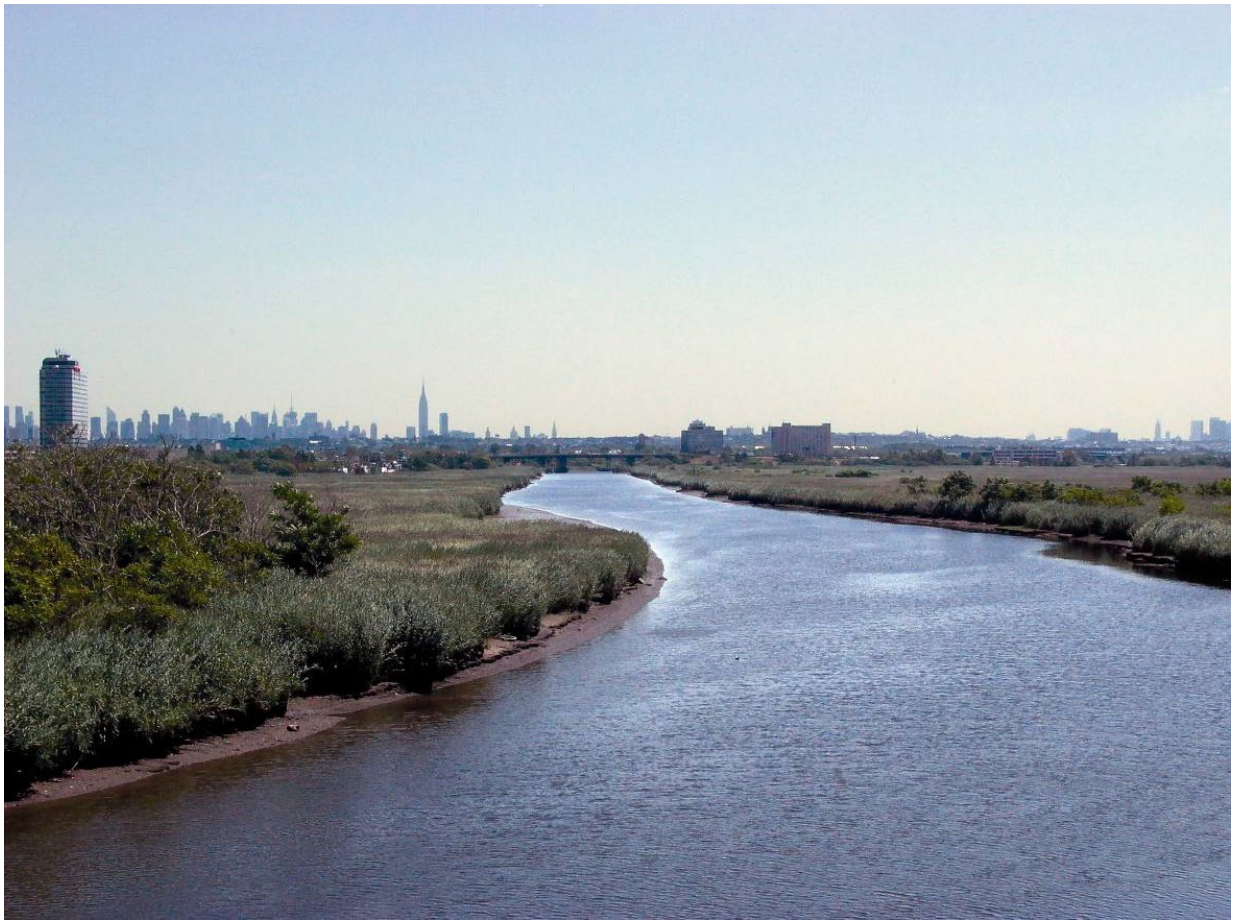

Berry's Creek Natural Resource Damage Assessment And Restoration

Damage Assessment Plan

DRAFT | APRIL 2026

United States Fish and Wildlife Service
National Oceanic and Atmospheric Administration

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List of Exhibits

List of Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
DIVER	NOAA Data Integration, Visualization, Exploration, and Reporting
DOC	U.S. Department of Commerce
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
HQ	hazard quotient
LOAEL	lowest observed adverse effect level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NPL	National Priorities List
NRDAR	Natural Resource Damage Assessment and Restoration
PAS	Preassessment Screen
NTCRA	Non-time Critical Removal Action
PAHs	polycyclic aromatic hydrocarbons
PEC	Probable Effects Concentration
PCBs	polychlorinated biphenyls
PI	Principal Investigator
ppb	parts per billion
ppm	parts per million
PRP	Potentially Responsible Party
QAP	Quality Assurance Plan
QA	Quality Assurance

QC	Quality Control
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
SCP	Scientific Chemical Processing
SQG	sediment quality guidelines
TRV	toxicity reference value
UOP	Universal Oil Products
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
V/V	Ventron/Velsicol

Executive Summary

Acting under their authority as natural resource trustees under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the U.S. Department of the Interior acting through the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration, collectively the Trustees, are conducting a natural resource damage assessment and restoration (NRDAR) for the Berry's Creek Watershed. This Berry's Creek NRDAR Damage Assessment Plan (Plan) describes the Trustees' proposed approach to conducting the NRDAR, summarizes existing data, confirms that natural resources have been exposed to hazardous substances, and outlines potential analyses and studies that may be used to evaluate contaminants and their effects on the natural resources and resource services of Berry's Creek. The Trustees intend to seek damages from potentially responsible parties with the goal of using recoveries to restore injured natural resources and lost natural resource services resulting from the releases of hazardous substances or oil. Throughout this process, the Trustees will communicate and coordinate with relevant federal and state agencies and the public to ensure that the assessment is conducted in a systematic manner and at a reasonable cost. This Plan is available for public comment for thirty days.

Berry's Creek. Photo courtesy of NOAA.

The Berry's Creek Watershed (Berry's Creek), situated in Bergen County, New Jersey, spans roughly 12 square miles and includes the 6.5-mile-long Berry's Creek, its tributaries, the Berry's Creek Canal, and surrounding wetlands. Together, the Hackensack River and Berry's Creek form part of the wetlands and marshes ecosystem in northeastern New Jersey, widely known as the Meadowlands. Berry's Creek contains three Superfund Sites: Ventron/Velsicol, Universal Oil Products, Inc., and Scientific Chemical Processing Inc. Operations at these facilities released hazardous substances including mercury, polychlorinated biphenyls, other metals, and oil (together, contaminants) into the environment. This resulted in the contamination of Berry's Creek and tidally connected open water, upland, and wetland habitat with high concentrations of mercury. Due to the nature and extent of the contamination, the United States Environmental Protection Agency added these three sites to the National Priorities List in 1983 and 1984. While remediation (i.e., cleanup) of Berry's Creek is beneficial, it does not compensate the public for natural resource injuries resulting from contaminant releases or the response action.

This Plan focuses on natural resources in Berry's Creek, including sediment, surface water, and biological resources such as benthic invertebrates, fish, and birds that utilize the open water, wetland, and upland habitats and that may have been exposed to hazardous substances released from the three NPL sites. This Plan also considers the ecological (e.g., food web) and human use (e.g., recreation) services provided by these resources. Building on existing information, the

Trustees will assess whether natural resources have been or are likely to have been injured as a result of exposure to the released contaminants.

If injury to natural resources is determined, the Trustees will quantify that injury to establish a basis for scaling restoration and quantifying damages consistent with CERCLA (42 U.S.C. § 9601 et seq.) and its implementing regulations (43 CFR Part 11). Quantification will account for the baseline condition of Berry's Creek natural resources (i.e., expected condition had the release of contaminants not occurred).

This Plan is available for the public to review. The Trustees are accepting written comments on this Plan for 30 days (May 6, 2026), (43 CFR § 11.32(c)(1)). Interested parties may submit comments in writing to:

Sean Bugel
U.S. Fish and Wildlife Service
4 E. Jimmie Leeds Road Suite 4
Galloway, NJ 08205
sean_bugel@fws.gov

A copy of this document is available for review online at:
https://www.diver.orr.noaa.gov/web/guest/diver-admin-record?diverWorkspaceSiteId=6832

And:
https://www.cerc.usgs.gov/orda_docs/DocHandler.ashx?task=get&ID=12732

Hard copies may be reviewed in person at:

Wood-Ridge Memorial Library
231 Hackensack Street
Wood-Ridge, NJ 07075

The Trustees will consider all written public comments on this draft Assessment Plan received during the public comment period prior to finalizing the Plan and will summarize their comment responses in an appendix to the Final Berry's Creek Assessment Plan.

CHAPTER 1 | Introduction and Background

Berry's Creek. Photo courtesy of NOAA.

Located in Bergen County, New Jersey, the Berry's Creek Watershed encompasses approximately 12 square miles.[1] The watershed includes the 6.5-mile-long Berry's Creek (headwaters near Teterboro Airport), its tributaries, the Berry's Creek Canal, and adjacent wetlands, and lies within a larger ecosystem of wetlands and marshes in northeastern New Jersey commonly known as the Meadowlands (Exhibit 1-1). Berry's Creek is one of the largest tidal tributaries of the lower Hackensack River, discharging into the river approximately 6 miles upstream of Newark Bay. In 1983 and 1984, the United States Environmental Protection Agency (EPA) listed three sites located within the Berry's Creek Watershed on the National Priorities List[2]: Ventron/Velsicol (V/V), Scientific Chemical Processing (SCP), and Universal Oil Products (UOP) (collectively, Facilities). For decades, chemical manufacturing, processing and recycling, waste recycling, solvent recovery, and waste disposal operations at these Facilities released hazardous substances including metals and organic compounds into the environment ("releases of hazardous substances" herein). Hazardous substances are still present in the Berry's Creek Watershed, exposing natural resources such as

[1] The Berry's Creek Watershed includes two sub-basins: 02030103180060 and 02030103180070 of the New Jersey Department of Environmental Protection 14-Digit Hydrologic Unit Code delineations for New Jersey. These sub-basins encompass both the tidal area that is the subject of the Berry's Creek Remedial Investigation and Feasibility Study (BCSA 2018) as well as the surrounding upland portions of the watershed.

[2] "The National Priorities List (NPL) is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation." (USEPA 2023). See also Section 105(a)(8)(B) of the Comprehensive Environmental Response, Compensation, and Liability Act.

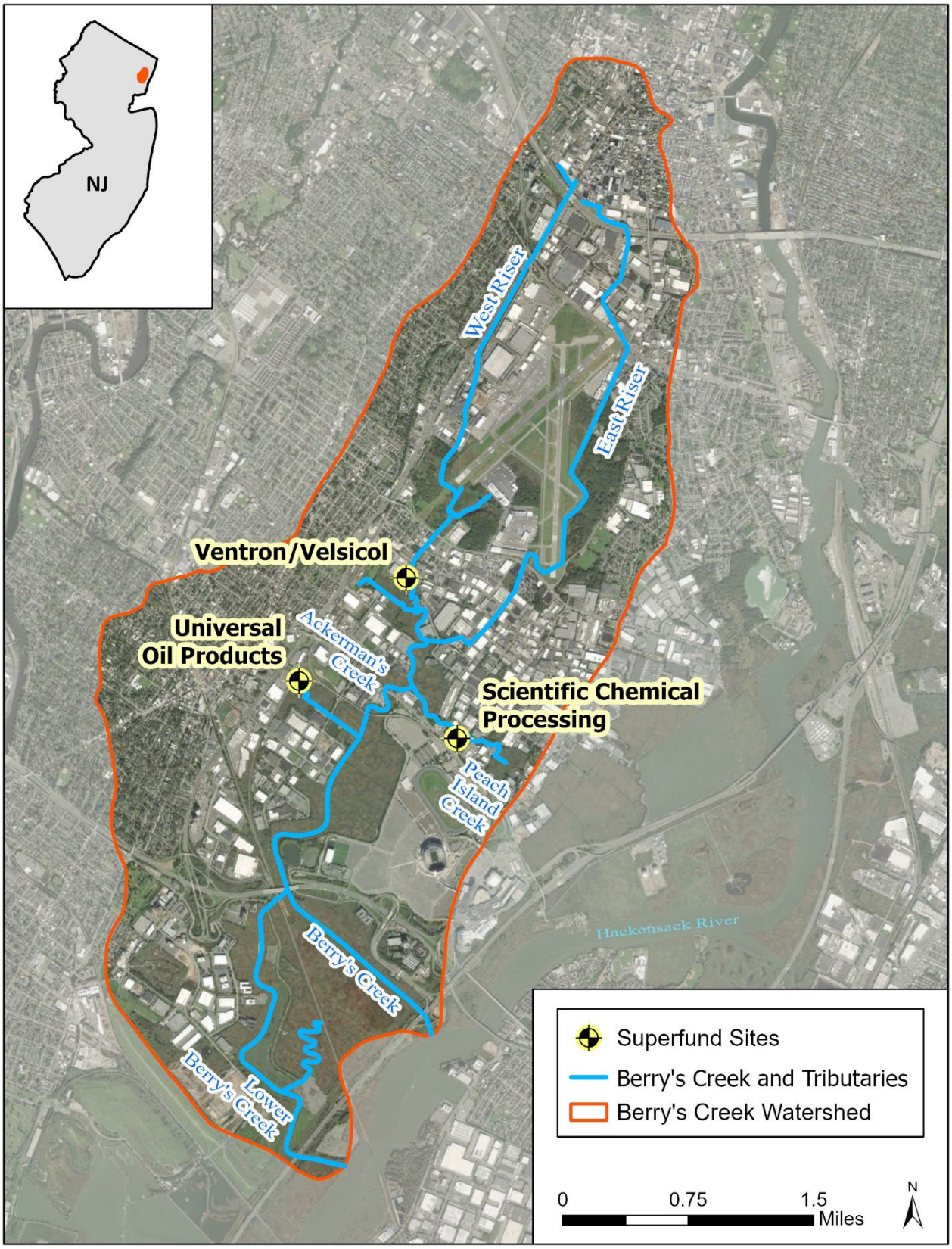
sediment, soil, invertebrates, fish, birds, and other wildlife to concentrations that may cause adverse effects. Berry's Creek is contaminated with mercury at high concentrations. While mercury is one of the primary contaminants of concern in the Berry's Creek system, other contaminants including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and other metals were released into the environment from the Facilities at levels of concern for human health and ecological receptors.

