United States Environmental Protection Agency

Wappinger Creek Superfund Site
Operable Unit 1
Wappingers Falls, Dutchess County, New York

July 2026

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:

July 23, 2026 to August 21, 2026

EPA will accept written comments on this Proposed Plan during the public comment period. Written comments must be postmarked no later than August 21, 2026. To request an extension to comment, send a request in writing by 5:00 PM on August 21, 2026 via the contact information on Page 2.

IN PERSON PUBLIC MEETING:

July 30, 2026 at 6 pm

EPA will hold a public meeting to explain the alternatives presented in the Focused Feasibility Study and this Proposed Plan and the preferred alternative. Oral and written comments will also be accepted at the meeting. The meeting will be held at:

Grinnell Community Library
2642 East Main Street, Wappingers Falls, NY 12590

In addition, documents from the administrative record are available online at:

http://www.epa.gov/superfund/wappinger-creek

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan for the Wappinger Creek Superfund Site (Site) describes the remedial alternatives considered for Operable Unit 1 (OU1) to address mercury contamination in sediment and streambank soils within the upstream portions of the Site and identifies the preferred interim remedy with the rationale for this preference. An interim remedial action (IRA) in the upper portion of the Site is proposed to accelerate a sitewide remedy by reducing risk and removing contaminant mass that could be a source for migration of contaminants further downstream. This OU is the first of two anticipated OUs for the Site. EPA anticipates that an eventual, final remedy for the Site will be selected as part of OU2. The Site consists of the tidally influenced portion of Wappinger Creek (Creek), beginning at the base of Wappingers Falls and extending two miles downstream to where the Creek meets the Hudson River (**Figure 1**).

This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), the lead agency for the Site, in consultation with the New York State Department of Environmental Conservation (NYSDEC), the support agency. EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA, also known as Superfund) and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of contamination of OU1 of the Site and the remedial alternatives summarized in this Proposed Plan are more fully described in the Remedial Investigation (RI) Report, dated January 2025, and the Focused Feasibility Study (FFS) Report, dated July 2026, as well as other documents in the Administrative Record file for this decision. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site, the Superfund activities that have been conducted, and the remedial alternative that is being proposed.

The purpose of this Proposed Plan is to inform the public of EPA's preferred remedial alternative and to solicit public comments pertaining to all of the remedial alternatives that are evaluated, including the preferred alternative.

The preferred alternative for OU1, referred to as Alternative 4, includes dredging and offsite disposal of contaminated sediment and streambank soils in the upper portions of the Site, followed by the placement of clean backfill over disturbed areas, monitoring, institutional controls (ICs), and access controls.

The preferred remedy for OU1 of the Site is described in this Proposed Plan. Changes to the preferred alternative, or a change from the preferred remedy to another remedial alternative described in this Proposed Plan, may be made by EPA, in consultation with NYSDEC, if public comments or additional data indicate that such a change will result in a more

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appropriate remedial action. EPA will make the final decision regarding the selected remedy after EPA has taken into consideration all public comments. For this reason, EPA is soliciting public comments on all of the alternatives considered in this Proposed Plan and on the detailed analysis section of the FFS Report because EPA may select an alternative other than the preferred alternative.

COMMUNITY ROLE IN SELECTION PROCESS

EPA provides an opportunity for the public to participate in the selection of remedies for each Superfund site. To this end, this Proposed Plan and other Site documents are made available to the public for a public comment period which begins on July 23, 2026 and concludes on August 21, 2026.

A public meeting will be held on July 30, 2026 at the Grinnell Community Library to present the conclusions of the Remedial Investigation and Feasibility Study (RI/FS), to elaborate further on the reasons for recommending the preferred alternative, and to receive public comments.

Comments received at the public meeting, as well as written comments received during the public comment period, together with EPA's responses, will be documented in a Responsiveness Summary Section of the Record of Decision (ROD), the document that memorializes the selection of the remedy.

Written comments on this Proposed Plan should be addressed to:

Emily Wong
U.S. Environmental Protection Agency
290 Broadway
New York, New York 10007-1866
Telephone: 212-637-4303
Email: wong.emily@epa.gov

SCOPE AND ROLE OF ACTION

This Proposed Plan addresses sediment and streambank soil contamination at the Site as part of an IRA. This OU is one of two anticipated OUs for the Site. At Superfund sites, site remediation activities are sometimes separated into different phases, or OUs, so that remediation of different geographic areas of a site can proceed separately, resulting in a more efficient and expeditious cleanup of the entire site.

