate	lb	0.0005	500
Lime, Hydrated, Packed	lb	0.0005	500
Molasses	lb	0.0005	1000
Phosphoric Acid, 70% in H2O	lb	0.0005	500
Potassium Permanganate	lb	0.0005	500
Sodium Hydroxide, 50% in H2O	lb	0.0005	500
Other Treatment Chemicals & Materials	lb	0.0005	500
User-defined material #1	TBD	TBD	500
User-defined material #2	TBD	TBD	500
User-defined material #3	TBD	TBD	500
User-defined material #4	TBD	TBD	500
User-defined material #5	TBD	TBD	500
User-defined material #6	TBD	TBD	500
User-defined material #7	TBD	TBD	500
User-defined material #8	TBD	TBD	500
User-defined material #9	TBD	TBD	500
User-defined material #10	TBD	TBD	500
User-defined material #11	TBD	TBD	500
User-defined material #12	TBD	TBD	500

Table 5. Mode of Transport. For Equipment and Materials (Usage Rate)	B20	Biodiesel	Diesel
Aircraft (gptm)	NO DATA	NO DATA	0.15
Barge (gptm)	0.0048	0.0051	0.0047
Combination Truck (gptm)	0.0157	0.0170	0.0153
Train (gptm)	0.0022	0.0024	0.002
Truck (mpg)	5.9	5.5	6
Truck single unit (gptm)	0.0328	0.035	0.0323
User Defined Vehicle #1	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #2	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #3	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #4	ENTER DATA	ENTER DATA	ENTER DATA
User Defined Vehicle #5	ENTER DATA	ENTER DATA	ENTER DATA

mpg = miles per gallon, gptm = gallons per ton-mile

- Airplane/jet fuel calculated as diesel for simplicity and due to similarities between kerosene and diesel

- Diesel fuel efficiencies for aircraft, barge, and truck (mpg) are obtained by from converting average CO2 emissions reported in Climate Leaders: Commuting, Business Travel and Product Transport (EPA430-R-08-006) to diesel usage assuming Climate Leaders value of 22.3 lbs of CO2 per gallon of diesel. The source for fuel usage rate for combination truck, train, and truck single unit is Table 20 of EPA's Life-Cycle Inventory Report[2].

** Default distance is one-way distance from site to disposal facility that can be used in absence of other information.*

Table 6. Waste Facility	Units	Conv. to tons	Default Distance*
Hazardous waste incineration	lb	0.0005	1000
Off-site waste water treatment (POTW)	gal x 1000	4.17	50
Recycled/reused on-site	tons	1	0
Recycled/reused off-site	tons	1	50
Off-site non-hazardous waste landfill	tons	1	25
Off-site hazardous waste landfill	tons	1	500
User-defined recycled/reused on-site #1	TBD	TBD	0
User-defined recycled/reused on-site #2	TBD	TBD	0
User-defined recycled/reused on-site #3	TBD	TBD	0
User-defined recycled/reused off-site #1	TBD	TBD	50
User-defined recycled/reused off-site #2	TBD	TBD	50
User-defined recycled/reused off-site #3	TBD	TBD	50
User-defined non-hazardous waste destination #1	tons	1	25
User-defined non-hazardous waste destination #2	TBD	TBD	25
User-defined non-hazardous waste destination #3	TBD	TBD	25
User-defined hazardous waste destination #1	tons	1	500
User-defined hazardous waste destination #2	TBD	TBD	500
User-defined hazardous waste destination #3	TBD	TBD	500

Table 7. Water Source	Units	Conv. to tons
Public Water	gal x 1000	4.17
Extracted Groundwater	gal x 1000	4.17
Surface Water	gal x 1000	4.17

Note: The tabs in this workbook are for data compilation only, and are not intended for user input.

Netwon Creek - East Branch FFS

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

Calculations Workbook

Alternative EB-B

	Enter the path name (if not saved in the same directory) and file name of the "Input" workbook for the project.
Path Name:	
Input File Name:	SEFA_input_EB FFS.xlsx

Component	Remedy Component Names
Component 1	Mobilization
Component 2	Shoreline Work (Bulkheads, ISS, etc.)
Component 3	Dredging (incl. Processing and Water Treatment)
Component 4	Backfill, Capping, and Outfall Protection
Component 5	Restoration and Demobilization
Component 6	0

Component names are autofilled from the "Main" workbook.

The following color coding applies to cells in the worksheets in this workbook.

(green)	Green cells indicate notes or instructions
(blue)	Values in blue are obtained from the "Input Summary" tab in the "Input" workbook.
(gray)	Gray cells are not available and/or not applicable for data entry
(orange)	Orange cells are calculated metrics that are forwarded to the "Energy & Air" tabs in the "Main" workbook.

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

U.S. Environmental Protection Agency (EPA), Office of Superfund Remediation and Technology Innovation

Overview of the "Calculations" Workbook

The "Calculations" workbook is used for applying footprint conversion factors for materials and activities entered in the "Input Template" tab in the "Input" workbook. The application of the footprint conversion factors occurs automatically and does not require attention by the user.

However, you must ensure that the "Input File Name" in Row 11 of the "General" tab of the "Calculations" workbook is filled in correctly (that is, to correctly reflect the file name of the "Input" workbook) in order for the SEFA workbooks to exchange data.

Notes Regarding the "Calculations" Workbook

1) The "Calculations" workbook receives information about the cleanup site from the "Input Summary" tab of the "Input" workbook (Columns Q – W). The information is populated automatically into Column C of the "Component 1 - 6" tabs and the "All Components" tab. The footprint conversion factors are automatically applied in Columns D through O.

2) The results of the footprint calculations are transferred automatically to the "Energy & Air" tabs in the "Main" workbook. From there the results are compiled and presented in the "Summary" and "Totals by Scope and Component" tab of the "Main" workbook.

3) The data transfer and calculation portions of the "Component" tabs are locked to prevent alteration by the user.

4) However, you may access the calculations in the "Component" tabs for use in custom-designed summaries, tables, and charts. The custom-designed summaries may be useful for a variety of purposes, including:

(a) On-site NOx, SOx, and PM are reported in aggregate in the "Summary" tab of the "Main" workbook, but may be accessed individually in the "Component" tabs in the "Calculations" workbook.

(b) Unique points of interest may be addressed, such as summing the footprint from all construction materials or all treatment chemicals.

(c) Total fuel and materials usages, or wastes generated, may be obtained from Column C of the "Component" tabs.

5) Additional subtotals are provided at the end of each "Component" tab (beginning at Row 221), for the convenience of the user.

6) The automatic calculations in the "Component" tabs are set to a default formatting and do not imply true significant figures. You may want to adjust calculated values to proper significant figures if you are using these sheets for summary or presentation purposes.

7) Certain sections throughout the "Calculations" tabs are unlocked to allow for notes and supplemental calculations by the user.

Mobilization - On-Site Footprint (Scope 1)

Contributors to Footprints	Units	Usage	Energy Conv. Factor	Energy MMBtus	GHG Conv. Factor	GHG lbs CO2e	NOx Conv. Factor	NOx lbs	SOx Conv. Factor	SOx lbs	PM Conv. Factor	PM lbs	HAPs Conv. Factor	HAPs lbs
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	435.9633	0.139	60.5989	22.21	9682.745	0.1565	68.22826	0.000145	0.063215	0.0145	6.321468	0.00004	0.017439
On-site diesel use 75<hp<750	Gal	6804.396	0.139	945.811	22.24	151329.8	0.101	687.244	0.00013	0.884571	0.009	61.23956	0.00004	0.272176
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**1,006**		**161,013**		**755**		**1**		**68**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**1,006.41**		**161,013**		**755**		**1**		**68**		**0**

Mobilization - Electricity Generation Footprint (Scope 2)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Mobilization - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy Conv. Factor	Energy MMBtus	Greenhouse Gas Conv. Factor	Greenhouse Gas lbs CO2e	NOx Conv. Factor	NOx lbs	SOx Conv. Factor	SOx lbs	PM Conv. Factor	PM lbs	HAPs Conv. Factor	HAPs lbs
Conventional Energy														
Transportation diesel use	gal	134255.8	0.139	18661.56	22.5	3020756	0.17	22823.49	0.0054	724.9813	0.0034	456.4697	5.2E-06	0.69813
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	1532	0.124	189.968	19.77	30287.64	0.027	41.364	0.00036	0.55152	0.003	4.596	0.0067	10.2644
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**18,852**		**3,051,043**		**22,865**		**726**		**461**		**11**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**18852**		**3051043**		**22865**		**726**		**461**		**11**

Mobilization - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.004038	0	0.005133	0	0.001443	0	0.000163	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Mobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	141496.2	0.017	2405.435	3.02	427318.4	0.0051	721.6304	0.0062	877.2762	0.0017	240.5435	0.0011	155.6458
Gasoline produced	gal	1532	0.033	50.556	2.8	4289.6	0.0046	7.0472	0.005	7.66	0.0015	2.298	0.001	1.532
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**2455.991**		**431608**		**728.6776**		**884.9362**		**242.8415**		**157.1778**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Mobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Notes:														

Mobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**2455.991**		**431608**		**728.6776**		**884.9362**		**242.8415**		**157.1778**

Mobilization - Intermediate Totals

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	1532	0.124	189.968	19.77	30287.64	0.027	41.364	0.00036	0.55152	0.003	4.596	0.0067	10.2644
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	1532	0.033	50.556	2.8	4289.6	0.0046	7.0472	0.005	7.66	0.0015	2.298	0.001	1.532
Total Gasoline Footprint		**1532**		**240.524**		**34577.24**		**48.4112**		**8.21152**		**6.894**		**11.7964**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	435.9633	0.139	60.5989	22.21	9682.745	0.1565	68.22826	0.000145	0.063215	0.0145	6.321468	0.00004	0.017439
On-site diesel use 75<hp<750	gal	6804.396	0.139	945.811	22.24	151329.8	0.101	687.244	0.00013	0.884571	0.009	61.23956	0.00004	0.272176
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	134255.8	0.139	18661.56	22.5	3020756	0.17	22823.49	0.0054	724.9813	0.0034	456.4697	5.2E-06	0.69813
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	141496.2	0.017	2405.435	3.02	427318.4	0.0051	721.6304	0.0062	877.2762	0.0017	240.5435	0.0011	155.6458
Total Diesel Footprint		**141496.2**		**22073.4**		**3609086**		**24300.59**		**1603.205**		**764.5742**		**156.6335**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Shoreline Work (Bulkheads, ISS, etc.) - On-Site Footprint (Scope 1)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	8684.037	0.139	1207.081	22.21	192872.5	0.1565	1359.052	0.000145	1.259185	0.0145	125.9185	0.00004	0.347361
On-site diesel use 75<hp<750	Gal	128254.9	0.139	17827.44	22.24	2852390	0.101	12953.75	0.00013	16.67314	0.009	1154.295	0.00004	5.130198
On-site diesel use >750 hp	Gal	38872.34	0.139	5403.255	22.24	864520.9	0.149	5791.979	0.00013	5.053404	0.006	233.234	0.00004	1.554894
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**24,438**		**3,909,783**		**20,105**		**23**		**1,513**		**7**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**24,437.77**		**3,909,783**		**20,105**		**23**		**1,513**		**7**

Shoreline Work (Bulkheads, ISS, etc.) - Electricity Generation Footprint (Scope 2)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	0	6.929	0	352	0	1.504	0	1.46966	0	0.07546	0	0.045403	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Shoreline Work (Bulkheads, ISS, etc.) - Transportation Footprint (Scope 3a)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	15622.95	0.139	2171.59	22.5	351516.3	0.17	2655.901	0.0054	84.36392	0.0034	53.11802	5.2E-06	0.081239
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	2750	0.124	341	19.77	54367.5	0.027	74.25	0.00036	0.99	0.003	8.25	0.0067	18.425
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**2,513**		**405,884**		**2,730**		**85**		**61**		**19**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**2513**		**405884**		**2730**		**85**		**61**		**19**

Shoreline Work (Bulkheads, ISS, etc.) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	Units	Usage	Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.004038	0	0.005133	0	0.001443	0	0.000163	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Shoreline Work (Bulkheads, ISS, etc.) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	191434.3	0.017	3254.383	3.02	578131.5	0.0051	976.3148	0.0062	1186.892	0.0017	325.4383	0.0011	210.5777
Gasoline produced	gal	2750	0.033	90.75	2.8	7700	0.0046	12.65	0.005	13.75	0.0015	4.125	0.001	2.75
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**3345.133**		**585831.5**		**988.9648**		**1200.642**		**329.5633**		**213.3277**
Notes:														
Public water	gal x 1000	1395.9	0.0092	12.84228	5	6979.5	0.0097	13.54023	0.0059	8.23581	0.016	22.3344	0.000015	0.020939
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Shoreline Work (Bulkheads, ISS, etc.) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	35.2	0	0.1504	0	0.146966	0	0.007546	0	0.00454	0
Notes:														

Shoreline Work (Bulkheads, ISS, etc.) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**3357.975**		**592811**		**1002.505**		**1208.878**		**351.8977**		**213.3486**

Shoreline Work (Bulkheads, ISS, etc.) - Intermediate Totals

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	2750	0.124	341	19.77	54367.5	0.027	74.25	0.00036	0.99	0.003	8.25	0.0067	18.425
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	2750	0.033	90.75	2.8	7700	0.0046	12.65	0.005	13.75	0.0015	4.125	0.001	2.75
Total Gasoline Footprint		**2750**		**431.75**		**62067.5**		**86.9**		**14.74**		**12.375**		**21.175**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	8684.037	0.139	1207.081	22.21	192872.5	0.1565	1359.052	0.000145	1.259185	0.0145	125.9185	0.00004	0.347361
On-site diesel use 75<hp<750	gal	128254.9	0.139	17827.44	22.24	2852390	0.101	12953.75	0.00013	16.67314	0.009	1154.295	0.00004	5.130198
On-site diesel use >750 hp	gal	38872.34	0.139	5403.255	22.24	864520.9	0.149	5791.979	0.00013	5.053404	0.006	233.234	0.00004	1.554894
Transportation diesel use	gal	15622.95	0.139	2171.59	22.5	351516.3	0.17	2655.901	0.0054	84.36392	0.0034	53.11802	5.2E-06	0.081239
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	191434.3	0.017	3254.383	3.02	578131.5	0.0051	976.3148	0.0062	1186.892	0.0017	325.4383	0.0011	210.5777
Total Diesel Footprint		**191434.3**		**29863.75**		**4839431**		**23737**		**1294.242**		**1892.003**		**217.6914**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Notes:														

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Dredging (incl. Processing and Water Treatment) - On-Site Footprint (Scope 1)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	66.732	3.413	227.7563										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	606.3853	0.139	84.28756	22.21	13467.82	0.1565	94.8993	0.000145	0.087926	0.0145	8.792587	0.00004	0.024255
On-site diesel use 75<hp<750	Gal	112346.1	0.139	15616.11	22.24	2498577	0.101	11346.96	0.00013	14.60499	0.009	1011.115	0.00004	4.493844
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**15,928**		**2,512,045**		**11,442**		**15**		**1,020**		**5**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**15,928.15**		**2,512,045**		**11,442**		**15**		**1,020**		**5**

Dredging (incl. Processing and Water Treatment) - Electricity Generation Footprint (Scope 2)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Electricity Generation														
Grid electricity	MWh	66.732	6.929	462.386	352	23489.66	1.504	100.3649	1.46966	98.07335	0.07546	5.035597	0.045403	3.029866
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												

Notes:

Dredging (incl. Processing and Water Treatment) - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Conventional Energy														
Transportation diesel use	gal	26369.96	0.139	3665.425	22.5	593324.1	0.17	4482.893	0.0054	142.3978	0.0034	89.65787	5.2E-06	0.137124
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	3716.8	0.124	460.8832	19.77	73481.14	0.027	100.3536	0.00036	1.338048	0.003	11.1504	0.0067	24.90256
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**4,126**		**666,805**		**4,583**		**144**		**101**		**25**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**4126**		**666805**		**4583**		**144**		**101**		**25**

Dredging (incl. Processing and Water Treatment) - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.004038	0	0.005133	0	0.001443	0	0.000163	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Dredging (incl. Processing and Water Treatment) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	139322.5	0.017	2368.482	3.02	420753.8	0.0051	710.5445	0.0062	863.7992	0.0017	236.8482	0.0011	153.2547
Gasoline produced	gal	3716.8	0.033	122.6544	2.8	10407.04	0.0046	17.09728	0.005	18.584	0.0015	5.5752	0.001	3.7168
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**2491.136**		**431160.9**		**727.6418**		**882.3832**		**242.4234**		**156.9715**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Dredging (incl. Processing and Water Treatment) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	Units	Usage	Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	86752	0.16	13880.32	25	2168800	0.14	12145.28	0.075	6506.4	0.4	34700.8	0.0014	121.4528
Off-site hazardous waste landfill	ton	2283	0.18	410.94	27.5	62782.5	0.154	351.582	0.0825	188.3475	0.44	1004.52	0.00154	3.51582
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	4.00392	3.1	12.22717	180.0	720.7056	0.8	3.083018	0.2	0.600588	0.0	0.072071	NP	
Natural gas extraction and processing	MWh	6.6732	1.6	10.88933	270.0	1801.764	0.2	1.201176	13.0	86.7516	0.0	0.04738	NP	
Nuclear fuel extraction and processing	MWh	1.33464	0.2	0.207499	25.0	33.366	0.2	0.200196	0.5	0.66732	0.0	0.002002	NP	
Oil extraction and processing	MWh	3.3366	2.3	7.658832	270.0	900.882	1.7	5.67222	0.1	0.230225	0.0	0.140137	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**30.98283**		**3456.718**		**10.15661**		**88.24973**		**0.261589**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	66.732	1.0342	69.01423	35.2	2348.966	0.1504	10.03649	0.146966	9.807335	0.007546	0.50356	0.00454	0.302987
Notes:														

Dredging (incl. Processing and Water Treatment) - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**16882.39**		**2668549**		**13244.7**		**7675.188**		**35948.51**		**282.2431**

Dredging (incl. Processing and Water Treatment) - Intermediate Totals

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	Units	Usage	Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	66.732	3.413	227.7563										
Electricity Generation														
Grid electricity	MWh	66.732	6.929	462.386	1124.3	75026.79	2.2421	149.6198	4.607887	307.4935	0.057518	3.838291	0.210237	14.02954
Resource Extraction for Electricity														
Coal extraction and processing	MWh	4.00392	3.1	12.22717	180.0	720.7056	0.8	3.083018	0.2	0.600588	0.0	0.072071	NP	
Natural gas extraction and processing	MWh	6.6732	1.6	10.88933	270.0	1801.764	0.2	1.201176	13.0	86.7516	0.0	0.04738	NP	
Nuclear fuel extraction and processing	MWh	1.33464	0.2	0.207499	25.0	33.366	0.2	0.200196	0.5	0.66732	0.0	0.002002	NP	
Oil extraction and processing	MWh	3.3366	2.3	7.658832	270.0	900.882	1.7	5.67222	0.1	0.230225	0.0	0.140137	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	66.732	1.0342	69.01423	112.43	7502.679	0.22421	14.96198	0.460789	30.74935	0.005752	0.383829	0.021024	1.402954
Total Grid Electricity Footprint				**790**		**85986**		**175**		**426**		**4**		**15**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	3716.8	0.124	460.8832	19.77	73481.14	0.027	100.3536	0.00036	1.338048	0.003	11.1504	0.0067	24.90256
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	3716.8	0.033	122.6544	2.8	10407.04	0.0046	17.09728	0.005	18.584	0.0015	5.5752	0.001	3.7168
Total Gasoline Footprint		**3716.8**		**583.5376**		**83888.18**		**117.4509**		**19.92205**		**16.7256**		**28.61936**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	606.3853	0.139	84.28756	22.21	13467.82	0.1565	94.8993	0.000145	0.087926	0.0145	8.792587	0.00004	0.024255
On-site diesel use 75<hp<750	gal	112346.1	0.139	15616.11	22.24	2498577	0.101	11346.96	0.00013	14.60499	0.009	1011.115	0.00004	4.493844
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	26369.96	0.139	3665.425	22.5	593324.1	0.17	4482.893	0.0054	142.3978	0.0034	89.65787	5.2E-06	0.137124
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	139322.5	0.017	2368.482	3.02	420753.8	0.0051	710.5445	0.0062	863.7992	0.0017	236.8482	0.0011	153.2547
Total Diesel Footprint		**139322.5**		**21734.3**		**3526123**		**16635.29**		**1020.89**		**1346.414**		**157.9099**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Backfill, Capping, and Outfall Protection - On-Site Footprint (Scope 1)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	9481.233	0.139	1317.891	22.21	210578.2	0.1565	1483.813	0.000145	1.374779	0.0145	137.4779	0.00004	0.379249
On-site diesel use 75<hp<750	Gal	214683.5	0.139	29841	22.24	4774560	0.101	21683.03	0.00013	27.90885	0.009	1932.151	0.00004	8.587339
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**31,159**		**4,985,139**		**23,167**		**29**		**2,070**		**9**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**31,158.89**		**4,985,139**		**23,167**		**29**		**2,070**		**9**

Backfill, Capping, and Outfall Protection - Electricity Generation Footprint (Scope 2)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Electricity Generation														
Grid electricity	MWh	0	6.929	0	352	0	1.504	0	1.46966	0	0.07546	0	0.045403	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Backfill, Capping, and Outfall Protection - Transportation Footprint (Scope 3a)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Conventional Energy														
Transportation diesel use	gal	67057.05	0.139	9320.93	22.5	1508784	0.17	11399.7	0.0054	362.1081	0.0034	227.994	5.2E-06	0.348697
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	2374.4	0.124	294.4256	19.77	46941.89	0.027	64.1088	0.00036	0.854784	0.003	7.1232	0.0067	15.90848
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**9,615**		**1,555,725**		**11,464**		**363**		**235**		**16**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	npg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**9615**		**1555725**		**11464**		**363**		**235**		**16**

Backfill, Capping, and Outfall Protection - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	1.21E+08	2.48E-05	2993.707	0.0024	289713.6	0.000018	2172.852	4.52E-06	545.6273	2.61E-06	315.0635	3.08E-07	37.17991
Sand	lb	1.28E+08	2.48E-05	3184.667	0.0024	308193.6	0.000018	2311.452	4.52E-06	580.4313	2.61E-06	335.1605	3.08E-07	39.55151
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	1016000	0.01885	19151.6	2.115	2148840	0.004038	4102.1	0.005133	5214.62	0.001443	1465.834	0.000163	165.1254
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Backfill, Capping, and Outfall Protection - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	Units	Usage	Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	818000	0.0356	29120.8	4.82	3942760	0.0793	64867.4	0.128	104704	0.000987	807.366	0.000657	537.426
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	291221.8	0.017	4950.77	3.02	879489.7	0.0051	1485.231	0.0062	1805.575	0.0017	495.077	0.0011	320.3439
Gasoline produced	gal	2374.4	0.033	78.3552	2.8	6648.32	0.0046	10.92224	0.005	11.872	0.0015	3.5616	0.001	2.3744
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**5029.125**		**886138**		**1496.153**		**1817.447**		**498.6386**		**322.7183**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Backfill, Capping, and Outfall Protection - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	35.2	0	0.1504	0	0.146966	0	0.007546	0	0.00454	0
Notes:														

Backfill, Capping, and Outfall Protection - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**59479.9**		**7575645**		**74949.96**		**112862.1**		**3422.063**		**1102.001**

Backfill, Capping, and Outfall Protection - Intermediate Totals

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	2374.4	0.124	294.4256	19.77	46941.89	0.027	64.1088	0.00036	0.854784	0.003	7.1232	0.0067	15.90848
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	2374.4	0.033	78.3552	2.8	6648.32	0.0046	10.92224	0.005	11.872	0.0015	3.5616	0.001	2.3744
Total Gasoline Footprint		**2374.4**		**372.7808**		**53590.21**		**75.03104**		**12.72678**		**10.6848**		**18.28288**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	9481.233	0.139	1317.891	22.21	210578.2	0.1565	1483.813	0.000145	1.374779	0.0145	137.4779	0.00004	0.379249
On-site diesel use 75<hp<750	gal	214683.5	0.139	29841	22.24	4774560	0.101	21683.03	0.00013	27.90885	0.009	1932.151	0.00004	8.587339
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	67057.05	0.139	9320.93	22.5	1508784	0.17	11399.7	0.0054	362.1081	0.0034	227.994	5.2E-06	0.348697
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	291221.8	0.017	4950.77	3.02	879489.7	0.0051	1485.231	0.0062	1805.575	0.0017	495.077	0.0011	320.3439
Total Diesel Footprint		**291221.8**		**45430.59**		**7373412**		**36051.77**		**2196.967**		**2792.7**		**329.6592**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Restoration and Demobilization - On-Site Footprint (Scope 1)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	1287.692	0.139	178.9892	22.24	28638.28	0.101	130.0569	0.00013	0.1674	0.009	11.58923	0.00004	0.051508
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**179**		**28,638**		**130**		**0**		**12**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**178.99**		**28,638**		**130**		**0**		**12**		**0**

Restoration and Demobilization - Electricity Generation Footprint (Scope 2)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Electricity Generation														
Grid electricity	MWh	0	6.929	0	352	0	1.504	0	1.46966	0	0.07546	0	0.045403	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

Restoration and Demobilization - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Conventional Energy														
Transportation diesel use	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	186	0.124	23.064	19.77	3677.22	0.027	5.022	0.00036	0.06696	0.003	0.558	0.0067	1.2462
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**23**		**3,677**		**5**		**0**		**1**		**1**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**23**		**3677**		**5**		**0**		**1**		**1**

Restoration and Demobilization - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.004038	0	0.005133	0	0.001443	0	0.000163	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

Restoration and Demobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	1287.692	0.017	21.89077	3.02	3888.831	0.0051	6.567231	0.0062	7.983692	0.0017	2.189077	0.0011	1.416462
Gasoline produced	gal	186	0.033	6.138	2.8	520.8	0.0046	0.8556	0.005	0.93	0.0015	0.279	0.001	0.186
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**28.02877**		**4409.631**		**7.422831**		**8.913692**		**2.468077**		**1.602462**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

Restoration and Demobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	35.2	0	0.1504	0	0.146966	0	0.007546	0	0.00454	0
Notes:														

Restoration and Demobilization - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**28.02877**		**4409.631**		**7.422831**		**8.913692**		**2.468077**		**1.602462**

Restoration and Demobilization - Intermediate Totals

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	186	0.124	23.064	19.77	3677.22	0.027	5.022	0.00036	0.06696	0.003	0.558	0.0067	1.2462
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	186	0.033	6.138	2.8	520.8	0.0046	0.8556	0.005	0.93	0.0015	0.279	0.001	0.186
Total Gasoline Footprint		**186**		**29.202**		**4198.02**		**5.8776**		**0.99696**		**0.837**		**1.4322**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	1287.692	0.139	178.9892	22.24	28638.28	0.101	130.0569	0.00013	0.1674	0.009	11.58923	0.00004	0.051508
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	1287.692	0.017	21.89077	3.02	3888.831	0.0051	6.567231	0.0062	7.983692	0.0017	2.189077	0.0011	1.416462
Total Diesel Footprint		**1287.692**		**200.88**		**32527.11**		**136.6242**		**8.151092**		**13.77831**		**1.467969**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**

Notes:

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

0 - On-Site Footprint (Scope 1)

			Energy		GHG		NOx		SOx		PM		HAPs	
Contributors to Footprints	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	0	3.413	0										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	Gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	Gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**0.00**		**0**		**0**		**0**		**0**		**0**

0 - Electricity Generation Footprint (Scope 2)

Contributors to Footprints	Units	Usage	Energy Conv. Factor	Energy MMBtus	GHG Conv. Factor	GHG lbs CO2e	NOx Conv. Factor	NOx lbs	SOx Conv. Factor	SOx lbs	PM Conv. Factor	PM lbs	HAPs Conv. Factor	HAPs lbs
Electricity Generation														
Grid electricity	MWh	0	6.929	0	352	0	1.504	0	1.46966	0	0.07546	0	0.045403	0
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												

Notes:

0 - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Conventional Energy														
Transportation diesel use	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0	0.124	0	19.77	0	0.027	0	0.00036	0	0.003	0	0.0067	0
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**0**		**0**		**0**		**0**		**0**		**0**

0 - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Sand	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	0	0.01885	0	2.115	0	0.004038	0	0.005133	0	0.001443	0	0.000163	0
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

0 - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	**Units**	**Usage**	**Conv. Factor**	**MMBtus**	**Conv. Factor**	**lbs CO2e**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**	**Conv. Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	0	0.0356	0	4.82	0	0.0793	0	0.128	0	0.000987	0	0.000657	0
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	0	0.017	0	3.02	0	0.0051	0	0.0062	0	0.0017	0	0.0011	0
Gasoline produced	gal	0	0.033	0	2.8	0	0.0046	0	0.005	0	0.0015	0	0.001	0
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Public water	gal x 1000	0	0.0092	0	5	0	0.0097	0	0.0059	0	0.016	0	0.000015	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

0 - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
Category	Units	Usage	Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	0	0.16	0	25	0	0.14	0	0.075	0	0.4	0	0.0014	0
Off-site hazardous waste landfill	ton	0	0.18	0	27.5	0	0.154	0	0.0825	0	0.44	0	0.00154	0
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	35.2	0	0.1504	0	0.146966	0	0.007546	0	0.00454	0
Notes:														

0 - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**0**		**0**		**0**		**0**		**0**		**0**

0 - Intermediate Totals

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Total Grid Electricity Footprint														
On-site grid electricity	MWh	0	3.413	0										
Electricity Generation														
Grid electricity	MWh	0	6.929	0	1124.3	0	2.2421	0	4.607887	0	0.057518	0	0.210237	0
Resource Extraction for Electricity														
Coal extraction and processing	MWh	0	3.1	0	180.0	0	0.8	0	0.2	0	0.0	0	NP	
Natural gas extraction and processing	MWh	0	1.6	0	270.0	0	0.2	0	13.0	0	0.0	0	NP	
Nuclear fuel extraction and processing	MWh	0	0.2	0	25.0	0	0.2	0	0.5	0	0.0	0	NP	
Oil extraction and processing	MWh	0	2.3	0	270.0	0	1.7	0	0.1	0	0.0	0	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	0	1.0342	0	112.43	0	0.22421	0	0.460789	0	0.005752	0	0.021024	0
Total Grid Electricity Footprint				**0**		**0**		**0**		**0**		**0**		**0**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	0	0.124	0	19.77	0	0.027	0	0.00036	0	0.003	0	0.0067	0
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	0	0.033	0	2.8	0	0.0046	0	0.005	0	0.0015	0	0.001	0
Total Gasoline Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	0	0.139	0	22.21	0	0.1565	0	0.000145	0	0.0145	0	0.00004	0
On-site diesel use 75<hp<750	gal	0	0.139	0	22.24	0	0.101	0	0.00013	0	0.009	0	0.00004	0
On-site diesel use >750 hp	gal	0	0.139	0	22.24	0	0.149	0	0.00013	0	0.006	0	0.00004	0
Transportation diesel use	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	0	0.017	0	3.02	0	0.0051	0	0.0062	0	0.0017	0	0.0011	0
Total Diesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Notes:														

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

All Components - On-Site Footprint (Scope 1)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
On-Site														
On-site Renewable Energy														
Renewable electricity generated on-site	MWh	0	3.413	0										
Landfill gas combusted on-site for energy use	ccf CH4	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined on-site renewable energy use #1	gal	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
On-site Conventional Energy														
On-site grid electricity	MWh	66.732	3.413	227.7563										
On-site diesel use - Other	Gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	Gal	19207.62	0.139	2669.859	22.21	426601.2	0.1565	3005.992	0.000145	2.785105	0.0145	278.5105	0.00004	0.768305
On-site diesel use 75<hp<750	Gal	463376.6	0.139	64409.35	22.24	10305496	0.101	46801.04	0.00013	60.23896	0.009	4170.39	0.00004	18.53506
On-site diesel use >750 hp	Gal	38872.34	0.139	5403.255	22.24	864520.9	0.149	5791.979	0.00013	5.053404	0.006	233.234	0.00004	1.554894
On-site gasoline use - Other	Gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	Gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	Gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
On-site compressed natural gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed natural gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site liquified petroleum gas use - Other	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	gal	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Conventional Energy Subtotals				**72,710**		**########**		**55,599**		**68**		**4,682**		**21**
Notes:														
Other On-site Emissions														
On-site HAP process emissions	lbs	0											1	0
On-site GHG emissions	lbs CO2e	0			1	0								
On-site carbon storage	lbs CO2e	0			1	0								
GHG avoided by flaring on-site landfill methane	Lbs	0			-262	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Other on-site NOx emissions or reductions	lbs	0					1	0						
Other on-site SOx emissions or reductions	lbs	0							1	0				
Other on-site PM emissions or reductions	lbs	0									1	0		
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
On-site Totals				**72,710.22**		**########**		**55,599**		**68**		**4,682**		**21**

All Components - Electricity Generation Footprint (Scope 2)

Contributors to Footprints	Units	Usage	Energy		GHG		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Electricity Generation														
Grid electricity	MWh	66.732	6.929	462.386	N/A*	23489.66	N/A*	100.3649	N/A*	98.07335	N/A*	5.035597	N/A*	3.029866
**** Conversion factors are not applied to grid electricity in the "All Components" tab since multiple fuel mixes may be used. The value for each cell shaded yellow in Row 51 is the sum of values from Components 1 - 6.***														
Voluntary purchase of renewable electricity	MWh	0												
Voluntary purchase of RECs	MWh	0												
Notes:														

All Components - Transportation Footprint (Scope 3a)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Conventional Energy														
Transportation diesel use	gal	243305.8	0.139	33819.5	22.5	5474380	0.17	41361.98	0.0054	1313.851	0.0034	827.2396	5.2E-06	1.26519
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	10559.2	0.124	1309.341	19.77	208755.4	0.027	285.0984	0.00036	3.801312	0.003	31.6776	0.0067	70.74664
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
User-defined conventional energy transportation #1	TBD	10	0	0	0	0	0	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Conventional Energy Subtotals				**35,129**		**5,683,135**		**41,647**		**1,318**		**859**		**72**
Notes:														
Renewable Energy														
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
User-defined renewable energy transportation #1	TBD	0	Biodiesel		0	0	0	0	0	0	0	0	Ref.	
User-defined renewable energy transportation #2	TBD	0	mpg or pmp		0	0	0	0	0	0	0	0	0	0
Renewable Energy Subtotals				**0**		**0**		**0**		**0**		**0**		**0**
Notes:														
Transportation Totals				**35129**		**5683135**		**41647**		**1318**		**859**		**72**

All Components - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Construction Materials														
Aluminum, Rolled Sheet	lb	0	0.0633	0	9.15	0	0.0148	0	0.0283	0	0.0088	0	0.00102	0
Asphalt, mastic	lb	0	0.0412	0	0.85	0	0.00271	0	0.00798	0	0.000766	0	0.00107	0
Asphalt, paving-grade	lb	0	0.5	0	8.58	0	0.0299	0	0.0969	0	0.0091	0	0.0133	0
Ethanol, Corn, 95%	lb	0	0.0318	0	-0.0199	0	0.00425	0	0.00303	0	0.000469	0	8.46E-05	0
Ethanol, Corn, 99.7%	lb	0	0.0324	0	0.0591	0	0.00431	0	0.0031	0	0.000472	0	0.000087	0
Ethanol, Petroleum, 99.7%	lb	0	0.0205	0	1.25	0	0.00199	0	0.00214	0	0.000277	0	5.89E-05	0
Gravel/Sand Mix, 65% Gravel	lb	0	2.48E-05	0	0.0024	0	0.000018	0	4.52E-06	0	2.61E-06	0	3.08E-07	0
Gravel/sand/clay	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0
HDPE	lb	0	0.0332	0	1.94	0	0.00325	0	0.00409	0	0.000439	0	6.41E-05	0
Photovoltaic system (installed)	W	0	0.0336	0	4.47	0	0.015	0	0.032	0	0.00063	0	2.9E-06	0
PVC	lb	0	0.0262	0	2.02	0	0.004	0	0.00274	0	0.000372	0	0.000375	0
Portland cement, US average	lb	0	0.0139	0	1.34	0	0.00654	0	0.0104	0	0.00378	0	0.00097	0
Ready-mixed concrete, 20 MPa	ft3	0	0.217	0	19.5	0	0.0975	0	0.154	0	0.057	0	0.0141	0
Round Gravel	lb	1.21E+08	2.48E-05	2993.707	0.0024	289713.6	0.000018	2172.852	4.52E-06	545.6273	2.61E-06	315.0635	3.08E-07	37.17991
Sand	lb	1.28E+08	2.48E-05	3184.667	0.0024	308193.6	0.000018	2311.452	4.52E-06	580.4313	2.61E-06	335.1605	3.08E-07	39.55151
Stainless Steel	lb	0	0.0116	0	3.4	0	0.0075	0	0.012	0	0.0044	0	0.000144	0
Steel	lb	0	0.0044	0	1.1	0	0.0014	0	0.0017	0	0.00056	0	0.000067	0
Other refined construction materials	lb	1016000	0.01885	19151.6	2.115	2148840	0.004038	4102.1	0.005133	5214.62	0.001443	1465.834	0.000163	165.1254
Other unrefined construction materials	lb	0	0.000028	0	0.00335	0	1.65E-05	0	0.000015	0	0.000002	0	2.05E-10	0

Notes:

All Components - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
Treatment Materials & Chemicals														
Cheese Whey	lbs	0	0.0025	0	0.031	0	0.000062	0	0.000033	0	0.000002	0	NP	
Emulsified vegetable oil	lbs	0	0.0077	0	3.44	0	0.0066	0	0.0019	0	0.000033	0	NP	
Granular activated carbon, primary	lbs	818000	0.0356	29120.8	4.82	3942760	0.0793	64867.4	0.128	104704	0.000987	807.366	0.000657	537.426
Granular activated carbon, regenerated	lbs	0	0.00873	0	1.7	0	0.00733	0	0.0129	0	0.000886	0	0.000671	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0.00979	0	1.19	0	0.00142	0	0.0024	0	0.000308	0	6.29E-05	0
Iron (II) Sulfate	lbs	0	0.00147	0	0.167	0	0.000316	0	0.000589	0	0.000103	0	0.000023	0
Lime, Hydrated, Packed	lbs	0	0.00206	0	0.762	0	0.000513	0	0.000358	0	0.00013	0	6.57E-06	0
Molasses	lbs	0	0.0044	0	0.48	0	0.0011	0	0.00024	0	4.1E-06	0	NP	
Phosphoric Acid, 70% in H2O	lbs	0	0.0067	0	0.882	0	0.00282	0	0.0294	0	0.00171	0	0.000163	0
Potassium Permanganate	lbs	0	0.00981	0	1.16	0	0.00234	0	0.0032	0	0.000422	0	0.000122	0
Sodium Hydroxide, 50% in H2O	lbs	0	0.00977	0	1.09	0	0.00194	0	0.00352	0	0.000403	0	0.000129	0
Other Treatment Chemicals & Materials	lbs	0	0.015	0	1.67	0	0.003	0	0.0065	0	0.00061	0	0.000016	0
Notes:														
Fuel Processing														
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Diesel produced	gal	764762.3	0.017	13000.96	3.02	2309582	0.0051	3900.288	0.0062	4741.526	0.0017	1300.096	0.0011	841.2386
Gasoline produced	gal	10559.2	0.033	348.4536	2.8	29565.76	0.0046	48.57232	0.005	52.796	0.0015	15.8388	0.001	10.5592
Liquefied Petroleum Gas Produced	gal	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Natural Gas - Compressed Produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Natural Gas Produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Fuel Processing Subtotals				**13349.41**		**2339148**		**3948.86**		**4794.322**		**1315.935**		**851.7978**
Notes:														
Public water	gal x 1000	1395.9	0.0092	12.84228	5	6979.5	0.0097	13.54023	0.0059	8.23581	0.016	22.3344	0.000015	0.020939
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														

All Components - Off-Site Footprint (Scope 3b)

Category	Units	Usage	Energy Conv. Factor	Energy MMBtus	Greenhouse Gas Conv. Factor	Greenhouse Gas lbs CO2e	NOx Conv. Factor	NOx lbs	SOx Conv. Factor	SOx lbs	PM Conv. Factor	PM lbs	HAPs Conv. Factor	HAPs lbs
Off-Site Services														
Hazardous waste incineration	lb	0	0.00609	0	2.43	0	0.0016	0	0.00167	0	0.000209	0	0.000087	0
Off-site waste water treatment (POTW)	gal x 1000	0	0.015	0	4.4	0	0.016	0	0.015	0	NP		NP	
Off-site non-hazardous waste landfill	ton	86752	0.16	13880.32	25	2168800	0.14	12145.28	0.075	6506.4	0.4	34700.8	0.0014	121.4528
Off-site hazardous waste landfill	ton	2283	0.18	410.94	27.5	62782.5	0.154	351.582	0.0825	188.3475	0.44	1004.52	0.00154	3.51582
Off-site Laboratory Analysis - Other	sample	0	0.058071	0	6.853438	0	0.131402	0	0.303876	0	0.04557	0	0.033017	0
Off-site Laboratory Analysis - Metals	sample	0	0.212	0	27.4693	0	0.6423	0	1.5072	0	0.2264	0	0.1643	0
Off-site Laboratory Analysis - Mercury	sample	0	0.073171	0	9.325458	0	0.212744	0	0.49824	0	0.074736	0	0.054233	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0.007402	0	0.645948	0	0.006768	0	0.014793	0	0.002202	0	0.001554	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0.01744	0	1.338192	0	0.007011	0	0.01325	0	0.00194	0	0.001283	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0.023885	0	1.871705	0	0.007981	0	0.014154	0	0.002055	0	0.001287	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0.033648	0	4.29897	0	0.095459	0	0.222665	0	0.03351	0	0.024251	0
Off-site Laboratory Analysis - Sulfate	sample	0	0.014122	0	1.472673	0	0.007981	0	0.013602	0	0.00198	0	0.001202	0
Off-site Laboratory Analysis - PCBs	sample	0	0.051277	0	5.224902	0	0.083334	0	0.190477	0	0.028439	0	0.021208	0
Off-site Laboratory Analysis - VOCs	sample	0	0.076204	0	9.016814	0	0.104498	0	0.227074	0	0.033951	0	0.023589	0
Off-site Laboratory Analysis - SVOCs	sample	0	0.07156	0	7.870422	0	0.145945	0	0.337304	0	0.050485	0	0.037258	0
Notes:														
Resource Extraction for Electricity														
Coal extraction and processing	MWh	4.00392	3.1	12.22717	180.0	720.7056	0.8	3.083018	0.2	0.600588	0.0	0.072071	NP	
Natural gas extraction and processing	MWh	6.6732	1.6	10.88933	270.0	1801.764	0.2	1.201176	13.0	86.7516	0.0	0.04738	NP	
Nuclear fuel extraction and processing	MWh	1.33464	0.2	0.207499	25.0	33.366	0.2	0.200196	0.5	0.66732	0.0	0.002002	NP	
Oil extraction and processing	MWh	3.3366	2.3	7.658832	270.0	900.882	1.7	5.67222	0.1	0.230225	0.0	0.140137	NP	
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0	0	0	0	0	0	0
Resource Extraction Subtotals				**30.98283**		**3456.718**		**10.15661**		**88.24973**		**0.261589**		**0**
Notes:														
Electricity Transmission														
Transmission and distribution losses	MWh	66.732	1.0342	69.01423										
Notes:														

All Components - Off-Site Footprint (Scope 3b)

			Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv.		Conv.		Conv.		Conv.		Conv.		Conv.	
Category	**Units**	**Usage**	**Factor**	**MMBtus**	**Factor**	**lbs CO2e**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**	**Factor**	**lbs**
User-defined Materials														
User-defined material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
User-defined Waste Destinations														
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	y(MMBtu/u		(lbs CO2e/u		Ox(lbs/unit)		Ox(lbs/unit)		M(lbs/unit)		APs(lbs/unit	
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Notes:														
Off-site Totals				**82204.29**		**11270674**		**89923.22**		**122630.2**		**39967.27**		**1756.07**

All Components - Intermediate Totals

Category	Units	Usage	Energy		Greenhouse Gas		NOx		SOx		PM		HAPs	
			Conv. Factor	MMBtus	Conv. Factor	lbs CO2e	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs	Conv. Factor	lbs
Total Grid Electricity Footprint														
On-site grid electricity	MWh	66.732	3.413	227.7563										
Electricity Generation														
Grid electricity	MWh	66.732	6.929	462.386	1124.3	75026.79	2.2421	149.6198	4.607887	307.4935	0.057518	3.838291	0.210237	14.02954
Resource Extraction for Electricity														
Coal extraction and processing	MWh	4.00392	3.1	12.22717	180.0	720.7056	0.8	3.083018	0.2	0.600588	0.0	0.072071	NP	
Natural gas extraction and processing	MWh	6.6732	1.6	10.88933	270.0	1801.764	0.2	1.201176	13.0	86.7516	0.0	0.04738	NP	
Nuclear fuel extraction and processing	MWh	1.33464	0.2	0.207499	25.0	33.366	0.2	0.200196	0.5	0.66732	0.0	0.002002	NP	
Oil extraction and processing	MWh	3.3366	2.3	7.658832	270.0	900.882	1.7	5.67222	0.1	0.230225	0.0	0.140137	NP	
Other fuel extraction and processing	MWh	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Electricity Transmission														
Transmission and distribution losses	MWh	66.732	1.0342	69.01423	112.43	7502.679	0.22421	14.96198	0.460789	30.74935	0.005752	0.383829	0.021024	1.402954
Total Grid Electricity Footprint				**790**		**85986**		**175**		**426**		**4**		**15**
Total Fuel Footprints														
Total Gasoline Footprint														
On-site gasoline use - Other	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
On-site gasoline use <25 hp	gal	0	0.124	0	17.48	0	0.037	0	0.00025	0	0.165	0	0.00008	0
On-site gasoline use >25 hp	gal	0	0.124	0	19.93	0	0.032	0	0.00029	0	0.002	0	0.00009	0
Transportation gasoline use	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Transportation gasoline use - car	gal	10559.2	0.124	1309.341	19.77	208755.4	0.027	285.0984	0.00036	3.801312	0.003	31.6776	0.0067	70.74664
Transportation gasoline use - passenger truck	gal	0	0.124	0	19.79	0	0.035	0	0.00036	0	0.003	0	0.00661	0
Transportation gasoline use - User Defined	gal	0	0.124	0	19.6	0	0.11	0	0.0045	0	0.00054	0	0.000039	0
Gasoline produced	gal	10559.2	0.033	348.4536	2.8	29565.76	0.0046	48.57232	0.005	52.796	0.0015	15.8388	0.001	10.5592
Total Gasoline Footprint		**10559.2**		**1657.794**		**238321.1**		**333.6707**		**56.59731**		**47.5164**		**81.30584**
Total Diesel Footprint														
On-site diesel use - Other	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
On-site diesel use <75 hp	gal	19207.62	0.139	2669.859	22.21	426601.2	0.1565	3005.992	0.000145	2.785105	0.0145	278.5105	0.00004	0.768305
On-site diesel use 75<hp<750	gal	463376.6	0.139	64409.35	22.24	10305496	0.101	46801.04	0.00013	60.23896	0.009	4170.39	0.00004	18.53506
On-site diesel use >750 hp	gal	38872.34	0.139	5403.255	22.24	864520.9	0.149	5791.979	0.00013	5.053404	0.006	233.234	0.00004	1.554894
Transportation diesel use	gal	243305.8	0.139	33819.5	22.5	5474380	0.17	41361.98	0.0054	1313.851	0.0034	827.2396	5.2E-06	1.26519
Transportation diesel use - car	gal	0	0.139	0	22.57	0	0.015	0	0.0002	0	0.003	0	0.00252	0
Transportation diesel use - passenger truck	gal	0	0.139	0	22.545	0	0.0585	0	0.0002	0	0.007	0	0.002605	0
Transportation diesel use - User Defined	gal	0	0.139	0	22.5	0	0.17	0	0.0054	0	0.0034	0	5.2E-06	0
Diesel produced	gal	764762.3	0.017	13000.96	3.02	2309582	0.0051	3900.288	0.0062	4741.526	0.0017	1300.096	0.0011	841.2386
Total Diesel Footprint		**764762.3**		**119302.9**		**19380580**		**100861.3**		**6123.455**		**6809.47**		**863.362**
Total Biodiesel Footprint														
On-site biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
On-site biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Transportation biodiesel use - User Defined	gal	0	0.127	0	22.3	0	0.2	0	0	0	0.00099	0	NP	
Biodiesel produced	gal	0	0.029	0	-16.8	0	0.018	0	0.033	0	0.00082	0	NP	
Total Biodiesel Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Natural Gas Footprint														
On-site natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Transportation natural gas use - User Defined	ccf	0	0.103	0	13.1	0	0.01	0	6.3E-06	0	0.00076	0	8.4E-06	0
Natural gas produced	ccf	0	0.0052	0	2.2	0	0.0037	0	0.0046	0	0.000072	0	6.1E-06	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Liquified Petroleum Gas Footprint														
On-site liquified petroleum gas use - Other	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
On-site liquified petroleum gas use	ccf	0	NP		12.69	0	0.021	0	0.00013	0	0.001	0	0	0
Liquified petroleum gas produced	ccf	0	0.088	0	1.47	0	0.0016	0	0.0024	0	0.0007	0	0.0003	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Total Compressed Gas Footprint														
On-site compressed gas use - Other	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
On-site compressed gas use	ccf	0	NP		1957.835	0	16.0325	0	0.023045	0	0.2775	0	0	0
Compressed gas produced	ccf	0	19.983	0	343.92	0	0.4732	0	2.1651	0	0.1846	0	0.2895	0
Total Natural Gas Footprint		**0**		**0**		**0**		**0**		**0**		**0**		**0**
Notes:														

Note: Please refer to the "Default Conversions" tab for references for the default conversion factors used on this calculation sheet.

Space below available for notes and calculations:

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

		Default Conversion Factors						
		Parameters Used, Extracted, Emitted, or Generated						
		Energy	**GHG***	**NOx**	**SOx**	**PM**	**HAPs**	**REFERENCE #**
Item or Activity		**Used**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	(Corresponds to list of references below)
	Unit	**MMBtu**	**lbs CO2e**	**lbs**	**lbs**	**lbs**	**lbs**	
Fuel Combustion								
Biodiesel use	gal	0.127	22.3	0.20	0	0.00099	NP	1
Diesel use	gal	0.139	22.5	0.17	0.0054	0.0034	5.2E-06	2
Diesel use - equipment <75 hp	gal	0.139	22.21	0.1565	0.000145	0.0145	4.0E-05	3
Diesel use - equipment >75 hp and <750 hp	gal	0.139	22.24	0.101	0.00013	0.009	4.0E-05	3
Diesel use - equipment >750 hp	gal	0.139	22.24	0.149	0.00013	0.006	4.0E-05	3
Diesel use - passenger car	gal	0.139	22.57	0.015	0.0002	0.003	2.5E-03	3
Diesel use - passenger truck	gal	0.139	22.545	0.0585	0.0002	0.007	2.6E-03	3
Diesel use - transport with combination truck	gal	0.139	22.53	0.122	0.0002	0.011	2.1E-03	3
Diesel use - transport with freight train	gal	0.139	25.26	0.307	0.00634	0.009	4.4E-03	3
Diesel use - transport with single unit truck	gal	0.139	22.52	0.088	0.0002	0.012	2.0E-03	3
Gasoline use	gal	0.124	19.6	0.11	0.0045	0.00054	3.9E-05	4
Gasoline use - equipment <25 hp	gal	0.124	17.48	0.037	0.00025	0.165	8.0E-05	3
Gasoline use - equipment >25 hp	gal	0.124	19.93	0.032	0.00029	0.002	9.0E-05	3
Gasoline use - passenger car	gal	0.124	19.77	0.027	0.00036	0.003	6.7E-03	3
Gasoline use - passenger truck	gal	0.124	19.79	0.035	0.00036	0.003	6.6E-03	3
Liquified petroleum gas use	gal	NP	12.69	0.021	0.00013	0.001	0.0E+00	3
Natural gas use	ccf	0.103	13.1	0.01	0.0000063	0.00076	8.4E-06	5
Natural gas use - compressed	ccf	NP	1957.835	16.0325	0.023045	0.2775	0.0E+00	3
Landfill gas use	ccf CH4	0.103	13.1	0.01	0.0000063	0.00076	8.4E-06	5
Construction Materials								
Aluminum, Rolled Sheet	lb	0.0633	9.15	0.0148	0.0283	0.0088	0.00102	3
Asphalt, mastic	lb	0.0412	0.85	0.0027	0.00798	0.0008	0.00107	3
Asphalt, paving-grade	lb	0.5000	8.58	0.0299	0.0969	0.0091	0.0133	3
Ethanol, Corn, 95%	lb	0.0318	-0.0199	0.00425	0.00303	0.000469	8.46E-05	3
Ethanol, Corn, 99.7%	lb	0.0324	0.0591	0.00431	0.0031	0.000472	8.70E-05	3
Ethanol, Petroleum, 99.7%	lb	0.0205	1.25	0.00199	0.00214	0.000277	5.89E-05	3
Gravel/Sand Mix, 65% Gravel	lb	2.48E-05	0.0024	0.00002	4.52E-06	0.000003	3.08E-07	3
Gravel/sand/clay	lb	0.000028	0.0034	0.000017	0.000015	0.0000020	2.1E-10	6
HDPE	lb	3.32E-02	1.9400	0.003250	0.00409	0.000439	6.4E-05	7
Photovoltaic system (installed)	W	0.034	4.5	0.015	0.032	0.00063	2.9E-06	8
PVC	lb	0.0262	2.02	0.004	0.00274	0.000372	3.8E-04	3
Portland cement, US average	lb	0.0139	1.34	0.00654	0.0104	0.00378	9.7E-04	3
Ready-mixed concrete, 20 MPa	ft^3	0.217	19.5	0.0975	0.154	0.057	0.0141	3
Round Gravel	lb	0.0000248	0.0024	0.000018	4.52E-06	2.61E-06	3.1E-07	3
Sand	lb	0.0000248	0.0024	0.000018	4.52E-06	2.61E-06	3.1E-07	3
Stainless Steel	lb	0.012	3.4	0.0075	0.012	0.0044	1.4E-04	9
Steel	lb	0.0044	1.1	0.0014	0.0017	0.00056	6.7E-05	10
Other refined construction materials	lb	0.019	2.1150	0.0040	0.0051	0.0014	1.6E-04	11
Other unrefined construction materials	lb	0.000028	0.00335	0.000017	0.000015	0.000002	2.05E-10	12
Treatment Materials & Chemicals								
Cheese Whey	lb	0.0025	0.031	0.000062	0.000033	0.000002	NP	13
Emulsified vegetable oil	lb	0.0077	3.44	0.0066	0.0019	0.000033	NP	14
Granular activated carbon, primary	lb	0.0356	4.82	0.0793	0.128	0.000987	0.000657	3
Granular activated carbon, regenerated	lb	0.00873	1.7	0.00733	0.0129	0.000886	0.000671	3
Hydrogen Peroxide, 50% in H2O	lb	0.00979	1.19	0.00142	0.0024	0.000308	6.29E-05	3
Iron (II) Sulfate	lb	0.00147	0.167	0.000316	0.000589	0.000103	2.30E-05	3
Lime, Hydrated, Packed	lb	0.00206	0.762	0.000513	0.000358	0.00013	6.57E-06	3
Molasses	lb	0.0044	0.48	0.0011	0.00024	0.0000041	NP	15
Phosphoric Acid, 70% in H2O	lb	0.0067	0.882	0.00282	0.0294	0.00171	0.000163	3
Potassium Permanganate	lb	0.00981	1.16	0.00234	0.0032	0.000422	0.000122	3
Sodium Hydroxide, 50% in H2O	lb	0.00977	1.09	0.00194	0.00352	0.000403	0.000129	3
Other Treatment Chemicals & Materials*	lb	0.015	1.7	0.003	0.0065	0.00061	1.6E-05	16
Fuel Processing								
Biodiesel Produced	gal	0.029	-16.8	0.018	0.033	0.00082	NP	1
Diesel Produced	gal	0.017	3.02	0.0051	0.0062	0.0017	1.1E-03	17
Gasoline Produced	gal	0.033	2.8	0.0046	0.005	0.0015	1.0E-03	18
Liquefied Petroleum Gas	gal	0.088	1.47	0.0016	0.0024	0.0007	3.0E-04	3
Natural Gas - Compressed Produced	ccf	19.983	343.92	0.4732	2.1651	0.1846	2.9E-01	3
Natural Gas Produced	ccf	0.0052	2.2	0.0037	0.0046	0.000072	6.1E-06	19
Public water	gal x 1000	0.0092	5	0.0097	0.0059	0.016	1.50E-05	20
Off-Site Services								
Hazardous Waste Incineration	lb	0.00609	2.43	0.0016	0.00167	0.000209	0.000087	3
Off-site waste water treatment (POTW)	gal x 1000	0.015	4.4	0.016	0.015	NP	NP	21
Off-site non-hazardous waste landfill	ton	0.16	25	0.14	0.075	0.4	1.40E-03	22
Off-site hazardous waste landfill	ton	0.18	27.5	0.154	0.0825	0.44	1.54E-03	23
Off-site Laboratory Analysis - Other	sample	0.0581	6.8534	0.1314	0.3039	0.0456	0.0330	24
Off-site Laboratory Analysis - Metals	sample	0.2120	27.5	0.6423	1.5072	0.2264	1.64E-01	3
Off-site Laboratory Analysis - Mercury	sample	0.0732	9.3	0.2127	0.4982	0.0747	5.42E-02	3
Off-site Laboratory Analysis - Inorganic Anions	sample	0.0074	0.6	0.0068	0.0148	0.0022	1.55E-03	3
Off-site Laboratory Analysis - Alkalinity	sample	0.0174	1.3	0.0070	0.0132	0.0019	1.28E-03	3
Off-site Laboratory Analysis - Perchlorate	sample	0.0239	1.9	0.0080	0.0142	0.0021	1.29E-03	3
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0.0336	4.3	0.0955	0.2227	0.0335	2.43E-02	3

Off-site Laboratory Analysis - Sulfate	sample	0.0141	1.5	0.0080	0.0136	0.0020	1.20E-03	3
Off-site Laboratory Analysis - PCBs	sample	0.0513	5.2	0.0833	0.1905	0.0284	2.12E-02	3
Off-site Laboratory Analysis - VOCs	sample	0.0762	9.0	0.1045	0.2271	0.0340	2.36E-02	3
Off-site Laboratory Analysis - SVOCs	sample	0.0716	7.9	0.1459	0.3373	0.0505	3.73E-02	3
Resource Extraction for Electricity								
Coal extraction and processing	MWh	3.1	180	0.77	0.15	0.018	NP	25
Natural gas extraction and processing	MWh	1.6	270	0.18	13	0.0071	NP	26
Nuclear fuel extraction and processing	MWh	0.16	25	0.15	0.5	0.0015	NP	27
Oil extraction and processing	MWh	2.3	270	1.7	0.069	0.042	NP	28
Grid renewable electricity	MWh	NP	NP	NP	NP	NP	NP	

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

REFERENCES:

Default Conversion Factors are from EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint, February 2012

1. Life Cycle Inventory of Biodiesel and Petroleum Diesel for Use in an Urban Bus, NREL/SR-580-24089 UC Category 1503, U.S. Department of Agriculture and U.S. Department of Energy, May 1998. The CO2e emissions for "biodiesel produced" are negative because of the uptake of CO2 in the crops used to produce the fuels. This CO2 is emitted during fuel combustion and is reflected in the CO2e emissions for "biodiesel use".

2. Multiple sources

a. Energy and CO2e emissions from Direct Emissions from Mobile Combustion Sources, EPA430-K-08-004, U.S. EPA, May 2008.

b. NOx, SOx, PM, and HAPs from NREL: SS Transport, single unit truck, diesel powered.xls

3. Randall, P., Meyer, D., Ingwersen, W., Vineyard, D., Bergmann, M., Unger, S., and Gonzalez, M., 2016. Life Cycle Inventory (LCI) Data- Treatment Chemicals, Construction Materials, Transportation, On-site Equipment, and Other Processes for Use in Spreadsheets for Environmental Footprint Analysis (SEFA): Revised Addition. U.S. Environmental Protection Agency, Office of Research and Development, Cincinnati, OH. EPA/600/R-16/176a.

4. Multiple sources

a. Energy and CO2e emissions from Direct Emissions from Mobile Combustion Sources, EPA430-K-08-004, U.S. EPA, May 2008.

b. NOx, SOx, PM, and HAPs from NREL: SS Transport, single unit truck, gasoline powered.xls

5. Multiple sources and simplifying assumption that emissions of natural gas reasonably represent combustion of methane component of landfill gas

a. Energy and CO2e emissions for compressed natural gas in heavy vehicles from Direct Emissions from Mobile Combustion Sources, EPA430-K-08-004, U.S. EPA, May 2008.

b. NOx, SOx, PM, and HAPs from NREL: SS Natural gas, combusted in industrial boiler.xls

6. EUROPA – Gravel 2/32

7. EUROPA – Polyethylene high density granulate (PE-HD)

8. Life-Cycle Assessment of the 33 kW Photovoltaic System on the Dana Building at the University of Michigan Thin Film Laminates, Multi-Crystalline Modules, and Balance of System Components Sergio Pacca, Deepak Sivaraman and Gregory A. Keoleian Center for Sustainable Systems, University of Michigan Report No. CSS05-09, June 1, 2006

9. EUROPA – Stainless steel

10. EUROPA – Average of Steel hot rolled section, Steel hot rolled coil, Steel rebar

11. Averages of conversion factors for cement, HDPE, PVC, stainless steel, and steel

12. Same as conversion factors for gravel/sand/clay

13. Offset values for cheese whey obtained from the module for yellow cheese from Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk, Andersen M and Jensen JD (2003). Marginale producenter af udvalgte basislevnedsmidler (in Danish) Udkast d. 5. februar 2003.

14. Values for rapeseed oil from Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk. Landbrugets rådgivningscenter (2000). Tal fra Fodermiddeltabellen, Raport nr. 91. In Danish. Weidema BP (1999). System expansions to handle co-products of renewable materials. Presentation Summaries of the 7th LCA Scenarios Symposium SETAC-Europe, 1999. Pp. 45-48. pdf. Weidema B (2003). Market information in life cycle assessments. Technical report, Danish Environmental Protection Agency (Environmental Project no. 863).

15. Offset values for molasses obtained from the module for sugar from Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk, Sugar Production based on Danisco Sugar Author: Per H. Nielsen July 2003

16. Intended for any common treatment chemical in pure form including chemical oxidants and regenerated granular activated carbon. For chemical solutions, use only the mass of the chemical portion of the solution. Conversion factor is based on average value of conversion factors for the following seven common treatment chemicals as reported by Ecoinvent v2.1 from the Ecoinvent Centre for Life-Cycle Inventories, http://www.ecoinvent.ch/

- Hydrochloric Acid (30 percent) – normalized to pure hydrochloric acid by dividing by database results by 0.3.

- Sodium hydroxide (50 percent) – normalized to pure sodium hydroxide by dividing database results by 0.5.

- Ferric chloride (iron III chloride)

- Potassium permanganate

- Sodium persulfate

- Chlorine gas

- Hydrogen peroxide (50 percent) – normalized to pure hydrogen peroxide by dividing database result by 0.5.

This averaging approach adds an additional layer of uncertainty to the conversion factors provided. For example, the range for energy is approximately 0.007 MMBtu to 0.025 MMBtu. The average (0.015 MMBtu) may overestimate the energy use value for some of the chemicals below by more than 100 percent and underestimate the energy us value for other chemicals by 40 percent. Additionally, some common treatment chemicals (e.g., sulfuric acid and ferrous sulfate) have energy footprints that are substantially outside the presented range and would not be accurately represented by these values. If an additional level of accuracy is preferred, readers of this methodology are encouraged to seek and document well referenced conversion factors as part of footprint analysis submittals

17. EUROPA – diesel at refinery

18. EUROPA – gasoline at refinery

19. EUROPA – natural gas at consumer

20. EUROPA - Drinking water from surface water and drinking water from groundwater

21. Calculated based on Life-Cycle Energy and Emissions for Municipal Water and Wastewater Services: Case-Studies of Treatment Plants in US Malavika Tripathi, Center for Sustainable Systems, University of Michigan Report No. CSS07-06, April 17, 2007

22. EUROPA – Inert waste disposal

23. Values from EUROPA inert waste disposal plus an arbitrary additional 10 percent to account additional practices required of a hazardous waste disposal facility

24. The default conversion factors for "Laboratory Analysis – Other" are averages of the default conversion factors for the 10 other laboratory analyses that are provided.

25. NREL – life cycle of electricity from bituminous coal minus the emissions from combusting coal

26. NREL – life cycle of electricity from natural gas minus the emissions from combusting natural gas

27. NREL – life cycle of electricity from nuclear

28. NREL – life cycle of electricity from residual oil minus the emissions from combusting residua oil

NREL = National Renewable Energy Laboratory, Life Cycle Inventory, provided by the National Renewable Energy Laboratory and operated by Alliance for Sustainable Energy, LLC under contract to the U.S. Department of Energy. www.nrel.gov/lci

EUROPA = European Reference Life Cycle Database (ELCD core database), version II compiled under contract on behalf of the European Commission - DG Joint Research Centre - Institute for Environment and Sustainability with technical and scientific support by JRC-IES from early 2008 to early 2009. (http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm)

Footprint Conversion Factors for Grid Electricity Generation - Component 1

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %
Coal	30.5%	6.929	2.113345	2200	671	6	1.83	15	4.575	0.092	0.02806	0.66	0.2013
Natural Gas	33.9%	6.929	2.348931	1300	440.7	1.1	0.3729	0.0066	0.0022374	0.08	0.02712	0.025	0.008475
Oil	0.7%	6.929	0.048503	1800	12.6	2.2	0.0154	2.8	0.0196	0.13	0.00091	0.066	0.000462
Nuclear	19.8%	6.929	1.371942	0	0	0	0	0	0	0	0	0	0
Biomass	1.7%	6.929	0.117793	0	0	1.4	0.0238	0.65	0.01105	0.084	0.001428	5.30E-06	9.01E-08
Geothermal	0.4%	6.929	0.027716	0	0	0	0	0	0	0	0	0	0
Hydro	6.4%	6.929	0.443456	0	0	0	0	0	0	0	0	0	0
Solar	0.9%	6.929	0.062361	0	0	0	0	0	0	0	0	0	0
Wind	5.6%	6.929	0.388024	0	0	0	0	0	0	0	0	0	0
Other	0.1%	6.929	0.006929	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**1124.3**		**2.2421**		**4.6078874**		**0.057518**		**0.21023709**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Footprint Conversion Factors for Grid Electricity Generation - Component 2

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %
Coal	6.0%	6.929	0.41574	2200	132	6	0.36	15	0.9	0.092	0.00552	0.66	0.0396
Natural Gas	10.0%	6.929	0.6929	1300	130	1.1	0.11	0.0066	0.00066	0.08	0.008	0.025	0.0025
Oil	5.0%	6.929	0.34645	1800	90	2.2	0.11	2.8	0.14	0.13	0.0065	0.066	0.0033
Nuclear	2.0%	6.929	0.13858	0	0	0	0	0	0	0	0	0	0
Biomass	66.0%	6.929	4.57314	0	0	1.4	0.924	0.65	0.429	0.084	0.05544	5.30E-06	3.50E-06
Geothermal	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Hydro	11.0%	6.929	0.76219	0	0	0	0	0	0	0	0	0	0
Solar	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Wind	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Other	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**352**		**1.504**		**1.46966**		**0.07546**		**0.0454035**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Footprint Conversion Factors for Grid Electricity Generation - Component 3

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %
Coal	6.0%	6.929	0.41574	2200	132	6	0.36	15	0.9	0.092	0.00552	0.66	0.0396
Natural Gas	10.0%	6.929	0.6929	1300	130	1.1	0.11	0.0066	0.00066	0.08	0.008	0.025	0.0025
Oil	5.0%	6.929	0.34645	1800	90	2.2	0.11	2.8	0.14	0.13	0.0065	0.066	0.0033
Nuclear	2.0%	6.929	0.13858	0	0	0	0	0	0	0	0	0	0
Biomass	66.0%	6.929	4.57314	0	0	1.4	0.924	0.65	0.429	0.084	0.05544	5.30E-06	3.50E-06
Geothermal	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Hydro	11.0%	6.929	0.76219	0	0	0	0	0	0	0	0	0	0
Solar	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Wind	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Other	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**352**		**1.504**		**1.46966**		**0.07546**		**0.0454035**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Footprint Conversion Factors for Grid Electricity Generation - Component 4

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %	Full Load	Adj. by %
Coal	6.0%	6.929	0.41574	2200	132	6	0.36	15	0.9	0.092	0.00552	0.66	0.0396
Natural Gas	10.0%	6.929	0.6929	1300	130	1.1	0.11	0.0066	0.00066	0.08	0.008	0.025	0.0025
Oil	5.0%	6.929	0.34645	1800	90	2.2	0.11	2.8	0.14	0.13	0.0065	0.066	0.0033
Nuclear	2.0%	6.929	0.13858	0	0	0	0	0	0	0	0	0	0
Biomass	66.0%	6.929	4.57314	0	0	1.4	0.924	0.65	0.429	0.084	0.05544	5.30E-06	3.50E-06
Geothermal	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Hydro	11.0%	6.929	0.76219	0	0	0	0	0	0	0	0	0	0
Solar	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Wind	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Other	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**352**		**1.504**		**1.46966**		**0.07546**		**0.0454035**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Footprint Conversion Factors for Grid Electricity Generation - Component 5

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**
Coal	6.0%	6.929	0.41574	2200	132	6	0.36	15	0.9	0.092	0.00552	0.66	0.0396
Natural Gas	10.0%	6.929	0.6929	1300	130	1.1	0.11	0.0066	0.00066	0.08	0.008	0.025	0.0025
Oil	5.0%	6.929	0.34645	1800	90	2.2	0.11	2.8	0.14	0.13	0.0065	0.066	0.0033
Nuclear	2.0%	6.929	0.13858	0	0	0	0	0	0	0	0	0	0
Biomass	66.0%	6.929	4.57314	0	0	1.4	0.924	0.65	0.429	0.084	0.05544	5.30E-06	3.50E-06
Geothermal	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Hydro	11.0%	6.929	0.76219	0	0	0	0	0	0	0	0	0	0
Solar	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Wind	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Other	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**352**		**1.504**		**1.46966**		**0.07546**		**0.0454035**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Footprint Conversion Factors for Grid Electricity Generation - Component 6

Type	% of Total Used	Energy (MMbtu/MWh)		GHG* (lbs CO2e/MWh)		NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		HAPs (lbs/MWh)	
		Full Load	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**	**Full Load**	**Adj. by %**
Coal	6.0%	6.929	0.41574	2200	132	6	0.36	15	0.9	0.092	0.00552	0.66	0.0396
Natural Gas	10.0%	6.929	0.6929	1300	130	1.1	0.11	0.0066	0.00066	0.08	0.008	0.025	0.0025
Oil	5.0%	6.929	0.34645	1800	90	2.2	0.11	2.8	0.14	0.13	0.0065	0.066	0.0033
Nuclear	2.0%	6.929	0.13858	0	0	0	0	0	0	0	0	0	0
Biomass	66.0%	6.929	4.57314	0	0	1.4	0.924	0.65	0.429	0.084	0.05544	5.30E-06	3.50E-06
Geothermal	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Hydro	11.0%	6.929	0.76219	0	0	0	0	0	0	0	0	0	0
Solar	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Wind	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Other	0.0%	6.929	0	0	0	0	0	0	0	0	0	0	0
Totals	**100%**		**6.929**		**352**		**1.504**		**1.46966**		**0.07546**		**0.0454035**

Note: "Total" cell has "See Note" if the all percentages in the "% of Total Used" column do not add to 100%.

**** Footprint conversion factors for greenhouse gases (CO2e) include consideration of CO2, CH4, and N2O (Nitrous oxide) emissions.***

Note on conversion factors: Full load emission values for GHG, NOx, SOx, PM and HAPs for each fuel type are obtained from www.nrel.gov/lci, as noted in Exhibit 3.17 of EPA's Methodology for Understanding and Reducing a Project's Environmental Footprint, February 2012. Full load conversion factors for Energy are described in Exhibit 3.17 of EPA's Methodology, and in the "Explanation of Elec Conversion Factors" tab in the "Calculations" workbook. Note that some or all of the emission values for nuclear fuel and renewable fuels are assumed in www.nrel.gov/lci to be zero.

Explanation of Energy Conversion Factors for Grid Electricity — **Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019**

This example illustrates how grid electricity use is translated into total energy use by SEFA. There are four components of total energy use in SEFA that result from grid electricity use:

- Scope 1: The on-site use of grid electricity
- Scope 2: The energy used for electricity generation offsite (assumes a 33% efficiency, such that of the total energy used at the power plant, 33% is ultimately used at the site as electricity)
- Scope 3b: Transmission losses: SEFA assumes 10% loss between the power plant and the site, so 10% of the sum of "Scope 1 + Scope 2" is accounted for as "transmission losses"
- Scope 3b: Resource extraction for electricity generation: This depends on the fuel mix identified for the electricity generation on the "grid electricity" tab of the input workbook

SEFA reports total energy used in units of MMBtu. The on-site electricity use is entered in units of MWh. There is a standard conversion that can be applied to convert from MWh to MMBtu:
1 MWh = 3.413 MMBtu
In cases where it appears that SEFA uses different conversions from MWh to MMBtu, it is the result of multiple conversions being performed at the same time such that outputs are calculated directly from on-site MWh used (illustrated in Approach 2 in the example below).