The National Oceanic and Atmospheric Administration (NOAA) and the United States Fish and Wildlife Service (USFWS), acting on behalf of the Department of the Interior (DOI) (collectively, the Trustees) are designated to act on behalf of the public as Trustees for natural resources (40 CFR §§ 300.600-605). Federal regulations authorize natural resource trustees to pursue claims for natural resource damages when natural resources and associated services have been injured by releases of hazardous substances.[3] For example, the Comprehensive Environmental Response, Compensation, and Liability Act as amended (CERCLA) establishes an administrative process for conducting a natural resource damage assessment and restoration (NRDAR) to determine and quantify injury; determine corresponding damages; and identify, select, and implement restoration to compensate the public for injuries to natural resources and associated lost services (i.e., ecological functions and human uses of natural resources; 43 CFR Part 11).[4] This Assessment Plan is one of the documents identified in the CERCLA NRDAR regulations.

[3] Hazardous substances as defined in section 101(14) of CERCLA.

[4] While following these regulations is optional, trustees who conduct an assessment consistent with these regulations are entitled by law to a rebuttable presumption in any subsequent litigation concerning the natural resource damages claim (42 U.S.C. § 9607(f)(2)(C); 43 CFR § 11.10).

Exhibit 1-1 Berry's Creek Watershed and Approximate Location of Superfund Sites



1.1 Purpose and Overview

The purpose of this Assessment Plan is to describe the Trustees' approach for conducting a NRDAR for the Berry's Creek Watershed in a cost-effective manner. This Assessment Plan outlines the Trustees' proposed approaches for determining and quantifying natural resource injuries, lost services, and determining corresponding damages.

A natural resource damage claim includes:

1. The cost to restore, rehabilitate, replace, and/or acquire equivalent resources for the injured resources, and
2. "Compensable value," or the monetary value of the natural resource services that were lost pending the restoration of injured resources to their "baseline" condition.

Injury means a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource, resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance (43 CFR § 11.14(v)).

Services are the physical and biological functions performed by the resource including the human uses of those functions (43 CFR § 11.14(nn)).

Baseline means the condition or conditions that would have existed in the assessment area had the discharge of oil or release of the hazardous substance(s) under investigation not occurred (43 CFR § 11.14(e)).

Damages is a legal term for the amount of money sought by trustees as compensation for injury, destruction, or loss of natural resources. Damages include the costs of assessing injuries, as well as the costs of restoration (42 U.S.C. §§ 9601(6), 9607(a)(4)(C); 43 CFR § 11.14(l)).

WHAT IS INJURY?

In NRDAR, injury refers to a decrease in a natural resource's ability to provide services due to contamination. Examples include, but are not limited to:

- Lower nesting success in birds,
- Wetlands unable to support vegetation and animals, and
- Decreased quality of fishing experience due to consumption advisories

Regulatory definition at 43 CFR § 11.14(v)

WHAT ARE DAMAGES?

In NRDAR, damages refer to the amount of money needed to restore resources to their baseline condition (i.e., condition prior to the release of the hazardous substance(s)) and compensate for interim losses. Trustees seek these monies from parties responsible for contamination.

Regulatory definition at 43 CFR § 11.14(l)

WHAT ARE SERVICES?

Natural resource services are the physical and biological functions performed by the natural resources including the human uses of those functions.

Regulatory definition at 43 CFR § 11.14(nn)

By developing an Assessment Plan, the Trustees ensure that the NRDAR will be completed at a reasonable cost relative to the magnitude of damages sought. This Plan also communicates proposed assessment methodologies to the public so that anyone can provide feedback on the assessment process.

The Assessment Plan, as currently written, describes the Trustees' understanding of the studies and other actions (e.g., data review and analysis) that may be needed to confirm exposure to releases

of hazardous substances from the Facilities and quantify injury to natural resources and resource services. Inclusion of a study within this Plan does not guarantee that it will be undertaken, and studies not included within the Plan may be deemed necessary at a later date. Supplements to this Plan that describe additional or revised assessment studies, if needed, will be made available for public review.

1.2 Authority to Conduct a NRDAR

The NRDAR for the Berry's Creek Watershed is being conducted jointly by the Trustees pursuant to their respective authorities and responsibilities as natural resource trustees. The Trustees have each been designated as a natural resource trustee pursuant to Section 107(f) of CERCLA, 42 U.S.C. § 9607(f); Section 311(f)(5) of the Federal Water Pollution Control Act (also known as the Clean Water Act), 33 U.S.C. § 1321(f)(5); and Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR §§ 300.600 - 300.615. Under these authorities, trustees act on behalf of the public to implement a NRDAR, which includes:

- Seeking damages for the injury, loss, or destruction of natural resources belonging to, managed by, controlled by, or appertaining to a State or the United States[5], that resulted from releases of hazardous substances, including injuries resulting from response (i.e., cleanup) actions (43 CFR § 11.84(c)(2)); and
- Planning and implementing actions to restore natural resources and their services that were or will be in the future injured or lost as the result of releases of hazardous substances.

Pursuant to the NCP, the Secretaries of DOI and DOC act as Trustees for natural resources and their supporting ecosystems that are managed or controlled by DOI and DOC, respectively (40 CFR 300.600(b)). For the Berry's Creek NRDAR, the USFWS is acting on behalf of the Secretary of DOI as the Trustee for natural resources under DOI jurisdiction. NOAA is acting on behalf of the Secretary of DOC as the Trustee for natural resources under DOC jurisdiction. The Trustees have responsibility over natural resources including, but not limited to, invertebrates, fish, wildlife, endangered and threatened species, and their supporting ecosystems.

The Trustees decided to proceed with this NRDAR based on the results of a Preassessment Screen (PAS) completed on March 18, 2014 (NOAA and FWS 2014; 43 CFR §§ 11.23-11.25). In the PAS, the Trustees determined:

- A discharge of oil and/or a release(s) of a hazardous substance occurred;
- Natural resources for which the Trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release;
- The quantity and concentration of the discharged oil or released hazardous substance is sufficient to potentially cause injury to natural resources;

[5] Relevant natural resources also include those belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by a local government, any foreign government, any Indian tribe, or under certain circumstances, any member of an Indian Tribe (43 CFR § 11.14(z)).

- Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
- Response (i.e., cleanup) actions carried out or planned do not or will not sufficiently remedy injury to natural resources without further action.

Therefore, the Trustees concluded that: (i) all preassessment screening criteria were met, (ii) natural resources that the Trustees may assert trusteeship over have been or may have been injured, and (iii) there are several viable parties that are potentially responsible for the contamination released into the Berry's Creek Watershed (potentially responsible parties; PRPs).

Berry's Creek. Photo courtesy of EPA.

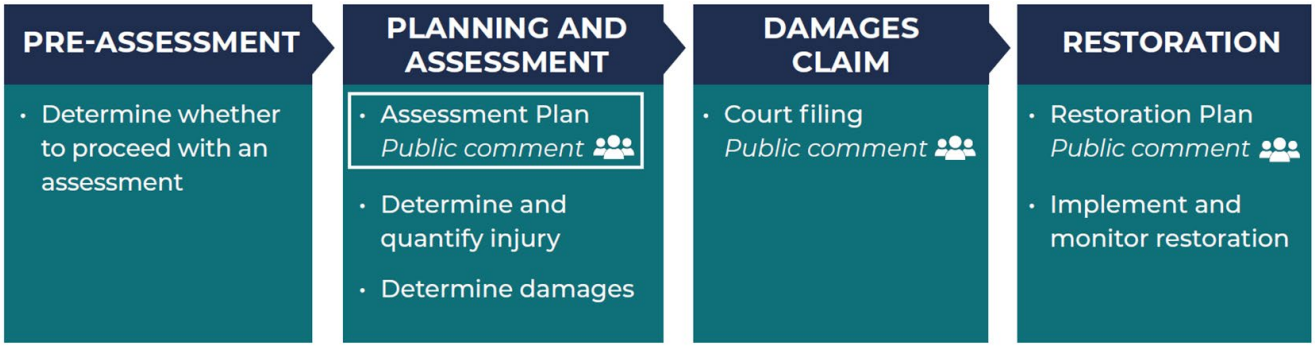
1.3 NRDAR Process Overview

The Trustees intend to conduct the Berry's Creek NRDAR consistent with the CERCLA NRDAR regulations at 43 CFR Part 11. This process includes the following phases (Exhibit 1-2):

- Preassessment (completed),
- Assessment (underway), and
- Post-Assessment.

Relevant documents will be electronically posted to an Administrative Record that will be made available to the public (see Section 1.5.1).

Exhibit 1-2 NRDAR Process Overview



As noted above, the Trustees have completed the Preassessment Phase with the public release of the PAS in 2014. The PAS determined there is a reasonable probability a successful claim can be made for damages to natural resources over which the Trustees have trusteeship and concluded that a natural resource damage assessment is justified. The PAS provided the basis for the Trustees' conclusion that further investigation was warranted based on readily available information of the exposure to and effects of releases of hazardous substances on natural resources.

The Trustees subsequently sent a notice of intent to initiate a NRDAR to the PRPs on June 30, 2014 (Natural Resource Trustees 2014; 43 CFR § 11.32(a)(2)(iii)(A)-(B)).

The Trustees are now in the Assessment Phase, which may include, as necessary:

- Assessment Plan (43 CFR §§ 11.30-11.38);
- Injury determination, including pathway determination (43 CFR §§ 11.61-11.64);
- Injury quantification, including baseline services determination and resource recoverability analyses (43 CFR §§ 11.70-11.73); and
- Damages determination (43 CFR §§ 11.80-11.84).

This Assessment Plan describes the Trustees' approaches to injury determination and quantification and the initial components of damages determination. The Trustees anticipate describing the remainder of the damages determination process in a separate plan that will also be available for public review and comment.

1.4 Coordination with Other Activities

The CERCLA NRDAR regulations support the coordination of a damage assessment, to the extent possible, with response actions or other investigations being performed pursuant to the NCP (i.e., cleanup activities). Consistent with 43 CFR § 11.31(a)(3)), the Trustees recognize the benefits of this coordination, as integration of Trustee considerations into remedial decisions may reduce or resolve certain natural resource damages, and/or decrease the cost of assessment activities through design and implementation efficiencies.

A brief description of the Facilities is included in Section 2.2, and a summary of Remedial Activities to-date is included in Appendix C.

1.5 Public Participation

Public participation is an integral part of the NRDAR process. To that end, this Assessment Plan is available for the public to review. The Trustees are accepting written comments on this plan for 30 days (May 6, 2026) (43 CFR § 11.32(c)(1)). Interested parties, including individuals, organizations, companies, and agencies, may submit comments in writing to:

Sean Bugel
U.S. Fish and Wildlife Service
4 E. Jimmie Leeds Road Suite 4
Galloway, NJ 08205
sean_bugel@fws.gov

A copy of this document is available for review online at:
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And:
https://www.cerc.usgs.gov/orda_docs/DocHandler.ashx?task=get&ID=12732

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The Trustees will consider all written public comments on this draft Assessment Plan received during the public comment period prior to finalizing the Plan and will summarize their comment responses in an appendix to the Final Berry's Creek Assessment Plan. Development of the Assessment Plan, the public comment process, and finalization of the Assessment Plan is performed solely by the Trustees. As the NRDAR proceeds and new information becomes available, the Trustees may modify the Assessment Plan. In the event of a significant modification, the Trustees will provide the public with an opportunity to comment on that amendment (43 CFR 11.32(e)).

1.5.1 Administrative Record

Pursuant to 43 CFR § 11.91(c), the Trustees are compiling information relied upon to plan and conduct the NRDAR, including this Plan. Documents are housed online through NOAA's Data Integration, Visualization, Exploration, and Reporting (DIVER) platform at:https://www.diver.orr.noaa.gov/web/guest/diver-admin-record?diverWorkspaceSiteId=6832.

1.6 Plan Organization

The remaining chapters in this plan are organized as follows:

- **Chapter 2 – Assessment Area and Natural Resources and Services:** This chapter provides an overview of the natural resources in the Berry's Creek Watershed, including the geographic scope and a summary of the Assessment Area's natural resources and the services they provide.
- **Chapter 3 – Injury Assessment and Pathway Determination Approach:** This chapter outlines the potential pathways of released hazardous substances from Berry's Creek operations to natural resources, describes information demonstrating injury to natural resources, and provides an overview of the Trustees' approach to determining injury resulting from these releases.
- **Chapter 4 – Injury Quantification and Damages Determination Approach:** This chapter discusses the framework for quantifying injury to natural resources and the services they provide (accounting for baseline) and the Trustees' proposed methods for determining damages.

CHAPTER 2 | Assessment Area and Natural Resources and Services

This chapter describes the physical and biological characteristics of the area within which the Trustees are assessing injury and damages for the Berry's Creek NRDAR, provides an overview of the Facilities, and summarizes the natural resources and resource services in the Assessment Area.

Berry's Creek. Photo courtesy of USFWS.