This Proposed Plan discusses the remedial alternatives considered for OU1 to address risks posed by total mercury (THg) and prevent source migration of THg in sediment found within the upper portion of the Site. Three upstream sections (Industrial Park, Upper Shoal, and Embayment sections) are targeted as part of this IRA (**Figure 1**). These locations contain high concentrations of THg in sediment, which is considered to be source material most likely to be redistributed across the Site, while also exhibiting a lower potential for recontamination from sediment deposition related to tidal impacts from the Hudson River. The extent of influence from the Hudson River, which also serves as the boundary of OU1, is marked by the Hudson River Line (HRL) and discussed further below. EPA anticipates that remediating THg-contaminated sediment in the upper portion of the Site will reduce THg contaminant concentrations in sediment throughout the Site, reduce the potential for mercury methylation and bioaccumulation in the food web and remove other collocated, site-related contaminants, thereby reducing risks to human and ecological receptors. Streambank soils are also targeted in this IRA due to their potential to erode and re-contaminate the sediment bed after the remedial action is complete.

While this IRA would only address sediment and streambank soil in the upper portion of the Site, it will form a part of the overall Site remedial strategy. Once targeted contaminated sediment is remediated in the upper portion of the Site and the interim performance criteria have been met, a post-IRA monitoring program would be implemented. Exact details of the monitoring program will be determined in the future and will include sampling for biotic (*e.g.*, fish tissue) and abiotic (*e.g.*, sediment, soil, surface water, pore water) media. A subsequent sitewide remedy would be developed based on the data from the post-IRA monitoring. The post-IRA monitoring program would inform the development of future sitewide objectives, verify that the interim remedy is functioning as designed, and evaluate the effectiveness of the IRA. This monitoring program would be designed to ensure that media are monitored such that trends in concentrations of site-related contaminants can be evaluated. Additionally, the data would be used to identify any potential ongoing sources of contamination, evaluate changes in the system over time, and assess the natural recovery of the Creek system.

Using the results of the post-IRA monitoring, the subsequent trends and site characterization can be evaluated to identify the nature and extent and the fate and transport of contamination remaining at the Site. EPA would use this information to develop a final site-wide remedy. EPA anticipates that a final remedial decision for the Site will be memorialized in a subsequent ROD.

SITE BACKGROUND

Site Description

The Site, located in Wappingers Falls, Dutchess County, New York, is defined as the tidally influenced portion of Wappinger Creek. The Site consists of a zone of sediment contamination that begins at the base of Wappingers Falls by the Market Street Industrial Park (Industrial Park) and extends approximately two miles downstream to where the Creek meets with the Hudson River. The Site is primarily oriented in a northeast-southwest fashion. A map of the Site is provided in **Figure 1**.

For the purposes of EPA's RI and in order the make the Site easier to investigate, the Site was divided into the following five sections, which were further broken up into transects T1-T30 (described in further detail below).

- <u>Industrial Park section</u> (T1-T11): This is the uppermost section of the Site and is located adjacent to the Industrial Park, which was the historical source of contamination.
- <u>Upper Shoal section</u> (T12-T14): This area is downstream of the Industrial Park section and upstream of the embayment.
- <u>Embayment section</u> (T15-T17): This section of the Creek is part of, and adjacent to, the embayment. The embayment is the primary depositional area of the Site and is largely protected from the Creek flow by the embayment peninsula. The Embayment section is the lowermost section of the Site to be addressed by the IRA and is bounded by the HRL. The HRL, located between transects T17 and T18, is also used to demarcate the approximate extent of potential sediment exchange between the Hudson River and Wappinger Creek.
- <u>Lower Shoal section</u> (T18-T25): This section of the Creek is downstream of the embayment but upstream of the confluence of the Creek with the Hudson River.
- <u>Confluence section</u> (T26-T30): This section of the Creek is downstream of the Lower Shoal section, extending to the confluence of Wappinger Creek with the Hudson River.

Upon review of the data collected throughout the Site, EPA concluded that there was a need to address significant levels of contamination acting as source material. The three upstream sections, identified by Transects T1-T17, are the focus of this IRA.

The Site and its surrounding areas are used for residential, recreational, and commercial purposes. A hydroelectric dam that controls the water levels in Wappinger Lake is located upstream of Wappingers Falls and discharges directly into the Site. The Industrial Park is located along the banks of the Site, approximately 0.2 miles downstream of Wappingers Falls. The Industrial Park has been active for more than 180 years and is currently home to several commercial facilities, operating within the existing historical industrial buildings. No additional structures have been added to the Industrial Park since industrial operations ceased. The Reese Audubon Sanctuary borders the Creek along the northwestern (northern) bank. Open space, Reese Park, residential properties, and a Department of Public Works facility are located along the southeastern (southern) bank of the Creek.