Example: 200 MWh grid electricity used on-site for remedy

Approach 1: Calculate everything based on MWh of the separate on-site and off-site aspects of the grid electricity, then convert directly from MWh to MMBtu using standard conversion (***not what SEFA does***):

Grid Electricity Use (Scope 1):	200	MWh	Assumed basis for example is 200 MWh grid electricity used on-site
Generation Efficiency:	33%		Assumption in Methodology
Total Energy Used for Generation at Plant:	606.1	MWh	This is Scope 1 + Scope 2, and is equal to Scope 1 divided by generation efficiency (not including transmission losses)
Grid Electricity Generation (Scope 2):	406.1	MWh	This is "total energy used for generation at plant" minus "Scope 1", and represents the waste energy at plant resulting from 33% efficiency In SEFA and the Methodology, Scope 2 is referred to as the "generation footprint" or "electricity generation"
Transmission Loss %:	10%		This is 10 percent of the total of Scope 1 + Scope 2
Transmission Loss (Scope 3b):	60.606	MWh	Scope 2 MWh value multiplied by Transmission Loss %
Conversion from MWh of each item to MMBtu:			
1 MWh =	3.413	MMBtu	Standard conversion
Grid Electricity Use (Scope 1) in MMBtu:	682.6	MMBtu	Scope 1 MWh multiplied by standard conversion
Grid Electricity Generation (Scope 2) in MMBtu:	1385.9	MMBtu	Scope 2 MWh multiplied by standard conversion
Transmission Loss (Scope 3b) in MMBtu:	206.8	MMBtu	Transmission Loss MWh multiplied by standard conversion
Resource Extraction (Scope 3b):	varies		Energy for resource extraction of fuels used for electricity generation; depends on grid electricity fuel mix specified by user

Approach 2: Calculate everything based on MWh of on-site electricity use, such that multiple conversions are performed simultaneously (***what SEFA does***):

Grid Electricity Use (Scope 1):	200	MWh	Assumed basis for example is 200 MWh grid electricity used on-site
Conversion Factor from Scope 1 MWh to Scope 1 MMBtu:	3.413		1 MWh = 3.413 MMBtu (standard conversion)
Grid Electricity Use (Scope 1) in MMBtu:	682.6	MMBtu	
Generation Efficiency:	33%		Assumption in Methodology
Conversion Factor from Scope 1 MWh to Scope 2 MMBtu:	6.929		***multiple conversions*** Equals (3.413 / 0.33) - 3.413 where the division converts Scope 1 MWh to total generation MMBtu, and then Scope 1 MMBtu is subtracted off (to avoid duplication of summing)
Grid Electricity Generation (Scope 2) in MMBtu:	1385.9	MMBtu	based on Scope 1 MWh and conversion factor of 6.929 derived above
Transmission Loss %:	10%		This is 10 percent of the total of Scope 1 + Scope 2
Conversion Factor from Scope 1 MWh to Transmission Loss MMBtu:	1.0342		***multiple conversions*** ("Conversion Factor from Scope 1 MWh to Scope 1 MMBtu" + "Conversion Factor from Scope 1 MWh to Scope 2 MMBtu") * (transmission loss %)
Transmission Loss (Scope 3b) in MMBtu:	206.8	MMBtu	based on Scope 1 MWh and conversion factor of 1.0342 derived above
Resource Extraction (Scope 3b):	varies		Energy for resource extraction of fuels used for electricity generation; depends on grid electricity fuel mix specified by user

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019 **Netwon Creek - East Branch FFS - Alternative EB-B**

Transfer of User-Defined Units and Conversion Factors from User-Defined Tab of Energy Input Sheet

User Defined Activity, Material, or Service	Unit	Tons per Unit*	Energy (MMBtu/unit)	GHG (lbs CO2e/unit)	NOx (lbs NOx/unit)	SOx (lbs SOx/unit)	PM (lbs PM/unit)	HAPs (lbs HAPs/unit)
User-defined emissions for biodiesel on-site equipment	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for diesel on-site equipment	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for gasoline on-site equipment	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for compressed natural gas on-site equipment	ccf			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for liquified petroleum gas on-site equipment	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for natural gas on-site equipment	ccf			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for biodiesel transportation	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for diesel transportation	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for gasoline transportation	gal			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined emissions for natural gas transportation	ccf			#N/A	#N/A	#N/A	#N/A	#N/A
User-defined material #1	TBD	TBD	0	0	0	0	0	0
User-defined material #2	TBD	TBD	0	0	0	0	0	0
User-defined material #3	TBD	TBD	0	0	0	0	0	0
User-defined material #4	TBD	TBD	0	0	0	0	0	0
User-defined material #5	TBD	TBD	0	0	0	0	0	0
User-defined material #6	TBD	TBD	0	0	0	0	0	0
User-defined material #7	TBD	TBD	0	0	0	0	0	0
User-defined material #8	TBD	TBD	0	0	0	0	0	0
User-defined material #9	TBD	TBD	0	0	0	0	0	0
User-defined material #10	TBD	TBD	0	0	0	0	0	0
User-defined material #11	TBD	TBD	0	0	0	0	0	0
User-defined material #12	TBD	TBD	0	0	0	0	0	0
User-defined material #13	TBD	TBD	0	0	0	0	0	0
User-defined material #14	TBD	TBD	0	0	0	0	0	0
User-defined material #15	TBD	TBD	0	0	0	0	0	0
User-defined material #16	TBD	TBD	0	0	0	0	0	0
User-defined material #17	TBD	TBD	0	0	0	0	0	0
User-defined material #18	TBD	TBD	0	0	0	0	0	0
User-defined material #19	TBD	TBD	0	0	0	0	0	0
User-defined material #20	TBD	TBD	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Item or Service Used	Unit	Tons per Unit*	Energy (MMBtu/unit)	GHG (lbs	NOx (lbs	SOx (lbs	PM (lbs	HAPs (lbs
User-defined recycled/reused on-site #1	TBD	TBD	0	0	0	0	0	0
User-defined recycled/reused on-site #2	TBD	TBD	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	TBD	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	TBD	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	TBD	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	TBD	0	0	0	0	0	0
User-defined non-hazardous waste destination #1	tons	1	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	TBD	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	TBD	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	1	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	TBD	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	TBD	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Item or Service Used	Unit	Tons per Unit*	Energy (MMBtu/unit)	GHG (lbs	NOx (lbs/unit)	SOx (lbs/unit)	PM (lbs/unit)	HAPs (lbs/unit)
User-defined on-site conventional energy use #1	TBD	0	0	0	0	0	0	0
User-defined on-site conventional energy use #2	TBD	0	0	0	0	0	0	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	0	0	0
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0
User-defined on-site renewable energy use #1	TBD	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019

Transfer of Factors for "Other" Grid Electricity Fuel from Grid Electricity

			Energy (MMBtu/MWh)		GHG (lbs CO2e/MWh)	
Electricity generation with "Other" fuel	MWh		0		0	
Fuel extraction & processing for "Other" fuel	MWh		0		0	

Netwon Creek - East Branch FFS - Alternative EB-B

Tab of Energy Input Sheet

NOx (lbs/MWh)		SOx (lbs/MWh)		PM (lbs/MWh)		Air Toxics (lbs/MWh)
0		0		0		0
0		0		0		0

Spreadsheets for Environmental Footprint Analysis (SEFA) Version 3.0, November 2019 **Netwon Creek - East Branch FFS - Alternative EB-B**

Transfer of Usages from Input Summary Tab of Input File

Item	Units	1	2	3	4	5	6	total
On-Site	0	0	0	0	0	0	0	0
On-site Renewable Energy	0	0	0	0	0	0	0	0
Renewable electricity generated on-site	MWh	0	0	0	0	0	0	0
Landfill gas combusted on-site for energy use	ccf CH4	0	0	0	0	0	0	0
On-site biodiesel use	gal	0	0	0	0	0	0	0
On-site biodiesel use - Other	gal	0	0	0	0	0	0	0
User-defined on-site renewable energy use #1	TBD	0	0	0	0	0	0	0
User-defined on-site renewable energy use #2	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
On-Site Conventional Energy	0	0	0	0	0	0	0	0
Grid electricity	MWh	0	0	66.732	0	0	0	66.732
On-site diesel use - Other	Gal	0	0	0	0	0	0	0
On-site diesel use <75 hp	Gal	435.9633	8684.037	606.3853	9481.233	0	0	19207.62
On-site diesel use 75<hp<750	Gal	6804.3956	128254.9	112346.1	214683.5	1287.692	0	463376.6
On-site diesel use >750 hp	Gal	0	38872.34	0	0	0	0	38872.34
On-site gasoline use - Other	Gal	0	0	0	0	0	0	0
On-site gasoline use <25 hp	Gal	0	0	0	0	0	0	0
On-site gasoline use >25 hp	Gal	0	0	0	0	0	0	0
On-site natural gas use	ccf	0	0	0	0	0	0	0
On-site compressed natural gas use - Other	ccf	0	0	0	0	0	0	0
On-site compressed natural gas use	ccf	0	0	0	0	0	0	0
On-site liquified petroleum gas use - Other	gal	0	0	0	0	0	0	0
On-site liquified petroleum gas use	gal	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #1	TBD	0	0	0	0	0	0	0
Other forms of on-site conventional energy use #2	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Other On-site Emissions	0	0	0	0	0	0	0	0
On-site HAP process emissions	Lbs	0	0	0	0	0	0	0
On-site GHG emissions	Lbs CO2e	0	0	0	0	0	0	0
On-site carbon storage	Lbs CO2e	0	0	0	0	0	0	0
GHG avoided by flaring on-site landfill methane	ccf CH4	0	0	0	0	0	0	0
Other on-site NOx emissions or reductions	Lbs	0	0	0	0	0	0	0
Other on-site SOx emissions or reductions	Lbs	0	0	0	0	0	0	0
Other on-site PM emissions or reductions	Lbs	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0
Grid electricity	MWh	0	0	66.732	0	0	0	66.732

Voluntary purchase of renewable electricity	MWh	0	0	0	0	0	0	0
Voluntary purchase of RECs	MWh	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0
Transportation Fuel Use Breakdown	0	0	0	0	0	0	0	0
Biodiesel use - Personnel Transport	gal	0	0	0	0	0	0	0
Biodiesel use - Personnel Transport - User Defined	gal	0	0	0	0	0	0	0
Biodiesel use - Equipment Transport	gal	0	0	0	0	0	0	0
Biodiesel use - Equipment Transport - User Defined	gal	0	0	0	0	0	0	0
Biodiesel use - Material Transport	gal	0	0	0	0	0	0	0
Biodiesel use - Material Transport - User Defined	gal	0	0	0	0	0	0	0
Biodiesel use - Waste Transport	gal	0	0	0	0	0	0	0
Biodiesel use - Waste Transport - User Defined	gal	0	0	0	0	0	0	0
Diesel use - Personnel Transport - other vehicles	gal	0	0	0	0	0	0	0
Diesel use - Personnel Transport - car	gal	0	0	0	0	0	0	0
Diesel use - Personnel Transport - passenger truck	gal	0	0	0	0	0	0	0
Diesel use - Personnel Transport - User Defined	gal	0	0	0	0	0	0	0
Diesel use - Equipment Transport	gal	134255.8	0	0	0	0	0	134255.8
Diesel use - Equipment Transport - User Defined	gal	0	0	0	0	0	0	0
Diesel use - Material Transport	gal	0	15622.95	10719.86	67057.05	0	0	93399.86
Diesel use - Material Transport - User Defined	gal	0	0	0	0	0	0	0
Diesel use - Waste Transport	gal	0	0	15650.1	0	0	0	15650.1
Diesel use - Waste Transport - User Defined	gal	0	0	0	0	0	0	0
Gasoline use - Personnel Transport - other vehicles	gal	0	0	0	0	0	0	0
Gasoline use - Personnel Transport - car	gal	1532	2750	3716.8	2374.4	186	0	10559.2
Gasoline use - Personnel Transport - passenger truck	gal	0	0	0	0	0	0	0
Gasoline use - Personnel Transport - User Defined	gal	0	0	0	0	0	0	0
Gasoline use - Equipment Transport	gal	0	0	0	0	0	0	0
Gasoline use - Equipment Transport - User Defined	gal	0	0	0	0	0	0	0
Natural Gas use - Personnel Transport	ccf	0	0	0	0	0	0	0
Natural Gas use - Personnel Transport - User Defined	ccf	0	0	0	0	0	0	0
Natural Gas use - Equipment Transport	ccf	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Conventional Energy	0	0	0	0	0	0	0	0
Transportation diesel use	gal	134255.8	15622.95	26369.96	67057.05	0	0	243305.8
Transportation gasoline use	gal	1532	2750	3716.8	2374.4	186	0	10559.2
Transportation natural gas use	ccf	0	0	0	0	0	0	0
User-defined conventional energy transportation #1	TBD	0	0	0	0	10	0	10
User-defined conventional energy transportation #2	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Renewable Energy	0	0	0	0	0	0	0	0
Transportation biodiesel use	gal	0	0	0	0	0	0	0
User-defined renewable energy transportation #1	TBD	0	0	0	0	0	0	0
User-defined renewable energy transportation #2	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Off-Site	0	0	0	0	0	0	0	0
Construction Materials	0	0	0	0	0	0	0	0
Aluminum, Rolled Sheet	lb	0	0	0	0	0	0	0
Asphalt, mastic	lb	0	0	0	0	0	0	0
Asphalt, paving-grade	lb	0	0	0	0	0	0	0
Ethanol, Corn, 95%	lb	0	0	0	0	0	0	0
Ethanol, Corn, 99.7%	lb	0	0	0	0	0	0	0
Ethanol, Petroleum, 99.7%	lb	0	0	0	0	0	0	0
Gravel/Sand Mix, 65% Gravel	lb	0	0	0	0	0	0	0
Gravel/sand/clay	lb	0	0	0	0	0	0	0
HDPE	lb	0	0	0	0	0	0	0
Photovoltaic system (installed)	W	0	0	0	0	0	0	0
PVC	lb	0	0	0	0	0	0	0
Portland cement, US average	lb	0	0	0	0	0	0	0
Ready-mixed concrete, 20 MPa	ft3	0	0	0	0	0	0	0
Round Gravel	lb	0	0	0	1.21E+08	0	0	1.21E+08
Sand	lb	0	0	0	1.28E+08	0	0	1.28E+08
Stainless Steel	lb	0	0	0	0	0	0	0
Steel	lb	0	0	0	0	0	0	0
Other refined construction materials	lb	0	0	0	1016000	0	0	1016000
Other unrefined construction materials	lb	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Treatment Materials & Chemicals	0	0	0	0	0	0	0	0
Cheese Whey	lbs	0	0	0	0	0	0	0
Emulsified vegetable oil	lbs	0	0	0	0	0	0	0
Granular activated carbon, primary	lbs	0	0	0	818000	0	0	818000
Granular activated carbon, regenerated	lbs	0	0	0	0	0	0	0
Hydrogen Peroxide, 50% in H2O	lbs	0	0	0	0	0	0	0
Iron (II) Sulfate	lbs	0	0	0	0	0	0	0
Lime, Hydrated, Packed	lbs	0	0	0	0	0	0	0
Molasses	lbs	0	0	0	0	0	0	0
Phosphoric Acid, 70% in H2O	lbs	0	0	0	0	0	0	0
Potassium Permanganate	lbs	0	0	0	0	0	0	0
Sodium Hydroxide, 50% in H2O	lbs	0	0	0	0	0	0	0
Other Treatment Chemicals & Materials	lbs	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Material Type	0	0	0	0	0	0	0	0
Total Virgin Refined Materials	tons	0	7275.83	4992.393	917	0	0	13185.22
Total Recycled Refined Materials	tons	0	0	0	0	0	0	0
Total Reused Refined Materials	tons	0	0	0	0	0	0	0
Total Refined Material	tons	0	7275.83	4992.393	917	0	0	13185.22
Total Virgin Unrefined Materials	tons	0	0	0	124564	0	0	124564
Total Recycled Unrefined Materials	tons	0	0	0	0	0	0	0
Total Reused Unrefined Materials	tons	0	0	0	0	0	0	0
Total Unrefined Material	tons	0	0	0	124564	0	0	124564
0	0	0	0	0	0	0	0	0

Fuel Processing	0	0	0	0	0	0	0	0
Biodiesel produced	gal	0	0	0	0	0	0	0
Diesel produced	gal	141496.16	191434.3	139322.5	291221.8	1287.692	0	764762.3
Gasoline produced	gal	1532	2750	3716.8	2374.4	186	0	10559.2
Compressed natural gas produced	ccf	0	0	0	0	0	0	0
Liquified petroleum gas produced	gal	0	0	0	0	0	0	0
Natural gas produced	ccf	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Water Use	0	0	0	0	0	0	0	0
Public Water Supply	gal x 1000	0	1395.9	0	0	0	0	1395.9
Extracted Groundwater	gal x 1000	0	0	0	0	0	0	0
Surface Water	gal x 1000	0	0	0	0	0	0	0
Reclaimed Water	gal x 1000	0	0	0	0	0	0	0
Collected/Diverted Storm Water	gal x 1000	0	0	0	0	0	0	0
User-defined water resource #1	gal x 1000	0	0	0	0	0	0	0
User-defined water resource #2	gal x 1000	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Waste/Recycle Handling	0	0	0	0	0	0	0	0
Hazardous waste incineration	lbs	0	0	0	0	0	0	0
Off-site waste water treatment (POTW)	gal x 1000	0	0	0	0	0	0	0
Off-site non-hazardous waste landfill	tons	0	0	86752	0	0	0	86752
Off-site hazardous waste landfill	tons	0	0	2283	0	0	0	2283
Recycled/Reused On-Site	tons	0	0	0	0	0	0	0
Recycled/Reused Off-Site	tons	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Solid Waste Totals	0	0	0	0	0	0	0	0
Total Non-Hazardous Waste	tons	0	0	86752	0	0	0	86752
Total Hazardous Waste	tons	0	0	2283	0	0	0	2283
Total Recycled/Reused	tons	0	0	0	0	0	0	0
Total Waste (all types)	tons	0	0	89035	0	0	0	89035
0	0	0	0	0	0	0	0	0
Lab Services	0	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Other	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Metals	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Mercury	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Inorganic Anions	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Alkalinity	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Perchlorate	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Nitrogen/Nitrate	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - Sulfate	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - PCBs	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - VOCs	sample	0	0	0	0	0	0	0
Off-site Laboratory Analysis - SVOCs	sample	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Resource Extraction for Electricity	0	0	0	0	0	0	0	0

Coal extraction and processing	MWh	0	0	4.00392	0	0	0	4.00392
Natural gas extraction and processing	MWh	0	0	6.6732	0	0	0	6.6732
Nuclear fuel extraction and processing	MWh	0	0	1.33464	0	0	0	1.33464
Oil extraction and processing	MWh	0	0	3.3366	0	0	0	3.3366
Other fuel extraction and processing	MWh	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
Electricity Transmission	0	0	0	0	0	0	0	0
Transmission and distribution losses	MWh	0	0	66.732	0	0	0	66.732
0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0
User-defined material #1	TBD	0	0	0	0	0	0	0
User-defined material #2	TBD	0	0	0	0	0	0	0
User-defined material #3	TBD	0	0	0	0	0	0	0
User-defined material #4	TBD	0	0	0	0	0	0	0
User-defined material #5	TBD	0	0	0	0	0	0	0
User-defined material #6	TBD	0	0	0	0	0	0	0
User-defined material #7	TBD	0	0	0	0	0	0	0
User-defined material #8	TBD	0	0	0	0	0	0	0
User-defined material #9	TBD	0	0	0	0	0	0	0
User-defined material #10	TBD	0	0	0	0	0	0	0
User-defined material #11	TBD	0	0	0	0	0	0	0
User-defined material #12	TBD	0	0	0	0	0	0	0
User-defined material #13	TBD	0	0	0	0	0	0	0
User-defined material #14	TBD	0	0	0	0	0	0	0
User-defined material #15	TBD	0	0	0	0	0	0	0
User-defined material #16	TBD	0	0	0	0	0	0	0
User-defined material #17	TBD	0	0	0	0	0	0	0
User-defined material #18	TBD	0	0	0	0	0	0	0
User-defined material #19	TBD	0	0	0	0	0	0	0
User-defined material #20	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
User-defined Waste Destinations	0	0	0	0	0	0	0	0
User-defined recycled/reused on-site #1	TBD	0	0	0	0	0	0	0
User-defined recycled/reused on-site #2	TBD	0	0	0	0	0	0	0
User-defined recycled/reused on-site #3	TBD	0	0	0	0	0	0	0
User-defined recycled/reused off-site #1	TBD	0	0	0	0	0	0	0
User-defined recycled/reused off-site #2	TBD	0	0	0	0	0	0	0
User-defined recycled/reused off-site #3	TBD	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #1	tons	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #2	TBD	0	0	0	0	0	0	0
User-defined non-hazardous waste destination #3	TBD	0	0	0	0	0	0	0
User-defined hazardous waste destination #1	tons	0	0	0	0	0	0	0
User-defined hazardous waste destination #2	TBD	0	0	0	0	0	0	0
User-defined hazardous waste destination #3	TBD	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

Appendix E
Shoreline/Bulkhead Stability Evaluation

DRAFT FINAL

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Shoreline/Bulkhead Stability Evaluation East Branch Early Action Focused Feasibility Study

Prepared for the Newtown Creek Group

DRAFT FINAL

August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Shoreline/Bulkhead Stability Evaluation East Branch Early Action Focused Feasibility Study

Prepared for
The Newtown Creek Group

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Project Number: E41037-01.01
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FIGURES

ATTACHMENTS

ABBREVIATIONS

°	degree
CPT	cone penetration test
FFS	Focused Feasibility Study
FoS	factor of safety
H:V	horizontal to vertical ratio
ISS	in situ stabilization/solidification
LiDAR	Light Detection and Ranging
MLLW	mean lower low water
NAVD88	North American Vertical Datum of 1988
pcf	pound per cubic foot
psf	pound per square foot
RD	remedial design
RI/FS	Remedial Investigation/Feasibility Study
SPT	standard penetration test
STA	station

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1 Introduction

1.1 Purpose

This appendix presents a summary of the preliminary shoreline/bulkhead stability evaluation performed within East Branch of Newtown Creek (Figure E1-1) as part of the Focused Feasibility Study (FFS) for East Branch. As discussed in the FFS, the remedial alternatives include a no action alternative (Alternative EB-A), as well as five alternatives with active remediation (Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F). Alternative EB-B is the least intrusive alternative, and each subsequent alternative was sequentially modified to increase the scope of the remedy (e.g., increase the areal extent of dredging and/or depths of dredging). The purposes of these analyses were to evaluate the relative risk to shoreline/bulkhead stability for each of the remedial alternatives and to identify suitable stabilization techniques to mitigate risk, as well as to support the cost estimate development described in Appendix F. This appendix provides a summary of the technical analyses completed in support of the shoreline/bulkhead stability evaluation.

1.2 Appendix Organization

This appendix is organized as follows:

- Section 2: Remedial Alternatives
- Section 3: Modeling Overview
- Section 4: Modeling Basis
- Section 5: Results and Interpretation
- Section 6: Recommendations for Future Studies
- Section 7: References

2 Remedial Alternatives

2.1 Summary of Alternatives

As described in Section 1, the identified alternatives include a no action alternative (Alternative EB-A), as well as five alternatives with active remediation (Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F). These alternatives are summarized as follows and described in detail in Section 5 of the FFS:

- Alternative EB-A: No Action
- Alternative EB-B: Dredge to Allow Placement of a Cap at or Below 0 Feet Mean Lower Low Water (MLLW)
- Alternative EB-C: Dredge to Allow Placement of Cap to Maintain Existing Water Depths
- Alternative EB-D: Dredge to Allow Placement of Cap to Maintain Existing Water Depths with Localized Deeper Dredging
- Alternative EB-E: Dredge All Within Navigation Channel, Cap Outside
- Alternative EB-F: Dredge All

2.2 Key Assumptions

Several of the remedial alternatives include dredging followed by capping. To evaluate the most critical condition, stability evaluations assume the temporary condition following dredging but prior to cap placement. Critical surfaces reported in this evaluation are those with the lowest calculated factor of safety (FoS) for any non-surficial or raveling-type failure surface. In addition to surcharge loads, soil stratigraphy and strength properties, slope geometry, and the presence of bulkhead structural elements will all influence the shape and extents of the critical failure surface. As detailed in Appendix C of the FFS, the required cap thickness decreases with increasing water depth due to the anticipated decrease in erosional forces. Accordingly, the following three cap thicknesses, and corresponding pre-cap dredge depths, are defined for capping on sediment and assigned by elevation:

- Deep water: cap thickness = 3 feet
  - Post-remedy mudline elevation < -13.5 feet MLLW
- Shallow water/nearshore: cap thickness = 3.75 feet
  - -13.5 feet MLLW ≤ post-remedy mudline elevation ≤ -4 feet MLLW
- Wake zone: cap thickness = 4.4 feet
  - Post-remedy mudline elevation > -4 feet MLLW

When evaluating Alternatives EB-C and EB-D, the dredge surface was developed by directly shifting the bathymetric surface (as determined from the 2022 survey data) down by the cap thickness as assigned by elevation (as outlined above) rather than being optimized or flattened to reflect a more refined, potential design configuration. In locations where the sediment thickness was less than approximately 5 feet, the full thickness of sediment was assumed to be dredged under Alternative

EB-D; these areas of complete sediment removal down to the native material may be refined as part of the FFS or future remedial design (RD) process.

When evaluating Alternative EB-E, dredging was assumed to be advanced to a depth of 3 feet below the authorized depth of the federal navigation channel or the surface of the native material, whichever depth was lesser. On either side of the navigation channel, the sediment was assumed to be dredged at a 3 horizontal to 1 vertical (3H:1V) slope with a sufficient horizontal offset (assumed to be 10 feet) to the dredge toe so that subsequent cap placement would not impinge on the navigation channel.

3 Modeling Overview

3.1 Approach

To evaluate shoreline/bulkhead stability, a total of 22 cross-sections throughout East Branch were selected to represent the range of shoreline/bulkhead types. At least one cross-section was evaluated within each unique length of shoreline identified within East Branch. The location of each cross-section was selected as the most critical location based on each unique shoreline's/bulkhead's proximity to the navigation channel (i.e., the location where dredging would occur closest to the shoreline/bulkhead), visual condition assessment (i.e., the location where there were visual signs of compromise, degradation, or failure), property ownership, and current upland use (i.e., the location with existing structures and/or large apparent upland surcharge load) (see Figure E3-1).

Global slope stability at all cross-sections was modeled using Slide2 (Rocscience 2023), a 2D limit equilibrium slope stability analysis software used to evaluate soil and rock slopes. Slide2 was used to determine both the existing FoS and post-dredge FoS for each remedial alternative. The FoS is defined as the ratio of the capacity to the demand or, in the case of slope stability evaluations, the ratio of the resisting capacity to the driving force. A FoS of less than 1.0 means that the driving force/demand is greater than the available capacity, which, in terms of slope stability, corresponds to an unstable slope condition. Slide2 assumes a non-deformable soil mass, and, while useful for understanding global stability, it cannot directly estimate strains within or at model boundaries.

Accordingly, six sheet pile bulkhead walls within East Branch were identified among the 22 cross-sections and were evaluated using SupportIT to estimate potential bulkhead deflections induced by the implementation of each remedial alternative. SupportIT is a design and analysis software used to model excavations shored with sheet pile or soldier pile and lagging walls (GTSoft 2020). SupportIT offers Rankine, Coulombe, and Terzaghi model methods and is based on British Steel Piling Handbook and US Steel Sheet Piling Design Manual methodologies. SupportIT was used to complete a preliminary, simplified geostructural analysis of sheet pile bulkhead walls using a series of assumptions regarding bulkhead construction, soil geotechnical properties, and upland loading. Limitations to the assumptions used are discussed in Section 3.4.

Other bulkhead wall types, including timber pile-supported concrete walls and timber pile and lagging walls, were evaluated using Slide2 as described above. Slide2's global stability analysis determined both an existing FoS and a post-dredge FoS for each remedial alternative. These bulkhead types were not structurally evaluated as part of this study because simplified modeling results were found to be highly sensitive to uncertain inputs. These bulkheads will be structurally evaluated during a future RD phase as structural uncertainties are reduced by records research and field investigations.

3.2 Interpretation Framework

For each cross-section evaluated, the relative impact of each remedial alternative was assessed with reference to the following categories:

- Visual condition assessment and site use or constraints
- Preliminary estimates of FoS and relative FoS change between existing and post-dredge conditions
- Preliminary estimates of bulkhead deflection (where applicable for sheet pile walls) and relative deflection change between existing and post-dredge conditions

3.2.1 Visual Condition Assessment

Inspections conducted between 2011 and 2019 by Anchor QEA, LLC, (as part of the Remedial Investigation/Feasibility Study [RI/FS]) and subsequent observations of recent changes have characterized the existing shoreline/bulkheads conditions as being in good, fair, or poor condition. Visual conditions were assessed from a vessel operated along each side of the creek. The visual assessment identified the bulkhead's type along each segment of shoreline and included visual assessments of each bulkhead based on a variety of qualitative categories including structural compromise (i.e., leaning, cracking, slope sloughing, or failure) and quality of material (i.e., degraded wood or riprap versus debris, corrosion, or erosion). Each shoreline/bulkhead was assigned the category of good, fair, or poor condition. The visual condition assessment was performed on a case-by-case basis, and locations were generally characterized as follows:

- "Good": No evidence of shoreline failure/compromise and little to no apparent degradation from as-built conditions
- "Fair": No evidence of shoreline failure, but the shoreline/bulkhead showed signs of degradation, including wear, corrosion, or erosion
- "Poor": Evidence of shoreline failure or significant loss of structural integrity

The results of the visual condition assessment are included in Table E-B-1, located in Attachment E-B. This conditions assessment pertains only to the existing conditions and does not reflect the impact of a remedial action. For the purposes of this evaluation, locations characterized as being in poor condition were considered more vulnerable to changes in FoS or bulkhead deflections associated with a future remedial action than those in good or fair condition. Conversely, those in good condition were considered less vulnerable to changes in FoS or bulkhead deflections than those in fair or poor condition.

3.2.2 *Factor of Safety Estimates*

In view of current uncertainties associated with subsurface stratigraphy and bulkhead structure properties (see Sections 3.4, 4.1.4, 4.2.4, and 4.3.6), the FoS estimates calculated using Slide2 were grouped into three general categories:

- FoS ≤1.1: likely unstable
- 1.1 <FoS ≤1.3: potentially unstable
- FoS >1.3: likely stable

Note that these categories were selected with reference to the interim stability during implementation of the RD. Alternatives that involve post-dredge capping are likely to increase in stability following placement of cap material; however, the interim (post-dredge, pre-cap placement) condition represents the worst-case scenario. Accordingly, a FoS of 1.3 was selected as the basis for differentiating between the potentially unstable and likely stable categories in accordance with typical recommendations for minimum FoS targets for temporary and immediate post-construction conditions (Duncan et al. 2014; USACE 2003). The post-remedy conditions will be evaluated during later design phases with consideration of an appropriate long-term minimum FoS criterion.

In some analyzed cases, the pre-dredge existing conditions were estimated to be likely unstable using the above FoS categories; however, the implementation of a remedial alternative did not result in an appreciable change in the calculated post-dredge FoS (e.g., existing [pre-dredge] FoS of 1.10 and post-dredge FoS of 1.05). Conversely, in other cases, the existing conditions were estimated to be likely stable, but the implementation of a remedial alternative resulted in a significant change in FoS while remaining in the same stability category (e.g., FoS decreasing from 1.75 to 1.35). To capture this sensitivity, relative changes in the post-dredge FoS compared to existing (pre-dredge) conditions were categorized as follows:

- Change in FoS of <5%: minimal impact
- Change in FoS of 5% to 15%: moderate impact
- Change in FoS of >15%: significant impact

3.2.3 *Deflection Estimates*

The SupportIT software provides design parameters for sheet pile walls based on a variety of user inputs including soil lithology and soil properties, groundwater height, sheet pile wall section type, excavation/cantilevered wall height, surcharges, and wall supports. The software calculates water pressure, earth pressure, moment, shear force, deflection, and embedment depth based on the selected method of analysis. For this evaluation, Terzaghi’s earth pressure theory (1943) was used along with the net-pressure analysis method. Multiple sheet pile wall structural sections were evaluated, as well as use of restraining elements (e.g., tieback anchors) to mimic likely design based on currently available information.

The deflections estimated using SupportIT were evaluated on a case-by-case basis with reference to condition, cantilever height, structural connections, and sensitivity to deflections based on site use (e.g., proximate structures or activities). Accordingly, the following categories were established for deflection estimates: likely unacceptable, potentially unacceptable, and likely acceptable. Categories were based on the FoS, proximity to navigation channel, upland site use, and percent change in deflection relative to the cantilevered height of each wall evaluated. A maximum threshold of deflection was not established using SupportIT; instead, because as-built information for most sheet pile walls was unavailable for this analysis, the evaluation was performed to understand sensitivity to dredge depths based on the currently available data. In some cases, modeled deflection estimates were not considered acceptable due to modeling limitations for corroded or damaged sheet pile walls. Generally, a percentage *change* in deflection relative to the cantilevered height of the wall under each proposed alternative were categorized as follows:

- Change in deflection <5%: likely acceptable
- Change in deflection of 5% to 10%: potentially unacceptable
- Change in deflection > 10%: likely unacceptable

3.3 Risk and Cost Development

Three risk categories (Low, Medium, and High) were established to qualitatively reflect the relative risk to shoreline/bulkhead stability for implementation of each remedial alternative. A Low Risk categorization was assigned to shorelines/bulkheads that presented a low likelihood that implementation of the remedial alternative would induce instability or damage. Examples may include a shoreline visually classified as being in good condition with minimal impacts to modeled stability due to implementation of the remedial alternative. A Medium Risk categorization was assigned where it was likely that implementation of the remedial alternative would impair performance of the bulkhead or induce limited slope instability, which would likely need mitigation measures to reduce risk. A High Risk categorization was assigned to shorelines/bulkheads that were in poor condition or showed signs of active failure and/or for which model results predicted high impacts to stability as a result of remedial action implementation.

Risk categories were initially assigned using conditional statements in a spreadsheet for each of the 27 potential combinations of results from the visual condition assessment, the calculated factor of safety, and the calculated change in factor of safety relative to existing conditions. Following this assignment, the relative change in the bulkhead wall deflection (where applicable), the local thickness of sediment, the proximity of existing site structures or sensitive features, and the proximity of the navigation channel were used to inform whether an adjustment to the initially assigned risk category was warranted based on previous experience and best professional judgement.

Stabilization techniques presented in the following subsections were identified for Medium Risk and High Risk categories as preliminary risk mitigation measures based on previous experience and best professional judgement; these techniques were not modeled during this evaluation. These risk categories and preliminarily identified stabilization techniques are described in the following subsections. Unit cost data for each of the stabilization techniques, and the costs associated with each alternative, can be found in Appendix F of the FFS. In general, the greater the risk, the greater the assumed cost and schedule duration, as discussed in Sections 6 and 7 of the FFS.

3.3.1 High Risk

Where this evaluation resulted in a categorization of High Risk, it was assumed that one of the following shoreline/bulkhead stabilization techniques would be used to allow the remedial alternative to be implemented:

- Bulkhead replacement
- New bulkhead installation

Bulkhead replacement would be applicable where there is an existing bulkhead that could be removed or another bulkhead could be installed immediately adjacent to the existing bulkhead. Where there is currently no bulkhead, it was assumed that a new bulkhead would be installed. Both bulkhead replacement and new bulkhead installation would take considerable time for coordination with property owners, design, and installation. The estimated bulkhead replacement cost assumed in Appendix F is higher than a new installation due to likely more restrictive site constraints and the potential need to remove the existing bulkhead.

3.3.2 Medium Risk

Where this evaluation resulted in a categorization of Medium Risk, it was assumed that some shoreline/bulkhead stabilization technique would allow the remedial alternative to be implemented. The preliminarily identified stabilization techniques are as follows:

- Dredging offset with capping
- Slot dredging[1]
- In situ stabilization/solidification (ISS)
- Bulkhead stabilization (e.g., repair)

Each stabilization technique has limitations and may only be implementable under certain conditions; therefore, they are not universally applicable to all areas characterized as Medium Risk. For instance, dredging offset with capping would only be applicable where the geometry of the slope

[1] Slot dredging (also referred to as interval dredging) is the process where dredging is performed incrementally in short sections followed by immediate backfill placement to limit the slope lengths affected by the dredge cut. The width of each dredge slot (or interval) and the timing of the backfill placement in these areas would be determined on a location-specific basis during the RD phase.

and proximity to the steep slopes extending into the deep portion of the navigation channel allow. Slot dredging is generally implementable in areas with a relatively shallow dredge depth (e.g., dredging to less than 3 or 4 feet below the mudline). Similar to a dredging offset with capping, the implementability of ISS depends on the slope geometry, proximity to the navigation channel, and the depth of planned dredging adjacent to the ISS area. ISS cannot be performed immediately adjacent to a deep dredge cut or on a steep slope because the stabilized sediment (i.e., the ISS monolith) will not be stable as an unsupported vertical "wall." Bulkhead stabilization would be appropriate where a bulkhead currently exists that is in fair or good condition and could be repaired or improved to support the dredging (e.g., installing, or supplementing tiebacks and walers).

Of the shoreline/bulkhead stabilization techniques identified to mitigate risk in Medium Risk areas, bulkhead stabilization and ISS would be the most expensive and time consuming followed by dredging offsets with capping, with slot dredging being the least expensive and time consuming. For the purposes of the FFS, these stabilization techniques were assigned to locations for each alternative on a qualitative basis, with consideration of local sediment thickness, existing shoreline/bulkhead conditions, and relative offset from the navigation channel.

3.3.3 Low Risk

Where the remedial alternative evaluation resulted in a categorization of Low Risk, it was assumed that the remedial alternative could be implemented without the need for risk mitigation (i.e., there would be no need for bulkhead/shoreline stabilization techniques). Accordingly, no costs beyond baseline implementation costs (e.g., dredging or capping) were included. Institutional controls, such as load restrictions, zone restrictions, or equipment offsets, may be required on a case-by-case basis and would be considered a no-cost impact to the implemented alternative.

3.4 Assumptions and Limitations

The interpretation framework and risk category allocation described in Sections 3.2 and 3.3 were adopted considering uncertainties that are inherent at this FFS stage, including limited geotechnical data, no as-built data, limited structural conditions information, and no knowledge of potential changes in potential upland site use. Accordingly, the results and interpretations are considered suitable for preliminary planning and risk-based cost estimating at the FFS phase; however, future investigations and coordination will be required to reduce uncertainties and develop detailed stabilization techniques for each shoreline/bulkhead segment.

4 Modeling Basis

4.1 Site Conditions

4.1.1 Topography

The land surrounding East Branch is relatively flat, a product of historical glaciation in the region, with typical ground surface elevations of surrounding properties ranging from elevation +3 to +12 feet North American Vertical Datum of 1988 (NAVD88). Historical topographic and geologic maps indicate that the area in the immediate vicinity of East Branch generally consisted of marsh-like wetlands; however, these wetlands and associated topographic lows, as well as the historical creek alignment, have been obscured by subsequent creek realignment and infilling for development.

The topographic data included as the basis for the ground surface in the analysis are derived from publicly available Light Detection and Ranging (LiDAR) data collected for New York City in May 2017. The result used for analysis was a bare earth digital elevation model with all vegetation and anthropogenic features removed. It was derived from green and near-infrared LiDAR data using triangular irregular network processing of the ground bottom point returns (OCM Partners 2023).

4.1.2 Upland Facilities and Surcharge Loads

The ownership of various parcels around East Branch was researched through available New York City tax maps and can be seen in Figure E4-1. The interpreted use of these parcels, including permanent structures and transient staging or stockpiling, was derived through a review of site photographs, as well as current and historical aerial imagery. This review was used to inform any localized corrections to the LiDAR data (e.g., temporary material stockpile versus ground surface), as well as to establish the location and magnitude of site-specific surcharge loads, such as those associated with large equipment or stacked concrete blocks (assumed to be 1,800 pounds per square foot [psf] based on six ecology blocks stacked up to 12 feet high and a unit weight of concrete of 150 pounds per cubic foot [pcf]), or general surcharge loads (assumed to be 250 psf in accordance with typical recommendations by the American Association of State Highway and Transportation Officials [AASHTO 2020]). During the RD phase, surcharge loading assumptions will be refined on a site-by-site basis, based on information obtained during coordination with property owners, as well as anticipated construction means and methods.

Where ecology blocks were present, 1,800-psf surcharge loads were used. Where ecology blocks were not present and significant uncertainty was present regarding the surcharge loads at a site, a sensitivity analysis was completed to assess the relative impact of varied surcharge loads from existing site operations on the calculated FoS for each remedial alternative. For example, at Station (STA) 290+75 (Feldman Metro property), surcharge loads were varied between 250 and 1,000 psf and yielded the respective stability categories noted in Table E4-1. Aside from Alternative EB-B at STA 290+75, this sensitivity analysis found that the calculated minimum FoS, and associated stability category, did not significantly change with the noted range of considered surcharge loads. For Alternative EB-B, the stability category changed from likely stable to potentially unstable when assuming surcharge loads of 750 and 1,000 psf. The higher surcharge loads of 750 and 1,000 psf are considered conservative for modeling the typical site operations, given that they are represented as being applied uniformly across the entirety of the site in the slope stability analysis, though it is likely that such loads (if present at all) would be transient and/or concentrated in discrete locations. Accordingly, even if higher surcharge loads were present, the actual horizontal loading applied to the bulkhead, and the impact on bulkhead stability, would likely be less than that represented by the uniform surcharge loads.

Table E4-1
Example Surcharge Sensitivity Analysis Results (STA 290+75)

Surcharge	EB-A	EB-B	EB-C and EB-D	EB-E	EB-F
250 psf	Likely stable	Likely stable	Potentially unstable	Likely unstable	Likely unstable
500 psf	Likely stable	Likely stable	Potentially unstable	Likely unstable	Likely unstable
750 psf	Potentially unstable	Potentially unstable	Potentially unstable	Likely unstable	Likely unstable
1,000 psf	Potentially unstable	Potentially unstable	Potentially unstable	Likely unstable	Likely unstable

4.1.3 Bathymetry and Navigation Channel

The bathymetric data used in these analyses were collected in 2022 primarily using multibeam survey methods. Cross-section surfaces were developed by exporting elevation data every 2 feet along the transect. Similar to the topography, a review of site photographs and bathymetric point cloud visualizations (a dense set of points of survey data oriented spatially in three dimensions to provide a pseudo-surface visualization of the bathymetry) was used to inform any corrections, including representations of bulkhead structures.

The depth and horizontal extents of the existing federal navigation channel were indicated in all models. The authorized depth for the navigation channel is -20 feet mean lower low water (MLLW), which corresponds to an elevation of -22.61 feet (NAVD88).

4.1.4 Uncertainty and Data Gaps

As noted, surcharge loads and locations used in the analysis were estimated with reference to LiDAR data, site photographs, and current and historical aerial imagery. These loading estimates are based on interpreted past and present use and do not reflect potential future changes in site condition or use. Accordingly, any future detailed design will require consideration of actual present site use, as well as planned usage changes that may occur prior to or immediately following construction.

4.2 Bulkhead Conditions

4.2.1 Visual Condition Assessment

Inspections conducted between 2011 and 2019 by Anchor QEA (as part of the RI/FS) have documented the shoreline/bulkhead type and condition along East Branch, including establishing start and end shoreline stationing of unique segments. To verify or modify the bulkhead type and condition described in the visual condition surveys through 2019, more recent shoreline photographs were reviewed, including photographs from 2021 and 2023 collected during site visits. The structural elements visible in the photographs, as well as their characterization in the visual condition assessment as being in good, fair, or poor condition, were accounted for in the development of the analytic models; however, in the absence of as-built records, various assumptions were required in the development of the analytic models. These assumptions include, for example, pile spacing, pile condition below the mudline, pile embedment depth, concrete gravity structure cross-section configuration and embedment, and tieback length and orientation. These assumptions will require verification and refinement during the RD phase.

4.2.2 Evaluations by Others

A partial bulkhead replacement program was recently completed in the Western Beef slip (on the north and east sides), and the permit drawings for this structure show a 50-foot-long PZ-27 sheet pile wall with a waler and tiebacks, spaced at 8 feet on-center, connecting to a deadman anchor system (Reich 2010). No as-built drawings were available for reference, and post-construction photographs indicate a waler may not have been installed, so it is unclear what design elements conveyed in the permit drawings were not included or were modified in the as-built structure. In any case, the interpreted bulkhead configuration was evaluated as part of the *Newtown Creek, Treatability Study and Construction Work Plan* (NRT 2021) and that configuration was replicated as part of this study.

4.2.3 Modeling Parameters

When modeling in Slide2, reinforced concrete and steel sheet pile walls were assumed to be of very high strength or impenetrable, forcing the critical slip surface path around the base of the structural element. For timber and crib walls, the equivalent of improved/modified soil strength properties were assumed, as these elements (often in poor condition in East Branch) are much weaker and may permit failure extending through them. Timber piles were considered as effectively discrete point or linear elements, depending on the orientation of the viewing plane, with the amount of strength contribution based on the estimated timber pile diameter and spacing. Timber pile properties were based on the *Timber Pile Design & Construction Manual* (Collin 2016), with allowable shear strength based on an average of typically available treated wood, then reduced by 25% for likely degradation over time in accordance with recommendations by van de Kuilen (2007) for an assumed pile installation age of approximately 75 years. The effective strength of the pile-soil plane was then calculated for 4- and 6-foot pile spacings, and the results are reported in Table E4-2. Pile spacing was visually estimated via review of shoreline photographs of underpier areas, where feasible.

Table E4-2
Effective Timber Pile Shear Strength Parameters for Slide2 Modeling

Pile Spacing	Total Unit Weight (pcf)	Effective Friction Angle (deg)	Effective Cohesion (psf)
4 feet	115	29	2,800
6 feet	115	32	1,800

4.2.4 Uncertainty and Data Gaps

As described previously, in the absence of as-built records, bulkhead characteristics and conditions were based on visual observations during shoreline inspections and historical aerial imagery. For pile-supported structures, the condition of piles below the water surface and their depth of embedment were estimated based on visual observations above the water surface and typical embedment requirements given an assumed subsurface stratigraphy (which is not fully understood), as described in Section 4.3.3. The depth of embedment for cantilever or restrained structures was not known, and where tiebacks or similar were visible on sheet pile walls, their length, condition, and type (e.g., reliant on soil-to-grout bond strength or connected to deadman anchors) were not known. Accordingly, wherever possible, future detailed evaluations should be based on as-built records and (depending on the age and condition of the bulkhead) non-destructive testing to assess relative degradation since the time of construction. Non-destructive testing should be included, where feasible and compatible with bulkhead type, at all locations where as-built records are not available.

4.3 Geotechnical Conditions

4.3.1 Geologic Setting

The geologic setting of East Branch is heavily influenced by historical glaciation in the region, with recessional outwash, glacial till, and glacial drift deposits all being mapped in the area surrounding Newtown Creek (Merrill et al. 1902). In the immediate vicinity of East Branch, mapping indicates the presence of swamp and marsh deposits that were locally infilled or modified for development in the area. Although no more recent geologic maps of the site were found during this study, the historical map from 1902 provides helpful context for understanding development progression and East Branch realignment since 1902, as shown in Figure E4-2.

4.3.2 Available Geotechnical Data

Geotechnical data within East Branch were limited at the time of this study, with the greatest concentration of in-water investigation locations and the only proximate upland investigations, located at the Western Beef Slip. Outside of the Western Beef Slip in the rest of East Branch, vibracores were advanced at two discrete locations and a cone penetration test (CPT) was performed at one of those locations, near the middle of the navigation channel for geotechnical characterization of subsurface materials. There are also 17 sediment cores distributed throughout East Branch that were advanced through the recently deposited sediments for environmental characterization. These cores identify the contact between the recent sediments and the older native materials but were not characterized for geotechnical properties. The locations of the noted geotechnical and environmental investigations are shown in Figure E4-3.

4.3.3 Soil Stratigraphy

Within East Branch, the mapping of the native surface developed in support of the FFS served as the basis for the contact between the recent sediments and the older native materials. Due to the limited upland and nearshore geotechnical data, the soil stratigraphy in the uplands immediately behind the shoreline/bulkheads was inferred based on historical geologic mapping, assumed site development, and the stratigraphy identified in the upland borings advanced around the Western Beef Slip. The logs from upland borings around the Western Beef Slip, as well as the strength testing[2] on samples collected, were compared with regionally mapped geologic units. Based on this review, clear correlations between the mapped geologic units and materials reported in the logs were not able to be drawn. Accordingly, rather than differentiating between glacially consolidated materials (e.g., till and advance outwash) and post-glacial deposits (e.g., recessional outwash), a singular native material unit was used for analysis. The material units selected for this phase of modeling and their use in the various cross-sections are summarized as follows:

- Riprap (reflective of existing riprap shorelines)
- Cap (proposed new sediment cap materials)
- Sediment (recent sediments within East Branch)
  - This unit was included only within the creek bounds and occurs between the bathymetric surface and the native surface, except where fill may be present in nearshore areas based on historical development and/or creek realignment.
- Upland fill material
  - This unit was assumed to be typically 5 to 8 feet in thickness, though locally thicker in nearshore areas depending on historical development and/or creek realignment.

[2] Boring logs and laboratory test data are summarized and attached to the Treatability Study Pre-Design Investigation Data Summary Report (NRT 2020).

- Native material
  - This unit was assumed to be everything below the native surface within the creek and everything below the upland fill material on the upland side.

These assumptions about soil stratigraphy will need to be verified and updated, if necessary, during the RD phase.

4.3.4 Modeling Parameters

Due to the limited availability of geotechnical data, geotechnical parameters for modeling were primarily derived from laboratory strength test results obtained in the Western Beef Slip, as well as limited in situ strength data (i.e., CPTs) as provided in the *Feasibility Study Field Sampling Program Data Summary Report Part 2* (Anchor QEA 2020) and the *Treatability Study Pre-Design Investigation Data Summary Report* (NRT 2020). The limited amount and spatial distribution of data collected generally precluded the development of statistically derived regional parameters or discrete, site-specific parameters. Accordingly, best estimate parameters were selected to be applied consistently at all sites based on a comparison of all test data and using best professional judgment. The final geotechnical parameters selected for analysis are reported in Table E4-3.

Table E4-3
Geotechnical Parameters for Analyses

Material Unit	Total Unit Weight (pcf)	Effective Friction Angle (deg)	Effective Cohesion (psf)
Riprap	135	38	0
Sediment	70	20	30
Upland fill material	115	32	0
Native material	120	33	0

4.3.5 Sensitivity Analysis

4.3.5.1 Nearshore Stratigraphy

As described previously, outside of Western Beef Slip (where records of proximate upland borings were available), the soil stratigraphy in the uplands immediately behind the shoreline/bulkheads was estimated based on historical geologic mapping and assumed site development. Historical topographic and geologic maps also represent the East Branch configuration prior to modification for navigation and upland development; however, due to the coarse resolution and georeferencing limitations of the historical maps, it was not possible to determine which sides of the channel may have been expanded by cutting into native soils versus which sides may have been infilled to facilitate further upland development.

Given this uncertainty, a sensitivity analysis was completed assuming cut and fill interpretations of the same cross-section (at STA 272+50, just outside of Western Beef Slip). The cut interpretation assumed an approximately 2H:1V cut slope into native material and extending into the channel, whereas the fill interpretation assumed a thick layer of fill material extending into the channel from the upland side (see Figures E4-4a and E4-4b for section views comparing these alternative interpretations). As presented in Table E4-4, this sensitivity analysis indicated that the calculated minimum post-dredge FoS was relatively insensitive to the cut versus fill interpretations for this modeling effort (although the calculated minimum post-dredge FoS was higher for the cut interpretation than the fill interpretation for all remedial alternatives), though this may be attributable to the shear strength parameters used for each of the materials in this analysis. Future geotechnical investigations may allow for differentiation between native units and perhaps a more significant relative strength difference between the upland fill material and some native units (e.g., glacial till).

Table E4-4
Example Channel Cut Versus Fill Interpretation Sensitivity Analysis Results (STA 272+50)

Remedial Alternative	Cut Interpretation		Fill Interpretation	
	Post-dredge FoS	Stability Category	Post-dredge FoS	Stability Category
EB-B	1.04	Likely unstable	1.00	Likely unstable
EB-C and EB-D	1.02	Likely unstable	0.98	Likely unstable
EB-E	1.02	Likely unstable	0.98	Likely unstable
EB-F	1.02	Likely unstable	0.98	Likely unstable

4.3.5.2 Sediment Unit Weight

The total unit weight of sediment generally increases with depth and is typically greater than the value assumed for this analysis. For this analysis, a lower bound total unit weight value representative of materials near the mudline was used for all sediment. The lower bound value assumed is a reasonable approximation for slip surfaces passing through only very shallow sediment. For deeper slip surfaces, this lower bound unit weight is considered conservative when applied uniformly to the sediment in the model because the sediment weight will tend to buttress the slide mass. To assess the sensitivity of selected models to the assumed sediment unit weight, the input unit weight for the sediment layer was varied between 70 and 90 pounds per cubic foot (pcf) and the results compared. For these analyses, a constant effective cohesion of 30 psf and an effective friction angle of 20 degrees, as presented in Table E4-3, were assumed. This sensitivity analysis indicated that the calculated minimum post-dredge FoS was relatively insensitive to this input parameter for many cross-sections, with little to no change in the calculated minimum post-dredge FoS and associated stability category. For cases where a deeper slip surface was found to be the critical surface, only a slight change in the post-dredge FoS was calculated and in one case resulted in a change to the assigned stability category. A comparison of these findings is presented with reference to two cross-sections (i.e., STA 253+50 and STA 258+00) in Table E4-5.

Table E4-5
Example Sediment Unit Weight Sensitivity Analysis Results (Alternatives EB-C and EB-D)

Total Unit Weight (pcf)	STA 253+50 (Thin Sediment)		STA 258+00 (Thick Sediment)	
	Post-dredge FoS	Stability Category	Post-dredge FoS	Stability Category
70	1.15	Potentially unstable	1.07	Likely unstable
90	1.15	Potentially unstable	1.11	Potentially unstable

4.3.5.3 Upland Fill Shear Strength

Due to the general uncertainty and variability of fill materials, a sensitivity analysis was conducted for a selected cross-section to evaluate the impacts of varied effective friction angles on the stability category of each remedial alternative. Values selected for this analysis ranged from 28° (likely conservative) to 34° (likely not conservative). Analyses provided in the *Treatability Study Pre-Design Investigation Data Summary Report* (NRT 2020) used an effective friction angle of 33° at the Western Beef Slip; however, given the likely heterogeneity of fill material types and placement methods throughout East Branch, some sites may include fill materials with an effective friction angle that is slightly lower. Accordingly, a comparison of the stability analysis results using effective friction angles of 30° and 32° indicated little to no change in the stability category (see Table E4-6), and an effective friction angle of 32° was selected as appropriate for this preliminary evaluation based on the results of the current sensitivity analyses and a comparison with the previously completed Treatability Study analyses.

Table E4-6
Example Upland Fill Shear Strength Sensitivity Analysis Results (STA 294+75)

Effective Friction Angle (deg)	Stability Category and Post-dredge FoS (in parentheses) for Identified Alternative			
	EB-B	EB-C and EB-D	EB-E	EB-F
28	Potentially unstable (1.12)	Likely unstable (1.10)	Potentially unstable (1.10)	Likely unstable (1.00)
30	Potentially unstable (1.18)	Potentially unstable (1.16)	Potentially unstable (1.19)	Likely unstable (1.09)
32	Potentially unstable (1.26)	Potentially unstable (1.23)	Potentially unstable (1.26)	Potentially unstable (1.19)
34	Potentially unstable (1.30)	Likely stable (1.31)	Likely stable (1.33)	Potentially unstable (1.28)

4.3.6 Uncertainty and Data Gaps

As noted throughout this section, there were limited site-specific geotechnical data available at the time these analyses were completed, including only limited in-water geotechnical investigations and only one area (Western Beef Slip) with upland geotechnical borings. Additionally, although historical topographic and geologic maps indicate that the creek width and alignment have changed (in some areas significantly) over the last approximately 120 years, these maps are not of sufficient resolution and accurate georeferencing to give clear indication of how and when these changes occurred. Accordingly, any future, more detailed evaluations will require both upland and in-water geotechnical investigation programs to characterize local soil conditions and develop refined geotechnical parameters.

5 Results and Interpretation

5.1 Overall Summary of Results

As discussed in Section 1, the remedial alternatives being evaluated in the East Branch FFS include a no action alternative (Alternative EB-A), as well as five alternatives with each subsequent alternative sequentially modified to increase depth and/or areal extent of dredging. Example analysis outputs from this evaluation are provided in Attachment E-A. The results of this shoreline/bulkhead stability evaluation are consistent with the sequenced scope of the remedies, with increasing shoreline/bulkhead stability risk throughout East Branch associated with those remedies consisting of greater dredge extents and depths. For example, under Alternative EB-C, only 17% (by length) of the shoreline/bulkheads were categorized as High Risk, as described in Section 3.3.1; however, with the increase in dredging under Alternative EB-F, 83% of the shoreline/bulkheads were categorized as High Risk. A summary of the relative distribution of risk categories (percent by length) for each alternative is provided in Chart E5-1.

As described in Section 3.3, preliminary shoreline/bulkhead stabilization techniques were assigned to locations for each alternative on a qualitative basis using best professional judgement, with consideration of local sediment thickness, existing shoreline/bulkhead conditions, proximity of existing site structures or sensitive features, and relative offset from the navigation channel. These stabilization techniques were identified for the purposes of the FFS and will require additional evaluation and refinement during the RD phase.

Corresponding to the increasing risk are increases in cost and duration to integrate the shoreline/bulkhead stabilization techniques necessary for each alternative. For example, there would be less cost and duration to incorporate slot dredging at suitable Medium Risk locations as opposed to bulkhead replacement at High Risk locations. Additional detailed discussions are provided for each of the evaluated remedial alternatives in the following sections, as well as in Sections 6 and 7 of the FFS.

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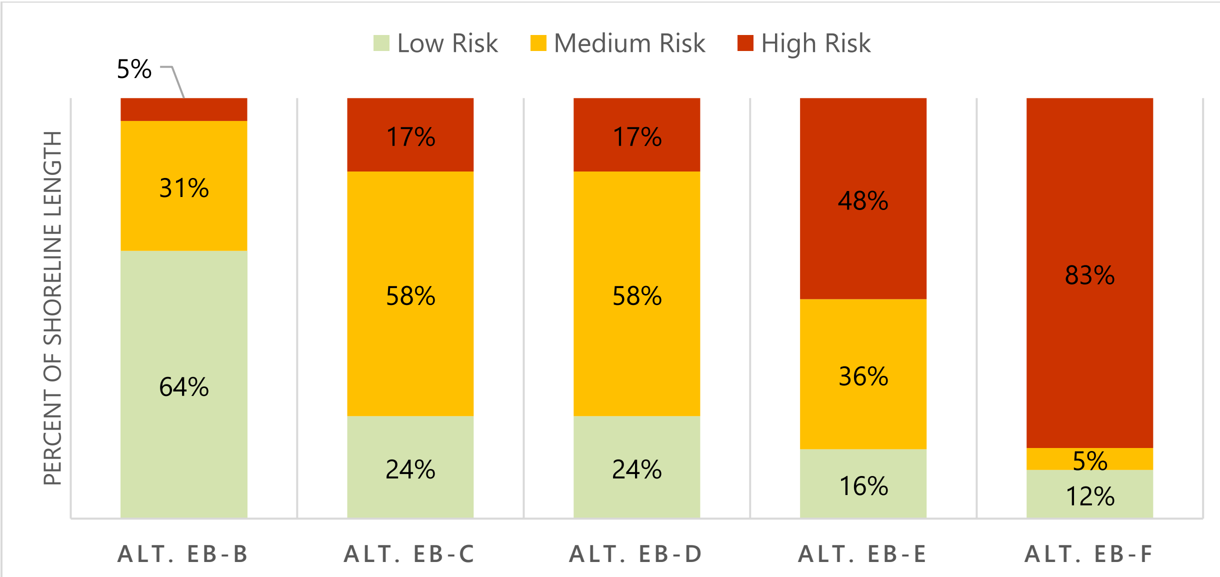
Chart E5-1
Shoreline/Bulkhead Stability Risk Category Distribution for Each Remedial Alternative



5.2 Results by Alternative

5.2.1 Alternative EB-A

Under Alternative EB-A, no remedial action would occur. A summary of the existing shoreline/bulkhead conditions is presented in Table E5-1and shown in Figure E5-1.

Table E5-1
Summary of Existing Visual Shoreline/Bulkhead Conditions

Visual Condition	Shoreline/Bulkhead	Extent of Visual Condition	
		Linear Feet	Percentage of Total Shoreline
Good	Shoreline	696	14%
	Bulkhead	746	15%
Fair	Shoreline	100	2%
	Bulkhead	919	18%
Poor	Shoreline	699	14%
	Bulkhead	1,933	38%

5.2.2 Alternative EB-B

Under Alternative EB-B, sediments above -4.4 feet MLLW are to be dredged and a 4.4-foot-thick cap installed entirely at (or below) 0 feet MLLW. Due to variable sediment surface elevations throughout East Branch, the local dredge depth required to implement Alternative EB-B will correspondingly vary. For example, >8 feet of dredging may be required to implement Alternative EB-B at the south end of East Branch (i.e., STA 283+25), whereas other locations may require little to no dredging (i.e., STA 296+00). Accordingly, this evaluation estimated that approximately two-thirds of the East Branch shoreline/bulkheads are categorized as Low Risk under Alternative EB-B (typically where little to no dredging is required); however, other locations with more significant dredge depths may preclude the use of less costly and less intrusive shoreline/bulkhead stabilization techniques (e.g., slot dredging). A summary of the results is presented in Table E5-2 and shown in Figure E5-2.

Table E5-2
Summary of Shoreline/Bulkhead Risk Categorization Results for Alternative EB-B

Shoreline/Bulkhead Risk Category	Shoreline/Bulkhead Stabilization Technique	Extent of Implementation	
		Linear Feet	Percentage of Total Shoreline
Low Risk[1]	No stabilization needed	3,242	64%
Medium Risk[2]	Slot dredging	682	13%
	Dredging offset with capping	0	0%
	ISS	893	18%
	Bulkhead stabilization (e.g., repair)	0	0%
High Risk[3]	Bulkhead replacement	276	5%
	Bulkhead installation (new)	0	0%

Notes:
1. Low Risk scenarios would likely not require stabilization but may require institutional controls as described in Section 3.3.3.
2. Stabilization techniques for Medium Risk scenarios are described in Section 3.3.2 and include modified dredging techniques (e.g., slot dredging), dredging offset with capping, ISS of sediment adjacent to the shoreline/bulkhead, or stabilization (e.g., repair or reinforcement) of existing bulkheads.
3. Stabilization approaches for High Risk scenarios are described in Section 3.3.1 and include replacement of existing bulkheads in poor condition or installation of new bulkheads where currently absent.

5.2.3 Alternatives EB-C and EB-D

Under Alternatives EB-C and EB-D, prior to placement of a cap with its required thickness (varying by depth as discussed in Section 2.2), an equivalent thickness of sediment is to be dredged to maintain existing water depth. Alternative EB-D is differentiated from EB-C in that the dredge depth can be locally extended to the native surface to eliminate the need for subsequent cap placement where the additional dredging required to reach the native surface is approximately 2 feet or less. This dredge optimization for Alternative EB-D occurs near the middle of the creek, away from the shoreline/bulkhead, thus resulting in the same shoreline/bulkhead risk categories for these two alternatives.

Compared to Alternative EB-B, broader shoreline/bulkhead impacts are associated with the implementation of Alternatives EB-C and EB-D, with only approximately one-quarter of shorelines categorized as Low Risk. Due to the relatively shallow dredge thickness associated with these alternatives, much of the shoreline was categorized as Medium Risk and may be conducive to slot dredging as a stabilization technique. Under Alternatives EB-C and EB-D, approximately one-tenth of the shoreline/bulkheads were categorized as High Risk and may require bulkhead replacement or new bulkhead installation. A summary of the results is presented in Table E5-3 and shown in Figure E5-3.

Table E5-3
Summary of Shoreline/Bulkhead Risk Categorization Results for Alternatives EB-C and EB-D

Shoreline/Bulkhead Risk Category	Shoreline/Bulkhead Stabilization Technique[1]	Extent of Implementation	
		Linear Feet	Percentage of Total Shoreline
Low Risk	No stabilization needed	1,242	24%
Medium Risk	Slot dredging	2,480	49%
	Dredging offset with capping	0	0%
	ISS	483	9%
	Bulkhead stabilization (e.g., repair)	0	0%
High Risk	Bulkhead replacement	634	13%
	Bulkhead installation (new)	254	5%

Note:
1. See notes in Table E5-2 regarding stabilization techniques.

5.2.4 Alternative EB-E

Under Alternative EB-E, dredging would extend below and beyond the federally authorized navigation channel so that cap placement would not impinge on the navigation channel; however, if native material is encountered within the authorized navigation channel, the dredging would extend only to native material. As noted in Section 2.2, one of the key assumptions in modeling this alternative was an assumed 3H:1V dredge slope in the sediment extending away from the navigation channel up toward the shoreline/bulkhead.

Compared to Alternatives EB-B, EB-C, and EB-D, this evaluation identified broader and more severe impacts associated with the implementation of Alternative EB-E. Nearly one-half of shoreline/bulkheads were categorized as High Risk under Alternative EB-E, with only approximately one-fourth categorized as Low Risk. In some locations the navigation channel abuts the shoreline or bulkhead, and the implementation of Alternative EB-E is locally equivalent to the implementation of Alternative EB-F (dredge all sediment, discussed in Section 5.2.5), whereas other shoreline/bulkhead locations are offset sufficiently from the navigation channel to reduce implementation risk and allow less costly and time-consuming stabilization techniques than bulkhead installation/replacement, such as ISS or dredging offset with capping. A summary of the results is presented in Table E5-4 and shown in Figure E5-4.

Table E5-4
Summary of Shoreline/Bulkhead Risk Categorization Results for Alternative EB-E

Shoreline/Bulkhead Risk Category	Shoreline/Bulkhead Stabilization Technique[1]	Extent of Implementation	
		Linear Feet	Percentage of Total Shoreline
Low Risk	No stabilization needed	840	17%
Medium Risk	Slot dredging	0	0%
	Dredging offset with capping	939	18%
	ISS	780	15%
	Bulkhead stabilization (e.g., repair)	99	2%
High Risk	Bulkhead replacement	1,688	33%
	Bulkhead installation (new)	747	15%

Note:
1. See notes in Table E5-2 regarding stabilization techniques.

5.2.5 Alternative EB-F

Alternative EB-F is the most intensive remedial measure, requiring that all sediments within East Branch be dredged. This evaluation identified broader and more severe impacts associated with the implementation of Alternative EB-F than any of the other alternatives, with more than four-fifths of shoreline/bulkheads categorized as High Risk and likely requiring either new bulkhead installation or bulkhead replacement. A summary of the results is presented in Table E5-5 and shown in Figure E5-5.

Table E5-5
Summary of Shoreline/Bulkhead Risk Categorization Results for Alternative EB-F

Shoreline/Bulkhead Risk Category	Shoreline/Bulkhead Stabilization Technique[1]	Extent of Implementation	
		Linear Feet	Percentage of Total Shoreline
Low Risk	No stabilization needed	590	11%
Medium Risk	Slot dredging	0	0%
	Dredging offset with capping	0	0%
	ISS	265	5%
	Bulkhead stabilization (e.g., repair)	0	0%
High Risk	Bulkhead replacement	3,545	70%
	Bulkhead installation (new)	693	14%

Note:
1. See notes in Table E5-2 regarding stabilization techniques.

6 Recommendations for Future Studies

As noted in Section 3.4, the analytic methods and evaluation framework were adopted considering uncertainties that are inherent at this FFS stage, including limited geotechnical data, no as-built data, limited structural conditions information, and no knowledge of potential changes in upland site use. Sections 4.1.4, 4.2.4, and 4.3.6 have been included to indicate specific areas of importance to focus future investigations and coordination, which will be required to reduce uncertainties and develop detailed stabilization techniques for each shoreline/bulkhead segment as the project progress. Recommendations are summarized as follows:

- Site conditions
  - Coordinate with property owners and local agencies to understand historical site development, current use restrictions, and planned use changes that may occur prior to or immediately following construction.
- Bulkhead conditions
  - Acquire available as-built records for all bulkhead structures (if possible).
  - Complete non-destructive testing (e.g., ultrasonic pulse-echo) to estimate embedment depth or identify irregularities and material degradation.
  - Assess the suitability of surface-based geophysics, such as ground penetrating radar or other appropriate methods, to evaluate approximate tieback or anchor locations and lengths, and complete investigations where appropriate.
- Geotechnical conditions
  - Complete upland and overwater subsurface investigations, including borings and CPTs, to characterize subsurface stratigraphy, index properties, and strength characteristics.
  - Complete geotechnical laboratory testing to determine the range of engineering properties of identified stratigraphic units.
  - Complete surface-based geophysics to assess the potential for buried obstructions (e.g., buried piles or rubble in fill materials).
- Structural analysis
  - During this study, structural analysis was limited to sheet pile bulkheads; however, when as-built or similar data become available, future analyses should include other bulkhead structure types (e.g., reinforced concrete).

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Figures

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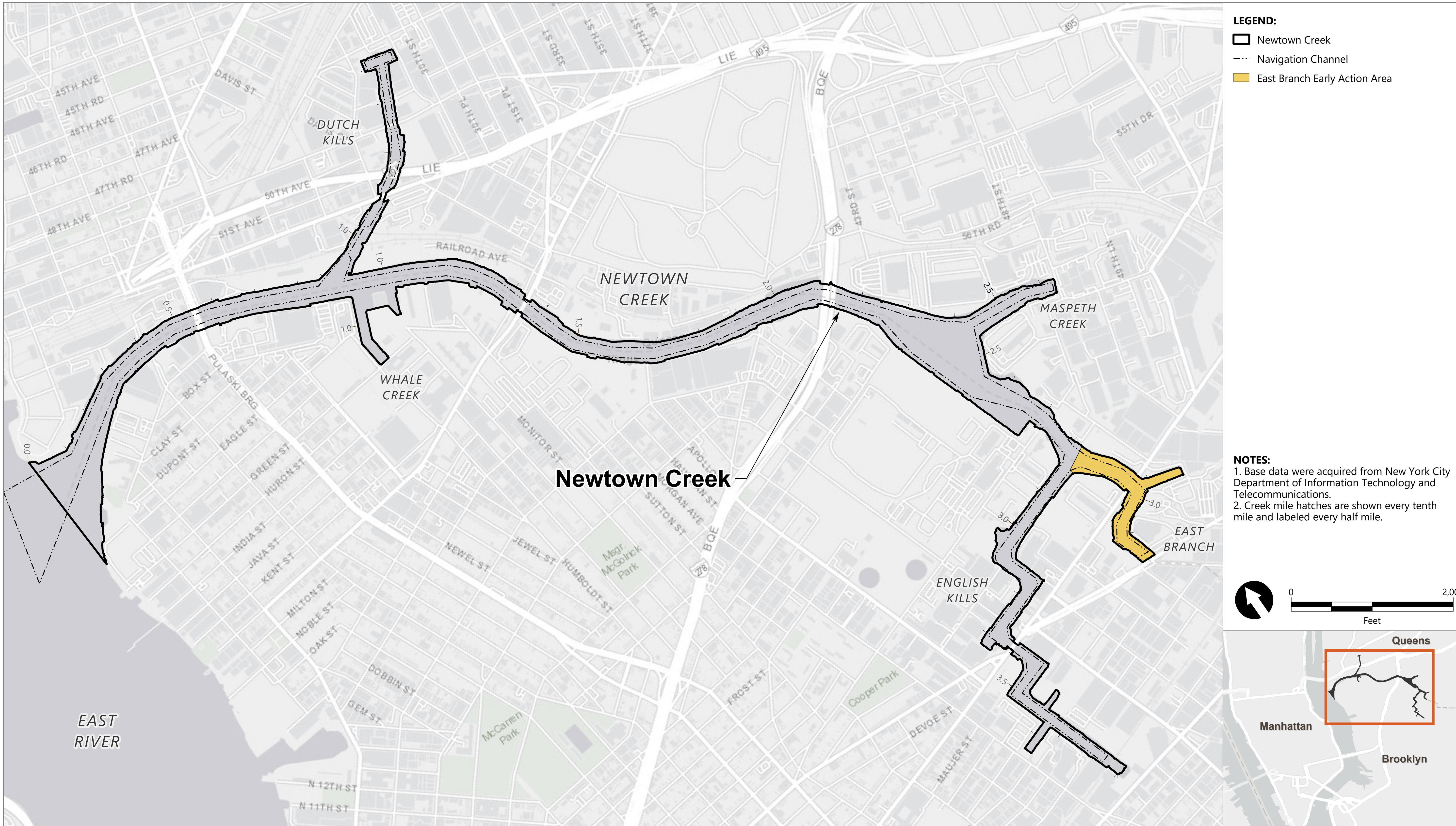

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Figure E1-1
East Branch Early Action Area
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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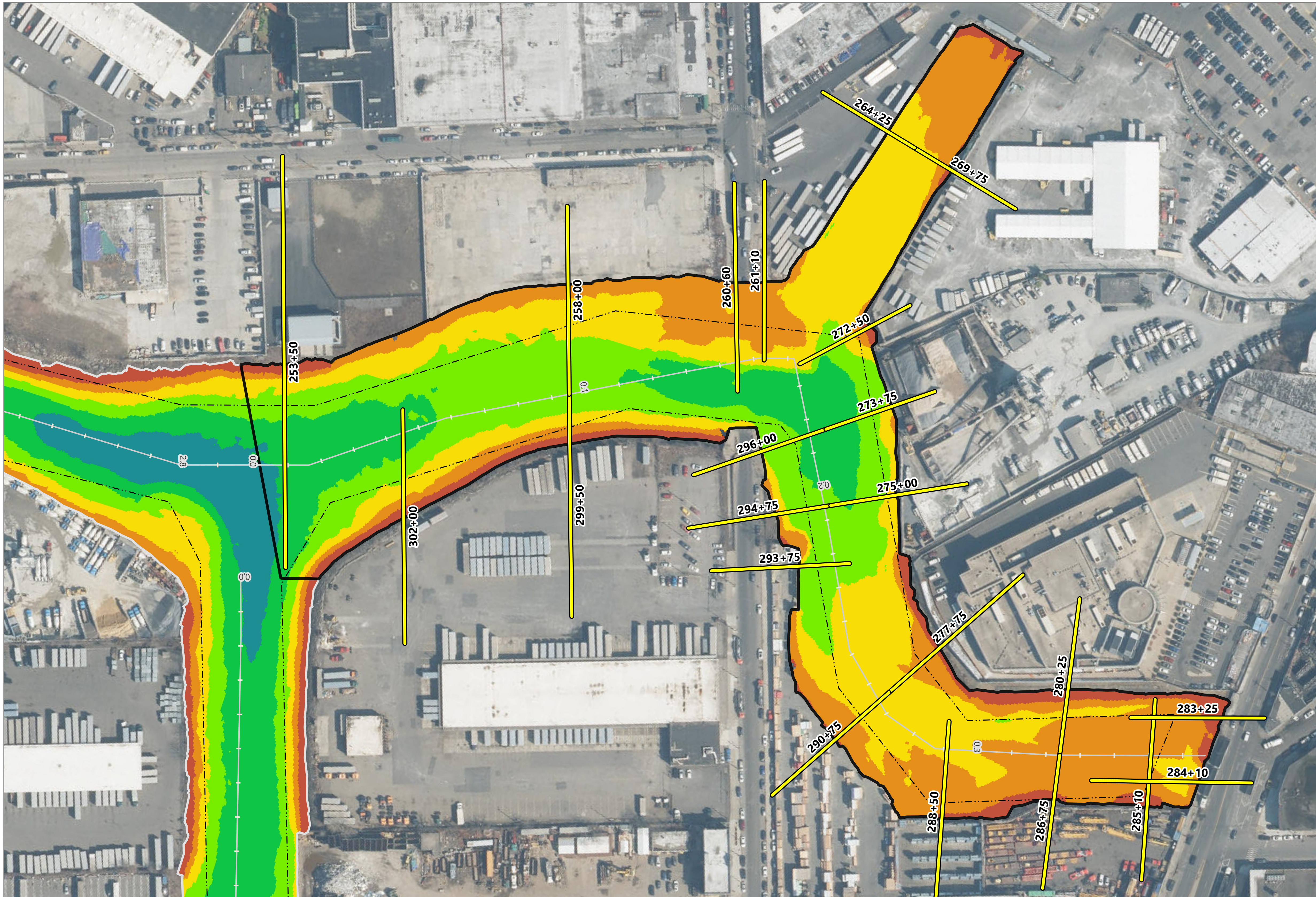

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- Shoreline Stability Cross-Section[4]

Bathymetry Elevation (feet MLLW)

- -28 – -25
- -24 – -20
- -19 – -15
- -14 – -10
- -9.9 – -5.0
- -4.9 – 0.0
- 0.01 – 4.4

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Bathymetry survey performed by Ocean Surveys, Inc., in two phases during summer 2022. Phase 1 was conducted July 11 through July 22, 2022. Phase 2 was conducted August 7 through August 11, 2022.
4. Indicated stationing corresponds to the measured shoreline station associated with the respective cross-section. Shoreline stationing measures the length of shoreline along the creek. Numbering begins at the north side (Queens) of the mouth of Newtown Creek and ends at the south side (Brooklyn) of the mouth of Newtown Creek. Labeled measurements are shown in terms of hundreds of feet (e.g., 273+75 representing 27,375 linear feet of measured shoreline from the Mouth of the Queens side of Newtown Creek).
5. Break values for numerical classification bins are rounded up. Values between displayed ranges are placed in the higher bin.

0 200
Feet

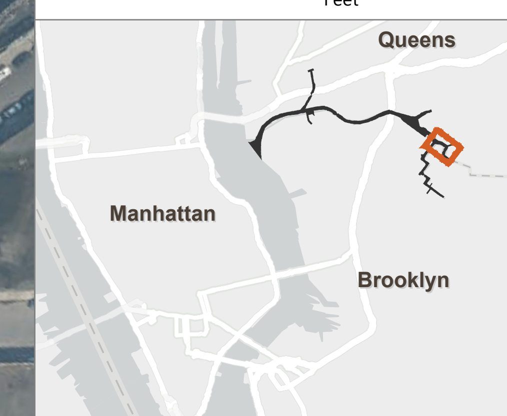

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Figure E3-1
Bathymetry and Cross-Section Location Map
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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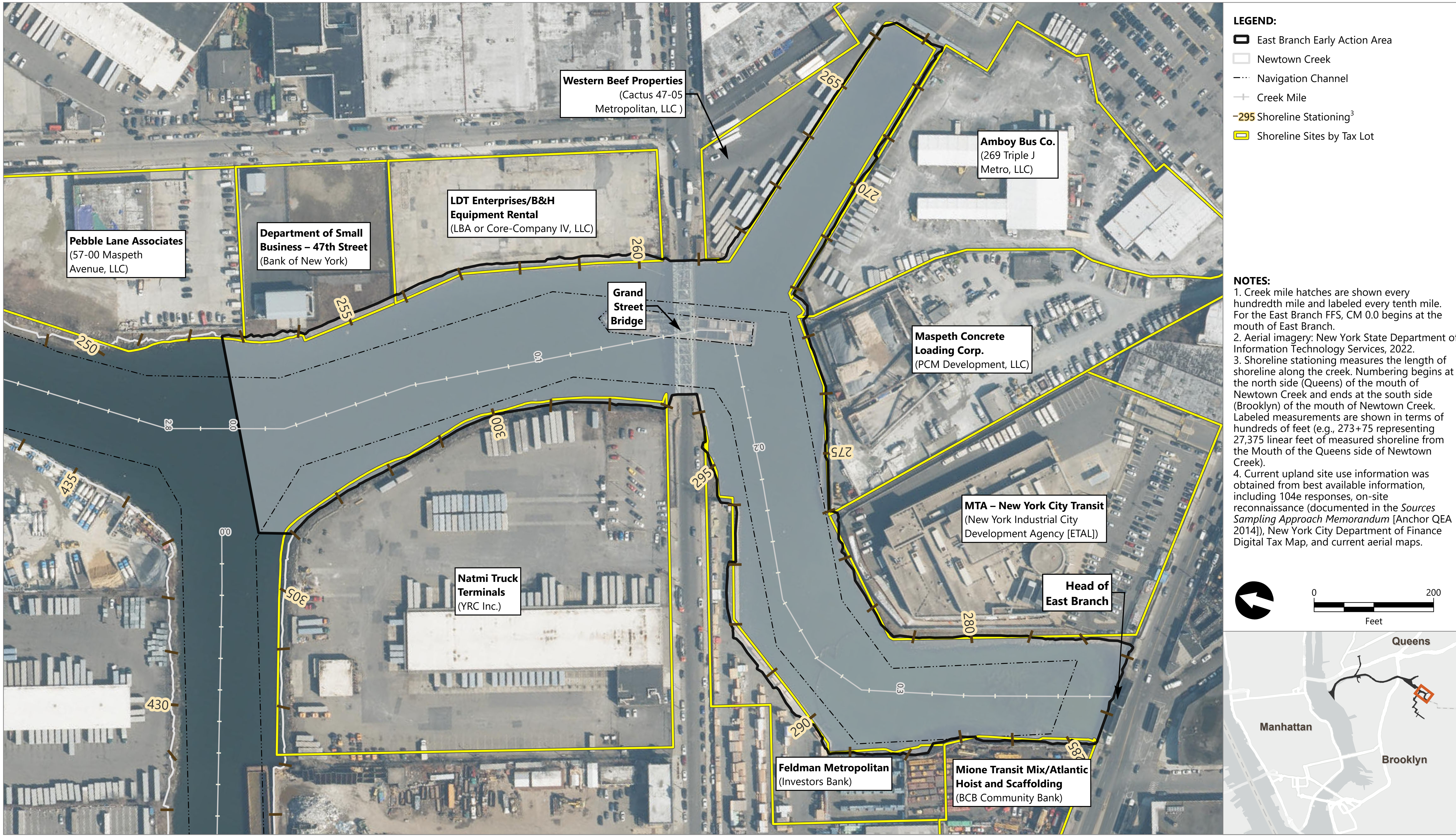

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Figure E4-1
Property Ownership in East Branch
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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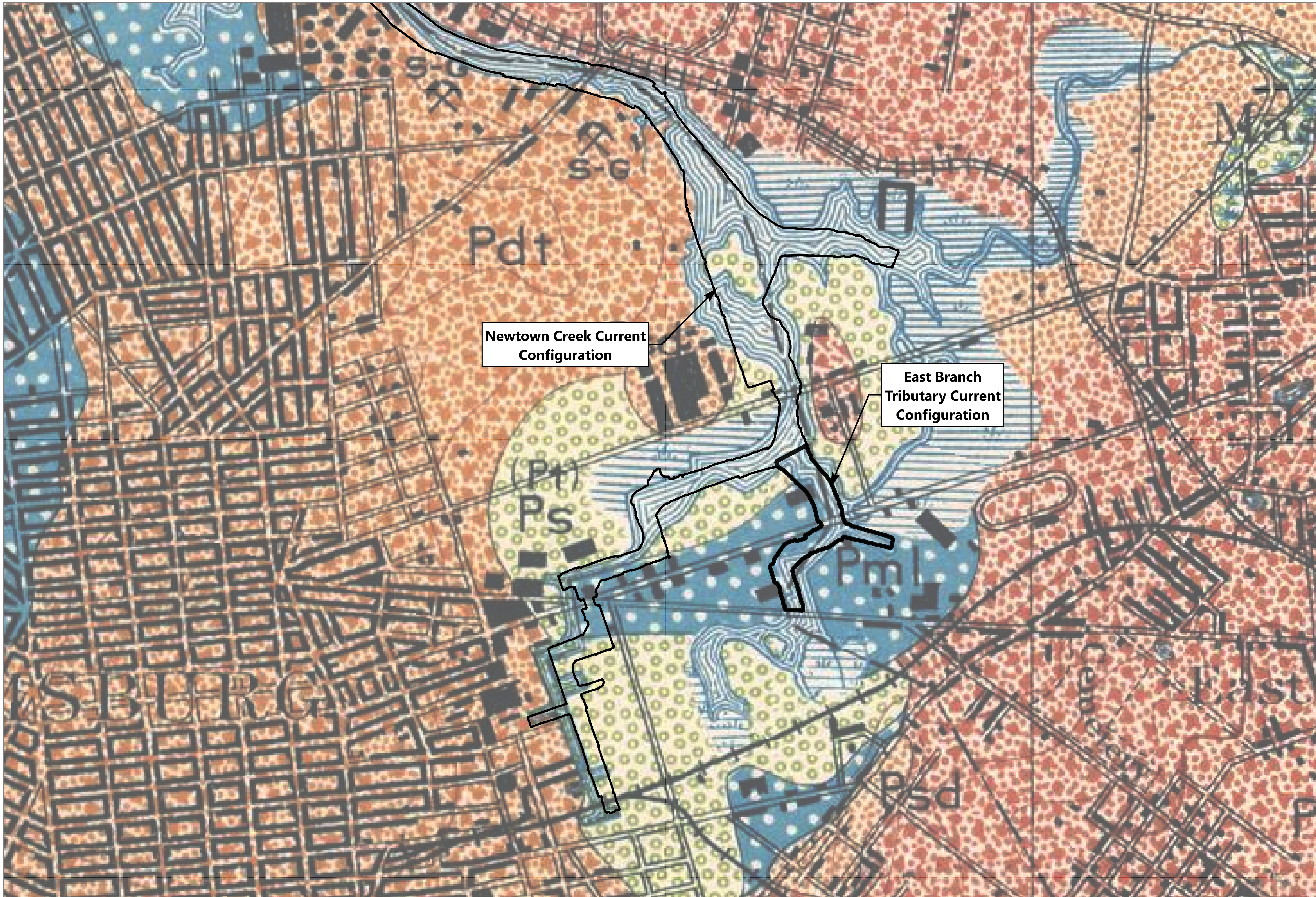

LEGEND:

East Branch Early Action Area
Newtown Creek

Mapped Surface Units

Pml (Made Land)
Ps (Swamp Muck)
Psd (Stratified Drift)
Pdt (Stratified Drift and Till)
Pt (Till)
Water

NOTE:
1. Surficial geology from USGS Geologic Atlas of the United States Folio, New York City Folio, Brooklyn Quadrangle, Series GF-83, published 1902.

0 1,000
Feet

The Bronx
Manhattan
Queens
Brooklyn

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Figure E4-2
Historical Geologic Map Circa 1902
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT
FINAL

LEGEND:

- East Branch Early Action Area
- Newtown Creek
- Navigation Channel
- Creek Mile
- FS Seepage-induced Consolidation Station
- FS In Situ Penetration Testing (CPT/SPT)
- FS Geotechnical Coring Station
- FS TS PDI Upland Geotechnical Boring
- FS TS PDI Geotechnical Coring Station
- Subsurface Sediment Core Location

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Subsurface sediment core locations are from RI Phase 1, RI Phase 2, FS Part 1, FS Part 2, and the East Branch TS PDI sampling programs. The upland geotechnical borings are from the East Branch TS PDI. The seepage-induced consolidation station and in situ penetration testing are from the FS Part 2 geotechnical sampling. The geotechnical coring stations are from the FS Part 2 geotechnical sampling and the East Branch TS PDI.