2.1 Assessment Area and Affected Natural Resources

An Assessment Area is defined as:

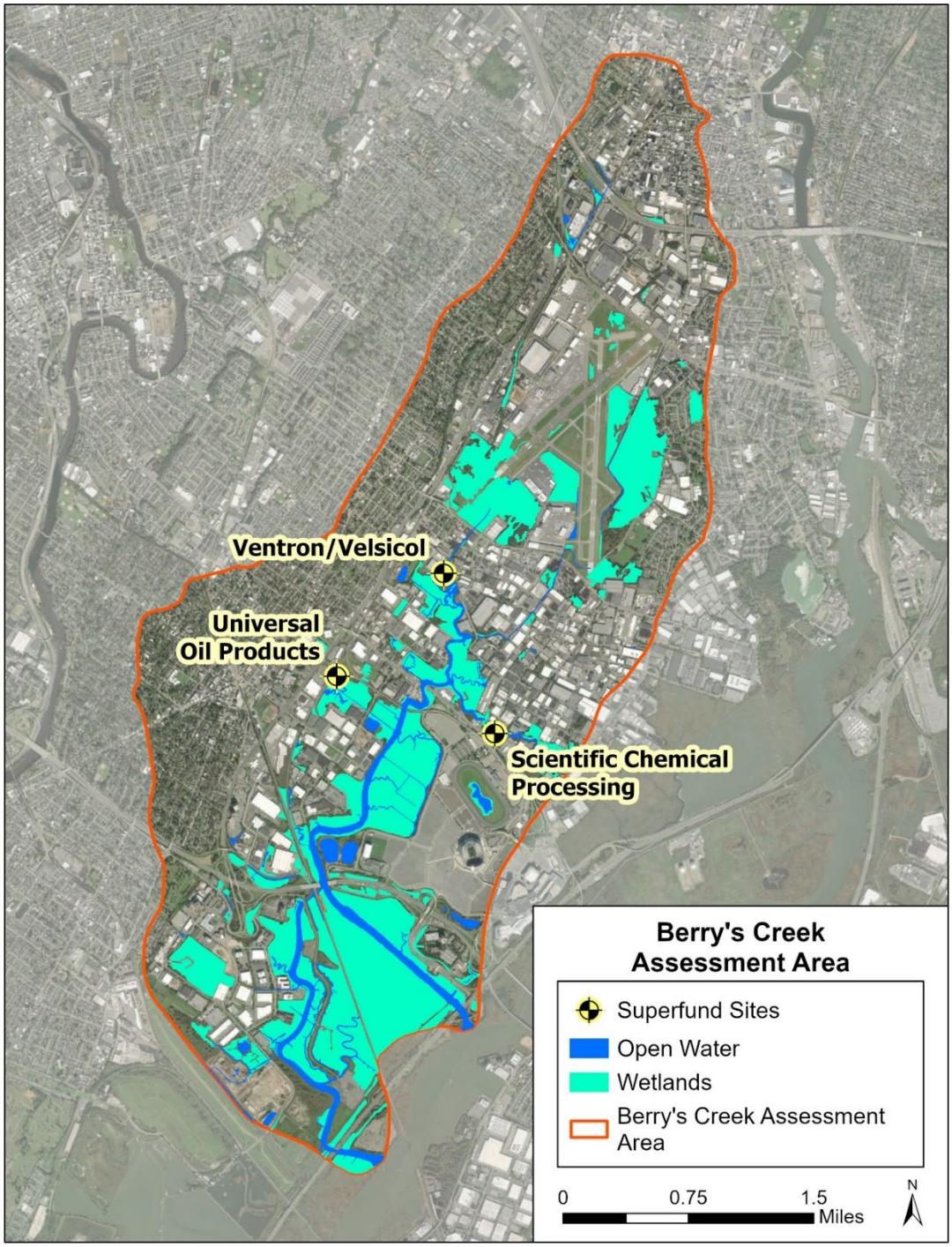
> *The area or areas within which natural resources have been affected directly or indirectly by the discharge of oil or release of a hazardous substance and that serves as the geographic basis for the injury assessment* (43 CFR § 11.14(c)).

The Assessment Area for the Berry's Creek NRDAR includes the areas where hazardous substances released from the Facilities have come to be located, as well as areas that may have been negatively impacted by cleanup actions or will be in the future. Based on the CERCLA NRDAR regulations; the industrial history of the Facilities; the completed, ongoing, and proposed remedial actions; and a review of available data, the Trustees identified the Berry's Creek Study Area as the area within which ecological and human use losses will be evaluated (Exhibit 2-1). The Assessment Area includes over 1,400 acres of open water and wetland habitat[6] (Exhibit 2-2).

[6] Open water is generally consistent with "waterways" in the RI and wetlands are generally consistent with "marshes" in the RI (BCSA 2018).

The Trustees may expand or revise the geographic scope of their studies as the assessment progresses.

Exhibit 2-1 Map of Assessment Area



The Assessment Area is located in the urbanized Berry's Creek Watershed within the Hackensack Meadowlands in Bergen County, New Jersey. Several factors influence water flow, sediment transport, and water quality characteristics. For example, the twice-daily tides in the Assessment Area have a range of approximately six feet and are primarily responsible for the delivery and distribution of sediments in the Assessment Area (BCSA 2018). The Assessment Area is also influenced by the relative balance of inputs from both the Hackensack River and freshwater upland sources. Moving north (upstream) from the Hackensack River, Berry's Creek becomes increasingly narrower, shallower, and less salty (BCSA 2018).

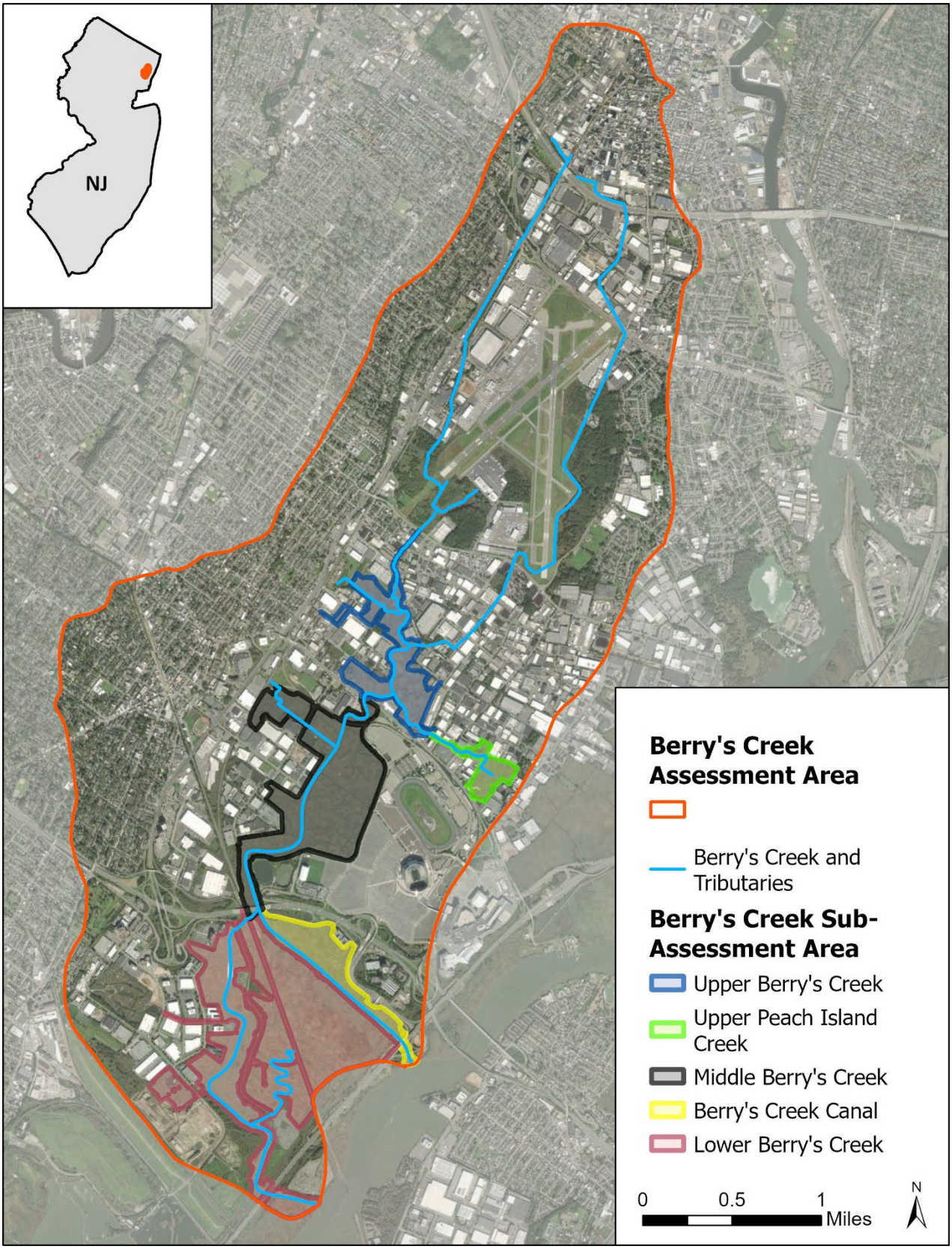
To account for the range in natural resource exposure to and projected recovery from releases of hazardous substances, the Assessment Area is divided into geographic sub-sections, with boundaries defined by a combination of the following factors:

- Physical characteristics, such as waterway width and salinity;
- Hydrological characteristics, such as flow rate or volume, hydrologic connection between open water and wetlands, intersection with other waterways (e.g., Berry's Creek and Peach Island Creek); and
- Infrastructure, such as streets.

Sub-sections include Upper Berry's Creek, Middle Berry's Creek, Berry's Creek Canal, Lower Berry's Creek, Peach Island Creek, and the Risers (Exhibit 2-2).

Striped bass. Photo courtesy of the Smithsonian Institution.

Exhibit 2-2 Assessment Area Sub-Assessment Areas



2.2 Facilities

As mentioned in Chapter 1, three Superfund sites are located within the Berry's Creek Watershed: Ventron/Velsicol, Scientific Chemical Processing, and Universal Oil Products.

- **The V/V site,** in the boroughs of Wood-Ridge and Carlstadt, New Jersey, operated as a mercury processing plant from 1929 to 1974. Prior to 1927, most of the site was marshes. Discharge from the plant passed through a private sewer and ultimately flowed into Berry's Creek. In addition, waste (e.g., chemical waste) from site operations was disposed of on-site, including approximately 160 tons of waste that were buried on the property (USEPA 2011c as cited in NOAA and USFWS 2014). After being demolished in 1974, the V/V facilities were replaced with a food distribution center and a warehouse. The V/V site was placed on the NPL in 1984. Mercury, methylmercury, and PCBs are the primary contaminants of concern at the V/V site, with elevated levels detected in surface water, sediment, and biota,[7] but other metals such as cadmium, chromium, copper, iron, lead, silver, thallium, and zinc were also used on-site (Exponent 2000). Surface waters at the site include Berry's Creek, associated wetlands, various ditches, and a small on-site basin. Groundwater exists at depths ranging from two to eight feet below ground surface and discharges into Berry's Creek (NJDH 2016). Most of the developed area of the site is located within the 10-year floodplain and the entire site is located within the 100-year floodplain (Exponent 2000).
- **The SCP site** is located along Peach Island Creek in Carlstadt, New Jersey. The six-acre site operated as a chemical recycling and waste processing plant from 1941 to 1980, handling the recovery and disposal of industrial wastes (USEPA 2002, USACE and USEPA 2005 as cited in NOAA and USFWS 2014). In 1970, SCP Company Inc. leased the property from Inmar Associates, and operated until the company was shut down by court order in 1980. A variety of hazardous materials were stored on-site and ultimately migrated into soils and groundwater (a shallow aquifer underlain by a clay layer and a till aquifer; USEPA 2012). The SCP site was placed on the NPL in 1983, with the primary contaminants of concern including PCBs, volatile organic compounds (VOCs), metals, and 1,4-dioxane. The upland portion of the site is currently a solar panel field with a land use designation of "light industrial" (USEPA 2022a, 2024b; NOAA and USFWS 2014).
- **The UOP site,** which encompasses 75-acres in East Rutherford, New Jersey, supported chemical manufacturing beginning in 1932, including ink, lacquer, coatings, and enamel production, and an aroma chemical laboratory. In 1955, a solvent recovery and waste handling facility was also constructed and began operating (NOAA and USFWS 2014, USEPA 1999, 2019). Wastewater and solid chemical wastes were stored in two holding lagoons. Between 1956 and 1971, seepage from the lagoons and the handling of waste materials resulted in releases of hazardous substances to the surrounding soil, groundwater, surface water, and tidal marshes. UOP Company purchased the facility in 1963 and became the owner and operator. The Signal Companies purchased the operations in 1975. The Signal Companies merged with Allied Corporation in 1985 forming Allied-Signal, Inc. which merged with Honeywell International Inc. in 2002 (USEPA 2019).

[7] Biota are the plants and animals in a habitat or region.

The primary contaminants at this site are PCBs and PAHs, but metals were also released to the environment. The UOP site was placed on the NPL in September 1983 (USEPA 2024c); an upland portion of the site was subsequently removed from the NPL in February 2024 (USEPA 2024a). Ackerman's Creek, a system of natural and constructed tidal surface-water channels, flows through the site to Berry's Creek. Groundwater occurs in two strata, a shallow aquifer is tidally influenced which flows toward and discharges into Ackerman's Creek and a lower confined aquifer (ENSR 1997; USEPA 2019, 2021).

2.3 Natural Resources

Natural resources include land, fish, wildlife, biota, air, water, and other such resources belonging to, managed by, or held in trust by the United States. The NRDAR regulations organize these resources into five categories: surface water (including sediments), groundwater, air, geological (including soil), and biological (plants and animals; 43 CFR § 11.14(z)).

Spotted sandpiper. Photo courtesy of USFWS.

This Plan focuses on the surface water, sediment, and biological resources in the Assessment Area, and the ecological and human use services provided by these resources.

Properly functioning surface water and sediment are essential for a healthy ecosystem and directly and/or indirectly support numerous biological resources. Biological resources are defined in the CERCLA NRDAR regulations as those natural resources referred to in Section 101(16) of CERCLA as fish, wildlife, and other biota including marine and freshwater species; aquatic and terrestrial species; game, non-game, and commercial species; threatened and sensitive species (designated by federal or state law); and other living organisms that are otherwise not listed in the definitions (43 CFR § 11.14(f)). Biological resources exposed or potentially exposed to hazardous substances include the plants, invertebrates, fish, birds, amphibians, reptiles, and mammals that utilize the open water and wetland habitats in the Assessment Area.

The **plant** community in Assessment Area is comprised of approximately 268 plant species, 56 percent of which are native to New Jersey such as smooth cordgrass and salt meadow cordgrass. *Phragmites*, a large perennial non-native invasive reed grass, and other non-native plant species are abundant and pervasive, including porcelain berry, tree-of-heaven, mugwort, and mile-a-minute vine (BCSA 2018).

There are at least 92 taxa of **invertebrates** in Assessment Area wetlands, including worms (e.g., polychaetes), amphipods, spiders, and crustaceans (e.g., Fiddler crabs) (BCSA 2018).

Although data on **amphibians** and **reptiles** in the Assessment Area is not available, these resources inhabit the Hackensack Meadowlands. Species include the northern spring salamander (*Gyrinophilus porphyriticus*), northern diamondback terrapin (*Malaclemys terrapin*), snapping turtles (*Chelydra serpentina*), and several frogs (e.g., *Rana temporaria*) (USFWS 2007 as cited in NOAA and USFWS 2014; Albers et al. 1986; NOAA and USFWS 2014). Mercury data is available for turtles in the Meadowlands including snapping turtles in Moonachie Creek marshes and terrapins between Berry's Creek and Kearney Marsh (Galluzzi 1981, as cited in Albers et al. 1986).