Wappinger Creek is currently designated as a Class C(T) Fresh Surface Water under New York State Codes, Rules, and Regulations (6 CRR-NY, Article 10, Part 857), meaning that the Creek is an active recreational fishery that may support a trout population and is suitable for contact recreation. The Creek is used by recreational users for activities including swimming, kayaking, and fishing. There is at least one boat launch and several fishing access points along the Site.

Site Geology & Hydrogeology

Wappinger Creek is a 41-mile long freshwater creek that originates in extensive headwater wetlands and lakes in northern Dutchess County. The Wappinger Creek watershed drains over 130,000 acres and is fed by approximately 320 miles of tributaries. Upstream of the Site, Wappinger Creek flows through Wappinger Lake and over Wappingers Falls. Surface water drainage in the Site area is toward Wappinger Creek and its associated wetlands and tributaries, and the overall drainage at the Site is towards the Hudson River. Two tributaries flow directly into the Site: an unnamed tributary, which meets the Creek from the northern bank within the Industrial Park section, and Hunter Creek, which confluences from the southern bank within the Upper Shoal section.

Wappinger Creek is tidally influenced between Wappingers Falls and the confluence with the Hudson River. The tidal cycles observed include a daily cycle, with every second high and low tide having a greater amplitude or a semidiurnal tide. The tide also follows a lunar cycle with the amplitude of tides swelling each month or during a spring tide. During the tidal cycle of the Hudson River, surface water levels at the Site can fluctuate as much as 3.5 feet at the upstream end of the tidal portion adjacent to the Industrial Park and up to 4 feet in the lower sections.

A shallow, unconsolidated aquifer of glacial/alluvial origin is the primary aquifer that interacts with Wappinger Creek. The groundwater elevation observed was close to the surface water elevation at the Site. Locally, shallow groundwater adjacent to the Creek flows toward and discharges to Wappinger Creek. The interaction between groundwater and surface water at the Site is also tidally influenced. Groundwater elevations in site monitoring wells were observed to vary up to three feet through a daily tidal cycle, indicating a substantial connection to the Creek. Deep groundwater may discharge to the Creek in areas where the bedrock surface is shallow after traveling through the fractured bedrock beneath the Creek.

Wappinger Creek sits above glacial and fluvial deposits bound on either side by bedrock outcrops. The Site is located within a stream valley that has incised a bedrock canyon in the uplifted bedrock to the east of the Hudson River. In the Industrial Park and Upper Shoal sections, the overburden was deposited above shale/graywacke bedrock which ranges from 0 to 66 feet below ground surface (bgs). In upland areas of the Industrial Park, non-native fill consisting of sandy gravel containing cinders, concrete, and brick was encountered and extends to approximately 4 feet bgs. The fill is underlain by approximately 16 feet of alluvium, consisting of coarse-to-fine-grained sand with gravel and silt. Portions of the Lower Shoal and Confluence sections overlie limestone and dolostone bedrock. Unconsolidated material encountered near the Site consisted of fill material, naturally deposited alluvium, and glacial till. These materials were present at depths ranging from 6 to 12 feet bgs.

Topography varies in the vicinity of the Site, with steep slopes bounding the west side of the Creek and developed land to the east. Most of the upland areas, including the Industrial Park, lie within the 100-year floodplain.

Industrial Park Section: The Creek at the Industrial Park section (Transects T1-T11) is approximately 2,300 feet long and 90 feet wide and is narrow relative to downstream sections. It is bounded on each shore by retaining walls bordering both sides of the Creek. Very little surface sediment is present in the areas closest to the hydroelectric dam (Transects T1-T5) where water velocity is greatest. The bottom of the Creek channel within these transects primarily consists of gravel, cobbles, and weathered bedrock. An unnamed tributary is located downstream of the retaining walls and flows intermittently into Wappinger Creek during and after precipitation events. Generally, the Creek profile is shallowest on the south side, with water depths ranging from approximately 7.5 feet during high tide to approximately 3.5 feet during low tide. The water depth increases to approximately 8 to 12 feet towards the northern shore, indicating the main channel beginning downstream of Transect T5 where gravelly sediment and sandy streambanks were observed. The Creek channel is subject to higher stream velocities, which is consistent with the coarser-grained sediment found within this section of the Site. The Industrial Park section is subject to flooding and aggravates flood hazards by increasing the volume and speed of storm runoff through a narrow channel of the Creek with a low-lying floodplain.