CPT: cone penetration test
FS: Feasibility Study field program (2017)
FS TS PDI: FS Treatability Study Pre-Design Investigation (2019)
SPT: standard penetration test

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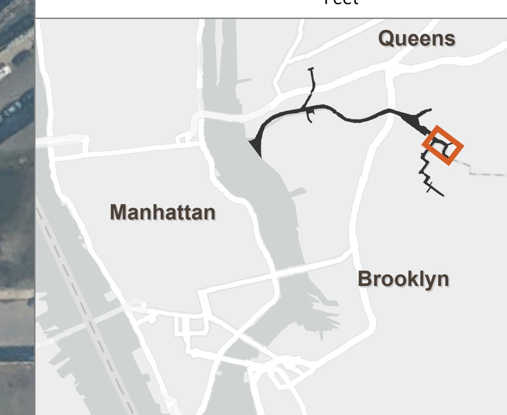

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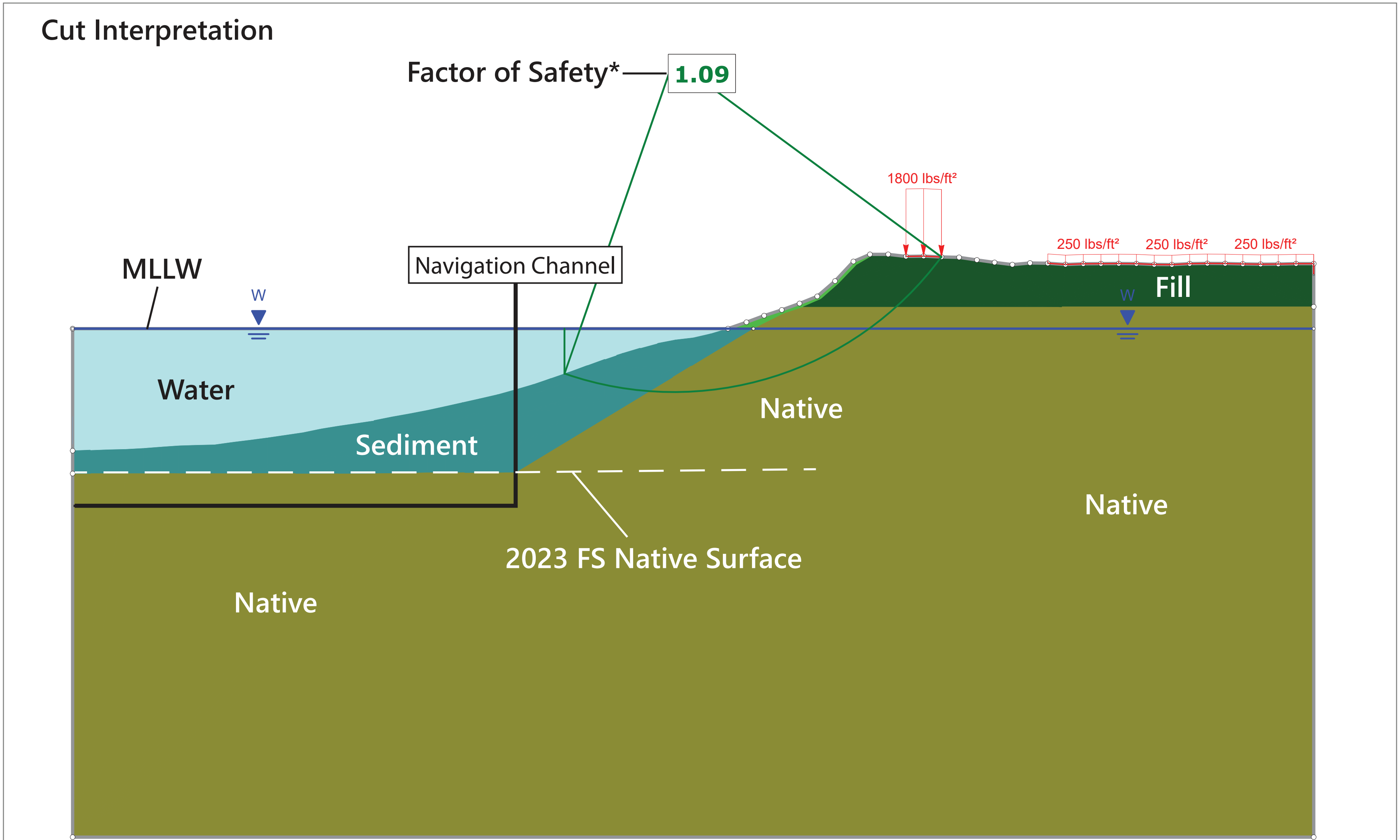
Figure E4-3
Subsurface Investigation and Testing Locations
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety is given for pre-dredge conditions as represented in the Figure

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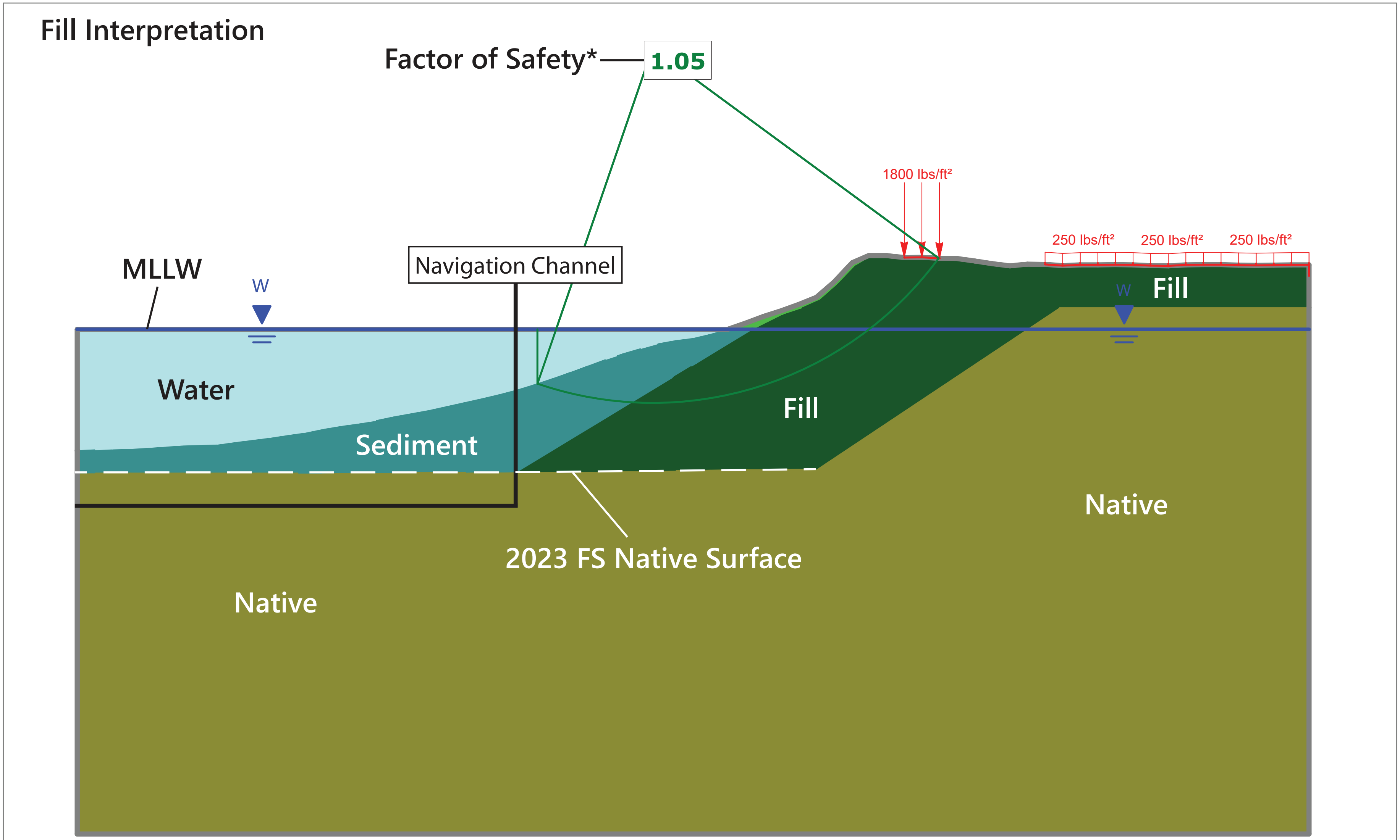
Figure E4-4a
Example Sensitivity Analysis Results: Shoreline Cut Interpretation (STA 272+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety is given for pre-dredge conditions as represented in the Figure

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Figure E4-4b
Example Sensitivity Analysis Results: Shoreline Fill Interpretation (STA 272+50)

Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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FINAL

LEGEND:

East Branch Early Action Area
Newtown Creek
Navigation Channel
Creek Mile
295 Shoreline Stationing[3]

Existing FS Shoreline Condition

Good
Fair
Poor

Existing Shoreline Material

Bare Ground
Pile-supported Concrete
Precast Concrete Blocks
Riprap
Steel Sheetpile
Vertical Concrete
Vertical Concrete with Timber Facing
Vertical Timber
Timber

NOTES:

1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.
3. Shoreline stationing measures the length of shoreline along the creek. Numbering begins at the north side (Queens) of the mouth of Newtown Creek and ends at the south side (Brooklyn) of the mouth of Newtown Creek. Labeled measurements are shown in terms of hundreds of feet (e.g., 273+75 representing 27,375 linear feet of measured shoreline from the Mouth of the Queens side of Newtown Creek).
4. Shoreline material and condition data were from the 2017 FS bulkhead survey and 2019 bulkhead survey.
5. Conditions represent existing condition of shoreline/structures and do not reflect anticipated performance resulting from remedy implementation.

0 200
Feet

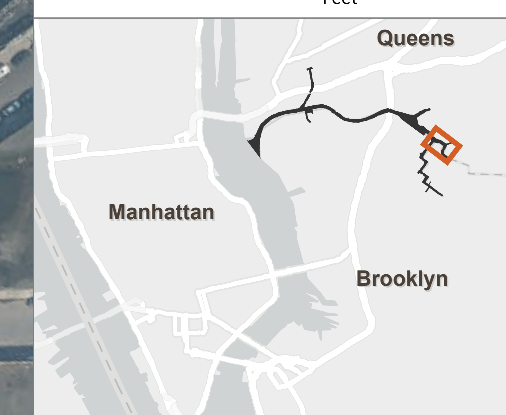

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Figure E5-1
Visual Condition Assessment (Existing Conditions): Alternative EB-A
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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Figure E5-2

Shoreline/Bulkhead Risk Category and Proposed Shoreline/Bulkhead Stabilization Technique: Alternative EB-B

Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

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Figure E5-3
Shoreline/Bulkhead Risk Category and Proposed Shoreline/Bulkhead Stabilization Technique: Alternatives EB-C and EB-D
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

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Figure E5-4
Shoreline/Bulkhead Risk Category and Proposed Shoreline/Bulkhead Stabilization Technique: Alternative EB-E
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

NOTES:
1. Creek mile hatches are shown every hundredth mile and labeled every tenth mile. For the East Branch FFS, CM 0.0 begins at the mouth of East Branch.
2. Aerial imagery: New York State Department of Information Technology Services, 2022.

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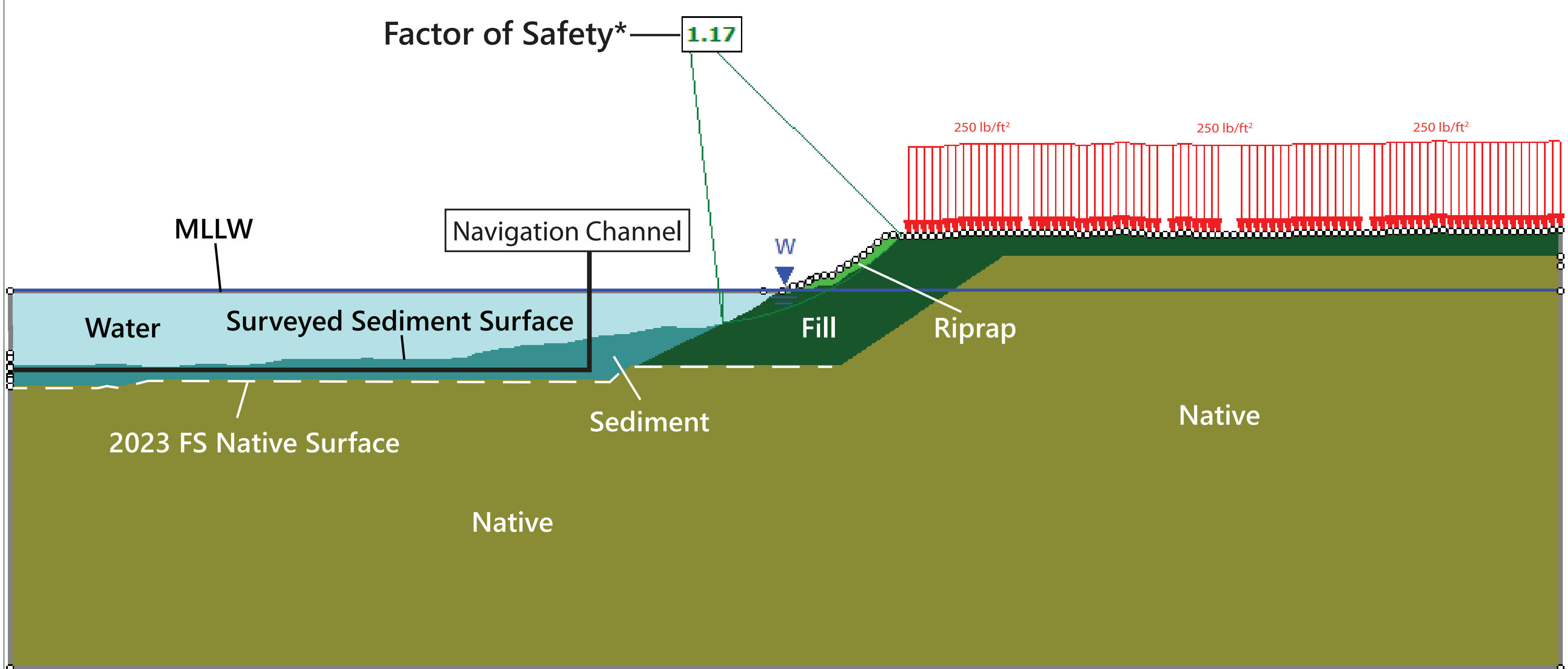
Figure E5-5
Shoreline/Bulkhead Risk Category and Proposed Shoreline/Bulkhead Stabilization Technique: Alternative EB-F
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

Attachment E-A
Example Slope Stability Results

DRAFT FINAL

Alternative EB-A



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for existing conditions as represented in the Figure

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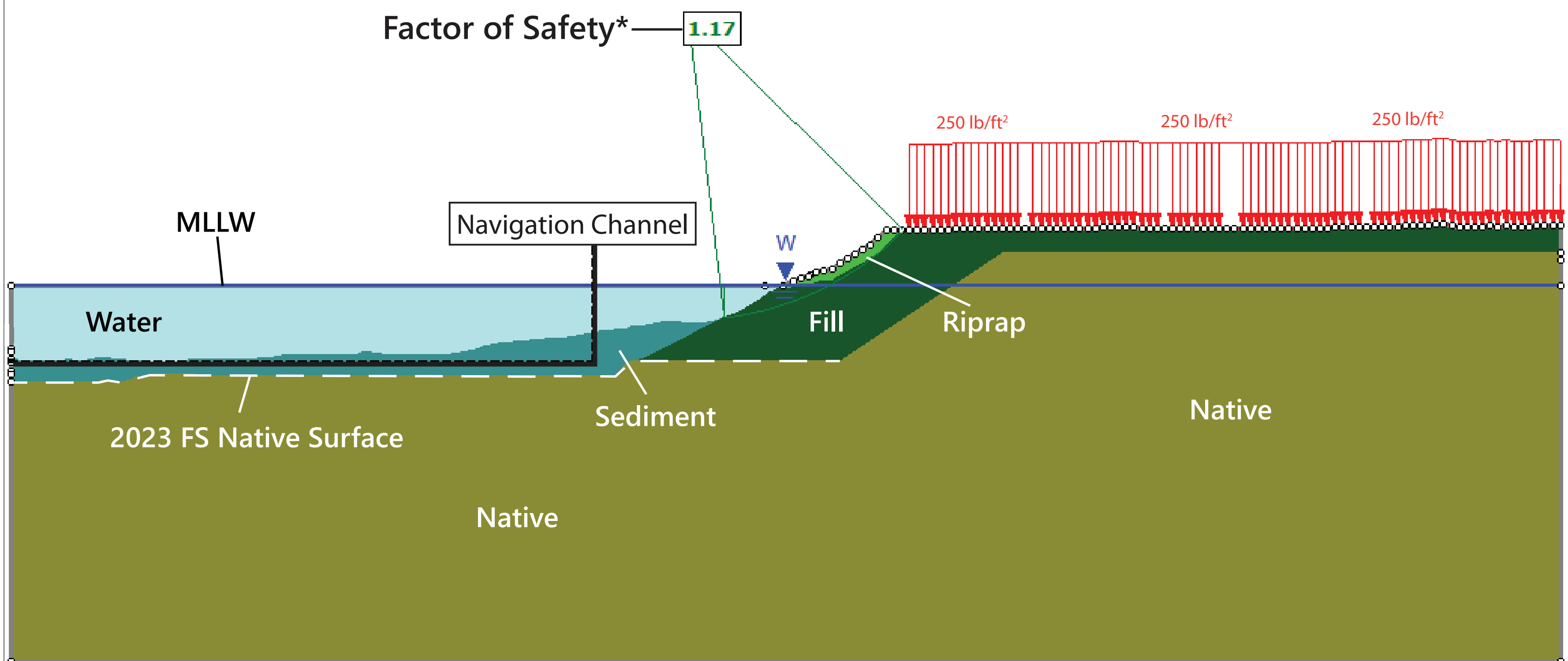
Figure E-A-1a
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-B



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

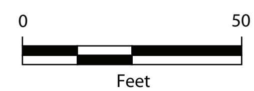


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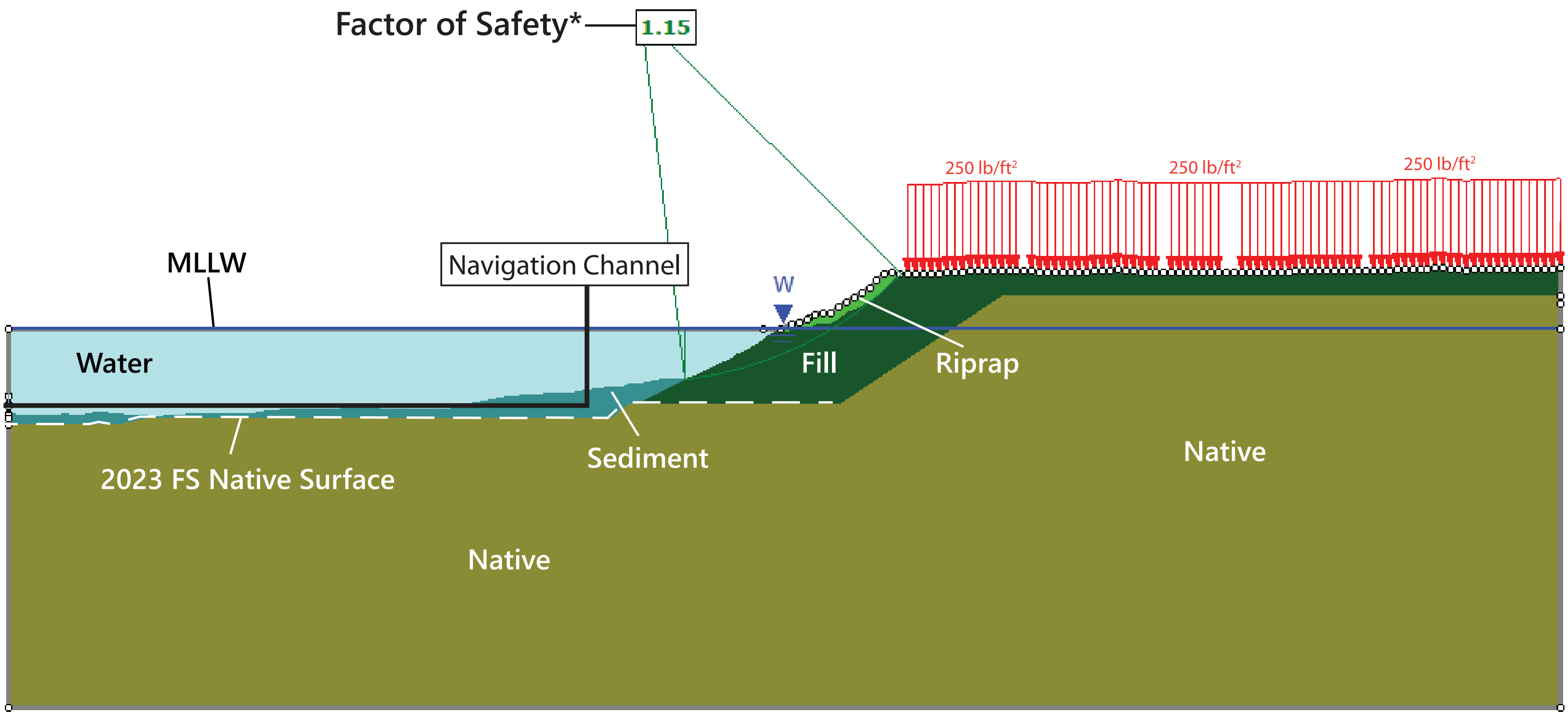
Figure E-A-1b
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-C



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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Feet

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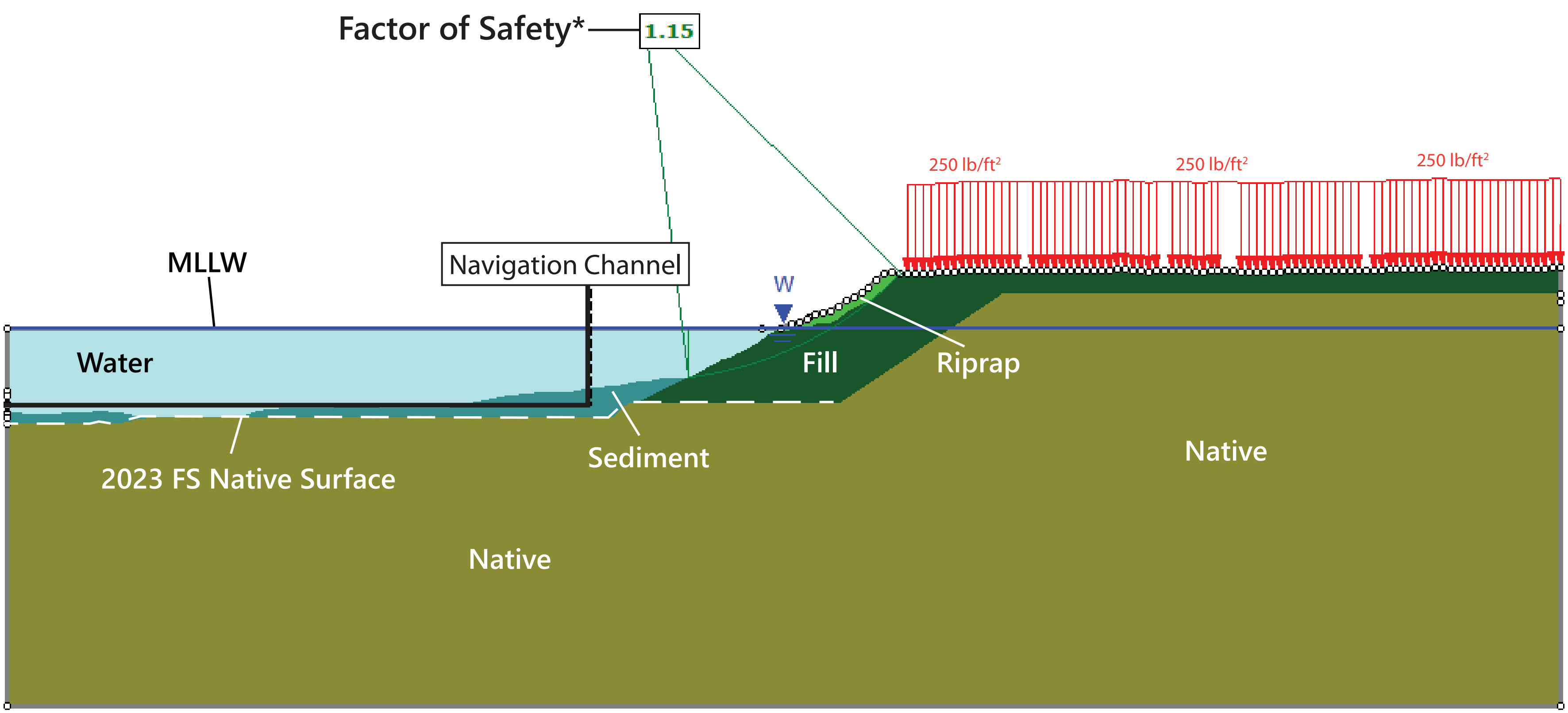
Figure E-A-1c
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-D



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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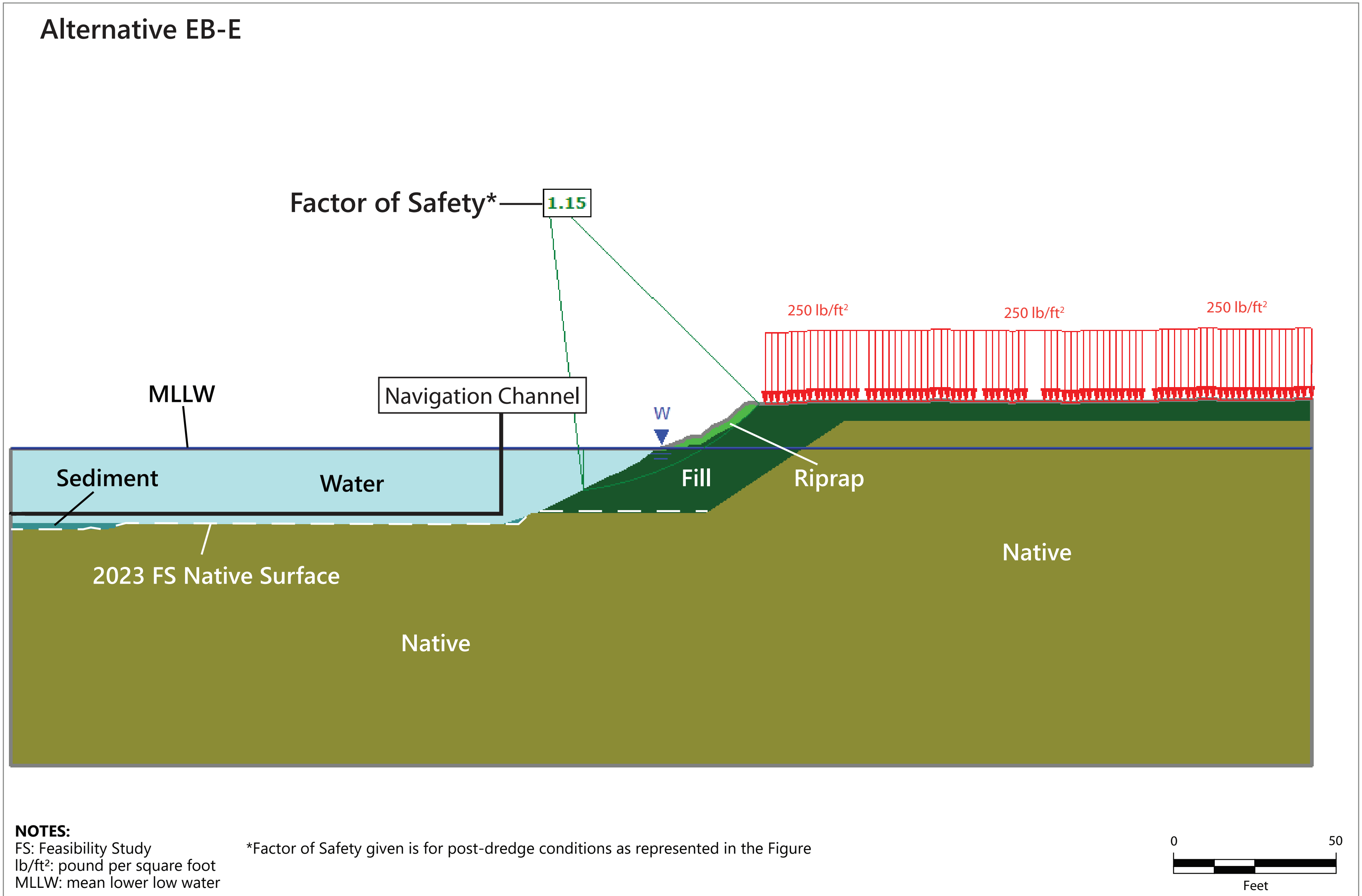
Figure E-A-1d
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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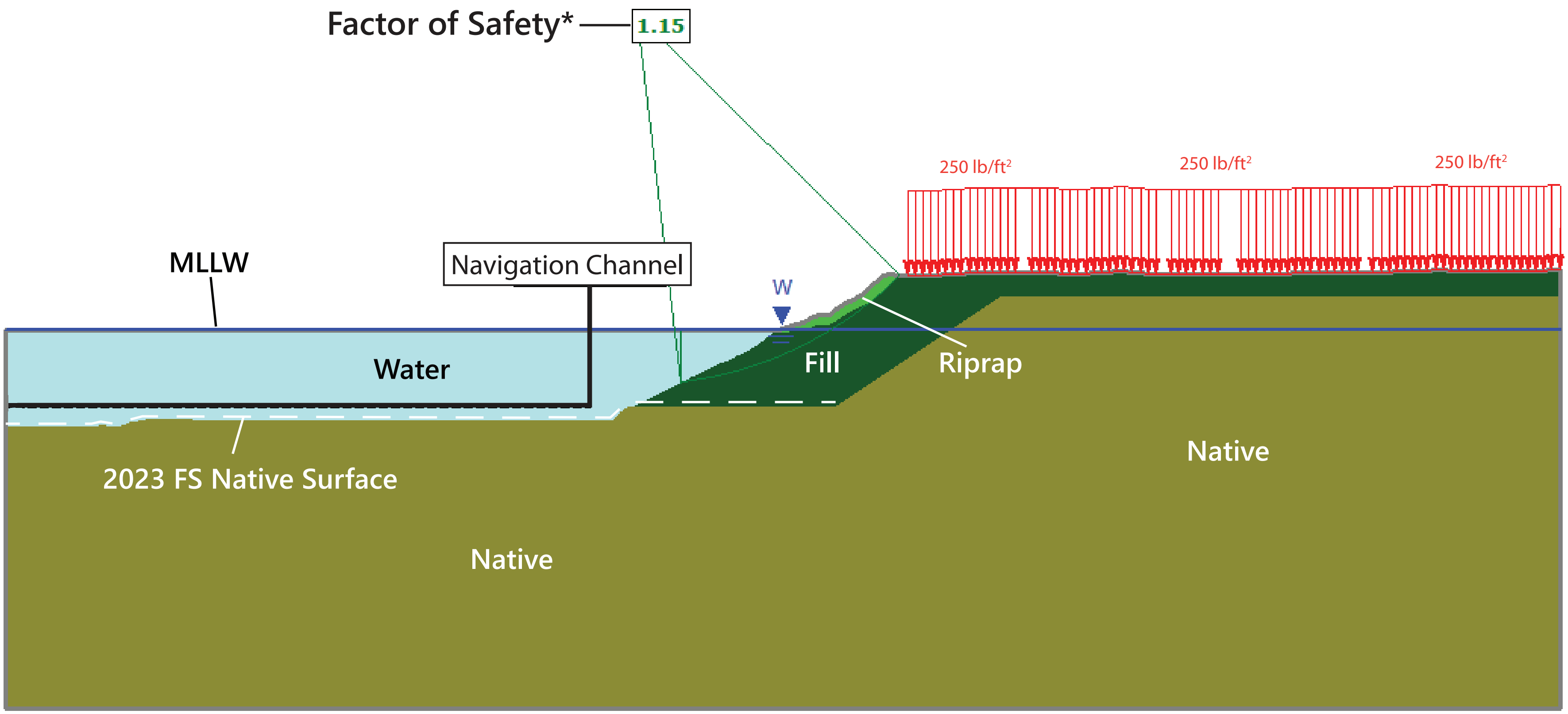
Figure E-A-1e
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-F



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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Feet

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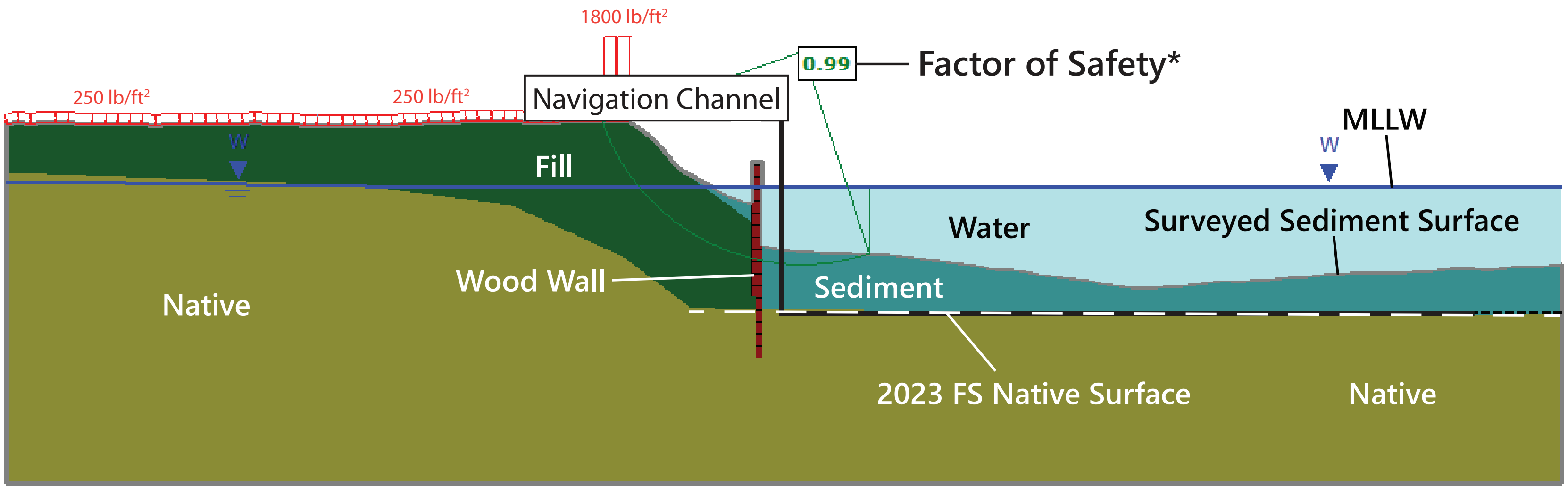
Figure E-A-1f
Example Slope Stability Results: Shoreline/Riprap (STA 253+50)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-A



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for existing conditions as represented in the Figure

0 40
Feet

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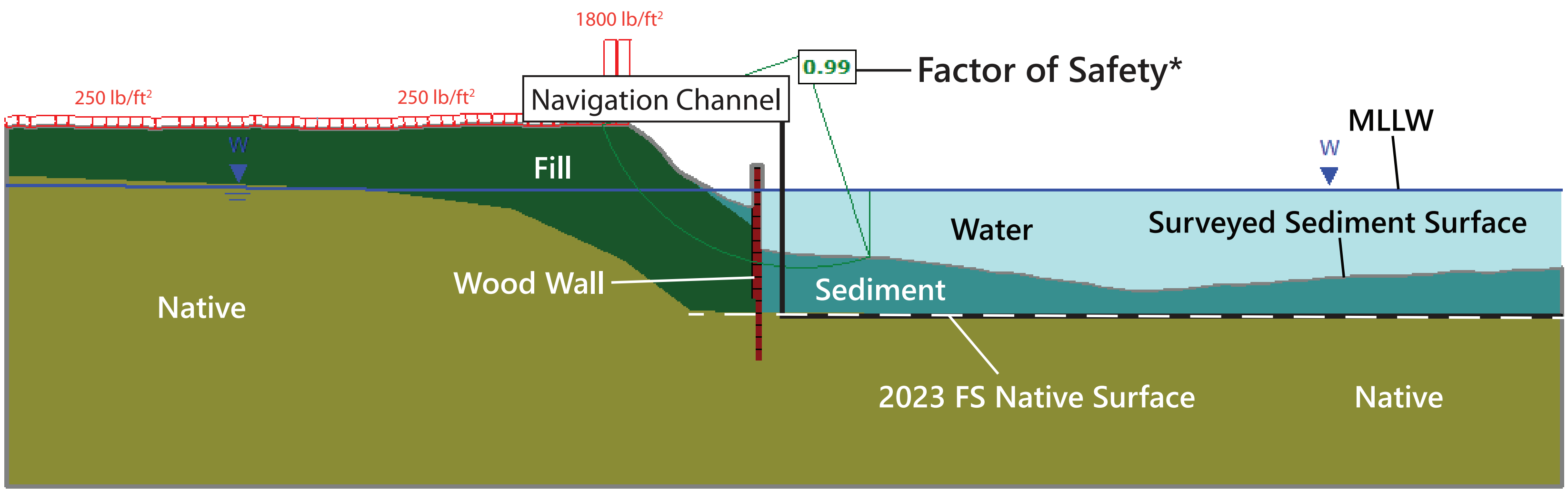
Figure E-A-2a
Example Slope Stability Results: Wood Wall (STA 275+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-B



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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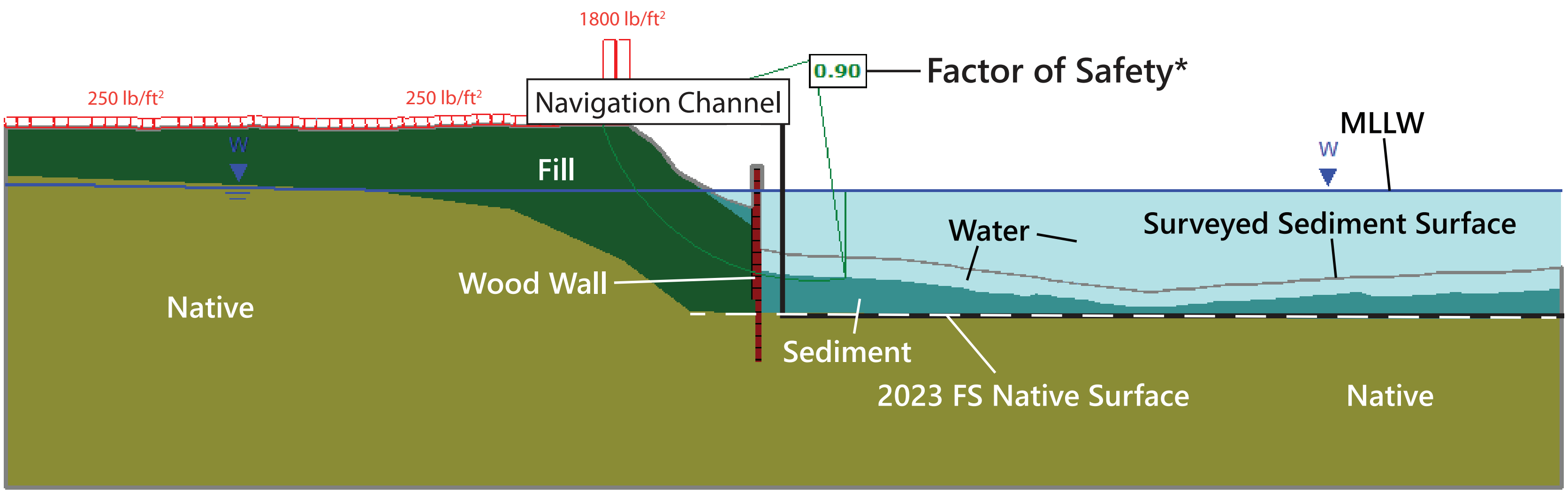
Figure E-A-2b
Example Slope Stability Results: Wood Wall (STA 275+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-C



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

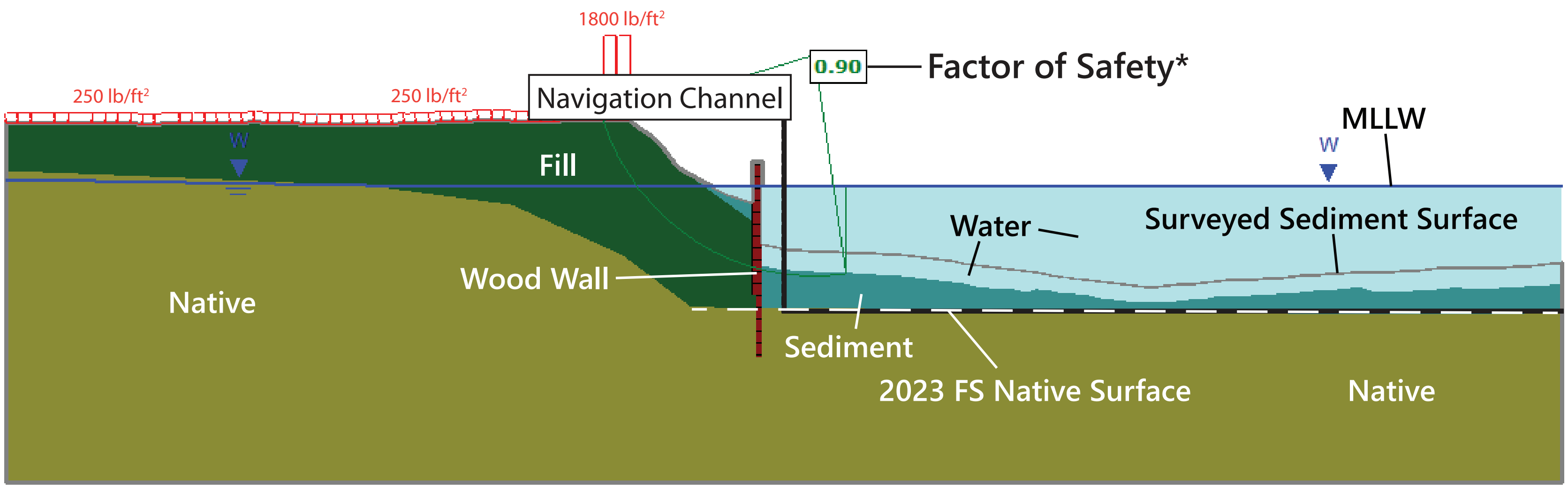
*Factor of Safety given is for post-dredge conditions as represented in the Figure

Figure E-A-2c
Example Slope Stability Results: Wood Wall (STA 275+00)

Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-D



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

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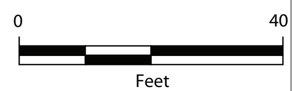

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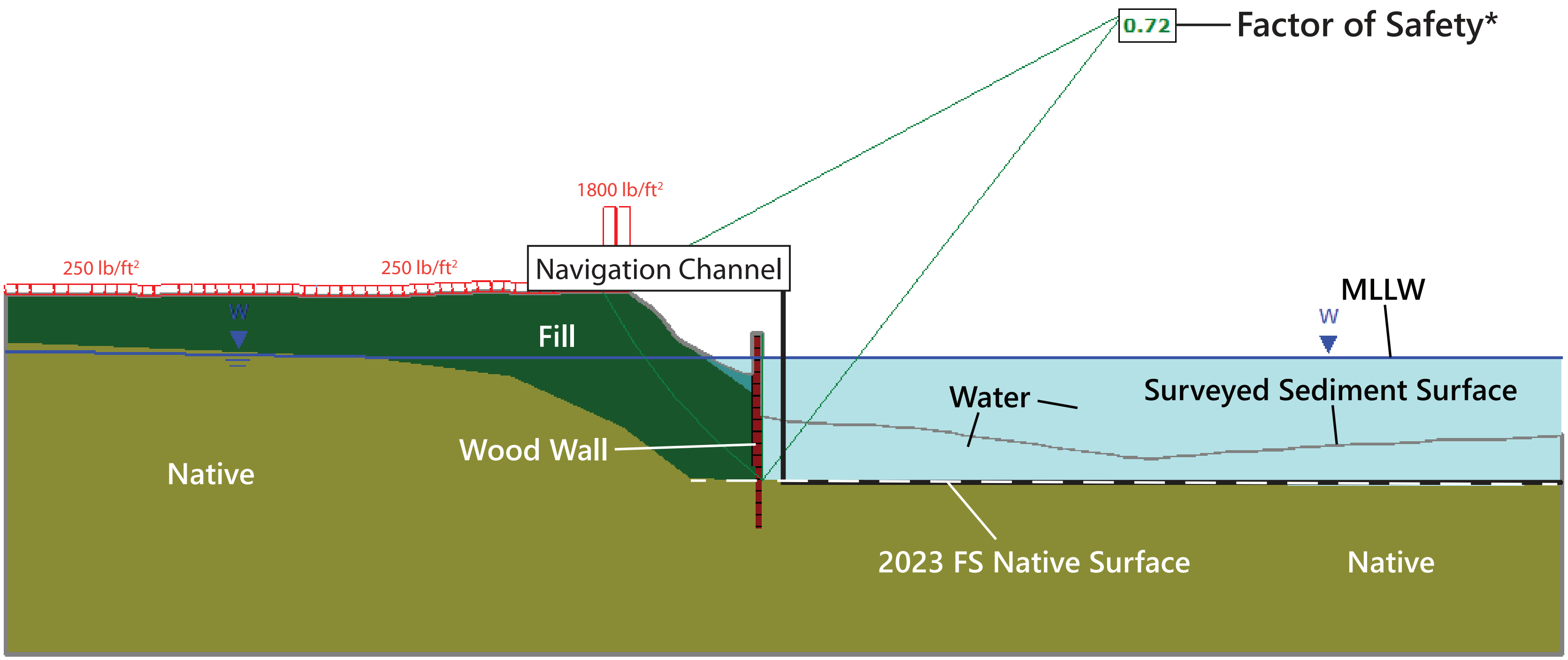
Figure E-A-2d
Example Slope Stability Results: Wood Wall (STA 275+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-E



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

0 40
Feet

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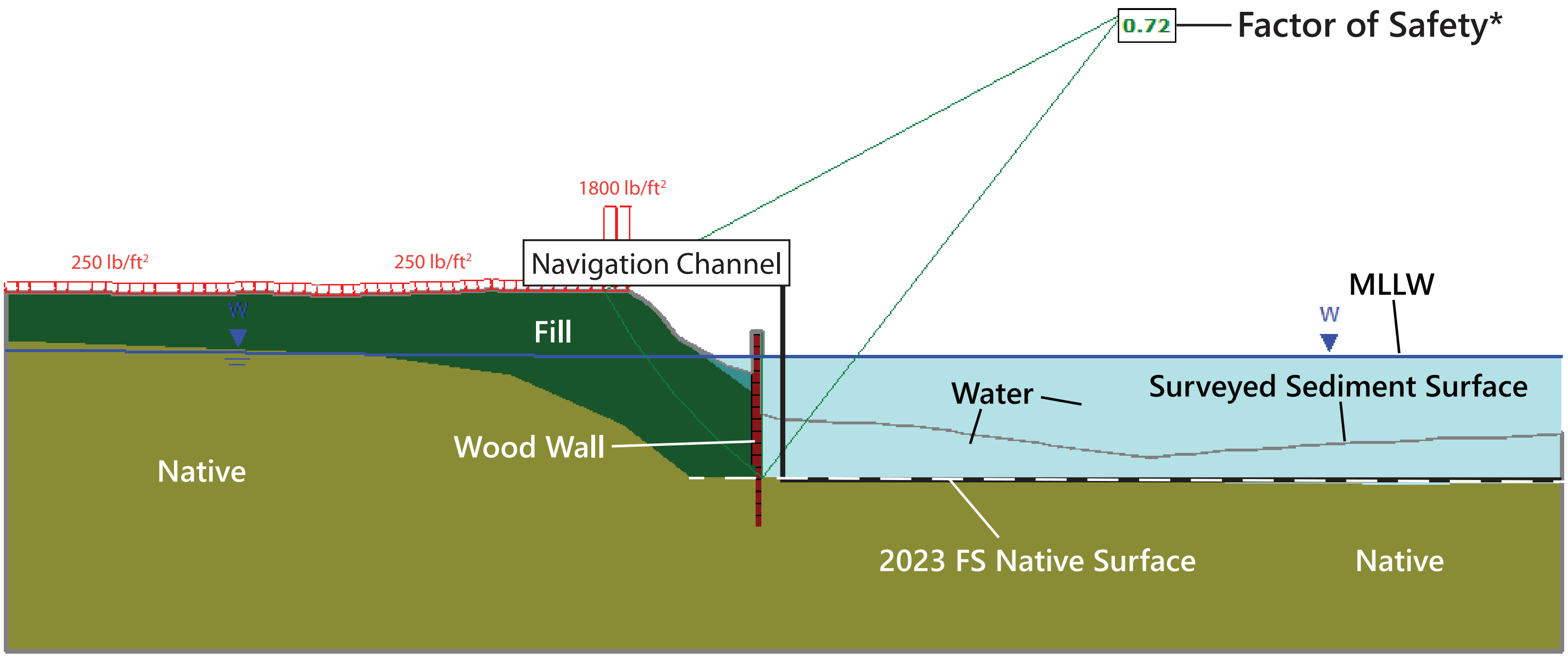
Figure E-A-2e
Example Slope Stability Results: Wood Wall (STA 275+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-F



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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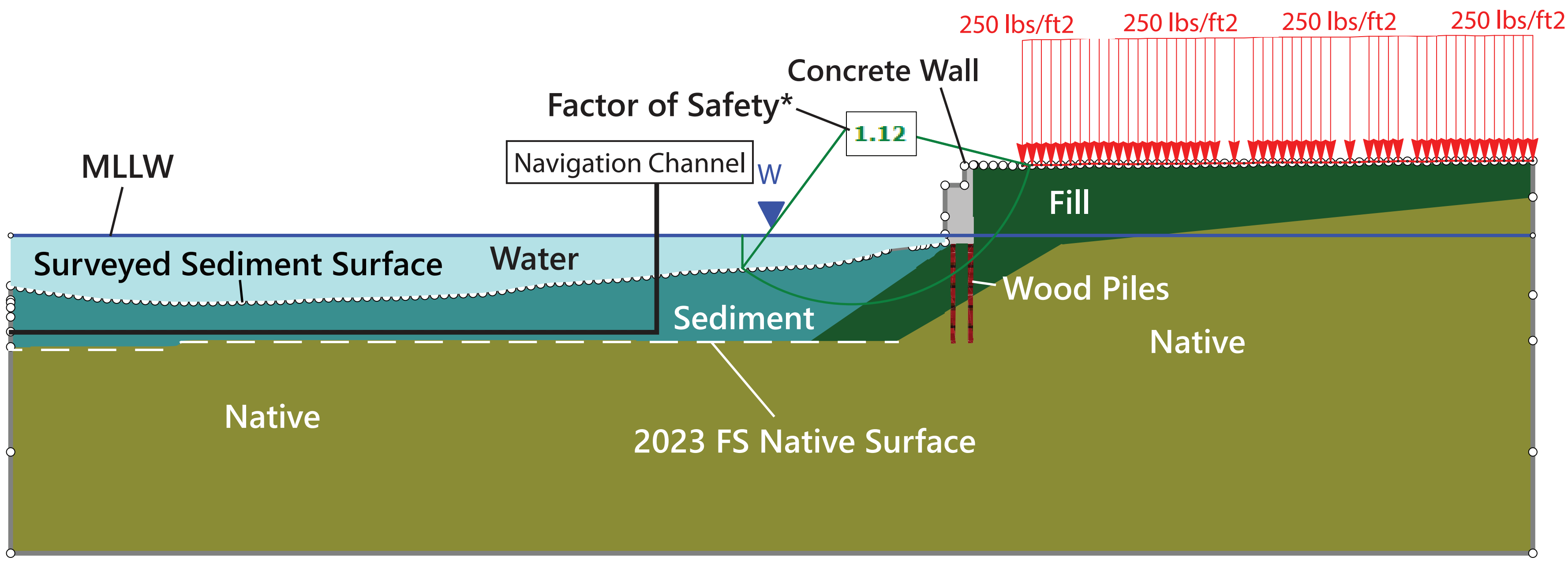
Figure E-A-2f
Example Slope Stability Results: Wood Wall (STA 275+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-A



NOTES:
FS: Feasibility Study
lb/ft^2: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for existing conditions as represented in the Figure

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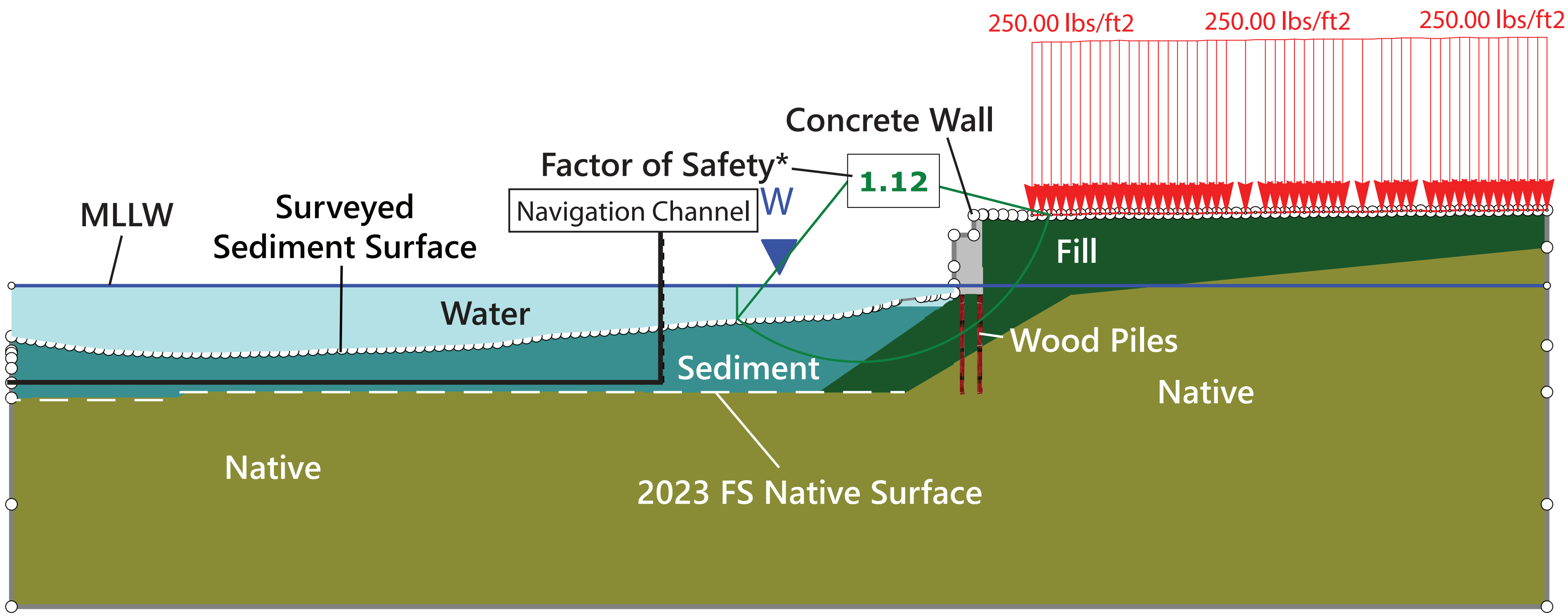
Figure E-A-3a
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-B



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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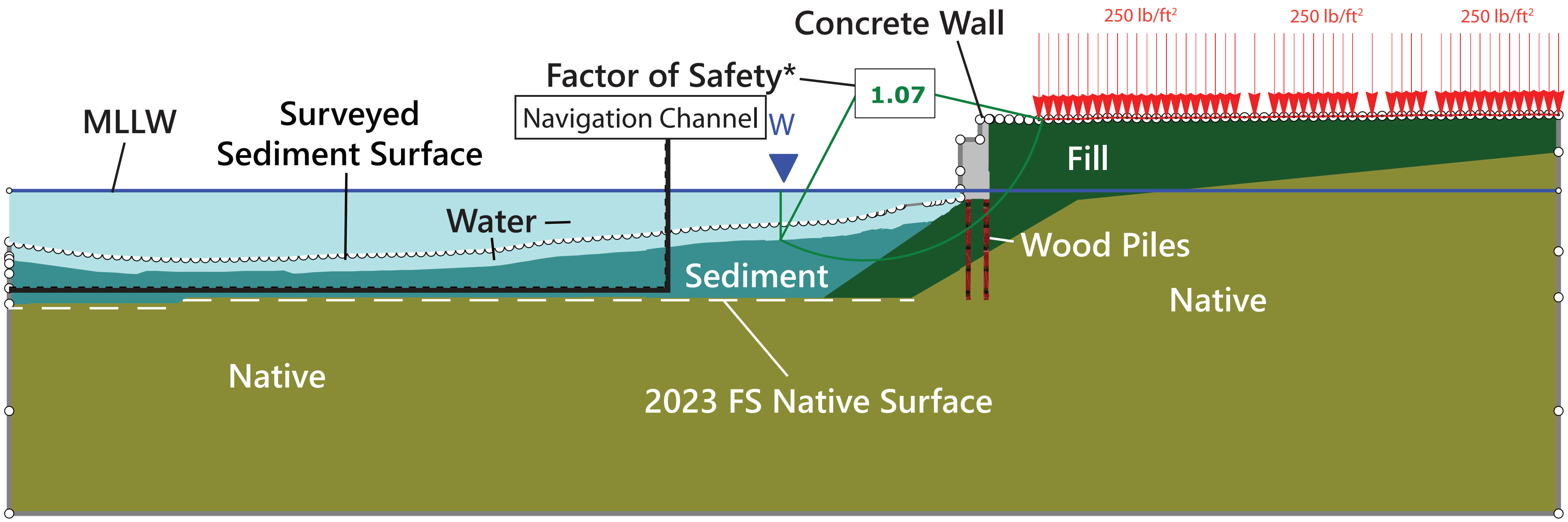
Figure E-A-3b
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-C



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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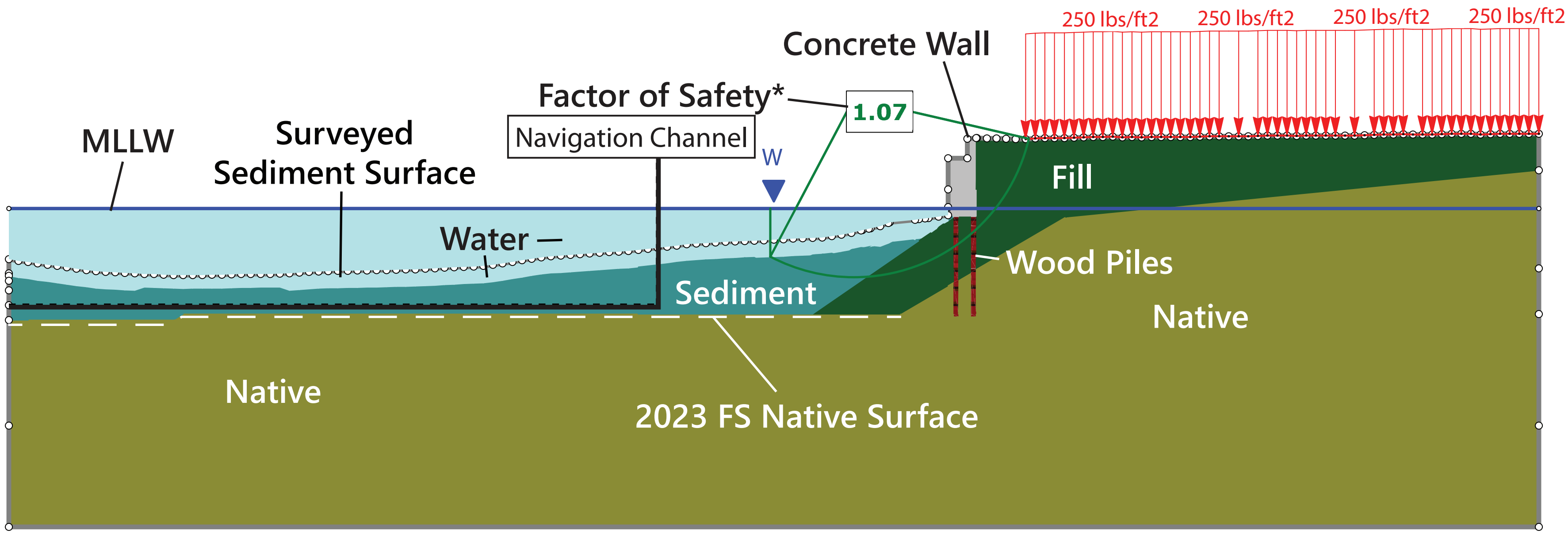
Figure E-A-3c
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-D



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

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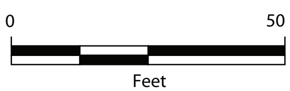

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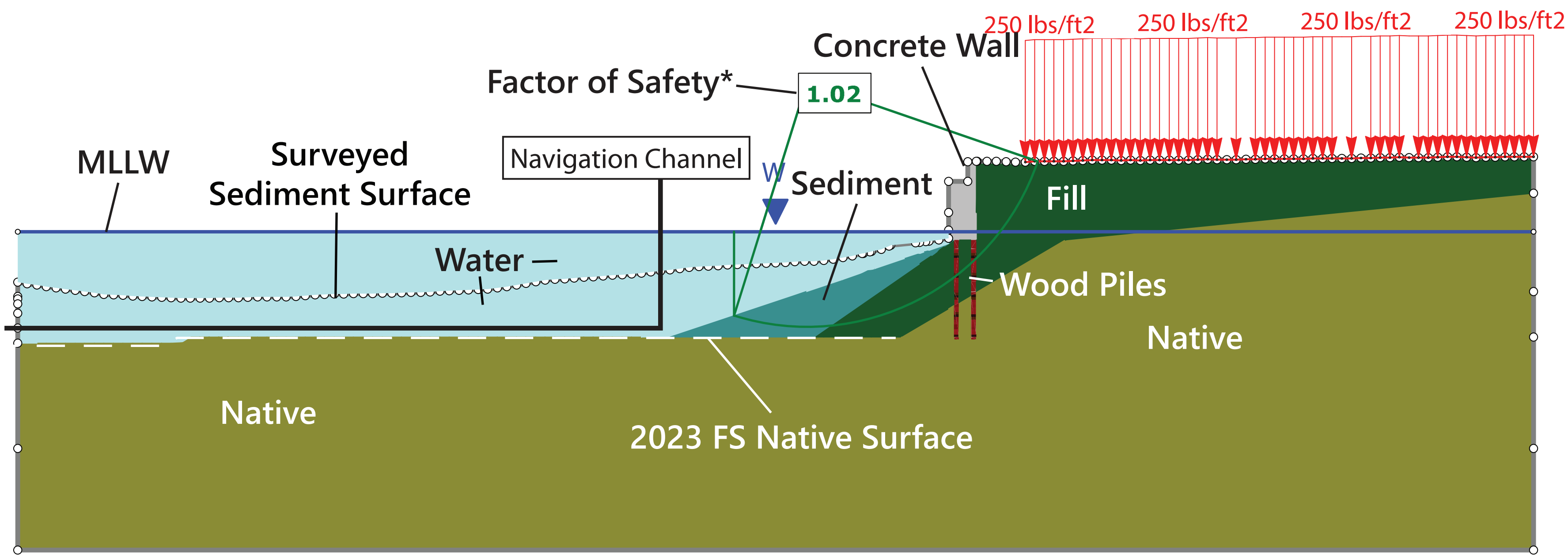
Figure E-A-3d
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-E



NOTES:
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lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

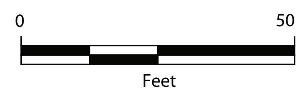

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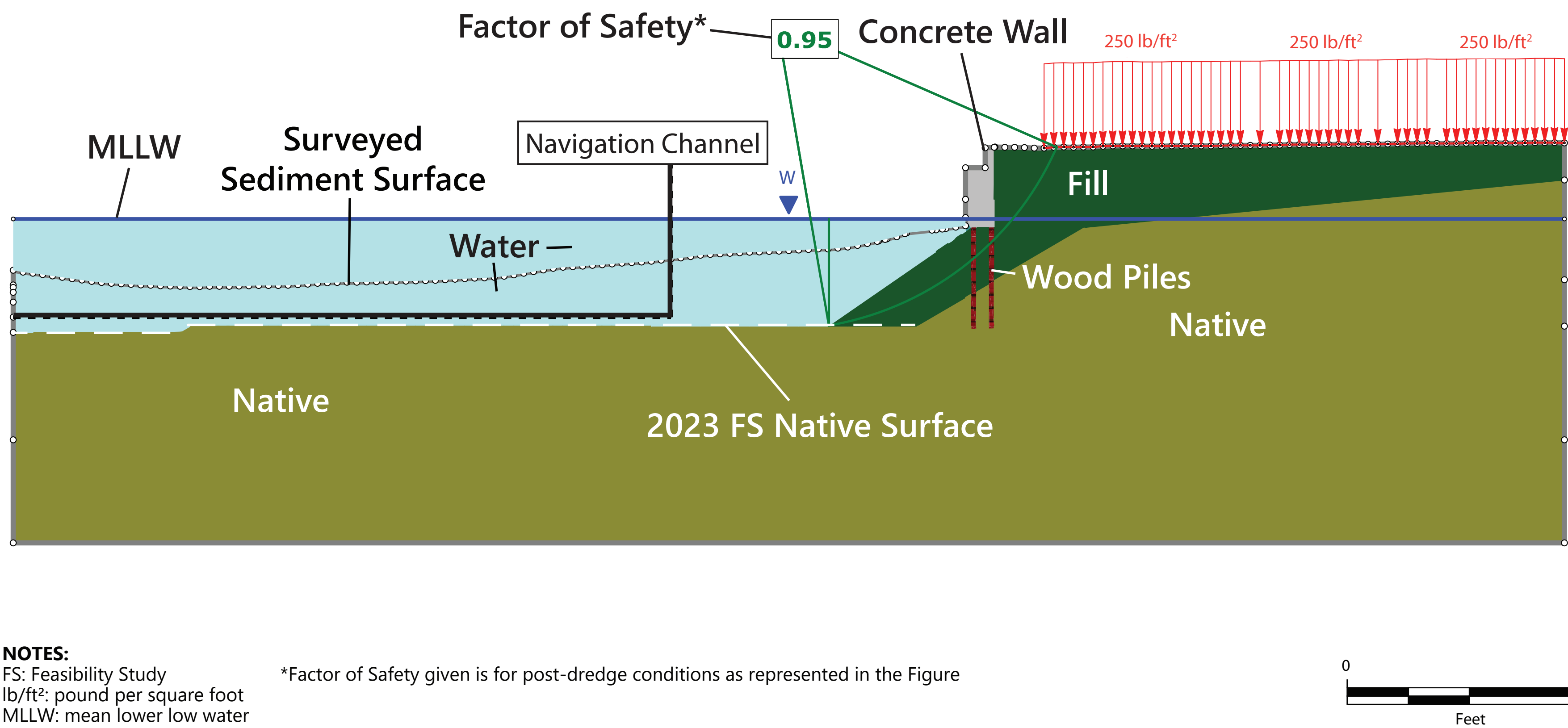
Figure E-A-3e
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-F



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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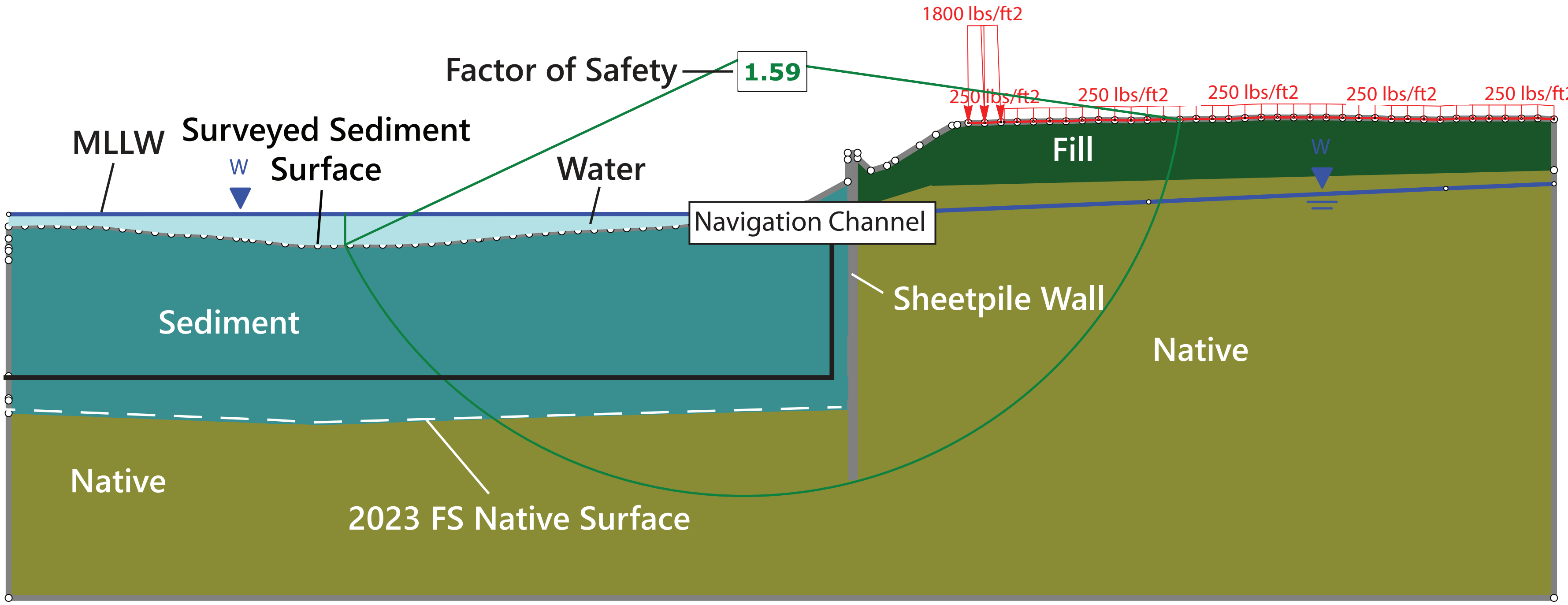
Figure E-A-3f
Example Slope Stability Results: Pile-Supported Concrete (STA 258+00)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-A



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for existing conditions as represented in the Figure

0 20
Feet

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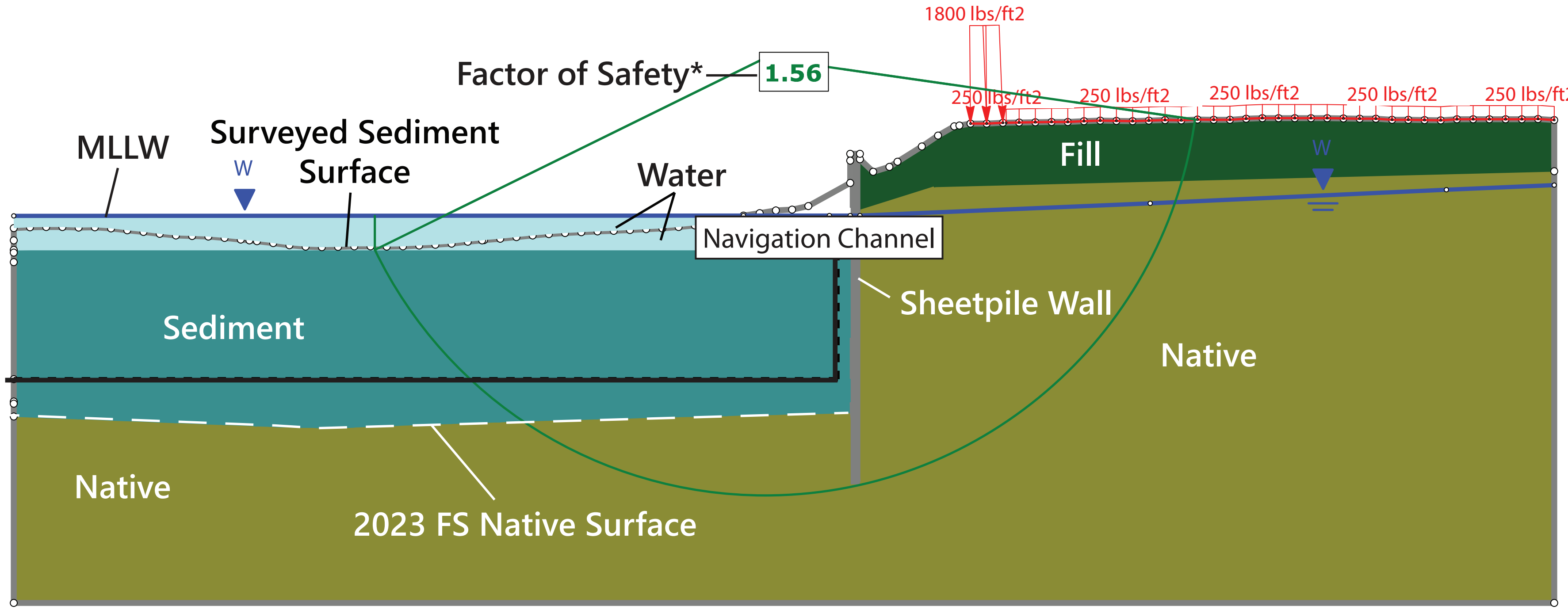
Figure E-A-4a
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-B



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

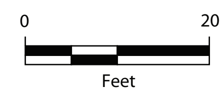


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Figure E-A-4b
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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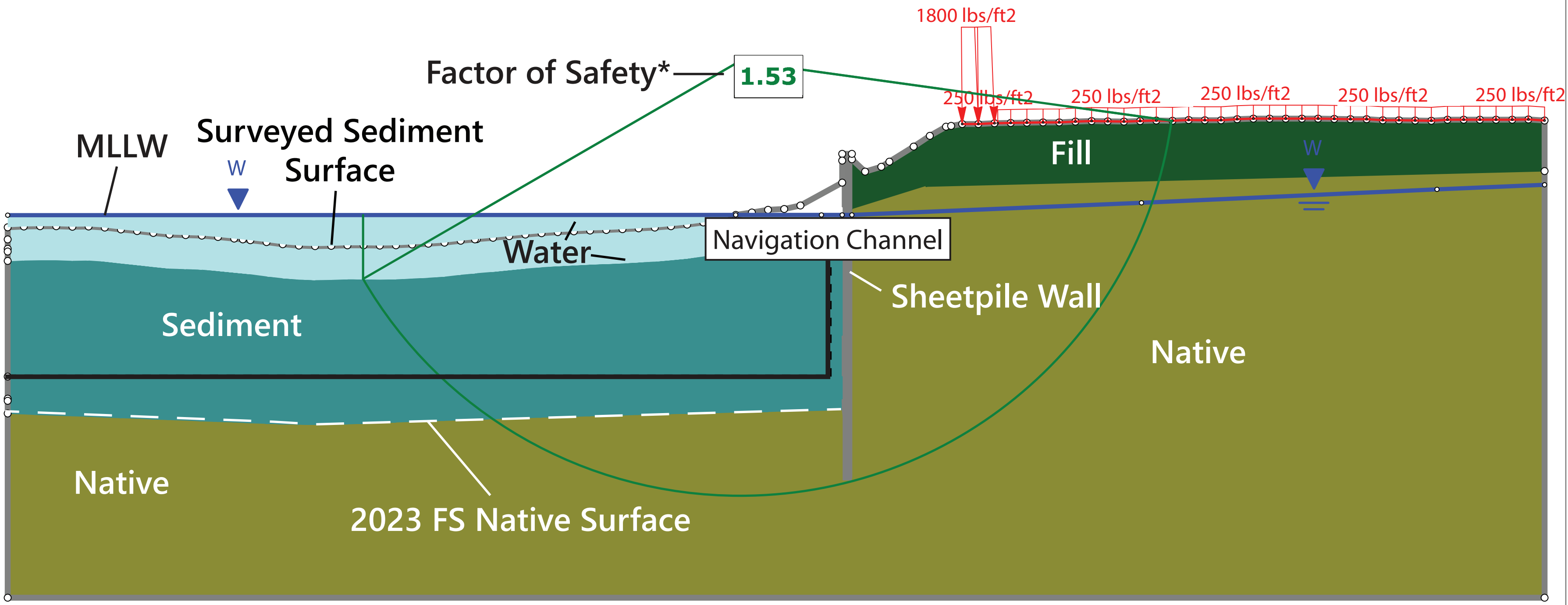
Alternative EB-C



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

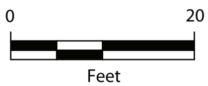


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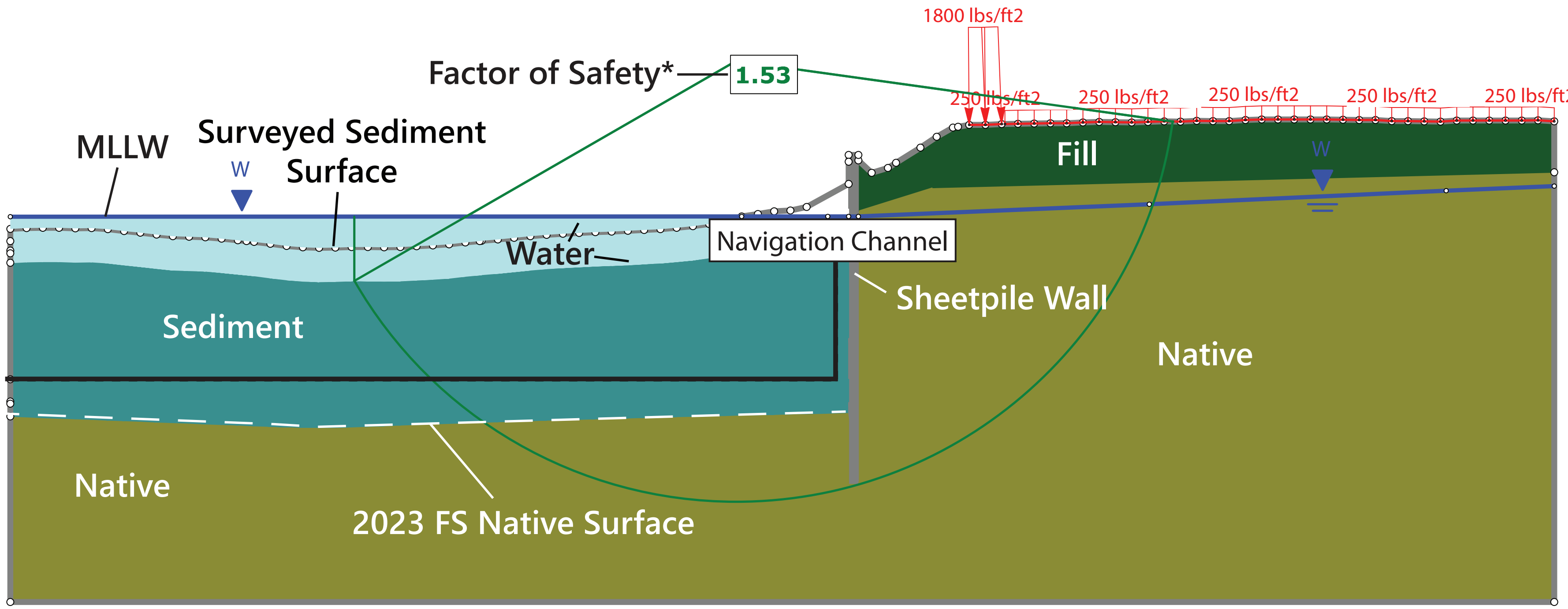
Figure E-A-4c
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-D



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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Figure E-A-4d
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

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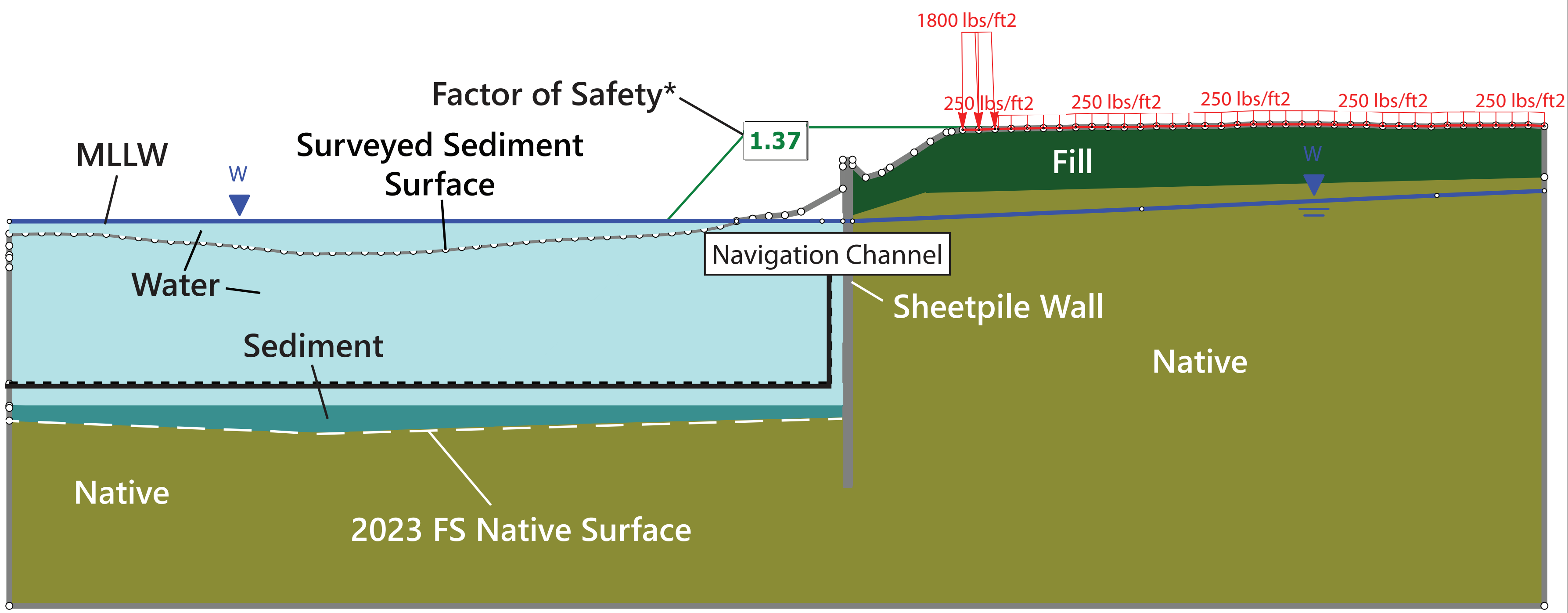
Alternative EB-E



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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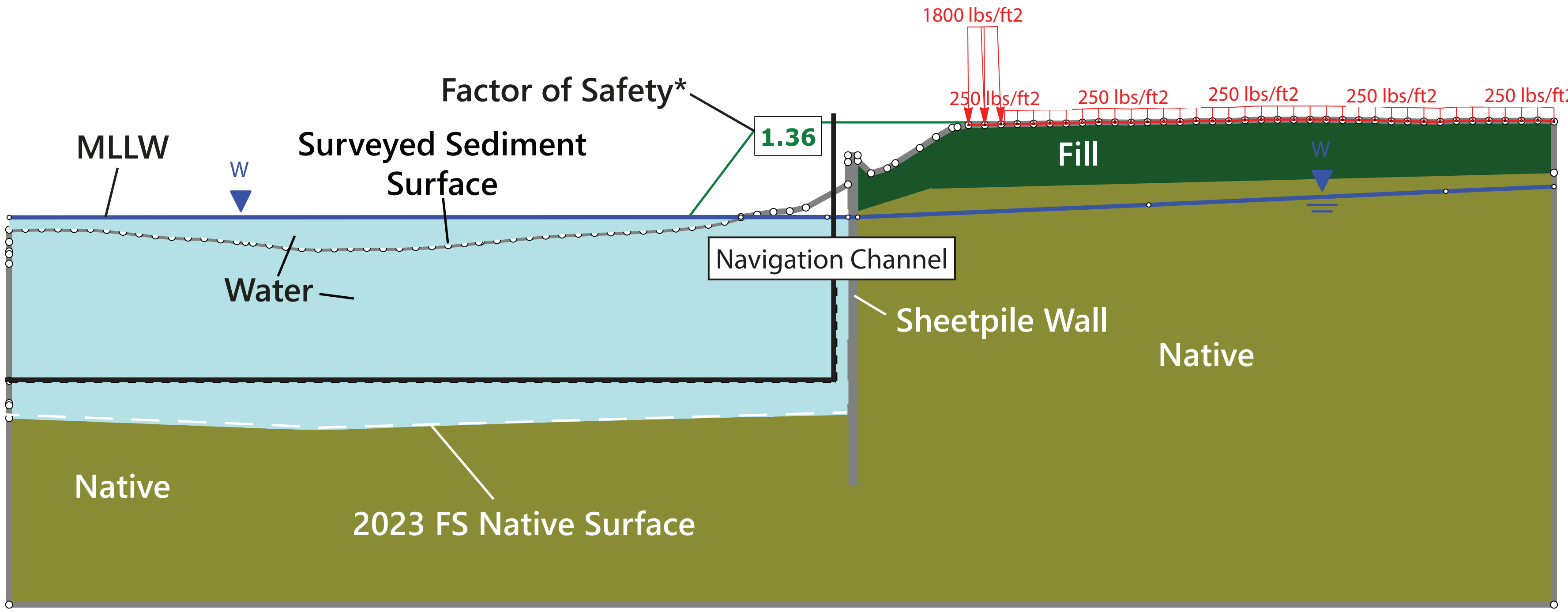
ANCHOR QEA

Figure E-A-4e
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

DRAFT FINAL

Alternative EB-F



NOTES:
FS: Feasibility Study
lb/ft²: pound per square foot
MLLW: mean lower low water

*Factor of Safety given is for post-dredge conditions as represented in the Figure

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Publish Date: 2024/03/17 | User: rpearson
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ANCHOR QEA

Figure E-A-4f
Example Slope Stability Results: Sheet Pile Wall (STA 286+75)
Shoreline/Bulkhead Stability Evaluation
Newtown Creek RI/FS

Attachment E-B
Summary of Existing Shoreline and Bulkhead Conditions

Table E-B-1
Summary of Existing Shoreline and Bulkhead Conditions

Shoreline Station (start)	Shoreline Station (end)	Shoreline Length (feet)	Property Owner	Shoreline Type	Visual Condition Assessment[1]	Modeled Cross Section Station[2]	Evaluation Software	Approximate Shoreline Slope (H:V)	Approximate Vertical Slope Height (feet)	Approximate Bulkhead Cantilevered Height (feet)
253+10	254+10	100	NYC Department of Small Business	Riprap	Fair	253+50	Slide2	1.5H:1V	24	--
254+10	260+46	636	LDT Enterprises/B&H Equipment Rental	Pile-supported Concrete	Fair	258+00	Slide2	--	--	9
260+46	260+92	46	NYCDOT	Vertical Concrete	Fair	260+60	Slide2	--	--	15
260+92	261+40	48	Western Beef Properties	Wood	Fair	261+10	Slide2	--	--	18
261+40	267+30	590	Western Beef Properties	Steel Sheet Pile	Good	264+25	Slide2 + SupportIT	--	--	11
267+30	272+13	483	Western Beef Properties	Wood	Poor	269+75	Slide2	--	--	14
272+13	272+67	54	Amboy Bus Co.	Riprap	Poor	272+50	Slide2	1H:1V	7	--
272+67	273+90	123	Maspeth Concrete Loading Corp.	Wood	Poor	273+75	Slide2	--	--	16
273+90	276+25	235	Maspeth Concrete Loading Corp.	Wood	Poor	275+00	Slide2	--	--	18
276+25	278+60	235	MTA-NYC Transit	Riprap + Steel Sheet Pile	Poor	277+75	Slide2	1.8H:1V	8	N/A
278+60	282+70	410	MTA-NYC Transit	Riprap + Steel Sheet Pile	Poor	280+25	Slide2	1H:1V	9	N/A
282+70	283+60	90	NYCDOT	Steel Sheet Pile w/ Concrete Cap	Fair	283+25	Slide2 + SupportIT	--	--	11
283+60	284+58	98	NYCDOT	Concrete Pier Roadway	Poor	284+10	Slide2	--	--	14
284+58	285+55	97	Mione Transit Mix/Atlantic Hoist and Scaffolding	Wood	Poor	285+10	Slide2	--	--	5.5
285+55	287+34	179	Mione Transit Mix/Atlantic Hoist and Scaffolding	Steel Sheet Pile	Poor	286+75	Slide2 + SupportIT	--	--	6
287+34	289+34	200	Feldman Metropolitan	Precast Concrete Blocks	Poor	288+50	Slide2	--	--	14
289+34	293+43	409	Feldman Metropolitan	Pile-supported Concrete	Poor	290+75	Slide2	--	--	15
293+43	294+42	99	Feldman Metropolitan	Pile-supported Concrete with Steel Sheet Pile	Fair	293+75	Slide2 + SupportIT	--	--	20
294+42	295+51	109	Feldman Metropolitan	Wood	Poor	294+75	Slide2	--	--	20
295+51	297+07	156	NYCDOT	Vertical Concrete	Good	296+00	Slide2	--	--	20
297+07	301+00	393	Natmi Truck Terminals	Riprap	Good	299+50	Slide2	3H:1V	8	--
301+00	304+03	303	Natmi Truck Terminals	Riprap	Good	301+00	Slide2	3H:1V	8	--

Notes:
1: Description of visual condition assessment ratings provided below:
"Good": No evidence of shoreline failure/compromise and little to no apparent degradation from as-built conditions
"Fair": No evidence of shoreline failure, but the shoreline/bulkhead showed signs of degradation, including wear, corrosion, or erosion
"Poor": Evidence of shoreline failure or significant loss of structural integrity
2: Cross section stationing represent measurements in terms of hundreds of feet (e.g., 273+75, representing 27,375 linear feet of measured shoreline from the mouth of the Queens side of Newtown Creek)
--: not applicable
H:V: horizontal to vertical
MTA: Metropolitan Transportation Authority
NYC: New York City
NYCDOT: New York City Department of Transportation

Appendix F
Cost Estimates

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Cost Estimates
East Branch Early Action Focused Feasibility Study

Prepared for Newtown Creek Group

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August 2024
Newtown Creek Remedial Investigation/Feasibility Study

Cost Estimates
East Branch Early Action Focused Feasibility Study

Prepared for
Newtown Creek Group

Prepared by
Anchor QEA
123 Tice Boulevard, Suite 205
Woodcliff Lake, New Jersey 07677

Project Number: E41037-01.01
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TABLE OF CONTENTS

ATTACHED TABLES

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EMBEDDED TABLES

ATTACHMENTS

ABBREVIATIONS

AC	activated carbon
ACBM	articulated concrete block mat
BMP	best management practice
cy	cubic yard
cy/day	cubic yard per day
FFS	Focused Feasibility Study
ISS	in situ stabilization/solidification
N/A	not applicable
NAPL	nonaqueous phase liquid
NPV	net present value
OMB	Office of Management and Budget
PTW	principal threat waste
RD	remedial design
TCC	total construction cost
TCLP	toxicity characteristic leaching procedure
USEPA	U.S. Environmental Protection Agency

1 Purpose and Organization

This appendix presents the approaches and assumptions used in the development of cost estimates for the East Branch Early Action Focused Feasibility Study (FFS) sediment remediation alternatives. As detailed in Section 5 of the FFS, the following six alternatives were evaluated:

- **Alternative EB-A:** No Action
- **Alternative EB-B:** Dredge to Allow Placement of a Cap at or Below 0 Foot MLLW
- **Alternative EB-C:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths
- **Alternative EB-D:** Dredge to Allow Placement of a Cap to Maintain Existing Water Depths with Localized Deeper Dredging
- **Alternative EB-E:** Dredge All Within Navigation Channel, Cap Outside
- **Alternative EB-F:** Dredge All

The cost estimates were developed in accordance with U.S. Environmental Protection Agency (USEPA) guidance (USEPA 2000). This guidance was supplemented with vendor and supplier quotes, online resources (e.g., RS Means or EquipmentWatch), available cost estimates for similar sites, and professional judgment (where appropriate) for use in estimating costs and production rates. Where applicable, regionalization factors and inflation adjustments were used to account for cost-of-living differences and cost increases over time. In addition, site-specific characteristics were considered to inform development of the cost estimates.