Twenty-one species of fish were collected during two **fish** community surveys in the Assessment Area. These surveys showed that open water habitats are dominated by mummichog and white perch, which together represent approximately 84 percent of the total number of fish surveyed (~48 percent mummichog, ~36 percent white perch). Banded killifish represented approximately 12 percent of the fish surveyed, with other species typically represented by less than 0.5 percent each (BCSA 2018).

A variety of **bird** species use the open water and wetland habitats in the Assessment Area. Shorebirds include spotted sandpiper, killdeer, and plovers. Wading birds include great egret, snowy egret, great blue heron, black-crowned night heron, yellow-crowned night heron, and bittern species (BCSA 2018). Raptors include bald eagles and ospreys (NOAA and USFWS 2014). Waterfowl include mallard, Canada goose, cormorant, and a variety of gulls (BCSA 2018). Songbirds include marsh wren, red-winged blackbird, song and swamp sparrow, yellow warbler, and swallow species (Tsipoura 2020).

Great blue heron. Photo courtesy of NPS.

Small **mammals** such as muskrat, little brown bat, and raccoon have been reported in the Assessment Area, some of which consume prey from Berry's Creek aquatic habitats, (Louis Berger Group 2001, Barrett and McBrien 2007, as cited in NOAA and USFWS 2014).[8]

Examples of biota that are found within the Assessment Area are presented in Exhibit 2-3.

Although no site-specific data are available, several State listed endangered and threatened species are also likely to use the Assessment Area and are presented in Appendix B (NJDEP 2012a, 2012b, 2012c as cited in NOAA and USFWS 2014).

[8] Although not common, harp seals (*Pagophilus groenlandicus*) and harbor seals (*Phoca vitulina*) were seen in the Hackensack River in 2010 and 2011 (NJMC 2010, 2011 as cited in NOAA and USFWS 2014).

Exhibit 2-3 Examples of Species Found within the Assessment Area

Species Type	Common Name	Scientific Name
Plants	Smooth cordgrass	*Spartina alterniflora*
	Salt meadow cordgrass	*Spartina patens*
	Common reed	*Phragmites australis*
	Mile-a-minute	*Persicaria perfoliata*
Invertebrates	Spider	*Various*
	Ladybug	*Coccinellidae*
	Long-legged fly	*Dolichopodidae*
	Blue crab	*Callinectes sapidus*
	Blue mussels	*Mytilus edulis*
	Ribbed mussel	*Geukensia demissa*
	Fiddler crab	*Uca spp.*
Fish	Atlantic silverside	*Menidia menidia*
	Gizzard shad	*Dorosoma cepediamum*
	Striped killifish	*Fundulus majalis*
	Striped bass	*Morone saxatilis*
	White perch	*Morone americana*
	Mummichog	*Fundulus heteroclitus*
Birds	Spotted sandpiper	*Actitis macularius*
	Bald eagle	*Haliaeetus leucocephalus*
	Great blue heron	*Ardea herodias*
Mammals	Meadow jumping mouse	*Zapus hudsonius*
	Muskrat	*Ondatra zibethicus*
	Eastern cottontail	*Sulvilagus floridanus*
	Little brown bat	*Myotis lucifugus*
	Red fox	*Vulpes vulpes*
	Raccoon	*Procyon lotor*
Reptiles	Snapping turtle	*Chelydra serpentina*

Species Type	Common Name	Scientific Name

Source: BCSA Final Remedial Investigation Report (BCSA 2018), Albers et al. 1986.

2.4 Natural Resource Services

As stated in Section 1.1, natural resource services are the physical and biological functions performed by the natural resources including the human uses of those functions and are a result of the quality of the resource (43 CFR § 11.14 (nn)). This includes both ecological and human use services.

2.4.1 Ecological Services

Each of the natural resources described above provides a variety of ecological services. For example, the wetlands and open waters of the Assessment Area contain aquatic plants that provide habitat and food resources for benthic invertebrates and fish. Wetland vegetation in particular provides protective cover, spawning, and nursery habitat for fish and wildlife, aids in nutrient cycling, maintains hydraulic flows, improves water quality by promoting sedimentation of particulate matter, sequesters carbon, and reduces storm surges. Invertebrates cycle nutrients, aerate sediment, and feed larger animals. Fish help control prey populations (e.g., algae, invertebrates including larval insects), comprise parts of the aquatic food web, and contribute to nutrient and energy cycling. Reptiles, amphibians, birds, and mammals feed on plants, invertebrates, and fish, contribute to nutrient and energy cycles, and connect aquatic and terrestrial ecosystems. Birds and mammals also serve as pollinators, scavengers, and seed dispersers.

2.4.2 Recreational Use Services

The Assessment Area provides potential opportunities for a variety of recreational activities such as fishing, crabbing, boating, swimming, and birdwatching. Recreational fishing and crabbing are currently and have historically been focused in and around waterway areas that are accessible from upland features such as bridges (NJDH 2016). Boating activity in Berry's Creek Canal mainly stems from the Hackensack River, with most boat traffic at the intersection of the Berry's Creek Canal and the Hackensack River (BCSA 2018).

CHAPTER 3 | Approach for Injury Assessment and Pathway Determination

The CERCLA NRDAR regulations define natural resource injuries as generally falling into two categories (43 CFR § 11.62). The first establishes injury based on physical, chemical, or biological changes to a resource due to contaminant exposure. Examples include changes in an organism's physical development, reproductive success, or survival. The second category establishes injury based on exceedance of regulatory criteria, including state health advisories recommending limits on consumption of contaminated biota. The Trustees plan to evaluate both types of injuries within the Assessment Area.

White perch. Photo courtesy of USFWS.

To determine injury in a planned, systematic manner and at a reasonable cost (43 CFR §§ 11.14(ee), 11.30(b)), the Trustees identified parameters on which to focus assessment efforts. The Trustees' approach will also emphasize the use of existing information, identification of data gaps, and evaluation of potential methods for addressing those data gaps. Studies will be implemented in phases to allow for subsequent adjustments in study design based on initial findings, as needed. Additionally, the Trustees will consider the relationship between injury and restoration to ensure that the metrics used to assess each of these components are comparable and that restoration will provide resources and resource services of a type and quality that are consistent with what was lost.

This Chapter identifies the hazardous substances released into the environment that the Trustees plan to focus on in this NRDAR, confirms exposure of natural resources to Facility-related contaminants, discusses pathways for those contaminants to reach natural resources, describes proposed approaches for determining injury to natural resources, and summarizes how the Trustees will evaluate the impacts of remediation.

3.1 Hazardous Substances

This NRDAR will focus on injuries resulting from exposure to hazardous substances released from the Facilities to the Assessment Area. These hazardous substances (also referred to as contaminants) include PCBs, mercury (including methylmercury), other metals, PAHs, and VOCs. To conduct this NRDAR efficiently and at reasonable cost, the Trustees are primarily focusing on injuries resulting from exposure to mercury and PCBs due to their elevated concentrations in Assessment Area sediment and biota sufficient to cause injury and persistence in the environment and to the overall mix of contaminants in the system. Details are provided below. The Trustees may assess injury resulting from natural resource exposure to additional individual contaminants of concern (COCs) as the NRDAR progresses or as new information becomes available.

3.1.1 Polychlorinated Biphenyls (PCBs)

PCBs are synthetic organic compounds manufactured from 1929 until EPA banned production in 1979 and required companies to phase out the use of PCBs by 1985 (USEPA 1979). PCBs were used primarily as insulating materials for electrical transformers and capacitors because of their chemical stability at high temperatures, but they were also used in diverse products such as paints and carbon copy paper. PCBs are persistent in the environment (i.e., do not readily degrade), accumulate in the fatty tissues of organisms, and bioaccumulate and biomagnify[9] through food webs (Eisler 2000).

PCBs can cause a range of adverse health effects in biota ranging from subtle to severe including impaired reproduction and death. Specific biological responses depend on the PCB mixture (there are 209 individual PCB compounds), and toxic effects are likely to be more severe at higher trophic levels due to biomagnification. PCBs are also classified as human carcinogens (i.e., as causing cancer; Lauby-Secretan 2015, IARC 2016).

3.1.2 Mercury

Mercury does not serve any biological function and is universally toxic in sufficient concentrations. Originally used in gold extraction and the production of mirrors, then in the chlor-alkali industry and in the production of electrical instruments, mercury is currently used in pharmaceuticals, agricultural fungicides, and in the production of plastics (Eisler 2000).

Mercury readily adsorbs (sticks) to sediment particles in aquatic systems. It can also be transformed into methylmercury (a more toxic form of mercury) through biological processes, becoming more bioavailable for uptake by biota.[10] Mercury bioconcentrates through food webs, which can affect higher trophic level organisms. At low concentrations mercury can cause adverse impacts to reproduction, growth, development, behavior, blood chemistry, vision, and metabolism, and at high concentrations is lethal (Eisler 2000).

3.1.3 Other Metals

Within the Assessment Area, concentrations of several metals including arsenic,[11] cadmium, chromium, copper, lead, nickel, and zinc have exceeded environmental guidelines or criteria for resources such as surface water and sediment. In aquatic environments, these metals adsorb to sediment or stay dissolved in the water depending on their chemical form (e.g., arsenic III or V) and environmental conditions (Eisler 1988). Some metals, such as cadmium, chromium, and lead, are likely to accumulate in sediment, especially if the sediment has a high organic content (Commonwealth of Australia 2010; John and Leventhal 1995). The extent to which metals other than mercury or methylmercury bioaccumulate generally varies with chemical form, organism, and environmental factors. The availability of these metals for biological uptake also varies, as some

[9] Bioaccumulation occurs when contaminants build up in an organism's body over time. Biomagnification occurs when animals consume contaminated prey, exposing organisms to increasing concentrations as one moves higher up in the food web.

[10] The majority of mercury measured in fish tissue is comprised of methylmercury (Bloom 1992, Lasorsa and Allen-Gil 1995, Kannan et al. 1998, Raymond and Rossmann 2009).

[11] Arsenic is a metalloid – an element whose properties are in between those of a metal and a non-metal.

bind to chemical complexes in sediment, which may limit the adverse impacts of exposure (USEPA 2005), although some metals bioaccumulate to high levels, e.g., arsenic, cadmium (NOAA 2025). When organisms are exposed, however, these metals can cause a range of adverse health effects including cancer, developmental delay, immunological issues, systemic effects, and death (ASTDR 2012).

3.1.4 PAHs

PAHs are organic compounds that occur naturally in coal, crude oil, and gasoline. They also are produced when materials such as coal, oil, gas, wood, garbage, and tobacco are burned. According to the Remedial Investigation for the BSCA, acenaphthene, acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, naphthalene, phenanthrene, and pyrene are PAHs considered contaminants of potential concern (BCSA 2018). PAHs tend to persist in the environment. In water, they generally adsorb to sediment, especially when the sediment has a high organic content (ATSDR 1995, Eisler 2000).

PAHs can cause a variety of developmental anomalies and tumors in fish and aquatic mammals, as well as other toxicological responses in organisms such as inhibited survival, growth, and reproduction (Eisler 2000, Incardona et al. 2004, Billard et al 2008, Geier et al 2017). Fish and other aquatic organisms exposed via water or through the consumption of contaminated sediment or food are particularly at risk. PAHs can bioconcentrate[12] in an individual organism as well as biomagnify through food webs, depending on the specific PAH and an organism's ability to absorb, metabolize[13], and excrete PAHs. However, because PAHs are readily metabolized by most fish and wildlife, they generally do not bioaccumulate significantly unless there is an active source (Honda and Suzuki 2020).[14]

3.2 Use of Available Data

The Trustees' general approach to the NRDAR is to review existing data including those collected as part of the Superfund response process, analyze data gaps, and then undertake additional studies or activities including testing and sampling as needed. This minimizes the cost of the assessment and maximizes the use of existing information.

3.3 Intent to Perform a Type B Assessment

As part of the assessment planning process, trustees decide whether to conduct a simplified assessment (Type A) or a comprehensive assessment (Type B) (43 CFR §§ 11.33-11.36). The Type A procedures, which use minimal field observations combined with computer models to generate a damage claim, are limited to the assessment of relatively minor, short duration discharges or releases (43 CFR § 11.34). Considering the complexities associated with the releases of hazardous

[12] Bioconcentration is the process by which the concentration of a chemical in an organism becomes higher than its concentration in the surrounding water.

[13] Metabolism is a chemical process in the body of an organism that involves breaking down a substance into smaller units (catabolism) and synthesizing complex substances from smaller units (anabolism).

[14] PAHs are sometimes found in higher concentrations in bile than in other tissue types (Honda and Suzuki 2020, Collier et al. 2013).

substances in the Assessment Area and that additional site-specific data can be collected at reasonable cost, the Trustees have concluded that the use of Type B procedures is appropriate and justified.

Before including any Type B methodologies in the Assessment Plan, the Trustees must confirm that at least one of the natural resources identified as potentially injured in the PAS has been exposed to a released hazardous substance (43 CFR § 11.37). These include surface water, sediment, aquatic and terrestrial invertebrates, fish, migratory birds, mammals, amphibians, reptiles, and plants. Confirmation of natural resource exposure to Facility-related hazardous substances is described in Sections 3.5 and 3.6.

This Plan also describes the information the Trustees expect to gather and the approaches the Trustees plan to apply to complete the three main steps of a Type B assessment identified in 43 CFR § 11.61, 11.70, and 11.80. These steps are described in Section 1.4.2 under Assessment Phase. This Plan satisfies the specific requirements for Type B procedures listed in 43 CFR § 11.31(c): confirmation of exposure (as noted above) and a Quality Assurance Plan that satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans (Appendix A).

3.4 Pathway

An important step in determining injury to natural resources is to establish a pathway from a known release of a hazardous substance to exposure of natural resources. Pathway is defined as the route or medium through which a hazardous substance was transported from the source of the release to the injured resource (43 CFR §11.14(dd)).

There is clear documentation of hazardous substance releases into the Assessment Area from all three Facilities, including direct discharges (e.g., outfalls, dumping, spills), landfills (e.g., contaminants leaching into groundwater), industrial facilities and operations (e.g., waste products), and other unpermitted discharges (BCSA 2018). For example:

- **V/V**: EPA testing around 1970 revealed the discharge of approximately two to four pounds of mercury per day into Berry's Creek (e.g., via a pipe draining directly into Berry's Creek). DEP estimated there were up to 160 tons of mercury buried beneath the property (Lipsky et al. 1980). Mercury-contaminated waste was also buried on-site, and groundwater has been contaminated with mercury and other metals (USEPA 2024d, USEPA 2011b, as cited in NOAA and FWS 2014).
- **UOP**: Solvents and waste chemicals were dumped into two unlined waste lagoons, resulting in PCB-contaminated soil, sludge, and shallow groundwater. The contaminated groundwater then seeped into Ackerman's Creek – a tributary to Berry's Creek (USEPA 1993).
- **SCP**: Under the 1987-1990 Remedial Investigation (RI), the site was found to contain PCB-contaminated soil, sludge, and shallow groundwater. The RI also found that this contamination had migrated into Peach Island Creek surface water and sediment (USEPA 2012).