Upper Shoal Section: The Upper Shoal section (Transects T12-14) is approximately 700 feet long, bending towards the south before widening to approximately 250 feet and curving back to the southwest. Water flow velocity decreases as the Creek becomes wider, creating sediment accumulation in low-velocity areas. The sediment deposit primarily comprises silt and organic material rather than sand and gravel. Moving downstream, increasing thicknesses of surface sediment are present outside of the main Creek channel along the shoal areas. Coarse-grained fluvial sediment is also present outside of the channel in the Upper Shoal section. Below or within the fluvial and alluvial sands and gravels, clay and/or silt is also present within the Creek. Generally, the Creek profile is shallowest on the south side of the Creek, with water depths ranging from approximately 3 to 4 feet during high tide to less than 1 foot during low tide. The water depth increases to approximately 8 to 12 feet towards the northern shore, indicating the main channel.

Embayment Section: The Embayment section (Transects T15-T17) is approximately 780 feet long. A shallow embayment, which is defined as a recess or indentation of the Creek shoreline, is located along the northwest shore following a bend directing the Creek to the southwest. This approximately 400- by 600-foot feature is bounded by steep slopes with exposed bedrock to the northwest and the embayment peninsula to the southeast. The embayment peninsula contains established trees and vegetation. The ground surface at the midpoint of the embayment peninsula is low enough that it is sometimes submerged during high tide, allowing for additional hydraulic connection to Wappinger Creek. The main flow of the Creek bypasses the embayment, which experiences minimal water velocity and can be described as quiescent. The sediment within the embayment comprises silt and organic matter, and the area also supports aquatic plant growth throughout. As a result of these conditions, the embayment is considered to be the primary depositional area of the Site.

In the portion of the Creek adjacent to the embayment, clay and glacial till were encountered at the base of the channel, indicating an erosional setting, whereas the silty sediment thickness in the embayment has been likely deposited by low-energy flow. Generally, the Creek profile is shallowest on the northwest side of the Creek, within the embayment with water depths ranging from approximately 3 feet during high tide to less than 1 foot during low tide. The water depth increases to approximately 8 to 12 feet towards the southern shore, indicating proximity to the main channel.

The Embayment section marks the extent of this IRA, using the HRL located between Transect T17 and T18 as the boundary of sediment exchange with the Hudson River. Additional data will be collected in the future to refine the HRL and the extent of impacts from the Hudson River for site-related contaminants.

Lower Shoal Section: The Lower Shoal section (Transects T18-T25) is approximately 2,600 feet long and is located downstream of the Embayment section. This section of the Site varies in width, ranging from approximately 400 feet to approximately 900 feet. The bottom sediment materials in this section of the Creek primarily comprise sand with silty organic matter and some gravel underlain by silt in the shallower area alongside the Creek channel. Generally, the main flow in this section of the Creek occurs along the Creek channel with water depths up to 14 feet. Shallow intertidal areas occur along both the northern and the southern shores throughout this section; approximately half of the area in this section of the tidal Creek occurs at depths of less than 3 feet. Proceeding downstream, the main Creek channel shifts from the south side of the Creek to the north side of the Creek.

Confluence Section: The Confluence section (Transects T26-T30) of Wappinger Creek is approximately 2,600 feet long and narrows to approximately 140 feet before widening to approximately 800 feet where it meets the Hudson River. The bottom sediment materials in this section of the Creek primarily comprise silt and sand, with rock and cobble content increasing with sediment depth. Generally, the main flow in this section of the Creek occurs along its southern shore. Channel depths range from 12 feet to approximately 26 feet. Generally, the Creek profile is shallowest on the northern side, with water depths ranging from approximately 5 feet during high tide to less than 3 feet during low tide. As the Creek cross section progresses to the southern shore, water depth increases to approximately 15 to 26 feet in the main channel.

Site History

The primary source of historical contamination at the Site is attributed to the operations that took place at the Industrial Park over its 180-year history, beginning in the early 1800s through the late 1900s. Historical activities conducted by tenants of the Industrial Park include textile dyeing operations, a manufactured gas plant, metal plating, plastic mold injecting, chemical and ammunition production, and felt hat production. Wappinger Creek has served as a stormwater drainage and direct discharge structure, historically receiving manufacturing waste and by-products from these industrial activities. Channels and lagoons were constructed within the footprints of the historical facilities directly adjacent to the Site, which served as manufacturing waste basins which flowed into the Creek. The most significant historical operations of the Industrial Park are discussed below.