Table F1-1 presents a summary of the active alternative cost estimates. All costs presented in this table are undiscounted costs in 2023 dollars. Where applicable, unit rates from prior projects (i.e., using "historical pricing") were adjusted accordingly to 2023 pricing.

Table F1-2 includes the same estimates, but all costs beyond year 0 are presented in terms of net present value (NPV), calculated using a 7% discount factor consistent with USEPA guidance (USEPA 2000). Construction costs were assumed to be incurred proportionally over the duration of in-water work for each of the five active remedial alternatives (e.g., Alternative EB-C has a three-season construction duration, so the construction costs were split over years 0, 1, and 2 according to how much work is projected to be completed in each of these years, then applying the appropriate discount factor to the total cost for that year to obtain the NPV cost for that year), whereas cap maintenance and long-term monitoring costs were assumed to occur during years 0 to 10 following construction. Cap maintenance and long-term monitoring costs beyond 10 years would be considered under the Operable Unit 1 Feasibility Study process.

Tables F1-3a through F1-3e present total cost and unit cost backups for each of the five active remedial alternatives.

The remainder of this appendix details the following:

- The method for developing unit rate costs estimates for the construction cost items, including the following:
  - Defining the construction items
  - Methods for developing quantities for each construction item
  - Detailed discussion of the cost approach for each construction item
- Project quantities for each of the alternatives, including the following:
  - Methods used to develop project quantities
  - Assumptions for project quantities

A sensitivity analysis was completed (see Section 3.6) consistent with USEPA guidance (USEPA 2000) for factors that have a relatively high degree of uncertainty that, with only a small change in their value, could significantly affect the overall cost of the alternative. Those factors are as follows:

- Discount factor used to determine the NPV cost
- Bulkhead stabilization, replacement, and installation costs

2 General Cost Estimate Notes

All assumptions, quantities, and unit prices used in this cost estimate are preliminary, for the purposes of the FFS. Cost estimates will be further refined during future design development efforts for the selected remedial alternative. All costs are provided in present-day dollars, except where noted, and all cost expenditures are assumed to occur at the start of construction. Costs do not include agency oversight efforts.

These costs have been developed using currently available information regarding site characteristics, such as site bathymetry, understanding of potential debris from Remedial Investigation/Feasibility Study and Treatability Study investigations, and physical and chemical properties of the existing sediment at the site. As information regarding these site characteristics changes or new information becomes available, these costs will be subject to change. Consistent with USEPA guidance (USEPA 2000), these cost estimates for detailed analysis of alternatives are expected to be accurate within the range of -30% to +50%.

These estimates were developed using current and generally accepted engineering cost estimation methods. Note that these estimates are based on assumptions concerning future events, and actual costs may be affected by known and unknown risks including, but not limited to, changes in general economic and business conditions; site conditions that were unknown to Anchor QEA at the time the estimates were performed; future changes in site conditions; regulatory or enforcement policy changes; and delays in performance. Actual costs may vary from these estimates and such variations may be material. Anchor QEA is not licensed as accountants or securities attorneys and, therefore, makes no representations that these costs form an appropriate basis for complying with any financial reporting requirements for such costs.

3 Unit Cost Development

This section presents the assumptions and the cost approach used for each construction item.

3.1 Construction Cost Items

Attachment A contains worksheets for each construction cost estimate line item organized by alternative, with the exception of Alternative EB-A, which has no cost because it involves no action:

- **Alternative EB-B:** Tables F-A-1a through F-A-1aa
- **Alternative EB-C:** Tables F-A-2a through F-A-2aa
- **Alternative EB-D:** Tables F-A-3a through F-A-3aa
- **Alternative EB-E:** Tables F-A-4a through F-A-4aa
- **Alternative EB-F:** Tables F-A-5a through F-A-5aa

The construction costs were developed under the following assumptions:

- **Pre-Design Investigations:** The exact activities that would be included in pre-design investigations for each alternative have not been formally developed for the FFS, and the costs presented in this appendix are based on experience with recent pre-design investigations on sediment sites with similar scopes of work. It is expected that pre-design investigations would include shoreline and bulkhead studies (including site, bulkhead, structural, and both upland and in-water geotechnical conditions studies and analyses, as detailed in Section 6 of Appendix E of the FFS), a debris survey, additional sediment and geotechnical sample analyses, a bench scale in situ stabilization/solidification (ISS) treatability study, and additional waste characterization, as necessary, following the selection of the preferred remedial alternative but prior to the completion of the remedial design (RD). The cost for pre-design investigations was assumed to be higher for alternatives that include deeper dredging to account for pre-design investigations associated with shoreline/bulkhead stabilization measures included in the active alternatives and more accurate vertical delineation of the depth of contamination where removal of all contaminated sediment is targeted. For instance, a complete dredge alternative (e.g., EB-E in many areas outside of the Western Beef Slip or EB-F) would require rigorous pre-design investigations adjacent to shorelines and bulkheads, and the density of coring to delineate the native surface elevation would be far greater than would be needed for alternatives with a nominal thickness dredge cut intended to facilitate cap placement (e.g., EB-B, EB-C, EB-D, or EB-E in the Western Beef Slip).
- **Mobilization:** These costs are associated with mobilizing personnel, equipment, and materials and were assumed to be different for initial mobilization and interim winterization and remobilization for alternatives that would require multiple construction seasons to implement. The assumptions for these items are as follows:

- **Initial Mobilization:** The lump sum costs were assumed to be 6% of a subset of the total construction cost (TCC)[1] that includes project facilities; shoreline work; ISS; dredging, material processing, and water treatment; backfill, capping, and outfall protection material placement; inspections and surveying; and site restoration. Mobilization percentage costs were not applied to transportation, off-site sediment processing, and disposal because these are assumed to be conducted by a third-party contractor or vendor, as opposed to the prime construction contractor. These assumptions are based on experience on previous projects with similar scope. They include assumed costs for launching equipment to perform work upstream of the Grand Street Bridge to recognize the additional effort that will be required.
- **Winterization and Remobilization:** The lump sum costs were assumed to be 2.5% of the same subset of TCC discussed previously for initial mobilization for each occurrence. This assumption is based on experience on previous projects with similar scope. Similar to the initial mobilization, these percentage-based costs accounts for demobilizing and remobilizing equipment upstream of the Grand Street Bridge.

- **Project Facilities:** The costs associated with project facilities include the following items:
  - **Staging Area Lease:** The costs include the monthly rental of a 1.5-acre parcel of land with waterfront access. For the purposes of this FFS, a preliminary evaluation was performed to identify underused parcels along Newtown Creek, and it was assumed that one or more of the identified underused parcels could be used as the upland staging area. The land would be used to stage on-site personnel, equipment, and materials; provide access to the project area; and load backfill and capping materials. Refer to cost estimating worksheets F-A-1a, F-A-2a, F-A-3a, F-A-4a, and F-A-5a and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - **Site Preparation Work:** The lump sum costs were assumed to include the personnel, equipment, and materials required to construct the staging area and to erect temporary perimeter fencing for security purposes. It was assumed that the staging area parcel would be in a state of disrepair and would require the following elements to be placed over the entire staging area, beginning with the base (lowest) layer:
    - Compacted 6-inch-dense-graded aggregate layer
    - Non-woven geotextile
    - Asphalt pavement

[1] The TCC includes costs associated with project facilities development; dredging, dredged material dewatering, and water treatment; transportation, processing, and disposal; backfill placement and capping; inspections and surveying; site restoration; and environmental monitoring.

The lump sum costs also include site preparation (e.g., stabilization) along the shoreline of the staging area to facilitate equipment use along the shoreline for loading of backfill and capping materials. A limited volume (i.e., approximately 2,000 cubic yards [cy]) of access dredging has been assumed to provide adequate draft for berthing backfill and cap material transport scows directly adjacent to the shoreline. Refer to cost estimating worksheets F-A-1b, F-A-2b, F-A-3b, F-A-4b, and F-A-5b and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

  - **Temporary Facilities and Utilities:** The monthly costs were assumed to include electrical hookup, office complex rentals and utilities (i.e., monthly water and electric services), light towers, Conex storage containers, portable restrooms, work trucks, and dumpster services for general refuse. Refer to cost estimating worksheets F-A-1c, F-A-2c, F-A-3c, F-A-4c, and F-A-5c and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

- **Bulkhead Work[2]:** Three separate shoreline stabilization techniques involving bulkheads were included in the remedial alternatives based on location- and alternative-specific details. The assessment of shorelines and bulkheads (see Appendix E of the FFS) identified the type of bulkhead work proposed under each alternative and, consequently, informed the mitigation measures (e.g., bulkhead stabilization) included in the cost estimate. Costs were developed for the following items:
  - **Bulkhead Stabilization:** The per linear foot cost was assumed to include personnel, equipment, and materials necessary to stabilize a bulkhead via tiebacks to a tieback wall. The tieback wall was assumed to be approximately 20 feet tall and constructed with AZ36 piles driven flush to the existing ground surface; tiebacks were assumed to be installed every 5 feet. Refer to cost estimating worksheets F-A-1d, F-A-2d, F-A-3d, F-A-4d, and F-A-5d and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - **Bulkhead Installation:** The per linear foot cost was assumed to include personnel, equipment, and materials to install a bulkhead in an area that does not currently have a bulkhead. The newly installed bulkhead was assumed to be constructed with AZ36 piles and to be approximately 45 feet tall, with an approximately 15-foot exposed height and 30-foot embedment depth. Refer to cost estimating worksheets F-A-1e, F-A-2e, F-A-3e,

[2] This cost estimate has been developed for an FFS, and detailed sheet pile designs have not been completed; however, the costs were developed using best professional judgement and knowledge of other bulkheads recently constructed within the region. Site-specific sheet pile designs and associated details will be determined during RD.

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F-A-4e, and F-A-5e and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

  - **Bulkhead Replacement:** The per linear foot cost was assumed to include personnel, equipment, and materials to replace an existing bulkhead, including removal of part or all of the existing bulkhead. Removal also assumed disposal of metal debris after removal (i.e., no salvage potential). The newly installed bulkhead was assumed to be constructed with AZ36 piles and to be approximately 45 feet tall, with an approximately 15-foot exposed height and 30-foot embedment depth. Refer to cost estimating worksheets F-A-1f, F-A-2f, F-A-3f, F-A-4f, and F-A-5f and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - **Sealed Bulkheads:** The use of sealed bulkheads for controlling an upland source(s) was assumed to be needed for 20% of the length requiring existing bulkhead replacement or new installation based on shoreline stability evaluations. However, the actual locations of sealed bulkheads would be determined during the RD phase and may not necessarily coincide with bulkhead installation for shoreline stability. Consistent with the alternative description comments received from USEPA (Schmidt 2024), the cost associated with applying a sealant is included in this appendix as a unit cost premium assumed to be approximately 20% in addition to the unit cost for installing or replacing bulkheads, based on experience on similar projects. The costs for bulkhead sealant were not developed through detailed worksheets similar to other remedial elements given the nature of their development as percentage-based items. Refer to Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- **Remedial Technologies:** The remedial technologies included in the evaluation of remedial alternatives are institutional controls, ISS, dredging and debris removal, dredged material processing (dewatering/water treatment, transportation, off-site sediment processing, disposal of debris, and processed dredged material), ex situ treatment (i.e., stabilization/solidification), and backfill and cap material placement. Additional details regarding the development of costs for the remedial technologies are presented in Section 6 of the FFS and Section 3.3 of this appendix.
- **Environmental Controls:** The lump sum costs assumed that a mobile resuspension control system (i.e., a "moon pool" constructed with two turbidity curtains) would be included during ISS and dredging operations. In addition, it was assumed that lengths of 50-foot turbidity curtain sections would be deployed during ISS and dredging activities and maintained weekly by contractor personnel in work boats for the duration of those activities. Refer to cost estimating worksheets F-A-1y, F-A-2y, F-A-3y, F-A-4y, and F-A-5y and Tables F3-1a through

F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

- **Inspections and Surveying:** The lump sum costs assumed that multibeam bathymetric surveys would be performed prior to construction and following the completion of dredging, backfilling, and capping within each compliance unit (i.e., dredge management unit or cap certification unit) to confirm that the compliance unit has been dredged and backfilled or capped to the design elevation. In addition, it was assumed that single-beam bathymetric surveys would be performed twice per week over an approximate 1-acre footprint to track progress. Costs for pre-construction structural inspections and structural monitoring surveys of adjacent structures were also included in this line item (including vibration monitoring). Finally, it was assumed that identification and surveying of utilities would be performed prior to beginning work. Refer to cost estimating worksheets F-A-1z, F-A-2z, F-A-3z, F-A-4z, and F-A-5z and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- **Site Restoration:** The lump sum costs were assumed to include the personnel, equipment, and materials to deconstruct the staging area, regrade the staging area as needed, dispose of general refuse and waste materials (e.g., geotextile, dense-graded aggregate, or pavement), and repave the staging area. Refer to cost estimating worksheets F-A-1aa, F-A-2aa, F-A-3aa, F-A-4aa, and F-A-5aa and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- **Demobilization:** The lump sum costs were assumed to be 6% of the TCC, excluding transportation, off-site sediment processing, and disposal, because these are assumed to be conducted by a third-party contractor or vendor, as opposed to the prime construction contractor. The demobilization assumptions include costs associated with demobilizing equipment from upstream of the Grand Street Bridge.
- **Environmental Monitoring:** This lump sum cost was assumed to be 3% of the TCC based on recent experience on similar projects and includes costs for water quality monitoring and air or dust monitoring during construction activities.
- **Ancillary Activities:** Costs for decontamination of equipment, plans, permits, and health and safety measures are assumed to be distributed across Mobilization/Demobilization and various professional/technical service items (see Section 3.2), including Project Management, Engineering Design, and Construction Management, consistent with USEPA cost estimating guidance (USEPA 2000). These ancillary activities are not included in the cost estimate as a standalone line item(s).

3.2 Professional/Technical Services Cost Items

Professional/technical services costs include elements that are not directly involved with efforts or expenses in completing the work. Some of these professional/technical services costs (e.g., taxes, overhead, or profit) were applied to each individual construction cost line item on a pro rata basis, whereas other professional/technical services costs were estimated as stand-alone cost items (e.g., project management, engineering design, or construction management).

The following professional/technical services costs were applied on a pro rata basis to the construction costs, resulting in a total unit cost for each line item. Tables F3-1a through F3-1e summarize the construction, professional/technical services, total unit costs and total costs for each of these items for Alternatives EB-B through EB-F, respectively. The total unit costs for each item were ultimately used in the development of the cost estimate for each active alternative (see Tables F1-3a through F1-3e).

- **General Conditions:** A general conditions line item was assumed as a percentage of the TCC to account for myriad minor costs that were not explicitly included in the cost estimate (e.g., minor tools and supplies, contractor administrative staff, and office supplies). Based on experience with similar projects, a general conditions cost has been applied at 15% of the TCC.
- **Taxes:** New York state sales tax of 8.875% (NYSDTF 2022) was applied to material and equipment costs.
- **Overhead and Profit:** This was assumed to be 20% of the TCC, consistent with guidance (USEPA 2000) and based on recent experience on similar projects.
- **Performance and Payment Bond:** This was assumed to be 1.5% of the TCC, based on recent experience on similar projects.
- **Contractor Professional/Technical Services Labor:** The lump sum cost includes the prime contractor's professional/technical services labor (e.g., project manager, project engineer, field engineer, quality assurance/quality control manager, health and safety officer, and superintendent) assumed full time for the duration of construction. A detailed contractor professional/technical services cost backup table (Table F-A-6) is included in Attachment F-A.

The following professional/technical services costs were developed as stand-alone cost items; these are summarized in Tables F1-3a through F1-3e for each of the five active alternatives:

- **Project Management:** This lump sum cost includes services that are not specific to RD, construction management, or technical operations and maintenance activities. These services include community relations, planning, bid and contract administration, permitting, and construction completion reporting. This was assumed to be 7% of the TCC, consistent with guidance (USEPA 2000) and experience on projects of similar scale.
- **Engineering Design:** This was assumed to be 6% of the TCC for non-bulkhead or shoreline stabilization-related work items, consistent with guidance (USEPA 2000).

- **Engineering Design for Work Near Bulkheads and Shorelines:** This was assumed to be 10% of the TCC for bulkhead and shoreline stabilization-related work items, based on recent experience on similar projects that include design refinements adjacent to the shorelines.
- **Construction Management:** This was assumed to be 10% of the TCC. While USEPA guidance (USEPA 2000) recommends construction management to be 6% of the TCC for a project of this scale, the percentage has been increased based on the NCG's recent experience on projects of similar scale.
- **Institutional Controls:** This lump sum cost includes all necessary work to develop and maintain institutional controls for activity restrictions on fishing and crabbing, consumption advisories, and dredging restrictions. A lump sum cost of $50,000 has been included for each active alternative (see Tables F1-3a through F1-3e) based on recent experience on similar projects.
- **Legal and Regulatory:** This lump sum cost, assumed to be 1% of the TCC, includes all necessary work for legal and regulatory matters, including but not limited to coordinating and acquiring site access agreements needed to perform the work.

3.3 Remedial Technologies

This section includes a summary of sources used to develop the remedial technology unit rates. In addition, this section includes the cost assumptions and approaches for each of the remedial technologies evaluated as part of the remedial alternatives discussed in the FFS. Project quantities for each remedial technology are included in this section for completeness.

3.3.1 Unit Rate Information Sources

Unit rates for the specific remedial technologies to be implemented as part of each alternative were developed using the following information sources:

- Material and service pricing was obtained from local vendors and suppliers.
- Equipment pricing was obtained from Rental Rate Blue Book for Construction Equipment (EquipmentWatch 2023) and from local vendors, when possible. When necessary, these pricing estimates considered cost differences across regions.
- Labor rates were obtained using a combination of Davis-Bacon wage determinations for Queens County, New York (WD No. NY20230003, revised April 14, 2023, and WD No. NY20230001, published January 6, 2023); New York State Department of Labor prevailing wage rates for Queens County, New York, for July 1, 2022, through June 30, 2023, last published on April 1, 2023; and recent experience on similar projects.
- Professional experience included estimates from similar projects that were reviewed while developing this cost estimate.

Attachment F-B includes additional information from vendors and suppliers to support development of unit rates.

3.3.2 Remedial Technology Cost Assumptions and Approaches

Costs were developed for the following remedial technologies:

- **ISS:** The costs were developed using the following assumptions:
  - A turbidity curtain system would be used in conjunction with operational best management practices (BMPs) to contain turbidity generated during work. The operational BMPs were accounted for in the estimated production rate of 180 cy of sediment treated per day. Given the limited proven application of ISS in sediments at the time the FFS was developed, this estimated daily production rate was based on conversations with marine contractors and consultants with experience on similar projects.
  - An 8-foot-diameter auger would be used for all ISS areas.
  - Debris removal within the ISS footprint was considered in the development of these costs.
  - The grout blend would consist of Portland cement and water and would be applied to sediment at a 20% dosage (dry weight of Portland cement to wet weight of sediment).
  - Refer to cost estimating worksheets F-A-1g, F-A-2g, F-A-3g, F-A-4g, and F-A-5g and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- **Dredging, Dredged Material Dewatering, and Water Treatment:** The costs for dredging, dredged material dewatering, and water treatment include the following items:
  - **Dredging and Debris Removal:** The costs were developed for mechanical dredging, debris removal, and slot dredging[3] and debris removal using the following assumptions:
    - Debris within the dredge area would be removed, to the extent practicable, prior to dredging using a clamshell bucket or orange-peel grapple.
    - To contain turbidity generated during work, a turbidity curtain system (see moon pool discussion in Section 3.1 under Environmental Controls) would be used in conjunction with operational BMPs that are accounted for in the estimated production rates.
    - Real-time kinematic differential global positioning system (RTK-DGPS) mounted on the dredge equipment, as well as bathymetric surveys, would be used to verify that the specified removal depths are achieved.
    - Each dredging activity was assumed to be performed from one platform working one 12-hour shift per day.
    - Table F3-2 summarizes the assumptions associated with mechanical dredging and debris removal and slot dredging and debris removal. These assumptions varied

[3] Slot dredging is a shoreline stability mitigation measure assumed for several of the remedial alternatives (see Appendix E of the FFS for a description of shoreline and bulkhead stability evaluations included in the FFS). It was assumed that slot dredging would be performed using a smaller dredge bucket to allow for more precision and control than the unrestricted mechanical dredging discussed previously. Slot dredging would therefore have lower daily production rates than unrestricted mechanical dredging.

depending on whether the work would be undertaken downstream or upstream of the Grand Street Bridge. The Grand Street Bridge, which crosses East Branch, is projected by New York City Department of Transportation to be replaced starting in 2025 or 2026. For the purposes of the FFS, it was assumed that the bridge in use (i.e., the current Grand Street Bridge, a temporary replacement bridge, or a permanent replacement bridge) during the East Branch remedial action implementation would be immovable and would have low clearance similar to the current Grand Street Bridge. Based on conversations with multiple marine contractors, specialized modified tug boats and smaller material transport scows would need to be used to navigate under the low clearance bridge. For construction activities like dredging and backfill and cap material placement, this specialized equipment is expected to result in lower overall production rates upstream of the Grand Street Bridge as compared to downstream of the bridge.

  - Unit costs for mechanical dredging and slot dredging were calculated using weighted production rates based on the estimated distribution of work upstream or downstream of the Grand Street Bridge. The estimated percent-weighting upstream and downstream of the Grand Street Bridge, by alternative, is as follows:
    - EB-B:
      - Mechanical dredging: 78% upstream, 22% downstream
      - Slot dredging: 100% upstream, 0% downstream
    - EB-C:
      - Mechanical dredging: 59% upstream, 41% downstream
      - Slot dredging: 100% upstream, 0% downstream
    - EB-D:
      - Mechanical dredging: 58% upstream, 42% downstream
      - Slot dredging: 100% upstream, 0% downstream
    - EB-E:
      - Mechanical dredging: 70% upstream, 30% downstream
      - Slot dredging: Not applicable (N/A)
    - EB-F:
      - Mechanical dredging: 60% upstream, 40% downstream
      - Slot dredging: N/A

- For mechanical dredging and debris removal, refer to cost estimating worksheets F-A-1h, F-A-2h, F-A-3h, F-A-4h, and F-A-5h and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

- For slot dredging and debris removal, refer to cost estimating worksheets F-A-1i, F-A-2i, F-A-3i, F-A-4i, and F-A-5i and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

Table F3-2
Summary of Dredging and Debris Removal Assumptions

Item	Location	Uptime (%)[1]	Bucket Size (cy)	Bucket Fill (%)	Cycle Time[2] (minutes)	Production Rate (cy/day)
Mechanical dredging and debris removal	Downstream of Grand Street Bridge	65%	5.5	70%	3	601
	Upstream of Grand Street Bridge	50%	5.5	70%	3	462
Slot dredging and debris removal	Downstream of Grand Street Bridge	65%	1	70%	2	164
	Upstream of Grand Street Bridge	50%	1	70%	2	126

Notes:
1. Uptime considers the time to account for start-up and shutdown times at the beginning and end of each shift, time spent relocating the dredging platform, downtime for equipment repairs, weather delays, lower overall productivity due to specialized equipment needed to work upstream of the Grand Street Bridge, and various other minor work stoppages. Uptime values were assigned based on prior experience, including projects of similar scale and scope.
2. Cycle time is the time between dredge cuts, considering operational BMPs.

- **Dredged Material Dewatering and Initial On-site Stabilization of Limited Volume of Dredged Material:** These costs include the following assumptions:
  - Removed sediments would be partially dewatered (e.g., via pumping of the supernatant water from the scow) before being transported to a commercially available, off-site, upland sediment processing facility in the New York or New Jersey regional area. This water would be treated at an on-site water treatment plant, discussed further in this section. The intent of this initial dewatering step is to facilitate transport and offloading at the regional off-site sediment processing facility. It was assumed that odor controls, including drums of foam and specialized application equipment (i.e., a pneumatic foam unit or similar), would be implemented during initial dewatering and stabilization activities.
  - It is assumed that a small subset of barges would require the addition of a stabilizing reagent to address excess water entrained in the sediment matrix or to reduce toxicity to below toxicity characteristic leaching procedure (TCLP) thresholds prior to transport to the off-site sediment processing facility. To account for this, it was conservatively assumed that 10% of dredged material would need to be amended with a solidifying agent (e.g., Portland cement,

quicklime, or fly ash) prior to leaving East Branch for transportation to the regional off-site sediment processing facility. Bench-scale testing would likely be performed prior to construction to determine the specific reagent and dosage that would be added to the dredged material. For the purposes of this FFS cost estimate, it was assumed that a dosage of 10% Portland cement (by dry weight) would be added. Additional stabilization and sediment processing that are assumed to occur off site at the commercially available sediment processing area are discussed under the Transportation, Off-site Sediment Processing, and Disposal work elements in the following bullets.

- Sediment dewatering and initial stabilization were assumed to have the same production rate as mechanical dredging and debris removal based on experience on similar projects.
- Refer to cost estimating worksheets F-A-1j, F-A-2j, F-A-3j, F-A-4j, and F-A-5j and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

– **Water Treatment:** The costs for water treatment associated with on-site initial dewatering and stabilization (i.e., prior to transport to a commercial sediment processing facility) were assumed to include equipment, labor, and materials required to operate a 300-gallon-per-minute water treatment system[4] that includes sand filtration, carbon filtration, and bag filters, and all required fixtures and appurtenances. It was assumed that the water treatment system would be staged on barges within East Branch and discharge back to East Branch. The costs are assumed to include water testing and disposal. Refer to cost estimating worksheets F-A-1k, F-A-2k, F-A-3k, F-A-4k, and F-A-5k and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

- **Transportation, Off-site Sediment Processing, and Disposal:** The dewatered dredged material was assumed to be transported by scow (assumed capacity of approximately 2,000 cy[5]) to a commercially available upland sediment processing facility in the New York or New Jersey regional area where it would be offloaded into a lined and bermed sediment processing area for additional management and stabilization, as required to pass paint filter testing and meet landfill disposal requirements. It was assumed that dredged sediment would require additional processing (i.e., beyond the partial dewatering and stabilization that was assumed to occur in East Branch) at the regional sediment management facility through a combination of passive

[4] A water treatment system would be designed to treat both organic and inorganic constituents, and selection of the appropriate water treatment technologies would be determined during RD.

[5] The 2,000-cy scow was assumed as the means of transporting sediment to the processing facility. It was assumed that material from upstream of the Grand Street Bridge would be transported downstream of the bridge in smaller 100-cy scows, and then transloaded to the 2,000-cy scows for more efficient, bulk transport.

(e.g., gravity drainage) and active (e.g., mechanical mixing) processing. The active processing component was assumed to incorporate a solidification agent (e.g., Portland cement).

- For Subtitle D landfill transportation, processing, and disposal of dredged sediment, refer to cost estimating worksheets F-A-1l, F-A-2l, F-A-3l, F-A-4l, and F-A-5l and Tables F3-1a through F3-1e for development of costs for this item for alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - Waste characterization sampling was included in the development of unit rates for the Subtitle D landfill transportation, processing, and disposal line item. Costs were informed by other recent sediment remediation projects and were inclusive of labor (boats, collection, processing, etc.) and laboratory costs at a frequency of one sample per 500 tons of material.
- For Subtitle C/TSCA landfill transportation, processing, and disposal of dredged sediment, refer to cost estimating worksheets F-A-1m, F-A-2m, F-A-3m, F-A-4m, and F-A-5m and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - Waste characterization sampling was included in the development of unit rates for the Subtitle C landfill transportation, processing, and disposal line item. Costs were informed by other recent sediment remediation projects and were inclusive of labor (boats, collection, processing, etc.) and laboratory costs at a frequency of one sample per 500 tons of material.
- For Subtitle D landfill transportation, processing, and disposal of debris, refer to cost estimating worksheets F-A-1n, F-A-2n, F-A-3n, F-A-4n, and F-A-5n and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
  - Wipe sampling was included in the development of unit rates for the debris transportation, processing, and disposal line item. Costs were informed by other recent sediment remediation projects and were inclusive of labor (collection, processing, etc.) and laboratory costs at a frequency of one sample per 500 tons of debris.

- **Backfill Placement and Capping[6]:** The costs were developed using the following assumptions:
  - Backfill and capping materials would be placed mechanically.
  - The following backfill and cap material types were considered in developing the remedial alternative costs:
    - Backfill (i.e., sand)

[6] It was assumed that costs for tasks such as backfill and capping material handling and testing were included under the General Conditions percentage-based markup.

- Sand and amended sand (i.e., sand amended with activated carbon (AC)[7] and sand amended with organoclay)
- Gravel
- Armor rock (armor rock was also used for armored outfall protection, as described in Section 3.3.3)

– Operational BMPs would minimize turbidity generated during work. The operational BMPs were accounted for in the estimated production rates for each backfill and cap material type.
– Each backfill and cap material placement activity is assumed to be performed from one platform working one shift per day for 12 hours per shift. Delivery of bulk capping materials was generally assumed to be performed by scow (assumed capacity of approximately 2,000 cy).
– Material verification sampling was included in the development of unit rates for the backfill and capping line items. Costs were informed by other recent sediment remediation projects and were inclusive of labor (collection, processing, etc.) and laboratory costs at a frequency of one sample per 1,000 tons of sand.
– Table F3-3 summarizes the assumptions associated with backfill placement, sand and amended sand placement, gravel placement, and armor rock placement. Similar to the dredging and debris removal discussion, these assumptions varied depending on whether the work would be undertaken downstream or upstream of the Grand Street Bridge.

Table F3-3
Summary of Backfill and Cap Material Placement Assumptions

Item	Location	Uptime (%)[1]	Bucket Size (cy)	Bucket Fill (%)	Cycle Time[2] (minutes)	Production Rate (cy/day)
Backfill placement	Downstream of Grand Street Bridge	65%	5.5	70%	3	601
	Upstream of Grand Street Bridge	50%	5.5	70%	3	462
Sand and amended sand placement	Downstream of Grand Street Bridge	65%	5.5	80%	3	686
	Upstream of Grand Street Bridge	50%	5.5	80%	3	528

[7] For this FFS, AC is assumed as a capping amendment to achieve long-term protectiveness of the remedy. The selection of the type/form of AC (i.e., granular activated carbon or powdered activated carbon) would be made during the RD phase. However, a specific type of AC needed to be selected to develop the FFS cost estimates; therefore, for the purposes of this FFS cost estimate, virgin granular activated carbon was assumed.

Item	Location	Uptime (%)[1]	Bucket Size (cy)	Bucket Fill (%)	Cycle Time[2] (minutes)	Production Rate (cy/day)
Gravel placement	Downstream of Grand Street Bridge	65%	5.5	80%	3	686
	Upstream of Grand Street Bridge	50%	5.5	80%	3	528
Armor rock placement	Downstream of Grand Street Bridge	65%	5.5	70%	3	601
	Upstream of Grand Street Bridge	50%	5.5	70%	3	462

Notes:

1. Uptime considers the time to account for start-up and shutdown times at the beginning and end of each shift, time spent relocating the backfill or capping platform, downtime for equipment repairs, weather delays, lower overall productivity due to specialized equipment needed to work upstream of the Grand Street Bridge, and various other minor work stoppages. Uptime values were assigned based on prior experience, including projects of similar scale and scope.
2. Cycle time is the time between placing buckets of material, considering operational BMPs.

3.3.3 Quantities

This section presents the approaches used to develop project quantities for the major construction items.

- **ISS:** Each ISS area was assumed be 40 feet wide (i.e., extending 40 feet perpendicular from the existing shoreline/bulkhead into the creek) by the length of the shoreline for which ISS is identified as an appropriate shoreline stabilization measure (see Appendix E of the FFS). The ISS depths were estimated to be the average depth of sediment within each ISS area plus an additional 2 feet below the sediment and native material interface. A grout dosage of 20% Portland cement (dry weight of Portland cement to wet weight of sediment) was assumed to result in a post-ISS swell of approximately 20% by volume that was included in the dredging quantity, as discussed in the following bullets.
- **Dredging, Dredged Material Dewatering, and Water Treatment:** The quantities for dredging, dredged material dewatering, and water treatment include the following items:
  - **Mechanical Debris Removal and Dredging:** The quantities of mechanical debris removal and dredging were developed using the following assumptions:
    - The neatline dredge volume included dredging the specified depth or to the specified target elevation for each remedial alternative.
    - The neatline volume was multiplied by a neatline factor that was uniquely estimated for each alternative to account for a 6-inch overdredge allowance, stable dredge prism side slopes, and refined dredge prism delineation during pre-design investigation. This approach is consistent with U.S. Army Corps of Engineers guidance (Palermo et al. 2008) that allows for evaluation of neatline factors based on site-specific conditions (i.e., dredge depths, required layback

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slopes, and confidence around the Feasibility Study-level characterization data) as opposed to using a generic recommended neatline factor of 1.5. The following neatline factors were preliminarily assumed for the purposes of the FFS and may be refined in the future RD phase:
  - Alternative EB-B: 1.47
  - Alternative EB-C: 1.33
  - Alternative EB-D: 1.33
  - Alternative EB-E: 1.23
  - Alternative EB-F: 1.13
- The debris volume was assumed to be 5% in excess of the dredge volume based on surveys to date and historical site operations.

  - **Dredged Material Dewatering and Initial On-site Stabilization of Limited Volume of Dredged Material:** Addition of a stabilization agent dosage of 10% Portland cement (by dry weight) was assumed.

- **Transportation, Processing, and Disposal:** These quantities were developed using the following assumptions:
  - **Subtitle D Landfill Transport, Processing, and Disposal:** Nonhazardous material was assumed to compose 95% (by weight) of the bulked and stabilized disposal material and 100% of the debris.
  - **Subtitle C/Toxic Substances Control Act Landfill Transportation, Processing, and Disposal:** Toxic Substances Control Act/Resource Conservation and Recovery Act material was assumed to compose 5% (by weight) of the bulked and stabilized disposal material.
- **Backfill Placement:** In areas where post-dredge caps are not required, backfill was assumed to be placed over the entire dredge footprint for dredge residuals management purposes. The backfill quantities were developed using the following assumptions:
  - For Alternative EB-D, sand backfill was assumed to be placed to pre-construction mudline elevations with a 6-inch overplacement allowance included in volume calculations.
  - For all other alternatives with backfill, a 12-inch sand backfill layer with a 3-inch overplacement allowance was included in volume calculations.
  - A 15% material loss factor was applied to the total quantity (i.e., neatline plus overplacement) to account for various factors including runout slopes, losses to the water column, consolidation, and constructability considerations.
  - Refer to cost estimating worksheets F-A-1o, F-A-2o, F-A-3o, F-A-4o, and F-A-5o and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- **Capping (Including Armored Outfall Protection):** Cap materials were assumed to be placed in various areas of the site, as described in Appendix C of the FFS. Six different cap types were

included in the alternatives, and they consist of varying thicknesses of the following materials: sand, AC, organoclay, gravel, and armor rock. In addition, three armored outfall protection types were included in the alternatives. The cap and armored outfall protection types and layers are summarized as follows (all thicknesses are presented as total thicknesses that include allowable overplacement):

- Amended cap—deep water:
  - 9 inches of sand with 5% organoclay, by volume
  - 15 inches of sand with 1% AC, by weight
  - 12 inches of sand
  - Refer to cost estimating worksheets F-A-1p, F-A-2p, F-A-3p, F-A-4p, and F-A-5p and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Amended cap—shallow water:
  - 9 inches of sand with 5% organoclay, by volume
  - 15 inches of sand with 1% AC, by weight
  - 9 inches of gravel
  - 12 inches of armor rock
  - Refer to cost estimating worksheets F-A-1q, F-A-2q, F-A-3q, F-A-4q, and F-A-5q and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Amended cap—wake zone:
  - 9 inches of sand with 5% organoclay, by volume
  - 15 inches of sand with 1% AC, by weight
  - 9 inches of gravel
  - 20 inches of armor rock
  - Refer to cost estimating worksheets F-A-1r, F-A-2r, F-A-3r, F-A-4r, and F-A-5r and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Amended cap—ISS areas:
  - 15 inches of sand with 1% AC, by weight
  - 9 inches of gravel
  - 12 inches of armor rock
  - Refer to cost estimating worksheets F-A-1s, F-A-2s, F-A-3s, F-A-4s, and F-A-5s and Tables F3-1a through F3-1e for development of costs for this item for

Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

- Amended cap—on native material (deep water):
  - 15 inches of sand with 1% AC, by weight
  - 12 inches of sand
  - Refer to cost estimating worksheets F-A-1t, F-A-2t, F-A-3t, F-A-4t, and F-A-5t and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Amended cap—on native material (shallow water):
  - 15 inches of sand with 1% AC, by weight
  - 9 inches of gravel
  - 12 inches of armor rock
  - Refer to cost estimating worksheets F-A-1u, F-A-2u, F-A-3u, F-A-4u, and F-A-5u and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Armored outfall protection—combined sewer overflows:
  - Geotextile liner
  - 9 inches of sand
  - Articulated concrete block mat (ACBM)
  - Gravel to fill voids in ACBM (assumed to be 6 inches over 15% of the ACBM surface area)
  - Grout to connect ACBMs (assumed to be 5% of the surface area)
  - Refer to cost estimating worksheets F-A-1v, F-A-2v, F-A-3v, F-A-4v, and F-A-5v and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Armored outfall protection—outfalls and municipal separate storm sewer systems (diameter 36 to 60 inches):
  - 30 inches of armor rock
  - Refer to cost estimating worksheets F-A-1w, F-A-2w, F-A-3w, F-A-4w, and F-A-5w and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.
- Armored outfall protection—outfalls (diameter 4 to 36 inches):
  - 18 inches of armor rock

- Refer to cost estimating worksheets F-A-1x, F-A-2x, F-A-3x, F-A-4x, and F-A-5x and Tables F3-1a through F3-1e for development of costs for this item for Alternatives EB-B, EB-C, EB-D, EB-E, and EB-F (as summarized in Tables F1-3a through F1-3e), respectively.

The cap material quantities were developed using overplacement allowance and material loss factors based on experience on similar projects. These assumptions are summarized in Table F3-4.

Table F3-4
Summary of Cap Material Volume Assumptions

Item	Overplacement Allowance (inches)	Material Loss Factor (%)[1]
AC	N/A[2]	20%
Organoclay	N/A	20%
Sand	3	15%
Gravel	3	5%
Armor rock	3 or 6[3]	0%

Notes:
1. Where applicable, a material loss factor was applied to the total material quantity (i.e., neatline plus overplacement) to account for various factors including runout slopes, losses to the water column, consolidation, and constructability considerations.
   i. A higher material loss factor was applied to AC and organoclay used in amended sand due to lower material densities than sand and higher potential for loss during placement.
   ii. No material loss factor was applied to the total armor rock quantity given the relatively high material density and likelihood of accounting for all placed armor rock.
2. AC and organoclay were not assigned specific overplacement allowance factors due to their placement as part of an overall amended sand mixture.
3. A 3-inch overplacement allowance was included in the armor rock layer in the "amended cap—shallow water," "amended cap—ISS areas," and "amended cap—on native material (shallow water)" cap types. A 6-inch overplacement allowance was included in the "amended cap—wake zone" cap type and armored outfall protection due to an assumed larger armor rock diameter.

3.4 Cap Maintenance and Long-Term Monitoring Costs

Post-construction cap maintenance costs were included to account for potential impacts to caps (via erosive forces, physical impacts, or other unforeseen means) in the years following construction. It was assumed that 5% of the cap surface area would be replaced during years 1 and 5 following construction.

As discussed in Section 5.3.8 of the FFS, long-term monitoring would be conducted to assess the general status and performance of the remedy and achievement of remedial action objectives. Depending on the full scope of selected technologies, technology-specific long-term monitoring may be necessary to monitor remedy achievement of remedial action objectives over time. The exact monitoring needs would be determined based on the selected remedy following completion of this

FFS.[8] For the purposes of this FFS, it was assumed that long-term monitoring would be performed immediately following construction (i.e., in the same year as the last year of construction; Table F1-2) and for a period of 10 years following construction. The long-term (10 plus years) monitoring costs will be included in the Operable Unit 1 Feasibility Study.

Actual sampling costs will be a direct function of the types and number of samples and the analytical suite included in a future long-term monitoring plan. However, because a detailed long-term monitoring plan has not been developed as a part of this FFS, annual long-term monitoring component costs for all five alternatives with active remediation were developed based on professional experience on similar projects. It was assumed that the long-term monitoring program would be similar for each alternative because the construction activities are similar among alternatives (e.g., all alternatives include dredging, capping, and ISS). The annual long-term monitoring costs for Alternative EB-B was assumed to be equal to 2.5% of the total construction cost (including contingency). The annual long-term monitoring costs for Alternatives EB-C (1.5%), EB-D (1.4%), EB-E (0.8%), and EB-F (0.6%) were also assumed to be a percentage of the total construction cost (including contingency) for each respective alternative, as noted in parentheses after each alternative. The estimated cost was assumed to account for labor, equipment, materials, analytical, program management, and data reporting during years 0 through 10.

3.5 Uncertainty

In addition, a contingency line item was assumed at a percentage of the total project cost. USEPA guidance (USEPA 2000) recommends a scope uncertainty of 10% to 25% and a bid uncertainty of 10% to 20%. Based on professional judgment and contracting experience, a contingency cost of 30% has been applied to account for both scope and bid uncertainties at this FFS stage.

3.6 Sensitivity Analysis

Sensitivity analyses were conducted consistent with Chapter 5.8 of USEPA guidance (USEPA 2000) for factors that have a relatively high degree of uncertainty that, with only a small change in their value, could significantly affect the overall cost of the alternative. The two factors evaluated for impact on the cost estimate are as follows:

- **Factor 1: Lower Discount Factor.** This scenario assumes a 1.3% discount factor to calculate the NPV, rather than the 7.0% discount factor used in the baseline case, as required by USEPA's guidance (USEPA 2000). A 1.3% discount factor was selected for this evaluation to be consistent with recent Office of Management and Budget (OMB) guidance[9] (OMB 2023).

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[8] Consistent with USEPA comments on the *East Branch Early Action Focused Feasibility Study Alternatives Memorandum* (Anchor QEA 2023), detailed monitoring specifics would be developed following the FFS.

[9] The 1.3% discount rate is the 5-year real discount rate presented in the OMB guidance (OMB 2023). Per the guidance, real discount rates are to be used for cost-effectiveness analyses such as those presented herein.

- **Factor 2: Lower Bulkhead Cost.** This scenario assumes a lower cost for bulkhead work (including bulkhead stabilization, replacement, and installation). This factor was evaluated due to the variability in conditions across the site and the significant uncertainty, at the time of this FFS, with the design details for each location where bulkhead stabilization, installation, or replacement would be required.

For the baseline case and both evaluated sensitivity scenarios, cost estimates were calculated for all alternatives. The results of these analyses are presented in Table F3-5. Factor 1 (lower discount factor) has the potential to increase costs from a range of $10.5M (6.9% increase) for Alternative EB-B to $84.4M (17.1% increase) for Alternative EB-F. Factor 2 (lower bulkhead costs) has the potential to decrease costs from a range of $6.9M (4.6% reduction) for Alternative EB-B to $93.6M (19.0% reduction) for Alternative EB-F.

4 ISS and Other Technology Options for Addressing NAPL or Principal Threat Waste

As discussed in Section 5.1.1 of the FFS, three remedial technology options are being evaluated for treating sediment with nonaqueous phase liquid (NAPL) or principal threat waste (PTW) within a 0.6-acre evaluation area in the Western Beef Slip (applicable to Alternatives EB-B, EB-C, EB-D, and EB-E). NAPL or PTW potentially warranting treatment using ISS have not been identified in East Branch; however, this evaluation would be applicable if either of these were to be identified to be present during future site investigations. These technology options include the following:

- **Option 1 (Amended Cap):** Placement of an amended cap to physically and chemically isolate contaminated sediments left in place
- **Option 2 (ISS):** Solidification/stabilization of NAPL or PTW (a post-ISS cap may be needed to control long-term diffusive flux from the ISS monolith)
- **Option 3 (Dredging):** Dredging to remove impacted sediment (a limited amount of sediment is expected to remain as residuals on the post-dredge surface and would need to be managed with post-dredge backfill)

Costs have been developed for these three technology options using the approaches and assumptions described in Sections 1 through 3. Costs were developed for the remedial technologies and professional/technical services line items specific to each option within the evaluation area. Pre-design investigations, mobilization, project facilities, bulkhead work, environmental controls, inspections and surveying, site restoration, demobilization, institutional controls, and cap maintenance and long-term monitoring costs are not included in these estimates.

Tables F4-1a through F4-1c present total unit cost backups for each of these three technology options.

5 Construction Schedule

This section provides a summary of the assumptions used to develop the schedule for each alternative, as further detailed in Section 4.2. The no action alternative (Alternative EB-A) does not include active remediation, so it has not been included in the following discussion.

5.1 General Assumptions

This section provides a summary of the schedule and sequence assumptions for each alternative. The prevailing scheduling assumptions are as follows:

- One work shift per day
- 12 hours per work shift
- 6 days per week
- 7 holidays per year (New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving [2 days], and Christmas Day)
- 168 in-water workdays per year (with consideration of seasonal work windows)

The U.S. Army Corps of Engineers Nationwide Permit (USACE 2021) fish window prohibits in-water work from March 1 to June 30. However, site-specific data can be used to shift, lengthen, or shorten the in-water work window, subject to agency approval. According to the federal trustees' pre-assessment screen, federally or state-listed species that may potentially occur in Newtown Creek include the shortnose sturgeon (*Acipenser brevirostrum*); sea turtles, including the Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), and green sea turtle (*Chelonia mydas*); and the piping plover (*Charadrius melodus*). Assuming no threatened or endangered species are present in Newtown Creek, it is anticipated that a revised site-specific fish window of March 1 to June 15 could be negotiated. The in-water work season was assumed to begin and end on the following dates:

- In-water work begins June 15.
- In-water work ends January 1 to account for some amount of shutdown during winter months.

The upland work window was assumed to be 285 days per year. This window accounts for some amount of shutdown during winter months.

5.2 Alternative Schedules

The schedule for each alternative is presented in this section. Several construction activities for all alternatives were assumed to be performed concurrently, including the following:

- Bulkhead work
- ISS
- Dredging/debris removal

- Dredged material dewatering and water treatment
- Backfill and cap material placement
- Confirmation surveying

5.2.1 Alternative EB-B Schedule

Construction for Alternative EB-B was estimated to be completed within two in-water work seasons. The estimated construction duration for each of the primary alternative components is as follows:

- Initial mobilization: 15 days
- Interim winterization and remobilization: 10 days (one event)
- Site preparation work: 27 days
- Bulkhead work: 35 days
- ISS: 145 days
- Dredging, dredged material dewatering, and water treatment: 81 days
- Backfill placement and capping: 176 days
- Inspections and surveying: 90 days
- Site restoration: 15 days
- Demobilization: 15 days

5.2.2 Alternative EB-C Schedule

Construction for Alternative EB-C was estimated to be completed within three in-water work seasons. The construction duration for each of the primary alternative components is as follows:

- Initial mobilization: 15 days
- Interim winterization and remobilization: 20 days (two events)
- Site preparation work: 27 days
- Bulkhead work: 102 days
- ISS: 55 days
- Dredging, dredged material dewatering, and water treatment: 237 days
- Backfill placement and capping: 171 days
- Inspections and surveying: 149 days
- Site restoration: 15 days
- Demobilization: 15 days

5.2.3 Alternative EB-D Schedule

Construction for Alternative EB-D was estimated to be completed within three in-water work seasons. The construction duration for each of the primary alternative components is as follows:

- Initial mobilization: 15 days
- Interim winterization and remobilization: 20 days (two events)

- Site preparation work: 27 days
- Bulkhead work: 102 days
- ISS: 55 days
- Dredging, dredged material dewatering, and water treatment: 254 days
- Backfill placement and capping: 189 days
- Inspections and surveying: 149 days
- Site restoration: 15 days
- Demobilization: 15 days

5.2.4 Alternative EB-E Schedule

Construction for Alternative EB-E was estimated to be completed within six in-water work seasons. The construction duration for each of the primary alternative components is as follows:

- Initial mobilization: 15 days
- Interim winterization and remobilization: 50 days (five events)
- Site preparation work: 27 days
- Bulkhead work: 281 days
- ISS: 96 days
- Dredging, dredged material dewatering, and water treatment: 489 days
- Backfill placement and capping: 124 days
- Inspections and surveying: 209 days
- Site restoration: 15 days
- Demobilization: 15 days

5.2.5 Alternative EB-F Schedule

Construction for Alternative EB-F was estimated to be completed within seven in-water work seasons. The construction duration for each of the primary alternative components is as follows:

- Initial mobilization: 15 days
- Interim winterization and remobilization: 60 days (six events)
- Site preparation work: 27 days
- Bulkhead work: 502 days
- ISS: 36 days
- Dredging, dredged material dewatering, and water treatment: 519 days
- Backfill placement and capping: 110 days
- Inspections and surveying: 211 days
- Site restoration: 15 days
- Demobilization: 15 days

6 References

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Tables

Table F1-1
Alternative Total Cost Summary Comparison

Summary of Costs	Alternative EB-B Cost	Alternative EB-C Cost	Alternative EB-D Cost	Alternative EB-E Cost	Alternative EB-F Cost
Total Construction Costs:	$87,130,000	$146,283,000	$151,884,000	$288,449,000	$356,079,000
Construction Costs + Contingency (30%)	$113,269,000	$190,167,900	$197,449,200	$374,983,700	$462,902,700
Professional/Technical Services	$28,139,516	$46,670,288	$48,403,370	$92,404,288	$115,090,848
Capital Costs Subtotal:	$141,409,000	$236,838,000	$245,853,000	$467,388,000	$577,994,000
Cap Maintenance and LTM (Year 0 to 10)	$33,351,000	$33,312,000	$33,323,000	$32,379,000	$32,133,000
Total Cost:	$174,760,000	$270,150,000	$279,176,000	$499,767,000	$610,127,000
Rounded Total:	**$174,800,000**	**$270,200,000**	**$279,200,000**	**$499,800,000**	**$610,100,000**

Abbreviation:
LTM: long-term monitoring

Table F1-2
Alternative Net Present Value Cost Summary Comparison

Base Year 2023	Discount Rate: 7.0%[1]	Construction NPV Cost (includes 30% contingency)					Cap Maintenance and Long-Term Monitoring NPV Cost (includes 30% contingency)					Total NPV Cost				
Year	**Discount Factor**	**Alternative EB-B**	**Alternative EB-C**	**Alternative EB-D**	**Alternative EB-E**	**Alternative EB-F**	**Alternative EB-B**	**Alternative EB-C**	**Alternative EB-D**	**Alternative EB-E**	**Alternative EB-F**	**Alternative EB-B**	**Alternative EB-C**	**Alternative EB-D**	**Alternative EB-E**	**Alternative EB-F**
0	1.000	$87,282,773	$80,930,487	$83,251,800	$91,432,612	$89,066,187	$0	$0	$0	$0	$0	$87,282,773	$80,930,487	$83,251,800	$91,432,612	$89,066,187
1	0.935	$41,271,894	$75,635,969	$77,805,421	$85,451,039	$83,239,427	$2,646,472	$0	$0	$0	$0	$43,918,366	$75,635,969	$77,805,421	$85,451,039	$83,239,427
2	0.873	$0	$56,802,714	$60,596,122	$79,860,784	$77,793,857	$3,723,509	$2,473,338	$2,473,338	$0	$0	$3,723,509	$59,276,052	$63,069,460	$79,860,784	$77,793,857
3	0.816	$0	$0	$0	$74,636,247	$72,704,540	$2,311,531	$3,459,057	$3,459,057	$0	$0	$2,311,531	$3,459,057	$3,459,057	$74,636,247	$72,704,540
4	0.763	$0	$0	$0	$69,753,502	$67,948,168	$2,160,309	$2,160,309	$2,160,309	$0	$0	$2,160,309	$2,160,309	$2,160,309	$69,753,502	$67,948,168
5	0.713	$0	$0	$0	$388,037	$63,502,961	$2,018,981	$2,018,981	$2,018,981	$2,018,981	$0	$2,018,981	$2,018,981	$2,018,981	$2,407,018	$63,502,961
6	0.666	$0	$0	$0	$0	$22,608,976	$2,840,647	$1,886,898	$1,886,898	$2,419,729	$1,886,898	$2,840,647	$1,886,898	$1,886,898	$2,419,729	$24,495,874
7	0.623	$0	$0	$0	$0	$0	$1,763,456	$2,638,898	$2,638,898	$1,763,456	$2,161,916	$1,763,456	$2,638,898	$2,638,898	$1,763,456	$2,161,916
8	0.582	$0	$0	$0	$0	$0	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090	$1,648,090
9	0.544	$0	$0	$0	$0	$0	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271	$1,540,271
10	0.508	$0	$0	$0	$0	$0	$1,439,505	$1,439,505	$1,439,505	$1,845,999	$1,439,505	$1,439,505	$1,439,505	$1,439,505	$1,845,999	$1,439,505
11	0.475	$0	$0	$0	$0	$0	$1,345,332	$1,345,332	$1,345,332	$1,345,332	$1,649,315	$1,345,332	$1,345,332	$1,345,332	$1,345,332	$1,649,315
12	0.444	$0	$0	$0	$0	$0	$0	$1,257,320	$1,257,320	$1,257,320	$1,257,320	$0	$1,257,320	$1,257,320	$1,257,320	$1,257,320
13	0.415	$0	$0	$0	$0	$0	$0	$0	$0	$1,175,065	$1,175,065	$0	$0	$0	$1,175,065	$1,175,065
14	0.388	$0	$0	$0	$0	$0	$0	$0	$0	$1,098,192	$1,098,192	$0	$0	$0	$1,098,192	$1,098,192
15	0.362	$0	$0	$0	$0	$0	$0	$0	$0	$1,026,347	$1,026,347	$0	$0	$0	$1,026,347	$1,026,347
16	0.339	$0	$0	$0	$0	$0	$0	$0	$0	$0	$959,203	$0	$0	$0	$0	$959,203
TOTAL	**--**	**$128,554,667**	**$213,369,169**	**$221,653,342**	**$401,522,220**	**$476,864,116**	**$23,438,104**	**$21,867,998**	**$21,867,998**	**$17,138,782**	**$15,842,122**	**$151,992,771**	**$235,237,167**	**$243,521,341**	**$418,661,002**	**$492,706,238**

Note:
1. A 7% discount factor was used, consistent with USEPA guidance (USEPA 2000).

Abbreviation:
NPV: net present value

Table F1-3a
Alternative EB-B Cost Estimate

Item No.	Description[1]	Unit	No. of Units	Unit Cost[2]	Estimated Cost
1	**Pre-Design Investigations**	LS	1	$2,300,000	$2,300,000
2	**Mobilization**				
2.01	Initial Mobilization	LS	1	$3,460,519	$3,461,000
2.02	Interim Winterization and Mobilization	EA	1	$1,441,883	$1,442,000
3	**Project Facilities**				
3.01	Staging Area Lease	MO	24	$390,345	$9,369,000
3.02	Site Preparation Work	LS	1	$2,487,496	$2,488,000
3.03	Temporary Facilities and Utilities	MO	13	$146,245	$1,902,000
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	$0	$0
4.02	Bulkhead Installation	LF	0	$0	$0
4.03	Bulkhead Replacement	LF	280	$20,765	$5,815,000
4.04	Bulkhead Sealant	LF	60	$3,946	$237,000
5	**ISS**	CY	25,990	$414	$10,772,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	32,300	$79	$2,553,000
6.02	Slot Dredging and Debris Removal	CY	1,800	$321	$579,000
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	32,300	$38	$1,242,000
6.04	Water Treatment	MO	4	$295,976	$1,184,000
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	43,400	$246	$10,680,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	2,300	$1,035	$2,380,000
7.03	Debris Transportation, Processing, and Disposal	TON	2,400	$439	$1,054,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	0.00	$0	$0
8.11	Amended Cap – Deep Water	AC	0.76	$1,191,264	$906,000
8.12	Amended Cap – Shallow Water	AC	4.74	$1,530,053	$7,253,000
8.13	Amended Cap – Wake Zone	AC	4.87	$1,670,751	$8,137,000
8.14	Amended Cap – ISS Areas	AC	0.83	$1,018,716	$846,000
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	$0	$0
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0	$0
8.21	Armored Outfall Protection – CSOs	AC	0.92	$2,634,163	$2,424,000
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$1,552,769	$47,000
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$527,958	$48,000
9	**Environmental Controls**	LS	1	$793,188	$794,000
10	**Inspections and Surveying**	LS	1	$1,951,367	$1,952,000
11	**Site Restoration**	LS	1	$1,314,232	$1,315,000
12	**Demobilization**	LS	1	$3,460,519	$3,461,000
13	**Environmental Monitoring**	LS	1	$2,488,072	$2,489,000
--	***Total Construction Cost:***				**$87,130,000**
--	**Total Construction Cost with 30% Contingency:**				**$113,269,000**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$7,928,830
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$5,438,706
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$2,262,390
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$11,326,900
18	Institutional Controls				$50,000
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$1,132,690
--	**Capital Cost Subtotal:**				**$141,409,000**
20	Cap Maintenance and LTM (Years 0 to 10)				$33,351,000
--	**Total Cost:**				**$174,760,000**
--	**Rounded Total:**				**$174,800,000**

Notes:

1. Construction costs are developed for items 3 through 11 in Tables F-A-1a through F-A-1aa in Attachment F-A. Section 3.1 (Table F3-1a) discusses costs for other line items.

2. Unit costs may vary slightly among alternatives due to rounding of durations used to calculate unit rates. In addition, as discussed in Section 3.2 of Appendix F, several professional/technical service cost elements were applied to each item on a pro rata basis, which introduces minor variability to the total unit costs presented in Tables F1-3a through F1-3e.

Abbreviations:
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
LTM: long-term monitoring
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F1-3b
Alternative EB-C Cost Estimate

Item No.	Description[1]	Unit	No. of Units	Unit Cost[2]	Estimated Cost
1	**Pre-Design Investigations**	LS	1	$2,587,500	$2,588,000
2	**Mobilization**				
2.01	Initial Mobilization	LS	1	$4,942,833	$4,943,000
2.02	Interim Winterization and Mobilization	EA	2	$2,059,514	$4,120,000
3	**Project Facilities**				
3.01	Staging Area Lease	MO	42	$390,453	$16,400,000
3.02	Site Preparation Work	LS	1	$2,488,181	$2,489,000
3.03	Temporary Facilities and Utilities	MO	22	$146,285	$3,219,000
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	$0	$0
4.02	Bulkhead Installation	LF	260	$17,924	$4,661,000
4.03	Bulkhead Replacement	LF	640	$20,649	$13,216,000
4.04	Bulkhead Sealant	LF	180	$3,660	$659,000
5	**ISS**	CY	9,890	$413	$4,089,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	89,100	$75	$6,654,000
6.02	Slot Dredging and Debris Removal	CY	8,100	$309	$2,506,000
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	92,300	$39	$3,604,000
6.04	Water Treatment	MO	10	$346,471	$3,465,000
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	124,000	$246	$30,495,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	6,600	$1,026	$6,772,000
7.03	Debris Transportation, Processing, and Disposal	TON	6,800	$441	$3,000,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	0.00	$0	$0
8.11	Amended Cap – Deep Water	AC	2.22	$1,185,349	$2,632,000
8.12	Amended Cap – Shallow Water	AC	5.58	$1,541,697	$8,603,000
8.13	Amended Cap – Wake Zone	AC	2.95	$1,682,480	$4,964,000
8.14	Amended Cap – ISS Areas	AC	0.45	$1,311,308	$591,000
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	$0	$0
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0	$0
8.21	Armored Outfall Protection – CSOs	AC	0.92	$2,634,857	$2,425,000
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$1,553,178	$47,000
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$528,097	$48,000
9	**Environmental Controls**	LS	1	$1,019,438	$1,020,000
10	**Inspections and Surveying**	LS	1	$2,624,246	$2,625,000
11	**Site Restoration**	LS	1	$1,314,584	$1,315,000
12	**Demobilization**	LS	1	$4,942,833	$4,943,000
13	**Environmental Monitoring**	LS	1	$4,189,293	$4,190,000
--	***Total Construction Cost:***				**$146,283,000**
--	**Total Construction Cost with 30% Contingency:**				**$190,167,900**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$13,311,753
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$9,123,036
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$3,267,030
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$19,016,790
18	Institutional Controls				$50,000
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$1,901,679
--	**Capital Cost Subtotal:**				**$236,838,000**
20	Cap Maintenance and LTM (Years 0 to 10)				$33,312,000
--	**Total Cost:**				**$270,150,000**
--	**Rounded Total:**				**$270,200,000**

Notes:

1. Construction costs are developed for items 3 through 11 in Tables F-A-2a through F-A-2aa in Attachment F-A. Section 3.1 (Table F3-1b) discusses costs for other line items.

2. Unit costs may vary slightly among alternatives due to rounding of durations used to calculate unit rates. In addition, as discussed in Section 3.2 of Appendix F, several professional/technical service cost elements were applied to each item on a pro rata basis, which introduces minor variability to the total unit costs presented in Tables F1-3a through F1-3e.

Abbrevations:

AC: acre

CSO: combined sewer overflow

CY: cubic yard

diam.: diameter

EA: each

ISS: in situ stabilization/solidification

LF: linear foot

LS: lump sum

LTM: long-term monitoring

MO: month

MS4: municipal separate storm sewer system

TSCA: Toxic Substances Control Act

Table F1-3c
Alternative EB-D Cost Estimate

Item No.	Description[1]	Unit	No. of Units	Unit Cost[2]	Estimated Cost
1	**Pre-Design Investigations**	LS	1	$2,875,000	$2,875,000
2	**Mobilization**				
2.01	Initial Mobilization	LS	1	$5,012,983	$5,013,000
2.02	Interim Winterization and Mobilization	EA	2	$2,088,743	$4,178,000
3	**Project Facilities**				
3.01	Staging Area Lease	MO	42	$389,915	$16,377,000
3.02	Site Preparation Work	LS	1	$2,484,768	$2,485,000
3.03	Temporary Facilities and Utilities	MO	22	$146,084	$3,214,000
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	$0	$0
4.02	Bulkhead Installation	LF	260	$17,901	$4,655,000
4.03	Bulkhead Replacement	LF	640	$20,622	$13,198,000
4.04	Bulkhead Sealant	LF	180	$3,655	$658,000
5	**ISS**	CY	9,890	$413	$4,084,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	98,200	$74	$7,302,000
6.02	Slot Dredging and Debris Removal	CY	8,100	$309	$2,503,000
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	101,000	$38	$3,863,000
6.04	Water Treatment	MO	10	$370,830	$3,709,000
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	135,700	$246	$33,336,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	7,200	$1,028	$7,400,000
7.03	Debris Transportation, Processing, and Disposal	TON	7,500	$437	$3,275,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	1.21	$1,480,059	$1,791,000
8.11	Amended Cap – Deep Water	AC	1.04	$1,170,722	$1,218,000
8.12	Amended Cap – Shallow Water	AC	5.28	$1,543,184	$8,149,000
8.13	Amended Cap – Wake Zone	AC	2.95	$1,680,286	$4,957,000
8.14	Amended Cap – ISS Areas	AC	0.45	$1,309,596	$590,000
8.15	Amended Cap – On Native (Deep Water)	AC	0.28	$682,111	$191,000
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0	$0
8.21	Armored Outfall Protection – CSOs	AC	0.92	$2,631,402	$2,421,000
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$1,551,142	$47,000
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$527,405	$48,000
9	**Environmental Controls**	LS	1	$1,057,341	$1,058,000
10	**Inspections and Surveying**	LS	1	$2,609,174	$2,610,000
11	**Site Restoration**	LS	1	$1,312,834	$1,313,000
12	**Demobilization**	LS	1	$5,012,983	$5,013,000
13	**Environmental Monitoring**	LS	1	$4,352,604	$4,353,000
--	***Total Construction Cost:***				**$151,884,000**
--	**Total Construction Cost with 30% Contingency:**				**$197,449,200**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$13,821,444
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$9,549,774
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$3,262,740
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$19,744,920
18	Institutional Controls				$50,000
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$1,974,492
--	**Capital Cost Subtotal:**				**$245,853,000**
20	Cap Maintenance and LTM (Years 0 to 10)				$33,323,000
--	**Total Cost:**				**$279,176,000**
--	**Rounded Total:**				**$279,200,000**

Notes:

1. Construction costs are developed for items 3 through 11 in Tables F-A-3a through F-A-3aa in Attachment F-A. Section 3.1 (Table F3-1c) discusses costs for other line items.

2. Unit costs may vary slightly among alternatives due to rounding of durations used to calculate unit rates. In addition, as discussed in Section 3.2 of Appendix F, several professional/technical service cost elements were applied to each item on a pro rata basis, which introduces minor variability to the total unit costs presented in Tables F1-3a through F1-3e.

Abbreviations:

AC: acre

CSO: combined sewer overflow

CY: cubic yard

diam.: diameter

EA: each

ISS: in situ stabilization/solidification

LF: linear foot

LS: lump sum

LTM: long-term monitoring

MO: month

MS4: municipal separate storm sewer system

TSCA: Toxic Substances Control Act

Table F1-3d
Alternative EB-E Cost Estimate

Item No.	Description[1]	Unit	No. of Units	Unit Cost[2]	Estimated Cost
1	**Pre-Design Investigations**	LS	1	$3,162,500	$3,163,000
2	**Mobilization**				
2.01	Initial Mobilization	LS	1	$8,234,677	$8,235,000
2.02	Interim Winterization and Mobilization	EA	5	$3,431,116	$17,156,000
3	**Project Facilities**				
3.01	Staging Area Lease	MO	66	$387,881	$25,601,000
3.02	Site Preparation Work	LS	1	$2,471,858	$2,472,000
3.03	Temporary Facilities and Utilities	MO	37	$145,322	$5,377,000
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	100	$6,496	$650,000
4.02	Bulkhead Installation	LF	750	$18,026	$13,520,000
4.03	Bulkhead Replacement	LF	1,690	$20,529	$34,694,000
4.04	Bulkhead Sealant	LF	490	$3,656	$1,792,000
5	**ISS**	CY	17,270	$411	$7,093,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	246,100	$76	$18,796,000
6.02	Slot Dredging and Debris Removal	CY	0	$0	$0
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	233,800	$32	$7,529,000
6.04	Water Treatment	MO	19	$373,852	$7,104,000
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	314,000	$244	$76,763,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	16,600	$1,025	$17,020,000
7.03	Debris Transportation, Processing, and Disposal	TON	17,300	$435	$7,533,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	3.09	$276,302	$854,000
8.11	Amended Cap – Deep Water	AC	0.71	$1,151,444	$818,000
8.12	Amended Cap – Shallow Water	AC	1.07	$1,513,107	$1,620,000
8.13	Amended Cap – Wake Zone	AC	0.44	$1,726,816	$760,000
8.14	Amended Cap – ISS Areas	AC	0.62	$1,292,660	$802,000
8.15	Amended Cap – On Native (Deep Water)	AC	5.28	$686,709	$3,626,000
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0	$0
8.21	Armored Outfall Protection – CSOs	AC	0.92	$2,618,333	$2,409,000
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$1,543,442	$47,000
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$524,787	$48,000
9	**Environmental Controls**	LS	1	$1,788,633	$1,789,000
10	**Inspections and Surveying**	LS	1	$3,369,187	$3,370,000
11	**Site Restoration**	LS	1	$1,306,215	$1,307,000
12	**Demobilization**	LS	1	$8,234,677	$8,235,000
13	**Environmental Monitoring**	LS	1	$8,265,301	$8,266,000
--	***Total Construction Cost:***				**$288,449,000**
--	**Total Construction Cost with 30% Contingency:**				**$374,983,700**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$26,248,859
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$17,349,852
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$7,507,370
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$37,498,370
18	Institutional Controls				$50,000
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$3,749,837
--	**Capital Cost Subtotal:**				**$467,388,000**
20	Cap Maintenance and LTM (Years 0 to 10)				$32,379,000
--	**Total Cost:**				**$499,767,000**
--	**Rounded Total:**				**$499,800,000**

Notes:

1. Construction costs are developed for items 3 through 11 in Tables F-A-4a through F-A-4aa in Attachment F-A. Section 3.1 (Table F3-1d) discusses costs for other line items.

2. Unit costs may vary slightly among alternatives due to rounding of durations used to calculate unit rates. In addition, as discussed in Section 3.2 of Appendix F, several professional/technical service cost elements were applied to each item on a pro rata basis, which introduces minor variability to the total unit costs presented in Tables F1-3a through F1-3e.

Abbreviations:

AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
LTM: long-term monitoring
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F1-3e
Alternative EB-F Cost Estimate

Item No.	Description[1]	Unit	No. of Units	Unit Cost[2]	Estimated Cost
1	**Pre-Design Investigations**	LS	1	$3,450,000	$3,450,000
2	**Mobilization**				
2.01	Initial Mobilization	LS	1	$10,657,102	$10,658,000
2.02	Interim Winterization and Mobilization	EA	6	$4,440,459	$26,643,000
3	**Project Facilities**				
3.01	Staging Area Lease	MO	84	$388,149	$32,605,000
3.02	Site Preparation Work	LS	1	$2,473,556	$2,474,000
3.03	Temporary Facilities and Utilities	MO	46	$145,422	$6,690,000
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	$0	$0
4.02	Bulkhead Installation	LF	700	$17,892	$12,525,000
4.03	Bulkhead Replacement	LF	3,550	$20,524	$72,860,000
4.04	Bulkhead Sealant	LF	850	$3,643	$3,097,000
5	**ISS**	CY	6,310	$420	$2,653,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	268,100	$74	$19,963,000
6.02	Slot Dredging and Debris Removal	CY	0	$0	$0
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	254,700	$31	$8,021,000
6.04	Water Treatment	MO	20	$377,198	$7,544,000
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	342,100	$245	$83,677,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	18,100	$1,025	$18,552,000
7.03	Debris Transportation, Processing, and Disposal	TON	18,800	$437	$8,212,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	4.35	$320,332	$1,394,000
8.11	Amended Cap – Deep Water	AC	0.00	$0	$0
8.12	Amended Cap – Shallow Water	AC	0.00	$0	$0
8.13	Amended Cap – Wake Zone	AC	0.00	$0	$0
8.14	Amended Cap – ISS Areas	AC	0.11	$1,435,172	$158,000
8.15	Amended Cap – On Native (Deep Water)	AC	6.30	$678,325	$4,274,000
8.16	Amended Cap – On Native (Shallow Water)	AC	0.44	$1,038,090	$457,000
8.21	Armored Outfall Protection – CSOs	AC	0.92	$2,620,052	$2,411,000
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$1,544,454	$47,000
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$525,132	$48,000
9	**Environmental Controls**	LS	1	$1,810,868	$1,811,000
10	**Inspections and Surveying**	LS	1	$3,698,568	$3,699,000
11	**Site Restoration**	LS	1	$1,307,086	$1,308,000
12	**Demobilization**	LS	1	$10,657,102	$10,658,000
13	**Environmental Monitoring**	LS	1	$10,189,399	$10,190,000
--	***Total Construction Cost:***				**$356,079,000**
--	**Total Construction Cost with 30% Contingency:**				**$462,902,700**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$32,403,189
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$19,870,812
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$11,847,550
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$46,290,270
18	Institutional Controls				$50,000
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$4,629,027
--	**Capital Cost Subtotal:**				**$577,994,000**
20	Cap Maintenance and LTM (Years 0 to 10)				$32,133,000
--	**Total Cost:**				**$610,127,000**
--	**Rounded Total:**				**$610,100,000**

Notes:

1. Construction costs are developed for items 3 through 11 in Tables F-A-5a through F-A-5aa in Attachment F-A. Section 3.1 (Table F3-1e) discusses costs for other line items.

2. Unit costs may vary slightly among alternatives due to rounding of durations used to calculate unit rates. In addition, as discussed in Section 3.2 of Appendix F, several professional/technical service cost elements were applied to each item on a pro rata basis, which introduces minor variability to the total unit costs presented in Tables F1-3a through F1-3e.