Once discharged or released, contaminants moved – and continue to move – through the environment via abiotic[15] pathways.[16] Surface water, which includes waterbodies, stormwater runoff, and overland flow, transports contaminants from sources at the Facilities to other parts of the Assessment Area. For example, surface runoff flows from V/V into Upper Berry's Creek, from SCP into Peach Island Creek, and from UOP into Ackerman's Creek; these creeks then all flow into the main stem of Berry's Creek. Surface water can also infiltrate soil, moving contaminants into the subsurface and underlying groundwater, which carries the contaminants to surface waterbodies (e.g., Berry's Creek and tributaries). Contaminants can also adsorb to sediments and are transported along with sediment particles (NOAA and USFWS 2014). The measured concentrations of COCs in Assessment Area sediment and soil, described in Sections 3.2 and 3.4, as well as the PAS (NOAA and USFWS 2014), provide evidence of these pathways.

Once in the soil and sediment, COCs move through biological pathways. Based on the physical and chemical nature of the COCs, example biological pathways in the Assessment Area include, but are not limited to:

- Root uptake of COCs from contaminated sediments by aquatic plants;
- Direct contact with and ingestion of contaminated soil and sediment by invertebrates, fish and wildlife; and
- Consumption of contaminated prey (e.g., invertebrates, fish and wildlife) by crustaceans, fish, birds, and mammals, exposing upper trophic level organisms.

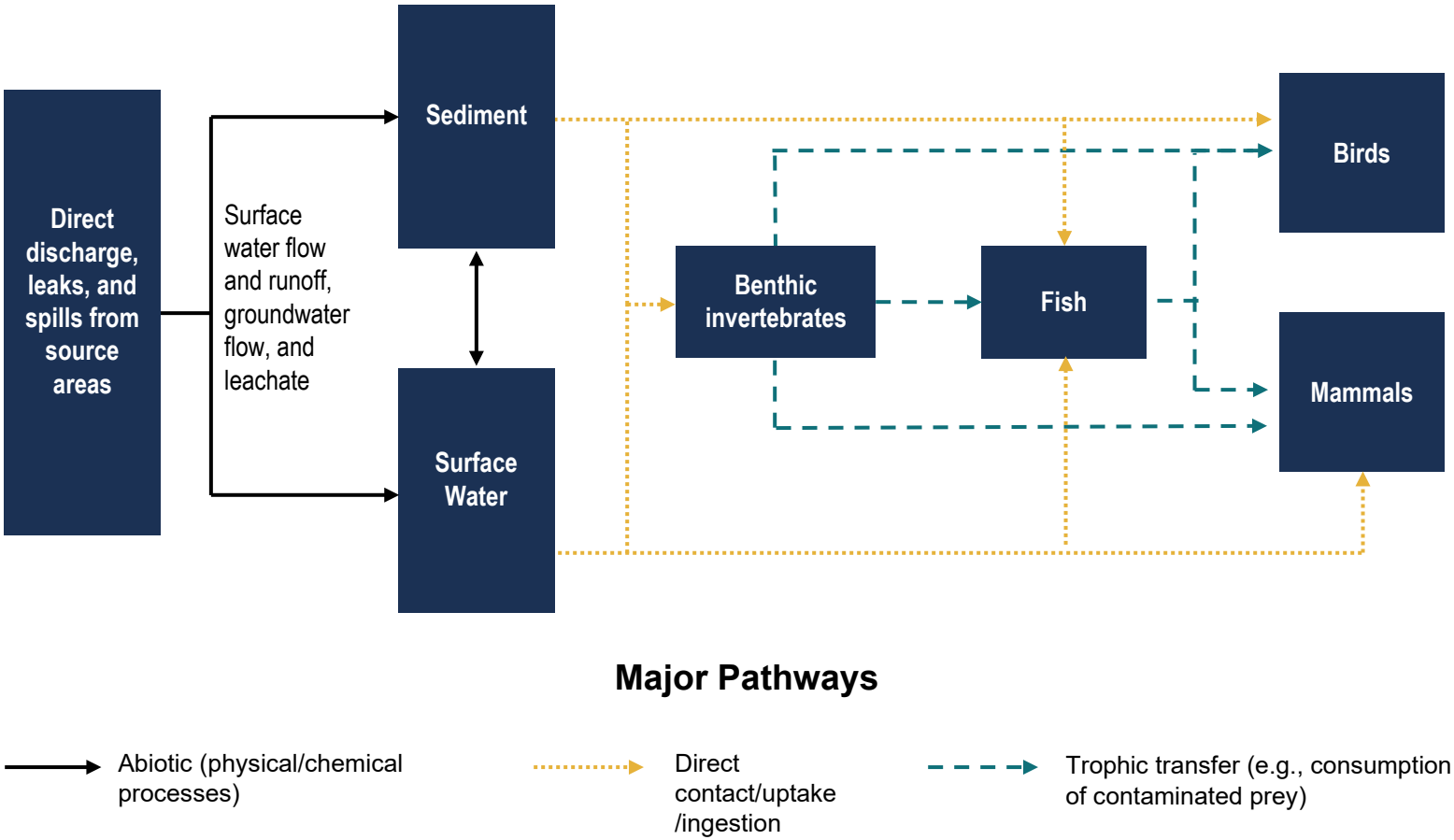
Food web transfer is an important factor in this NRDAR due to the potential of the COCs to bioaccumulate and biomagnify. For example, invertebrates are likely to accumulate and become a pathway for both PCBs and mercury (Eisler 2000, Walters et al. 2009, Janssen et al 2023). Consumers of invertebrates, such as fish and birds, are then exposed to these COCs in their diet. Exhibit 3-1 shows a conceptual site model that presents examples of abiotic and biotic pathways that likely occur in the Assessment Area. As the NRDAR proceeds, the Trustees may identify additional pathways of concern.

Spotted sandpiper. Photo courtesy of USFWS.

[15] Abiotic means physical or chemical, not biological.

[16] While air is a potential pathway for contaminant transport, it is not considered a significant pathway in the Assessment Area.

Exhibit 3-1 Example Conceptual Site Model for Berry's Creek Assessment Area Showing Major Pathways



3.5 Confirmation of Exposure

A natural resource has been exposed to a hazardous substance if all or part of the resource is, or has been, in physical contact with a hazardous substance or with media containing a hazardous substance (43 CFR § 11.14(q)). Consistent with 43 CFR § 11.31(c)(1) and § 11.37, this Assessment Plan documents that natural resources have been exposed to hazardous substances, thereby supporting the Trustees' decision to implement a formal assessment. Numerous sources, such as the PAS (NOAA and USFWS 2014), remedial documents (e.g., BCSA 2018), and scientific studies (e.g., NJMC 2003, ERM 1985) report measured contaminant concentrations in Assessment Area natural resources (e.g., surface water, sediment, and fish), confirming exposure of these resources to Facility-related contaminants, including PCBs and mercury. More detail on COC concentrations in Assessment Area resources and the use of these data to assess injury to those resources is presented in Section 3.6.

3.6 Injury to Natural Resources

The Trustees have confirmed natural resource exposure to contaminants, identified environmental pathways, and will evaluate whether injury to natural resources has occurred. This Plan focuses on assessing injury to natural resources in the Assessment Area, including:

- Injury to sediment (categorized as a surface water resource (43 CFR 11.14(pp)) based on adverse impacts to biota exposed to contamination in the sediment;
- Injury to animals based on the toxic effects of contaminants; and
- Injury to surface water, sediment, and animals based on exceedances of regulatory criteria, guidelines or the existence of consumption advisories.

3.6.1 Surface Water Resources Including Sediment

An injury to a surface water resource has resulted from the release of a hazardous substance if, for example:

- Concentrations of hazardous substances in surface water exceed applicable federal or state regulatory water quality criteria (e.g., established under section 304(a)(1) of the Clean Water Act or section 7:9B-1.14 of the N.J. Administrative Code).[17]
- Concentrations and duration of substances measured in suspended, bed, bank, or shoreline sediments are sufficient to have caused injury to biological resources (43 CFR 11.62(b)(1)).

The Trustees intend to use existing data, as well as any additional data to be collected as part of this NRDAR, to determine: 1) whether concentrations of COCs in surface water or sediments exceed applicable water quality criteria or sediment quality guidelines, and 2) whether COC concentrations in Assessment Area sediment are sufficient to injure biological resources, as described in Section 3.6.2. Other studies or analyses to further determine injury to sediment may be developed as necessary.

[17] The surface water must have met the criteria prior to the discharge or release of the hazardous substance(s) and have a committed use. Berry's Creek is classified as FW2-NT/SE, a fresh/saline-no-trout waterbody (New Jersey Administrative Code Section 7:9B-1.15).

Initial review of concentration data from surface water samples collected by EPA as part of the RI (2009–2015) demonstrates that surface water COC concentrations are higher than EPA's Recommended Water Quality Criteria for Aquatic Life (i.e., the concentration above which adverse effects to aquatic life are likely to occur; BCSA 2018, USEPA 2017). Surface water concentrations, for example, exceed the thresholds for mercury and PCBs throughout the Assessment Area, indicating injury to surface water has occurred (Exhibit 3-2). Exceedance of a regulatory criterion constitutes an injury under the CERCLA NRDAR regulations (43 CFR § 11.62(b)(1)(iii)).

Exhibit 3-2 Assessment Area Surface Water Concentrations of PCBs and Mercury and Corresponding Water Quality Criteria

Assessment Sub-Area	Mercury Concentration Range (ppb)[1,2,3]	Total PCBs Concentration Range (ppb)[1,2,3]
Criteria for Adverse Effects[5]:	0.77	0.014
Upper Berry's Creek	ND – 37.0	ND – 2.0
Upper Peach Island Creek	ND – 8.0	ND – 0.87
Middle Berry's Creek	ND – 9.4	ND – 0.87
Lower Berry's Creek	ND – 1.07	ND – 0.109
Berry's Creek Canal	ND – 13.0	ND – 0.42
East Riser Ditch	ND – 0.36	ND – 0.03
West Riser Ditch (Berry's Creek upstream of West Riser Tide Gate)	0.00071 – 1.54	ND – 0.1

Notes:

1. Data were compiled from the Draft Removal Action Report for West Riser Tide Gate Sediment Removal Project Appendix I – Table I1 (Parsons 2010) and the BCSA Final Remedial Investigation Report Appendix K – Attachment K3 and Appendix E – Attachment E3 - Table 1 (BCSA 2018) and may reflect only a sub-set of the available data.
2. ND = non-detect.
3. ppb = parts per billion.
4. Total PCBs are the sum of Aroclors.
5. Criteria are EPA's Recommended Criterion Continuous Concentration (chronic) freshwater Aquatic Life Water Quality Criteria as well as NJ Surface Water Quality Standards (NJAC 7:9B). These values represent the highest concentration of each contaminant that is not expected to pose a significant risk to the majority of species in freshwater (USEPA 2017). Per EPA, the mercury criterion of 0.77 ppb "might not be adequately protective" of certain fish species that are known to inhabit Berry's Creek, including the bluegill, "if a substantial portion of the mercury in the water column is methylmercury."

In addition, mercury and PCB surface sediment concentrations in the Assessment Area are significantly higher than relevant sediment quality guidelines (SQGs; Exhibit 3-3). For example, surface sediment mercury concentrations were measured up to 11,100 parts per million (ppm) in the top 2 cm and 89,162 ppm in a 15.24-22.86 cm sediment interval (NOAA 2025), which is more than four orders of magnitude greater than the mercury Probable Effects Concentration (PEC; 1.06

ppm; BCSA 2018, NJMC 2003, MacDonald et al. 2000)[18]. The PEC is the contaminant concentration above which adverse effects to sediment-dwelling biota are likely to occur (e.g., reduced growth, reproduction, and survival; MacDonald et al. 2000). Assessment Area surface sediment PCB concentrations were reported up to 2,000 ppm (top 30.48 cm), which is over three orders of magnitude greater than the PCB PEC of 0.676 ppm (BCSA 2018, MacDonald et al. 2000, NOAA DIVER Database – NOAA 2023)[18]. Note that these thresholds do not account for the potential for COCs to bioaccumulate or negatively impact consumers of benthic invertebrates.

Exhibit 3-3 Assessment Area Surface Sediment* Concentrations of Mercury and PCBs and Corresponding Sediment Quality Guidelines

Assessment Sub-Area	Mercury Concentration Range (ppm)[1,2,3]	Percent of Samples with Mercury Exceedance[1,2,3]	Total PCBs Concentration Range (ppm) [1,2,3]	Percent of Samples with Total PCBs Exceedance[1,2,3]
Probable Effects Concentration[4]	1.06		0.676	
Upper Berry's Creek	ND – 1,747	93%	0.007 – 31.6	65%
Upper Peach Island Creek	9.8 – 1,200	96%	0.086 – 13.0	73%
Middle Berry's Creek	ND – 1,490	84%	ND – 2,000	62%
Lower Berry's Creek	ND – 38.7	80%	ND – 2.5	17%
Berry's Creek Canal	ND – 49.0	87%	ND – 1.9	29%
East Riser Ditch	0.075 – 75.7	75%	0.047 – 2.87	100%
West Riser Ditch (Berry's Creek upstream of West Riser Tide Gate)[5]	0.22 – 11,100	92%	0.049 – 1	88%

*Maximum surface concentrations reported here (minimum depth of 0 cm; see #1 below) differ from those reported in the text preceding Exhibit 3-3, which describes the maximum concentrations of any slice in top 30 cm.