Dutchess Bleachery operated at the Industrial Park along both sides of the Creek. The bleachery was primarily associated with cloth dyeing operations. Wastewater from the bleachery was reportedly discharged into a channel that emptied into a lagoon (later named the Three Star Lagoon) and subsequently into Wappinger Creek. Mercuric chloride, a form of inorganic mercury, may have been used to dye cloth at the bleachery. Adjacent to Dutchess Bleachery was a facility that manufactured felt hats, which historically used another form of inorganic mercury called mercuric nitrate. A manufactured gas plant facility also operated on the southern bank of the Creek. Coal is also known to naturally contain mercury, which is emitted during this process. The Creek served as a transport route for coal delivery to the plant. During plant operations, coal was barged up the Creek from the Hudson River and stored in large coal sheds located on the northern and southern banks of the Creek. Coal cinders were used as fill behind the retaining wall built on the southern bank near the industrial facilities.

Following the closure of Dutchess Bleachery in 1955, a metal plating facility known as Three Star Anodizing moved into its former location along the southern bank of Wappinger Creek and operated from 1958 to approximately 1995. From 1958 to 1980, wastewater was discharged to the Three Star Lagoon and emptied into Wappinger Creek at a rate of 20,000 to 60,000 gallons per day. Initial investigations at the Site began during this time.

Previous NYSDEC Investigations

The first state regulatory action at the Site began when the sanitary facilities in the Three Star Anodizing buildings failed a dye test in 1971. Wastewater that did not meet the applicable water quality standards was found to be discharging directly into the Three Star Lagoon and Creek. As a result, the facility was required to obtain a State Pollutant Discharge Elimination System (SPDES) permit in 1975 to continue discharging wastewater to the Creek. Between 1977 and 1979, NYSDEC documented that the Three Star Anodizing facility operations occasionally exceeded SPDES effluent limitations for nickel and copper. An investigation conducted in the mid-1980s revealed that wastewater from the Three Star Anodizing operations contained caustic dyes, acids, and various trace metals including copper, nickel, chromium, aluminum, and zinc. In 1983, NYSDEC listed the Three Star Anodizing Site as a Class 2 site, which indicated that the site posed a significant threat to public health or the environment and remedial action was required. The Three Star Anodizing Site is comprised of upland areas on the southern side of Wappinger Creek and a portion of the Creek adjacent to the former facility.

The first RI for the Three Star Anodizing Site was conducted by NYSDEC between 2001-2002 and investigated sediment within the tidal portion of Wappinger Creek, surface water and sediment in the Three Star Lagoon, and soil and groundwater within the former facility footprint. A supplemental RI was conducted from 2005 to 2007, in which NYSDEC concluded that Wappinger Creek sediment was impacted by nearby activities at the Three Star Anodizing Site. Sediment sampling results identified two hotspot areas at the Site, the shoal and embayment areas. The highest concentrations were detected at deeper depths, suggesting that historical contamination in surface sediment may have been buried over time. The 2007 RI also revealed that surface soil, subsurface soil, and groundwater beneath the Three Star Site facility was contaminated with VOCs, polycyclic aromatic hydrocarbons (PAHs), and inorganic contaminants, including mercury, lead, and chromium. Surface water sample results were generally within the then-current NYSDEC water quality screening values. However, elevated levels of contaminants, primarily PAHs and inorganic contaminants, exceeded the then-current NYSDEC ecological screening values.

In 2007, NYSDEC performed a Fish and Wildlife Impact Analysis using RI data to identify contaminants of potential ecological concern (COPECs) for Wappinger Creek and the Three Star Anodizing Site. Mercury and antimony constituted the inorganic COPECs with the highest calculated hazard quotient (HQ) values, an indicator of potential risk to human health. Other COPECs identified included cadmium, chromium, and zinc as well as semi-volatile organic compounds (SVOCs).

NYSDEC signed a ROD in March 2009 for the Three Star Anodizing Site. The NYSDEC ROD designated the Three Star Anodizing Site as OU1. The main components of the OU1 remedy included the removal and disposal of contaminated soil, debris, asbestos-containing materials and waste containers, installation of soil and asphalt covers, dredging of sediment from the Three Star Lagoon, groundwater treatment via chemical injections, installation of a sub-slab depressurization system at an onsite building, and restoration of remediated areas. No remedy was selected for Wappinger Creek, which was designated as OU2. In October 2009, a third RI focusing on the tidal portion of Wappinger Creek was conducted by NYSDEC. Samples were collected near the Three Star Anodizing site as well as along the tidal Creek and analyzed for metals, including mercury and methylmercury (MeHg). The 2010 RI report concluded that results were generally consistent with the findings from the 2007 RI report. Identified contaminants of concern (COCs) were antimony, arsenic, cadmium, chromium, lead, mercury, zinc, and cyanide. Concentrations of COCs in sediment appeared to pose risk to aquatic biota and human users of the Creek.