Abbreviations:

AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
LTM: long-term monitoring
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-1a
Alternative EB-B Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Professional and Technical Services Labor		
1	Pre-Design Investigations	LS	1	--	--	--	--	$2,000,000.00	$300,000.00	$0.00	--	--	--	$2,300,000.00	$2,300,000.00
2.01	Initial Mobilization	LS	1	--	--	--	--	$2,413,572.97	$362,035.95	$0.00	$482,714.59	$36,203.59	$165,991.69	$3,460,518.80	$3,461,000.00
2.02	Interim Winterization and Mobilization	EA	1	--	--	--	--	$1,005,655.41	$150,848.31	$0.00	$201,131.08	$15,084.83	$69,163.20	$1,441,882.83	$1,442,000.00
3.01	Staging Area Lease	MO	24	$0.00	$0.00	$0.00	$6,534,000.00	$6,534,000.00	$980,100.00	$0.00	$1,306,800.00	$98,010.00	$449,370.99	$390,345.04	$9,369,000.00
3.02	Site Preparation Work	LS	1	$113,296.95	$95,521.36	$19,020.17	$1,500,000.00	$1,727,838.48	$259,175.77	$10,165.56	$345,567.70	$25,917.58	$118,830.81	$2,487,495.89	$2,488,000.00
3.03	Temporary Facilities and Utilities	MO	13	$0.00	$0.00	$0.00	$1,326,000.00	$1,326,000.00	$198,900.00	$0.00	$265,200.00	$19,890.00	$91,194.66	$146,244.97	$1,902,000.00
4.01	Bulkhead Stabilization	LF	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.02	Bulkhead Installation	LF	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.03	Bulkhead Replacement	LF	280	$524,852.45	$2,687,386.71	$576,210.31	$64,666.59	$3,853,116.07	$577,967.41	$289,644.24	$770,623.21	$57,796.74	$264,995.19	$20,764.80	$5,815,000.00
4.04	Bulkhead Sealant	LF	60	--	--	--	--	$165,133.55	$24,770.03	$0.00	$33,026.71	$2,477.00	$11,356.94	$3,946.07	$237,000.00
5	ISS	CY	25,990	$953,259.50	$1,628,349.65	$4,548,862.51	$0.00	$7,130,471.67	$1,069,570.75	$548,227.58	$1,426,094.33	$106,957.08	$490,392.89	$414.46	$10,772,000.00
6.01	Mechanical Dredging and Debris Removal	CY	32,300	$683,421.50	$338,669.96	$694,163.67	$0.00	$1,716,255.12	$257,438.27	$91,663.98	$343,251.02	$25,743.83	$118,034.17	$79.02	$2,553,000.00
6.02	Slot Dredging and Debris Removal	CY	1,800	$155,323.07	$76,940.44	$156,426.01	$0.00	$388,689.52	$58,303.43	$20,711.27	$77,737.90	$5,830.34	$26,731.83	$321.11	$579,000.00
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	32,300	$275,751.19	$219,922.62	$336,121.68	$0.00	$831,795.49	$124,769.32	$49,348.93	$166,359.10	$12,476.93	$57,206.12	$38.45	$1,242,000.00
6.04	Water Treatment	MO	4	$316,104.21	$3,130.55	$476,784.62	$0.00	$796,019.37	$119,402.91	$42,592.47	$159,203.87	$11,940.29	$54,745.64	$295,976.14	$1,184,000.00
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	43,400	$25,041.69	$852,876.87	$10,923.04	$6,506,328.44	$7,395,170.04	$1,109,275.51	$76,662.24	$1,479,034.01	$110,927.55	$508,597.32	$246.08	$10,680,000.00
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	2,300	$4,419.12	$52,154.74	$1,927.59	$1,598,045.58	$1,656,547.04	$248,482.06	$4,799.81	$331,309.41	$24,848.21	$113,927.79	$1,034.75	$2,380,000.00
7.03	Debris Transportation, Processing, and Disposal (Subtitle D)	TON	2,400	$2,946.08	$15,603.16	$1,285.06	$713,784.97	$733,619.28	$110,042.89	$1,498.83	$146,723.86	$11,004.29	$50,454.12	$438.89	$1,054,000.00

Table F3-1a
Alternative EB-B Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Professional and Technical Services Labor		
8.01	Backfill Placement	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.11	Amended Cap – Deep Water	AC	0.76	$49,584.67	$464,775.57	$83,174.69	$0.00	$597,534.92	$89,630.24	$48,630.59	$119,506.98	$8,963.02	$41,095.02	$1,191,264.18	$906,000.00
8.12	Amended Cap – Shallow Water	AC	4.74	$375,426.77	$3,780,143.69	$629,751.22	$0.00	$4,785,321.68	$717,798.25	$391,378.17	$957,064.34	$71,779.83	$329,106.94	$1,530,052.58	$7,253,000.00
8.13	Amended Cap – Wake Zone	AC	4.87	$481,679.63	$4,082,537.61	$807,982.69	$0.00	$5,372,199.94	$805,829.99	$434,033.68	$1,074,439.99	$80,583.00	$369,469.06	$1,670,750.65	$8,137,000.00
8.14	Amended Cap – ISS Areas	AC	0.83	$63,751.72	$388,375.81	$106,938.89	$0.00	$559,066.41	$83,859.96	$43,959.18	$111,813.28	$8,386.00	$38,449.38	$1,018,715.91	$846,000.00
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.21	Armored Outfall Protection – CSOs	AC	0.92	$300,423.79	$999,575.89	$309,231.14	$0.00	$1,609,230.82	$241,384.62	$116,156.62	$321,846.16	$24,138.46	$110,673.65	$2,634,163.42	$2,424,000.00
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$5,499.83	$17,102.13	$8,314.57	$0.00	$30,916.53	$4,637.48	$2,255.73	$6,183.31	$463.75	$2,126.26	$1,552,768.69	$47,000.00
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$5,499.83	$17,715.04	$8,314.57	$0.00	$31,529.44	$4,729.42	$2,310.13	$6,305.89	$472.94	$2,168.41	$527,958.07	$48,000.00
9	Environmental Controls	LS	1	$57,046.75	$462,545.47	$4,701.88	$0.00	$524,294.09	$78,644.11	$41,468.20	$104,858.82	$7,864.41	$36,057.94	$793,187.58	$794,000.00
10	Inspections and Surveying	LS	1	$0.00	$0.00	$0.00	$1,361,000.00	$1,361,000.00	$204,150.00	$0.00	$272,200.00	$20,415.00	$93,601.76	$1,951,366.76	$1,952,000.00
11	Site Restoration	LS	1	$62,942.75	$487,354.64	$10,566.76	$324,939.00	$885,803.15	$132,870.47	$44,190.52	$177,160.63	$13,287.05	$60,920.45	$1,314,232.27	$1,315,000.00
12	Demobilization	LS	1	--	--	--	--	$2,413,572.97	$362,035.95	$0.00	$482,714.59	$36,203.59	$165,991.69	$3,460,518.80	$3,461,000.00
13	Environmental Monitoring	LS	1	--	--	--	--	$1,735,330.62	$260,299.59	$0.00	$347,066.12	$26,029.96	$119,346.07	$2,488,072.37	$2,489,000.00

Table F3-1a
Alternative EB-B Unit Costs

Abbreviations:
--: not applicable
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-1b
Alternative EB-C Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor		
1	Pre-Design Investigations	LS	1	--	--	--	--	$2,250,000.00	$337,500.00	$0.00	--	--	--	$2,587,500.00	$2,588,000.00
2.01	Initial Mobilization	LS	1	--	--	--	--	$3,446,474.02	$516,971.10	$0.00	$689,294.80	$51,697.11	$238,396.24	$4,942,833.27	$4,943,000.00
2.02	Interim Winterization and Mobilization	EA	2	--	--	--	--	$2,872,061.68	$430,809.25	$0.00	$574,412.34	$43,080.93	$198,663.53	$2,059,513.86	$4,120,000.00
3.01	Staging Area Lease	MO	42	$0.00	$0.00	$0.00	$11,434,500.00	$11,434,500.00	$1,715,175.00	$0.00	$2,286,900.00	$171,517.50	$790,936.41	$390,453.07	$16,400,000.00
3.02	Site Preparation Work	LS	1	$113,296.95	$95,521.36	$19,020.17	$1,500,000.00	$1,727,838.48	$259,175.77	$10,165.56	$345,567.70	$25,917.58	$119,516.41	$2,488,181.49	$2,489,000.00
3.03	Temporary Facilities and Utilities	MO	22	$0.00	$0.00	$0.00	$2,244,000.00	$2,244,000.00	$336,600.00	$0.00	$448,800.00	$33,660.00	$155,219.84	$146,285.45	$3,219,000.00
4.01	Bulkhead Stabilization	LF	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.02	Bulkhead Installation	LF	260	$329,907.25	$2,387,198.67	$362,189.34	$0.00	$3,079,295.26	$461,894.29	$244,008.19	$615,859.05	$46,189.43	$212,998.10	$17,924.02	$4,661,000.00
4.03	Bulkhead Replacement	LF	640	$1,199,662.74	$6,169,843.86	$1,317,052.14	$64,666.59	$8,751,225.33	$1,312,683.80	$664,462.02	$1,750,245.07	$131,268.38	$605,331.47	$20,648.78	$13,216,000.00
4.04	Bulkhead Sealant	LF	180	--	--	--	--	$459,310.19	$68,896.53	$0.00	$91,862.04	$6,889.65	$31,770.97	$3,659.61	$659,000.00
5	ISS	CY	9,890	$361,581.19	$618,724.27	$1,725,430.61	$0.00	$2,705,736.07	$405,860.41	$208,043.75	$541,147.21	$40,586.04	$187,158.61	$413.40	$4,089,000.00
6.01	Mechanical Dredging and Debris Removal	CY	89,100	$1,781,037.85	$882,587.69	$1,809,032.59	$0.00	$4,472,658.12	$670,898.72	$238,881.30	$894,531.62	$67,089.87	$309,378.47	$74.67	$6,654,000.00
6.02	Slot Dredging and Debris Removal	CY	8,100	$673,066.63	$333,394.58	$677,846.04	$0.00	$1,684,307.25	$252,646.09	$89,747.60	$336,861.45	$25,264.61	$116,505.31	$309.30	$2,506,000.00
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	92,300	$806,827.57	$622,831.69	$983,467.15	$0.00	$2,413,126.41	$361,968.96	$142,559.02	$482,625.28	$36,196.90	$166,918.49	$39.04	$3,604,000.00
6.04	Water Treatment	MO	10	$924,897.49	$9,008.82	$1,395,036.47	$0.00	$2,328,942.79	$349,341.42	$124,609.02	$465,788.56	$34,934.14	$161,095.43	$346,471.13	$3,465,000.00
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	124,000	$67,759.88	$2,427,372.72	$29,556.45	$18,586,190.12	$21,110,879.16	$3,166,631.87	$218,052.46	$4,222,175.83	$316,663.19	$1,460,261.74	$245.92	$30,495,000.00
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	6,600	$5,892.16	$139,206.32	$2,570.13	$4,565,029.15	$4,712,697.76	$706,904.66	$12,582.66	$942,539.55	$70,690.47	$325,982.27	$1,025.97	$6,772,000.00
7.03	Debris Transportation, Processing, and Disposal (Subtitle D)	TON	6,800	$5,892.16	$41,206.32	$2,570.13	$2,039,021.43	$2,088,690.05	$313,303.51	$3,885.16	$417,738.01	$31,330.35	$144,476.89	$441.09	$3,000,000.00
8.01	Backfill Placement	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Table F3-1b
Alternative EB-C Unit Costs

Item No.	Description	Units	Quantity	Construction Costs: Labor	Material	Equipment	Miscellaneous	Total Construction Cost	Other Capital Costs: General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor	Total Unit Cost	Total Capital Cost
8.11	Amended Cap – Deep Water	AC	2.22	$141,670.48	$1,356,855.96	$237,641.97	$0.00	$1,736,168.41	$260,425.26	$141,511.69	$347,233.68	$26,042.53	$120,092.60	$1,185,348.72	$2,632,000.00
8.12	Amended Cap – Shallow Water	AC	5.58	$453,345.54	$4,461,416.31	$760,454.30	$0.00	$5,675,216.15	$851,282.42	$463,441.02	$1,135,043.23	$85,128.24	$392,560.68	$1,541,697.44	$8,603,000.00
8.13	Amended Cap – Wake Zone	AC	2.95	$297,508.01	$2,479,857.46	$499,048.13	$0.00	$3,276,413.60	$491,462.04	$264,377.87	$655,282.72	$49,146.20	$226,632.98	$1,682,479.80	$4,964,000.00
8.14	Amended Cap – ISS Areas	AC	0.45	$42,501.14	$276,154.54	$71,292.59	$0.00	$389,948.27	$58,492.24	$30,835.93	$77,989.65	$5,849.22	$26,973.13	$1,311,307.67	$591,000.00
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.21	Armored Outfall Protection – CSOs	AC	0.92	$300,423.79	$999,575.89	$309,231.14	$0.00	$1,609,230.82	$241,384.62	$116,156.62	$321,846.16	$24,138.46	$111,312.19	$2,634,857.48	$2,425,000.00
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$5,499.83	$17,102.13	$8,314.57	$0.00	$30,916.53	$4,637.48	$2,255.73	$6,183.31	$463.75	$2,138.53	$1,553,177.61	$47,000.00
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$5,499.83	$17,715.04	$8,314.57	$0.00	$31,529.44	$4,729.42	$2,310.13	$6,305.89	$472.94	$2,180.92	$528,097.08	$48,000.00
9	Environmental Controls	LS	1	$100,742.12	$566,221.96	$8,303.32	$0.00	$675,267.41	$101,290.11	$50,989.12	$135,053.48	$10,129.01	$46,708.96	$1,019,438.09	$1,020,000.00
10	Inspections and Surveying	LS	1	$0.00	$0.00	$0.00	$1,829,800.00	$1,829,800.00	$274,470.00	$0.00	$365,960.00	$27,447.00	$126,569.19	$2,624,246.19	$2,625,000.00
11	Site Restoration	LS	1	$62,942.75	$487,354.64	$10,566.76	$324,939.00	$885,803.15	$132,870.47	$44,190.52	$177,160.63	$13,287.05	$61,271.94	$1,314,583.76	$1,315,000.00
12	Demobilization	LS	1	--	--	--	--	$3,446,474.02	$516,971.10	$0.00	$689,294.80	$51,697.11	$238,396.24	$4,942,833.27	$4,943,000.00
13	Environmental Monitoring	LS	1	--	--	--	--	$2,921,055.31	$438,158.30	$0.00	$584,211.06	$43,815.83	$202,052.47	$4,189,292.97	$4,190,000.00

Table F3-1b
Alternative EB-C Unit Costs

Abbreviations:
--: not applicable
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-1c
Alternative EB-D Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor		
1	Pre-Design Investigations	LS	1	--	--	--	--	$2,500,000.00	$375,000.00	$0.00	--	--	--	$2,875,000.00	$2,875,000.00
2.01	Initial Mobilization	LS	1	--	--	--	--	$3,500,208.45	$525,031.27	$0.00	$700,041.69	$52,503.13	$235,197.97	$5,012,982.51	$5,013,000.00
2.02	Interim Winterization and Mobilization	EA	2	--	--	--	--	$2,916,840.37	$437,526.06	$0.00	$583,368.07	$43,752.61	$195,998.31	$2,088,742.71	$4,178,000.00
3.01	Staging Area Lease	MO	42	$0.00	$0.00	$0.00	$11,434,500.00	$11,434,500.00	$1,715,175.00	$0.00	$2,286,900.00	$171,517.50	$768,346.02	$389,915.20	$16,377,000.00
3.02	Site Preparation Work	LS	1	$113,296.95	$95,521.36	$19,020.17	$1,500,000.00	$1,727,838.48	$259,175.77	$10,165.56	$345,567.70	$25,917.58	$116,102.83	$2,484,767.91	$2,485,000.00
3.03	Temporary Facilities and Utilities	MO	22	$0.00	$0.00	$0.00	$2,244,000.00	$2,244,000.00	$336,600.00	$0.00	$448,800.00	$33,660.00	$150,786.52	$146,083.93	$3,214,000.00
4.01	Bulkhead Stabilization	LF	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.02	Bulkhead Installation	LF	260	$329,907.25	$2,387,198.67	$362,189.34	$0.00	$3,079,295.26	$461,894.29	$244,008.19	$615,859.05	$46,189.43	$206,914.54	$17,900.62	$4,655,000.00
4.03	Bulkhead Replacement	LF	640	$1,199,662.74	$6,169,843.86	$1,317,052.14	$64,666.59	$8,751,225.33	$1,312,683.80	$664,462.02	$1,750,245.07	$131,268.38	$588,042.25	$20,621.76	$13,198,000.00
4.04	Bulkhead Sealant	LF	180	--	--	--	--	$459,310.19	$68,896.53	$0.00	$91,862.04	$6,889.65	$30,863.54	$3,654.57	$658,000.00
5	ISS	CY	9,890	$361,581.19	$618,724.27	$1,725,430.61	$0.00	$2,705,736.07	$405,860.41	$208,043.75	$541,147.21	$40,586.04	$181,813.07	$412.86	$4,084,000.00
6.01	Mechanical Dredging and Debris Removal	CY	98,200	$1,957,070.66	$969,819.78	$1,987,832.32	$0.00	$4,914,722.76	$737,208.41	$262,491.62	$982,944.55	$73,720.84	$330,246.86	$74.35	$7,302,000.00
6.02	Slot Dredging and Debris Removal	CY	8,100	$673,066.63	$333,394.58	$677,846.04	$0.00	$1,684,307.25	$252,646.09	$89,747.60	$336,861.45	$25,264.61	$113,177.73	$308.89	$2,503,000.00
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	101,000	$864,701.28	$671,460.28	$1,054,011.20	$0.00	$2,590,172.76	$388,525.91	$153,135.59	$518,034.55	$38,852.59	$174,047.74	$38.25	$3,863,000.00
6.04	Water Treatment	MO	10	$991,240.35	$9,649.40	$1,495,102.38	$0.00	$2,495,992.13	$374,398.82	$133,546.72	$499,198.43	$37,439.88	$167,719.24	$370,829.52	$3,709,000.00
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	135,700	$73,652.04	$2,661,579.04	$32,126.58	$20,341,568.01	$23,108,925.67	$3,466,338.85	$239,066.37	$4,621,785.13	$346,633.88	$1,552,813.95	$245.66	$33,336,000.00
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	7,200	$7,365.20	$150,257.90	$3,212.66	$4,996,174.60	$5,157,010.36	$773,551.55	$13,620.51	$1,031,402.07	$77,355.16	$346,527.47	$1,027.70	$7,400,000.00
7.03	Debris Transportation, Processing, and Disposal (Subtitle D)	TON	7,500	$5,892.16	$43,706.32	$2,570.13	$2,231,597.38	$2,283,765.99	$342,564.90	$4,107.03	$456,753.20	$34,256.49	$153,458.61	$436.65	$3,275,000.00
8.01	Backfill Placement	AC	1.21	$212,505.72	$629,557.41	$347,809.11	$0.00	$1,189,872.24	$178,480.84	$86,741.28	$237,974.45	$17,848.08	$79,953.96	$1,480,058.55	$1,791,000.00

Table F3-1c
Alternative EB-D Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor		
8.11	Amended Cap – Deep Water	AC	1.04	$63,751.72	$633,551.54	$106,938.89	$0.00	$804,242.14	$120,636.32	$65,718.53	$160,848.43	$12,063.63	$54,041.39	$1,170,721.57	$1,218,000.00
8.12	Amended Cap – Shallow Water	AC	5.28	$432,094.96	$4,225,511.36	$724,808.00	$0.00	$5,382,414.33	$807,362.15	$439,340.84	$1,076,482.87	$80,736.21	$361,673.59	$1,543,183.71	$8,149,000.00
8.13	Amended Cap – Wake Zone	AC	2.95	$297,508.01	$2,479,857.46	$499,048.13	$0.00	$3,276,413.60	$491,462.04	$264,377.87	$655,282.72	$49,146.20	$220,159.99	$1,680,285.57	$4,957,000.00
8.14	Amended Cap – ISS Areas	AC	0.45	$42,501.14	$276,154.54	$71,292.59	$0.00	$389,948.27	$58,492.24	$30,835.93	$77,989.65	$5,849.22	$26,202.74	$1,309,595.69	$590,000.00
8.15	Amended Cap – On Native (Deep Water)	AC	0.28	$14,167.05	$88,469.37	$23,764.20	$0.00	$126,400.62	$18,960.09	$9,960.73	$25,280.12	$1,896.01	$8,493.54	$682,111.11	$191,000.00
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.21	Armored Outfall Protection – CSOs	AC	0.92	$300,423.79	$999,575.89	$309,231.14	$0.00	$1,609,230.82	$241,384.62	$116,156.62	$321,846.16	$24,138.46	$108,132.94	$2,631,401.77	$2,421,000.00
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$5,499.83	$17,102.13	$8,314.57	$0.00	$30,916.53	$4,637.48	$2,255.73	$6,183.31	$463.75	$2,077.45	$1,551,141.62	$47,000.00
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$5,499.83	$17,715.04	$8,314.57	$0.00	$31,529.44	$4,729.42	$2,310.13	$6,305.89	$472.94	$2,118.63	$527,404.96	$48,000.00
9	Environmental Controls	LS	1	$101,955.88	$590,776.86	$8,403.36	$0.00	$701,136.11	$105,170.42	$53,177.24	$140,227.22	$10,517.04	$47,113.13	$1,057,341.17	$1,058,000.00
10	Inspections and Surveying	LS	1	$0.00	$0.00	$0.00	$1,821,800.00	$1,821,800.00	$273,270.00	$0.00	$364,360.00	$27,327.00	$122,416.61	$2,609,173.61	$2,610,000.00
11	Site Restoration	LS	1	$62,942.75	$487,354.64	$10,566.76	$324,939.00	$885,803.15	$132,870.47	$44,190.52	$177,160.63	$13,287.05	$59,521.91	$1,312,833.74	$1,313,000.00
12	Demobilization	LS	1	--	--	--	--	$3,500,208.45	$525,031.27	$0.00	$700,041.69	$52,503.13	$235,197.97	$5,012,982.51	$5,013,000.00
13	Environmental Monitoring	LS	1	--	--	--	--	$3,039,113.00	$455,866.95	$0.00	$607,822.60	$45,586.70	$204,214.47	$4,352,603.72	$4,353,000.00

Table F3-1c
Alternative EB-D Unit Costs

Abbreviations:
--: not applicable
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-1d
Alternative EB-E Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Professional and Technical Services Labor		
1	Pre-Design Investigations	LS	1	--	--	--	--	$2,750,000.00	$412,500.00	$0.00	--	--	--	$3,162,500.00	$3,163,000.00
2.01	Initial Mobilization	LS	1	--	--	--	--	$5,779,841.26	$866,976.19	$0.00	$1,155,968.25	$86,697.62	$345,194.16	$8,234,677.48	$8,235,000.00
2.02	Interim Winterization and Mobilization	EA	5	--	--	--	--	$12,041,335.96	$1,806,200.39	$0.00	$2,408,267.19	$180,620.04	$719,154.51	$3,431,115.62	$17,156,000.00
3.01	Staging Area Lease	MO	66	$0.00	$0.00	$0.00	$17,968,500.00	$17,968,500.00	$2,695,275.00	$0.00	$3,593,700.00	$269,527.50	$1,073,147.35	$387,881.06	$25,601,000.00
3.02	Site Preparation Work	LS	1	$113,296.95	$95,521.36	$19,020.17	$1,500,000.00	$1,727,838.48	$259,175.77	$10,165.56	$345,567.70	$25,917.58	$103,193.10	$2,471,858.18	$2,472,000.00
3.03	Temporary Facilities and Utilities	MO	37	$0.00	$0.00	$0.00	$3,774,000.00	$3,774,000.00	$566,100.00	$0.00	$754,800.00	$56,610.00	$225,397.67	$145,321.83	$5,377,000.00
4.01	Bulkhead Stabilization	LF	100	$104,970.49	$215,163.45	$115,242.06	$0.00	$435,376.00	$65,306.40	$29,323.49	$87,075.20	$6,530.64	$26,002.32	$6,496.14	$650,000.00
4.02	Bulkhead Installation	LF	750	$944,734.41	$7,006,297.96	$1,037,178.56	$0.00	$8,988,210.93	$1,348,231.64	$713,858.54	$1,797,642.19	$134,823.16	$536,810.24	$18,026.10	$13,520,000.00
4.03	Bulkhead Replacement	LF	1,690	$3,164,110.48	$16,410,151.25	$3,473,725.01	$64,666.59	$23,112,653.33	$3,466,898.00	$1,764,694.02	$4,622,530.67	$346,689.80	$1,380,375.81	$20,528.90	$34,694,000.00
4.04	Bulkhead Sealant	LF	490	--	--	--	--	$1,257,359.97	$188,603.99	$0.00	$251,471.99	$18,860.40	$75,094.33	$3,655.90	$1,792,000.00
5	ISS	CY	17,270	$631,123.53	$1,080,198.36	$3,011,660.70	$0.00	$4,722,982.60	$708,447.39	$363,152.49	$944,596.52	$70,844.74	$282,074.53	$410.66	$7,093,000.00
6.01	Mechanical Dredging and Debris Removal	CY	246,100	$5,063,532.02	$2,509,209.59	$5,143,121.73	$0.00	$12,715,863.33	$1,907,379.50	$679,144.40	$2,543,172.67	$190,737.95	$759,439.86	$76.37	$18,796,000.00
6.02	Slot Dredging and Debris Removal	CY	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	233,800	$1,664,720.17	$1,377,802.90	$2,029,179.05	$0.00	$5,071,702.12	$760,755.32	$302,369.65	$1,014,340.42	$76,075.53	$302,901.39	$32.20	$7,529,000.00
6.04	Water Treatment	MO	19	$1,908,332.80	$18,504.49	$2,878,366.40	$0.00	$4,805,203.69	$720,780.55	$257,097.29	$961,040.74	$72,078.06	$286,985.09	$373,851.86	$7,104,000.00
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	314,000	$170,872.73	$6,145,983.37	$74,533.66	$47,099,993.64	$53,491,383.41	$8,023,707.51	$552,070.89	$10,698,276.68	$802,370.75	$3,194,709.43	$244.47	$76,763,000.00
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	16,600	$13,257.37	$336,964.23	$5,782.78	$11,568,419.49	$11,924,423.87	$1,788,663.58	$30,418.80	$2,384,884.77	$178,866.36	$712,172.07	$1,025.27	$17,020,000.00
7.03	Debris Transportation, Processing, and Disposal (Subtitle D)	TON	17,300	$10,311.29	$98,361.07	$4,497.72	$5,167,164.22	$5,280,334.29	$792,050.14	$9,128.72	$1,056,066.86	$79,205.01	$315,361.70	$435.38	$7,533,000.00
8.01	Backfill Placement	AC	3.09	$99,169.34	$308,449.92	$162,310.92	$0.00	$569,930.18	$85,489.53	$41,780.02	$113,986.04	$8,548.95	$34,038.40	$276,301.98	$854,000.00

Table F3-1d
Alternative EB-E Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Professional and Technical Services Labor		
8.11	Amended Cap – Deep Water	AC	0.71	$42,501.14	$428,863.39	$71,292.59	$0.00	$542,657.13	$81,398.57	$44,388.84	$108,531.43	$8,139.86	$32,409.55	$1,151,444.19	$818,000.00
8.12	Amended Cap – Shallow Water	AC	1.07	$85,002.29	$847,137.64	$142,585.18	$0.00	$1,074,725.10	$161,208.77	$87,837.90	$214,945.02	$16,120.88	$64,186.68	$1,513,106.87	$1,620,000.00
8.13	Amended Cap – Wake Zone	AC	0.44	$49,584.67	$372,171.53	$83,174.69	$0.00	$504,930.89	$75,739.63	$40,411.98	$100,986.18	$7,573.96	$30,156.40	$1,726,816.00	$760,000.00
8.14	Amended Cap – ISS Areas	AC	0.62	$56,668.19	$381,140.73	$95,056.79	$0.00	$532,865.71	$79,929.86	$42,262.53	$106,573.14	$7,992.99	$31,824.77	$1,292,659.68	$802,000.00
8.15	Amended Cap – On Native (Deep Water)	AC	5.28	$269,173.91	$1,690,787.64	$451,519.74	$0.00	$2,411,481.29	$361,722.19	$190,129.78	$482,296.26	$36,172.22	$144,022.86	$686,709.20	$3,626,000.00
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.21	Armored Outfall Protection – CSOs	AC	0.92	$300,423.79	$999,575.89	$309,231.14	$0.00	$1,609,230.82	$241,384.62	$116,156.62	$321,846.16	$24,138.46	$96,109.40	$2,618,332.71	$2,409,000.00
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$5,499.83	$17,102.13	$8,314.57	$0.00	$30,916.53	$4,637.48	$2,255.73	$6,183.31	$463.75	$1,846.45	$1,543,441.75	$47,000.00
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$5,499.83	$17,715.04	$8,314.57	$0.00	$31,529.44	$4,729.42	$2,310.13	$6,305.89	$472.94	$1,883.06	$524,787.45	$48,000.00
9	Environmental Controls	LS	1	$175,995.28	$1,001,625.92	$14,505.80	$0.00	$1,192,127.00	$178,819.05	$90,181.69	$238,425.40	$17,881.90	$71,198.37	$1,788,633.41	$1,789,000.00
10	Inspections and Surveying	LS	1	$0.00	$0.00	$0.00	$2,364,800.00	$2,364,800.00	$354,720.00	$0.00	$472,960.00	$35,472.00	$141,234.88	$3,369,186.88	$3,370,000.00
11	Site Restoration	LS	1	$62,942.75	$487,354.64	$10,566.76	$324,939.00	$885,803.15	$132,870.47	$44,190.52	$177,160.63	$13,287.05	$52,903.54	$1,306,215.36	$1,307,000.00
12	Demobilization	LS	1	--	--	--	--	$5,779,841.26	$866,976.19	$0.00	$1,155,968.25	$86,697.62	$345,194.16	$8,234,677.48	$8,235,000.00
13	Environmental Monitoring	LS	1	--	--	--	--	$5,801,335.43	$870,200.31	$0.00	$1,160,267.09	$87,020.03	$346,477.88	$8,265,300.74	$8,266,000.00

Table F3-1d
Alternative EB-E Unit Costs

Abbreviations:
--: not applicable
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-1e
Alternative EB-F Unit Costs

				Construction Costs					Other Capital Costs						
Item No.	Description	Units	Quantity	Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor	Total Unit Cost	Total Capital Cost
1	Pre-Design Investigations	LS	1	--	--	--	--	$3,000,000.00	$450,000.00	$0.00	--	--	--	$3,450,000.00	$3,450,000.00
2.01	Initial Mobilization	LS	1	--	--	--	--	$7,474,962.22	$1,121,244.33	$0.00	$1,494,992.44	$112,124.43	$453,778.68	$10,657,102.11	$10,658,000.00
2.02	Interim Winterization and Mobilization	EA	6	--	--	--	--	$18,687,405.56	$2,803,110.83	$0.00	$3,737,481.11	$280,311.08	$1,134,446.70	$4,440,459.21	$26,643,000.00
3.01	Staging Area Lease	MO	84	$0.00	$0.00	$0.00	$22,869,000.00	$22,869,000.00	$3,430,350.00	$0.00	$4,573,800.00	$343,035.00	$1,388,296.59	$388,148.59	$32,605,000.00
3.02	Site Preparation Work	LS	1	$113,296.95	$95,521.36	$19,020.17	$1,500,000.00	$1,727,838.48	$259,175.77	$10,165.56	$345,567.70	$25,917.58	$104,891.00	$2,473,556.08	$2,474,000.00
3.03	Temporary Facilities and Utilities	MO	46	$0.00	$0.00	$0.00	$4,692,000.00	$4,692,000.00	$703,800.00	$0.00	$938,400.00	$70,380.00	$284,834.83	$145,422.06	$6,690,000.00
4.01	Bulkhead Stabilization	LF	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
4.02	Bulkhead Installation	LF	700	$869,755.49	$6,496,064.81	$954,862.80	$0.00	$8,320,683.09	$1,248,102.46	$661,269.82	$1,664,136.62	$124,810.25	$505,119.42	$17,891.60	$12,525,000.00
4.03	Bulkhead Replacement	LF	3,550	$6,658,128.21	$34,470,630.02	$7,309,639.35	$64,666.59	$48,503,064.18	$7,275,459.63	$3,707,998.91	$9,700,612.84	$727,545.96	$2,944,450.51	$20,523.70	$72,860,000.00
4.04	Bulkhead Sealant	LF	850	--	--	--	--	$2,171,709.63	$325,756.45	$0.00	$434,341.93	$32,575.64	$131,836.86	$3,642.61	$3,097,000.00
5	ISS	CY	6,310	$236,671.32	$399,574.64	$1,129,372.76	$0.00	$1,765,618.73	$264,842.81	$135,694.08	$353,123.75	$26,484.28	$107,184.51	$420.44	$2,653,000.00
6.01	Mechanical Dredging and Debris Removal	CY	268,100	$5,374,178.15	$2,663,148.57	$5,458,650.67	$0.00	$13,495,977.38	$2,024,396.61	$720,809.68	$2,699,195.48	$202,439.66	$819,293.34	$74.46	$19,963,000.00
6.02	Slot Dredging and Debris Removal	CY	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	254,700	$1,766,850.25	$1,478,699.78	$2,153,668.56	$0.00	$5,399,218.58	$809,882.79	$322,372.69	$1,079,843.72	$80,988.28	$327,767.58	$31.49	$8,021,000.00
6.04	Water Treatment	MO	20	$2,025,408.43	$19,634.93	$3,054,953.29	$0.00	$5,099,996.66	$764,999.50	$272,869.70	$1,019,999.33	$76,499.95	$309,602.87	$377,198.40	$7,544,000.00
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	342,100	$184,130.10	$6,701,447.60	$80,316.44	$51,302,980.63	$58,268,874.77	$8,740,331.22	$601,881.56	$11,653,774.95	$874,033.12	$3,537,298.54	$244.60	$83,677,000.00
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	18,100	$14,730.41	$367,015.81	$6,425.32	$12,600,732.08	$12,988,903.61	$1,948,335.54	$33,142.90	$2,597,780.72	$194,833.55	$788,510.68	$1,024.95	$18,552,000.00
7.03	Debris Transportation, Processing, and Disposal (Subtitle D)	TON	18,800	$11,784.33	$107,412.65	$5,140.25	$5,628,258.21	$5,752,595.43	$862,889.31	$9,989.07	$1,150,519.09	$86,288.93	$349,219.85	$436.78	$8,212,000.00
8.01	Backfill Placement	AC	4.35	$141,670.48	$554,853.22	$231,872.74	$0.00	$928,396.44	$139,259.47	$69,821.93	$185,679.29	$13,925.95	$56,359.68	$320,331.67	$1,394,000.00

Table F3-1e
Alternative EB-F Unit Costs

Item No.	Description	Units	Quantity	Construction Costs					Other Capital Costs					Total Unit Cost	Total Capital Cost
				Labor	Material	Equipment	Miscellaneous	Total Construction Cost	General Conditions (15%)	Taxes (on Material and Equip, 8.875%)	Overhead and Profit (20%)	Performance and Payment Bonding (1.5%)	Contractor Professional and Technical Services Labor		
8.11	Amended Cap – Deep Water	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.12	Amended Cap – Shallow Water	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.13	Amended Cap – Wake Zone	AC	0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
8.14	Amended Cap – ISS Areas	AC	0.11	$14,167.05	$67,140.26	$23,764.20	$0.00	$105,071.51	$15,760.73	$8,067.77	$21,014.30	$1,576.07	$6,378.52	$1,435,171.82	$158,000.00
8.15	Amended Cap – On Native (Deep Water)	AC	6.30	$311,675.06	$2,005,548.93	$522,812.33	$0.00	$2,840,036.32	$426,005.45	$224,392.06	$568,007.26	$42,600.54	$172,408.62	$678,325.44	$4,274,000.00
8.16	Amended Cap – On Native (Shallow Water)	AC	0.44	$35,417.62	$208,846.97	$59,410.49	$0.00	$303,675.09	$45,551.26	$23,807.85	$60,735.02	$4,555.13	$18,435.05	$1,038,089.52	$457,000.00
8.21	Armored Outfall Protection – CSOs	AC	0.92	$300,423.79	$999,575.89	$309,231.14	$0.00	$1,609,230.82	$241,384.62	$116,156.62	$321,846.16	$24,138.46	$97,690.75	$2,620,051.56	$2,411,000.00
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.03	$5,499.83	$17,102.13	$8,314.57	$0.00	$30,916.53	$4,637.48	$2,255.73	$6,183.31	$463.75	$1,876.83	$1,544,454.44	$47,000.00
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.09	$5,499.83	$17,715.04	$8,314.57	$0.00	$31,529.44	$4,729.42	$2,310.13	$6,305.89	$472.94	$1,914.04	$525,131.71	$48,000.00
9	Environmental Controls	LS	1	$222,118.18	$968,312.22	$18,307.32	$0.00	$1,208,737.72	$181,310.66	$87,562.48	$241,747.54	$18,131.07	$73,378.22	$1,810,867.68	$1,811,000.00
10	Inspections and Surveying	LS	1	$0.00	$0.00	$0.00	$2,594,200.00	$2,594,200.00	$389,130.00	$0.00	$518,840.00	$38,913.00	$157,484.76	$3,698,567.76	$3,699,000.00
11	Site Restoration	LS	1	$62,942.75	$487,354.64	$10,566.76	$324,939.00	$885,803.15	$132,870.47	$44,190.52	$177,160.63	$13,287.05	$53,774.00	$1,307,085.82	$1,308,000.00
12	Demobilization	LS	1	--	--	--	--	$7,474,962.22	$1,121,244.33	$0.00	$1,494,992.44	$112,124.43	$453,778.68	$10,657,102.11	$10,658,000.00
13	Environmental Monitoring	LS	1	--	--	--	--	$7,146,912.23	$1,072,036.83	$0.00	$1,429,382.45	$107,203.68	$433,863.92	$10,189,399.11	$10,190,000.00

Table F3-1e
Alternative EB-F Unit Costs

Abbreviations:
--: not applicable
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
MO: month
MS4: municipal separate storm sewer system
TSCA: Toxic Substances Control Act

Table F3-5

Sensitivity Analysis Cost Summary

Year	Alternative EB-B			Alternative EB-C			Alternative EB-D			Alternative EB-E			Alternative EB-F		
	Baseline	Factor 1[1,2]	Factor 2[3]	Baseline	Factor 1[1,2]	Factor 2[3]	Baseline	Factor 1[1,2]	Factor 2[3]	Baseline	Factor 1[1,2]	Factor 2[3]	Baseline	Factor 1[1,2]	Factor 2[3]
0	$87,282,773	$87,282,773	$88,973,014	$80,930,487	$80,930,487	$80,350,976	$83,251,800	$83,251,800	$82,984,289	$91,432,612	$91,432,612	$91,854,581	$89,066,187	$89,066,187	$88,218,628
1	$43,918,366	$46,389,587	$36,176,504	$75,635,969	$79,891,892	$75,094,370	$77,805,421	$82,183,416	$77,555,410	$85,451,039	$90,259,242	$85,845,402	$83,239,427	$87,923,186	$82,447,316
2	$3,723,509	$4,154,331	$3,604,620	$59,276,052	$66,134,479	$38,281,090	$63,069,460	$70,366,796	$41,615,683	$79,860,784	$89,100,929	$80,229,348	$77,793,857	$86,794,853	$77,053,567
3	$2,311,531	$2,724,098	$2,200,717	$3,459,057	$4,076,436	$3,349,193	$3,465,118	$4,083,580	$3,349,193	$74,636,247	$87,957,482	$74,980,699	$72,704,540	$85,681,000	$72,012,679
4	$2,160,309	$2,689,139	$2,056,745	$2,160,309	$2,689,139	$2,056,745	$2,160,309	$2,689,139	$2,056,745	$69,753,502	$86,828,709	$17,490,021	$67,948,168	$84,581,441	$64,150,454
5	$2,018,981	$2,654,629	$1,922,191	$2,018,981	$2,654,629	$1,922,191	$2,018,981	$2,654,629	$1,922,191	$2,407,018	$3,164,834	$2,492,268	$63,502,961	$83,495,993	$2,378,595
6	$2,840,647	$3,945,148	$2,749,947	$1,886,898	$2,620,562	$1,796,440	$1,886,898	$2,620,562	$1,796,440	$2,419,729	$3,360,568	$1,796,440	$24,495,874	$34,020,362	$1,796,440
7	$1,763,456	$2,586,932	$1,678,916	$2,638,898	$3,871,176	$2,555,083	$2,643,522	$3,877,959	$2,555,083	$1,763,456	$2,586,932	$1,678,916	$2,161,916	$3,171,459	$1,678,916
8	$1,648,090	$2,553,733	$1,569,081	$1,648,090	$2,553,733	$1,569,081	$1,648,090	$2,553,733	$1,569,081	$1,648,090	$2,553,733	$1,569,081	$1,648,090	$2,553,733	$1,569,081
9	$1,540,271	$2,520,961	$1,466,430	$1,540,271	$2,520,961	$1,466,430	$1,540,271	$2,520,961	$1,466,430	$1,540,271	$2,520,961	$1,901,339	$1,540,271	$2,520,961	$1,814,619
10	$1,439,505	$2,488,609	$1,370,496	$1,439,505	$2,488,609	$1,370,496	$1,439,505	$2,488,609	$1,370,496	$1,845,999	$3,191,353	$1,370,496	$1,439,505	$2,488,609	$1,370,496
11	$1,345,332	$2,456,672	$1,280,837	$1,345,332	$2,456,672	$1,280,837	$1,345,332	$2,456,672	$1,280,837	$1,345,332	$2,456,672	$1,280,837	$1,649,315	$3,011,767	$1,280,837
12	$0	$0	$0	$1,257,320	$2,425,145	$1,197,044	$1,257,320	$2,425,145	$1,197,044	$1,257,320	$2,425,145	$1,197,044	$1,257,320	$2,425,145	$1,197,044
13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,175,065	$2,394,023	$1,118,733	$1,175,065	$2,394,023	$1,118,733
14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,098,192	$2,363,300	$1,045,545	$1,098,192	$2,363,300	$1,045,545
15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,026,347	$2,332,971	$0	$1,026,347	$2,332,971	$0
16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$959,203	$2,303,032	$0
TOTAL	**$151,992,771**	**$162,446,612**	**$145,049,497**	**$235,237,167**	**$255,313,919**	**$212,289,977**	**$243,532,027**	**$264,173,001**	**$220,718,921**	**$418,661,002**	**$474,929,465**	**$365,850,750**	**$492,706,238**	**$577,128,021**	**$399,132,950**
Percent Change	--	6.88%	-4.57%	--	8.53%	-9.75%	--	8.48%	-9.37%	--	13.44%	-12.61%	--	17.13%	-18.99%

Notes:

1. Factor 1 assumes lower discount factor (equal to 1.3%) than the 7% included in the baseline cost estimates, as requried by USEPA guidance (USEPA 2000). All other cost elements are identical to baseline. Additional information is included in Section 3.6 of Appendix F.
2. The 1.3% discount rate is the 5-year real discount rate presented in the OMB guidance (OMB 2023). Per the guidance, real discount rates are to be used for cost-effectiveness analyses such as those presented in Section 3.6 of Appendix F.
3. Factor 2 assumes lower bulkhead stabilization, replacement, and installation costs than included in the baseline cost estimates. All other cost elements are identical to baseline. Additional information is included in Section 3.6 of Appendix F.

Table F4-1a

Option 1 for Addressing NAPL or PTW: Amended Cap Cost Estimate

Item No.	Description	Unit	No. of Units	Unit Cost	Estimated Cost
1	**Pre-Design Investigations**	LS	0	N/A	$0
2	**Mobilization**				
2.01	Initial Mobilization	LS	0	N/A	$0
2.02	Interim Winterization and Mobilization	EA	0	N/A	$0
3	**Project Facilities**				
3.01	Staging Area Lease	MO	0	N/A	$0
3.02	Site Preparation Work	LS	0	N/A	$0
3.03	Temporary Facilities and Utilities	MO	0	N/A	$0
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	N/A	$0
4.02	Bulkhead Installation	LF	0	N/A	$0
4.03	Bulkhead Replacement	LF	0	N/A	$0
4.04	Bulkhead Sealant	LF	0	N/A	$0
5	**ISS**	CY	0	N/A	$0
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	5,300	$28	$148,000
6.02	Slot Dredging and Debris Removal	CY	0	N/A	$0
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	5,100	$15	$78,000
6.04	Water Treatment	MO	0	N/A	$0
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	6,800	$235	$1,596,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	400	$908	$364,000
7.03	Debris Transportation, Processing, and Disposal	TON	400	$401	$161,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	0.00	N/A	$0
8.11	Amended Cap – Deep Water	AC	0.00	N/A	$0
8.12	Amended Cap – Shallow Water	AC	0.40	$1,199,715	$480,000
8.13	Amended Cap – Wake Zone	AC	0.22	$1,425,500	$314,000
8.14	Amended Cap – ISS Areas	AC	0.00	N/A	$0
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	N/A	$0
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	N/A	$0
8.21	Armored Outfall Protection – CSOs	AC	0.00	N/A	$0
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.00	N/A	$0
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.00	N/A	$0
9	**Environmental Controls**	LS	0	N/A	$0
10	**Inspections and Surveying**	LS	0	N/A	$0
11	**Site Restoration**	LS	0	N/A	$0
12	**Demobilization**	LS	0	N/A	$0
13	**Environmental Monitoring**	LS	0	N/A	$0
--	***Total Construction Cost:***				**$3,141,000**
--	**Total Construction Cost with 30% Contingency:**				**$4,100,000**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$287,000
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$188,460
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				N/A
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$410,000
18	Institutional Controls				N/A
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$41,000
--	**Capital Cost Subtotal:**				**$5,026,460**
20	Cap Maintenance and LTM (Years 0 to 10)				N/A
--	**Total Cost:**				**$5,026,460**
--	**Rounded Total:**				**$5,000,000**

Note:

1. Construction costs are developed for items 6 through 8 consistent with the approach presented in the tables for the respective line items in Attachment F-A. Section 3.1 discusses costs for other line items.

Abbreviations:

AC: acre

CSO: combined sewer overflow

CY: cubic yard

diam.: diameter

EA: each

ISS: in situ stabilization/solidification

LF: linear foot

LS: lump sum

LTM: long-term monitoring

MO: month

MS4: municipal separate storm sewer system

N/A: not applicable

NPV: net present value

TSCA: Toxic Substances Control Act

Table F4-1b

Option 2 for Addressing NAPL or PTW: ISS Cost Estimate

Item No.	Description	Unit	No. of Units	Unit Cost	Estimated Cost
1	**Pre-Design Investigations**	LS	0	N/A	$0
2	**Mobilization**				
2.01	Initial Mobilization	LS	0	N/A	$0
2.02	Interim Winterization and Mobilization	EA	0	N/A	$0
3	**Project Facilities**				
3.01	Staging Area Lease	MO	0	N/A	$0
3.02	Site Preparation Work	LS	0	N/A	$0
3.03	Temporary Facilities and Utilities	MO	0	N/A	$0
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	N/A	$0
4.02	Bulkhead Installation	LF	0	N/A	$0
4.03	Bulkhead Replacement	LF	0	N/A	$0
4.04	Bulkhead Sealant	LF	0	N/A	$0
5	**ISS**	CY	13,700	$405	$5,555,000
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	3,700	$20	$76,000
6.02	Slot Dredging and Debris Removal	CY	0	N/A	$0
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	3,500	$15	$54,000
6.04	Water Treatment	MO	0	N/A	$0
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	4,700	$241	$1,131,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	300	$880	$264,000
7.03	Debris Transportation, Processing, and Disposal	TON	300	$386	$116,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	0.00	N/A	$0
8.11	Amended Cap – Deep Water	AC	0.00	N/A	$0
8.12	Amended Cap – Shallow Water	AC	0.00	N/A	$0
8.13	Amended Cap – Wake Zone	AC	0.00	N/A	$0
8.14	Amended Cap – ISS Areas	AC	0.62	$1,262,239	$783,000
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	N/A	$0
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	N/A	$0
8.21	Armored Outfall Protection – CSOs	AC	0.00	N/A	$0
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.00	N/A	$0
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.00	N/A	$0
9	**Environmental Controls**	LS	0	N/A	$0
10	**Inspections and Surveying**	LS	0	N/A	$0
11	**Site Restoration**	LS	0	N/A	$0
12	**Demobilization**	LS	0	N/A	$0
13	**Environmental Monitoring**	LS	0	N/A	$0
--	***Total Construction Cost:***				**$7,979,000**
--	**Total Construction Cost with 30% Contingency:**				**$10,400,000**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$728,000
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$145,440
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				$555,500
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$1,040,000
18	Institutional Controls				N/A
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$104,000
--	**Capital Cost Subtotal:**				**$12,972,940**
20	Cap Maintenance and LTM (Years 0 to 10)				N/A
--	**Total Cost:**				**$12,972,940**
--	**Rounded Total:**				**$13,000,000**

Note:

1. Construction costs are developed for items 5 through 8 consistent with the approach presented in the tables for the respective line items in Attachment F-A. Section 3.1 discusses costs for other line items.

Abbreviations:

AC: acre

CSO: combined sewer overflow

CY: cubic yard

diam.: diameter

EA: each

ISS: in situ stabilization/solidification

LF: linear foot

LS: lump sum

LTM: long-term monitoring

MO: month

MS4: municipal separate storm sewer system

N/A: not applicable

NPV: net present value

TSCA: Toxic Substances Control Act

Table F4-1c

Option 3 for Addressing NAPL or PTW: Dredge Cost Estimate

Item No.	Description	Unit	No. of Units	Unit Cost	Estimated Cost
1	**Pre-Design Investigations**	LS	0	N/A	$0
2	**Mobilization**				
2.01	Initial Mobilization	LS	0	N/A	$0
2.02	Interim Winterization and Mobilization	EA	0	N/A	$0
3	**Project Facilities**				
3.01	Staging Area Lease	MO	0	N/A	$0
3.02	Site Preparation Work	LS	0	N/A	$0
3.03	Temporary Facilities and Utilities	MO	0	N/A	$0
4	**Bulkhead Work**				
4.01	Bulkhead Stabilization	LF	0	N/A	$0
4.02	Bulkhead Installation	LF	0	N/A	$0
4.03	Bulkhead Replacement	LF	0	N/A	$0
4.04	Bulkhead Sealant	LF	0	N/A	$0
5	**ISS**	CY	0	N/A	$0
6	**Dredging, Dredged Material Dewatering, and Water Treatment**				
6.01	Mechanical Dredging and Debris Removal	CY	15,800	$47	$741,000
6.02	Slot Dredging and Debris Removal	CY	0	N/A	$0
6.03	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	CY	15,000	$21	$321,000
6.04	Water Treatment	MO	0	N/A	$0
7	**Transportation, Offsite Sediment Processing, and Disposal**				
7.01	Subtitle D Landfill Transportation, Processing, and Disposal	TON	20,200	$235	$4,757,000
7.02	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	TON	1,100	$973	$1,071,000
7.03	Debris Transportation, Processing, and Disposal	TON	1,200	$392	$471,000
8	**Backfill Placement and Capping**				
8.01	Backfill Placement	AC	0.62	$180,880	$113,000
8.11	Amended Cap – Deep Water	AC	0.00	N/A	$0
8.12	Amended Cap – Shallow Water	AC	0.00	N/A	$0
8.13	Amended Cap – Wake Zone	AC	0.00	N/A	$0
8.14	Amended Cap – ISS Areas	AC	0.00	N/A	$0
8.15	Amended Cap – On Native (Deep Water)	AC	0.00	N/A	$0
8.16	Amended Cap – On Native (Shallow Water)	AC	0.00	N/A	$0
8.21	Armored Outfall Protection – CSOs	AC	0.00	N/A	$0
8.22	Armored Outfall Protection – Outfalls and MS4s (Diam. 36 to 60 inches)	AC	0.00	N/A	$0
8.23	Armored Outfall Protection – Outfalls (Diam. 4 to 36 inches)	AC	0.00	N/A	$0
9	**Environmental Controls**	LS	0	N/A	$0
10	**Inspections and Surveying**	LS	0	N/A	$0
11	**Site Restoration**	LS	0	N/A	$0
12	**Demobilization**	LS	0	N/A	$0
13	**Environmental Monitoring**	LS	0	N/A	$0
--	***Total Construction Cost:***				**$7,473,000**
--	**Total Construction Cost with 30% Contingency:**				**$9,700,000**
14	Project Management (7% of Total Construction Cost with 30% Contingency)				$679,000
15	Engineering Design (6% of Total Construction Cost with 30% Contingency)				$448,380
16	Engineering Design for Work Near Bulkheads and Shorelines (10% of Total Construction Cost with 30% Contingency)				N/A
17	Construction Management (10% of Total Construction Cost with 30% Contingency)				$970,000
18	Institutional Controls				N/A
19	Legal and Regulatory (1% of Total Construction Cost with 30% Contingency)				$97,000
--	**Capital Cost Subtotal:**				**$11,894,380**
20	Cap Maintenance and LTM (Years 0 to 10)				N/A
--	**Total Cost:**				**$11,894,380**
--	**Rounded Total:**				**$11,900,000**

Note:
1. Construction costs are developed for items 6 through 8 consistent with the approach presented in the tables for the respective line items in Attachment F-A. Section 3.1 discusses costs for other line items.

Abbreviations:
AC: acre
CSO: combined sewer overflow
CY: cubic yard
diam.: diameter
EA: each
ISS: in situ stabilization/solidification
LF: linear foot
LS: lump sum
LTM: long-term monitoring
MO: month
MS4: municipal separate storm sewer system
N/A: not applicable
NPV: net present value
TSCA: Toxic Substances Control Act

Attachment F-A
Construction Cost Item Worksheets

Attachment F-A
Construction Cost Item Worksheets

Table F-A-1a

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 3.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Staging Area Lease	3.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	24.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	53.3	12.31	--	320

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Staging Area Lease	3.01	$ -	$ -	$ -	$ 6,534,000.00	$ 6,534,000.00	Land lease for upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 6,534,000.00**	**$ 6,534,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 272,250.00**	**$ 272,250.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
LAND LEASE	ALL	36	$181,500	AC*MO	$6,534,000.00
BARE UNIT COST →	$ 272,250.00	TOTAL COST →			$ 6,534,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1b

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 3.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Preparation Work	3.02

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	4.5	1.04	--	27
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Preparation Work	3.02	$ 113,296.95	$ 95,521.36	$ 19,020.17	$ 1,500,000.00	$ 1,727,838.48	Equipment, labor, and materials for pre-remediation site work, including access dredging and construction of an upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	
UNIT PRICES		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ACCESS DREDGING	ALL	1	$1,000,000	LS	$1,000,000.00	CAT 910M FRONT LOADER	ALL	1,426	1	324	$ 24.11	$ 7,812.37
STAGING AREA SHORELINE MODIFICATIONS	ALL	1	$500,000	LS	$500,000.00	CAT 272 SKID STEER	ALL	1,354	1	324	$ 24.14	$ 7,822.42
						TRENCH ROLLER WITH REMOTE	ALL	314	1	324	$ 10.45	$ 3,385.38
BARE UNIT COST →	$ 1,500,000.00	TOTAL COST →			$ 1,500,000.00	BARE UNIT COST →	$ 19,020.17	3,094		TOTAL RENTED EQUIP →		$ 19,020.17

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
UNION OPERATOR 1	ALL	1	324	$ 65.99	$ 21,379.88	DIESEL	ALL	3,094	$ 4.20	GAL	$ 12,986.73
UNION OPERATOR 2	ALL	2	648	$ 65.99	$ 42,759.76	DGA	ALL	887	$ 33.80	CY	$ 29,991.87
UNION LABORER	ALL	3	972	$ 50.57	$ 49,157.30	CHAIN LINK FENCING	ALL	1,300	$ 30.79	LF	$ 40,024.71
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -	NON-WOVEN GEOTEXTILE	ALL	71,874	$ 0.17	SF	$ 12,518.06
BARE UNIT COST →	$ 113,296.95	TOTAL LABOR COST →			$ 113,296.95	BARE UNIT COST →	$ 95,521.36	TOTAL MATERIAL COST →			$ 95,521.36

Table F-A-1c

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 3.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Temporary Facilities and Utilities	3.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	13.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	53.3	12.31	--	320

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Temporary Facilities and Utilities	3.03	$ -	$ -	$ -	$ 1,326,000.00	$ 1,326,000.00	Temporary facilities and utilities for work.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 1,326,000.00**	**$ 1,326,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 102,000.00**	**$ 102,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TEMPORARY FACILITIES AND UTILITIES	ALL	13	$102,000	MO	$1,326,000.00							
BARE UNIT COST →	$ 102,000.00	TOTAL COST →			$ 1,326,000.00	BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -	BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1d

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 4.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Stabilization (High Cost)	4.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Stabilization (High Cost)	4.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 10.00	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 9.82	$ -
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 76.92	$ -
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 57.69	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 156.26	$ -
BARGE (80'X40')	INSTALL	0	3	0	$ 76.92	$ -
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	0	2	0	$ 49.04	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	0	2	0	$ 156.26	$ -
TUG BOAT 1 - 380 HP	ALL	0	2	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	ALL	0	1	0	$ 53.54	$ -
WORK BOAT - 115 HP	ALL	0	2	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	0	$ 147.88	$ -
UNION TUG OPERATOR	ALL	3	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	8	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	3	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SHEETPILE - TIEBACK WALL (HIGH)	ALL	0	$ 5,600.00	TON	$ -
TIEBACKS (HIGH)	ALL	0	$ 3,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-1e

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 4.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Installation (High Cost)	4.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Installation (High Cost)	4.02	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 10.00	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 9.82	$ -
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 76.92	$ -
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 57.69	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 156.26	$ -
BARGE (80'X40')	INSTALL	0	3	0	$ 76.92	$ -
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	0	2	0	$ 49.04	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	0	2	0	$ 156.26	$ -
TUG BOAT 1 - 380 HP	ALL	0	2	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	ALL	0	1	0	$ 53.54	$ -
WORK BOAT - 115 HP	ALL	0	2	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	0	$ 147.88	$ -
UNION TUG OPERATOR	ALL	3	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	8	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	3	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SHEETPILE (HIGH)	ALL	0	$ 11,100.00	TON	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1f

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 4.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Replacement (High Cost)	4.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	280.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	5.8	1.35	--	35

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Replacement (High Cost)	4.03	$ 524,852.45	$ 2,687,386.71	$ 576,210.31	$ 64,666.59	$ 3,853,116.07	Equipment, labor, and materials for replacement of bulkheads at shorelines (including disposal).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 524,852.45**	**$ 2,687,386.71**	**$ 576,210.31**	**$ 64,666.59**	**$ 3,853,116.07**	
UNIT PRICES		**$ 1,874.47**	**$ 9,597.81**	**$ 2,057.89**	**$ 230.95**	**$ 13,761.13**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL	ALL	215.6	$300	TON	$64,666.59
BARE UNIT COST →	$ 230.95	TOTAL COST →			$ 64,666.59

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	18	1	420	$ 10.00	$ 4,200.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	420	$ 9.82	$ 4,125.35
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	1260	$ 76.92	$ 96,923.08
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	1260	$ 57.69	$ 72,692.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	7,872	1	420	$ 156.26	$ 65,630.60
BARGE (80'X40')	INSTALL	0	3	1260	$ 76.92	$ 96,923.08
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	15,338	2	840	$ 49.04	$ 41,192.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	15,745	2	840	$ 156.26	$ 131,261.20
TUG BOAT 1 - 380 HP	ALL	14,045	2	840	$ 40.20	$ 33,770.99
TUG BOAT 2 - 700 HP	ALL	12,936	1	420	$ 53.54	$ 22,488.60
WORK BOAT - 115 HP	ALL	4,250	2	840	$ 8.34	$ 7,002.80
BARE UNIT COST →	$ 2,057.89	70,206		TOTAL RENTED EQUIP →		$ 576,210.31

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	1260	$ 147.88	$ 186,322.50
UNION TUG OPERATOR	ALL	3	1260	$ 72.18	$ 90,946.86
UNION LABORER	ALL	2	840	$ 50.57	$ 42,481.62
UNION DECKHAND	ALL	8	3360	$ 50.57	$ 169,926.47
Per Diem Unit Rate (Hourly)	ALL	3	1260	$ 27.92	$ 35,175.00
BARE UNIT COST →	$ 1,874.47	TOTAL LABOR COST →			$ 524,852.45

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	70,206	$ 4.20	GAL	$ 294,722.77
SHEETPILE (HIGH)	ALL	215.6	$ 11,100.00	TON	$ 2,392,663.94
BARE UNIT COST → $ 9,597.81		TOTAL MATERIAL COST →			$ 2,687,386.71

Table F-A-1g

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 5

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	ISS	5.0

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	25,990.0		12	6	24.2	5.58	--	145
ITEM UNIT	CY							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
ISS	5.00	$ 953,259.50	$ 1,628,349.65	$ 4,548,862.51	$ -	$ 7,130,471.67	Equipment, labor, and materials for ISS at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 953,259.50**	**$ 1,628,349.65**	**$ 4,548,862.51**	**$ -**	**$ 7,130,471.67**	
UNIT PRICES		**$ 36.68**	**$ 62.65**	**$ 175.02**	**$ -**	**$ 274.35**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ISS OPERATION - DECK BARGE	MATERIAL BARGE	0	1	1740	$ 84.89	$ 147,716.05
ISS OPERATION - HORIZONTAL PIG (4,200 CF)	MATERIAL BARGE	0	8	13920	$ 85.36	$ 1,188,273.35
ISS OPERATION - SUCTION HOSE (4" X 20')	MATERIAL BARGE	0	3	5220	$ 1.24	$ 6,476.78
ISS OPERATION - DISCHARGE HOSE (4" X 50')	MATERIAL BARGE	0	4	6960	$ 1.24	$ 8,635.71
ISS OPERATION - GODWIN PUMP (4")	MATERIAL BARGE	10,412	8	13920	$ 16.87	$ 234,891.24
ISS OPERATION - FRAC TANK (18,000 GAL)	MATERIAL BARGE	0	2	3480	$ 17.81	$ 61,995.29
ISS OPERATION - HME SPUD BARGE	DRILL BARGE	0	4	6960	$ 117.55	$ 818,119.65
ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	DRILL BARGE	0	1	1740	$ 22.26	$ 38,724.33
ISS OPERATION - GENERATOR (175 KW)	DRILL BARGE	21,360	1	1740	$ 49.63	$ 86,357.07
ISS OPERATION - BATCH PLANT (45 CM/HR)	DRILL BARGE	0	1	1740	$ 174.36	$ 303,386.04
ISS OPERATION - BAUER RG 22S DRILL RIG	DRILL BARGE	78,321	1	1740	$ 780.24	$ 1,357,624.11
ISS OPERATION - HORIZONTAL SILO (1,200 CF)	DRILL BARGE	0	1	1740	$ 48.44	$ 84,289.05
ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	DRILL BARGE	0	1	1740	$ 14.84	$ 25,816.22
ISS OPERATION - GAS WELDER	DRILL BARGE	0	1	1740	$ 12.02	$ 20,907.50
ISS OPERATION - LIGHT PLANT	ALL	0	1	1740	$ 13.49	$ 23,475.49
TUG BOAT 2 - 700 HP	ALL	53,592	1	1740	$ 53.54	$ 93,167.07
WATER TRUCK (4,000 GAL)	ALL	22,968	1	1740	$ 28.17	$ 49,007.56
BARE UNIT COST →	$ 175.02	186,653		TOTAL RENTED EQUIP →		$ 4,548,862.51

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION FOREMAN	DRILL BARGE	1	1740	$ 148.65	$ 258,642.30
UNION OPERATOR 1	DRILL BARGE	3	5220	$ 65.99	$ 344,453.65
UNION DECKHAND	DRILL BARGE	2	3480	$ 50.57	$ 175,995.28
UNION TUG OPERATOR	TUG BOAT	1	1740	$ 72.18	$ 125,593.28
Per Diem Unit Rate (Hourly)	ALL	1	1740	$ 27.92	$ 48,575.00
BARE UNIT COST →	$ 36.68	TOTAL LABOR COST →			$ 953,259.50

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	186,653	$ 4.20	GAL	$ 783,570.47
PORTLAND CEMENT	ALL	5,729	$ 146.05	CY	$ 836,754.63
WATER	ALL	1,395,900	$ 0.01	GAL	$ 8,024.56
BARE UNIT COST →	$ 62.65	TOTAL MATERIAL COST →			$ 1,628,349.65

Table F-A-1h

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 6.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Mechanical Dredging and Debris Removal	6.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	32,300.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	CY		12	6	11.0	2.54	--	66

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Mechanical Dredging and Debris Removal	6.01	$ 683,421.50	$ 338,669.96	$ 694,163.67	$ -	$ 1,716,255.12	Equipment, labor, and materials for mechanical dredging and debris removal.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 683,421.50**	**$ 338,669.96**	**$ 694,163.67**	**$ -**	**$ 1,716,255.12**	
UNIT PRICES		**$ 21.16**	**$ 10.49**	**$ 21.49**	**$ -**	**$ 53.13**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	14,915	1	792	$ 84.97	$ 67,299.29
BUCKET (5.5 CY)	DREDGING	35	1	792	$ 10.00	$ 7,920.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	792	$ 9.82	$ 7,779.24
EXCAVATOR RAKE	DREDGING	0	1	792	$ 5.80	$ 4,596.82
BARGE (80'X40')	DREDGING	0	2	1584	$ 76.92	$ 121,846.15
TUG BOAT 1 - 380 HP	DREDGING	13,242	1	792	$ 40.20	$ 31,841.22
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	3168	$ 9.62	$ 30,461.54
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	14,845	1	792	$ 156.26	$ 123,760.56
BARGE (80'X40')	MATERIAL TRANSFER	0	1	792	$ 76.92	$ 60,923.08
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	13,242	1	792	$ 40.20	$ 31,841.22
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	24,394	1	792	$ 53.54	$ 42,407.08
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	2376	$ 57.69	$ 137,076.92
WORK BOAT - 115 HP	ALL	1	4	3168	$ 8.34	$ 26,410.56
BARE UNIT COST →	$ 21.49	80,674		TOTAL RENTED EQUIP →		$ 694,163.67

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	792	$ 147.88	$ 117,117.00
UNION TUG OPERATOR	DREDGING	1	792	$ 72.18	$ 57,166.60
UNION TUG OPERATOR	MATERIAL TRANSFER	1	792	$ 72.18	$ 57,166.60
UNION OPERATOR 1	MATERIAL TRANSFER	1	792	$ 65.99	$ 52,261.93
UNION TUG OPERATOR	TRANSPORT	1	792	$ 72.18	$ 57,166.60
UNION LABORER	ALL	2	1584	$ 50.57	$ 80,108.20
UNION DECKHAND	ALL	6	4752	$ 50.57	$ 240,324.59
Per Diem Unit Rate (Hourly)	ALL	1	792	$ 27.92	$ 22,110.00
BARE UNIT COST →	$ 21.16	TOTAL LABOR COST →			$ 683,421.50

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	80,674	$ 4.20	GAL	$ 338,669.96
BARE UNIT COST → $ 10.49		TOTAL MATERIAL COST →			$ 338,669.96

Table F-A-1i

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 6.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Slot Dredging and Debris Removal	6.02

COST ESTIMATE DATA			PRODUCTION DATA						
TOTAL QUANTITY ON COST ESTIMATE	1,800.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	CY		12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Slot Dredging and Debris Removal	6.02	$ 155,323.07	$ 76,940.44	$ 156,426.01	$ -	$ 388,689.52	Equipment, labor, and materials for slot dredging and debris removal along shorelines (e.g., slot dredging).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 155,323.07**	**$ 76,940.44**	**$ 156,426.01**	**$ -**	**$ 388,689.52**	
UNIT PRICES		**$ 86.29**	**$ 42.74**	**$ 86.90**	**$ -**	**$ 215.94**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	3,390	1	180	$ 84.97	$ 15,295.29
BUCKET (1.0 CY)	DREDGING	0	1	180	$ 2.56	$ 461.54
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	180	$ 9.82	$ 1,768.01
EXCAVATOR RAKE	DREDGING	0	1	180	$ 5.80	$ 1,044.73
BARGE (80'X40')	DREDGING	0	2	360	$ 76.92	$ 27,692.31
TUG BOAT 1 - 380 HP	DREDGING	3,010	1	180	$ 40.20	$ 7,236.64
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	720	$ 9.62	$ 6,923.08
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	3,374	1	180	$ 156.26	$ 28,127.40
BARGE (80'X40')	MATERIAL TRANSFER	0	1	180	$ 76.92	$ 13,846.15
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	3,010	1	180	$ 40.20	$ 7,236.64
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	5,544	1	180	$ 53.54	$ 9,637.97
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	540	$ 57.69	$ 31,153.85
WORK BOAT - 115 HP	ALL	1	4	720	$ 8.34	$ 6,002.40
BARE UNIT COST →	$ 86.90	18,328		TOTAL RENTED EQUIP →		$ 156,426.01

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	180	$ 147.88	$ 26,617.50
UNION TUG OPERATOR	DREDGING	1	180	$ 72.18	$ 12,992.41
UNION TUG OPERATOR	MATERIAL TRANSFER	1	180	$ 72.18	$ 12,992.41
UNION OPERATOR 1	MATERIAL TRANSFER	1	180	$ 65.99	$ 11,877.71
UNION TUG OPERATOR	TRANSPORT	1	180	$ 72.18	$ 12,992.41
UNION LABORER	ALL	2	360	$ 50.57	$ 18,206.41
UNION DECKHAND	ALL	6	1080	$ 50.57	$ 54,619.22
Per Diem Unit Rate (Hourly)	ALL	1	180	$ 27.92	$ 5,025.00
BARE UNIT COST →	$ 86.29	TOTAL LABOR COST →			$ 155,323.07

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	18,328	$ 4.20	GAL	$ 76,940.44
BARE UNIT COST →	$ 42.74	TOTAL MATERIAL COST →			$ 76,940.44

Table F-A-1j

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 6.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	32,300.0		12	6	13.5	3.12	--	81
ITEM UNIT	CY							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03	$ 275,751.19	$ 219,922.62	$ 336,121.68	$ -	$ 831,795.49	Dredged material dewatering and limited stabilization with amendment.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 275,751.19**	**$ 219,922.62**	**$ 336,121.68**	**$ -**	**$ 831,795.49**	
UNIT PRICES		**$ 8.54**	**$ 6.81**	**$ 10.41**	**$ -**	**$ 25.75**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	ALL	43	1	972	$ 10.00	$ 9,720.00
BARGE (80'X40')	ALL	0	2	1944	$ 76.92	$ 149,538.46
CAT 349 E	ALL	18,476	1	972	$ 70.13	$ 68,162.90
WATER TRUCK (4,000 GAL)	ALL	12,830	1	972	$ 28.17	$ 27,376.63
SILO	ALL	0	1	972	$ 48.44	$ 47,085.61
PFU400/25 (PNUEMATIC FOAM UNIT)	ALL	1,944	2	1944	$ 17.61	$ 34,238.08
BARE UNIT COST →	$ 10.41	33,293		TOTAL RENTED EQUIP →		$ 336,121.68

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	2	1944	$ 65.99	$ 128,279.29
UNION LABORER	ALL	3	2916	$ 50.57	$ 147,471.90
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 8.54	TOTAL LABOR COST →			$ 275,751.19

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	33,293	$ 4.20	GAL	$ 139,763.78
PORTLAND CEMENT	ALL	356	$ 146.05	CY	$ 51,987.34
DRUM OF ODOR CONTROL FOAM	ALL	33	$ 585.50	EA	$ 19,321.50
PFU400/25 FOAM UNIT FRIEGHT	ALL	2	$ 3,475.00	EA	$ 6,950.00
TRAINED FOAM TECHNICAN	ALL	2	$ 950.00	DAY	$ 1,900.00
BARE UNIT COST →	$ 6.81	TOTAL MATERIAL COST →			$ 219,922.62

Table F-A-1k

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 6.04

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Water Treatment	6.04

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	4.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	13.5	3.12	--	81

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Water Treatment	6.04	$ 316,104.21	$ 3,130.55	$ 476,784.62	$ -	$ 796,019.37	Equipment, labor, and materials for running an on-barge water treatment system for treating decant water from barges, concurrent with dredging operations.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 316,104.21**	**$ 3,130.55**	**$ 476,784.62**	**$ -**	**$ 796,019.37**	
UNIT PRICES		**$ 79,026.05**	**$ 782.64**	**$ 119,196.15**	**$ -**	**$ 199,004.84**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST	$ -	TOTAL COST			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	ALL	0	4	3888	$ 3.71	$ 14,421.47
WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	ALL	0	10	9720	$ 1.24	$ 12,060.21
WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	ALL	0	6	5832	$ 17.81	$ 103,895.55
WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	ALL	0	2	1944	$ 22.27	$ 43,289.81
WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	ALL	727	1	972	$ 16.87	$ 16,401.89
WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	ALL	0	2	1944	$ 117.55	$ 228,509.28
WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	ALL	0	1	972	$ 5.94	$ 5,776.21
WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	ALL	0	1	972	$ 8.16	$ 7,934.35
WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	ALL	0	2	1944	$ 22.27	$ 43,289.81
WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	ALL	0	1	972	$ 1.24	$ 1,206.02
BARE UNIT COST	$ 119,196.15	727		TOTAL RENTED EQUIP		$ 476,784.62

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
WATER TREATMENT OPERATOR	ALL	1	972	$ 95.00	$ 92,340.00
UNION DECKHAND	ALL	2	1944	$ 50.57	$ 98,314.60
UNION LABORER	ALL	2	1944	$ 50.57	$ 98,314.60
Per Diem Unit Rate (Hourly)	ALL	1	972	$ 27.92	$ 27,135.00
BARE UNIT COST	$ 79,026.05	TOTAL LABOR COST			$ 316,104.21

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	727	$ 4.20	GAL	$ 3,052.18
WATER TREATMENT (ON-BARGE) - BAG FILTER	ALL	20	$ 3.92	EA	$ 78.36
BARE UNIT COST	$ 782.64	TOTAL MATERIAL COST			$ 3,130.55

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 7.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle D Landfill Transportation, Processing, and Disposal	7.01

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	43,400.0		12	6	2.8	0.65	--	17
ITEM UNIT	TON							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle D Landfill Transportation, Processing, and Disposal	7.01	$ 25,041.69	$ 852,876.87	$ 10,923.04	$ 6,506,328.44	$ 7,395,170.04	Equipment, labor, and materials for Subtitle D Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 25,041.69**	**$ 852,876.87**	**$ 10,923.04**	**$ 6,506,328.44**	**$ 7,395,170.04**	
UNIT PRICES		**$ 0.58**	**$ 19.65**	**$ 0.25**	**$ 149.92**	**$ 170.40**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	43,376	$150	TON	$6,506,328.44
BARE UNIT COST →	$ 149.92	TOTAL COST →			$ 6,506,328.44

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	6,283	1	204	$ 53.54	$ 10,923.04
BARE UNIT COST →	$ 0.25	6,283		TOTAL RENTED EQUIP →		$ 10,923.04

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	204	$ 72.18	$ 14,724.73
UNION DECKHAND	ALL	1	204	$ 50.57	$ 10,316.96
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.58	TOTAL LABOR COST →			$ 25,041.69

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	6,283	$ 4.20	GAL	$ 26,376.87
WASTE CHARACTERIZATION SAMPLING	ALL	87	$ 9,500.00	EA	$ 826,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 19.65	TOTAL MATERIAL COST →			$ 852,876.87

Table F-A-1m

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 7.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	2,300.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	0.5	0.12	--	3

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02	$ 4,419.12	$ 52,154.74	$ 1,927.59	$ 1,598,045.58	$ 1,656,547.04	Equipment, labor, and materials for Subtitle C/TSCA Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 4,419.12**	**$ 52,154.74**	**$ 1,927.59**	**$ 1,598,045.58**	**$ 1,656,547.04**	
UNIT PRICES		**$ 1.92**	**$ 22.68**	**$ 0.84**	**$ 694.80**	**$ 720.24**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE C/TSCA PROCESSING, TRANSPORT, AND DISPOSAL	ALL	2,283	$700	TON	$1,598,045.58
BARE UNIT COST →	$ 694.80	TOTAL COST →			$ 1,598,045.58

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	1,109	1	36	$ 53.54	$ 1,927.59
BARE UNIT COST →	$ 0.84	1,109		TOTAL RENTED EQUIP →		$ 1,927.59

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	36	$ 72.18	$ 2,598.48
UNION DECKHAND	ALL	1	36	$ 50.57	$ 1,820.64
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 1.92	TOTAL LABOR COST →			$ 4,419.12

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,109	$ 4.20	GAL	$ 4,654.74
WASTE CHARACTERIZATION SAMPLING	ALL	5	$ 9,500.00	EA	$ 47,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 22.68	TOTAL MATERIAL COST →			$ 52,154.74

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 7.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Debris Transportation, Processing, and Disposal	7.03

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	2,400.0	
ITEM UNIT	TON	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.3	0.08	--	2

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL
Debris Transportation, Processing, and Disposal	7.03	$ 2,946.08	$ 15,603.16	$ 1,285.06	$ 713,784.97	$ 733,619.28
						$ -
						$ -
						$ -
GRAND TOTALS		**$ 2,946.08**	**$ 15,603.16**	**$ 1,285.06**	**$ 713,784.97**	**$ 733,619.28**
UNIT PRICES		**$ 1.23**	**$ 6.50**	**$ 0.54**	**$ 297.41**	**$ 305.67**

Notes: Equipment, labor, and materials for Debris Transportation and Disposal (Subtitle D Landfill). Assumes all-in management/transloading of materials at a shoreline processing facility.