Notes:

1. Sediment data were compiled from multiple sampling studies between 1972 to 2016 (NOAA DIVER Database – NOAA 2023, except as noted in #5 below). DIVER has since been updated with additional data. Data are queried surface sediment samples in DIVER Explorer (extracts the first interval (top slice) between a minimum depth = 0 cm and a maximum depth = up to 30.48 cm). See Footnote 20 for more details. Note that the Trustees may revisit the depth of the biologically active zone as part of the NRDAR.
2. ND = non-detect.
3. ppm = parts per million.
4. The Probable Effects Concentration is the concentration of a contaminant in sediment above which adverse (i.e., toxic) effects to sediment-dwelling organisms are likely to occur (MacDonald et al. 2000).
5. An outfall historically discharged into the West Riser Ditch. A removal action was conducted in the West Riser Ditch between the West Riser Tide Gate and upstream railroad crossing in 2009 as part of the OU1 remedy (Parsons 2009, 2010).

[18] Maximum mercury and PCB concentrations were determined using surface sediment data from the DIVER database. See footnote 20 for additional details about how surface sediment is defined in DIVER.

3.6.2 Biological Resources

As described in Section 2.3, biological resources include plants, fish, wildlife, and other biota (43 CFR § 11.14(f)). Injury to a biological resource has resulted from the release of a hazardous substance if the concentration of the substance:

- Is sufficient to cause adverse changes to the biological resource or its offspring;
- In edible portions of the organisms exceeds action or tolerance levels established under section 401 of the Food, Drug, and Cosmetic Act (21 U.S.C 342); or
- Exceeds levels set by state health agencies for consumption (43 CFR § 11.62(f)(1)).

Therefore, injury to biological resources can be assessed through documented site-specific toxicity, exceedances of toxic effects thresholds, or the existence of a consumption advisory.

Information available for resources within the Assessment Area suggests that benthic invertebrates, fish, birds, and mammals have been exposed to and potentially injured by hazardous substances released from the Facilities (described below). The Trustees may also consider other resources as the assessment progresses, including species for which minimal data currently exist, or that are expected to be found in the Assessment Area, but have not been documented or are less common than expected. [19]

The Trustees intend to use existing data and other relevant information to the fullest possible extent to establish injury metrics. Additionally, the Trustees plan to consider a phased approach for developing studies or analyses as necessary to address any data gaps. These are cost effective strategies that are expected to comply with the definition and standard of reasonable cost described in 43 CFR § 11.14(ee).

[19] The text in Section 3.6.2 describes the biological resources for which substantial quantities of data have been collected (i.e., benthic invertebrates, fish, and birds). Minimal data exist for other biological resources found within the Assessment Area, such as mammals, reptiles (e.g., turtles), and plants. The Trustees acknowledge that additional biological resources beyond those described herein may have been injured by releases of hazardous substances, and may determine that additional assessment of those resources is warranted in the future.

Benthic Invertebrates

The potential for injury to benthic invertebrates is demonstrated by several lines of evidence:

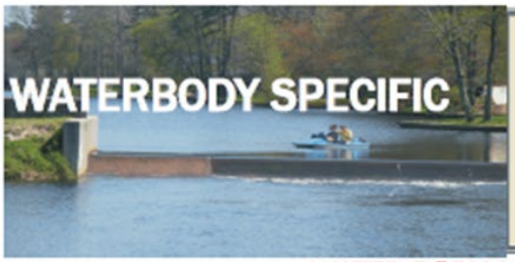
Berry's Creek. Photo courtesy of NOAA.

1. Site-specific 28- or 42-day sediment toxicity tests with the amphipod *Hyalella azteca* exhibited adverse effects, including reduced reproduction, growth, and survival, when exposed to Assessment Area sediment (BCSA 2017b).
2. Surface sediment concentrations (see footnote 24) of mercury and PCBs in the Assessment Area exceed SQGs, indicating that reductions in growth, reproduction, and/or survival are likely to occur (Exhibit 3-3). For example, 84 percent and 50 percent of surface sediment samples in the top slice[20] collected from 1972 to 2016 exceeded the PECs for mercury and PCBs, respectively (Exhibit 3-3; NOAA DIVER Database - NOAA 2023).
3. Breteler et al. (1981) implied that their inability to collect fiddler crabs from Berry's Creek could be due to elevated concentrations of mercury in sediments in comparison with the similar habitat (soil, vegetation) of nearby Saw Mill marsh where these crabs were found in abundance, and mercury concentrations were at least an order of magnitude lower.
4. Consumption advisories associated with mercury, PCBs, and dioxin contamination recommend restrictions on harvesting and eating blue crabs from the Newark Bay Complex, which includes Berry's Creek.[21] These advisories have been in place since 1983 (Exhibit 3-4; NJDEP 2024, 2019, 1993).

[20] This is based on a query of surface sediment in the DIVER database, which is defined therein as 0-30 cm. When querying data for "surface sediment", only the first interval (top slice) of sediment sampled is included in the output. As such, the start depth is 0 for all results, but the end depth can vary between samples and locations.

[21] For purposes of evaluating consumption advisories, the New Jersey Department of Environmental Protection and the New Jersey Department of Health define the Newark Bay Complex as including Newark Bay, the tidal portion of the Hackensack River, Arthur Kill, Kill Van Kull, and tidal tributaries such as Berry's Creek (NJDEP 2024).

Exhibit 3-4 2023 Fish and Shellfish Consumption Advisories That Apply to Berry's Creek



Newark Bay Complex

Including Newark Bay, tidal Hackensack River, Arthur Kill, Kill Van Kull and all tidal tributaries

WATER BODY SPECIFIC ADVISORIES

Fish Identification	Species	General Population EAT NO MORE THAN:	High Risk Population EAT NO MORE THAN:
	Blue Crab*	Do not Harvest or Eat [5]	Do not Harvest or Eat [5]
	Striped Bass*	Four meals per year	Do Not Eat
	White Perch	Four meals per year	Do Not Eat
	White Catfish	One meal per year	Do Not Eat
	American Eel	Four meals per year	Do Not Eat
	Bluefish	One meal per month	Do Not Eat
	Summer Flounder	One meal per month	Do Not Eat
	Atlantic Needlefish	One meal per month	Do Not Eat
	Rainbow Smelt	One meal per month	Do Not Eat
	Gizzard Shad	Do Not Eat	Do Not Eat

Notes:

Sources: NJDEP 2024, NJDEP and NJDOH 2019

1. High-Risk Individuals include infants, children, pregnant women, nursing mothers and women of childbearing age.
2. One meal is defined as an eight-ounce serving.
3. Eat only the fillet portions of the fish. Use proper trimming techniques to remove fat, and cooking methods that allow juices to drain from the fish (e.g., baking broiling, frying, grilling, or steaming).
4. Do not harvest means no taking or attempting to take any blue crabs from these waters.

Fish

The potential for injury to fish is demonstrated using two lines of evidence:

1. Some mercury and PCB concentrations measured in fish from the Assessment Area[22] (Exhibit 3-5) exceed thresholds above which adverse effects on endpoints such as growth, reproduction, and survival have been reported in the peer-reviewed literature. For example, between 1976 and 2021, mercury was measured up to 4.67 ppm in mummichog and 6.2 ppm in white perch, which are more than an order of magnitude greater than an example adverse effect threshold of 0.1 ppm (Dillon et al. 2010, NOAA 2023).[23] During that same time period up to 7.6 ppm PCBs in whole body mummichog and 19.5 ppm PCBs in whole body white perch were documented, which also substantially exceed example adverse effects thresholds of 0.3 ppm for the two fish species (BCSA 2018; Hugla and Thomé 1998; HMDC 1988, 1987; ERM 1985, NOAA 2023).
2. Fish consumption advisories recommend restrictions on eating fish from the Newark Bay Complex, which includes Berry's Creek[24] (Exhibit 3-4). These advisories have been issued with varying levels of severity since the early 1980s and are driven by contaminants such as mercury, dioxin, and PCBs (NJDEP 2024, 2019, 1993).

[22] Based on a review of whole-body fish tissue data, including fillet data converted to whole body concentrations using site-specific conversion factors derived from data in DIVER (mercury [0.62] and methylmercury [0.73]).

[23] In addition to white perch and mummichog, tissue samples from several other fish species collected within the Berry's Creek Study Area are available on DIVER (e.g., pumpkinseed, bullhead, common carp, and others). However, white perch and mummichog account for 99.3 percent of all available fish contaminant data.

[24] For purposes of evaluating consumption advisories, the New Jersey Department of Environmental Protection defines the Newark Bay Complex as including Newark Bay, the tidal portion of the Hackensack River, Arthur Kill, Kill Van Kull, and tidal tributaries such as Berry's Creek (NJDEP 2024).

Exhibit 3-5 Assessment Area Mummichog and White Perch Whole-Body Concentrations of Mercury and PCBs and Example Adverse Effect Thresholds for Fish and Birds

Assessment Sub-Area		Mercury Concentration Range (ppm)[1]	Total PCBs Concentration Range (ppm)[1]
Example Dietary Effects Thresholds for birds[2,3]		0.21	0.5
Mummichog	Example Effects Thresholds[4,5]	0.1	0.3
Upper Berry's Creek		0.02 – 4.67	0.25 – 6.63
Upper Peach Island Creek		0.15 - 0.53	0.01 – 2.85
Middle Berry's Creek		0.1 – 2.7	0.15 – 4.24
Lower Berry's Creek		0.02 – 0.78	0.03 – 1.18
Berry's Creek Canal		0.07 – 2.8	0.17 – 1.6
White Perch	Example Effects Thresholds[4,5]	0.1	0.3
Upper Berry's Creek		0.12 – 0.68	0.15 – 16
Upper Peach Island Creek		--	--
Middle Berry's Creek		0.16 – 4.5	0.11 – 19.5
Lower Berry's Creek		0.08 – 0.42	0.04 – 4.7
Berry's Creek Canal		0.06 – 6.2	0.06 – 4.41

Notes:

1. Data Sources: NOAA DIVER Database (NOAA 2023).
2. Dietary mercury bird threshold (reproductive endpoint): Burgess and Meyer 2008.
3. Dietary PCB bird threshold (biochemical endpoint): Peakall and Lincer 1970.
4. Mercury fish threshold (lethality endpoint based on whole body concentration): Dillon et al. 2010.
5. PCB fish threshold (lethality endpoint): Hugla and Thomé 1998, estimated from Figure 2.

Birds

While data on COC concentrations in Assessment Area birds are limited, the potential for injury to this resource can also be demonstrated through the consumption of contaminated prey (the main route of avian exposure to mercury and PCBs) and direct sediment ingestion. For example, fish are one of the main prey sources for birds in the Assessment Area. Whole body mummichog and white perch concentrations of mercury and PCBs in the Assessment Area exceed dietary-based adverse effects thresholds reported in the literature (e.g., concentrations above which adverse effects on avian reproduction are expected). Effects include reduced reproduction, hatching success, and survival (Exhibit 3-4).

Potential exposure of wading birds (represented by great blue heron and black-crowned night heron) and shorebirds (represented by spotted sandpiper) was also evaluated as part of the RI Baseline Ecological Risk Assessment (BCSA 2017a). Several lines of evidence indicate that birds have been exposed to and potentially injured by COC concentrations in the Assessment Area based on hazard quotient (HQ) ratios, which were calculated using bird dietary exposure and two

types of toxicity reference values (TRVs): no observed and lowest observed adverse effects levels (NOAEL and LOAEL[25]). An HQ ratio greater than 1 indicates exposure to COCs is sufficient to potentially cause an adverse effect. The RI Baseline Ecological Risk Assessment (BCSA Coordinating PRP Group 2017a) reports the following:

- For great blue heron, which eats primarily fish, the NOAEL-based HQ is 2 for mercury and ranges from 2 to 5 for total PCBs.
- For black-crowned night heron, which eats smaller fish and crustacean, the NOAEL-based HQ is 2 for mercury and 2 for total PCBs.
- For spotted sandpiper, which eats various aquatic invertebrates and is likely to ingest sediment when eating, the NOAEL-based HQ ranges from 2 to 4 for mercury and 2 to 6 for total PCBs.

Great blue heron. Photo courtesy of USFWS.

3.7 Injury Caused by Response Actions

While remedial actions can accelerate the recovery of natural resources by removing contamination, often remedial actions do not fully return natural resources and/or lost services to baseline conditions because remedial actions are designed to manage unacceptable immediate and future risks to human health and the environment. Further, remedial actions that involve sediment removal or capping, stream reconstruction, vegetation removal, or other physical alterations of the environment may also result in unavoidable, additional injury that is compensable under the CERCLA NRDAR regulations (43 CFR § 11.15(a)(1)). Remedial actions that have or may be undertaken within the Berry's Creek Assessment Area include, but are not limited to, the removal and backfilling or capping of contaminated soil and sediments, dewatering and off-site removal of dredged sediments, marsh excavation, long-term monitoring, and institutional controls (e.g., consumption advisories and other measures to protect placed caps) (USEPA 2018a, 2020).

The nature and extent of remedial injury, if any, will be directly related to the specific remedial actions conducted within the Assessment Area. The Trustees will identify and quantify the extent to which remediation affects natural resources -both positively through accelerated recovery and negatively by assessing physical injuries throughout the documented or expected timeframe of recovery. This evaluation will be based on a review of remedial documents that describe what remedial actions have occurred or are being planned and the timing of those actions, as well as the

[25] NOAEL-TRVs are values based on the highest contaminant concentration at which no adverse effect has been observed. LOAEL-TRVs are values based on the lowest contaminant concentration at which an adverse effect has been observed.

result, or expected result, in terms of habitat condition, or other relevant parameters (43 CFR §11.15(a)(1)).

As described in Appendix C, some remedial actions have already occurred at the three Superfund sites within the Assessment Area. Other remedial actions are ongoing or are planned for future implementation. For example, EPA's 2018 Record of Decision describes the interim actions for source control within the Assessment Area (e.g., sediment removal in waterways and marshes; USEPA 2018b). The Trustees will use this information to identify potential remediation-related impacts.

3.8 Summary of the Injury Determination Process

According to the NRDAR regulations, "The purpose of this phase is to establish that one or more natural resources have been injured as a result of the discharge of oil or release of a hazardous substance. …[T]he Injury Determination phase include[s] definitions of injury, guidance on determining pathways, and testing and sampling methods. These methods are to be used to determine both the pathways through which resources have been exposed to oil or a hazardous substance and the nature of the injury" (43 CFR 11.13 (1)).

Currently available data demonstrate that natural resources in the Assessment Area have been exposed to and potentially injured by the releases of Facility-related hazardous substances (e.g., sediment COC concentrations in exceedance of adverse effects thresholds, presence of fish and crab consumption advisories). The Trustees have identified specific categories of injury and corresponding resources that are the focus of NRDAR efforts, that is, the effects of COCs on surface water, sediment, and biological resources. The Trustees may consider additional research and analysis of existing information, as well as primary studies, to further determine injury to natural resources within the Assessment Area.