Initial EPA Involvement

In 2004, EPA conducted a removal action at the request of NYSDEC to clear debris and remove containers with known and unknown waste from buildings at the Three Star Anodizing Site. Onsite structures that were deemed unstable or prevented access to the waste containers were demolished to complete this removal action. Approximately 12,000 gallons of liquid and 20 compressed gas cylinders were removed and disposed offsite.

In 2015, as part of EPA's Hazard Ranking System evaluation, EPA's Region 2 Site Assessment Team collected soil, surface water, and sediment samples near the Industrial Park along Wappinger Creek. Samples were also collected from Wappinger Lake and upstream of the Industrial Park in order to evaluate background conditions. All soil, surface water, and sediment samples were analyzed for VOCs, SVOCs, and metals. A subset of sediment samples was also analyzed for dioxins, furans, and MeHg. While the 2015 investigation identified mercury and benzo(a)pyrene (BAP), a type of PAH, as the main contaminants of concern in Site sediment, a review of historical documents identified several other contaminants at the Site, including VOCs, other PAHs and metals, and manufactured gas plant cinders.

EPA placed the Site on the National Priorities List on September 9, 2016.

Results of EPA's Remedial Investigation

During 2021 and 2022, EPA conducted an RI and collected soil, sediment, surface water, porewater, groundwater, air and fish samples to define the nature and extent of contamination at the Site. A hydrogeological assessment was also performed at the Site, which included a thermal infrared imaging survey and the installation of monitoring wells, staff gauges, stilling wells, piezometers; porewater and groundwater screening; long-term water level monitoring; and synoptic water level measuring. A bathymetric survey was conducted to measure Creek depth and map the underwater features at the Site.

Based on the results of the RI, EPA determined that THg is the principal COC in sediment at this Site. Mercury is a metal that exists in several forms: elemental, inorganic, and organic. It is released to the environment through a variety of processes, including metals processing, coal burning, industrial effluent discharge, burning of municipal and medical waste, and atmospheric deposition.

Elemental mercury is a shiny, silver-white metal that is liquid at room temperature. Unlike inorganic and organic forms of mercury, elemental mercury is an element that has not reacted with another substance. At room temperature, exposed elemental mercury can evaporate to become an invisible, odorless toxic vapor. If heated, it is a colorless, odorless gas. Inorganic mercury is commonly found in the form of mercury salts, which are formed when elemental mercury is combined with another substance. Once mercury is released to the environment, it can also be converted to a highly toxic form called methylmercury, through a process called methylation. Methylation occurs when inorganic mercury is processed by bacteria in water and soils and converted into methylmercury. Methylmercury is the most common form of organic mercury found in the environment, especially in anoxic sediment (sediment with little to no oxygen), and it can bioaccumulate in fish tissue. The forms of mercury that comprise THg at the Site are inorganic mercury and methylmercury.

Other site-related contaminants include inorganic compounds (lead, chromium, cyanide, and arsenic) and organic compounds (PAHs, PCBs, pesticides, and dioxin/furans), which were found throughout the Site at high concentrations. The discussion below summarizes the RI findings of the site-related contaminants within the media sampled at the Site.

Sediment and Streambank Soils

Sediment is the primary media contaminated with THg and other site-related contaminants and is the focus of the IRA. Contamination is primarily present in the particulate phase, sorbed to particulates. The highest concentrations of site-related contaminants are generally observed between 0.5 to 2.0 feet below sediment surface (bss), indicating depositional burial of historically contaminated sediment at the Site. Concentrations begin to decrease below the 2-foot bss depth interval for most contaminants and at most sample locations.

Sitewide contamination among inorganic and organic compounds is highest along the outer margins of the channel where the sediment bed contains softer, fine-grained material. These areas exhibit thicker sediment beds because of slower water velocities that flow along the inside of the Creek bends, allowing for deposition of particulates to occur more readily. This depositional tendency is evidenced by the consistently high concentrations of inorganic and organic contaminants in the riverbank soils along the embayment peninsula, within the embayment area itself, and in the floodplain material within the wetlands bordering the northern bank of the embayment area.

The embayment is notably one of the most contaminated areas of the Site, mainly because of its semi-protected, shallow environment away from the main channel that allows contaminants to settle out of the water column. Some of the highest concentrations of inorganic contaminants in the Creek were also detected in areas near the former business operations in the Industrial Park, particularly along the southern bank. This area is directly next to the historical Industrial Park footprint, where depositional features of the Creek are present.