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	2,379	$300	TON	$713,784.97
BARE UNIT COST	$ 297.41	TOTAL COST			$ 713,784.97

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	739	1	24	$ 53.54	$ 1,285.06
BARE UNIT COST	$ 0.54	739		TOTAL RENTED EQUIP		$ 1,285.06

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	24	$ 72.18	$ 1,732.32
UNION DECKHAND	ALL	1	24	$ 50.57	$ 1,213.76
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST	$ 1.23	TOTAL LABOR COST			$ 2,946.08

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	739	$ 4.20	GAL	$ 3,103.16
WIPE SAMPLING (DEBRIS)	ALL	5	$ 2,500.00	EA	$ 12,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST $ 6.50		TOTAL MATERIAL COST			$ 15,603.16

Table F-A-1o

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Backfill Placement	8.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Backfill Placement	8.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	BACKFILL PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	BACKFILL PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	BACKFILL PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	BACKFILL PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	BACKFILL PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	BACKFILL PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	BACKFILL PLACEMENT	0	1	0	$ 10.00	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	BACKFILL PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	BACKFILL PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SAND	ALL	0	$ 27.13	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1p

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Deep Water	8.11

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.76		12	6	1.2	0.27	--	7
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Deep Water	8.11	$ 49,584.67	$ 464,775.57	$ 83,174.69	$ -	$ 597,534.92	Equipment, labor, and materials for placing deep water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 49,584.67**	**$ 464,775.57**	**$ 83,174.69**	**$ -**	**$ 597,534.92**	
UNIT PRICES		**$ 65,242.98**	**$ 611,546.80**	**$ 109,440.38**	**$ -**	**$ 786,230.16**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	351	1	84	$ 24.14	$ 2,028.03
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	370	1	84	$ 24.11	$ 2,025.43
TELEBELT 130	MATERIAL TRANSFER	1,497	1	84	$ 225.00	$ 18,900.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,574	1	84	$ 156.26	$ 13,126.12
BARGE (80'X40')	MATERIAL TRANSFER	0	1	84	$ 76.92	$ 6,461.54
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	168	$ 57.69	$ 9,692.31
TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,587	1	84	$ 53.54	$ 4,497.72
SCOW (100 CY)	CAP PLACEMENT	0	4	336	$ 9.62	$ 3,230.77
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,809	2	168	$ 40.20	$ 6,754.20
BARGE (80'X40')	CAP PLACEMENT	0	1	84	$ 76.92	$ 6,461.54
CAT 375 L	CAP PLACEMENT	1,582	1	84	$ 84.97	$ 7,137.80
BUCKET (5.5 CY)	CAP PLACEMENT	4	1	84	$ 10.00	$ 840.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	84	$ 24.04	$ 2,019.23
BARE UNIT COST →	$ 109,440.38	10,774		TOTAL RENTED EQUIP →		$ 83,174.69

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	84	$ 147.88	$12,421.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	84	$ 65.99	$ 5,542.93
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	84	$ 65.99	$ 5,542.93
UNION OPERATOR 1	MATERIAL TRANSFER	1	84	$ 65.99	$ 5,542.93
UNION TUG OPERATOR	CAP PLACEMENT	3	252	$ 72.18	$18,189.37
Per Diem Unit Rate (Hourly)	ALL	1	84	$ 27.92	$ 2,345.00
BARE UNIT COST →	$ 65,242.98	TOTAL LABOR COST →			$ 49,584.67

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	10,774	$ 4.20	GAL	$ 45,228.58
ORGANOCLAY	ALL	55	$ 3,307.50	CY	$ 181,402.39
GAC	ALL	62	$ 1,827.19	CY	$ 113,123.31
SAND	ALL	4,093	$ 27.13	CY	$ 111,021.29
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	7	$ 2,000.00	EA	$ 14,000.00
BARE UNIT COST →	$ 611,546.80	TOTAL MATERIAL COST →			$ 464,775.57

Table F-A-1q

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.12

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Shallow Water	8.12

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	4.74	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	8.8	2.04	--	53

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Shallow Water	8.12	$ 375,426.77	$ 3,780,143.69	$ 629,751.22	$ -	$ 4,785,321.68	Equipment, labor, and materials for placing shallow water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 375,426.77**	**$ 3,780,143.69**	**$ 629,751.22**	**$ -**	**$ 4,785,321.68**	
UNIT PRICES		**$ 79,203.96**	**$ 797,498.67**	**$ 132,858.91**	**$ -**	**$ 1,009,561.54**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	2,658	1	636	$ 24.14	$ 15,355.12
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	2,798	1	636	$ 24.11	$ 15,335.39
TELEBELT 130	MATERIAL TRANSFER	11,334	1	636	$ 225.00	$ 143,100.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	11,921	1	636	$ 156.26	$ 99,383.48
BARGE (80'X40')	MATERIAL TRANSFER	0	1	636	$ 76.92	$ 48,923.08
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1272	$ 57.69	$ 73,384.62
TUG BOAT 2 - 700 HP	CAP PLACEMENT	78,355	1	636	$ 53.54	$ 34,054.17
SCOW (100 CY)	CAP PLACEMENT	0	4	2544	$ 9.62	$ 24,461.54
TUG BOAT 1 - 380 HP	CAP PLACEMENT	10,634	2	1272	$ 40.20	$ 51,138.93
BARGE (80'X40')	CAP PLACEMENT	0	1	636	$ 76.92	$ 48,923.08
CAT 375 L	CAP PLACEMENT	11,977	1	636	$ 84.97	$ 54,043.37
BUCKET (5.5 CY)	CAP PLACEMENT	28	1	636	$ 10.00	$ 6,360.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	636	$ 24.04	$ 15,288.46
BARE UNIT COST →	$ 132,858.91	129,706		TOTAL RENTED EQUIP →		$ 629,751.22

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	636	$ 147.88	$ 94,048.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	636	$ 65.99	$ 41,967.92
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	636	$ 65.99	$ 41,967.92
UNION OPERATOR 1	MATERIAL TRANSFER	1	636	$ 65.99	$ 41,967.92
UNION TUG OPERATOR	CAP PLACEMENT	3	1908	$ 72.18	$ 137,719.52
Per Diem Unit Rate (Hourly)	ALL	1	636	$ 27.92	$ 17,755.00
BARE UNIT COST →	$ 79,203.96	TOTAL LABOR COST →			$ 375,426.77

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	129,706	$ 4.20	GAL	$ 544,505.12
ORGANOCLAY	ALL	344	$ 3,307.50	CY	$ 1,137,957.60
GAC	ALL	388	$ 1,827.19	CY	$ 709,635.24
SAND	ALL	16,883	$ 27.13	CY	$ 457,952.90
GRAVEL	ALL	6,021	$ 67.18	CY	$ 404,471.68
ARMOR STONE 3-9 INCHES	ALL	7,646	$ 61.69	CY	$ 471,621.16
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	27	$ 2,000.00	EA	$ 54,000.00
BARE UNIT COST →	$ 797,498.67	TOTAL MATERIAL COST →			$ 3,780,143.69

Table F-A-1r

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.13

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Wake Zone	8.13

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	4.87	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	11.3	2.62	--	68

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Wake Zone	8.13	$ 481,679.63	$ 4,082,537.61	$ 807,982.69	$ -	$ 5,372,199.94	Equipment, labor, and materials for placing armored amended caps in wake zone areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 481,679.63**	**$ 4,082,537.61**	**$ 807,982.69**	**$ -**	**$ 5,372,199.94**	
UNIT PRICES		**$ 98,907.52**	**$ 838,303.41**	**$ 165,910.20**	**$ -**	**$ 1,103,121.14**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	3,411	1	816	$ 24.14	$ 19,700.91
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	3,590	1	816	$ 24.11	$ 19,675.59
TELEBELT 130	MATERIAL TRANSFER	14,541	1	816	$ 225.00	$ 183,600.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	15,295	1	816	$ 156.26	$ 127,510.88
BARGE (80'X40')	MATERIAL TRANSFER	0	1	816	$ 76.92	$ 62,769.23
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1632	$ 57.69	$ 94,153.85
TUG BOAT 2 - 700 HP	CAP PLACEMENT	25,133	1	816	$ 53.54	$ 43,692.14
SCOW (100 CY)	CAP PLACEMENT	0	4	3264	$ 9.62	$ 31,384.62
TUG BOAT 1 - 380 HP	CAP PLACEMENT	27,287	2	1632	$ 40.20	$ 65,612.21
BARGE (80'X40')	CAP PLACEMENT	0	1	816	$ 76.92	$ 62,769.23
CAT 375 L	CAP PLACEMENT	15,367	1	816	$ 84.97	$ 69,338.66
BUCKET (5.5 CY)	CAP PLACEMENT	36	1	816	$ 10.00	$ 8,160.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	816	$ 24.04	$ 19,615.38
BARE UNIT COST →	$ 165,910.20	104,660		TOTAL RENTED EQUIP →		$ 807,982.69

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	816	$ 147.88	$ 120,666.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	816	$ 65.99	$ 53,845.63
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	816	$ 65.99	$ 53,845.63
UNION OPERATOR 1	MATERIAL TRANSFER	1	816	$ 65.99	$ 53,845.63
UNION TUG OPERATOR	CAP PLACEMENT	3	2448	$ 72.18	$ 176,696.75
Per Diem Unit Rate (Hourly)	ALL	1	816	$ 27.92	$ 22,780.00
BARE UNIT COST →	$ 98,907.52	TOTAL LABOR COST →			$ 481,679.63

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	104,660	$ 4.20	GAL	$ 439,363.35
ORGANOCLAY	ALL	353	$ 3,307.50	CY	$ 1,168,268.47
GAC	ALL	399	$ 1,827.19	CY	$ 728,537.23
SAND	ALL	17,333	$ 27.13	CY	$ 470,151.03
GRAVEL	ALL	6,181	$ 67.18	CY	$ 415,245.27
ARMOR STONE 3-9 INCHES	ALL	13,082	$ 61.69	CY	$ 806,972.27
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	27	$ 2,000.00	EA	$ 54,000.00
BARE UNIT COST →	$ 838,303.41	TOTAL MATERIAL COST →			$ 4,082,537.61

Table F-A-1s

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.14

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - ISS Areas	8.14

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.83	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	1.5	0.35	--	9

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - ISS Areas	8.14	$ 63,751.72	$ 388,375.81	$ 106,938.89	$ -	$ 559,066.41	Equipment, labor, and materials for placing armored amended caps in ISS areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 63,751.72**	**$ 388,375.81**	**$ 106,938.89**	**$ -**	**$ 559,066.41**	
UNIT PRICES		**$ 76,809.30**	**$ 467,922.66**	**$ 128,842.03**	**$ -**	**$ 673,573.98**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	451	1	108	$ 24.14	$ 2,607.47
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	475	1	108	$ 24.11	$ 2,604.12
TELEBELT 130	MATERIAL TRANSFER	1,925	1	108	$ 225.00	$ 24,300.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	2,024	1	108	$ 156.26	$ 16,876.44
BARGE (80'X40')	MATERIAL TRANSFER	0	1	108	$ 76.92	$ 8,307.69
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	216	$ 57.69	$ 12,461.54
TUG BOAT 2 - 700 HP	CAP PLACEMENT	3,326	1	108	$ 53.54	$ 5,782.78
SCOW (100 CY)	CAP PLACEMENT	0	4	432	$ 9.62	$ 4,153.85
TUG BOAT 1 - 380 HP	CAP PLACEMENT	3,612	2	216	$ 40.20	$ 8,683.97
BARGE (80'X40')	CAP PLACEMENT	0	1	108	$ 76.92	$ 8,307.69
CAT 375 L	CAP PLACEMENT	2,034	1	108	$ 84.97	$ 9,177.18
BUCKET (5.5 CY)	CAP PLACEMENT	5	1	108	$ 10.00	$ 1,080.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	108	$ 24.04	$ 2,596.15
BARE UNIT COST →	$ 128,842.03	13,852		TOTAL RENTED EQUIP →		$ 106,938.89

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	108	$ 147.88	$ 15,970.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	108	$ 65.99	$ 7,126.63
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	108	$ 65.99	$ 7,126.63
UNION OPERATOR 1	MATERIAL TRANSFER	1	108	$ 65.99	$ 7,126.63
UNION TUG OPERATOR	CAP PLACEMENT	3	324	$ 72.18	$ 23,386.33
Per Diem Unit Rate (Hourly)	ALL	1	108	$ 27.92	$ 3,015.00
BARE UNIT COST →	$ 76,809.30	TOTAL LABOR COST →			$ 63,751.72

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	13,852	$ 4.20	GAL	$ 58,151.03
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	67	$ 1,827.19	CY	$ 122,791.74
SAND	ALL	1,837	$ 27.13	CY	$ 49,838.31
GRAVEL	ALL	1,042	$ 67.18	CY	$ 69,987.76
ARMOR STONE 3-9 INCHES	ALL	1,323	$ 61.69	CY	$ 81,606.97
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	3	$ 2,000.00	EA	$ 6,000.00
BARE UNIT COST →	$ 467,922.66	TOTAL MATERIAL COST →			$ 388,375.81

Table F-A-1t

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.15

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Deep Water)	8.15

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Deep Water)	8.15	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1u

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.16

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Shallow Water)	8.16

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Shallow Water)	8.16	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-1v

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.21

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - CSOs	8.21

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.9		12	6	6.2	1.42	--	37
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - CSOs	8.21	$ 300,423.79	$ 999,575.89	$ 309,231.14	$ -	$ 1,609,230.82	Equipment, labor, and materials for placing outfall protection at CSOs. Assumes mats required for outfall protection can all be delivered and placed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 300,423.79**	**$ 999,575.89**	**$ 309,231.14**	**$ -**	**$ 1,609,230.82**	
UNIT PRICES		**$ 326,547.60**	**$ 1,086,495.53**	**$ 336,120.81**	**$ -**	**$ 1,749,163.93**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	MAT PLACEMENT	16,723	2	888	$ 84.97	$ 75,456.78
BUCKET (5.5 CY)	MAT PLACEMENT	39	2	888	$ 10.00	$ 8,880.00
BARGE (80'X40')	MAT PLACEMENT	0	2	888	$ 76.92	$ 68,307.69
TUG BOAT 1 - 380 HP	MAT PLACEMENT	14,847	2	888	$ 40.20	$ 35,700.76
WORK BOAT - 115 HP	MAT PLACEMENT	2,247	1	444	$ 8.34	$ 3,701.48
BARGE (80'X40')	MAT DELIVERY	0	1	444	$ 76.92	$ 34,153.85
TUG BOAT 2 - 700 HP	MAT DELIVERY	13,675	1	444	$ 53.54	$ 23,773.67
GROUT PLANT	GROUTING	1,289	2	888	$ 66.73	$ 59,256.92
BARE UNIT COST →	$ 336,120.81	48,820		TOTAL RENTED EQUIP →		$ 309,231.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	MAT PLACEMENT	2	888	$ 147.88	$ 131,313.00
UNION DECKHAND	MAT PLACEMENT	1	444	$ 50.57	$ 22,454.57
UNION LABORER	MAT PLACEMENT	4	1776	$ 50.57	$ 89,818.28
UNION TUG OPERATOR	MAT PLACEMENT	1	444	$ 72.18	$ 32,047.94
Per Diem Unit Rate (Hourly)	ALL	2	888	$ 27.92	$ 24,790.00
BARE UNIT COST →	$ 326,547.60	TOTAL LABOR COST →			$ 300,423.79

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	48,820	$ 4.20	GAL	$ 204,948.31
NON-WOVEN GEOTEXTILE	ALL	44,000	$ 0.17	SF	$ 7,663.33
SAND	ALL	1,278	$ 27.13	CY	$ 34,659.72
ARTICULATED CONCRETE MATTRESSES	ALL	40,000	$ 12.67	SF	$ 506,800.00
GRAVEL	ALL	111	$ 67.18	CY	$ 7,464.17
UNDERWATER GROUT (SUPERSACK)	ALL	117	$ 2,000.00	EA	$ 234,000.00
WATER	ALL	7,020	$ 0.01	GAL	$ 40.36
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST →	$ 1,086,495.53	TOTAL MATERIAL COST →			$ 999,575.89

Table F-A-1w

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.22

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22

COST ESTIMATE DATA

		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.0	
ITEM UNIT	AC	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22	$ 5,499.83	$ 17,102.13	$ 8,314.57	$ -	$ 30,916.53	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of 12 inches or greater. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,102.13**	**$ 8,314.57**	**$ -**	**$ 30,916.53**	
UNIT PRICES		**$ 183,327.64**	**$ 570,071.09**	**$ 277,152.36**	**$ -**	**$ 1,030,551.08**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 277,152.36	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 183,327.64	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	104	$ 114.92	CY	$ 11,970.83
BARE UNIT COST →	$ 570,071.09	TOTAL MATERIAL COST →			$ 17,102.13

Table F-A-1x

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 8.23

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.1	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23	$ 5,499.83	$ 17,715.04	$ 8,314.57	$ -	$ 31,529.44	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of less than 12 inches. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,715.04**	**$ 8,314.57**	**$ -**	**$ 31,529.44**	
UNIT PRICES		**$ 61,109.21**	**$ 196,833.77**	**$ 92,384.12**	**$ -**	**$ 350,327.10**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 92,384.12	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 61,109.21	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	204	$ 61.69	CY	$ 12,583.74
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
BARE UNIT COST →	$ 196,833.77	TOTAL MATERIAL COST →			$ 17,715.04

Table F-A-1y

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 9

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Environmental Controls	9.0

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	3.9	0.90	--	24
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Environmental Controls	9.0	$ 57,046.75	$ 462,545.47	$ 4,701.88	$ -	$ 524,294.09	Equipment, labor, and materials for installing and maintaning environmental controls (i.e., silt curtains) during aquatic work activities.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 57,046.75**	**$ 462,545.47**	**$ 4,701.88**	**$ -**	**$ 524,294.09**	
UNIT PRICES		**$ 57,046.75**	**$ 462,545.47**	**$ 4,701.88**	**$ -**	**$ 524,294.09**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WORK BOAT - 115 HP	ALL	2,854	2	564	$ 8.34	$ 4,701.88
BARE UNIT COST →	$ 4,701.88	2,854		TOTAL RENTED EQUIP →		$ 4,701.88

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION DECKHAND	ALL	4	1128	$ 50.57	$ 57,046.75
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 57,046.75	TOTAL LABOR COST →			$ 57,046.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	2,854	$ 4.20	GAL	$ 11,980.42
MOBILE RESUSPENSION CONTROL SYSTEM (ALT. EB-B)	ALL	1	$ 418,300.00	LS	$ 418,300.00
SILT CURTAIN	ALL	22	$ 1,466.59	EA	$ 32,265.05
BARE UNIT COST →	$ 462,545.47		TOTAL MATERIAL COST →		$ 462,545.47

Table F-A-1z

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 10

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Inspections and Surveying	10.0

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes
ITEM UNIT	LS	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	15.0	3.46	--	90

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Inspections and Surveying	10.0	$ -	$ -	$ -	$ 1,361,000.00	$ 1,361,000.00	Equipment, labor, and materials for surveying and bulkhead inspections.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 1,361,000.00**	**$ 1,361,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 1,361,000.00**	**$ 1,361,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
MULTIBEAM BATHYMETRIC SURVEYS	ALL	17	$10,200	DAY	$173,400.00
BULKHEAD INSPECTIONS	ALL	1	$500,000	LS	$500,000.00
BATHYMETRIC PROGRESS SURVEYS	ALL	73	$6,200	DAY	$452,600.00
UTILITY ID AND SURVEY	ALL	1	$200,000	LS	$200,000.00
VIBRATION MONITORING	ALL	35	$1,000	DAY	$35,000.00
BARE UNIT COST →	$ 1,361,000.00	TOTAL COST →			$ 1,361,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-1aa

Alternative EB-B

CONSTRUCTION COST ESTIMATE WORKSHEET 11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Restoration	11.0

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes
ITEM UNIT	LS	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Restoration	11.0	$ 62,942.75	$ 487,354.64	$ 10,566.76	$ 324,939.00	$ 885,803.15	Equipment, labor, and materials for site restoration (includes disposal of DGA from staging area).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	
UNIT PRICES		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
OTHER SITE RESTORATION	ALL	1	$100,000	LS	$100,000.00
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	1,500	$150	TON	$224,939.00
BARE UNIT COST ⟶ $ 324,939.00			TOTAL COST ⟶		$ 324,939.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	792	1	180	$ 24.11	$ 4,340.20
CAT 272 SKID STEER	ALL	752	1	180	$ 24.14	$ 4,345.79
TRENCH ROLLER WITH REMOTE	ALL	174	1	180	$ 10.45	$ 1,880.77
BARE UNIT COST ⟶ $ 10,566.76		1,719		TOTAL RENTED EQUIP ⟶		$ 10,566.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	180	$ 65.99	$ 11,877.71
UNION OPERATOR 2	ALL	2	360	$ 65.99	$ 23,755.42
UNION LABORER	ALL	3	540	$ 50.57	$ 27,309.61
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST ⟶ $ 62,942.75		TOTAL LABOR COST ⟶			$ 62,942.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ASPHALT PAVING	ALL	65,340	$ 7.46	SF	$ 487,354.64
BARE UNIT COST ⟶ $ 487,354.64		TOTAL MATERIAL COST ⟶			$ 487,354.64

Table F-A-2a

Alternative EB-C			
CONSTRUCTION COST ESTIMATE WORKSHEET 3.01			BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Staging Area Lease	3.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	42.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	91.3	21.08	--	548

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Staging Area Lease	3.01	$ -	$ -	$ -	$ 11,434,500.00	$ 11,434,500.00	Land lease for upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 11,434,500.00**	**$ 11,434,500.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 272,250.00**	**$ 272,250.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
LAND LEASE	ALL	63	$181,500	AC*MO	$11,434,500.00							
BARE UNIT COST →	$ 272,250.00	TOTAL COST →			$ 11,434,500.00	BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -	BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-2b

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 3.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Preparation Work	3.02

COST ESTIMATE DATA			
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	
ITEM UNIT	LS		

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	4.5	1.04	--	27

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Preparation Work	3.02	$ 113,296.95	$ 95,521.36	$ 19,020.17	$ 1,500,000.00	$ 1,727,838.48	Equipment, labor, and materials for pre-remediation site work, including access dredging and construction of an upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	
UNIT PRICES		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ACCESS DREDGING	ALL	1	$1,000,000	LS	$1,000,000.00
STAGING AREA SHORELINE MODIFICATIONS	ALL	1	$500,000	LS	$500,000.00
BARE UNIT COST →	$ 1,500,000.00	TOTAL COST →			$ 1,500,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	1,426	1	324	$ 24.11	$ 7,812.37
CAT 272 SKID STEER	ALL	1,354	1	324	$ 24.14	$ 7,822.42
TRENCH ROLLER WITH REMOTE	ALL	314	1	324	$ 10.45	$ 3,385.38
BARE UNIT COST →	$ 19,020.17	3,094		TOTAL RENTED EQUIP →		$ 19,020.17

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	324	$ 65.99	$ 21,379.88
UNION OPERATOR 2	ALL	2	648	$ 65.99	$ 42,759.76
UNION LABORER	ALL	3	972	$ 50.57	$ 49,157.30
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 113,296.95	TOTAL LABOR COST →			$ 113,296.95

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,094	$ 4.20	GAL	$ 12,986.73
DGA	ALL	887	$ 33.80	CY	$ 29,991.87
CHAIN LINK FENCING	ALL	1,300	$ 30.79	LF	$ 40,024.71
NON-WOVEN GEOTEXTILE	ALL	71,874	$ 0.17	SF	$ 12,518.06
BARE UNIT COST →	$ 95,521.36		TOTAL MATERIAL COST →		$ 95,521.36

Table F-A-2c

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 3.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Temporary Facilities and Utilities	3.03

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	22.0
ITEM UNIT	MO
Cost Estimate Data Notes	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	91.3	21.08	--	548

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Temporary Facilities and Utilities	3.03	$ -	$ -	$ -	$ 2,244,000.00	$ 2,244,000.00	Temporary facilities and utilities for work.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 2,244,000.00**	**$ 2,244,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 102,000.00**	**$ 102,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
TEMPORARY FACILITIES AND UTILITIES	ALL	22	$102,000	MO	$2,244,000.00
BARE UNIT COST →	$ 102,000.00	TOTAL COST →			$ 2,244,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-2d

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 4.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Stabilization (High Cost)	4.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Stabilization (High Cost)	4.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 10.00	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 9.82	$ -
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 76.92	$ -
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 57.69	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 156.26	$ -
BARGE (80'X40')	INSTALL	0	3	0	$ 76.92	$ -
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	0	2	0	$ 49.04	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	0	2	0	$ 156.26	$ -
TUG BOAT 1 - 380 HP	ALL	0	2	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	ALL	0	1	0	$ 53.54	$ -
WORK BOAT - 115 HP	ALL	0	2	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	0	$ 147.88	$ -
UNION TUG OPERATOR	ALL	3	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	8	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	3	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SHEETPILE - TIEBACK WALL (HIGH)	ALL	0	$ 5,600.00	TON	$ -
TIEBACKS (HIGH)	ALL	0	$ 3,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-2e

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 4.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Installation (High Cost)	4.02

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	260.0	
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	3.7	0.85	--	22

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Installation (High Cost)	4.02	$ 329,907.25	$ 2,387,198.67	$ 362,189.34	$ -	$ 3,079,295.26	Equipment, labor, and materials for installation of new bulkheads at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 329,907.25**	**$ 2,387,198.67**	**$ 362,189.34**	**$ -**	**$ 3,079,295.26**	
UNIT PRICES		**$ 1,268.87**	**$ 9,181.53**	**$ 1,393.04**	**$ -**	**$ 11,843.44**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	12	1	264	$ 10.00	$ 2,640.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	264	$ 9.82	$ 2,593.08
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	792	$ 76.92	$ 60,923.08
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	792	$ 57.69	$ 45,692.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	4,948	1	264	$ 156.26	$ 41,253.52
BARGE (80'X40')	INSTALL	0	3	792	$ 76.92	$ 60,923.08
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	9,641	2	528	$ 49.04	$ 25,892.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	9,897	2	528	$ 156.26	$ 82,507.04
TUG BOAT 1 - 380 HP	ALL	8,828	2	528	$ 40.20	$ 21,227.48
TUG BOAT 2 - 700 HP	ALL	8,131	1	264	$ 53.54	$ 14,135.69
WORK BOAT - 115 HP	ALL	2,672	2	528	$ 8.34	$ 4,401.76
BARE UNIT COST →	$ 1,393.04	44,129		TOTAL RENTED EQUIP →		$ 362,189.34

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	792	$ 147.88	$ 117,117.00
UNION TUG OPERATOR	ALL	3	792	$ 72.18	$ 57,166.60
UNION LABORER	ALL	2	528	$ 50.57	$ 26,702.73
UNION DECKHAND	ALL	8	2112	$ 50.57	$ 106,810.93
Per Diem Unit Rate (Hourly)	ALL	3	792	$ 27.92	$ 22,110.00
BARE UNIT COST →	$ 1,268.87	TOTAL LABOR COST →			$ 329,907.25

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	44,129	$ 4.20	GAL	$ 185,254.31
SHEETPILE (HIGH)	ALL	198	$ 11,100.00	TON	$ 2,201,944.35
BARE UNIT COST → $ 9,181.53		TOTAL MATERIAL COST →			$ 2,387,198.67

Table F-A-2f

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 4.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Replacement (High Cost)	4.03

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	640.0	Cost Estimate Data Notes
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	13.3	3.08	--	80

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Replacement (High Cost)	4.03	$ 1,199,662.74	$ 6,169,843.86	$ 1,317,052.14	$ 64,666.59	$ 8,751,225.33	Equipment, labor, and materials for replacement of bulkheads at shorelines (including disposal).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,199,662.74**	**$ 6,169,843.86**	**$ 1,317,052.14**	**$ 64,666.59**	**$ 8,751,225.33**	
UNIT PRICES		**$ 1,874.47**	**$ 9,640.38**	**$ 2,057.89**	**$ 101.04**	**$ 13,673.79**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	215.6	$300	TON	$64,666.59
BARE UNIT COST →	$ 101.04	TOTAL COST →			$ 64,666.59

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	42	1	960	$ 10.00	$ 9,600.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	960	$ 9.82	$ 9,429.38
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	2880	$ 76.92	$ 221,538.46
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	2880	$ 57.69	$ 166,153.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	17,994	1	960	$ 156.26	$ 150,012.80
BARGE (80'X40')	INSTALL	0	3	2880	$ 76.92	$ 221,538.46
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	35,059	2	1920	$ 49.04	$ 94,153.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	35,988	2	1920	$ 156.26	$ 300,025.59
TUG BOAT 1 - 380 HP	ALL	32,102	2	1920	$ 40.20	$ 77,190.83
TUG BOAT 2 - 700 HP	ALL	29,568	1	960	$ 53.54	$ 51,402.52
WORK BOAT - 115 HP	ALL	9,715	2	1920	$ 8.34	$ 16,006.40
BARE UNIT COST →	$ 2,057.89	160,470		TOTAL RENTED EQUIP →		$ 1,317,052.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	2880	$ 147.88	$ 425,880.00
UNION TUG OPERATOR	ALL	3	2880	$ 72.18	$ 207,878.53
UNION LABORER	ALL	2	1920	$ 50.57	$ 97,100.84
UNION DECKHAND	ALL	8	7680	$ 50.57	$ 388,403.37
Per Diem Unit Rate (Hourly)	ALL	3	2880	$ 27.92	$ 80,400.00
BARE UNIT COST →	$ 1,874.47	TOTAL LABOR COST →			$ 1,199,662.74

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	160,470	$ 4.20	GAL	$ 673,652.05
SHEETPILE (HIGH)	ALL	495.2	$ 11,100.00	TON	$ 5,496,191.81
BARE UNIT COST →	$ 9,640.38	TOTAL MATERIAL COST →			$ 6,169,843.86

Table F-A-2g

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 5

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	ISS	5.0

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	9,890.0		12	6	9.2	2.12	--	55
ITEM UNIT	CY							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
ISS	5.00	$ 361,581.19	$ 618,724.27	$ 1,725,430.61	$ -	$ 2,705,736.07	Equipment, labor, and materials for ISS at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 361,581.19**	**$ 618,724.27**	**$ 1,725,430.61**	**$ -**	**$ 2,705,736.07**	
UNIT PRICES		**$ 36.56**	**$ 62.56**	**$ 174.46**	**$ -**	**$ 273.58**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ISS OPERATION - DECK BARGE	MATERIAL BARGE	0	1	660	$ 84.89	$ 56,030.23
ISS OPERATION - HORIZONTAL PIG (4,200 CF)	MATERIAL BARGE	0	8	5280	$ 85.36	$ 450,724.37
ISS OPERATION - SUCTION HOSE (4" X 20')	MATERIAL BARGE	0	3	1980	$ 1.24	$ 2,456.71
ISS OPERATION - DISCHARGE HOSE (4" X 50')	MATERIAL BARGE	0	4	2640	$ 1.24	$ 3,275.61
ISS OPERATION - GODWIN PUMP (4")	MATERIAL BARGE	3,949	8	5280	$ 16.87	$ 89,096.68
ISS OPERATION - FRAC TANK (18,000 GAL)	MATERIAL BARGE	0	2	1320	$ 17.81	$ 23,515.45
ISS OPERATION - HME SPUD BARGE	DRILL BARGE	0	4	2640	$ 117.55	$ 310,321.25
ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESS(	DRILL BARGE	0	1	660	$ 22.26	$ 14,688.54
ISS OPERATION - GENERATOR (175 KW)	DRILL BARGE	8,102	1	660	$ 49.63	$ 32,756.13
ISS OPERATION - BATCH PLANT (45 CM/HR)	DRILL BARGE	0	1	660	$ 174.36	$ 115,077.46
ISS OPERATION - BAUER RG 22S DRILL RIG	DRILL BARGE	29,708	1	660	$ 780.24	$ 514,960.87
ISS OPERATION - HORIZONTAL SILO (1,200 CF)	DRILL BARGE	0	1	660	$ 48.44	$ 31,971.71
ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	DRILL BARGE	0	1	660	$ 14.84	$ 9,792.36
ISS OPERATION - GAS WELDER	DRILL BARGE	0	1	660	$ 12.02	$ 7,930.43
ISS OPERATION - LIGHT PLANT	ALL	0	1	660	$ 13.49	$ 8,904.50
TUG BOAT 2 - 700 HP	ALL	20,328	1	660	$ 53.54	$ 35,339.23
WATER TRUCK (4,000 GAL)	ALL	8,712	1	660	$ 28.17	$ 18,589.07
BARE UNIT COST →	$ 174.46	70,800		TOTAL RENTED EQUIP →		$ 1,725,430.61

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION FOREMAN	DRILL BARGE	1	660	$ 148.65	$ 98,105.70
UNION OPERATOR 1	DRILL BARGE	3	1980	$ 65.99	$ 130,654.83
UNION DECKHAND	DRILL BARGE	2	1320	$ 50.57	$ 66,756.83
UNION TUG OPERATOR	TUG BOAT	1	660	$ 72.18	$ 47,638.83
Per Diem Unit Rate (Hourly)	ALL	1	660	$ 27.92	$ 18,425.00
BARE UNIT COST →	$ 36.56	TOTAL LABOR COST →			$ 361,581.19

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	70,800	$ 4.20	GAL	$ 297,216.38
PORTLAND CEMENT	ALL	2,180	$ 146.05	CY	$ 318,453.89
WATER	ALL	531,255	$ 0.01	GAL	$ 3,054.00
BARE UNIT COST →	$ 62.56	TOTAL MATERIAL COST →			$ 618,724.27

Table F-A-2h

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 6.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Mechanical Dredging and Debris Removal	6.01

COST ESTIMATE DATA			
TOTAL QUANTITY ON COST ESTIMATE	89,100.0	Cost Estimate Data Notes	
ITEM UNIT	CY		

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	28.7	6.62	--	172

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Mechanical Dredging and Debris Removal	6.01	$ 1,781,037.85	$ 882,587.69	$ 1,809,032.59	$ -	$ 4,472,658.12	Equipment, labor, and materials for mechanical dredging and debris removal.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,781,037.85**	**$ 882,587.69**	**$ 1,809,032.59**	**$ -**	**$ 4,472,658.12**	
UNIT PRICES		**$ 19.99**	**$ 9.91**	**$ 20.30**	**$ -**	**$ 50.20**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL COST → $ -			

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	38,869	1	2064	$ 84.97	$ 175,386.02
BUCKET (5.5 CY)	DREDGING	91	1	2064	$ 10.00	$ 20,640.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	2064	$ 9.82	$ 20,273.16
EXCAVATOR RAKE	DREDGING	0	1	2064	$ 5.80	$ 11,979.59
BARGE (80'X40')	DREDGING	0	2	4128	$ 76.92	$ 317,538.46
TUG BOAT 1 - 380 HP	DREDGING	34,510	1	2064	$ 40.20	$ 82,980.14
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	8256	$ 9.62	$ 79,384.62
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	38,688	1	2064	$ 156.26	$ 322,527.51
BARGE (80'X40')	MATERIAL TRANSFER	0	1	2064	$ 76.92	$ 158,769.23
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	34,510	1	2064	$ 40.20	$ 82,980.14
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	63,571	1	2064	$ 53.54	$ 110,515.42
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	6192	$ 57.69	$ 357,230.77
WORK BOAT - 115 HP	ALL	1	4	8256	$ 8.34	$ 68,827.52
BARE UNIT COST →	$ 20.30	210,240		TOTAL RENTED EQUIP →		$ 1,809,032.59

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	2064	$ 147.88	$ 305,214.00
UNION TUG OPERATOR	DREDGING	1	2064	$ 72.18	$ 148,979.61
UNION TUG OPERATOR	MATERIAL TRANSFER	1	2064	$ 72.18	$ 148,979.61
UNION OPERATOR 1	MATERIAL TRANSFER	1	2064	$ 65.99	$ 136,197.76
UNION TUG OPERATOR	TRANSPORT	1	2064	$ 72.18	$ 148,979.61
UNION LABORER	ALL	2	4128	$ 50.57	$ 208,766.81
UNION DECKHAND	ALL	6	12384	$ 50.57	$ 626,300.44
Per Diem Unit Rate (Hourly)	ALL	1	2064	$ 27.92	$ 57,620.00
BARE UNIT COST → $ 19.99		TOTAL LABOR COST →			$ 1,781,037.85

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	210,240	$ 4.20	GAL	$ 882,587.69
BARE UNIT COST → $ 9.91		TOTAL MATERIAL COST →			$ 882,587.69

Table F-A-2i

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 6.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Slot Dredging and Debris Removal	6.02

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	8,100.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	10.8	2.50	--	65

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Slot Dredging and Debris Removal	6.02	$ 673,066.63	$ 333,394.58	$ 677,846.04	$ -	$ 1,684,307.25	Equipment, labor, and materials for slot dredging and debris removal along shorelines (e.g., slot dredging).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 673,066.63**	**$ 333,394.58**	**$ 677,846.04**	**$ -**	**$ 1,684,307.25**	
UNIT PRICES		**$ 83.09**	**$ 41.16**	**$ 83.68**	**$ -**	**$ 207.94**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
						CAT 375 L	DREDGING	14,689	1	780	$ 84.97	$ 66,279.60
						BUCKET (1.0 CY)	DREDGING	0	1	780	$ 2.56	$ 2,000.00
						ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	780	$ 9.82	$ 7,661.37
						EXCAVATOR RAKE	DREDGING	0	1	780	$ 5.80	$ 4,527.17
						BARGE (80'X40')	DREDGING	0	2	1560	$ 76.92	$ 120,000.00
						TUG BOAT 1 - 380 HP	DREDGING	13,042	1	780	$ 40.20	$ 31,358.78
						SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	3120	$ 9.62	$ 30,000.00
						SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	14,620	1	780	$ 156.26	$ 121,885.40
						BARGE (80'X40')	MATERIAL TRANSFER	0	1	780	$ 76.92	$ 60,000.00
						TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	13,042	1	780	$ 40.20	$ 31,358.78
						TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	24,024	1	780	$ 53.54	$ 41,764.55
						SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	2340	$ 57.69	$ 135,000.00
						WORK BOAT - 115 HP	ALL	1	4	3120	$ 8.34	$ 26,010.40
BARE UNIT COST →	$ -	TOTAL COST →			$ -	BARE UNIT COST →	$ 83.68	79,417		TOTAL RENTED EQUIP →		$ 677,846.04

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	780	$ 147.88	$ 115,342.50	DIESEL	ALL	79,417	$ 4.20	GAL	$ 333,394.58
UNION TUG OPERATOR	DREDGING	1	780	$ 72.18	$ 56,300.43						
UNION TUG OPERATOR	MATERIAL TRANSFER	1	780	$ 72.18	$ 56,300.43						
UNION OPERATOR 1	MATERIAL TRANSFER	1	780	$ 65.99	$ 51,470.09						
UNION TUG OPERATOR	TRANSPORT	1	780	$ 72.18	$ 56,300.43						
UNION LABORER	ALL	2	1560	$ 50.57	$ 78,894.43						
UNION DECKHAND	ALL	6	4680	$ 50.57	$ 236,683.30						
Per Diem Unit Rate (Hourly)	ALL	1	780	$ 27.92	$ 21,775.00						
BARE UNIT COST →	$ 83.09	TOTAL LABOR COST →			$ 673,066.63	BARE UNIT COST →	$ 41.16	TOTAL MATERIAL COST →			$ 333,394.58

Table F-A-2j

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 6.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	92,300.0		12	6	39.5	9.12	--	237
ITEM UNIT	CY							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03	$ 806,827.57	$ 622,831.69	$ 983,467.15	$ -	$ 2,413,126.41	Dredged material dewatering and limited stabilization with amendment.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 806,827.57**	**$ 622,831.69**	**$ 983,467.15**	**$ -**	**$ 2,413,126.41**	
UNIT PRICES		**$ 8.74**	**$ 6.75**	**$ 10.66**	**$ -**	**$ 26.14**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST ⟶	$ -	TOTAL COST ⟶			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	ALL	125	1	2844	$ 10.00	$ 28,440.00
BARGE (80'X40')	ALL	0	2	5688	$ 76.92	$ 437,538.46
CAT 349 E	ALL	54,059	1	2844	$ 70.13	$ 199,439.60
WATER TRUCK (4,000 GAL)	ALL	37,541	1	2844	$ 28.17	$ 80,102.01
SILO	ALL	0	1	2844	$ 48.44	$ 137,769.00
PFU400/25 (PNUEMATIC FOAM UNIT)	ALL	5,688	2	5688	$ 17.61	$ 100,178.08
BARE UNIT COST ⟶	$ 10.66	97,413		TOTAL RENTED EQUIP ⟶		$ 983,467.15

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	2	5688	$ 65.99	$375,335.70
UNION LABORER	ALL	3	8532	$ 50.57	$431,491.87
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST ⟶	$ 8.74	TOTAL LABOR COST ⟶			$ 806,827.57

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	97,413	$ 4.20	GAL	$ 408,938.46
PORTLAND CEMENT	ALL	1,017	$ 146.05	CY	$ 148,508.73
DRUM OF ODOR CONTROL FOAM	ALL	89	$ 585.50	EA	$ 52,109.50
PFU400/25 FOAM UNIT FRIEGHT	ALL	3	$ 3,475.00	EA	$ 10,425.00
TRAINED FOAM TECHNICAN	ALL	3	$ 950.00	DAY	$ 2,850.00
BARE UNIT COST ⟶ $ 6.75		TOTAL MATERIAL COST ⟶			$ 622,831.69

Table F-A-2k

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 6.04

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Water Treatment	6.04

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	10.0		12	6	39.5	9.12	--	237
ITEM UNIT	MO							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Water Treatment	6.04	$ 924,897.49	$ 9,008.82	$ 1,395,036.47	$ -	$ 2,328,942.79	Equipment, labor, and materials for running an on-barge water treatment system for treating decant water from barges, concurrent with dredging operations.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 924,897.49**	**$ 9,008.82**	**$ 1,395,036.47**	**$ -**	**$ 2,328,942.79**	
UNIT PRICES		**$ 92,489.75**	**$ 900.88**	**$ 139,503.65**	**$ -**	**$ 232,894.28**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	ALL	0	4	11376	$ 3.71	$ 42,196.17
WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	ALL	0	10	28440	$ 1.24	$ 35,287.29
WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	ALL	0	6	17064	$ 17.81	$ 303,990.69
WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	ALL	0	2	5688	$ 22.27	$ 126,662.79
WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	ALL	2,127	1	2844	$ 16.87	$ 47,990.71
WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	ALL	0	2	5688	$ 117.55	$ 668,601.23
WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	ALL	0	1	2844	$ 5.94	$ 16,900.75
WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	ALL	0	1	2844	$ 8.16	$ 23,215.32
WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	ALL	0	2	5688	$ 22.27	$ 126,662.79
WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	ALL	0	1	2844	$ 1.24	$ 3,528.73
BARE UNIT COST →	$ 139,503.65	2,127		TOTAL RENTED EQUIP →		$ 1,395,036.47

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
WATER TREATMENT OPERATOR	ALL	1	2844	$ 95.00	$ 270,180.00
UNION DECKHAND	ALL	2	5688	$ 50.57	$ 287,661.25
UNION LABORER	ALL	2	5688	$ 50.57	$ 287,661.25
Per Diem Unit Rate (Hourly)	ALL	1	2844	$ 27.92	$ 79,395.00
BARE UNIT COST →	$ 92,489.75	TOTAL LABOR COST →			$ 924,897.49

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	2,127	$ 4.20	GAL	$ 8,930.46
WATER TREATMENT (ON-BARGE) - BAG FILTER	ALL	20	$ 3.92	EA	$ 78.36
BARE UNIT COST →	$ 900.88	TOTAL MATERIAL COST →			$ 9,008.82

Table F-A-2l

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 7.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle D Landfill Transportation, Processing, and Disposal	7.01

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	124,000.0	
ITEM UNIT	TON	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	7.7	1.77	--	46

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle D Landfill Transportation, Processing, and Disposal	7.01	$ 67,759.88	$ 2,427,372.72	$ 29,556.45	$ 18,586,190.12	$ 21,110,879.16	Equipment, labor, and materials for Subtitle D Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 67,759.88**	**$ 2,427,372.72**	**$ 29,556.45**	**$ 18,586,190.12**	**$ 21,110,879.16**	
UNIT PRICES		**$ 0.55**	**$ 19.58**	**$ 0.24**	**$ 149.89**	**$ 170.25**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	123,908	$150	TON	$18,586,190.12
BARE UNIT COST →	$ 149.89	TOTAL COST →			$ 18,586,190.12

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	17,002	1	552	$ 53.54	$ 29,556.45
BARE UNIT COST →	$ 0.24	17,002		TOTAL RENTED EQUIP →		$ 29,556.45

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	552	$ 72.18	$ 39,843.38
UNION DECKHAND	ALL	1	552	$ 50.57	$ 27,916.49
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.55	TOTAL LABOR COST →			$ 67,759.88

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	17,002	$ 4.20	GAL	$ 71,372.72
WASTE CHARACTERIZATION SAMPLING	ALL	248	$ 9,500.00	EA	$ 2,356,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 19.58	TOTAL MATERIAL COST →			$ 2,427,372.72

Table F-A-2m

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 7.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	6,600.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	0.7	0.15	--	4

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02	$ 5,892.16	$ 139,206.32	$ 2,570.13	$ 4,565,029.15	$ 4,712,697.76	Equipment, labor, and materials for Subtitle C/TSCA Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,892.16**	**$ 139,206.32**	**$ 2,570.13**	**$ 4,565,029.15**	**$ 4,712,697.76**	
UNIT PRICES		**$ 0.89**	**$ 21.09**	**$ 0.39**	**$ 691.67**	**$ 714.05**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE C/TSCA PROCESSING, TRANSPORT, AND DISPOSAL	ALL	6,521	$700	TON	$4,565,029.15
BARE UNIT COST →	$ 691.67	TOTAL COST →			$ 4,565,029.15

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	1,478	1	48	$ 53.54	$ 2,570.13
BARE UNIT COST →	$ 0.39	1,478		TOTAL RENTED EQUIP →		$ 2,570.13

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	48	$ 72.18	$ 3,464.64
UNION DECKHAND	ALL	1	48	$ 50.57	$ 2,427.52
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.89	TOTAL LABOR COST →			$ 5,892.16

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,478	$ 4.20	GAL	$ 6,206.32
WASTE CHARACTERIZATION SAMPLING	ALL	14	$ 9,500.00	EA	$ 133,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 21.09	TOTAL MATERIAL COST →			$ 139,206.32

Table F-A-2n

Alternative EB-C													
CONSTRUCTION COST ESTIMATE WORKSHEET 7.03													BASE YEAR: 2023
COST ESTIMATE DATE		PROJECT LOCATION					DESCRIPTION OF ITEM						ITEM NO.
July 30, 2024		NEWTOWN CREEK EXPEDITED ACTION					Debris Transportation, Processing, and Disposal						7.03
COST ESTIMATE DATA							PRODUCTION DATA						
TOTAL QUANTITY ON COST ESTIMATE	6,800.0	Cost Estimate Data Notes					HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE		DAYS REQ. TO COMPLETE
ITEM UNIT	TON						12	6	0.7	0.15	--		4

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Debris Transportation, Processing, and Disposal	7.03	$ 5,892.16	$ 41,206.32	$ 2,570.13	$ 2,039,021.43	$ 2,088,690.05	Equipment, labor, and materials for Debris Transportation and Disposal (Subtitle D Landfill). Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,892.16**	**$ 41,206.32**	**$ 2,570.13**	**$ 2,039,021.43**	**$ 2,088,690.05**	
UNIT PRICES		**$ 0.87**	**$ 6.06**	**$ 0.38**	**$ 299.86**	**$ 307.16**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	6,797	$300	TON	$2,039,021.43
BARE UNIT COST ⟶	$ 299.86	TOTAL COST ⟶			$ 2,039,021.43

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	1,478	1	48	$ 53.54	$ 2,570.13
BARE UNIT COST ⟶	$ 0.38	1,478		TOTAL RENTED EQUIP ⟶		$ 2,570.13

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	48	$ 72.18	$ 3,464.64
UNION DECKHAND	ALL	1	48	$ 50.57	$ 2,427.52
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST ⟶	$ 0.87	TOTAL LABOR COST ⟶			$ 5,892.16

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,478	$ 4.20	GAL	$ 6,206.32
WIPE SAMPLING (DEBRIS)	ALL	14	$ 2,500.00	EA	$ 35,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST ⟶	$ 6.06	TOTAL MATERIAL COST ⟶			$ 41,206.32

Table F-A-2o

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Backfill Placement	8.01

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA					
			HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.0		12	6	0.0	0.00	--	0
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Backfill Placement	8.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	BACKFILL PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	BACKFILL PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	BACKFILL PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	BACKFILL PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	BACKFILL PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	BACKFILL PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	BACKFILL PLACEMENT	0	1	0	$ 10.00	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	BACKFILL PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	BACKFILL PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SAND	ALL	0	$ 27.13	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-2p

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Deep Water	8.11

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	2.22	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	3.3	0.77	--	20

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Deep Water	8.11	$ 141,670.48	$ 1,356,855.96	$ 237,641.97	$ -	$ 1,736,168.41	Equipment, labor, and materials for placing deep water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 141,670.48**	**$ 1,356,855.96**	**$ 237,641.97**	**$ -**	**$ 1,736,168.41**	
UNIT PRICES		**$ 63,815.53**	**$ 611,196.38**	**$ 107,045.93**	**$ -**	**$ 782,057.84**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	1,003	1	240	$ 24.14	$ 5,794.38
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	1,056	1	240	$ 24.11	$ 5,786.94
TELEBELT 130	MATERIAL TRANSFER	4,277	1	240	$ 225.00	$ 54,000.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	4,499	1	240	$ 156.26	$ 37,503.20
BARGE (80'X40')	MATERIAL TRANSFER	0	1	240	$ 76.92	$ 18,461.54
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	480	$ 57.69	$ 27,692.31
TUG BOAT 2 - 700 HP	CAP PLACEMENT	7,392	1	240	$ 53.54	$ 12,850.63
SCOW (100 CY)	CAP PLACEMENT	0	4	960	$ 9.62	$ 9,230.77
TUG BOAT 1 - 380 HP	CAP PLACEMENT	8,026	2	480	$ 40.20	$ 19,297.71
BARGE (80'X40')	CAP PLACEMENT	0	1	240	$ 76.92	$ 18,461.54
CAT 375 L	CAP PLACEMENT	4,520	1	240	$ 84.97	$ 20,393.72
BUCKET (5.5 CY)	CAP PLACEMENT	11	1	240	$ 10.00	$ 2,400.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	240	$ 24.04	$ 5,769.23
BARE UNIT COST →	$ 107,045.93	30,782		TOTAL RENTED EQUIP →		$ 237,641.97

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	240	$ 147.88	$ 35,490.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	240	$ 65.99	$ 15,836.95
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	240	$ 65.99	$ 15,836.95
UNION OPERATOR 1	MATERIAL TRANSFER	1	240	$ 65.99	$ 15,836.95
UNION TUG OPERATOR	CAP PLACEMENT	3	720	$ 72.18	$ 51,969.63
Per Diem Unit Rate (Hourly)	ALL	1	240	$ 27.92	$ 6,700.00
BARE UNIT COST →	$ 63,815.53	TOTAL LABOR COST →			$ 141,670.48

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	30,782	$ 4.20	GAL	$ 129,224.52
ORGANOCLAY	ALL	161	$ 3,307.50	CY	$ 532,125.74
GAC	ALL	182	$ 1,827.19	CY	$ 331,835.89
SAND	ALL	12,006	$ 27.13	CY	$ 325,669.82
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	19	$ 2,000.00	EA	$ 38,000.00
BARE UNIT COST →	$ 611,196.38	TOTAL MATERIAL COST →			$ 1,356,855.96

Table F-A-2q

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.12

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Shallow Water	8.12

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	5.58		12	6	10.7	2.46	--	64
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Shallow Water	8.12	$ 453,345.54	$ 4,461,416.31	$ 760,454.30	$ -	$ 5,675,216.15	Equipment, labor, and materials for placing shallow water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 453,345.54**	**$ 4,461,416.31**	**$ 760,454.30**	**$ -**	**$ 5,675,216.15**	
UNIT PRICES		**$ 81,244.72**	**$ 799,536.97**	**$ 136,282.13**	**$ -**	**$ 1,017,063.83**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	3,210	1	768	$ 24.14	$ 18,542.03
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	3,379	1	768	$ 24.11	$ 18,518.20
TELEBELT 130	MATERIAL TRANSFER	13,686	1	768	$ 225.00	$ 172,800.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	14,395	1	768	$ 156.26	$ 120,010.24
BARGE (80'X40')	MATERIAL TRANSFER	0	1	768	$ 76.92	$ 59,076.92
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1536	$ 57.69	$ 88,615.38
TUG BOAT 2 - 700 HP	CAP PLACEMENT	94,618	1	768	$ 53.54	$ 41,122.02
SCOW (100 CY)	CAP PLACEMENT	0	4	3072	$ 9.62	$ 29,538.46
TUG BOAT 1 - 380 HP	CAP PLACEMENT	12,841	2	1536	$ 40.20	$ 61,752.66
BARGE (80'X40')	CAP PLACEMENT	0	1	768	$ 76.92	$ 59,076.92
CAT 375 L	CAP PLACEMENT	14,463	1	768	$ 84.97	$ 65,259.91
BUCKET (5.5 CY)	CAP PLACEMENT	34	1	768	$ 10.00	$ 7,680.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	768	$ 24.04	$ 18,461.54
BARE UNIT COST →	$ 136,282.13	156,626		TOTAL RENTED EQUIP →		$ 760,454.30

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	768	$ 147.88	$ 113,568.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	768	$ 65.99	$ 50,678.24
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	768	$ 65.99	$ 50,678.24
UNION OPERATOR 1	MATERIAL TRANSFER	1	768	$ 65.99	$ 50,678.24
UNION TUG OPERATOR	CAP PLACEMENT	3	2304	$ 72.18	$ 166,302.82
Per Diem Unit Rate (Hourly)	ALL	1	768	$ 27.92	$ 21,440.00
BARE UNIT COST →	$ 81,244.72	TOTAL LABOR COST →			$ 453,345.54

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	156,626	$ 4.20	GAL	$ 657,515.61
ORGANOCLAY	ALL	405	$ 3,307.50	CY	$ 1,338,343.20
GAC	ALL	457	$ 1,827.19	CY	$ 834,596.55
SAND	ALL	19,856	$ 27.13	CY	$ 538,594.89
GRAVEL	ALL	7,081	$ 67.18	CY	$ 475,696.03
ARMOR STONE 3-9 INCHES	ALL	8,992	$ 61.69	CY	$ 554,670.03
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	31	$ 2,000.00	EA	$ 62,000.00
BARE UNIT COST →	$ 799,536.97	TOTAL MATERIAL COST →			$ 4,461,416.31

Table F-A-2r

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.13

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Wake Zone	8.13

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	2.95	
ITEM UNIT	AC	

PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	7.0	1.62	--	42

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL
Amended Cap - Wake Zone	8.13	$ 297,508.01	$ 2,479,857.46	$ 499,048.13	$ -	$ 3,276,413.60
						$ -
						$ -
						$ -
GRAND TOTALS		**$ 297,508.01**	**$ 2,479,857.46**	**$ 499,048.13**	**$ -**	**$ 3,276,413.60**
UNIT PRICES		**$ 100,850.17**	**$ 840,629.65**	**$ 169,168.86**	**$ -**	**$ 1,110,648.68**

Notes: Equipment, labor, and materials for placing armored amended caps in wake zone areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL COST → $ -			

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	2,107	1	504	$ 24.14	$ 12,168.21
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	2,218	1	504	$ 24.11	$ 12,152.57
TELEBELT 130	MATERIAL TRANSFER	8,981	1	504	$ 225.00	$ 113,400.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	9,447	1	504	$ 156.26	$ 78,756.72
BARGE (80'X40')	MATERIAL TRANSFER	0	1	504	$ 76.92	$ 38,769.23
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1008	$ 57.69	$ 58,153.85
TUG BOAT 2 - 700 HP	CAP PLACEMENT	15,523	1	504	$ 53.54	$ 26,986.32
SCOW (100 CY)	CAP PLACEMENT	0	4	2016	$ 9.62	$ 19,384.62
TUG BOAT 1 - 380 HP	CAP PLACEMENT	16,854	2	1008	$ 40.20	$ 40,525.19
BARGE (80'X40')	CAP PLACEMENT	0	1	504	$ 76.92	$ 38,769.23
CAT 375 L	CAP PLACEMENT	9,491	1	504	$ 84.97	$ 42,826.82
BUCKET (5.5 CY)	CAP PLACEMENT	22	1	504	$ 10.00	$ 5,040.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	504	$ 24.04	$ 12,115.38
BARE UNIT COST →	$ 169,168.86	64,643		TOTAL RENTED EQUIP →		$ 499,048.13

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	504	$ 147.88	$ 74,529.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	504	$ 65.99	$ 33,257.59
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	504	$ 65.99	$ 33,257.59
UNION OPERATOR 1	MATERIAL TRANSFER	1	504	$ 65.99	$ 33,257.59
UNION TUG OPERATOR	CAP PLACEMENT	3	1512	$ 72.18	$ 109,136.23
Per Diem Unit Rate (Hourly)	ALL	1	504	$ 27.92	$ 14,070.00
BARE UNIT COST → $ 100,850.17		TOTAL LABOR COST →			$ 297,508.01

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	64,643	$ 4.20	GAL	$ 271,371.48
ORGANOCLAY	ALL	214	$ 3,307.50	CY	$ 707,790.49
GAC	ALL	242	$ 1,827.19	CY	$ 441,381.18
SAND	ALL	10,501	$ 27.13	CY	$ 284,839.00
GRAVEL	ALL	3,745	$ 67.18	CY	$ 251,574.58
ARMOR STONE 3-9 INCHES	ALL	7,926	$ 61.69	CY	$ 488,900.72
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	17	$ 2,000.00	EA	$ 34,000.00
BARE UNIT COST → $ 840,629.65		TOTAL MATERIAL COST →			$ 2,479,857.46

Table F-A-2s

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.14

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - ISS Areas	8.14

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.45		12	6	1.0	0.23	--	6
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - ISS Areas	8.14	$ 42,501.14	$ 276,154.54	$ 71,292.59	$ -	$ 389,948.27	Equipment, labor, and materials for placing armored amended caps in ISS areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 42,501.14**	**$ 276,154.54**	**$ 71,292.59**	**$ -**	**$ 389,948.27**	
UNIT PRICES		**$ 94,446.99**	**$ 613,676.75**	**$ 158,427.98**	**$ -**	**$ 866,551.71**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
						CAT 272 SKID STEER	STOCKPILE MANAGEMENT	301	1	72	$ 24.14	$ 1,738.32
						CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	317	1	72	$ 24.11	$ 1,736.08
						TELEBELT 130	MATERIAL TRANSFER	1,283	1	72	$ 225.00	$ 16,200.00
						SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,350	1	72	$ 156.26	$ 11,250.96
						BARGE (80'X40')	MATERIAL TRANSFER	0	1	72	$ 76.92	$ 5,538.46
						SCOW (225'X42'X12')	CAP PLACEMENT	0	2	144	$ 57.69	$ 8,307.69
						TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,218	1	72	$ 53.54	$ 3,855.19
						SCOW (100 CY)	CAP PLACEMENT	0	4	288	$ 9.62	$ 2,769.23
						TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,408	2	144	$ 40.20	$ 5,789.31
						BARGE (80'X40')	CAP PLACEMENT	0	1	72	$ 76.92	$ 5,538.46
						CAT 375 L	CAP PLACEMENT	1,356	1	72	$ 84.97	$ 6,118.12
						BUCKET (5.5 CY)	CAP PLACEMENT	3	1	72	$ 10.00	$ 720.00
						KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	72	$ 24.04	$ 1,730.77
BARE UNIT COST →	$ -	TOTAL COST →			$ -	BARE UNIT COST →	$ 158,427.98	9,235		TOTAL RENTED EQUIP →		$ 71,292.59

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	72	$ 147.88	$ 10,647.00	DIESEL	ALL	9,235	$ 4.20	GAL	$ 38,767.35
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08	ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08	GAC	ALL	58	$ 1,827.19	CY	$ 106,263.67
UNION OPERATOR 1	MATERIAL TRANSFER	1	72	$ 65.99	$ 4,751.08	SAND	ALL	1,590	$ 27.13	CY	$ 43,129.95
UNION TUG OPERATOR	CAP PLACEMENT	3	216	$ 72.18	$ 15,590.89	GRAVEL	ALL	564	$ 67.18	CY	$ 37,854.52
Per Diem Unit Rate (Hourly)	ALL	1	72	$ 27.92	$ 2,010.00	ARMOR STONE 3-9 INCHES	ALL	716	$ 61.69	CY	$ 44,139.04
						ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
						MATERIAL VERIFICATION SAMPLING	ALL	3	$ 2,000.00	EA	$ 6,000.00
BARE UNIT COST →	$ 94,446.99	TOTAL LABOR COST →			$ 42,501.14	BARE UNIT COST →	$ 613,676.75	TOTAL MATERIAL COST →			$ 276,154.54

Table F-A-2t

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.15

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Deep Water)	8.15

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.00	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Deep Water)	8.15	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -		TOTAL MATERIAL COST →		$ -

Table F-A-2u

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.16

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Shallow Water)	8.16

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Shallow Water)	8.16	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-2v

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.21

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - CSOs	8.21

COST ESTIMATE DATA						
TOTAL QUANTITY ON COST ESTIMATE	0.9	Cost Estimate Data Notes				
ITEM UNIT	AC					

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.2	1.42	--	37

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - CSOs	8.21	$ 300,423.79	$ 999,575.89	$ 309,231.14	$ -	$ 1,609,230.82	Equipment, labor, and materials for placing outfall protection at CSOs. Assumes mats required for outfall protection can all be delivered and placed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 300,423.79**	**$ 999,575.89**	**$ 309,231.14**	**$ -**	**$ 1,609,230.82**	
UNIT PRICES		**$ 326,547.60**	**$ 1,086,495.53**	**$ 336,120.81**	**$ -**	**$ 1,749,163.93**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL COST → $ -			

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	MAT PLACEMENT	16,723	2	888	$ 84.97	$ 75,456.78
BUCKET (5.5 CY)	MAT PLACEMENT	39	2	888	$ 10.00	$ 8,880.00
BARGE (80'X40')	MAT PLACEMENT	0	2	888	$ 76.92	$ 68,307.69
TUG BOAT 1 - 380 HP	MAT PLACEMENT	14,847	2	888	$ 40.20	$ 35,700.76
WORK BOAT - 115 HP	MAT PLACEMENT	2,247	1	444	$ 8.34	$ 3,701.48
BARGE (80'X40')	MAT DELIVERY	0	1	444	$ 76.92	$ 34,153.85
TUG BOAT 2 - 700 HP	MAT DELIVERY	13,675	1	444	$ 53.54	$ 23,773.67
GROUT PLANT	GROUTING	1,289	2	888	$ 66.73	$ 59,256.92
BARE UNIT COST →	$ 336,120.81	48,820		TOTAL RENTED EQUIP →		$ 309,231.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	MAT PLACEMENT	2	888	$ 147.88	$ 131,313.00
UNION DECKHAND	MAT PLACEMENT	1	444	$ 50.57	$ 22,454.57
UNION LABORER	MAT PLACEMENT	4	1776	$ 50.57	$ 89,818.28
UNION TUG OPERATOR	MAT PLACEMENT	1	444	$ 72.18	$ 32,047.94
Per Diem Unit Rate (Hourly)	ALL	2	888	$ 27.92	$ 24,790.00
BARE UNIT COST → $ 326,547.60		TOTAL LABOR COST → $ 300,423.79			

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	48,820	$ 4.20	GAL	$ 204,948.31
NON-WOVEN GEOTEXTILE	ALL	44,000	$ 0.17	SF	$ 7,663.33
SAND	ALL	1,278	$ 27.13	CY	$ 34,659.72
ARTICULATED CONCRETE MATTRESSES	ALL	40,000	$ 12.67	SF	$ 506,800.00
GRAVEL	ALL	111	$ 67.18	CY	$ 7,464.17
UNDERWATER GROUT (SUPERSACK)	ALL	117	$ 2,000.00	EA	$ 234,000.00
WATER	ALL	7,020	$ 0.01	GAL	$ 40.36
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST → $ 1,086,495.53		TOTAL MATERIAL COST →			$ 999,575.89

Table F-A-2w

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.22

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22	$ 5,499.83	$ 17,102.13	$ 8,314.57	$ -	$ 30,916.53	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of 12 inches or greater. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,102.13**	**$ 8,314.57**	**$ -**	**$ 30,916.53**	
UNIT PRICES		**$ 183,327.64**	**$ 570,071.09**	**$ 277,152.36**	**$ -**	**$1,030,551.08**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 277,152.36	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 183,327.64	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	104	$ 114.92	CY	$ 11,970.83
BARE UNIT COST →	$ 570,071.09	TOTAL MATERIAL COST →			$ 17,102.13

Table F-A-2x

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 8.23

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	0.1
ITEM UNIT	AC

Cost Estimate Data Notes

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL
Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23	$ 5,499.83	$ 17,715.04	$ 8,314.57	$ -	$ 31,529.44
						$ -
						$ -
						$ -
GRAND TOTALS		**$ 5,499.83**	**$ 17,715.04**	**$ 8,314.57**	**$ -**	**$ 31,529.44**
UNIT PRICES		**$ 61,109.21**	**$ 196,833.77**	**$ 92,384.12**	**$ -**	**$ 350,327.10**

Notes: Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of less than 12 inches. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 92,384.12	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 61,109.21	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	204	$ 61.69	CY	$ 12,583.74
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
BARE UNIT COST →	$ 196,833.77		TOTAL MATERIAL COST →		$ 17,715.04

Table F-A-2y

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 9

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Environmental Controls	9.0

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes
ITEM UNIT	LS	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.9	1.60	--	42

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Environmental Controls	9.0	$ 100,742.12	$ 566,221.96	$ 8,303.32	$ -	$ 675,267.41	Equipment, labor, and materials for installing and maintaning environmental controls (i.e., silt curtains) during aquatic work activities.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 100,742.12**	**$ 566,221.96**	**$ 8,303.32**	**$ -**	**$ 675,267.41**	
UNIT PRICES		**$ 100,742.12**	**$ 566,221.96**	**$ 8,303.32**	**$ -**	**$ 675,267.41**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WORK BOAT - 115 HP	ALL	5,040	2	996	$ 8.34	$ 8,303.32
BARE UNIT COST →	$ 8,303.32	5,040		TOTAL RENTED EQUIP →		$ 8,303.32

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION DECKHAND	ALL	4	1992	$ 50.57	$ 100,742.12
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 100,742.12	TOTAL LABOR COST →			$ 100,742.12

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	5,040	$ 4.20	GAL	$ 21,156.91
MOBILE RESUSPENSION CONTROL SYSTEM (ALT. EB-C)	ALL	1	$ 512,800.00	LS	$ 512,800.00
SILT CURTAIN	ALL	22	$ 1,466.59	EA	$ 32,265.05
BARE UNIT COST →	$ 566,221.96	TOTAL MATERIAL COST →			$ 566,221.96

Table F-A-2z

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 10

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Inspections and Surveying	10.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	24.8	5.73	--	149

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Inspections and Surveying	10.0	$ -	$ -	$ -	$ 1,829,800.00	$ 1,829,800.00	Equipment, labor, and materials for surveying and bulkhead inspections.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 1,829,800.00**	**$ 1,829,800.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 1,829,800.00**	**$ 1,829,800.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
MULTIBEAM BATHYMETRIC SURVEYS	ALL	26	$10,200	DAY	$265,200.00
BULKHEAD INSPECTIONS	ALL	1	$500,000	LS	$500,000.00
BATHYMETRIC PROGRESS SURVEYS	ALL	123	$6,200	DAY	$762,600.00
UTILITY ID AND SURVEY	ALL	1	$200,000	LS	$200,000.00
VIBRATION MONITORING	ALL	102	$1,000	DAY	$102,000.00
BARE UNIT COST →	$ 1,829,800.00	TOTAL COST →			$ 1,829,800.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-2aa

Alternative EB-C

CONSTRUCTION COST ESTIMATE WORKSHEET 11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 30, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Restoration	11.0

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes
ITEM UNIT	LS	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Restoration	11.0	$ 62,942.75	$ 487,354.64	$ 10,566.76	$ 324,939.00	$ 885,803.15	Equipment, labor, and materials for site restoration (includes disposal of DGA from staging area).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	
UNIT PRICES		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
OTHER SITE RESTORATION	ALL	1	$100,000	LS	$100,000.00
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	1,500	$150	TON	$224,939.00
BARE UNIT COST →	$ 324,939.00	TOTAL COST →			$ 324,939.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	792	1	180	$ 24.11	$ 4,340.20
CAT 272 SKID STEER	ALL	752	1	180	$ 24.14	$ 4,345.79
TRENCH ROLLER WITH REMOTE	ALL	174	1	180	$ 10.45	$ 1,880.77
BARE UNIT COST →	$ 10,566.76	1,719		TOTAL RENTED EQUIP →		$ 10,566.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	180	$ 65.99	$ 11,877.71
UNION OPERATOR 2	ALL	2	360	$ 65.99	$ 23,755.42
UNION LABORER	ALL	3	540	$ 50.57	$ 27,309.61
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 62,942.75	TOTAL LABOR COST →			$ 62,942.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ASPHALT PAVING	ALL	65,340	$ 7.46	SF	$ 487,354.64
BARE UNIT COST → $ 487,354.64		TOTAL MATERIAL COST →			$ 487,354.64

Table F-A-3a

Alternative EB-D			
CONSTRUCTION COST ESTIMATE WORKSHEET 3.01			BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Staging Area Lease	3.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	42.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	92.2	21.27	--	553

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Staging Area Lease	3.01	$ -	$ -	$ -	$ 11,434,500.00	$ 11,434,500.00	Land lease for upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 11,434,500.00**	**$ 11,434,500.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 272,250.00**	**$ 272,250.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
LAND LEASE	ALL	63	$181,500	AC*MO	$11,434,500.00
BARE UNIT COST →	$ 272,250.00	TOTAL COST →			$ 11,434,500.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-3b

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 3.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Preparation Work	3.02

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	4.5	1.04	--	27
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Preparation Work	3.02	$ 113,296.95	$ 95,521.36	$ 19,020.17	$ 1,500,000.00	$ 1,727,838.48	Equipment, labor, and materials for pre-remediation site work, including access dredging and construction of an upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	
UNIT PRICES		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ACCESS DREDGING	ALL	1	$1,000,000	LS	$1,000,000.00
STAGING AREA SHORELINE MODIFICATIONS	ALL	1	$500,000	LS	$500,000.00
BARE UNIT COST →	$ 1,500,000.00	TOTAL COST →			$ 1,500,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	1,426	1	324	$ 24.11	$ 7,812.37
CAT 272 SKID STEER	ALL	1,354	1	324	$ 24.14	$ 7,822.42
TRENCH ROLLER WITH REMOTE	ALL	314	1	324	$ 10.45	$ 3,385.38
BARE UNIT COST →	$ 19,020.17	3,094		TOTAL RENTED EQUIP →		$ 19,020.17

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	324	$ 65.99	$ 21,379.88
UNION OPERATOR 2	ALL	2	648	$ 65.99	$ 42,759.76
UNION LABORER	ALL	3	972	$ 50.57	$ 49,157.30
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 113,296.95	TOTAL LABOR COST →			$ 113,296.95

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,094	$ 4.20	GAL	$ 12,986.73
DGA	ALL	887	$ 33.80	CY	$ 29,991.87
CHAIN LINK FENCING	ALL	1,300	$ 30.79	LF	$ 40,024.71
NON-WOVEN GEOTEXTILE	ALL	71,874	$ 0.17	SF	$ 12,518.06
BARE UNIT COST →	$ 95,521.36	TOTAL MATERIAL COST →			$ 95,521.36

Table F-A-3c

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 3.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Temporary Facilities and Utilities	3.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	22.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	92.2	21.27	--	553

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Temporary Facilities and Utilities	3.03	$ -	$ -	$ -	$ 2,244,000.00	$ 2,244,000.00	Temporary facilities and utilities for work.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 2,244,000.00**	**$ 2,244,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 102,000.00**	**$ 102,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
TEMPORARY FACILITIES AND UTILITIES	ALL	22	$102,000	MO	$2,244,000.00
BARE UNIT COST →	$ 102,000.00	TOTAL COST →			$ 2,244,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-3d

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 4.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Stabilization (High Cost)	4.01

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Stabilization (High Cost)	4.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 10.00	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 9.82	$ -
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 76.92	$ -
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 57.69	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 156.26	$ -
BARGE (80'X40')	INSTALL	0	3	0	$ 76.92	$ -
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	0	2	0	$ 49.04	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	0	2	0	$ 156.26	$ -
TUG BOAT 1 - 380 HP	ALL	0	2	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	ALL	0	1	0	$ 53.54	$ -
WORK BOAT - 115 HP	ALL	0	2	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	0	$ 147.88	$ -
UNION TUG OPERATOR	ALL	3	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	8	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	3	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SHEETPILE - TIEBACK WALL (HIGH)	ALL	0	$ 5,600.00	TON	$ -
TIEBACKS (HIGH)	ALL	0	$ 3,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-3e

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 4.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Installation (High Cost)	4.02

COST ESTIMATE DATA		
		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	260.0	
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	3.7	0.85	--	22

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Installation (High Cost)	4.02	$ 329,907.25	$ 2,387,198.67	$ 362,189.34	$ -	$ 3,079,295.26	Equipment, labor, and materials for installation of new bulkheads at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 329,907.25**	**$ 2,387,198.67**	**$ 362,189.34**	**$ -**	**$ 3,079,295.26**	
UNIT PRICES		**$ 1,268.87**	**$ 9,181.53**	**$ 1,393.04**	**$ -**	**$ 11,843.44**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	12	1	264	$ 10.00	$ 2,640.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	264	$ 9.82	$ 2,593.08
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	792	$ 76.92	$ 60,923.08
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	792	$ 57.69	$ 45,692.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	4,948	1	264	$ 156.26	$ 41,253.52
BARGE (80'X40')	INSTALL	0	3	792	$ 76.92	$ 60,923.08
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	9,641	2	528	$ 49.04	$ 25,892.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	9,897	2	528	$ 156.26	$ 82,507.04
TUG BOAT 1 - 380 HP	ALL	8,828	2	528	$ 40.20	$ 21,227.48
TUG BOAT 2 - 700 HP	ALL	8,131	1	264	$ 53.54	$ 14,135.69
WORK BOAT - 115 HP	ALL	2,672	2	528	$ 8.34	$ 4,401.76
BARE UNIT COST →	$ 1,393.04	44,129		TOTAL RENTED EQUIP →		$ 362,189.34

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	792	$ 147.88	$ 117,117.00
UNION TUG OPERATOR	ALL	3	792	$ 72.18	$ 57,166.60
UNION LABORER	ALL	2	528	$ 50.57	$ 26,702.73
UNION DECKHAND	ALL	8	2112	$ 50.57	$ 106,810.93
Per Diem Unit Rate (Hourly)	ALL	3	792	$ 27.92	$ 22,110.00
BARE UNIT COST →	$ 1,268.87	TOTAL LABOR COST →			$ 329,907.25

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	44,129	$ 4.20	GAL	$ 185,254.31
SHEETPILE (HIGH)	ALL	198	$ 11,100.00	TON	$ 2,201,944.35
BARE UNIT COST → $ 9,181.53		TOTAL MATERIAL COST →			$ 2,387,198.67

Table F-A-3f

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 4.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Replacement (High Cost)	4.03

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	640.0		HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	13.3	3.08	--	80

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Replacement (High Cost)	4.03	$ 1,199,662.74	$ 6,169,843.86	$ 1,317,052.14	$ 64,666.59	$ 8,751,225.33	Equipment, labor, and materials for replacement of bulkheads at shorelines (including disposal).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,199,662.74**	**$ 6,169,843.86**	**$ 1,317,052.14**	**$ 64,666.59**	**$ 8,751,225.33**	
UNIT PRICES		**$ 1,874.47**	**$ 9,640.38**	**$ 2,057.89**	**$ 101.04**	**$ 13,673.79**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	215.6	$300	TON	$64,666.59
BARE UNIT COST →	$ 101.04	TOTAL COST →			$ 64,666.59

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	42	1	960	$ 10.00	$ 9,600.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	960	$ 9.82	$ 9,429.38
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	2880	$ 76.92	$ 221,538.46
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	2880	$ 57.69	$ 166,153.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	17,994	1	960	$ 156.26	$ 150,012.80
BARGE (80'X40')	INSTALL	0	3	2880	$ 76.92	$ 221,538.46
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	35,059	2	1920	$ 49.04	$ 94,153.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	35,988	2	1920	$ 156.26	$ 300,025.59
TUG BOAT 1 - 380 HP	ALL	32,102	2	1920	$ 40.20	$ 77,190.83
TUG BOAT 2 - 700 HP	ALL	29,568	1	960	$ 53.54	$ 51,402.52
WORK BOAT - 115 HP	ALL	9,715	2	1920	$ 8.34	$ 16,006.40
BARE UNIT COST →	$ 2,057.89	160,470		TOTAL RENTED EQUIP →		$ 1,317,052.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	2880	$ 147.88	$ 425,880.00
UNION TUG OPERATOR	ALL	3	2880	$ 72.18	$ 207,878.53
UNION LABORER	ALL	2	1920	$ 50.57	$ 97,100.84
UNION DECKHAND	ALL	8	7680	$ 50.57	$ 388,403.37
Per Diem Unit Rate (Hourly)	ALL	3	2880	$ 27.92	$ 80,400.00
BARE UNIT COST →	$ 1,874.47	TOTAL LABOR COST →			$ 1,199,662.74

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	160,470	$ 4.20	GAL	$ 673,652.05
SHEETPILE (HIGH)	ALL	495.2	$ 11,100.00	TON	$ 5,496,191.81
BARE UNIT COST →	$ 9,640.38	TOTAL MATERIAL COST →			$ 6,169,843.86

Table F-A-3g

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 5

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	ISS	5.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	9,890.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	CY		12	6	9.2	2.12	--	55

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
ISS	5.00	$ 361,581.19	$ 618,724.27	$ 1,725,430.61	$ -	$ 2,705,736.07	Equipment, labor, and materials for ISS at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 361,581.19**	**$ 618,724.27**	**$ 1,725,430.61**	**$ -**	**$ 2,705,736.07**	
UNIT PRICES		**$ 36.56**	**$ 62.56**	**$ 174.46**	**$ -**	**$ 273.58**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ISS OPERATION - DECK BARGE	MATERIAL BARGE	0	1	660	$ 84.89	$ 56,030.23
ISS OPERATION - HORIZONTAL PIG (4,200 CF)	MATERIAL BARGE	0	8	5280	$ 85.36	$ 450,724.37
ISS OPERATION - SUCTION HOSE (4" X 20')	MATERIAL BARGE	0	3	1980	$ 1.24	$ 2,456.71
ISS OPERATION - DISCHARGE HOSE (4" X 50')	MATERIAL BARGE	0	4	2640	$ 1.24	$ 3,275.61
ISS OPERATION - GODWIN PUMP (4")	MATERIAL BARGE	3,949	8	5280	$ 16.87	$ 89,096.68
ISS OPERATION - FRAC TANK (18,000 GAL)	MATERIAL BARGE	0	2	1320	$ 17.81	$ 23,515.45
ISS OPERATION - HME SPUD BARGE	DRILL BARGE	0	4	2640	$ 117.55	$ 310,321.25
ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	DRILL BARGE	0	1	660	$ 22.26	$ 14,688.54
ISS OPERATION - GENERATOR (175 KW)	DRILL BARGE	8,102	1	660	$ 49.63	$ 32,756.13
ISS OPERATION - BATCH PLANT (45 CM/HR)	DRILL BARGE	0	1	660	$ 174.36	$ 115,077.46
ISS OPERATION - BAUER RG 22S DRILL RIG	DRILL BARGE	29,708	1	660	$ 780.24	$ 514,960.87
ISS OPERATION - HORIZONTAL SILO (1,200 CF)	DRILL BARGE	0	1	660	$ 48.44	$ 31,971.71
ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	DRILL BARGE	0	1	660	$ 14.84	$ 9,792.36
ISS OPERATION - GAS WELDER	DRILL BARGE	0	1	660	$ 12.02	$ 7,930.43
ISS OPERATION - LIGHT PLANT	ALL	0	1	660	$ 13.49	$ 8,904.50
TUG BOAT 2 - 700 HP	ALL	20,328	1	660	$ 53.54	$ 35,339.23
WATER TRUCK (4,000 GAL)	ALL	8,712	1	660	$ 28.17	$ 18,589.07
BARE UNIT COST →	$ 174.46	70,800		TOTAL RENTED EQUIP →		$ 1,725,430.61

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION FOREMAN	DRILL BARGE	1	660	$ 148.65	$ 98,105.70
UNION OPERATOR 1	DRILL BARGE	3	1980	$ 65.99	$ 130,654.83
UNION DECKHAND	DRILL BARGE	2	1320	$ 50.57	$ 66,756.83
UNION TUG OPERATOR	TUG BOAT	1	660	$ 72.18	$ 47,638.83
Per Diem Unit Rate (Hourly)	ALL	1	660	$ 27.92	$ 18,425.00
BARE UNIT COST →	$ 36.56	TOTAL LABOR COST →			$ 361,581.19

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	70,800	$ 4.20	GAL	$ 297,216.38
PORTLAND CEMENT	ALL	2,180	$ 146.05	CY	$ 318,453.89
WATER	ALL	531,255	$ 0.01	GAL	$ 3,054.00
BARE UNIT COST →	$ 62.56	TOTAL MATERIAL COST →			$ 618,724.27

Table F-A-3h

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 6.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Mechanical Dredging and Debris Removal	6.01

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	98,200.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	31.5	7.27	--	189

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Mechanical Dredging and Debris Removal	6.01	$ 1,957,070.66	$ 969,819.78	$ 1,987,832.32	$ -	$ 4,914,722.76	Equipment, labor, and materials for mechanical dredging and debris removal.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,957,070.66**	**$ 969,819.78**	**$ 1,987,832.32**	**$ -**	**$ 4,914,722.76**	
UNIT PRICES		**$ 19.93**	**$ 9.88**	**$ 20.24**	**$ -**	**$ 50.05**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST ⟶	$ -	TOTAL COST ⟶			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	42,711	1	2268	$ 84.97	$ 192,720.68
BUCKET (5.5 CY)	DREDGING	100	1	2268	$ 10.00	$ 22,680.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	2268	$ 9.82	$ 22,276.90
EXCAVATOR RAKE	DREDGING	0	1	2268	$ 5.80	$ 13,163.62
BARGE (80'X40')	DREDGING	0	2	4536	$ 76.92	$ 348,923.08
TUG BOAT 1 - 380 HP	DREDGING	37,921	1	2268	$ 40.20	$ 91,181.67
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	9072	$ 9.62	$ 87,230.77
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	42,511	1	2268	$ 156.26	$ 354,405.23
BARGE (80'X40')	MATERIAL TRANSFER	0	1	2268	$ 76.92	$ 174,461.54
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	37,921	1	2268	$ 40.20	$ 91,181.67
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	69,854	1	2268	$ 53.54	$ 121,438.46
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	6804	$ 57.69	$ 392,538.46
WORK BOAT - 115 HP	ALL	1	4	9072	$ 8.34	$ 75,630.24
BARE UNIT COST ⟶	$ 20.24	231,019		TOTAL RENTED EQUIP ⟶		$ 1,987,832.32

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	2268	$ 147.88	$ 335,380.50
UNION TUG OPERATOR	DREDGING	1	2268	$ 72.18	$ 163,704.34
UNION TUG OPERATOR	MATERIAL TRANSFER	1	2268	$ 72.18	$ 163,704.34
UNION OPERATOR 1	MATERIAL TRANSFER	1	2268	$ 65.99	$ 149,659.17
UNION TUG OPERATOR	TRANSPORT	1	2268	$ 72.18	$ 163,704.34
UNION LABORER	ALL	2	4536	$ 50.57	$ 229,400.74
UNION DECKHAND	ALL	6	13608	$ 50.57	$ 688,202.22
Per Diem Unit Rate (Hourly)	ALL	1	2268	$ 27.92	$ 63,315.00
BARE UNIT COST ⟶	$ 19.93	TOTAL LABOR COST ⟶			$ 1,957,070.66

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	231,019	$ 4.20	GAL	$ 969,819.78
BARE UNIT COST ⟶	$ 9.88	TOTAL MATERIAL COST ⟶			$ 969,819.78

Table F-A-3i

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 6.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Slot Dredging and Debris Removal	6.02

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	8,100.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	10.8	2.50	--	65

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Slot Dredging and Debris Removal	6.02	$ 673,066.63	$ 333,394.58	$ 677,846.04	$ -	$ 1,684,307.25	Equipment, labor, and materials for slot dredging and debris removal along shorelines (e.g. slot dredging).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 673,066.63**	**$ 333,394.58**	**$ 677,846.04**	**$ -**	**$ 1,684,307.25**	
UNIT PRICES		**$ 83.09**	**$ 41.16**	**$ 83.68**	**$ -**	**$ 207.94**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	14,689	1	780	$ 84.97	$ 66,279.60
BUCKET (1.0 CY)	DREDGING	0	1	780	$ 2.56	$ 2,000.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	780	$ 9.82	$ 7,661.37
EXCAVATOR RAKE	DREDGING	0	1	780	$ 5.80	$ 4,527.17
BARGE (80'X40')	DREDGING	0	2	1560	$ 76.92	$ 120,000.00
TUG BOAT 1 - 380 HP	DREDGING	13,042	1	780	$ 40.20	$ 31,358.78
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	3120	$ 9.62	$ 30,000.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	14,620	1	780	$ 156.26	$ 121,885.40
BARGE (80'X40')	MATERIAL TRANSFER	0	1	780	$ 76.92	$ 60,000.00
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	13,042	1	780	$ 40.20	$ 31,358.78
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	24,024	1	780	$ 53.54	$ 41,764.55
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	2340	$ 57.69	$ 135,000.00
WORK BOAT - 115 HP	ALL	1	4	3120	$ 8.34	$ 26,010.40
BARE UNIT COST →	$ 83.68	79,417		TOTAL RENTED EQUIP →		$ 677,846.04

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	780	$ 147.88	$ 115,342.50
UNION TUG OPERATOR	DREDGING	1	780	$ 72.18	$ 56,300.43
UNION TUG OPERATOR	MATERIAL TRANSFER	1	780	$ 72.18	$ 56,300.43
UNION OPERATOR 1	MATERIAL TRANSFER	1	780	$ 65.99	$ 51,470.09
UNION TUG OPERATOR	TRANSPORT	1	780	$ 72.18	$ 56,300.43
UNION LABORER	ALL	2	1560	$ 50.57	$ 78,894.43
UNION DECKHAND	ALL	6	4680	$ 50.57	$ 236,683.30
Per Diem Unit Rate (Hourly)	ALL	1	780	$ 27.92	$ 21,775.00
BARE UNIT COST →	$ 83.09	TOTAL LABOR COST →			$ 673,066.63

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	79,417	$ 4.20	GAL	$ 333,394.58
BARE UNIT COST → $ 41.16		TOTAL MATERIAL COST →			$ 333,394.58

Table F-A-3j

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 6.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03

COST ESTIMATE DATA			
		Cost Estimate Data Notes	
TOTAL QUANTITY ON COST ESTIMATE	101,000.0		
ITEM UNIT	CY		

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	42.3	9.77	--	254

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03	$ 864,701.28	$ 671,460.28	$ 1,054,011.20	$ -	$ 2,590,172.76	Dredged material dewatering and limited stabilization with amendment.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 864,701.28**	**$ 671,460.28**	**$ 1,054,011.20**	**$ -**	**$ 2,590,172.76**	
UNIT PRICES		**$ 8.56**	**$ 6.65**	**$ 10.44**	**$ -**	**$ 25.65**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST ⟶	$ -	TOTAL COST ⟶			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	ALL	134	1	3048	$ 10.00	$ 30,480.00
BARGE (80'X40')	ALL	0	2	6096	$ 76.92	$ 468,923.08
CAT 349 E	ALL	57,936	1	3048	$ 70.13	$ 213,745.40
WATER TRUCK (4,000 GAL)	ALL	40,234	1	3048	$ 28.17	$ 85,847.72
SILO	ALL	0	1	3048	$ 48.44	$ 147,651.16
PFU400/25 (PNUEMATIC FOAM UNIT)	ALL	6,096	2	6096	$ 17.61	$ 107,363.85
BARE UNIT COST ⟶	$ 10.44	104,400		TOTAL RENTED EQUIP ⟶		$ 1,054,011.20

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	2	6096	$ 65.99	$ 402,258.51
UNION LABORER	ALL	3	9144	$ 50.57	$ 462,442.76
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST ⟶	$ 8.56	TOTAL LABOR COST ⟶			$ 864,701.28