CHAPTER 4 | Injury Quantification and Damages Determination Approach

Once injury to natural resources has been determined, the Trustees intend to quantify that injury to establish a basis for scaling restoration and determining damages (43 CFR § 11.70(a)). Injuries to natural resources can be quantified in terms of the actual measured loss of specific resources and/or the services that the injured resources would have provided had the release of hazardous substances not occurred. In the quantification phase, the extent of the injury is measured, the baseline condition and services are identified, the recoverability of the injured resource is determined, and the reduction in services resulting from the hazardous substances are calculated (43 CFR § 11.70(c)). The Trustees plan to then determine damages using methods described in the CERCLA NRDAR regulations where applicable (43 CFR § 11.80).

The steps and approaches to quantify injury and determine damages are discussed below, including determination of baseline conditions and the temporal scope of the assessment.

4.1 Baseline

As mentioned in Section 1.1, baseline is defined as the natural resource or resource service condition(s) that would have existed if the hazardous substances had not been released into the Assessment Area (43 CFR §11.14(e)). Therefore, baseline data should reflect expected conditions in the Assessment Area had the release of hazardous substances not occurred. The baseline condition of natural resources reflects natural processes and changes that result from human activities that are not contaminant-related (e.g., dredging for navigation). As discussed in Section 2.1 the Assessment Area is located in the urbanized Berry's Creek Watershed within the Hackensack Meadowlands. While some site-specific information regarding historical conditions in the Assessment Area are available, the Trustees lack site-specific data on baseline contaminant concentrations in environmental media that would exist but for discharges and releases into Berry's Creek. To address this data gap, the Trustees plan to use, in order of priority, data from reference areas/control groups (43 CFR § 11.72(d)) and/or relevant literature (43 CFR § 11.72(c)(2)) unless site-specific pre-release information is found.

4.2 Ecological Injury Quantification and Damages Determination Approach

Losses of ecological services can result from exposure of natural resources to hazardous substances. These losses reflect a reduction in the ability of a resource to provide the level and type of ecological functions that would have been provided under baseline conditions.

Spotted sandpiper chick. Photo courtesy of USFWS.

For this NRDAR, the Trustees anticipate quantifying ecological service losses to representative resources for both open water and wetland habitat. These resources may include benthic invertebrates, fish, and birds, but could include other biota or habitat types. For each species group in each habitat, ecological injury quantification will focus on effect endpoints that are considered biologically relevant (e.g., endpoints that directly impact a resource's ability to function and provide services) such as growth, reproduction, and survival. The Trustees also plan to consider the exposure of these resources to COCs over time (i.e., in the past and expected to occur in the future; 43 CFR § 11.70(e)). Existing data, in combination with potential analyses and studies, would generate data appropriate for quantifying losses for each resource and endpoint over time. The Trustees plan to consider each resource/endpoint combination as indicators of losses in the Assessment Area. Studies may include, but are not limited to, field-based efforts (e.g., to confirm exposure to Assessment Area contaminants and evaluate the type and magnitude of injury resulting from that exposure), laboratory studies to confirm that COCs cause the kinds of effects that have been observed in field-based studies, and studies to verify the completeness of contaminant pathways.

To determine the damages required to compensate for ecological injures to resources within the Assessment Area, the Trustees intend to use appropriate equivalency analyses (e.g., habitat equivalency analysis, resource equivalency analysis, habitat-based resource equivalency method[26]; 43 CFR § 11.83(c)(2)) to scale restoration projects such that sufficient ecological benefit is provided to compensate for losses. Equivalency analyses quantify habitat or resource losses from contamination over the spatial extent and timeframe of injury and quantify habitat or resource gains from restoration over the spatial extent and timeframe of the restoration project(s). Losses and gains would be measured in the same unit for clear comparison (e.g., number of organisms, biomass, acres of habitat). Damages would be calculated as the cost to implement that restoration.

[26] HEA (Habitat Equivalency Analysis), REA (Resource Equivalency Analysis), and HaBREM (Habitat-Based Resource Equivalency Method) are tools used to evaluate and quantify ecological injuries and restoration requirements. HEA focuses on habitat loss and gains, using a service loss framework to estimate the amount of restoration required to compensate for injuries. REA assesses direct impacts on individual resources (e.g., specific organisms) rather than habitats. HaBREM, a more recent approach, integrates elements of both, emphasizing the interplay between habitat quality and resource use to provide a more holistic assessment (Baker et al. 2020).

The Trustees are required to ensure that there is no double-counting of losses in the quantification process (43 CFR § 11.83(c)(2)). This approach includes an evaluation of whether restoration scaled to the losses experienced by one resource will also compensate (fully or partially) for the losses associated with another injured resource.

4.3 Recreational Use Injury Quantification and Damages Determination Approach

In addition to ecological services, Berry's Creek directly and indirectly provides a suite of other services to the public, including a variety of recreational activities and uses. The presence of crab and fish consumption advisories (see Section 3.6.2) constitute an injury under the CERCLA NRDAR regulations and suggest that there has been, and will continue to be, associated compensable losses. Damages related to recreational losses would be quantified based on the nature and extent of lost recreational services (e.g., lost and diminished recreational fishing and crabbing trips).

Striped bass. Photo courtesy of USGS

Based on an ongoing review of available information, the Trustees anticipate that existing data on angler effort and relevant economic values may be adequate to conduct a secondary (e.g., benefits transfer-based) analysis of recreational fishing damages (43 CFR § 11.83(c)(2)). If additional information regarding the nature and extent of potential losses becomes available, the Trustees may consider designing and implementing a primary valuation study to calculate damages.

Other potential sources of recreational use losses include boating, birding, swimming, and wildlife observation. The Trustees plan to continue gathering any available information on the nature, location, and levels of such activities in relation to the Assessment Area, as well as the extent to which releases have reduced or diminished public use. To augment existing information, the Trustees may conduct targeted qualitative research in the form of interviews or focus groups to determine whether further evaluation and potential data collection related to these other uses is warranted.

4.4 Temporal Scope

The temporal scope of this NRDAR will be based on the determination of injury to natural resources and corresponding damages (43 CFR § 11.83(a)(4)(ii)). Under CERCLA, the Trustees are authorized to recover natural resource damages since January 1981 for injuries to or losses of natural resources and services resulting from releases that occurred before or after that date, including damages arising from ongoing injuries or losses that began prior to January 1981. The statute prohibits recovery of damages where both the damages and the release that gave rise to them occurred wholly in the past. Here, hazardous substances, oil, and related contaminants are

still present in the Assessment Area in concentrations that are high enough to cause current and future injury to natural resources and corresponding services; thus injuries are not wholly in the past (prior to 1981). All injury quantification calculations will include losses through the reasonable expected recovery of resource services, which is expected to occur in the future (43 CFR § 11.73(a)(1)). The recovery period will be estimated based on available existing data and analyses of historical and recent trends in contaminant concentration and the projected time periods for injured natural resources to return to baseline condition. The recovery period of each natural resource and natural resource services can vary depending on many factors, such as proposed or implemented remedial actions, restoration activities, and natural attenuation. If a resource is not expected to fully recover, the associated injuries will be considered permanent.

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Appendix A | Quality Assurance Plan

The CERCLA NRDAR regulations require that trustees develop a Quality Assessment Plan (QAP) that "satisfies the requirements listed in the NCP [National Contingency Plan] and applicable EPA guidance for quality control and quality assurance plans" (43 CFR § 11.31(c)(2)). The Trustees recognize the importance of data quality, given the many decisions involved in accomplishing the NRDAR that ultimately require the use of environmental data. The collection, compilation, evaluation, and reporting of environmental data are necessary to perform the assessment. The Trustees must therefore properly document the origin and quality of the data used to make decisions so that data limitations may be identified; and assessments of the severity, location, and extent of injury are accurate. This assists the Trustees in making appropriate decisions regarding the type and scale of restoration actions necessary to compensate for natural resource injuries. Also relevant to this effort are the NOAA and USFWS guidelines established under the Information Quality Act of 2001. All information developed and used in this NRDAR will comply with these guidelines.

This Plan covers studies that evaluate existing datasets as well as studies that generate new information. With respect to the evaluation of existing data, the study's principal investigator (PI) will carefully document the source(s) of all data, available information about quality assurance (QA)/quality control (QC) procedures used by the original investigator, and any data qualifiers or other information restricting application of the data. This approach will also be applied to new data and analyses developed by Federal and State agencies, academics, and information developed through other activities or programs. For new studies that are specifically undertaken to support the NRDAR process, appropriate study specific QAPs will be developed according to the general principles described below.

As noted by USEPA (2001), QAPs will "vary according to the nature of the work being performed and the intended use of the data" and as such, need to be tailored to match the specific data-gathering needs of a particular project (40 CFR § 300.5). The NRDAR effort will entail a variety of data-gathering efforts; therefore, it may not be appropriate or necessary to develop a single, detailed QAP to cover all these activities. Instead, the Trustees may ensure that individual study plans adequately address project-specific QA issues. The discussion in this document therefore focuses on the required elements in any acceptable study plan.

In general, a study-specific QAP must provide sufficient detail to demonstrate that:

- The project's technical and quality objectives are identified and agreed upon;
- The intended measurements, data generation, or data acquisition methods are appropriate for achieving project objectives;
- Assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and
- Any limitations on the use of the data can be identified and documented (USEPA 2001).

Accordingly, study specific QAPs developed for this assessment will include the four elements called for by EPA:

- **Project Management** – documents that the project has a defined goal(s), that the participants understand the goal(s) and the approach to be used, and that the planning outputs have been documented;
- **Data Generation and Acquisition** – ensures that all aspects of project design and implementation including methods for sampling, measurement and analysis, data collection or generation, data compiling/handling, and QC activities are documented and employed;
- **Assessment and Oversight** – assesses the effectiveness of the implementation of the project and associated QA and QC activities; and,
- **Data Validation and Usability** – addresses the QA activities that occur after the data collection or generation phase of the project is completed.

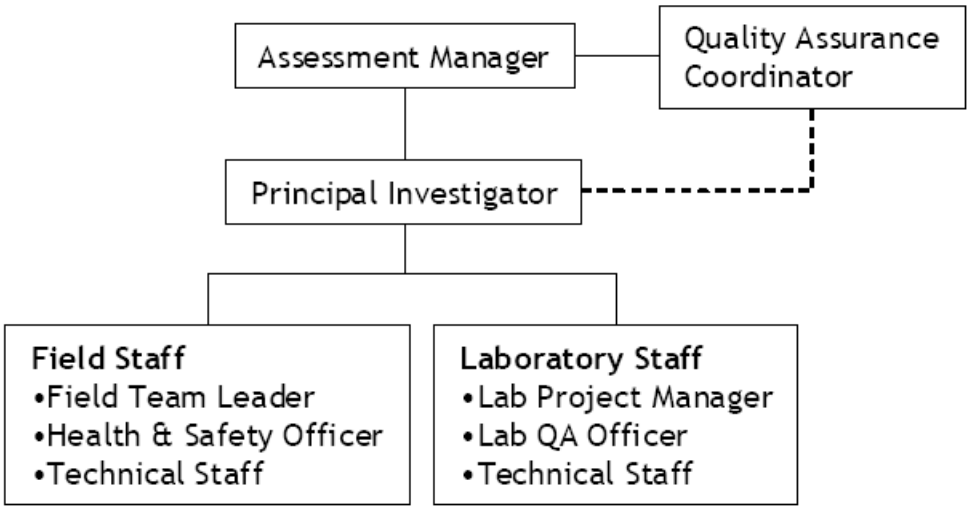
A.1 Study Management

Effective implementation of project objectives requires clear project organization, which includes carefully defining the roles and responsibilities of each project participant. Unambiguous personnel frameworks help ensure that each individual is aware of their specific area(s) of responsibility, as well as clarifying internal lines of communication and authority, which is important for decision-making purposes as projects progress. Individuals' and organizations' roles and responsibilities may vary by study or task, but each person's role and responsibility should be clearly described in the project's study plan. Exhibit A-1 below presents a generic personnel plan for a NRDAR project.

The Assessment Manager is the designated Trustee representative with responsibility for the review and acceptance of the project-specific study plan. This individual is also responsible for ensuring that the project's goals and design will meet the broader requirements of this NRDAR. The Assessment Manager coordinates with the QA Coordinator and oversees the PI for the study.

The QA Coordinator oversees the overall conduct of the quality system. Appointed by the Trustees, this individual's responsibilities include: reviewing/assisting the PI with the development of project-specific study plans; conducting audits and ensuring implementation of both project-specific and overall plans; archiving samples, data, and all documentation supporting the data in a secure and accessible form; and reporting to the Trustees. To ensure independence, the person serving as QA Coordinator will not serve as either the Assessment Manager or as a PI for any NRDAR study.

Exhibit A-1 Personnel Plan



Study-specific PIs oversee the design and implementation of particular NRDAR studies. Each PI is responsible for ensuring that all health, safety, and relevant QA requirements are met. If deviations from the QAP occur, the PI (or his/her designee) will document these deviations and report them to the Assessment Manager and the QA Coordinator.

The Field Team Leader supervises day-to-day field investigations, including sample collection, field observations, and field measurements. The Field Team Leader generally is responsible for ensuring compliance with all field quality assurance procedures defined in the study-specific QAP. Similarly, the Laboratory Project Manager is responsible for monitoring and documenting the quality of laboratory work. The Health & Safety Officer (who may also be the Field Team Leader) is responsible for ensuring adherence to specified safety protocols in the field.

A.2 Data Generation and Acquisition

All studies conducted under the direction of the Trustees in support of the NRDAR will have a standalone or embedded QAP that will be developed or referenced as part of the study plan and will be completed prior to the initiation of any work. These QAPs will be submitted to, and approved by, the QA Coordinator or designee and generally include:

- Rationale for generating or acquiring the data;
- Proposed method(s) for generating or acquiring the data, including descriptions of (or references to) standard operating procedures for all sampling or data-generating methods and analytical methods;
- Types and numbers of samples required;
- Analyses to be performed;
- Sampling locations and frequencies;

- Sample handling and storage procedures;
- Chain-of-custody procedures;
- Data quality requirements (for instance, with respect to precision, accuracy, completeness, representativeness, comparability, and sensitivity);
- Description of the procedures to be used in determining if the data meet these requirements;
- Description of the interpretation techniques to be used, including statistical analyses; and
- Procedures for archiving samples and management of samples including their final disposition.