<u>Inorganic Contamination</u>

<u>Total Mercury</u>**:** THg concentrations increase moving downstream past the historical source areas within the Industrial Park section, where they remain elevated at many sample locations along Transects T11 through T22. Detected concentrations of THg in this area ranged from 0.0074 to 210 milligrams per kilogram (mg/kg), with an average detected concentration of 4.73 mg/kg. Elevated concentrations of THg are observed primarily within the top 2 feet of sediment, with the highest concentrations observed vertically within the 0.5 to 2-foot bss depth interval. The highest concentration of THg was found in the Embayment section of the Site, with significantly elevated concentration levels also detected along the outer margins of the Upper and Lower Shoal sections. Streambank soils are most impacted with THg along the banks of the Embayment section. Downstream of the embayment area, concentrations drop to below background levels.

<u>Lead, Chromium, Cyanide, Arsenic</u>**:** Lead, chromium, and cyanide follow a similar contaminant distribution to that of THg. Higher concentrations of these contaminants were also more frequently detected in the shallow sediment from 0.5 to 2.0 feet bss within the embayment and shoal areas, with concentrations increasing immediately downstream of the Industrial Park section. Lead is detected at its highest concentration of 3,200 mg/kg within the Industrial Park section; total chromium is detected at its highest concentration of 3,100 mg/kg near the embayment area; and cyanide is detected at its highest concentration of 74 mg/kg near the embayment area. In contrast to other inorganic contaminants at the Site, arsenic levels did not reveal a notable difference in concentrations throughout the top two feet. However, the lateral distribution of arsenic is similarly concentrated in the embayment and shoal areas and

downstream of the Industrial Park section. The maximum concentration of arsenic was detected in the Embayment section at 82 mg/kg.

Streambank soil contamination for lead, chromium, cyanide, and arsenic is most severe along the embayment area wetlands, where sediment exchange likely occurs, and immediately downstream of the Industrial Park section, where the historical source of contamination originates. Arsenic concentrations increase noticeably from the southern bank toward the northern bank, where the embayment area is located. Locations exhibiting the highest impacts are next to the point of the embayment peninsula and the southern bank of the embayment area, which form the boundary between the main channel and the embayment area along the northern bank of the Creek. Chromium and arsenic reach peak concentrations in this area. Lead and cyanide impacts are also observed along the length of the embayment's bank; however, the highest streambank soil concentrations for lead and cyanide were detected in the Upper Shoal section.

Organic Contamination

Methylmercury**:** MeHg concentrations are highest within the Embayment section where the water is the shallowest and in areas where vegetation is dominated by water lilies. Concentrations of MeHg in shallow surface sediment (0 to 2 inches bss) throughout Wappinger Creek ranged from 0.04 to 4.17 nanograms per gram (ng/g), which were higher than the range in the 0 to 0.5-foot bss interval of 0.04 to 1.54 ng/g, and well above concentrations observed in deeper intervals.

Although MeHg concentration levels are highest in the Embayment section, mercury methylation is enhanced in the shoal areas, which are dominated by water chestnut plants, and in sediment that is regularly exposed to the atmosphere during low tide. The shoal areas represent the largest footprint of increased MeHg (e.g., ratio of MeHg to inorganic mercury) within Wappinger Creek. This is because mercury methylation in a freshwater system like Wappinger Creek is most active in the top 2 inches of surface sediment where anaerobic microorganisms can function with a fresh supply of oxidized substrate to enhance their activity. However, MeHg concentrations are highest in the Embayment section where there are approximately three to five times higher THg concentrations relative to the shoal areas. This indicates that the availability of THg, rather than methylating conditions, is driving MeHg concentrations at the Site.

Benzo(a)pyrene**:** PAHs, particularly BAP, are the most prevalent organic contaminant group in Site sediment. BAP follows a similar distribution pattern to the inorganic contaminants, with its highest concentrations observed within the 0.5- to 2-foot bss interval, with concentrations decreasing below 2 feet bss. The most significant BAP impacts are present between Transects T10 and T17. BAP impacts in streambank soils are observed primarily along the southern bank throughout the Industrial Park section and Upper Shoal section. Heavier impacted streambank soils are present along the northern bank that extends from the area between Transects T11 and T14, and throughout the northern bank of the embayment area.