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	104,400	$ 4.20	GAL	$ 438,271.60
PORTLAND CEMENT	ALL	1,113	$ 146.05	CY	$ 162,534.68
DRUM OF ODOR CONTROL FOAM	ALL	98	$ 585.50	EA	$ 57,379.00
PFU400/25 FOAM UNIT FRIEGHT	ALL	3	$ 3,475.00	EA	$ 10,425.00
TRAINED FOAM TECHNICAN	ALL	3	$ 950.00	DAY	$ 2,850.00
BARE UNIT COST ⟶	$ 6.65	TOTAL MATERIAL COST ⟶			$ 671,460.28

Table F-A-3k

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 6.04

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Water Treatment	6.04

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	10.0	Cost Estimate Data Notes
ITEM UNIT	MO	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	42.3	9.77	--	254

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Water Treatment	6.04	$ 991,240.35	$ 9,649.40	$ 1,495,102.38	$ -	$ 2,495,992.13	Equipment, labor, and materials for running an on-barge water treatment system for treating decant water from barges, concurrent with dredging operations.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 991,240.35**	**$ 9,649.40**	**$ 1,495,102.38**	**$ -**	**$ 2,495,992.13**	
UNIT PRICES		**$ 99,124.04**	**$ 964.94**	**$ 149,510.24**	**$ -**	**$ 249,599.21**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	ALL	0	4	12192	$ 3.71	$ 45,222.90
WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	ALL	0	10	30480	$ 1.24	$ 37,818.44
WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	ALL	0	6	18288	$ 17.81	$ 325,795.93
WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	ALL	0	2	6096	$ 22.27	$ 135,748.31
WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	ALL	2,280	1	3048	$ 16.87	$ 51,433.08
WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	ALL	0	2	6096	$ 117.55	$ 716,559.97
WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	ALL	0	1	3048	$ 5.94	$ 18,113.04
WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	ALL	0	1	3048	$ 8.16	$ 24,880.55
WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	ALL	0	2	6096	$ 22.27	$ 135,748.31
WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	ALL	0	1	3048	$ 1.24	$ 3,781.84
BARE UNIT COST →	$ 149,510.24	2,280	TOTAL RENTED EQUIP →			$ 1,495,102.38

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
WATER TREATMENT OPERATOR	ALL	1	3048	$ 95.00	$ 289,560.00
UNION DECKHAND	ALL	2	6096	$ 50.57	$ 308,295.18
UNION LABORER	ALL	2	6096	$ 50.57	$ 308,295.18
Per Diem Unit Rate (Hourly)	ALL	1	3048	$ 27.92	$ 85,090.00
BARE UNIT COST →	$ 99,124.04	TOTAL LABOR COST →			$ 991,240.35

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	2,280	$ 4.20	GAL	$ 9,571.04
WATER TREATMENT (ON-BARGE) - BAG FILTER	ALL	20	$ 3.92	EA	$ 78.36
BARE UNIT COST →	$ 964.94	TOTAL MATERIAL COST →			$ 9,649.40

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 7.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle D Landfill Transportation, Processing, and Disposal	7.01

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	135,700.0	Cost Estimate Data Notes
ITEM UNIT	TON	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	8.3	1.92	--	50

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle D Landfill Transportation, Processing, and Disposal	7.01	$ 73,652.04	$ 2,661,579.04	$ 32,126.58	$ 20,341,568.01	$ 23,108,925.67	Equipment, labor, and materials for Subtitle D Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 73,652.04**	**$ 2,661,579.04**	**$ 32,126.58**	**$ 20,341,568.01**	**$ 23,108,925.67**	
UNIT PRICES		**$ 0.54**	**$ 19.61**	**$ 0.24**	**$ 149.90**	**$ 170.29**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	135,610	$150	TON	$20,341,568.01
BARE UNIT COST →	$ 149.90	TOTAL COST →			$ 20,341,568.01

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	18,480	1	600	$ 53.54	$ 32,126.58
BARE UNIT COST →	$ 0.24	18,480		TOTAL RENTED EQUIP →		$ 32,126.58

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	600	$ 72.18	$ 43,308.03
UNION DECKHAND	ALL	1	600	$ 50.57	$ 30,344.01
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.54	TOTAL LABOR COST →			$ 73,652.04

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	18,480	$ 4.20	GAL	$ 77,579.04
WASTE CHARACTERIZATION SAMPLING	ALL	272	$ 9,500.00	EA	$ 2,584,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 19.61	TOTAL MATERIAL COST →			$ 2,661,579.04

Table F-A-3m

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 7.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	7,200.0		12	6	0.8	0.19	--	5
ITEM UNIT	TON							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02	$ 7,365.20	$ 150,257.90	$ 3,212.66	$ 4,996,174.60	$ 5,157,010.36	Equipment, labor, and materials for Subtitle C/TSCA Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 7,365.20**	**$ 150,257.90**	**$ 3,212.66**	**$ 4,996,174.60**	**$ 5,157,010.36**	
UNIT PRICES		**$ 1.02**	**$ 20.87**	**$ 0.45**	**$ 693.91**	**$ 716.25**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE C/TSCA PROCESSING, TRANSPORT, AND DISPOSAL	ALL	7,137	$700	TON	$4,996,174.60
BARE UNIT COST →	$ 693.91	TOTAL COST →			$ 4,996,174.60

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	1,848	1	60	$ 53.54	$ 3,212.66
BARE UNIT COST →	$ 0.45	1,848		TOTAL RENTED EQUIP →		$ 3,212.66

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	60	$ 72.18	$ 4,330.80
UNION DECKHAND	ALL	1	60	$ 50.57	$ 3,034.40
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 1.02	TOTAL LABOR COST →			$ 7,365.20

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,848	$ 4.20	GAL	$ 7,757.90
WASTE CHARACTERIZATION SAMPLING	ALL	15	$ 9,500.00	EA	$ 142,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 20.87	TOTAL MATERIAL COST →			$ 150,257.90

Table F-A-3n

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 7.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Debris Transportation, Processing, and Disposal	7.03

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	7,500.0	Cost Estimate Data Notes
ITEM UNIT	TON	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.7	0.15	--	4

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Debris Transportation, Processing, and Disposal	7.03	$ 5,892.16	$ 43,706.32	$ 2,570.13	$ 2,231,597.38	$ 2,283,765.99	Equipment, labor, and materials for Debris Transportation and Disposal (Subtitle D Landfill). Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,892.16**	**$ 43,706.32**	**$ 2,570.13**	**$ 2,231,597.38**	**$ 2,283,765.99**	
UNIT PRICES		**$ 0.79**	**$ 5.83**	**$ 0.34**	**$ 297.55**	**$ 304.50**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	7,439	$300	TON	$2,231,597.38
BARE UNIT COST →	$ 297.55	TOTAL COST →			$ 2,231,597.38

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	1,478	1	48	$ 53.54	$ 2,570.13
BARE UNIT COST →	$ 0.34	1,478		TOTAL RENTED EQUIP →		$ 2,570.13

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	48	$ 72.18	$ 3,464.64
UNION DECKHAND	ALL	1	48	$ 50.57	$ 2,427.52
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.79	TOTAL LABOR COST →			$ 5,892.16

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,478	$ 4.20	GAL	$ 6,206.32
WIPE SAMPLING (DEBRIS)	ALL	15	$ 2,500.00	EA	$ 37,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 5.83	TOTAL MATERIAL COST →			$ 43,706.32

Table F-A-3o

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Backfill Placement	8.01

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.2		12	6	5.0	1.15	--	30
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Backfill Placement	8.01	$ 212,505.72	$ 629,557.41	$ 347,809.11	$ -	$ 1,189,872.24	Equipment, labor, and materials for placement of backfil to pre-construction grade after dredging.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 212,505.72**	**$ 629,557.41**	**$ 347,809.11**	**$ -**	**$ 1,189,872.24**	
UNIT PRICES		**$ 175,624.56**	**$ 520,295.38**	**$ 287,445.54**	**$ -**	**$ 983,365.49**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	1,505	1	360	$ 24.14	$ 8,691.58
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	1,584	1	360	$ 24.11	$ 8,680.41
TELEBELT 130	MATERIAL TRANSFER	6,415	1	360	$ 225.00	$ 81,000.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	6,748	1	360	$ 156.26	$ 56,254.80
BARGE (80'X40')	MATERIAL TRANSFER	0	1	360	$ 76.92	$ 27,692.31
SCOW (225'X42'X12')	BACKFILL PLACEMENT	0	2	720	$ 57.69	$ 41,538.46
TUG BOAT 2 - 700 HP	BACKFILL PLACEMENT	11,088	1	360	$ 53.54	$ 19,275.95
SCOW (100 CY)	BACKFILL PLACEMENT	0	4	1440	$ 9.62	$ 13,846.15
TUG BOAT 1 - 380 HP	BACKFILL PLACEMENT	12,038	2	720	$ 40.20	$ 28,946.56
BARGE (80'X40')	BACKFILL PLACEMENT	0	1	360	$ 76.92	$ 27,692.31
CAT 375 L	BACKFILL PLACEMENT	6,780	1	360	$ 84.97	$ 30,590.58
BUCKET (5.5 CY)	BACKFILL PLACEMENT	16	1	360	$ 10.00	$ 3,600.00
BARE UNIT COST →	$ 287,445.54	46,174		TOTAL RENTED EQUIP →		$ 347,809.11

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	BACKFILL PLACEMENT	1	360	$ 147.88	$ 53,235.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	360	$ 65.99	$ 23,755.42
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	360	$ 65.99	$ 23,755.42
UNION OPERATOR 1	MATERIAL TRANSFER	1	360	$ 65.99	$ 23,755.42
UNION TUG OPERATOR	BACKFILL PLACEMENT	3	1080	$ 72.18	$ 77,954.45
Per Diem Unit Rate (Hourly)	ALL	1	360	$ 27.92	$ 10,050.00
BARE UNIT COST →	$ 175,624.56	TOTAL LABOR COST →			$ 212,505.72

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	46,174	$ 4.20	GAL	$ 193,836.77
SAND	ALL	14,368	$ 27.13	CY	$ 389,720.64
MATERIAL VERIFICATION SAMPLING	ALL	23	$ 2,000.00	EA	$ 46,000.00
BARE UNIT COST →	$ 520,295.38	TOTAL MATERIAL COST →			$ 629,557.41

Table F-A-3p

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Deep Water	8.11

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.04	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	1.5	0.35	--	9

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Deep Water	8.11	$ 63,751.72	$ 633,551.54	$ 106,938.89	$ -	$ 804,242.14	Equipment, labor, and materials for placing deep water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 63,751.72**	**$ 633,551.54**	**$ 106,938.89**	**$ -**	**$ 804,242.14**	
UNIT PRICES		**$ 61,299.73**	**$ 609,184.17**	**$ 102,825.85**	**$ -**	**$ 773,309.75**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL COST → $ -			

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	451	1	108	$ 24.14	$ 2,607.47
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	475	1	108	$ 24.11	$ 2,604.12
TELEBELT 130	MATERIAL TRANSFER	1,925	1	108	$ 225.00	$ 24,300.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	2,024	1	108	$ 156.26	$ 16,876.44
BARGE (80'X40')	MATERIAL TRANSFER	0	1	108	$ 76.92	$ 8,307.69
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	216	$ 57.69	$ 12,461.54
TUG BOAT 2 - 700 HP	CAP PLACEMENT	3,326	1	108	$ 53.54	$ 5,782.78
SCOW (100 CY)	CAP PLACEMENT	0	4	432	$ 9.62	$ 4,153.85
TUG BOAT 1 - 380 HP	CAP PLACEMENT	3,612	2	216	$ 40.20	$ 8,683.97
BARGE (80'X40')	CAP PLACEMENT	0	1	108	$ 76.92	$ 8,307.69
CAT 375 L	CAP PLACEMENT	2,034	1	108	$ 84.97	$ 9,177.18
BUCKET (5.5 CY)	CAP PLACEMENT	5	1	108	$ 10.00	$ 1,080.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	108	$ 24.04	$ 2,596.15
BARE UNIT COST → $ 102,825.85		13,852		TOTAL RENTED EQUIP →		$ 106,938.89

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	108	$ 147.88	$ 15,970.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	108	$ 65.99	$ 7,126.63
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	108	$ 65.99	$ 7,126.63
UNION OPERATOR 1	MATERIAL TRANSFER	1	108	$ 65.99	$ 7,126.63
UNION TUG OPERATOR	CAP PLACEMENT	3	324	$ 72.18	$ 23,386.33
Per Diem Unit Rate (Hourly)	ALL	1	108	$ 27.92	$ 3,015.00
BARE UNIT COST → $ 61,299.73		TOTAL LABOR COST →			$ 63,751.72

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	13,852	$ 4.20	GAL	$ 58,151.03
ORGANOCLAY	ALL	75	$ 3,307.50	CY	$ 249,326.93
GAC	ALL	85	$ 1,827.19	CY	$ 155,481.34
SAND	ALL	5,626	$ 27.13	CY	$ 152,592.23
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	9	$ 2,000.00	EA	$ 18,000.00
BARE UNIT COST → $ 609,184.17		TOTAL MATERIAL COST →			$ 633,551.54

Table F-A-3q

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.12

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Shallow Water	8.12

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	5.28	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	10.2	2.35	--	61

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Shallow Water	8.12	$ 432,094.96	$ 4,225,511.36	$ 724,808.00	$ -	$ 5,382,414.33	Equipment, labor, and materials for placing shallow water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 432,094.96**	**$ 4,225,511.36**	**$ 724,808.00**	**$ -**	**$ 5,382,414.33**	
UNIT PRICES		**$ 81,836.17**	**$ 800,286.24**	**$ 137,274.24**	**$ -**	**$ 1,019,396.65**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	3,060	1	732	$ 24.14	$ 17,672.87
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	3,221	1	732	$ 24.11	$ 17,650.16
TELEBELT 130	MATERIAL TRANSFER	13,044	1	732	$ 225.00	$ 164,700.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	13,721	1	732	$ 156.26	$ 114,384.76
BARGE (80'X40')	MATERIAL TRANSFER	0	1	732	$ 76.92	$ 56,307.69
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1464	$ 57.69	$ 84,461.54
TUG BOAT 2 - 700 HP	CAP PLACEMENT	90,182	1	732	$ 53.54	$ 39,194.42
SCOW (100 CY)	CAP PLACEMENT	0	4	2928	$ 9.62	$ 28,153.85
TUG BOAT 1 - 380 HP	CAP PLACEMENT	12,239	2	1464	$ 40.20	$ 58,858.01
BARGE (80'X40')	CAP PLACEMENT	0	1	732	$ 76.92	$ 56,307.69
CAT 375 L	CAP PLACEMENT	13,785	1	732	$ 84.97	$ 62,200.86
BUCKET (5.5 CY)	CAP PLACEMENT	32	1	732	$ 10.00	$ 7,320.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	732	$ 24.04	$ 17,596.15
BARE UNIT COST →	$ 137,274.24	149,284		TOTAL RENTED EQUIP →		$ 724,808.00

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	732	$ 147.88	$ 108,244.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	732	$ 65.99	$ 48,302.70
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	732	$ 65.99	$ 48,302.70
UNION OPERATOR 1	MATERIAL TRANSFER	1	732	$ 65.99	$ 48,302.70
UNION TUG OPERATOR	CAP PLACEMENT	3	2196	$ 72.18	$ 158,507.38
Per Diem Unit Rate (Hourly)	ALL	1	732	$ 27.92	$ 20,435.00
BARE UNIT COST →	$ 81,836.17	TOTAL LABOR COST →			$ 432,094.96

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	149,284	$ 4.20	GAL	$ 626,694.57
ORGANOCLAY	ALL	383	$ 3,307.50	CY	$ 1,265,707.39
GAC	ALL	432	$ 1,827.19	CY	$ 789,300.56
SAND	ALL	18,778	$ 27.13	CY	$ 509,363.77
GRAVEL	ALL	6,697	$ 67.18	CY	$ 449,870.62
ARMOR STONE 3-9 INCHES	ALL	8,504	$ 61.69	CY	$ 524,566.46
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	30	$ 2,000.00	EA	$ 60,000.00
BARE UNIT COST →	$ 800,286.24	TOTAL MATERIAL COST →			$ 4,225,511.36

Table F-A-3r

Alternative EB-D			
CONSTRUCTION COST ESTIMATE WORKSHEET 8.13			BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Wake Zone	8.13

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	2.95	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	7.0	1.62	--	42

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Wake Zone	8.13	$ 297,508.01	$ 2,479,857.46	$ 499,048.13	$ -	$ 3,276,413.60	Equipment, labor, and materials for placing armored amended caps in wake zone areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 297,508.01**	**$ 2,479,857.46**	**$ 499,048.13**	**$ -**	**$ 3,276,413.60**	
UNIT PRICES		**$ 100,850.17**	**$ 840,629.65**	**$ 169,168.86**	**$ -**	**$ 1,110,648.68**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	2,107	1	504	$ 24.14	$ 12,168.21
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	2,218	1	504	$ 24.11	$ 12,152.57
TELEBELT 130	MATERIAL TRANSFER	8,981	1	504	$ 225.00	$ 113,400.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	9,447	1	504	$ 156.26	$ 78,756.72
BARGE (80'X40')	MATERIAL TRANSFER	0	1	504	$ 76.92	$ 38,769.23
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1008	$ 57.69	$ 58,153.85
TUG BOAT 2 - 700 HP	CAP PLACEMENT	15,523	1	504	$ 53.54	$ 26,986.32
SCOW (100 CY)	CAP PLACEMENT	0	4	2016	$ 9.62	$ 19,384.62
TUG BOAT 1 - 380 HP	CAP PLACEMENT	16,854	2	1008	$ 40.20	$ 40,525.19
BARGE (80'X40')	CAP PLACEMENT	0	1	504	$ 76.92	$ 38,769.23
CAT 375 L	CAP PLACEMENT	9,491	1	504	$ 84.97	$ 42,826.82
BUCKET (5.5 CY)	CAP PLACEMENT	22	1	504	$ 10.00	$ 5,040.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	504	$ 24.04	$ 12,115.38
BARE UNIT COST →	$ 169,168.86	64,643		TOTAL RENTED EQUIP →		$ 499,048.13

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	504	$ 147.88	$ 74,529.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	504	$ 65.99	$ 33,257.59
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	504	$ 65.99	$ 33,257.59
UNION OPERATOR 1	MATERIAL TRANSFER	1	504	$ 65.99	$ 33,257.59
UNION TUG OPERATOR	CAP PLACEMENT	3	1512	$ 72.18	$ 109,136.23
Per Diem Unit Rate (Hourly)	ALL	1	504	$ 27.92	$ 14,070.00
BARE UNIT COST →	$ 100,850.17	TOTAL LABOR COST →			$ 297,508.01

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	64,643	$ 4.20	GAL	$ 271,371.48
ORGANOCLAY	ALL	214	$ 3,307.50	CY	$ 707,790.49
GAC	ALL	242	$ 1,827.19	CY	$ 441,381.18
SAND	ALL	10,501	$ 27.13	CY	$ 284,839.00
GRAVEL	ALL	3,745	$ 67.18	CY	$ 251,574.58
ARMOR STONE 3-9 INCHES	ALL	7,926	$ 61.69	CY	$ 488,900.72
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	17	$ 2,000.00	EA	$ 34,000.00
BARE UNIT COST →	$ 840,629.65	TOTAL MATERIAL COST →			$ 2,479,857.46

Table F-A-3s

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.14

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - ISS Areas	8.14

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.45	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.0	0.23	--	6

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - ISS Areas	8.14	$ 42,501.14	$ 276,154.54	$ 71,292.59	$ -	$ 389,948.27	Equipment, labor, and materials for placing armored amended caps in ISS areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 42,501.14**	**$ 276,154.54**	**$ 71,292.59**	**$ -**	**$ 389,948.27**	
UNIT PRICES		**$ 94,446.99**	**$ 613,676.75**	**$ 158,427.98**	**$ -**	**$ 866,551.71**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →		$ -	

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	301	1	72	$ 24.14	$ 1,738.32
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	317	1	72	$ 24.11	$ 1,736.08
TELEBELT 130	MATERIAL TRANSFER	1,283	1	72	$ 225.00	$ 16,200.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,350	1	72	$ 156.26	$ 11,250.96
BARGE (80'X40')	MATERIAL TRANSFER	0	1	72	$ 76.92	$ 5,538.46
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	144	$ 57.69	$ 8,307.69
TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,218	1	72	$ 53.54	$ 3,855.19
SCOW (100 CY)	CAP PLACEMENT	0	4	288	$ 9.62	$ 2,769.23
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,408	2	144	$ 40.20	$ 5,789.31
BARGE (80'X40')	CAP PLACEMENT	0	1	72	$ 76.92	$ 5,538.46
CAT 375 L	CAP PLACEMENT	1,356	1	72	$ 84.97	$ 6,118.12
BUCKET (5.5 CY)	CAP PLACEMENT	3	1	72	$ 10.00	$ 720.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	72	$ 24.04	$ 1,730.77
BARE UNIT COST →	$ 158,427.98	9,235		TOTAL RENTED EQUIP →		$ 71,292.59

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	72	$ 147.88	$ 10,647.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08
UNION OPERATOR 1	MATERIAL TRANSFER	1	72	$ 65.99	$ 4,751.08
UNION TUG OPERATOR	CAP PLACEMENT	3	216	$ 72.18	$ 15,590.89
Per Diem Unit Rate (Hourly)	ALL	1	72	$ 27.92	$ 2,010.00
BARE UNIT COST →	$ 94,446.99	TOTAL LABOR COST →			$ 42,501.14

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	9,235	$ 4.20	GAL	$ 38,767.35
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	58	$ 1,827.19	CY	$ 106,263.67
SAND	ALL	1,590	$ 27.13	CY	$ 43,129.95
GRAVEL	ALL	564	$ 67.18	CY	$ 37,854.52
ARMOR STONE 3-9 INCHES	ALL	716	$ 61.69	CY	$ 44,139.04
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	3	$ 2,000.00	EA	$ 6,000.00
BARE UNIT COST →	$ 613,676.75	TOTAL MATERIAL COST →			$ 276,154.54

Table F-A-3t

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.15

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Deep Water)	8.15

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA					
			HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.28		12	6	0.3	0.08	--	2
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Deep Water)	8.15	$ 14,167.05	$ 88,469.37	$ 23,764.20	$ -	$ 126,400.62	Equipment, labor, and materials for placing armored amended caps in areas dredged to native. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 14,167.05**	**$ 88,469.37**	**$ 23,764.20**	**$ -**	**$ 126,400.62**	
UNIT PRICES		**$ 50,596.60**	**$ 315,962.04**	**$ 84,872.13**	**$ -**	**$ 451,430.77**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	100	1	24	$ 24.14	$ 579.44
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	106	1	24	$ 24.11	$ 578.69
TELEBELT 130	MATERIAL TRANSFER	428	1	24	$ 225.00	$ 5,400.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	450	1	24	$ 156.26	$ 3,750.32
BARGE (80'X40')	MATERIAL TRANSFER	0	1	24	$ 76.92	$ 1,846.15
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	48	$ 57.69	$ 2,769.23
TUG BOAT 2 - 700 HP	CAP PLACEMENT	739	1	24	$ 53.54	$ 1,285.06
SCOW (100 CY)	CAP PLACEMENT	0	4	96	$ 9.62	$ 923.08
TUG BOAT 1 - 380 HP	CAP PLACEMENT	803	2	48	$ 40.20	$ 1,929.77
BARGE (80'X40')	CAP PLACEMENT	0	1	24	$ 76.92	$ 1,846.15
CAT 375 L	CAP PLACEMENT	452	1	24	$ 84.97	$ 2,039.37
BUCKET (5.5 CY)	CAP PLACEMENT	1	1	24	$ 10.00	$ 240.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	24	$ 24.04	$ 576.92
BARE UNIT COST →	$ 84,872.13	3,078		TOTAL RENTED EQUIP →		$ 23,764.20

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	24	$ 147.88	$ 3,549.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	24	$ 65.99	$ 1,583.69
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	24	$ 65.99	$ 1,583.69
UNION OPERATOR 1	MATERIAL TRANSFER	1	24	$ 65.99	$ 1,583.69
UNION TUG OPERATOR	CAP PLACEMENT	3	72	$ 72.18	$ 5,196.96
Per Diem Unit Rate (Hourly)	ALL	1	24	$ 27.92	$ 670.00
BARE UNIT COST →	$ 50,596.60	TOTAL LABOR COST →			$ 14,167.05

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,078	$ 4.20	GAL	$ 12,922.45
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	22	$ 1,827.19	CY	$ 41,072.67
SAND	ALL	1,123	$ 27.13	CY	$ 30,474.25
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST →	$ 315,962.04	TOTAL MATERIAL COST →			$ 88,469.37

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.16

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Shallow Water)	8.16

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Shallow Water)	8.16	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-3v

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.21

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - CSOs	8.21

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.9	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.2	1.42	--	37

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - CSOs	8.21	$ 300,423.79	$ 999,575.89	$ 309,231.14	$ -	$ 1,609,230.82	Equipment, labor, and materials for placing outfall protection at CSOs. Assumes mats required for outfall protection can all be delivered and placed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 300,423.79**	**$ 999,575.89**	**$ 309,231.14**	**$ -**	**$ 1,609,230.82**	
UNIT PRICES		**$ 326,547.60**	**$ 1,086,495.53**	**$ 336,120.81**	**$ -**	**$ 1,749,163.93**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	MAT PLACEMENT	16,723	2	888	$ 84.97	$ 75,456.78
BUCKET (5.5 CY)	MAT PLACEMENT	39	2	888	$ 10.00	$ 8,880.00
BARGE (80'X40')	MAT PLACEMENT	0	2	888	$ 76.92	$ 68,307.69
TUG BOAT 1 - 380 HP	MAT PLACEMENT	14,847	2	888	$ 40.20	$ 35,700.76
WORK BOAT - 115 HP	MAT PLACEMENT	2,247	1	444	$ 8.34	$ 3,701.48
BARGE (80'X40')	MAT DELIVERY	0	1	444	$ 76.92	$ 34,153.85
TUG BOAT 2 - 700 HP	MAT DELIVERY	13,675	1	444	$ 53.54	$ 23,773.67
GROUT PLANT	GROUTING	1,289	2	888	$ 66.73	$ 59,256.92
BARE UNIT COST →	$ 336,120.81	48,820		TOTAL RENTED EQUIP →		$ 309,231.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	MAT PLACEMENT	2	888	$ 147.88	$ 131,313.00
UNION DECKHAND	MAT PLACEMENT	1	444	$ 50.57	$ 22,454.57
UNION LABORER	MAT PLACEMENT	4	1776	$ 50.57	$ 89,818.28
UNION TUG OPERATOR	MAT PLACEMENT	1	444	$ 72.18	$ 32,047.94
Per Diem Unit Rate (Hourly)	ALL	2	888	$ 27.92	$ 24,790.00
BARE UNIT COST →	$ 326,547.60	TOTAL LABOR COST →			$ 300,423.79

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	48,820	$ 4.20	GAL	$ 204,948.31
NON-WOVEN GEOTEXTILE	ALL	44,000	$ 0.17	SF	$ 7,663.33
SAND	ALL	1,278	$ 27.13	CY	$ 34,659.72
ARTICULATED CONCRETE MATTRESSES	ALL	40,000	$ 12.67	SF	$ 506,800.00
GRAVEL	ALL	111	$ 67.18	CY	$ 7,464.17
UNDERWATER GROUT (SUPERSACK)	ALL	117	$ 2,000.00	EA	$ 234,000.00
WATER	ALL	7,020	$ 0.01	GAL	$ 40.36
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST →	$ 1,086,495.53	TOTAL MATERIAL COST →			$ 999,575.89

Table F-A-3w

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.22

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22	$ 5,499.83	$ 17,102.13	$ 8,314.57	$ -	$ 30,916.53	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of 12 inches or greater. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,102.13**	**$ 8,314.57**	**$ -**	**$ 30,916.53**	
UNIT PRICES		**$ 183,327.64**	**$ 570,071.09**	**$ 277,152.36**	**$ -**	**$ 1,030,551.08**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 277,152.36	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 183,327.64	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	104	$ 114.92	CY	$ 11,970.83
BARE UNIT COST →	$ 570,071.09	TOTAL MATERIAL COST →			$ 17,102.13

Table F-A-3x

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 8.23

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23

COST ESTIMATE DATA		
		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.1	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23	$ 5,499.83	$ 17,715.04	$ 8,314.57	$ -	$ 31,529.44	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of less than 12 inches. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,715.04**	**$ 8,314.57**	**$ -**	**$ 31,529.44**	
UNIT PRICES		**$ 61,109.21**	**$ 196,833.77**	**$ 92,384.12**	**$ -**	**$ 350,327.10**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST	$ -	TOTAL COST			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST	$ 92,384.12	1,222		TOTAL RENTED EQUIP		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST	$ 61,109.21	TOTAL LABOR COST			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	204	$ 61.69	CY	$ 12,583.74
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
BARE UNIT COST	$ 196,833.77	TOTAL MATERIAL COST			$ 17,715.04

Table F-A-3y

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 9

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Environmental Controls	9.0

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	7.0	1.62	--	42
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Environmental Controls	9.0	$ 101,955.88	$ 590,776.86	$ 8,403.36	$ -	$ 701,136.11	Equipment, labor, and materials for installing and maintaning environmental controls (i.e., silt curtains) during aquatic work activities.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 101,955.88**	**$ 590,776.86**	**$ 8,403.36**	**$ -**	**$ 701,136.11**	
UNIT PRICES		**$ 101,955.88**	**$ 590,776.86**	**$ 8,403.36**	**$ -**	**$ 701,136.11**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WORK BOAT - 115 HP	ALL	5,100	2	1008	$ 8.34	$ 8,403.36
BARE UNIT COST →	$ 8,403.36	5,100		TOTAL RENTED EQUIP →		$ 8,403.36

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION DECKHAND	ALL	4	2016	$ 50.57	$ 101,955.88
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 101,955.88	TOTAL LABOR COST →			$ 101,955.88

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	5,100	$ 4.20	GAL	$ 21,411.82
MOBILE RESUSPENSION CONTROL SYSTEM (ALT. EB-D)	ALL	1	$ 537,100.00	LS	$ 537,100.00
SILT CURTAIN	ALL	22	$ 1,466.59	EA	$ 32,265.05
BARE UNIT COST →	$ 590,776.86		TOTAL MATERIAL COST →		$ 590,776.86

Table F-A-3z

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 10

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Inspections and Surveying	10.0

COST ESTIMATE DATA

		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	1.0	
ITEM UNIT	LS	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	24.8	5.73	--	149

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Inspections and Surveying	10.0	$ -	$ -	$ -	$ 1,821,800.00	$ 1,821,800.00	Equipment, labor, and materials for surveying and bulkhead inspections.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 1,821,800.00**	**$ 1,821,800.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 1,821,800.00**	**$ 1,821,800.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
MULTIBEAM BATHYMETRIC SURVEYS	ALL	24	$10,200	DAY	$244,800.00
BULKHEAD INSPECTIONS	ALL	1	$500,000	LS	$500,000.00
BATHYMETRIC PROGRESS SURVEYS	ALL	125	$6,200	DAY	$775,000.00
UTILITY ID AND SURVEY	ALL	1	$200,000	LS	$200,000.00
VIBRATION MONITORING	ALL	102	$1,000	DAY	$102,000.00
BARE UNIT COST →	$ 1,821,800.00	TOTAL COST →			$ 1,821,800.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-3aa

Alternative EB-D

CONSTRUCTION COST ESTIMATE WORKSHEET 11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Restoration	11.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Restoration	11.0	$ 62,942.75	$ 487,354.64	$ 10,566.76	$ 324,939.00	$ 885,803.15	Equipment, labor, and materials for site restoration (includes disposal of DGA from staging area).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	
UNIT PRICES		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
OTHER SITE RESTORATION	ALL	1	$100,000	LS	$100,000.00
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	1,500	$150	TON	$224,939.00
BARE UNIT COST →	$ 324,939.00	TOTAL COST →			$ 324,939.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	792	1	180	$ 24.11	$ 4,340.20
CAT 272 SKID STEER	ALL	752	1	180	$ 24.14	$ 4,345.79
TRENCH ROLLER WITH REMOTE	ALL	174	1	180	$ 10.45	$ 1,880.77
BARE UNIT COST →	$ 10,566.76	1,719		TOTAL RENTED EQUIP →		$ 10,566.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	180	$ 65.99	$ 11,877.71
UNION OPERATOR 2	ALL	2	360	$ 65.99	$ 23,755.42
UNION LABORER	ALL	3	540	$ 50.57	$ 27,309.61
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 62,942.75	TOTAL LABOR COST →			$ 62,942.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ASPHALT PAVING	ALL	65,340	$ 7.46	SF	$ 487,354.64
BARE UNIT COST → $ 487,354.64		TOTAL MATERIAL COST →			$ 487,354.64

Table F-A-4a

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 3.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Staging Area Lease	3.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	66.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	158.0	36.46	--	948

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Staging Area Lease	3.01	$ -	$ -	$ -	$ 17,968,500.00	$ 17,968,500.00	Land lease for upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 17,968,500.00**	**$ 17,968,500.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 272,250.00**	**$ 272,250.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
LAND LEASE	ALL	99	$181,500	AC*MO	$17,968,500.00
BARE UNIT COST →	$ 272,250.00	TOTAL COST →			$ 17,968,500.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-4b

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 3.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Preparation Work	3.02

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	1.0	
ITEM UNIT	LS	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	4.5	1.04	--	27

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Preparation Work	3.02	$ 113,296.95	$ 95,521.36	$ 19,020.17	$ 1,500,000.00	$ 1,727,838.48	Equipment, labor, and materials for pre-remediation site work, including access dredging and construction of an upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	
UNIT PRICES		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ACCESS DREDGING	ALL	1	$1,000,000	LS	$1,000,000.00
STAGING AREA SHORELINE MODIFICATIONS	ALL	1	$500,000	LS	$500,000.00
BARE UNIT COST →	$ 1,500,000.00	TOTAL COST →			$ 1,500,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	1,426	1	324	$ 24.11	$ 7,812.37
CAT 272 SKID STEER	ALL	1,354	1	324	$ 24.14	$ 7,822.42
TRENCH ROLLER WITH REMOTE	ALL	314	1	324	$ 10.45	$ 3,385.38
BARE UNIT COST →	$ 19,020.17	3,094		TOTAL RENTED EQUIP →		$ 19,020.17

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	324	$ 65.99	$ 21,379.88
UNION OPERATOR 2	ALL	2	648	$ 65.99	$ 42,759.76
UNION LABORER	ALL	3	972	$ 50.57	$ 49,157.30
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 113,296.95	TOTAL LABOR COST →			$ 113,296.95

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,094	$ 4.20	GAL	$ 12,986.73
DGA	ALL	887	$ 33.80	CY	$ 29,991.87
CHAIN LINK FENCING	ALL	1,300	$ 30.79	LF	$ 40,024.71
NON-WOVEN GEOTEXTILE	ALL	71,874	$ 0.17	SF	$ 12,518.06
BARE UNIT COST →	$ 95,521.36		TOTAL MATERIAL COST →		$ 95,521.36

Table F-A-4c

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 3.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Temporary Facilities and Utilities	3.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	37.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	158.0	36.46	--	948

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Temporary Facilities and Utilities	3.03	$ -	$ -	$ -	$ 3,774,000.00	$ 3,774,000.00	Temporary facilities and utilities for work.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 3,774,000.00**	**$ 3,774,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 102,000.00**	**$ 102,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TEMPORARY FACILITIES AND UTILITIES	ALL	37	$102,000	MO	$3,774,000.00							
BARE UNIT COST →	$ 102,000.00	TOTAL COST →			$ 3,774,000.00	BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -	BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-4d

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 4.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Stabilization (High Cost)	4.01

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	100.0	
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.2	0.27	--	7

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Stabilization (High Cost)	4.01	$ 104,970.49	$ 215,163.45	$ 115,242.06	$ -	$ 435,376.00	Equipment, labor, and materials for existing bulkhead repair at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 104,970.49**	**$ 215,163.45**	**$ 115,242.06**	**$ -**	**$ 435,376.00**	
UNIT PRICES		**$ 1,049.70**	**$ 2,151.63**	**$ 1,152.42**	**$ -**	**$ 4,353.76**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	4	1	84	$ 10.00	$ 840.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	84	$ 9.82	$ 825.07
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	252	$ 76.92	$ 19,384.62
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	252	$ 57.69	$ 14,538.46
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	1,574	1	84	$ 156.26	$ 13,126.12
BARGE (80'X40')	INSTALL	0	3	252	$ 76.92	$ 19,384.62
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	3,068	2	168	$ 49.04	$ 8,238.46
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	3,149	2	168	$ 156.26	$ 26,252.24
TUG BOAT 1 - 380 HP	ALL	2,809	2	168	$ 40.20	$ 6,754.20
TUG BOAT 2 - 700 HP	ALL	2,587	1	84	$ 53.54	$ 4,497.72
WORK BOAT - 115 HP	ALL	850	2	168	$ 8.34	$ 1,400.56
BARE UNIT COST →	$ 1,152.42	14,041		TOTAL RENTED EQUIP →		$ 115,242.06

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	252	$ 147.88	$ 37,264.50
UNION TUG OPERATOR	ALL	3	252	$ 72.18	$ 18,189.37
UNION LABORER	ALL	2	168	$ 50.57	$ 8,496.32
UNION DECKHAND	ALL	8	672	$ 50.57	$ 33,985.29
Per Diem Unit Rate (Hourly)	ALL	3	252	$ 27.92	$ 7,035.00
BARE UNIT COST →	$ 1,049.70	TOTAL LABOR COST →			$ 104,970.49

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	14,041	$ 4.20	GAL	$ 58,944.55
SHEETPILE - TIEBACK WALL (HIGH)	ALL	17	$ 5,600.00	TON	$ 96,218.89
TIEBACKS (HIGH)	ALL	20	$ 3,000.00	EA	$ 60,000.00
BARE UNIT COST →	$ 2,151.63		TOTAL MATERIAL COST →		$ 215,163.45

Table F-A-4e

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 4.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Installation (High Cost)	4.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	750.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	10.5	2.42	--	63

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Installation (High Cost)	4.02	$ 944,734.41	$ 7,006,297.96	$ 1,037,178.56	$ -	$ 8,988,210.93	Equipment, labor, and materials for installation of new bulkheads at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 944,734.41**	**$ 7,006,297.96**	**$ 1,037,178.56**	**$ -**	**$ 8,988,210.93**	
UNIT PRICES		**$ 1,259.65**	**$ 9,341.73**	**$ 1,382.90**	**$ -**	**$ 11,984.28**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	33	1	756	$ 10.00	$ 7,560.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	756	$ 9.82	$ 7,425.63
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	2268	$ 76.92	$ 174,461.54
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	2268	$ 57.69	$ 130,846.15
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	14,170	1	756	$ 156.26	$ 118,135.08
BARGE (80'X40')	INSTALL	0	3	2268	$ 76.92	$ 174,461.54
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	27,609	2	1512	$ 49.04	$ 74,146.15
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	28,341	2	1512	$ 156.26	$ 236,270.15
TUG BOAT 1 - 380 HP	ALL	25,281	2	1512	$ 40.20	$ 60,787.78
TUG BOAT 2 - 700 HP	ALL	23,285	1	756	$ 53.54	$ 40,479.49
WORK BOAT - 115 HP	ALL	7,651	2	1512	$ 8.34	$ 12,605.04
BARE UNIT COST →	$ 1,382.90	126,370		TOTAL RENTED EQUIP →		$ 1,037,178.56

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	2268	$ 147.88	$ 335,380.50
UNION TUG OPERATOR	ALL	3	2268	$ 72.18	$ 163,704.34
UNION LABORER	ALL	2	1512	$ 50.57	$ 76,466.91
UNION DECKHAND	ALL	8	6048	$ 50.57	$ 305,867.65
Per Diem Unit Rate (Hourly)	ALL	3	2268	$ 27.92	$ 63,315.00
BARE UNIT COST →	$ 1,259.65	TOTAL LABOR COST →			$ 944,734.41

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	126,370	$ 4.20	GAL	$ 530,500.99
SHEETPILE (HIGH)	ALL	583	$ 11,100.00	TON	$ 6,475,796.97
BARE UNIT COST → $ 9,341.73		TOTAL MATERIAL COST →			$ 7,006,297.96

Table F-A-4f

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 4.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Replacement (High Cost)	4.03

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	1,690.0	Cost Estimate Data Notes
ITEM UNIT	LF	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	35.2	8.12	--	211

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Replacement (High Cost)	4.03	$ 3,164,110.48	$ 16,410,151.25	$ 3,473,725.01	$ 64,666.59	$ 23,112,653.33	Equipment, labor, and materials for replacement of bulkheads at shorelines (including disposal).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 3,164,110.48**	**$ 16,410,151.25**	**$ 3,473,725.01**	**$ 64,666.59**	**$ 23,112,653.33**	
UNIT PRICES		**$ 1,872.25**	**$ 9,710.15**	**$ 2,055.46**	**$ 38.26**	**$ 13,676.13**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	215.6	$300	TON	$64,666.59
BARE UNIT COST →	$ 38.26	TOTAL COST →			$ 64,666.59

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	111	1	2532	$ 10.00	$ 25,320.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	2532	$ 9.82	$ 24,869.98
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	7596	$ 76.92	$ 584,307.69
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	7596	$ 57.69	$ 438,230.77
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	47,460	1	2532	$ 156.26	$ 395,658.75
BARGE (80'X40')	INSTALL	0	3	7596	$ 76.92	$ 584,307.69
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	92,469	2	5064	$ 49.04	$ 248,330.77
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	94,920	2	5064	$ 156.26	$ 791,317.50
TUG BOAT 1 - 380 HP	ALL	84,670	2	5064	$ 40.20	$ 203,590.82
TUG BOAT 2 - 700 HP	ALL	77,986	1	2532	$ 53.54	$ 135,574.15
WORK BOAT - 115 HP	ALL	25,624	2	5064	$ 8.34	$ 42,216.88
BARE UNIT COST →	$ 2,055.46	423,239		TOTAL RENTED EQUIP →		$ 3,473,725.01

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	7596	$ 147.88	$ 1,123,258.50
UNION TUG OPERATOR	ALL	3	7596	$ 72.18	$ 548,279.62
UNION LABORER	ALL	2	5064	$ 50.57	$ 256,103.47
UNION DECKHAND	ALL	8	20256	$ 50.57	$ 1,024,413.89
Per Diem Unit Rate (Hourly)	ALL	3	7596	$ 27.92	$ 212,055.00
BARE UNIT COST →	$ 1,872.25	TOTAL LABOR COST →			$ 3,164,110.48

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	423,239	$ 4.20	GAL	$ 1,776,757.29
SHEETPILE (HIGH)	ALL	1,318.3	$ 11,100.00	TON	$ 14,633,393.96
BARE UNIT COST → $ 9,710.15		TOTAL MATERIAL COST →			$ 16,410,151.25

Table F-A-4g

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 5

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	ISS	5.0

COST ESTIMATE DATA			
TOTAL QUANTITY ON COST ESTIMATE	17,270.0	Cost Estimate Data Notes	
ITEM UNIT	CY		

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	16.0	3.69	--	96

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
ISS	5.00	$ 631,123.53	$ 1,080,198.36	$ 3,011,660.70	$ -	$ 4,722,982.60	Equipment, labor, and materials for ISS at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 631,123.53**	**$ 1,080,198.36**	**$ 3,011,660.70**	**$ -**	**$ 4,722,982.60**	
UNIT PRICES		**$ 36.54**	**$ 62.55**	**$ 174.39**	**$ -**	**$ 273.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ISS OPERATION - DECK BARGE	MATERIAL BARGE	0	1	1152	$ 84.89	$ 97,798.21
ISS OPERATION - HORIZONTAL PIG (4,200 CF)	MATERIAL BARGE	0	8	9216	$ 85.36	$ 786,718.90
ISS OPERATION - SUCTION HOSE (4" X 20')	MATERIAL BARGE	0	3	3456	$ 1.24	$ 4,288.08
ISS OPERATION - DISCHARGE HOSE (4" X 50')	MATERIAL BARGE	0	4	4608	$ 1.24	$ 5,717.43
ISS OPERATION - GODWIN PUMP (4")	MATERIAL BARGE	6,894	8	9216	$ 16.87	$ 155,514.20
ISS OPERATION - FRAC TANK (18,000 GAL)	MATERIAL BARGE	0	2	2304	$ 17.81	$ 41,045.16
ISS OPERATION - HME SPUD BARGE	DRILL BARGE	0	4	4608	$ 117.55	$ 541,651.63
ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	DRILL BARGE	0	1	1152	$ 22.26	$ 25,638.18
ISS OPERATION - GENERATOR (175 KW)	DRILL BARGE	14,142	1	1152	$ 49.63	$ 57,174.34
ISS OPERATION - BATCH PLANT (45 CM/HR)	DRILL BARGE	0	1	1152	$ 174.36	$ 200,862.48
ISS OPERATION - BAUER RG 22S DRILL RIG	DRILL BARGE	51,854	1	1152	$ 780.24	$ 898,840.79
ISS OPERATION - HORIZONTAL SILO (1,200 CF)	DRILL BARGE	0	1	1152	$ 48.44	$ 55,805.16
ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	DRILL BARGE	0	1	1152	$ 14.84	$ 17,092.12
ISS OPERATION - GAS WELDER	DRILL BARGE	0	1	1152	$ 12.02	$ 13,842.21
ISS OPERATION - LIGHT PLANT	ALL	0	1	1152	$ 13.49	$ 15,542.39
TUG BOAT 2 - 700 HP	ALL	35,482	1	1152	$ 53.54	$ 61,683.03
WATER TRUCK (4,000 GAL)	ALL	15,206	1	1152	$ 28.17	$ 32,446.38
BARE UNIT COST →	$ 174.39	123,577		TOTAL RENTED EQUIP →		$ 3,011,660.70

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION FOREMAN	DRILL BARGE	1	1152	$ 148.65	$ 171,239.04
UNION OPERATOR 1	DRILL BARGE	3	3456	$ 65.99	$ 228,052.07
UNION DECKHAND	DRILL BARGE	2	2304	$ 50.57	$ 116,521.01
UNION TUG OPERATOR	TUG BOAT	1	1152	$ 72.18	$ 83,151.41
Per Diem Unit Rate (Hourly)	ALL	1	1152	$ 27.92	$ 32,160.00
BARE UNIT COST →	$ 36.54	TOTAL LABOR COST →			$ 631,123.53

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	123,577	$ 4.20	GAL	$ 518,777.69
PORTLAND CEMENT	ALL	3,808	$ 146.05	CY	$ 556,087.74
WATER	ALL	927,683	$ 0.01	GAL	$ 5,332.93
BARE UNIT COST →	$ 62.55	TOTAL MATERIAL COST →			$ 1,080,198.36

Table F-A-4h

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 6.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Mechanical Dredging and Debris Removal	6.01

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	246,100.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	81.5	18.81	--	489

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Mechanical Dredging and Debris Removal	6.01	$ 5,063,532.02	$ 2,509,209.59	$ 5,143,121.73	$ -	$ 12,715,863.33	Equipment, labor, and materials for mechanical dredging and debris removal.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,063,532.02**	**$ 2,509,209.59**	**$ 5,143,121.73**	**$ -**	**$ 12,715,863.33**	
UNIT PRICES		**$ 20.58**	**$ 10.20**	**$ 20.90**	**$ -**	**$ 51.67**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	110,506	1	5868	$ 84.97	$ 498,626.53
BUCKET (5.5 CY)	DREDGING	258	1	5868	$ 10.00	$ 58,680.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	5868	$ 9.82	$ 57,637.06
EXCAVATOR RAKE	DREDGING	0	1	5868	$ 5.80	$ 34,058.26
BARGE (80'X40')	DREDGING	0	2	11736	$ 76.92	$ 902,769.23
TUG BOAT 1 - 380 HP	DREDGING	98,113	1	5868	$ 40.20	$ 235,914.48
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	23472	$ 9.62	$ 225,692.31
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	109,990	1	5868	$ 156.26	$ 916,953.22
BARGE (80'X40')	MATERIAL TRANSFER	0	1	5868	$ 76.92	$ 451,384.62
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	98,113	1	5868	$ 40.20	$ 235,914.48
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	180,734	1	5868	$ 53.54	$ 314,197.92
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	17604	$ 57.69	$ 1,015,615.38
WORK BOAT - 115 HP	ALL	1	4	23472	$ 8.34	$ 195,678.24
BARE UNIT COST →	$ 20.90	597,715		TOTAL RENTED EQUIP →		$ 5,143,121.73

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	5868	$ 147.88	$ 867,730.50
UNION TUG OPERATOR	DREDGING	1	5868	$ 72.18	$ 423,552.50
UNION TUG OPERATOR	MATERIAL TRANSFER	1	5868	$ 72.18	$ 423,552.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	5868	$ 65.99	$ 387,213.41
UNION TUG OPERATOR	TRANSPORT	1	5868	$ 72.18	$ 423,552.50
UNION LABORER	ALL	2	11736	$ 50.57	$ 593,528.90
UNION DECKHAND	ALL	6	35208	$ 50.57	$ 1,780,586.70
Per Diem Unit Rate (Hourly)	ALL	1	5868	$ 27.92	$ 163,815.00
BARE UNIT COST →	$ 20.58	TOTAL LABOR COST →			$ 5,063,532.02

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	597,715	$ 4.20	GAL	$ 2,509,209.59
BARE UNIT COST → $ 10.20		TOTAL MATERIAL COST →			$ 2,509,209.59

Table F-A-4i

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 6.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Slot Dredging and Debris Removal	6.02

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Slot Dredging and Debris Removal	6.02	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	0	1	0	$ 84.97	$ -
BUCKET (1.0 CY)	DREDGING	0	1	0	$ 2.56	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	0	$ 9.82	$ -
EXCAVATOR RAKE	DREDGING	0	1	0	$ 5.80	$ -
BARGE (80'X40')	DREDGING	0	2	0	$ 76.92	$ -
TUG BOAT 1 - 380 HP	DREDGING	0	1	0	$ 40.20	$ -
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	0	$ 9.62	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	0	1	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	0	1	0	$ 53.54	$ -
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	0	$ 57.69	$ -
WORK BOAT - 115 HP	ALL	0	4	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	0	$ 147.88	$ -
UNION TUG OPERATOR	DREDGING	1	0	$ 72.18	$ -
UNION TUG OPERATOR	MATERIAL TRANSFER	1	0	$ 72.18	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	TRANSPORT	1	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	6	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-4j

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 6.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	233,800.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	CY		12	6	81.5	18.81	--	489

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03	$ 1,664,720.17	$ 1,377,802.90	$ 2,029,179.05	$ -	$ 5,071,702.12	Dredged material dewatering and limited stabilization with amendment.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,664,720.17**	**$ 1,377,802.90**	**$ 2,029,179.05**	**$ -**	**$ 5,071,702.12**	
UNIT PRICES		**$ 7.12**	**$ 5.89**	**$ 8.68**	**$ -**	**$ 21.69**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	ALL	258	1	5868	$ 10.00	$ 58,680.00
BARGE (80'X40')	ALL	0	2	11736	$ 76.92	$ 902,769.23
CAT 349 E	ALL	111,539	1	5868	$ 70.13	$ 411,501.96
WATER TRUCK (4,000 GAL)	ALL	77,458	1	5868	$ 28.17	$ 165,273.76
SILO	ALL	0	1	5868	$ 48.44	$ 284,257.55
PFU400/25 (PNUEMATIC FOAM UNIT)	ALL	11,736	2	11736	$ 17.61	$ 206,696.54
BARE UNIT COST →	$ 8.68	200,991		TOTAL RENTED EQUIP →		$ 2,029,179.05

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	2	11736	$ 65.99	$ 774,426.82
UNION LABORER	ALL	3	17604	$ 50.57	$ 890,293.35
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 7.12	TOTAL LABOR COST →			$ 1,664,720.17

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	200,991	$ 4.20	GAL	$ 843,759.11
PORTLAND CEMENT	ALL	2,577	$ 146.05	CY	$ 376,341.79
DRUM OF ODOR CONTROL FOAM	ALL	224	$ 585.50	EA	$ 131,152.00
PFU400/25 FOAM UNIT FRIEGHT	ALL	6	$ 3,475.00	EA	$ 20,850.00
TRAINED FOAM TECHNICAN	ALL	6	$ 950.00	DAY	$ 5,700.00
BARE UNIT COST →	$ 5.89	TOTAL MATERIAL COST →			$ 1,377,802.90

Table F-A-4k

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 6.04

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Water Treatment	6.04

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA					
			HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	19.0		12	6	81.5	18.81	--	489
ITEM UNIT	MO							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Water Treatment	6.04	$ 1,908,332.80	$ 18,504.49	$ 2,878,366.40	$ -	$ 4,805,203.69	Equipment, labor, and materials for running an on-barge water treatment system for treating decant water from barges, concurrent with dredging operations.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,908,332.80**	**$ 18,504.49**	**$ 2,878,366.40**	**$ -**	**$ 4,805,203.69**	
UNIT PRICES		**$ 100,438.57**	**$ 973.92**	**$ 151,492.97**	**$ -**	**$ 252,905.46**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	ALL	0	4	23472	$ 3.71	$ 87,062.98
WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	ALL	0	10	58680	$ 1.24	$ 72,807.95
WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	ALL	0	6	35208	$ 17.81	$ 627,221.31
WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	ALL	0	2	11736	$ 22.27	$ 261,342.21
WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	ALL	4,389	1	5868	$ 16.87	$ 99,018.81
WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	ALL	0	2	11736	$ 117.55	$ 1,379,519.00
WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	ALL	0	1	5868	$ 5.94	$ 34,871.17
WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	ALL	0	1	5868	$ 8.16	$ 47,899.97
WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	ALL	0	2	11736	$ 22.27	$ 261,342.21
WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	ALL	0	1	5868	$ 1.24	$ 7,280.79
BARE UNIT COST →	$ 151,492.97	4,389		TOTAL RENTED EQUIP →		$ 2,878,366.40

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
WATER TREATMENT OPERATOR	ALL	1	5868	$ 95.00	$ 557,460.00
UNION DECKHAND	ALL	2	11736	$ 50.57	$ 593,528.90
UNION LABORER	ALL	2	11736	$ 50.57	$ 593,528.90
Per Diem Unit Rate (Hourly)	ALL	1	5868	$ 27.92	$ 163,815.00
BARE UNIT COST →	$ 100,438.57	TOTAL LABOR COST →			$ 1,908,332.80

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	4,389	$ 4.20	GAL	$ 18,426.13
WATER TREATMENT (ON-BARGE) - BAG FILTER	ALL	20	$ 3.92	EA	$ 78.36
BARE UNIT COST →	$ 973.92	TOTAL MATERIAL COST →			$ 18,504.49

Table F-A-4l

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 7.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle D Landfill Transportation, Processing, and Disposal	7.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	314,000.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	19.3	4.46	--	116

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle D Landfill Transportation, Processing, and Disposal	7.01	$ 170,872.73	$ 6,145,983.37	$ 74,533.66	$ 47,099,993.64	$ 53,491,383.41	Equipment, labor, and materials for Subtitle D Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 170,872.73**	**$ 6,145,983.37**	**$ 74,533.66**	**$ 47,099,993.64**	**$ 53,491,383.41**	
UNIT PRICES		**$ 0.54**	**$ 19.57**	**$ 0.24**	**$ 150.00**	**$ 170.35**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	314,000	$150	TON	$47,099,993.64
BARE UNIT COST →	$ 150.00	TOTAL COST →			$ 47,099,993.64

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	42,874	1	1392	$ 53.54	$ 74,533.66
BARE UNIT COST →	$ 0.24	42,874		TOTAL RENTED EQUIP →		$ 74,533.66

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	1392	$ 72.18	$ 100,474.62
UNION DECKHAND	ALL	1	1392	$ 50.57	$ 70,398.11
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.54	TOTAL LABOR COST →			$ 170,872.73

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	42,874	$ 4.20	GAL	$ 179,983.37
WASTE CHARACTERIZATION SAMPLING	ALL	628	$ 9,500.00	EA	$ 5,966,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 19.57	TOTAL MATERIAL COST →			$ 6,145,983.37

Table F-A-4m

Alternative EB-E			
CONSTRUCTION COST ESTIMATE WORKSHEET 7.02			
			BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	16,600.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	1.5	0.35	--	9

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02	$ 13,257.37	$ 336,964.23	$ 5,782.78	$ 11,568,419.49	$ 11,924,423.87	Equipment, labor, and materials for Subtitle C/TSCA Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 13,257.37**	**$ 336,964.23**	**$ 5,782.78**	**$ 11,568,419.49**	**$ 11,924,423.87**	
UNIT PRICES		**$ 0.80**	**$ 20.30**	**$ 0.35**	**$ 696.89**	**$ 718.34**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE C/TSCA PROCESSING, TRANSPORT, AND DISPOSAL	ALL	16,526	$700	TON	$11,568,419.49
BARE UNIT COST →	$ 696.89	TOTAL COST →			$ 11,568,419.49

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	3,326	1	108	$ 53.54	$ 5,782.78
BARE UNIT COST →	$ 0.35	3,326		TOTAL RENTED EQUIP →		$ 5,782.78

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	108	$ 72.18	$ 7,795.44
UNION DECKHAND	ALL	1	108	$ 50.57	$ 5,461.92
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.80	TOTAL LABOR COST →			$ 13,257.37

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,326	$ 4.20	GAL	$ 13,964.23
WASTE CHARACTERIZATION SAMPLING	ALL	34	$ 9,500.00	EA	$ 323,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 20.30	TOTAL MATERIAL COST →			$ 336,964.23

Table F-A-4n

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 7.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Debris Transportation, Processing, and Disposal	7.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	17,300.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	1.2	0.27	--	7

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Debris Transportation, Processing, and Disposal	7.03	$ 10,311.29	$ 98,361.07	$ 4,497.72	$ 5,167,164.22	$ 5,280,334.29	Equipment, labor, and materials for Debris Transportation and Disposal (Subtitle D Landfill). Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 10,311.29**	**$ 98,361.07**	**$ 4,497.72**	**$ 5,167,164.22**	**$ 5,280,334.29**	
UNIT PRICES		**$ 0.60**	**$ 5.69**	**$ 0.26**	**$ 298.68**	**$ 305.22**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	17,224	$300	TON	$5,167,164.22
BARE UNIT COST →	$ 298.68	TOTAL COST →			$ 5,167,164.22

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	2,587	1	84	$ 53.54	$ 4,497.72
BARE UNIT COST →	$ 0.26	2,587		TOTAL RENTED EQUIP →		$ 4,497.72

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	84	$ 72.18	$ 6,063.12
UNION DECKHAND	ALL	1	84	$ 50.57	$ 4,248.16
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.60	TOTAL LABOR COST →			$ 10,311.29

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	2,587	$ 4.20	GAL	$ 10,861.07
WIPE SAMPLING (DEBRIS)	ALL	35	$ 2,500.00	EA	$ 87,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 5.69	TOTAL MATERIAL COST →			$ 98,361.07

Table F-A-4o

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Backfill Placement	8.01

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	3.1	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	2.3	0.54	--	14

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Backfill Placement	8.01	$ 99,169.34	$ 308,449.92	$ 162,310.92	$ -	$ 569,930.18	Equipment, labor, and materials for placement of backfil/residuals management cover after dredging.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 99,169.34**	**$ 308,449.92**	**$ 162,310.92**	**$ -**	**$ 569,930.18**	
UNIT PRICES		**$ 32,093.64**	**$ 99,821.98**	**$ 52,527.80**	**$ -**	**$ 184,443.42**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	702	1	168	$ 24.14	$ 4,056.07
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	739	1	168	$ 24.11	$ 4,050.86
TELEBELT 130	MATERIAL TRANSFER	2,994	1	168	$ 225.00	$ 37,800.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	3,149	1	168	$ 156.26	$ 26,252.24
BARGE (80'X40')	MATERIAL TRANSFER	0	1	168	$ 76.92	$ 12,923.08
SCOW (225'X42'X12')	BACKFILL PLACEMENT	0	2	336	$ 57.69	$ 19,384.62
TUG BOAT 2 - 700 HP	BACKFILL PLACEMENT	5,174	1	168	$ 53.54	$ 8,995.44
SCOW (100 CY)	BACKFILL PLACEMENT	0	4	672	$ 9.62	$ 6,461.54
TUG BOAT 1 - 380 HP	BACKFILL PLACEMENT	5,618	2	336	$ 40.20	$ 13,508.40
BARGE (80'X40')	BACKFILL PLACEMENT	0	1	168	$ 76.92	$ 12,923.08
CAT 375 L	BACKFILL PLACEMENT	3,164	1	168	$ 84.97	$ 14,275.61
BUCKET (5.5 CY)	BACKFILL PLACEMENT	7	1	168	$ 10.00	$ 1,680.00
BARE UNIT COST →	$ 52,527.80	21,548	TOTAL RENTED EQUIP →			$ 162,310.92

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	BACKFILL PLACEMENT	1	168	$ 147.88	$ 24,843.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	168	$ 65.99	$ 11,085.86
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	168	$ 65.99	$ 11,085.86
UNION OPERATOR 1	MATERIAL TRANSFER	1	168	$ 65.99	$ 11,085.86
UNION TUG OPERATOR	BACKFILL PLACEMENT	3	504	$ 72.18	$ 36,378.74
Per Diem Unit Rate (Hourly)	ALL	1	168	$ 27.92	$ 4,690.00
BARE UNIT COST →	$ 32,093.64	TOTAL LABOR COST →			$ 99,169.34

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	21,548	$ 4.20	GAL	$ 90,457.16
SAND	ALL	7,152	$ 27.13	CY	$ 193,992.76
MATERIAL VERIFICATION SAMPLING	ALL	12	$ 2,000.00	EA	$ 24,000.00
BARE UNIT COST →	$ 99,821.98	TOTAL MATERIAL COST →			$ 308,449.92

Table F-A-4p

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Deep Water	8.11

COST ESTIMATE DATA

		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.71	
ITEM UNIT	AC	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.0	0.23	--	6

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Deep Water	8.11	$ 42,501.14	$ 428,863.39	$ 71,292.59	$ -	$ 542,657.13	Equipment, labor, and materials for placing deep water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 42,501.14**	**$ 428,863.39**	**$ 71,292.59**	**$ -**	**$ 542,657.13**	
UNIT PRICES		**$ 59,860.77**	**$ 604,032.95**	**$ 100,412.10**	**$ -**	**$ 764,305.81**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	301	1	72	$ 24.14	$ 1,738.32
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	317	1	72	$ 24.11	$ 1,736.08
TELEBELT 130	MATERIAL TRANSFER	1,283	1	72	$ 225.00	$ 16,200.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,350	1	72	$ 156.26	$ 11,250.96
BARGE (80'X40')	MATERIAL TRANSFER	0	1	72	$ 76.92	$ 5,538.46
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	144	$ 57.69	$ 8,307.69
TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,218	1	72	$ 53.54	$ 3,855.19
SCOW (100 CY)	CAP PLACEMENT	0	4	288	$ 9.62	$ 2,769.23
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,408	2	144	$ 40.20	$ 5,789.31
BARGE (80'X40')	CAP PLACEMENT	0	1	72	$ 76.92	$ 5,538.46
CAT 375 L	CAP PLACEMENT	1,356	1	72	$ 84.97	$ 6,118.12
BUCKET (5.5 CY)	CAP PLACEMENT	3	1	72	$ 10.00	$ 720.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	72	$ 24.04	$ 1,730.77
BARE UNIT COST →	$ 100,412.10	9,235		TOTAL RENTED EQUIP →		$ 71,292.59

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	72	$ 147.88	$ 10,647.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	72	$ 65.99	$ 4,751.08
UNION OPERATOR 1	MATERIAL TRANSFER	1	72	$ 65.99	$ 4,751.08
UNION TUG OPERATOR	CAP PLACEMENT	3	216	$ 72.18	$ 15,590.89
Per Diem Unit Rate (Hourly)	ALL	1	72	$ 27.92	$ 2,010.00
BARE UNIT COST →	$ 59,860.77	TOTAL LABOR COST →			$ 42,501.14

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	9,235	$ 4.20	GAL	$ 38,767.35
ORGANOCLAY	ALL	51	$ 3,307.50	CY	$ 169,123.50
GAC	ALL	58	$ 1,827.19	CY	$ 105,466.14
SAND	ALL	3,816	$ 27.13	CY	$ 103,506.40
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	6	$ 2,000.00	EA	$ 12,000.00
BARE UNIT COST →	$ 604,032.95	TOTAL MATERIAL COST →			$ 428,863.39

Table F-A-4q

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.12

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Shallow Water	8.12

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	1.07
ITEM UNIT	AC

Cost Estimate Data Notes:

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	2.0	0.46	--	12

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL
Amended Cap - Shallow Water	8.12	$ 85,002.29	$ 847,137.64	$ 142,585.18	$ -	$ 1,074,725.10
						$ -
						$ -
						$ -
GRAND TOTALS		**$ 85,002.29**	**$ 847,137.64**	**$ 142,585.18**	**$ -**	**$ 1,074,725.10**
UNIT PRICES		**$ 79,441.39**	**$ 791,717.42**	**$ 133,257.18**	**$ -**	**$ 1,004,415.99**

Notes: Equipment, labor, and materials for placing shallow water armored amended caps. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST	$ -	TOTAL COST		$ -	

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	602	1	144	$ 24.14	$ 3,476.63
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	634	1	144	$ 24.11	$ 3,472.16
TELEBELT 130	MATERIAL TRANSFER	2,566	1	144	$ 225.00	$ 32,400.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	2,699	1	144	$ 156.26	$ 22,501.92
BARGE (80'X40')	MATERIAL TRANSFER	0	1	144	$ 76.92	$ 11,076.92
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	288	$ 57.69	$ 16,615.38
TUG BOAT 2 - 700 HP	CAP PLACEMENT	17,741	1	144	$ 53.54	$ 7,710.38
SCOW (100 CY)	CAP PLACEMENT	0	4	576	$ 9.62	$ 5,538.46
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,408	2	288	$ 40.20	$ 11,578.62
BARGE (80'X40')	CAP PLACEMENT	0	1	144	$ 76.92	$ 11,076.92
CAT 375 L	CAP PLACEMENT	2,712	1	144	$ 84.97	$ 12,236.23
BUCKET (5.5 CY)	CAP PLACEMENT	6	1	144	$ 10.00	$ 1,440.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	144	$ 24.04	$ 3,461.54
BARE UNIT COST	$ 133,257.18	29,367		TOTAL RENTED EQUIP		$ 142,585.18

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	144	$ 147.88	$ 21,294.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	144	$ 65.99	$ 9,502.17
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	144	$ 65.99	$ 9,502.17
UNION OPERATOR 1	MATERIAL TRANSFER	1	144	$ 65.99	$ 9,502.17
UNION TUG OPERATOR	CAP PLACEMENT	3	432	$ 72.18	$ 31,181.78
Per Diem Unit Rate (Hourly)	ALL	1	144	$ 27.92	$ 4,020.00
BARE UNIT COST	$ 79,441.39	TOTAL LABOR COST			$ 85,002.29

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	29,367	$ 4.20	GAL	$ 123,284.18
ORGANOCLAY	ALL	77	$ 3,307.50	CY	$ 254,604.36
GAC	ALL	87	$ 1,827.19	CY	$ 158,772.37
SAND	ALL	3,777	$ 27.13	CY	$ 102,461.47
GRAVEL	ALL	1,347	$ 67.18	CY	$ 90,495.68
ARMOR STONE 3-9 INCHES	ALL	1,711	$ 61.69	CY	$ 105,519.58
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	6	$ 2,000.00	EA	$ 12,000.00
BARE UNIT COST	$ 791,717.42		TOTAL MATERIAL COST		$ 847,137.64

Table F-A-4r

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.13

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Wake Zone	8.13

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.44	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.2	0.27	--	7

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Wake Zone	8.13	$ 49,584.67	$ 372,171.53	$ 83,174.69	$ -	$ 504,930.89	Equipment, labor, and materials for placing armored amended caps in wake zone areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 49,584.67**	**$ 372,171.53**	**$ 83,174.69**	**$ -**	**$ 504,930.89**	
UNIT PRICES		**$ 112,692.43**	**$ 845,844.40**	**$ 189,033.38**	**$ -**	**$ 1,147,570.21**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	351	1	84	$ 24.14	$ 2,028.03
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	370	1	84	$ 24.11	$ 2,025.43
TELEBELT 130	MATERIAL TRANSFER	1,497	1	84	$ 225.00	$ 18,900.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,574	1	84	$ 156.26	$ 13,126.12
BARGE (80'X40')	MATERIAL TRANSFER	0	1	84	$ 76.92	$ 6,461.54
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	168	$ 57.69	$ 9,692.31
TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,587	1	84	$ 53.54	$ 4,497.72
SCOW (100 CY)	CAP PLACEMENT	0	4	336	$ 9.62	$ 3,230.77
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,809	2	168	$ 40.20	$ 6,754.20
BARGE (80'X40')	CAP PLACEMENT	0	1	84	$ 76.92	$ 6,461.54
CAT 375 L	CAP PLACEMENT	1,582	1	84	$ 84.97	$ 7,137.80
BUCKET (5.5 CY)	CAP PLACEMENT	4	1	84	$ 10.00	$ 840.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	84	$ 24.04	$ 2,019.23
BARE UNIT COST →	$ 189,033.38	10,774		TOTAL RENTED EQUIP →		$ 83,174.69

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	84	$ 147.88	$ 12,421.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	84	$ 65.99	$ 5,542.93
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	84	$ 65.99	$ 5,542.93
UNION OPERATOR 1	MATERIAL TRANSFER	1	84	$ 65.99	$ 5,542.93
UNION TUG OPERATOR	CAP PLACEMENT	3	252	$ 72.18	$ 18,189.37
Per Diem Unit Rate (Hourly)	ALL	1	84	$ 27.92	$ 2,345.00
BARE UNIT COST →	$ 112,692.43	TOTAL LABOR COST →			$ 49,584.67

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	10,774	$ 4.20	GAL	$ 45,228.58
ORGANOCLAY	ALL	32	$ 3,307.50	CY	$ 104,466.24
GAC	ALL	36	$ 1,827.19	CY	$ 65,145.59
SAND	ALL	1,550	$ 27.13	CY	$ 42,040.77
GRAVEL	ALL	553	$ 67.18	CY	$ 37,131.12
ARMOR STONE 3-9 INCHES	ALL	1,170	$ 61.69	CY	$ 72,159.23
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	3	$ 2,000.00	EA	$ 6,000.00
BARE UNIT COST →	$ 845,844.40		TOTAL MATERIAL COST →		$ 372,171.53

Table F-A-4s

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.14

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - ISS Areas	8.14

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.62	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.3	0.31	--	8

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - ISS Areas	8.14	$ 56,668.19	$ 381,140.73	$ 95,056.79	$ -	$ 532,865.71	Equipment, labor, and materials for placing armored amended caps in ISS areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 56,668.19**	**$ 381,140.73**	**$ 95,056.79**	**$ -**	**$ 532,865.71**	
UNIT PRICES		**$ 91,400.31**	**$ 614,743.12**	**$ 153,317.40**	**$ -**	**$ 859,460.83**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	401	1	96	$ 24.14	$ 2,317.75
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	422	1	96	$ 24.11	$ 2,314.78
TELEBELT 130	MATERIAL TRANSFER	1,711	1	96	$ 225.00	$ 21,600.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,799	1	96	$ 156.26	$ 15,001.28
BARGE (80'X40')	MATERIAL TRANSFER	0	1	96	$ 76.92	$ 7,384.62
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	192	$ 57.69	$ 11,076.92
TUG BOAT 2 - 700 HP	CAP PLACEMENT	2,957	1	96	$ 53.54	$ 5,140.25
SCOW (100 CY)	CAP PLACEMENT	0	4	384	$ 9.62	$ 3,692.31
TUG BOAT 1 - 380 HP	CAP PLACEMENT	3,210	2	192	$ 40.20	$ 7,719.08
BARGE (80'X40')	CAP PLACEMENT	0	1	96	$ 76.92	$ 7,384.62
CAT 375 L	CAP PLACEMENT	1,808	1	96	$ 84.97	$ 8,157.49
BUCKET (5.5 CY)	CAP PLACEMENT	4	1	96	$ 10.00	$ 960.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	96	$ 24.04	$ 2,307.69
BARE UNIT COST →	$ 153,317.40	12,313		TOTAL RENTED EQUIP →		$ 95,056.79

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	96	$ 147.88	$ 14,196.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	96	$ 65.99	$ 6,334.78
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	96	$ 65.99	$ 6,334.78
UNION OPERATOR 1	MATERIAL TRANSFER	1	96	$ 65.99	$ 6,334.78
UNION TUG OPERATOR	CAP PLACEMENT	3	288	$ 72.18	$ 20,787.85
Per Diem Unit Rate (Hourly)	ALL	1	96	$ 27.92	$ 2,680.00
BARE UNIT COST →	$ 91,400.31	TOTAL LABOR COST →			$ 56,668.19

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	12,313	$ 4.20	GAL	$ 51,689.81
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	81	$ 1,827.19	CY	$ 147,625.09
SAND	ALL	2,209	$ 27.13	CY	$ 59,917.59
GRAVEL	ALL	783	$ 67.18	CY	$ 52,588.79
ARMOR STONE 3-9 INCHES	ALL	994	$ 61.69	CY	$ 61,319.46
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	4	$ 2,000.00	EA	$ 8,000.00
BARE UNIT COST →	$ 614,743.12	TOTAL MATERIAL COST →			$ 381,140.73

Table F-A-4t

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.15

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Deep Water)	8.15

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	5.28	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.3	1.46	--	38

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Deep Water)	8.15	$ 269,173.91	$ 1,690,787.64	$ 451,519.74	$ -	$ 2,411,481.29	Equipment, labor, and materials for placing armored amended caps in areas dredged to native. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 269,173.91**	**$ 1,690,787.64**	**$ 451,519.74**	**$ -**	**$ 2,411,481.29**	
UNIT PRICES		**$ 50,979.91**	**$ 320,224.93**	**$ 85,515.10**	**$ -**	**$ 456,719.94**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	1,906	1	456	$ 24.14	$ 11,009.33
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	2,006	1	456	$ 24.11	$ 10,995.18
TELEBELT 130	MATERIAL TRANSFER	8,126	1	456	$ 225.00	$ 102,600.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	8,547	1	456	$ 156.26	$ 71,256.08
BARGE (80'X40')	MATERIAL TRANSFER	0	1	456	$ 76.92	$ 35,076.92
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	912	$ 57.69	$ 52,615.38
TUG BOAT 2 - 700 HP	CAP PLACEMENT	14,045	1	456	$ 53.54	$ 24,416.20
SCOW (100 CY)	CAP PLACEMENT	0	4	1824	$ 9.62	$ 17,538.46
TUG BOAT 1 - 380 HP	CAP PLACEMENT	15,249	2	912	$ 40.20	$ 36,665.64
BARGE (80'X40')	CAP PLACEMENT	0	1	456	$ 76.92	$ 35,076.92
CAT 375 L	CAP PLACEMENT	8,587	1	456	$ 84.97	$ 38,748.07
BUCKET (5.5 CY)	CAP PLACEMENT	20	1	456	$ 10.00	$ 4,560.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	456	$ 24.04	$ 10,961.54
BARE UNIT COST →	$ 85,515.10	58,487		TOTAL RENTED EQUIP →		$ 451,519.74

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	456	$ 147.88	$ 67,431.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	456	$ 65.99	$ 30,090.20
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	456	$ 65.99	$ 30,090.20
UNION OPERATOR 1	MATERIAL TRANSFER	1	456	$ 65.99	$ 30,090.20
UNION TUG OPERATOR	CAP PLACEMENT	3	1368	$ 72.18	$ 98,742.30
Per Diem Unit Rate (Hourly)	ALL	1	456	$ 27.92	$ 12,730.00
BARE UNIT COST →	$ 50,979.91	TOTAL LABOR COST →			$ 269,173.91

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	58,487	$ 4.20	GAL	$ 245,526.58
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	433	$ 1,827.19	CY	$ 790,639.01
SAND	ALL	21,627	$ 27.13	CY	$ 586,622.04
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	34	$ 2,000.00	EA	$ 68,000.00
BARE UNIT COST → $ 320,224.93		TOTAL MATERIAL COST →			$ 1,690,787.64

Table F-A-4u

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.16

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Shallow Water)	8.16

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.00	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Shallow Water)	8.16	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-4v

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.21

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - CSOs	8.21

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.9	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.2	1.42	--	37

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - CSOs	8.21	$ 300,423.79	$ 999,575.89	$ 309,231.14	$ -	$ 1,609,230.82	Equipment, labor, and materials for placing outfall protection at CSOs. Assumes mats required for outfall protection can all be delivered and placed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 300,423.79**	**$ 999,575.89**	**$ 309,231.14**	**$ -**	**$ 1,609,230.82**	
UNIT PRICES		**$ 326,547.60**	**$ 1,086,495.53**	**$ 336,120.81**	**$ -**	**$ 1,749,163.93**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	MAT PLACEMENT	16,723	2	888	$ 84.97	$ 75,456.78
BUCKET (5.5 CY)	MAT PLACEMENT	39	2	888	$ 10.00	$ 8,880.00
BARGE (80'X40')	MAT PLACEMENT	0	2	888	$ 76.92	$ 68,307.69
TUG BOAT 1 - 380 HP	MAT PLACEMENT	14,847	2	888	$ 40.20	$ 35,700.76
WORK BOAT - 115 HP	MAT PLACEMENT	2,247	1	444	$ 8.34	$ 3,701.48
BARGE (80'X40')	MAT DELIVERY	0	1	444	$ 76.92	$ 34,153.85
TUG BOAT 2 - 700 HP	MAT DELIVERY	13,675	1	444	$ 53.54	$ 23,773.67
GROUT PLANT	GROUTING	1,289	2	888	$ 66.73	$ 59,256.92
BARE UNIT COST →	$ 336,120.81	48,820		TOTAL RENTED EQUIP →		$ 309,231.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	MAT PLACEMENT	2	888	$ 147.88	$ 131,313.00
UNION DECKHAND	MAT PLACEMENT	1	444	$ 50.57	$ 22,454.57
UNION LABORER	MAT PLACEMENT	4	1776	$ 50.57	$ 89,818.28
UNION TUG OPERATOR	MAT PLACEMENT	1	444	$ 72.18	$ 32,047.94
Per Diem Unit Rate (Hourly)	ALL	2	888	$ 27.92	$ 24,790.00
BARE UNIT COST →	$ 326,547.60	TOTAL LABOR COST →			$ 300,423.79

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	48,820	$ 4.20	GAL	$ 204,948.31
NON-WOVEN GEOTEXTILE	ALL	44,000	$ 0.17	SF	$ 7,663.33
SAND	ALL	1,278	$ 27.13	CY	$ 34,659.72
ARTICULATED CONCRETE MATTRESSES	ALL	40,000	$ 12.67	SF	$ 506,800.00
GRAVEL	ALL	111	$ 67.18	CY	$ 7,464.17
UNDERWATER GROUT (SUPERSACK)	ALL	117	$ 2,000.00	EA	$ 234,000.00
WATER	ALL	7,020	$ 0.01	GAL	$ 40.36
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST →	$ 1,086,495.53		TOTAL MATERIAL COST →		$ 999,575.89

Table F-A-4w

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.22

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	0.0	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22	$ 5,499.83	$ 17,102.13	$ 8,314.57	$ -	$ 30,916.53	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of 12 inches or greater. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,102.13**	**$ 8,314.57**	**$ -**	**$ 30,916.53**	
UNIT PRICES		**$ 183,327.64**	**$ 570,071.09**	**$ 277,152.36**	**$ -**	**$ 1,030,551.08**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 277,152.36	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 183,327.64	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	104	$ 114.92	CY	$ 11,970.83
BARE UNIT COST →	$ 570,071.09	TOTAL MATERIAL COST →			$ 17,102.13

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 8.23

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.1	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL
Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23	$ 5,499.83	$ 17,715.04	$ 8,314.57	$ -	$ 31,529.44
						$ -
						$ -
						$ -
GRAND TOTALS		**$ 5,499.83**	**$ 17,715.04**	**$ 8,314.57**	**$ -**	**$ 31,529.44**
UNIT PRICES		**$ 61,109.21**	**$ 196,833.77**	**$ 92,384.12**	**$ -**	**$ 350,327.10**

Notes: Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of less than 12 inches. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 92,384.12	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 61,109.21	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	204	$ 61.69	CY	$ 12,583.74
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
BARE UNIT COST →	$ 196,833.77	TOTAL MATERIAL COST →			$ 17,715.04

Table F-A-4y

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 9

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Environmental Controls	9.0

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	12.1	2.79	--	73
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Environmental Controls	9.0	$ 175,995.28	$ 1,001,625.92	$ 14,505.80	$ -	$ 1,192,127.00	Equipment, labor, and materials for installing and maintaning environmental controls (i.e., silt curtains) during aquatic work activities.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 175,995.28**	**$ 1,001,625.92**	**$ 14,505.80**	**$ -**	**$ 1,192,127.00**	
UNIT PRICES		**$ 175,995.28**	**$ 1,001,625.92**	**$ 14,505.80**	**$ -**	**$ 1,192,127.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WORK BOAT - 115 HP	ALL	8,804	2	1740	$ 8.34	$ 14,505.80
BARE UNIT COST →	$ 14,505.80	8,804		TOTAL RENTED EQUIP →		$ 14,505.80

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION DECKHAND	ALL	4	3480	$ 50.57	$ 175,995.28
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST → $ 175,995.28		TOTAL LABOR COST →			$ 175,995.28

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	8,804	$ 4.20	GAL	$ 36,960.87
MOBILE RESUSPENSION CONTROL SYSTEM (ALT. EB-E)	ALL	1	$ 932,400.00	LS	$ 932,400.00
SILT CURTAIN	ALL	22	$ 1,466.59	EA	$ 32,265.05
BARE UNIT COST → $ 1,001,625.92		TOTAL MATERIAL COST →			$ 1,001,625.92

Table F-A-4z

Alternative EB-E

CONSTRUCTION COST ESTIMATE WORKSHEET 10

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Inspections and Surveying	10.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	34.8	8.04	--	209