In addition, to the extent practicable, laboratories will be required to comply with Good Laboratory Practices. This includes descriptions and documentation of maintenance, inspections of instruments, and acceptance testing of instruments, equipment, and their components, as well as the calibration of such equipment and the maintenance of all records relating to these exercises. Documentation to be included with the final report(s) from each study will include field logs for the collection or generation of the samples, chain of custody records, and other QA/QC documentation as applicable.

A.3 Assessment and Oversight

To ensure that the study plan for each project is implemented effectively, the QA Coordinator will review QAPs for all Trustee studies that generate data. The QA Coordinator or designee will also audit all such studies. Audits will include technical system audits (e.g., evaluations of operations) as well as scrutinizing data and reports (e.g., evaluations of data quality and adequacy of documentation).

If, in the professional opinion of the QA Coordinator, the results of an audit indicate a compromise in the quality of the collection, generation, analysis, or interpretation of the data, the QA Coordinator has the authority to stop work by oral direction. Within two working days of this direction, the QA Coordinator will submit to the Trustee Council a written report describing the necessity for this direction. The Assessment Manager will consult with the Trustees regarding measures to be taken in response to the QA Coordinator's report.

A.4 Data Validation and Usability

In addition to the assessment and oversight activities described previously, analytical data will be considered for validation by an independent third party. Prompt validation of analytical data can assist the analyst or analytical facility in developing data that meet the requirements for precision and accuracy. If undertaken, it is expected that data validation will use the study-specific study plans and EPA Guidance on Environmental Verification and Validation (USEPA 2002).

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Appendix B | New Jersey State-Listed Endangered, Threatened, and Special Concern Species Potentially Found in the Assessment Area

State-listed Endangered Species	Common Name	Scientific Name
Birds	American bittern	*Botaurus lentiginosus*
	Northern harrier	*Circus hudsonius*
	Pied-billed grebe	*Podilymbus podiceps*
	Red-shouldered hawk	*Buteo lineatus*
	Peregrine falcon	*Falco peregrinus*
	Least tern	*Sternula antillarum*
	Short-eared owl	*Asio flammeus*
	Northern goshawk	*Accipiter gentilis*
	Black skimmer	*Rynchops niger*
	Sedge wren	*Cistothorus platensis*
	Upland sandpiper	*Bartramia longicauda*
	Roseate tern	*Sterna dougallii*
	Loggerhead shrike	*Lanius ludovicianus*
	Vesper sparrow	*Pooecetes gramineus*
Amphibians	Blue-spotted salamander	*Ambystoma laterale*
State-Listed Threatened Species	**Common Name**	***Scientific Name***
Birds	Long-eared Owl	*Asio otus*
	Yellow-crowned night-heron	*Nyctanassa violacea*
	Black-crowned night heron	*Nycticorax nycticorax*
	Cooper's hawk	*Accipiter cooperii*
	Red knot	*Calidris canutus*
	Barred owl	*Strix varia*
	Red-headed woodpecker	*Melanerpes erythrocephalus*
	Savannah sparrow	*Passerculus sandwichensis*
	Bobolink	*Dolichonyx oryzivorus*
	Grasshopper sparrow	*Ammodramus savannarum*

State-Listed Threatened Species	Common Name	*Scientific Name*
Mollusk	Triangle floater	*Alasmidonta undulata*
Reptile	Wood turtle	*Glyptemys insculpta*
Fish	American Shad	*Alosa sapidissima*
State-Listed Special Concern Species	**Common Name**	***Scientific Name***
Birds	Bald Eagle	*Haliaeetus leucocephalus*

Sources: NOAA and USFWS 2014, NJDEP 2025.

Appendix C | Summary of Response Actions

Response efforts are being designed and planned within the Assessment Area with oversight from the EPA. The distinction between response activities and NRDAR is important, particularly since both sets of activities often operate concurrently and overlap in geographic scope. Response actions aim to reduce contaminants to acceptable levels that minimize human health and ecological risks associated with hazardous substances at a site. This process is described in CERCLA (42 USC §9601(24)). These efforts are typically funded by the PRPs, the EPA CERCLA Superfund program, or a combination of both. Response activities (also referred to as cleanup) can encompass a range of actions: no action, monitored natural attenuation, dredging, capping, and treatment. These activities can, for a short or long time period, continue to expose natural resources to hazardous substances and physically impact habitat. It is an anticipated risk of the CERCLA process that is tempered by the knowledge that long-term benefits will be obtained through reduction of human and natural resource exposure to the hazardous substances.

To date, the Trustees are aware of one NJDEP Record of Decision (ROD) and six EPA RODs that have been issued to address and remediate contaminants present at, or migrating out from, the three Superfund sites:

- **V/V:** In 2006, the NJDEP issued a ROD for the upland portion of the property (Operable Unit (OU)1). The remedy called for excavation and off-site disposal of soil with mercury concentrations greater than 620 parts per million (ppm), capping of soil with mercury concentrations greater than the New Jersey Non-Residential Direct Contact Soil Cleanup Criteria (270 ppm), deed restrictions on all properties with mercury concentrations greater than the New Jersey Residential Direct Contact Soil Cleanup Criteria (RDCSCC) (14 ppm) except the Lin-Mor property where excavation of contaminated soil will be conducted[27], and excavation of soil for the establishment of a 55-foot clean buffer zone between the capped area and open water/wetlands. In addition, a vertical hydraulic barrier system was installed to serve as a physical barrier to the flow of groundwater and contain high levels of mercury under a warehouse (NJDEP 2006). According to EPA's second 5-year review, the OU1 remedy selected in the 2006 ROD is functioning as intended. Contamination has been either been removed or appears to be contained on site (USEPA 2022b). In 2018, EPA issued an interim ROD for OU2, also designated the Berry's Creek Study Area. The source control remedy will address contamination within portions of Berry's Creek and its main tributaries Ackerman's Creek and Peach Island Creek as well as Upper Peach Island Creek Marsh. The remedial design for the interim remedy was approved in September 2025 (Sivak 2025). EPA is negotiating a consent decree with the PRP to implement the remedy, which is expected to start in 2026 (Holsten personal communication).
- **SCP:** In 1990, EPA selected an interim remedy for OU1 consisting of a slurry wall, infiltration barrier, groundwater collection and off-site disposal, and operations, maintenance, and monitoring (USEPA 1990). These remediation efforts were completed in 1992 (USEPA

[27] The ROD indicated that the owners of the Lin-Mor property did not consent to placing a deed restriction on their property. Thus, cleanup to meet the NJDEP RDSCSS was required (NJDEP 2006).

2024). In 2002, EPA issued a ROD for the final OU2 remedy for the on-property soil, sludge and shallow groundwater (USEPA 2002). This included removal of approximately 3,400 tons of soil materials from a hot spot and disposal at an off-site facility. Other components of the remedy included capping a landfill, soil stabilization, and upgrades to existing sheet piling and an interim groundwater recovery system. Field work for these remedial actions finished in 2011. In 2012, EPA selected a final remedy for OU3 to address deep and off-site groundwater contamination, which is being implemented by PRPs and overseen by EPA (USEPA 2025). Institutional controls have also been placed on soils and groundwater. According to EPA's sixth 5-year review, remediation of the groundwater and soil are preventing the further spread of contamination and direct contact with contaminated media (USEPA 2022a). Construction was completed in 2025 (USEPA 2025).

- **UOP:** In 1993, EPA issued an interim action ROD for OU1 at UOP to remove contaminated water and soil from the holding lagoon areas. Other remedial actions to address contamination in upland soil and groundwater were also completed. Thermal desorption and thermal desorption were initially selected to treat PCBs, PAHs, and VOCs in soil, but was subsequently changed to excavation of PCB/PAH-contaminated soils (USEPA 1998) and thermally enhanced vapor extraction of excavated VOC-contaminated soils (USEPA 1999). Lead-contaminated soil was excavated to a remediation goal of 600 ppm and capped (USEPA 1993). The ROD was amended in 2022, leading to a no further action decision for shallow groundwater (USEPA 2022c). A portion of OU1 (Area 2) was delisted in 2024 (USEPA 2025). In 2010, Honeywell signed an Administrative Settlement Agreement and Order on Consent with EPA to complete an RI/FS for OU2 and perform a Non-time Critical Removal Action (NTCRA). The goal of the NTCRA was to eliminate heavily contaminated sediment from the former wastewater lagoons and nearby sections of Ackerman's Creek that had not been previously remediated. Completed in 2013, the NTCRA involved excavating the lagoon berms and sediment for off-site disposal, followed by the placement of a one-foot sand layer at the base of the excavated area (USEPA 2023). As a result of the NTCRA, the area is now hydrologically connected to Ackerman's Creek and is subject to the tidal fluctuations that affect the surrounding watershed (USEPA 2021b). EPA issued an interim action ROD for OU2 in 2019 for sediment, groundwater discharge monitoring and institutional controls (USEPA 2019). The waterways in UOP ROD2 are incorporated into the Berry's Creek Study Area remedial design, mentioned above for Ventron/Velsicol (USEPA (2021a).

Berry's Creek Study Area Remedial Investigation

In 2008, EPA signed a settlement agreement with approximately 100 parties (referred to as the Berry's Creek Study Area Group, or BCSA Group) to conduct an RI/FS for Berry's Creek wetlands and waterways including Upper Peach Island Creek and Ackerman's Creek. A workplan for the RI/FS was approved by EPA in 2009 and included a three-phase data collection program that took place from 2009 to 2017, which identified PCBs and mercury as the primary contaminants of concern. For more information on the BCSA Group and EPA's Remedial Investigation, see the BCSA webpage at www.berryscreekstudyarea.com.

In 2018, EPA signed an interim ROD that described the $332 million cleanup plan for the BCSA. Remedial actions include, but are not limited to (USEPA 2021a, 2018a, 2018b):

- Dredging soft sediment in Upper Berry's Creek, Middle Berry's Creek waterways, Ackerman's Creek and Peach Island Creek
- Removing sediment and capping marsh in Upper Peach Island Creek Marsh.

In 2019, the BCSA Group signed a settlement agreement with EPA to develop the engineering design for the remedy selected in the 2018 ROD. The completed remedial design was approved in 2025. EPA expects to reach a negotiated settlement with members of the BCSA Group and enter a judicial Consent Decree to perform the work (USEPA 2021a).

An abridged timeline of events related to cleanup in Berry's Creek is presented in Exhibit C-1.

Exhibit C-1: Abridged Timeline of Major Events Related to Cleanup within the Assessment Area

Year	Event
1982	Fish consumption advisories put in place
1983	UOP and SCP sites placed on the National Priorities List
1984	V/V site placed on National Priorities List
1990	EPA issued interim action ROD for SCP OU1 to address groundwater contamination (VOC, PCBs, metals) prior to addressing contaminated saturated soils
1993	EPA issued an interim action ROD for OU1 of the UOP site to treat contaminated leachate[28] and remove, treat, and dispose on-site or isolate contaminated soil (PCBs, PAHs, VOCs, lead)
1995	Start of remedial action at UOP
1999	EPA issued an ESD for OU1 of the UOP site that modified treatment for VOC-contaminated soil
2002	EPA issued a ROD for OU2 at SCP for the soil, sludges, and shallow groundwater remedy (PCBs, arsenic, VOCs)
2006	NJDEP issued a ROD for OU1 at V/V for excavation and off-site disposal of soil, capping of mercury-contaminated soils, installation of a hydraulic barrier and monitoring of groundwater, and deed restrictions (mercury, VOCs, naphthalene, arsenic, chromium, lead, zinc)
2008	EPA signed an Administrative Order on Consent with 98 parties to conduct an RI/FS of contamination in the BCSA
2009	West Riser Ditch removal action completed; West Riser tide gate replaced.
2009-2012	OU1 remedy implemented in 2009-2010. Remedial Action Completion Report finalized in 2012.
2012	EPA selected the remedy for deep and off-site groundwater for OU3 at SCP (VOCs, PAHs, 1,4-dioxane)
2013	Completion of UOP NTCRA to remove highly contaminated sediment in former wastewater lagoons and areas of Ackerman's Creek followed by off-site disposal

[28] The Fifth Five Year Review clarifies that "leachate" refers to shallow groundwater (USEPA 2021b).

Year	Event
2018	RI/FS for BCSA (marshes and waterways not addressed in remedial plans for the three Superfund sites) published by EPA
2018	Proposed Plan published by EPA describing the interim remedial alternatives for the BCSA
2018	EPA signed an interim action ROD for OU2 at the V/V site describing $332 million source control through dredging and subsequent capping of sediments and institutional controls in portions of the BCSA (PCBs, mercury, methyl mercury, chromium)
2019	EPA's ROD for UOP OU2 required excavation of contaminated sediment in Ackerman's Creek, Ackerman South Area, and North Channel (west side of Murray Hill Parkway) followed by placement of backfill
2019	BCSA Group (90 parties) signed an Administrative Settlement Agreement and Order on Consent with EPA to develop the remedial design for the interim action remedy selected in the 2018 ROD
2019	Start EPA-supervised OU2 V/V (BCSA) remedial design
2022	OU1 UOP ROD amendment selects no further action for shallow groundwater discharging to surface water and adds requirement for deed notices about potential vapor intrusion.
2023	OU2 UOP ESD allows for placement of clean sand in removal area where backfill was previously placed in NTCRA and sediment subsequently deposited; eliminates removal of North Channel Culvert (under Murray Hill Parkway) and pushes out remedy selection of North Channel to a later date consistent with surrounding marsh
2024	Area 2 of the UOP site removed from the National Priorities List (partial site removal)
2025	Construction completed at SCP.
2026	Anticipate start of interim cleanup at V/V OU2 and UOP OU2 (BCSA Phase 1)

Notes:

BCSA = Berry's Creek Study Area including Upper Peach Island Creek/marsh and Ackerman's Creek

ESD = Explanation of Significant Differences

EPA = United States Environmental Protection Agency

NJDEP = New Jersey Department of Environmental Protection

NTCRA = Non-Time Critical Removal Action

OU = Operable Unit

PAH = Polycyclic Aromatic Hydrocarbon

PCBs = Polychlorinated Biphenyls

RI/FS = Remedial Investigation/Feasibility Study

ROD = Record of Decision

SCP = Scientific Chemical Processing

UOP = Universal Oil Products

VOCs = Volatile Organic Compounds

V/V = Ventron/Velsicol

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