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Inspections and Surveying	10.0	$ -	$ -	$ -	$ 2,364,800.00	$ 2,364,800.00	Equipment, labor, and materials for surveying and bulkhead inspections.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 2,364,800.00**	**$ 2,364,800.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 2,364,800.00**	**$ 2,364,800.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
MULTIBEAM BATHYMETRIC SURVEYS	ALL	22	$10,200	DAY	$224,400.00
BULKHEAD INSPECTIONS	ALL	1	$500,000	LS	$500,000.00
BATHYMETRIC PROGRESS SURVEYS	ALL	187	$6,200	DAY	$1,159,400.00
UTILITY ID AND SURVEY	ALL	1	$200,000	LS	$200,000.00
VIBRATION MONITORING	ALL	281	$1,000	DAY	$281,000.00
BARE UNIT COST →	$ 2,364,800.00	TOTAL COST →			$ 2,364,800.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-4aa

Alternative EB-E					
CONSTRUCTION COST ESTIMATE WORKSHEET 11					BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION		DESCRIPTION OF ITEM		ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION		Site Restoration		11.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Restoration	11.0	$ 62,942.75	$ 487,354.64	$ 10,566.76	$ 324,939.00	$ 885,803.15	Equipment, labor, and materials for site restoration (includes disposal of DGA from staging area).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	
UNIT PRICES		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
OTHER SITE RESTORATION	ALL	1	$100,000	LS	$100,000.00
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	1,500	$150	TON	$224,939.00
BARE UNIT COST →	$ 324,939.00	TOTAL COST →			$ 324,939.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	792	1	180	$ 24.11	$ 4,340.20
CAT 272 SKID STEER	ALL	752	1	180	$ 24.14	$ 4,345.79
TRENCH ROLLER WITH REMOTE	ALL	174	1	180	$ 10.45	$ 1,880.77
BARE UNIT COST →	$ 10,566.76	1,719		TOTAL RENTED EQUIP →		$ 10,566.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	180	$ 65.99	$ 11,877.71
UNION OPERATOR 2	ALL	2	360	$ 65.99	$ 23,755.42
UNION LABORER	ALL	3	540	$ 50.57	$ 27,309.61
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 62,942.75	TOTAL LABOR COST →			$ 62,942.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ASPHALT PAVING	ALL	65,340	$ 7.46	SF	$ 487,354.64
BARE UNIT COST → $ 487,354.64		TOTAL MATERIAL COST →			$ 487,354.64

Table F-A-5a

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 3.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Staging Area Lease	3.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	84.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	198.2	45.73	--	1,189

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Staging Area Lease	3.01	$ -	$ -	$ -	$ 22,869,000.00	$ 22,869,000.00	Land lease for upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 22,869,000.00**	**$ 22,869,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 272,250.00**	**$ 272,250.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
LAND LEASE	ALL	126	$181,500	AC*MO	$22,869,000.00
BARE UNIT COST →	$ 272,250.00	TOTAL COST →			$ 22,869,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-5b

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 3.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Preparation Work	3.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	4.5	1.04	--	27

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Preparation Work	3.02	$ 113,296.95	$ 95,521.36	$ 19,020.17	$ 1,500,000.00	$ 1,727,838.48	Equipment, labor, and materials for pre-remediation site work, including access dredging and construction of an upland staging area.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	
UNIT PRICES		**$ 113,296.95**	**$ 95,521.36**	**$ 19,020.17**	**$ 1,500,000.00**	**$ 1,727,838.48**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ACCESS DREDGING	ALL	1	$1,000,000	LS	$1,000,000.00
STAGING AREA SHORELINE MODIFICATIONS	ALL	1	$500,000	LS	$500,000.00
BARE UNIT COST →	$ 1,500,000.00	TOTAL COST →			$ 1,500,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	1,426	1	324	$ 24.11	$ 7,812.37
CAT 272 SKID STEER	ALL	1,354	1	324	$ 24.14	$ 7,822.42
TRENCH ROLLER WITH REMOTE	ALL	314	1	324	$ 10.45	$ 3,385.38
BARE UNIT COST →	$ 19,020.17	3,094		TOTAL RENTED EQUIP →		$ 19,020.17

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	324	$ 65.99	$ 21,379.88
UNION OPERATOR 2	ALL	2	648	$ 65.99	$ 42,759.76
UNION LABORER	ALL	3	972	$ 50.57	$ 49,157.30
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 113,296.95	TOTAL LABOR COST →			$ 113,296.95

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,094	$ 4.20	GAL	$ 12,986.73
DGA	ALL	887	$ 33.80	CY	$ 29,991.87
CHAIN LINK FENCING	ALL	1,300	$ 30.79	LF	$ 40,024.71
NON-WOVEN GEOTEXTILE	ALL	71,874	$ 0.17	SF	$ 12,518.06
BARE UNIT COST →	$ 95,521.36	TOTAL MATERIAL COST →			$ 95,521.36

Table F-A-5c

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 3.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Temporary Facilities and Utilities	3.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	46.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	MO		12	6	198.2	45.73	--	1,189

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Temporary Facilities and Utilities	3.03	$ -	$ -	$ -	$ 4,692,000.00	$ 4,692,000.00	Temporary facilities and utilities for work.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 4,692,000.00**	**$ 4,692,000.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 102,000.00**	**$ 102,000.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
TEMPORARY FACILITIES AND UTILITIES	ALL	46	$102,000	MO	$4,692,000.00
BARE UNIT COST →	$ 102,000.00	TOTAL COST →			$ 4,692,000.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-5d

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 4.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Stabilization (High Cost)	4.01

COST ESTIMATE DATA

		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.0	
ITEM UNIT	LF	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Stabilization (High Cost)	4.01	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 10.00	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 9.82	$ -
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 76.92	$ -
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	0	$ 57.69	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	0	1	0	$ 156.26	$ -
BARGE (80'X40')	INSTALL	0	3	0	$ 76.92	$ -
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	0	2	0	$ 49.04	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	0	2	0	$ 156.26	$ -
TUG BOAT 1 - 380 HP	ALL	0	2	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	ALL	0	1	0	$ 53.54	$ -
WORK BOAT - 115 HP	ALL	0	2	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	0	$ 147.88	$ -
UNION TUG OPERATOR	ALL	3	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	8	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	3	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
SHEETPILE - TIEBACK WALL (HIGH)	ALL	0	$ 5,600.00	TON	$ -
TIEBACKS (HIGH)	ALL	0	$ 3,000.00	EA	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-5e

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 4.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Installation (High Cost)	4.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	700.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	9.7	2.23	--	58

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Installation (High Cost)	4.02	$ 869,755.49	$ 6,496,064.81	$ 954,862.80	$ -	$ 8,320,683.09	Equipment, labor, and materials for installation of new bulkheads at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 869,755.49**	**$ 6,496,064.81**	**$ 954,862.80**	**$ -**	**$ 8,320,683.09**	
UNIT PRICES		**$ 1,242.51**	**$ 9,280.09**	**$ 1,364.09**	**$ -**	**$ 11,886.69**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST	$ -	TOTAL COST			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	31	1	696	$ 10.00	$ 6,960.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	696	$ 9.82	$ 6,836.30
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	2088	$ 76.92	$ 160,615.38
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	2088	$ 57.69	$ 120,461.54
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	13,046	1	696	$ 156.26	$ 108,759.28
BARGE (80'X40')	INSTALL	0	3	2088	$ 76.92	$ 160,615.38
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	25,418	2	1392	$ 49.04	$ 68,261.54
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	26,092	2	1392	$ 156.26	$ 217,518.56
TUG BOAT 1 - 380 HP	ALL	23,274	2	1392	$ 40.20	$ 55,963.35
TUG BOAT 2 - 700 HP	ALL	21,437	1	696	$ 53.54	$ 37,266.83
WORK BOAT - 115 HP	ALL	7,044	2	1392	$ 8.34	$ 11,604.64
BARE UNIT COST	$ 1,364.09	116,341		TOTAL RENTED EQUIP		$ 954,862.80

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	2088	$ 147.88	$ 308,763.00
UNION TUG OPERATOR	ALL	3	2088	$ 72.18	$ 150,711.93
UNION LABORER	ALL	2	1392	$ 50.57	$ 70,398.11
UNION DECKHAND	ALL	8	5568	$ 50.57	$ 281,592.44
Per Diem Unit Rate (Hourly)	ALL	3	2088	$ 27.92	$ 58,290.00
BARE UNIT COST	$ 1,242.51	TOTAL LABOR COST			$ 869,755.49

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	116,341	$ 4.20	GAL	$ 488,397.74
SHEETPILE (HIGH)	ALL	541	$ 11,100.00	TON	$ 6,007,667.07
BARE UNIT COST	$ 9,280.09		TOTAL MATERIAL COST		$ 6,496,064.81

Table F-A-5f

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 4.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Bulkhead Replacement (High Cost)	4.03

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	3,550.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LF		12	6	74.0	17.08	--	444

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Bulkhead Replacement (High Cost)	4.03	$ 6,658,128.21	$ 34,470,630.02	$ 7,309,639.35	$ 64,666.59	$ 48,503,064.18	Equipment, labor, and materials for replacement of bulkheads at shorelines (including disposal).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 6,658,128.21**	**$ 34,470,630.02**	**$ 7,309,639.35**	**$ 64,666.59**	**$ 48,503,064.18**	
UNIT PRICES		**$ 1,875.53**	**$ 9,710.04**	**$ 2,059.05**	**$ 18.22**	**$ 13,662.83**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	215.6	$300	TON	$64,666.59
BARE UNIT COST →	$ 18.22	TOTAL COST →			$ 64,666.59

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	REMOVAL + DEBRIS MANAGEMENT	234	1	5328	$ 10.00	$ 53,280.00
ORANGE PEEL GRAPPLE (1.25 CY)	REMOVAL + DEBRIS MANAGEMENT	0	1	5328	$ 9.82	$ 52,333.04
BARGE (80'X40')	REMOVAL + DEBRIS MANAGEMENT	0	3	15984	$ 76.92	$ 1,229,538.46
SCOW (225'X42'X12')	REMOVAL + DEBRIS MANAGEMENT	0	3	15984	$ 57.69	$ 922,153.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	REMOVAL + DEBRIS MANAGEMENT	99,868	1	5328	$ 156.26	$ 832,571.02
BARGE (80'X40')	INSTALL	0	3	15984	$ 76.92	$ 1,229,538.46
VIBRATORY HAMMER (HPSI MODEL 300)	INSTALL	194,579	2	10656	$ 49.04	$ 522,553.85
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	INSTALL	199,736	2	10656	$ 156.26	$ 1,665,142.04
TUG BOAT 1 - 380 HP	ALL	178,168	2	10656	$ 40.20	$ 428,409.11
TUG BOAT 2 - 700 HP	ALL	164,102	1	5328	$ 53.54	$ 285,284.00
WORK BOAT - 115 HP	ALL	53,919	2	10656	$ 8.34	$ 88,835.52
BARE UNIT COST →	$ 2,059.05	890,607		TOTAL RENTED EQUIP →		$ 7,309,639.35

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	ALL	3	15984	$ 147.88	$ 2,363,634.00
UNION TUG OPERATOR	ALL	3	15984	$ 72.18	$ 1,153,725.83
UNION LABORER	ALL	2	10656	$ 50.57	$ 538,909.68
UNION DECKHAND	ALL	8	42624	$ 50.57	$ 2,155,638.71
Per Diem Unit Rate (Hourly)	ALL	3	15984	$ 27.92	$ 446,220.00
BARE UNIT COST →	$ 1,875.53	TOTAL LABOR COST →			$ 6,658,128.21

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	890,607	$ 4.20	GAL	$ 3,738,768.89
SHEETPILE (HIGH)	ALL	2,768.6	$ 11,100.00	TON	$ 30,731,861.13
BARE UNIT COST →	$ 9,710.04		TOTAL MATERIAL COST →		$ 34,470,630.02

Table F-A-5g

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 5

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	ISS	5.0

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	6,310.0	Cost Estimate Data Notes
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	6.0	1.38	--	36

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
ISS	5.00	$ 236,671.32	$ 399,574.64	$ 1,129,372.76	$ -	$ 1,765,618.73	Equipment, labor, and materials for ISS at shorelines.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 236,671.32**	**$ 399,574.64**	**$ 1,129,372.76**	**$ -**	**$ 1,765,618.73**	
UNIT PRICES		**$ 37.51**	**$ 63.32**	**$ 178.98**	**$ -**	**$ 279.81**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
ISS OPERATION - DECK BARGE	MATERIAL BARGE	0	1	432	$ 84.89	$ 36,674.33
ISS OPERATION - HORIZONTAL PIG (4,200 CF)	MATERIAL BARGE	0	8	3456	$ 85.36	$ 295,019.59
ISS OPERATION - SUCTION HOSE (4" X 20')	MATERIAL BARGE	0	3	1296	$ 1.24	$ 1,608.03
ISS OPERATION - DISCHARGE HOSE (4" X 50')	MATERIAL BARGE	0	4	1728	$ 1.24	$ 2,144.04
ISS OPERATION - GODWIN PUMP (4")	MATERIAL BARGE	2,585	8	3456	$ 16.87	$ 58,317.83
ISS OPERATION - FRAC TANK (18,000 GAL)	MATERIAL BARGE	0	2	864	$ 17.81	$ 15,391.93
ISS OPERATION - HME SPUD BARGE	DRILL BARGE	0	4	1728	$ 117.55	$ 203,119.36
ISS OPERATION - INGERSOLL RAND DIESEL AIR COMPRESSOR (185 CFM)	DRILL BARGE	0	1	432	$ 22.26	$ 9,614.32
ISS OPERATION - GENERATOR (175 KW)	DRILL BARGE	5,303	1	432	$ 49.63	$ 21,440.38
ISS OPERATION - BATCH PLANT (45 CM/HR)	DRILL BARGE	0	1	432	$ 174.36	$ 75,323.43
ISS OPERATION - BAUER RG 22S DRILL RIG	DRILL BARGE	19,445	1	432	$ 780.24	$ 337,065.30
ISS OPERATION - HORIZONTAL SILO (1,200 CF)	DRILL BARGE	0	1	432	$ 48.44	$ 20,926.94
ISS OPERATION - SLAG COUNTERWEIGHT (ON RAILS)	DRILL BARGE	0	1	432	$ 14.84	$ 6,409.54
ISS OPERATION - GAS WELDER	DRILL BARGE	0	1	432	$ 12.02	$ 5,190.83
ISS OPERATION - LIGHT PLANT	ALL	0	1	432	$ 13.49	$ 5,828.40
TUG BOAT 2 - 700 HP	ALL	13,306	1	432	$ 53.54	$ 23,131.14
WATER TRUCK (4,000 GAL)	ALL	5,702	1	432	$ 28.17	$ 12,167.39
BARE UNIT COST →	$ 178.98	46,342		TOTAL RENTED EQUIP →		$ 1,129,372.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION FOREMAN	DRILL BARGE	1	432	$ 148.65	$ 64,214.64
UNION OPERATOR 1	DRILL BARGE	3	1296	$ 65.99	$ 85,519.53
UNION DECKHAND	DRILL BARGE	2	864	$ 50.57	$ 43,695.38
UNION TUG OPERATOR	TUG BOAT	1	432	$ 72.18	$ 31,181.78
Per Diem Unit Rate (Hourly)	ALL	1	432	$ 27.92	$ 12,060.00
BARE UNIT COST →	$ 37.51	TOTAL LABOR COST →			$ 236,671.32

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	46,342	$ 4.20	GAL	$ 194,541.63
PORTLAND CEMENT	ALL	1,391	$ 146.05	CY	$ 203,085.40
WATER	ALL	338,793	$ 0.01	GAL	$ 1,947.61
BARE UNIT COST →	$ 63.32	TOTAL MATERIAL COST →			$ 399,574.64

Table F-A-5h

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 6.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Mechanical Dredging and Debris Removal	6.01

COST ESTIMATE DATA		
		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	268,100.0	
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	86.5	19.96	--	519

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Mechanical Dredging and Debris Removal	6.01	$ 5,374,178.15	$ 2,663,148.57	$ 5,458,650.67	$ -	$ 13,495,977.38	Equipment, labor, and materials for mechanical dredging and debris removal.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,374,178.15**	**$ 2,663,148.57**	**$ 5,458,650.67**	**$ -**	**$ 13,495,977.38**	
UNIT PRICES		**$ 20.05**	**$ 9.93**	**$ 20.36**	**$ -**	**$ 50.34**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	117,286	1	6228	$ 84.97	$ 529,217.11
BUCKET (5.5 CY)	DREDGING	274	1	6228	$ 10.00	$ 62,280.00
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	6228	$ 9.82	$ 61,173.08
EXCAVATOR RAKE	DREDGING	0	1	6228	$ 5.80	$ 36,147.73
BARGE (80'X40')	DREDGING	0	2	12456	$ 76.92	$ 958,153.85
TUG BOAT 1 - 380 HP	DREDGING	104,132	1	6228	$ 40.20	$ 250,387.76
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	24912	$ 9.62	$ 239,538.46
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	116,738	1	6228	$ 156.26	$ 973,208.02
BARGE (80'X40')	MATERIAL TRANSFER	0	1	6228	$ 76.92	$ 479,076.92
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	104,132	1	6228	$ 40.20	$ 250,387.76
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	191,822	1	6228	$ 53.54	$ 333,473.87
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	18684	$ 57.69	$ 1,077,923.08
WORK BOAT - 115 HP	ALL	1	4	24912	$ 8.34	$ 207,683.04
BARE UNIT COST →	$ 20.36	634,385		TOTAL RENTED EQUIP →		$ 5,458,650.67

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	6228	$ 147.88	$ 920,965.50
UNION TUG OPERATOR	DREDGING	1	6228	$ 72.18	$ 449,537.32
UNION TUG OPERATOR	MATERIAL TRANSFER	1	6228	$ 72.18	$ 449,537.32
UNION OPERATOR 1	MATERIAL TRANSFER	1	6228	$ 65.99	$ 410,968.84
UNION TUG OPERATOR	TRANSPORT	1	6228	$ 72.18	$ 449,537.32
UNION LABORER	ALL	2	12456	$ 50.57	$ 629,941.72
UNION DECKHAND	ALL	6	37368	$ 50.57	$ 1,889,825.15
Per Diem Unit Rate (Hourly)	ALL	1	6228	$ 27.92	$ 173,865.00
BARE UNIT COST →	$ 20.05	TOTAL LABOR COST →			$ 5,374,178.15

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	634,385	$ 4.20	GAL	$ 2,663,148.57
BARE UNIT COST → $ 9.93		TOTAL MATERIAL COST →			$ 2,663,148.57

Table F-A-5i

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 6.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Slot Dredging and Debris Removal	6.02

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.0		12	6	0.0	0.00	--	0
ITEM UNIT	CY							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Slot Dredging and Debris Removal	6.02	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 375 L	DREDGING	0	1	0	$ 84.97	$ -
BUCKET (1.0 CY)	DREDGING	0	1	0	$ 2.56	$ -
ORANGE PEEL GRAPPLE (1.25 CY)	DREDGING	0	1	0	$ 9.82	$ -
EXCAVATOR RAKE	DREDGING	0	1	0	$ 5.80	$ -
BARGE (80'X40')	DREDGING	0	2	0	$ 76.92	$ -
TUG BOAT 1 - 380 HP	DREDGING	0	1	0	$ 40.20	$ -
SCOW (100 CY)	DREDGING + MATERIAL TRANSFER	0	4	0	$ 9.62	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
TUG BOAT 1 - 380 HP	MATERIAL TRANSFER	0	1	0	$ 40.20	$ -
TUG BOAT 2 - 700 HP	MATERIAL TRANSFER	0	1	0	$ 53.54	$ -
SCOW (225'X42'X12')	MATERIAL TRANSFER + TRANSPORT	0	3	0	$ 57.69	$ -
WORK BOAT - 115 HP	ALL	0	4	0	$ 8.34	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	DREDGING	1	0	$ 147.88	$ -
UNION TUG OPERATOR	DREDGING	1	0	$ 72.18	$ -
UNION TUG OPERATOR	MATERIAL TRANSFER	1	0	$ 72.18	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	TRANSPORT	1	0	$ 72.18	$ -
UNION LABORER	ALL	2	0	$ 50.57	$ -
UNION DECKHAND	ALL	6	0	$ 50.57	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-5j

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 6.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03

COST ESTIMATE DATA		
		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	254,700.0	
ITEM UNIT	CY	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	86.5	19.96	--	519

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Dredged Material Dewatering and Initial Onsite Stabilization of Limited Volume of Dredged Material	6.03	$ 1,766,850.25	$ 1,478,699.78	$ 2,153,668.56	$ -	$ 5,399,218.58	Dredged material dewatering and limited stabilization with amendment.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 1,766,850.25**	**$ 1,478,699.78**	**$ 2,153,668.56**	**$ -**	**$ 5,399,218.58**	
UNIT PRICES		**$ 6.94**	**$ 5.81**	**$ 8.46**	**$ -**	**$ 21.20**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BUCKET (5.5 CY)	ALL	274	1	6228	$ 10.00	$ 62,280.00
BARGE (80'X40')	ALL	0	2	12456	$ 76.92	$ 958,153.85
CAT 349 E	ALL	118,382	1	6228	$ 70.13	$ 436,747.48
WATER TRUCK (4,000 GAL)	ALL	82,210	1	6228	$ 28.17	$ 175,413.25
SILO	ALL	0	1	6228	$ 48.44	$ 301,696.67
PFU400/25 (PNUEMATIC FOAM UNIT)	ALL	12,456	2	12456	$ 17.61	$ 219,377.31
BARE UNIT COST →	$ 8.46	213,321		TOTAL RENTED EQUIP →		$ 2,153,668.56

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	2	12456	$ 65.99	$ 821,937.67
UNION LABORER	ALL	3	18684	$ 50.57	$ 944,912.58
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 6.94	TOTAL LABOR COST →			$ 1,766,850.25

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	213,321	$ 4.20	GAL	$ 895,523.47
PORTLAND CEMENT	ALL	2,807	$ 146.05	CY	$ 409,924.81
DRUM OF ODOR CONTROL FOAM	ALL	243	$ 585.50	EA	$ 142,276.50
PFU400/25 FOAM UNIT FRIEGHT	ALL	7	$ 3,475.00	EA	$ 24,325.00
TRAINED FOAM TECHNICAN	ALL	7	$ 950.00	DAY	$ 6,650.00
BARE UNIT COST →	$ 5.81	TOTAL MATERIAL COST →			$ 1,478,699.78

Table F-A-5k

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 6.04

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Water Treatment	6.04

COST ESTIMATE DATA		
		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	20.0	
ITEM UNIT	MO	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	86.5	19.96	--	519

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Water Treatment	6.04	$ 2,025,408.43	$ 19,634.93	$ 3,054,953.29	$ -	$ 5,099,996.66	Equipment, labor, and materials for running an on-barge water treatment system for treating decant water from barges, concurrent with dredging operations.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 2,025,408.43**	**$ 19,634.93**	**$ 3,054,953.29**	**$ -**	**$ 5,099,996.66**	
UNIT PRICES		**$ 101,270.42**	**$ 981.75**	**$ 152,747.66**	**$ -**	**$ 254,999.83**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WATER TREATMENT (ON-BARGE) - BAG FILTER HOUSINGS	ALL	0	4	24912	$ 3.71	$ 92,404.26
WATER TREATMENT (ON-BARGE) - DISCHARGE HOSE (4" X 50')	ALL	0	10	62280	$ 1.24	$ 77,274.69
WATER TREATMENT (ON-BARGE) - FRAC TANK (18,000 GAL)	ALL	0	6	37368	$ 17.81	$ 665,701.14
WATER TREATMENT (ON-BARGE) - GAC TANK (8-FT DIAM.)	ALL	0	2	12456	$ 22.27	$ 277,375.48
WATER TREATMENT (ON-BARGE) - GODWIN PUMP (4")	ALL	4,659	1	6228	$ 16.87	$ 105,093.58
WATER TREATMENT (ON-BARGE) - HME SPUD BARGE	ALL	0	2	12456	$ 117.55	$ 1,464,152.07
WATER TREATMENT (ON-BARGE) - MAGNETIC FLOW METER	ALL	0	1	6228	$ 5.94	$ 37,010.51
WATER TREATMENT (ON-BARGE) - POLYBLEND FOR 200 GPM SYSTEM	ALL	0	1	6228	$ 8.16	$ 50,838.61
WATER TREATMENT (ON-BARGE) - SAND FILTER (8-FT DIAM.)	ALL	0	2	12456	$ 22.27	$ 277,375.48
WATER TREATMENT (ON-BARGE) - SUCTION HOSE (4" X 20')	ALL	0	1	6228	$ 1.24	$ 7,727.47
BARE UNIT COST →	$ 152,747.66	4,659		TOTAL RENTED EQUIP →		$ 3,054,953.29

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
WATER TREATMENT OPERATOR	ALL	1	6228	$ 95.00	$ 591,660.00
UNION DECKHAND	ALL	2	12456	$ 50.57	$ 629,941.72
UNION LABORER	ALL	2	12456	$ 50.57	$ 629,941.72
Per Diem Unit Rate (Hourly)	ALL	1	6228	$ 27.92	$ 173,865.00
BARE UNIT COST →	$ 101,270.42	TOTAL LABOR COST →			$ 2,025,408.43

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	4,659	$ 4.20	GAL	$ 19,556.57
WATER TREATMENT (ON-BARGE) - BAG FILTER	ALL	20	$ 3.92	EA	$ 78.36
BARE UNIT COST →	$ 981.75	TOTAL MATERIAL COST →			$ 19,634.93

Table F-A-5l

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 7.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle D Landfill Transportation, Processing, and Disposal	7.01

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	342,100.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	20.8	4.81	--	125

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle D Landfill Transportation, Processing, and Disposal	7.01	$ 184,130.10	$ 6,701,447.60	$ 80,316.44	$ 51,302,980.63	$ 58,268,874.77	Equipment, labor, and materials for Subtitle D Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 184,130.10**	**$ 6,701,447.60**	**$ 80,316.44**	**$ 51,302,980.63**	**$ 58,268,874.77**	
UNIT PRICES		**$ 0.54**	**$ 19.59**	**$ 0.23**	**$ 149.96**	**$ 170.33**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	342,020	$150	TON	$51,302,980.63	TUG BOAT 2 - 700 HP	TRANSPORT	46,200	1	1500	$ 53.54	$ 80,316.44
BARE UNIT COST →	$ 149.96	TOTAL COST →			$ 51,302,980.63	BARE UNIT COST →	$	0.23	46,200	TOTAL RENTED EQUIP →		$ 80,316.44

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
UNION TUG OPERATOR	ALL	1	1500	$ 72.18	$ 108,270.07	DIESEL	ALL	46,200	$ 4.20	GAL	$ 193,947.60
UNION DECKHAND	ALL	1	1500	$ 50.57	$ 75,860.03	WASTE CHARACTERIZATION SAMPLING	ALL	685	$ 9,500.00	EA	$ 6,507,500.00
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -						$ -
											$ -
											$ -
											$ -
											$ -
											$ -
BARE UNIT COST →	$ 0.54	TOTAL LABOR COST →			$ 184,130.10	BARE UNIT COST →	$	19.59	TOTAL MATERIAL COST →		$ 6,701,447.60

Table F-A-5m

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 7.02

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	18,100.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	TON		12	6	1.7	0.38	--	10

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Subtitle C/TSCA Landfill Transportation, Processing, and Disposal	7.02	$ 14,730.41	$ 367,015.81	$ 6,425.32	$ 12,600,732.08	$ 12,988,903.61	Equipment, labor, and materials for Subtitle C/TSCA Transportation and Disposal. Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 14,730.41**	**$ 367,015.81**	**$ 6,425.32**	**$ 12,600,732.08**	**$ 12,988,903.61**	
UNIT PRICES		**$ 0.81**	**$ 20.28**	**$ 0.35**	**$ 696.17**	**$ 717.62**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
SUBTITLE C/TSCA PROCESSING, TRANSPORT, AND DISPOSAL	ALL	18,001	$700	TON	$12,600,732.08
BARE UNIT COST →	$ 696.17	TOTAL COST →			$ 12,600,732.08

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	3,696	1	120	$ 53.54	$ 6,425.32
BARE UNIT COST →	$ 0.35	3,696		TOTAL RENTED EQUIP →		$ 6,425.32

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	120	$ 72.18	$ 8,661.61
UNION DECKHAND	ALL	1	120	$ 50.57	$ 6,068.80
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 0.81	TOTAL LABOR COST →			$ 14,730.41

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,696	$ 4.20	GAL	$ 15,515.81
WASTE CHARACTERIZATION SAMPLING	ALL	37	$ 9,500.00	EA	$ 351,500.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST →	$ 20.28	TOTAL MATERIAL COST →			$ 367,015.81

Table F-A-5n

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 7.03

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Debris Transportation, Processing, and Disposal	7.03

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	18,800.0	Cost Estimate Data Notes
ITEM UNIT	TON	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	1.3	0.31	--	8

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Debris Transportation, Processing, and Disposal	7.03	$ 11,784.33	$ 107,412.65	$ 5,140.25	$ 5,628,258.21	$ 5,752,595.43	Equipment, labor, and materials for Debris Transportation and Disposal (Subtitle D Landfill). Assumes all-in management/transloading of materials at a shoreline processing facility.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 11,784.33**	**$ 107,412.65**	**$ 5,140.25**	**$ 5,628,258.21**	**$ 5,752,595.43**	
UNIT PRICES		**$ 0.63**	**$ 5.71**	**$ 0.27**	**$ 299.38**	**$ 305.99**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DEBRIS PROCESSING, TRANSPORT, AND DISPOSAL (SUBTITLE D)	ALL	18,761	$300	TON	$5,628,258.21
BARE UNIT COST	$ 299.38	TOTAL COST			$ 5,628,258.21

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
TUG BOAT 2 - 700 HP	TRANSPORT	2,957	1	96	$ 53.54	$ 5,140.25
BARE UNIT COST	$ 0.27	2,957		TOTAL RENTED EQUIP		$ 5,140.25

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION TUG OPERATOR	ALL	1	96	$ 72.18	$ 6,929.28
UNION DECKHAND	ALL	1	96	$ 50.57	$ 4,855.04
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST	$ 0.63	TOTAL LABOR COST			$ 11,784.33

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	2,957	$ 4.20	GAL	$ 12,412.65
WIPE SAMPLING (DEBRIS)	ALL	38	$ 2,500.00	EA	$ 95,000.00
					$ -
					$ -
					$ -
					$ -
					$ -
					$ -
BARE UNIT COST	$ 5.71	TOTAL MATERIAL COST			$ 107,412.65

Table F-A-5o

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.01

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Backfill Placement	8.01

COST ESTIMATE DATA		
TOTAL QUANTITY ON COST ESTIMATE	4.4	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	3.3	0.77	--	20

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Backfill Placement	8.01	$ 141,670.48	$ 554,853.22	$ 231,872.74	$ -	$ 928,396.44	Equipment, labor, and materials for placement of backfil/residuals management cover after dredging.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 141,670.48**	**$ 554,853.22**	**$ 231,872.74**	**$ -**	**$ 928,396.44**	
UNIT PRICES		**$ 32,567.93**	**$ 127,552.47**	**$ 53,304.08**	**$ -**	**$ 213,424.47**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	1,003	1	240	$ 24.14	$ 5,794.38
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	1,056	1	240	$ 24.11	$ 5,786.94
TELEBELT 130	MATERIAL TRANSFER	4,277	1	240	$ 225.00	$ 54,000.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	4,499	1	240	$ 156.26	$ 37,503.20
BARGE (80'X40')	MATERIAL TRANSFER	0	1	240	$ 76.92	$ 18,461.54
SCOW (225'X42'X12')	BACKFILL PLACEMENT	0	2	480	$ 57.69	$ 27,692.31
TUG BOAT 2 - 700 HP	BACKFILL PLACEMENT	7,392	1	240	$ 53.54	$ 12,850.63
SCOW (100 CY)	BACKFILL PLACEMENT	0	4	960	$ 9.62	$ 9,230.77
TUG BOAT 1 - 380 HP	BACKFILL PLACEMENT	8,026	2	480	$ 40.20	$ 19,297.71
BARGE (80'X40')	BACKFILL PLACEMENT	0	1	240	$ 76.92	$ 18,461.54
CAT 375 L	BACKFILL PLACEMENT	4,520	1	240	$ 84.97	$ 20,393.72
BUCKET (5.5 CY)	BACKFILL PLACEMENT	11	1	240	$ 10.00	$ 2,400.00
BARE UNIT COST →	$ 53,304.08	30,782	TOTAL RENTED EQUIP →			$ 231,872.74

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	BACKFILL PLACEMENT	1	240	$ 147.88	$ 35,490.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	240	$ 65.99	$ 15,836.95
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	240	$ 65.99	$ 15,836.95
UNION OPERATOR 1	MATERIAL TRANSFER	1	240	$ 65.99	$ 15,836.95
UNION TUG OPERATOR	BACKFILL PLACEMENT	3	720	$ 72.18	$ 51,969.63
Per Diem Unit Rate (Hourly)	ALL	1	240	$ 27.92	$ 6,700.00
BARE UNIT COST →	$ 32,567.93	TOTAL LABOR COST →			$ 141,670.48

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	30,782	$ 4.20	GAL	$ 129,224.52
SAND	ALL	10,088	$ 27.13	CY	$ 273,628.71
WASTE CHARACTERIZATION SAMPLING	ALL	16	$ 9,500.00	EA	$ 152,000.00
MATERIAL VERIFICATION SAMPLING					
BARE UNIT COST →	$ 127,552.47	TOTAL MATERIAL COST →			$ 554,853.22

Table F-A-5p

Alternative EB-F	CONSTRUCTION COST ESTIMATE WORKSHEET 8.11		BASE YEAR: 2023
COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Deep Water	8.11

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Deep Water	8.11	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-5q

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.12

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Shallow Water	8.12

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Shallow Water	8.12	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0	TOTAL RENTED EQUIP →			$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-5r

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.13

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - Wake Zone	8.13

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.00	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.0	0.00	--	0

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - Wake Zone	8.13	$ -	$ -	$ -	$ -	$ -	Cost is zero because this item is not included in this Alternative.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	0	1	0	$ 24.14	$ -
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	0	1	0	$ 24.11	$ -
TELEBELT 130	MATERIAL TRANSFER	0	1	0	$ 225.00	$ -
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	0	1	0	$ 156.26	$ -
BARGE (80'X40')	MATERIAL TRANSFER	0	1	0	$ 76.92	$ -
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	0	$ 57.69	$ -
TUG BOAT 2 - 700 HP	CAP PLACEMENT	0	1	0	$ 53.54	$ -
SCOW (100 CY)	CAP PLACEMENT	0	4	0	$ 9.62	$ -
TUG BOAT 1 - 380 HP	CAP PLACEMENT	0	2	0	$ 40.20	$ -
BARGE (80'X40')	CAP PLACEMENT	0	1	0	$ 76.92	$ -
CAT 375 L	CAP PLACEMENT	0	1	0	$ 84.97	$ -
BUCKET (5.5 CY)	CAP PLACEMENT	0	1	0	$ 10.00	$ -
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	0	$ 24.04	$ -
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	0	$ 147.88	$ -
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	0	$ 65.99	$ -
UNION OPERATOR 1	MATERIAL TRANSFER	1	0	$ 65.99	$ -
UNION TUG OPERATOR	CAP PLACEMENT	3	0	$ 72.18	$ -
Per Diem Unit Rate (Hourly)	ALL	1	0	$ 27.92	$ -
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	0	$ 4.20	GAL	$ -
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	0	$ 1,827.19	CY	$ -
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	0	$ 2,000.00	EA	$ -
BARE UNIT COST → $ -		TOTAL MATERIAL COST →			$ -

Table F-A-5s

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.14

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - ISS Areas	8.14

COST ESTIMATE DATA								
TOTAL QUANTITY ON COST ESTIMATE	0.11	Cost Estimate Data Notes	PRODUCTION DATA					
			HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	0.3	0.08	--	2

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - ISS Areas	8.14	$ 14,167.05	$ 67,140.26	$ 23,764.20	$ -	$ 105,071.51	Equipment, labor, and materials for placing armored amended caps in ISS areas. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 14,167.05**	**$ 67,140.26**	**$ 23,764.20**	**$ -**	**$ 105,071.51**	
UNIT PRICES		**$ 128,791.35**	**$ 610,366.02**	**$ 216,038.15**	**$ -**	**$ 955,195.52**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	100	1	24	$ 24.14	$ 579.44
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	106	1	24	$ 24.11	$ 578.69
TELEBELT 130	MATERIAL TRANSFER	428	1	24	$ 225.00	$ 5,400.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	450	1	24	$ 156.26	$ 3,750.32
BARGE (80'X40')	MATERIAL TRANSFER	0	1	24	$ 76.92	$ 1,846.15
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	48	$ 57.69	$ 2,769.23
TUG BOAT 2 - 700 HP	CAP PLACEMENT	739	1	24	$ 53.54	$ 1,285.06
SCOW (100 CY)	CAP PLACEMENT	0	4	96	$ 9.62	$ 923.08
TUG BOAT 1 - 380 HP	CAP PLACEMENT	803	2	48	$ 40.20	$ 1,929.77
BARGE (80'X40')	CAP PLACEMENT	0	1	24	$ 76.92	$ 1,846.15
CAT 375 L	CAP PLACEMENT	452	1	24	$ 84.97	$ 2,039.37
BUCKET (5.5 CY)	CAP PLACEMENT	1	1	24	$ 10.00	$ 240.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	24	$ 24.04	$ 576.92
BARE UNIT COST →	$ 216,038.15	3,078	TOTAL RENTED EQUIP →			$ 23,764.20

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	24	$ 147.88	$ 3,549.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	24	$ 65.99	$ 1,583.69
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	24	$ 65.99	$ 1,583.69
UNION OPERATOR 1	MATERIAL TRANSFER	1	24	$ 65.99	$ 1,583.69
UNION TUG OPERATOR	CAP PLACEMENT	3	72	$ 72.18	$ 5,196.96
Per Diem Unit Rate (Hourly)	ALL	1	24	$ 27.92	$ 670.00
BARE UNIT COST →	$ 128,791.35	TOTAL LABOR COST →			$ 14,167.05

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	3,078	$ 4.20	GAL	$ 12,922.45
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	13	$ 1,827.19	CY	$ 23,980.83
SAND	ALL	359	$ 27.13	CY	$ 9,733.26
GRAVEL	ALL	127	$ 67.18	CY	$ 8,542.74
ARMOR STONE 3-9 INCHES	ALL	161	$ 61.69	CY	$ 9,960.99
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	1	$ 2,000.00	EA	$ 2,000.00
BARE UNIT COST →	$ 610,366.02	TOTAL MATERIAL COST →			$ 67,140.26

Table F-A-5t

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.15

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Deep Water)	8.15

COST ESTIMATE DATA

TOTAL QUANTITY ON COST ESTIMATE	6.30	Cost Estimate Data Notes
ITEM UNIT	AC	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	7.3	1.69	--	44

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Deep Water)	8.15	$ 311,675.06	$ 2,005,548.93	$ 522,812.33	$ -	$ 2,840,036.32	Equipment, labor, and materials for placing armored amended caps in areas dredged to native. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 311,675.06**	**$ 2,005,548.93**	**$ 522,812.33**	**$ -**	**$ 2,840,036.32**	
UNIT PRICES		**$ 49,472.23**	**$ 318,341.10**	**$ 82,986.08**	**$ -**	**$ 450,799.42**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	2,207	1	528	$ 24.14	$ 12,747.65
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	2,323	1	528	$ 24.11	$ 12,731.26
TELEBELT 130	MATERIAL TRANSFER	9,409	1	528	$ 225.00	$ 118,800.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	9,897	1	528	$ 156.26	$ 82,507.04
BARGE (80'X40')	MATERIAL TRANSFER	0	1	528	$ 76.92	$ 40,615.38
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	1056	$ 57.69	$ 60,923.08
TUG BOAT 2 - 700 HP	CAP PLACEMENT	16,262	1	528	$ 53.54	$ 28,271.39
SCOW (100 CY)	CAP PLACEMENT	0	4	2112	$ 9.62	$ 20,307.69
TUG BOAT 1 - 380 HP	CAP PLACEMENT	17,656	2	1056	$ 40.20	$ 42,454.96
BARGE (80'X40')	CAP PLACEMENT	0	1	528	$ 76.92	$ 40,615.38
CAT 375 L	CAP PLACEMENT	9,943	1	528	$ 84.97	$ 44,866.19
BUCKET (5.5 CY)	CAP PLACEMENT	23	1	528	$ 10.00	$ 5,280.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	528	$ 24.04	$ 12,692.31
BARE UNIT COST →	$ 82,986.08	67,721		TOTAL RENTED EQUIP →		$ 522,812.33

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	528	$ 147.88	$ 78,078.00
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	528	$ 65.99	$ 34,841.29
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	528	$ 65.99	$ 34,841.29
UNION OPERATOR 1	MATERIAL TRANSFER	1	528	$ 65.99	$ 34,841.29
UNION TUG OPERATOR	CAP PLACEMENT	3	1584	$ 72.18	$114,333.19
Per Diem Unit Rate (Hourly)	ALL	1	528	$ 27.92	$ 14,740.00
BARE UNIT COST →	$ 49,472.23	TOTAL LABOR COST →			$ 311,675.06

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	67,721	$ 4.20	GAL	$ 284,293.93
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	516	$ 1,827.19	CY	$ 942,189.01
SAND	ALL	25,772	$ 27.13	CY	$ 699,065.99
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	40	$ 2,000.00	EA	$ 80,000.00
BARE UNIT COST →	$ 318,341.10	TOTAL MATERIAL COST →			$ 2,005,548.93

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.16

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Amended Cap - On Native (Shallow Water)	8.16

COST ESTIMATE DATA			
TOTAL QUANTITY ON COST ESTIMATE	0.44	Cost Estimate Data Notes	
ITEM UNIT	AC		

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.8	0.19	--	5

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Amended Cap - On Native (Shallow Water)	8.16	$ 35,417.62	$ 208,846.97	$ 59,410.49	$ -	$ 303,675.09	Equipment, labor, and materials for placing armored amended caps in areas dredged to native. Assumes mixing of amended capping layers and some stockpile management occurs in the upland.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 35,417.62**	**$ 208,846.97**	**$ 59,410.49**	**$ -**	**$ 303,675.09**	
UNIT PRICES		**$ 80,494.59**	**$ 474,652.21**	**$ 135,023.85**	**$ -**	**$ 690,170.65**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 272 SKID STEER	STOCKPILE MANAGEMENT	251	1	60	$ 24.14	$ 1,448.60
CAT 910M FRONT LOADER	STOCKPILE MANAGEMENT	264	1	60	$ 24.11	$ 1,446.73
TELEBELT 130	MATERIAL TRANSFER	1,069	1	60	$ 225.00	$ 13,500.00
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	1,125	1	60	$ 156.26	$ 9,375.80
BARGE (80'X40')	MATERIAL TRANSFER	0	1	60	$ 76.92	$ 4,615.38
SCOW (225'X42'X12')	CAP PLACEMENT	0	2	120	$ 57.69	$ 6,923.08
TUG BOAT 2 - 700 HP	CAP PLACEMENT	1,848	1	60	$ 53.54	$ 3,212.66
SCOW (100 CY)	CAP PLACEMENT	0	4	240	$ 9.62	$ 2,307.69
TUG BOAT 1 - 380 HP	CAP PLACEMENT	2,006	2	120	$ 40.20	$ 4,824.43
BARGE (80'X40')	CAP PLACEMENT	0	1	60	$ 76.92	$ 4,615.38
CAT 375 L	CAP PLACEMENT	1,130	1	60	$ 84.97	$ 5,098.43
BUCKET (5.5 CY)	CAP PLACEMENT	3	1	60	$ 10.00	$ 600.00
KAFKA 814 BLENDING HOPPER	MATERIAL MIXING	0	1	60	$ 24.04	$ 1,442.31
BARE UNIT COST →	$ 135,023.85	7,696		TOTAL RENTED EQUIP →		$ 59,410.49

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	CAP PLACEMENT	1	60	$ 147.88	$ 8,872.50
UNION OPERATOR 1	STOCKPILE MANAGEMENT	1	60	$ 65.99	$ 3,959.24
UNION OPERATOR 2	STOCKPILE MANAGEMENT	1	60	$ 65.99	$ 3,959.24
UNION OPERATOR 1	MATERIAL TRANSFER	1	60	$ 65.99	$ 3,959.24
UNION TUG OPERATOR	CAP PLACEMENT	3	180	$ 72.18	$ 12,992.41
Per Diem Unit Rate (Hourly)	ALL	1	60	$ 27.92	$ 1,675.00
BARE UNIT COST →	$ 80,494.59	TOTAL LABOR COST →			$ 35,417.62

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	7,696	$ 4.20	GAL	$ 32,306.13
ORGANOCLAY	ALL	0	$ 3,307.50	CY	$ -
GAC	ALL	36	$ 1,827.19	CY	$ 65,345.38
SAND	ALL	978	$ 27.13	CY	$ 26,522.17
GRAVEL	ALL	554	$ 67.18	CY	$ 37,244.99
ARMOR STONE 3-9 INCHES	ALL	704	$ 61.69	CY	$ 43,428.32
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST →	$ 474,652.21	TOTAL MATERIAL COST →			$ 208,846.97

Table F-A-5v

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.21

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - CSOs	8.21

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	0.9	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	AC		12	6	6.2	1.42	--	37

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - CSOs	8.21	$ 300,423.79	$ 999,575.89	$ 309,231.14	$ -	$ 1,609,230.82	Equipment, labor, and materials for placing outfall protection at CSOs. Assumes mats required for outfall protection can all be delivered and placed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 300,423.79**	**$ 999,575.89**	**$ 309,231.14**	**$ -**	**$ 1,609,230.82**	
UNIT PRICES		**$ 326,547.60**	**$ 1,086,495.53**	**$ 336,120.81**	**$ -**	**$ 1,749,163.93**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST	RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
						CAT 375 L	MAT PLACEMENT	16,723	2	888	$ 84.97	$ 75,456.78
						BUCKET (5.5 CY)	MAT PLACEMENT	39	2	888	$ 10.00	$ 8,880.00
						BARGE (80'X40')	MAT PLACEMENT	0	2	888	$ 76.92	$ 68,307.69
						TUG BOAT 1 - 380 HP	MAT PLACEMENT	14,847	2	888	$ 40.20	$ 35,700.76
						WORK BOAT - 115 HP	MAT PLACEMENT	2,247	1	444	$ 8.34	$ 3,701.48
						BARGE (80'X40')	MAT DELIVERY	0	1	444	$ 76.92	$ 34,153.85
						TUG BOAT 2 - 700 HP	MAT DELIVERY	13,675	1	444	$ 53.54	$ 23,773.67
						GROUT PLANT	GROUTING	1,289	2	888	$ 66.73	$ 59,256.92
BARE UNIT COST ⟶	$ -	TOTAL COST ⟶			$ -	BARE UNIT COST ⟶	$ 336,120.81	48,820		TOTAL RENTED EQUIP ⟶		$ 309,231.14

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST	MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
NON-UNION OPERATOR 1	MAT PLACEMENT	2	888	$ 147.88	$ 131,313.00	DIESEL	ALL	48,820	$ 4.20	GAL	$ 204,948.31
UNION DECKHAND	MAT PLACEMENT	1	444	$ 50.57	$ 22,454.57	NON-WOVEN GEOTEXTILE	ALL	44,000	$ 0.17	SF	$ 7,663.33
UNION LABORER	MAT PLACEMENT	4	1776	$ 50.57	$ 89,818.28	SAND	ALL	1,278	$ 27.13	CY	$ 34,659.72
UNION TUG OPERATOR	MAT PLACEMENT	1	444	$ 72.18	$ 32,047.94	ARTICULATED CONCRETE MATTRESSES	ALL	40,000	$ 12.67	SF	$ 506,800.00
Per Diem Unit Rate (Hourly)	ALL	2	888	$ 27.92	$ 24,790.00	GRAVEL	ALL	111	$ 67.18	CY	$ 7,464.17
						UNDERWATER GROUT (SUPERSACK)	ALL	117	$ 2,000.00	EA	$ 234,000.00
						WATER	ALL	7,020	$ 0.01	GAL	$ 40.36
						MATERIAL VERIFICATION SAMPLING	ALL	2	$ 2,000.00	EA	$ 4,000.00
BARE UNIT COST ⟶	$ 326,547.60	TOTAL LABOR COST ⟶			$ 300,423.79	BARE UNIT COST ⟶	$ 1,086,495.53	TOTAL MATERIAL COST ⟶			$ 999,575.89

Table F-A-5w

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.22

BASE YEAR: 202

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22

COST ESTIMATE DATA			PRODUCTION DATA					
		Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	0.0		12	6	0.2	0.04	--	1
ITEM UNIT	AC							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls and MS4s (Diam. 36 to 60 inches)	8.22	$ 5,499.83	$ 17,102.13	$ 8,314.57	$ -	$ 30,916.53	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of 12 inches or greater. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,102.13**	**$ 8,314.57**	**$ -**	**$ 30,916.53**	
UNIT PRICES		**$ 183,327.64**	**$ 570,071.09**	**$ 277,152.36**	**$ -**	**$ 1,030,551.08**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 277,152.36	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 183,327.64	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	0	$ 61.69	CY	$ -
ARMOR STONE 12-24 INCHES	ALL	104	$ 114.92	CY	$ 11,970.83
BARE UNIT COST →	$ 570,071.09	TOTAL MATERIAL COST →			$ 17,102.13

Table F-A-5x

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 8.23

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23

COST ESTIMATE DATA		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	0.1	
ITEM UNIT	AC	

PRODUCTION DATA					
HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	0.2	0.04	--	1

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Armored Outfall Protection - Outfalls (Diam. 4 to 36 inches)	8.23	$ 5,499.83	$ 17,715.04	$ 8,314.57	$ -	$ 31,529.44	Equipment, labor, and materials for placing outfall protection at outfalls with a diameter of less than 12 inches. Assumes aggregate required for outfall protection can all be delivered and managed via barge (i.e., no upland management needed).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 5,499.83**	**$ 17,715.04**	**$ 8,314.57**	**$ -**	**$ 31,529.44**	
UNIT PRICES		**$ 61,109.21**	**$ 196,833.77**	**$ 92,384.12**	**$ -**	**$ 350,327.10**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
SENNEBOGAN 870 MH W/ HYD. CLAMSHELL BUCKET	MATERIAL TRANSFER	225	1	12	$ 156.26	$ 1,875.16
BARGE (80'X40')	MATERIAL TRANSFER	0	1	12	$ 76.92	$ 923.08
SCOW (225'X42'X12')	OUTFALL PROT. PLACEMENT	0	2	24	$ 57.69	$ 1,384.62
TUG BOAT 2 - 700 HP	OUTFALL PROT. PLACEMENT	370	1	12	$ 53.54	$ 642.53
SCOW (100 CY)	OUTFALL PROT. PLACEMENT	0	4	48	$ 9.62	$ 461.54
TUG BOAT 1 - 380 HP	OUTFALL PROT. PLACEMENT	401	2	24	$ 40.20	$ 964.89
BARGE (80'X40')	OUTFALL PROT. PLACEMENT	0	1	12	$ 76.92	$ 923.08
CAT 375 L	OUTFALL PROT. PLACEMENT	226	1	12	$ 84.97	$ 1,019.69
BUCKET (5.5 CY)	OUTFALL PROT. PLACEMENT	1	1	12	$ 10.00	$ 120.00
BARE UNIT COST →	$ 92,384.12	1,222		TOTAL RENTED EQUIP →		$ 8,314.57

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
NON-UNION OPERATOR 1	OUTFALL PROT. PLACEMENT	1	12	$ 147.88	$ 1,774.50
UNION OPERATOR 1	MATERIAL TRANSFER	1	12	$ 65.99	$ 791.85
UNION TUG OPERATOR	OUTFALL PROT. PLACEMENT	3	36	$ 72.18	$ 2,598.48
Per Diem Unit Rate (Hourly)	ALL	1	12	$ 27.92	$ 335.00
BARE UNIT COST →	$ 61,109.21	TOTAL LABOR COST →			$ 5,499.83

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	1,222	$ 4.20	GAL	$ 5,131.30
SAND	ALL	0	$ 27.13	CY	$ -
GRAVEL	ALL	0	$ 67.18	CY	$ -
ARMOR STONE 3-9 INCHES	ALL	204	$ 61.69	CY	$ 12,583.74
ARMOR STONE 12-24 INCHES	ALL	0	$ 114.92	CY	$ -
BARE UNIT COST →	$ 196,833.77	TOTAL MATERIAL COST →			$ 17,715.04

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 9

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Environmental Controls	9.0

COST ESTIMATE DATA

		Cost Estimate Data Notes
TOTAL QUANTITY ON COST ESTIMATE	1.0	
ITEM UNIT	LS	

PRODUCTION DATA

HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
12	6	15.3	3.52	--	92

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Environmental Controls	9.0	$ 222,118.18	$ 968,312.22	$ 18,307.32	$ -	$ 1,208,737.72	Equipment, labor, and materials for installing and maintaning environmental controls (i.e., silt curtains) during aquatic work activities.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 222,118.18**	**$ 968,312.22**	**$ 18,307.32**	**$ -**	**$ 1,208,737.72**	
UNIT PRICES		**$ 222,118.18**	**$ 968,312.22**	**$ 18,307.32**	**$ -**	**$ 1,208,737.72**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL COST →			$ -

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
WORK BOAT - 115 HP	ALL	11,112	2	2196	$ 8.34	$ 18,307.32
BARE UNIT COST → $ 18,307.32		11,112		TOTAL RENTED EQUIP →		$ 18,307.32

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION DECKHAND	ALL	4	4392	$ 50.57	$222,118.18
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 222,118.18	TOTAL LABOR COST →			$ 222,118.18

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
DIESEL	ALL	11,112	$ 4.20	GAL	$ 46,647.17
MOBILE RESUSPENSION CONTROL SYSTEM (ALT. EB-F)	ALL	1	$ 889,400.00	LS	$ 889,400.00
SILT CURTAIN	ALL	22	$ 1,466.59	EA	$ 32,265.05
BARE UNIT COST → $ 968,312.22		TOTAL MATERIAL COST →			$ 968,312.22

Table F-A-5z

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 10

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Inspections and Surveying	10.0

COST ESTIMATE DATA		Cost Estimate Data Notes	PRODUCTION DATA: HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
TOTAL QUANTITY ON COST ESTIMATE	1.0		12	6	35.2	8.12	--	211
ITEM UNIT	LS							

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Inspections and Surveying	10.0	$ -	$ -	$ -	$ 2,594,200.00	$ 2,594,200.00	Equipment, labor, and materials for surveying and bulkhead inspections.
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ -**	**$ -**	**$ -**	**$ 2,594,200.00**	**$ 2,594,200.00**	
UNIT PRICES		**$ -**	**$ -**	**$ -**	**$ 2,594,200.00**	**$ 2,594,200.00**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
MULTIBEAM BATHYMETRIC SURVEYS	ALL	21	$10,200	DAY	$214,200.00
BULKHEAD INSPECTIONS	ALL	1	$500,000	LS	$500,000.00
BATHYMETRIC PROGRESS SURVEYS	ALL	190	$6,200	DAY	$1,178,000.00
UTILITY ID AND SURVEY	ALL	1	$200,000	LS	$200,000.00
VIBRATION MONITORING	ALL	502	$1,000	DAY	$502,000.00
BARE UNIT COST →	$ 2,594,200.00	TOTAL COST →			$ 2,594,200.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
BARE UNIT COST →	$ -	0		TOTAL RENTED EQUIP →		$ -

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
BARE UNIT COST →	$ -	TOTAL LABOR COST →			$ -

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
BARE UNIT COST →	$ -	TOTAL MATERIAL COST →			$ -

Table F-A-5aa

Alternative EB-F

CONSTRUCTION COST ESTIMATE WORKSHEET 11

BASE YEAR: 2023

COST ESTIMATE DATE	PROJECT LOCATION	DESCRIPTION OF ITEM	ITEM NO.
July 31, 2024	NEWTOWN CREEK EXPEDITED ACTION	Site Restoration	11.0

COST ESTIMATE DATA			PRODUCTION DATA					
TOTAL QUANTITY ON COST ESTIMATE	1.0	Cost Estimate Data Notes	HOURS PER DAY	DAYS PER WEEK	TOTAL WEEKS	TOTAL MONTHS	DAILY UNIT PRODUCTION RATE	DAYS REQ. TO COMPLETE
ITEM UNIT	LS		12	6	2.5	0.58	--	15

ESTIMATE WORKSHEET	ITEM NO.	TOTAL LABOR	TOTAL MATERIAL	TOTAL RENTED EQUIP	TOTAL MISCELLANEOUS	TOTAL	Notes
Site Restoration	11.0	$ 62,942.75	$ 487,354.64	$ 10,566.76	$ 324,939.00	$ 885,803.15	Equipment, labor, and materials for site restoration (includes disposal of DGA from staging area).
						$ -	
						$ -	
						$ -	
GRAND TOTALS		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	
UNIT PRICES		**$ 62,942.75**	**$ 487,354.64**	**$ 10,566.76**	**$ 324,939.00**	**$ 885,803.15**	

MISCELLANEOUS	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
OTHER SITE RESTORATION	ALL	1	$100,000	LS	$100,000.00
SUBTITLE D PROCESSING, TRANSPORT, AND DISPOSAL	ALL	1,500	$150	TON	$224,939.00
BARE UNIT COST →	$ 324,939.00	TOTAL COST →			$ 324,939.00

RENTAL EQUIP	WORK TO PERFORM	FUEL GALS.	TOTAL UNITS	TOTAL HOURS	UNIT RATE	TOTAL COST
CAT 910M FRONT LOADER	ALL	792	1	180	$ 24.11	$ 4,340.20
CAT 272 SKID STEER	ALL	752	1	180	$ 24.14	$ 4,345.79
TRENCH ROLLER WITH REMOTE	ALL	174	1	180	$ 10.45	$ 1,880.77
BARE UNIT COST →	$ 10,566.76	1,719		TOTAL RENTED EQUIP →		$ 10,566.76

LABOR CLASSIFICATION	WORK TO PERFORM	TOTAL WORKERS	TOTAL HOURS	HRLY RATE	TOTAL COST
UNION OPERATOR 1	ALL	1	180	$ 65.99	$ 11,877.71
UNION OPERATOR 2	ALL	2	360	$ 65.99	$ 23,755.42
UNION LABORER	ALL	3	540	$ 50.57	$ 27,309.61
Per Diem Unit Rate (Hourly)	ALL	0	0	$ 27.92	$ -
BARE UNIT COST →	$ 62,942.75	TOTAL LABOR COST →			$ 62,942.75

MATERIAL / SERVICES	WORK TO PERFORM	QUANTITY UNITS	UNIT COST	UNIT OF MEAS.	TOTAL COST
ASPHALT PAVING	ALL	65,340	$ 7.46	SF	$ 487,354.64
BARE UNIT COST →	$ 487,354.64		TOTAL MATERIAL COST →		$ 487,354.64

Attachment F-B

Unit Rate Supporting Information

ATMOS

17 Campus Blvd, Suite 100, Newtown Square, PA 19073
610436-4314

TO: Jonathan Hart, Anchor QEA
JHart@anchorqea.com
(978) 378-6223

FROM: Jeffrey Yarnell
jyarnell@atmos-technologies.com
(610) 436-4314

DATE: June 23rd, 2023

Thank you for your inquiry into Atmos Long Duration Foam. We are pleased to quote your company the following Long Duration Foam products for emission and odor control:

AC-645 (Active Excavation/Overnight Cover)
Long Duration Foam for overnight coverage and for use during active excavation. Chemical comes as liquid concentrate in 55 gallon drums, 450 lbs. per drum; dilution ratio is 6.5 parts water to 1 part chemical. Each 450 lb. drum will cover approximately 4,000 - 4,500 square feet, dependent upon surface of substrate.

$ 1.24 / lb. 4-39 drums
$ 1.19 / lb. 40 + drums
$ 0.10 / lb. wintergreen/vanilla scent

AC-904 (Stockpile/Extended Cover)
Long Duration Foam for coverage lasting 2-3 weeks on stockpiled soil or open parts of the excavation cell. Product is direct use (do not dilute) and ships in 450 lb. drums. Each 450 lb. drum will cover approximately 900 square feet dependent upon surface of substrate.

$ 1.05/ lb. (4-39 drums)
$ 1.00 / lb. (40+ drums)

NTC/8
Portable Pneumatic Foam Unit. Unit is skid mounted and requires a source of compressed air; pick-up tube provided for feeding chemical to unit. Please see attached specification sheet for further details.

$ 3,495.00 Monthly Rental
$ 225.00 Daily Rental

PFU400/25
Pneumatic Foam Unit for small to medium applications. Unit is completely self-contained and towable around site with a pick-up truck. System includes air compressor, pump, hoses, nozzles, 400 gallon solution storage tank, 200' of hose and freeze protection system. Please see attached specification sheet for further details.

$ 5,495.00 Monthly Rental
$ 300.00 Daily Rental

ATMOS

17 Campus Blvd, Suite 100, Newtown Square, PA 19073
610436-4314

Atmos Granules (Perimeter Fencing Masking Agents)
Perimeter odor control granules designed to provide the same odor neutralizing effects as a perimeter misting system. Granules come in different scents dependent on the type of odor: Garbage/Compost, Gases, and Petroleum. One pound is enough to control 270 sq. ft.

$ 16.52 / lb.

Atmos Neutralizing Concentrates (Dust/Vapor/Odor Agents) **BioSolve Replacement**
Perimeter & Active Misting products dilute 300-1,000 parts water to 1 part chemical. Using environmentally safe essential oils, RusScent neutralizes unpleasant smells without masking, without causing potentially toxic chemical reactions and without the need to handle caustic and volatile chemicals. This odor neutralizing liquid can be applied through a misting system, turbine fan, a drip feed system or sprayed directly onto the odor source. Able to work in all climates.

$ 38.75 / gallon

FREIGHT	To ship PFU400/25 + up to 40 drums	**$ 3,475.00** estimated
FREIGHT	To ship NTC/8 Foam Machine	**$ 2,022.35** estimated

Freight quotes are subject to change due to fluctuations in fuel surcharge, weather, and any possible jobsite delivery restrictions. Please confirm freight quote at time of order; return freight cost can be calculated 30 days prior to return shipment date. Depending on weather at the time of shipment, we can fit up to 40 drums of foam on the trailer with the 400/25 unit. If freezing temperatures prohibit exposed transportation, chemical will ship separately via LTL carrier, freight pre-paid and added to invoice.

NOTES:

Chemical is sold in four drum lots unless premium paid as noted above. First four drums are non-refundable: 50% restocking charge on unopened drums after initial four. Restocking fee may also vary depending on age of product & condition of the drums. Drums of AC-667SE, 900 series, & neutralizer products are non-refundable. There is a $.15/lb. surcharge for any order less than 4 drums. OSHA/HAZWOPER trained technicians are available at $950.00 / day plus expenses for travel and on-site training in using the equipment, if needed. Equipment is subject to availability at time of order.

Prices are in US Dollars and do not include freight, duties or tax. 5% charge for all credit cards.
Quote is valid for thirty (30) days from date. Terms are Net 30 Days upon app

Dan Harris
General Manager

Office: 609-971-8810
Cell: 405-206-4659

Email: dan@iwtcargoguard.com
Website: www.iwtcargoguard.com
P.O. Box 454 Waretown, NJ 08758

Client: Anchor QEA – Sonnet Agran-St. Pierre
Jobsite:NYC Metro Dredging Site
Email: sagran-stpierre@anchorqea.com
Phone: 978.378.6210
Date:2-28-23

Quotation

	Description	Quantity	Unit Price	Total
1.	LM800NT Nonwoven – 15' x 300'	4 rolls	$ 585 ea	$ 2,340
	Freight	1 load		$ 795

TERMS AND CONDITIONS: NET 30 days with approved credit, otherwise we accept Visa, Master Card and American Express. A processing fee will be applied to all credit card transactions. All orders are subject to state and local sales tax unless the appropriate exemption forms are properly executed and on file. Seller has based its quoted prices upon all of the (estimated, not guaranteed) quantities listed in this quotation. If Buyer elects to purchase from Seller only a portion of the material quoted, Seller shall have the right to adjust its prices to reflect the impact of all resulting cost. Please note material cost is subject to the price of resin. Any increases in the cost of resin shall be passed along to the buyer. IWT provides no warranties as to the fitness for a specific use or merchantability of products referred to, no guarantee of satisfactory results, and disclaims all liability for resulting loss or damage. All sales are final. Only material deemed a manufacturing defect after inspection will be eligible for return.

Thank you for the opportunity to be of service!

Dan Harris

PRODUCT LINE
GEOMEMBRANE LINERS --- GEOTEXTILES --- GEOCOMPOSITE
SILT FENCE --- EROSION CONTROL MATS --- GEOGRID --- REINFORCED FILMS
TARPS --- TURBIDITY BARRIER --- OILBOOM --- GEOCOMPOSITE --- GEOWEB
SUPER ABSORBANT POLYMER --- SAFETY FENCE --- CUSTOM CONVERTING
SPILL SUPPLY --- GEOTUBES --- GABIONS & RENO MATTRESSES
BULK BAGS --- SOIL PILE COVERS --- VISUALBARRIERS --- SAND BAGS
CONSTRUCTION FILM --- DAILY COVERS -- RAIL & TRUCK LINERS

Quotation

Vulcan Materials Company
and Subsidiaries

Attn: Sonnet Agran-St.Pierre

Anchor QEA
9 Water Street

Acct#: MP0005689

Quote Name: Newtown Creek Remediation - Brooklyn, NY
Quote #: 1730176

Newtown Creek

BROOKLYN, NY 11222

Date:	Tuesday, April 11, 2023
Quote Created:	Tuesday, April 11, 2023
Effective From:	Tuesday, April 11, 2023
Quote Expiration:	Sunday, December 31, 2023
Price Expiration:	Thursday, May 11, 2023

Sales Rep :	Roy Reining (201) 587-5651 ,
Phone:	Dispatch - 973-827-7625
Fax :	
Email:	reiningr@vmcmail.com

Special Instructions:

Material prices are subject to escalation after price expiration date.

All trucking and material is quoted and based upon availability.

Energy & Fuel Surcharges - All Aggregate & Sand material sales will be subject to a Fuel & Energy Surcharge. These surcharges are based on the average cost of diesel fuel in the Central Atlantic Region as published weekly by the US Dept. of Energy. Material/Production/Energy Surcharge will be adjusted weekly $0.02 per ton for every $0.10 per gallon change in the posted diesel fuel index; base price is $3.50 per gallon. Trucking/Fuel Surcharge rates will be adjusted weekly 1% for each $0.10 per gallon change in the posted diesel fuel index, base price is $3.50 per gallon.

Non Union Trailer Loads

100 - Aggregates

Plant	Product Name	Product #	Qty	U/M	Delivered
PIER J	ASTM #57 3/4" STONE	2529P209	26,000	Tons	$39.75

Prices quoted above are per unit of measure (U/M) and do not include any state or local sales and use tax, if any applies for this project.

Prices quoted are for shipments during normal daytime working hours unless other shipping hours are mutually agreed upon in writing by both parties.

Prices are FOB plant as stated above. Terms are Net 15th month prox. Please note standard terms and conditions apply. (Subject to credit approval)

This quote is limited to acceptance within 30 days from the date of this quotation after which time quotation is subject to review/revision. Quoted Haul Rates Subject to Revision. Please contact Sales prior to placing the order.

Accepted by: ______________________ **Date:** ______________________

Sales Representative: ______________________ **Date:** ______________________

We appreciate the opportunity to provide you this quote and trust that Vulcan will have the pleasure of serving your needs for this and future projects.

GENERAL TERMS AND CONDITIONS

PRICES AND TERMS

Prices are based on the terms and conditions set forth on page 1 of this Quotation, of which these General Terms and Conditions form a part, the terms and conditions stated in Customer's Application for Business Credit, and, if applicable, any terms and conditions relating to the delivery or shipment of materials by truck, barge, vessel, rail or other means which are provided by Vulcan to Customer in addition to this Quotation (each, a "Vulcan Sales Document", and collectively, the "Vulcan Sales Documents"). Prices are available only to the customer specifically named therein, and are only for the quantities mentioned in such Quotation or Sales Order plus or minus 10% of such quantities. A charge of 1.5% per month, (18% annum), will accrue on a daily basis from the date of invoice and will continue to accrue on a daily basis on any unpaid balance, both before and after judgment, until the date the balance is paid in full, or at the maximum amount permitted by law in which the sale occurred, whichever is less. **However, the assessment of a finance charge on invoices paid in full by the payment due date will be waived.** Quotation is offered for furnishing the total aggregate requirements for the project only. Customer's contract with Vulcan regarding the sale by Vulcan to Customer of the materials listed in this Quotation is subject to the terms and conditions set forth in the Vulcan Sales Documents. Prices reflect Customer's acceptance of materials at the quoted plant based upon gradation analysis performed and reported by Vulcan's certified plant quality control personnel. Any penalties that result from in place sampling shall be the full responsibility of Customer.

THE TERMS AND CONDITIONS OF THE VULCAN SALES DOCUMENTS GOVERN THE RIGHTS AND OBLIGATIONS OF THE PARTIES

If Customer has issued a purchase order for the materials quoted by Vulcan in this Quotation, this Quotation is not an acceptance of said purchase order, or any of its terms or conditions, which are hereby rejected. Any sale by Vulcan to Customer of the materials listed in this Quotation shall be subject to the terms and conditions set forth in the Vulcan Sales Documents, and Customer's receipt or acceptance of said materials shall constitute acceptance of the offer that this Quotation constitutes. Any terms or conditions of a subsequent purchase order issued by Customer that are inconsistent with the terms and conditions of the Vulcan Sales Documents shall be null and void.

SHIPMENT AND DELIVERY

Unless a "delivered" price is quoted by Vulcan in the Vulcan Sales Documents, all prices are F.O.B. point of shipment from the locations designated. All taxes applicable to the sale or delivery of materials that are not paid directly by Customer will be added to the sales price, invoiced to and paid by Customer, unless Customer provides Vulcan with satisfactory evidence of exemption from same. Shipment will be in accordance with Customer's reasonable instructions or, if none, then by whatever means Vulcan shall deem practicable. The quantities of material delivered to Customer shall be conclusively presumed to be the quantities shown on the tickets produced from a certified weigh scale at Vulcan's quarry or sales yard.

CREDIT AND DEFAULT

Vulcan shall have no obligation to ship or deliver except upon its determination prior to each shipment or delivery that Customer is worthy of the credit to be extended and is not in default upon any obligation to Vulcan. Upon default, Customer agrees to pay all of Vulcan's collection expenses, including attorneys' fees.

INSURANCE

A Memorandum of Insurance containing current information regarding Vulcan's insurance program is available at
<https://marshdigital.marsh.com/marshconnect/viewMOI.action?clientId=632529479>.

EXCULPATORY PROVISIONS

Vulcan shall have no liability for delay or failure to make shipments, or delivery, as a result of strikes, labor problems, severe weather conditions, casualty, mechanical breakdown or other conditions beyond Vulcan's reasonable control. In no event shall Vulcan be liable for any incidental or consequential damages. Vulcan's liability and Customer's exclusive remedy for any cause of action arising out of the provision of material quoted herein shall be the replacement of, or payment of the purchase price for, the materials which are the subject of this Quotation.

CHANGE OF TERMS

Vulcan may change the price and/or quantity upon 30 days' notice to Customer. Vulcan shall also have right to change, modify or amend any other terms and conditions upon written notice of such change to customer. The effect of the change shall be as stated in the written notice and accepted by Customer upon placing of orders with seller following receipt of such notice.

APPLICABLE LAW

All orders are subject to acceptance by Vulcan at the headquarters of its Winston-Salem, North Carolina, and the laws of the state in which the materials was shipped from shall apply to the sale of all materials subject hereto. In the event material is imported into the U.S., the law in the state in which the material was sold to the customer will prevail. All disputes regarding finance charges shall be governed by Alabama law.

LIMITED WARRANTY AND WARRANTY DISCLAIMER

Vulcan warrants for a period of one (1) year from date of delivery only that the material sold hereunder substantially complies with Vulcan's specifications for said material or the specifications set forth in Vulcan's quotation. **VULCAN HEREBY EXCLUDES ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PURPOSE, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, OF THE MATERIAL SOLD HEREUNDER, OTHER THAN THE EXPRESS WARRANTY STATED ABOVE.** In addition, except to the extent otherwise set forth in the specifications described above, Vulcan makes no warranty whatsoever with respect to specific gravity, absorption, whether the material is innocuous, non-deleterious, or non-reactive, or whether the material is in conformance with any plans, other specifications, regulations, ordinances, statutes, or other standards applicable to Customer's job or to said material as used by Customer. VULCAN SHALL IN NO EVENT BE RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE CAUSED BY NON-COMPLIANCE OF THE MATERIAL WITH SPECIFICATIONS, OR FOR ANY DEFECTS IN THE MATERIAL SOLD HEREUNDER.

From: Matt Geary
To: Sonnet Agran-St. Pierre
Subject: RE: [External] RE: Organoclay and Quicklime pricing
Date: Friday, March 24, 2023 1:04:42 PM
Attachments: image001.gif

CAUTION: This Message Is from an External Sender
This email originated from outside of Anchor QEA. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello Sonnet,

Cetco does not have a quicklime source. As for Current organoclay pricing. The current price is $2.45/lb. (1 CF = approx. 50 lbs.).

Thank you,

Matt Geary
Technical Sales Manager, Environmental Products
CETCO / A Minerals Technologies Company
Direct: 518-430-8790
matt.geary@mineralstech.com | www.cetco.com
MTI-CETCO logo and tagline_e-mail_footer

From: Sonnet Agran-St. Pierre <sagran-stpierre@anchorqea.com>
Sent: Friday, March 24, 2023 3:40 PM
To: Matt Geary <matt.geary@mineralstech.com>
Subject: [External] RE: Organoclay and Quicklime pricing

You don't often get email from sagran-stpierre@anchorqea.com. Learn why this is important

** IMPORTANT: This is an external email. Only open attachments or click links from trusted senders **

Hello Matt,

I wanted to follow up to my previous email to see if you might be able to provide some updated pricing estimates for quicklime and organoclay for a NYC based project. You previously provided $3200/CY for organoclay back in August 2019 and I was hoping you could provide an updated rate for that as well as a new rate for your quicklime product as well.

Thank you,
Sonnet

Sonnet Agran-St. Pierre | ANCHOR QEA, LLC
Professional Staff

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From: Sonnet Agran-St. Pierre
Sent: Friday, March 3, 2023 5:03 PM
To: matt.geary@mineralstech.com
Subject: Organoclay and Quicklime pricing

Hi Matt,

I am an engineer for a consulting company and we are currently working on a project in NYC. We are working on a feasibility study and are evaluating a range of alternatives for the project. For the alternatives evaluation we need to pull together engineer's cost estimates, so I am hoping you can provide some cost information for your organoclay and quicklime products. We reached out to you in 2019 for the same project that stalled and we are now reaching back out for updated costs. We are looking at range of estimates requiring approximately 3,000 – 39,000 CY of quicklime and approximately 1,500 CY of organoclay (PM-200 or PM-199). Please let me know if you have any questions.

Thank you,
Sonnet

Sonnet Agran-St. Pierre | ANCHOR QEA, LLC
Professional Staff
sagran-stpierre@anchorqea.com
9 Water Street, First Floor
Amesbury, MA 01913
T 978.378.6210

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From:	Saccomanno, Joe
To:	Sonnet Agran-St. Pierre
Subject:	Re: ---[EXTERNAL]---Materials Quote
Date:	Monday, April 3, 2023 8:47:10 AM

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Sonnet

Current pricing would be as follows picked up at our facilities.

Concrete sand. $17.50/ton
Dga. $20.00/ton
Rip rap 6" (3-9"). $36.50/ton
12-24". $68.00/ton
No top soil.

Concrete blocks 2x2x6. 55.00/each

Anticipate a yearly price increase on all products

Let me know if you have any questions

Thanks

Joe Saccomanno
Aggregate Sales Manager
Silvi Materials
www.silvi.com

Cell: 267-566-3809
jsaccomanno@silvi.com

On Mar 30, 2023, at 11:49 AM, Sonnet Agran-St. Pierre <sagran-stpierre@anchorqea.com> wrote:

Hi Joe,

Thanks for reaching out regarding my inquiry. The project is located in the Lower Hudson Area and we are currently evaluating a range of alternatives so quantities are approximate at this time. It's a confidential project so I can't give you much more info on the specifics unless you acknowledge a confidentiality agreement our client group has prepared. It's just a few sentences and I can send it to you via email, all you need to do is reply with an acknowledgement that you agree. Let me know if you need a more precise location or project specifics and I can send the agreement. Requested materials and approximate quantities are as follows:

- Sand (concrete sand for fill applications) (~15,000 – 40,000 CY)
- DGA (~2500 CY)
- Concrete blocks (650 ft perimeter so ~110 six foot blocks)
- Rip Rap (4-12" and 12-24") (~1500 CY each)
- Top Soil (~1300 CY)

Thank you much,
Sonnet

Sonnet Agran-St. Pierre | ANCHOR QEA, LLC
Professional Staff
sagran-stpierre@anchorqea.com
9 Water Street, First Floor
Amesbury, MA 01913
T 978.378.6210

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From:	Shultz, Jennifer
To:	Sonnet Agran-St. Pierre
Subject:	RE: [External]RE: Calgon Carbon Corporation Contact
Date:	Tuesday, April 11, 2023 6:53:50 AM

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Hello Sonnet,

Thank you for your email. Budgetary pricing for the 2025 capping project in New York, NY 11222 is:

PRODUCT: Filtrasorb 400
PACKAGING: 2000-pound supersacks
PRICE: $1.75-$1.95/lb
QUANTITY: 1600 tons (3.2 MM pounds)
FREIGHT: $4155.00 per 44,000-pound truckload

Thank you,
Jennifer

Calgon Carbon Corporation – A Kuraray Company
Senior Technical Sales Representative
Cell phone: (717)743-9754
Email: jennifer.shultz@kuraray.com
www.calgoncarbon.com

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From: Sonnet Agran-St. Pierre <sagran-stpierre@anchorqea.com>
Sent: Tuesday, April 11, 2023 9:44 AM
To: Shultz, Jennifer <Jennifer.Shultz@kuraray.com>
Subject: [External]RE: Calgon Carbon Corporation Contact

Hi Jennifer,

I just wanted to follow up on the GAC estimate following our conversation last week.

Thanks much,
Sonnet

Sonnet Agran-St. Pierre | ANCHOR QEA, LLC
Professional Staff

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From: Shultz, Jennifer <Jennifer.Shultz@kuraray.com>
Sent: Monday, April 3, 2023 4:39 PM
To: Sonnet Agran-St. Pierre <sagran-stpierre@anchorqea.com>
Subject: Calgon Carbon Corporation Contact

Hello Sonnet,

My colleague, Carol Johnston, shared your inquiry with me today. I am the Technical Sales Representative that can help you with F400. I did leave a voicemail for you. Please call at your convenience.

Thank you,
Jennifer

Calgon Carbon Corporation – A Kuraray Company
Senior Technical Sales Representative
Cell phone: (717)743-9754
Email: jennifer.shultz@kuraray.com
www.calgoncarbon.com

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From:	Elizabeth Hlasnicek
To:	Sonnet Agran-St. Pierre
Cc:	Pam McSwain
Subject:	RE: New submission from website contact form
Date:	Wednesday, March 29, 2023 10:54:05 AM
Attachments:	Anchor QEA-Sonnet Agran-St. Pierre-3-29-2023.pdf

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Good Afternoon Mr. St. Pierre

Thank you for your quote request. Please find your quote attached.

Let me know if you need additional information or have any questions.

Have a great day!

Best Regards,

Elizabeth

Parker Systems Inc.
757-485-2952
ehlasnicek@parkersystemsinc.com

From: Pam McSwain <pmcswain@parkersystemsinc.com>
Sent: Wednesday, March 29, 2023 12:37 PM
To: Elizabeth Hlasnicek <eHlasnicek@parkersystemsinc.com>
Subject: FW: New submission from website contact form

Pam McSwain
Vice President Sales & Marketing
Parker Systems, Inc.
757-485-2952
pmcswain@parkersystemsinc.com
www.parkersystemsinc.com

Manufactured in the USA
52 years in business 1970-2022

From: Sonnet Agran-St. Pierre <sagran-stpierre@anchorqea.com>
Sent: Wednesday, March 29, 2023 12:36 PM
To: Pam McSwain <pmcswain@parkersystemsinc.com>
Subject: New submission from website contact form

Who do you wish to contact?*
Sales / Quote Inquiries
Name
Sonnet Agran-St. Pierre
Email
sagran-stpierre@anchorqea.com
Company
Anchor QEA
Comments
Hello, we have previously received a quote for a Custom Fabricated Super Heavy Duty Waterproof 28 oz. Urethane Tarpaulin (Approx. 40'x60') is this something you still provide and if so would you be willing to provide an updated estimate?

Quote

PO Box 6380 Chesapeake, VA 23323
Phone: 757-485-2952
Fax: 757-487-5872
www.parkersystemsinc.com

Customer

Anchor QEA
Sonnet Agran-St. Pierre
sagran-stpierre@anchorqea.com

Date	3/29/2023
Terms	Net 30 with approved credit
Quote #	32923EH
Valid Until	30 days
Manufacture Time	4-6 weeks ARO
Provided By	Elizabeth Hlasnicek
Email	ehlasnicek@parkersystemsinc.com

Item	Description	Qty.	U/M	Unit Price	Total
1	Tarp - 40x60 Urethane Part # AC-TARP40X60U Tarp 40' x 60', 28 oz. Urethane with grommets in corners	1	EA	$9,269.04	$9,269.04

FOB Chesapeake, VA 23323 NOT INCLUDED

Total $9,269.04

Comments:

** Lead times are standard and may vary. Call for earlier ship date if needed.
**** In the event of a new imposed Tariff, the Buyer will pay 100% of said Tarriff.**
** All amounts are in US Dollars