Pesticides and dioxins/furans**:** Pesticides and dioxins/furans were found to be most elevated in Site sediment within the Industrial Park section, along Transects T7 and T10-T17, adjacent to areas of historical operations and downstream of the Industrial Park section. The northern bank of the Embayment section has the most significantly impacted streambank soils at the Site. Dioxin/furan concentrations throughout the remainder of the Creek are primarily elevated in the shoal areas.

Polychlorinated biphenyls**:** PCB Aroclors were detected within all sections of the Site. However, the distribution of PCB Aroclors does not follow the same trend observed for the other site-related contaminants, particularly in the lower portions of the Site. The highest PCB concentration detected was 0.36 mg/kg at Transect T8, where Aroclor 1254 was found to be more than double the concentration of any other PCB detection at the Site. However, both the number of detections and the median concentration levels of PCBs are higher in the Lower Shoal and Confluence sections than the upper portions of the Site. Additionally, no PCB Aroclors are present between Transects T17 and T20, which have many detections for the other site-related contaminants. Furthermore, there is a distinct transition point in the distribution and composition of Aroclors at approximately Transect T15. Samples within the Industrial Park, Upper Shoal, and Embayment sections have a different Aroclor signature (Aroclors 1248, 1254, and 1260) than the samples collected from the transects closest to the Hudson River (Aroclors 1242 and 1254), specifically downstream of Transect T15. Aroclors 1260 and 1248 were not detected in the Lower Shoal or Confluence sections.

This distribution of Aroclor fingerprints likely corresponds to a discrete release in the Industrial Park that has contributed to Aroclor 1248, 1254, and 1260 concentrations in the upper sections of the Site, upstream of T15. The presence of Aroclor 1254 downstream of T15 likely relates to the discrete release at Transect T8 and the subsequent migration of contamination across the Site over time. Aroclor detections closest to the Hudson River confluence, or downstream of T15, also have a prevalence of Aroclor 1242, which is the most commonly detected Aroclor in Hudson River sediment. The change in Aroclor signatures could partially explain the role of the Hudson River's influence through the deposition of impacted sediment into the Creek during periods of tidal fluctuation, storm events, and shifts in seasonal flow, where historically buried contaminated sediment have been potentially resuspended and transported into the Creek.

Based on the Aroclor signature change at Transect T15, the HRL was established to estimate the boundary of influence from the Hudson River within the Site. This line divides the Site into an area below the HRL (where there is a higher potential for recontamination) and an area above the HRL (where there is a lower potential for recontamination). Because the embayment is not prone to the most significant channel flows and is the most heavily impacted section at the Site, it was deemed, in its entirety, to be a priority area for early risk reduction through implementation of an IRA. Consequently, the HRL boundary was moved just south of the embayment, between Transects T17 and T18, and may be refined in the future as additional data is collected.

Groundwater and Porewater

Groundwater and porewater are not considered impacted media at the Site. Groundwater discharges into the Creek along its length; however, impacts to the Creek from groundwater discharge are not expected at the Site given the low contaminant concentrations.

VOCs are present in groundwater upland of the Industrial Park section, primarily in areas adjacent to and within areas of known historical operations. The presence of VOCs is likely related to direct waste discharges, and the infiltration and seepage of waste storage into the water table over extended periods of time. PAH-impacted groundwater and porewater are primarily confined to the Industrial Park section. Two porewater screening samples had elevated PAH concentrations downstream in the Lower Shoal and Confluence section. These samples were collected in areas with heavily impacted deep sediment, and the PAHs present in porewater in the lower sections are not indicative of impacted groundwater discharge into the Creek and porewater.

Site-related inorganic contaminants including lead, mercury, and chromium were detected at slightly elevated concentrations at one porewater sample location. However, their presence is likely a result of elevated turbidity levels as they were not detected in the corresponding filtered sample.

Surface Water

Contamination in surface water is present at low concentrations. SVOC-impacted surface water is very limited at the Site, with most surface water detections within the Embayment section. Pesticides were only detected in the Lower shoal and Confluence sections when Creek flows were elevated, suggesting that resuspension of pesticides from the sediment bed to the water column is likely during high-flow events.

Lead was the only site-related inorganic contaminant detected at slightly elevated concentrations in surface water samples. Differences in the inorganic contaminants present in sediment and surface water indicate that inorganic contaminant mass within the sediment is not readily migrating into the surface water. Concentrations and the number of detections are generally higher in unfiltered samples, indicating inorganic material is primarily present in the particulate phase.

Air

Ambient air samples were collected to determine whether potential elemental mercury trapped in Wappinger Creek sediment may be volatilizing to the air. Elevated mercury vapor readings were not detected during field screening of the breathing zone (space where a person breathes as they stand, sit, or lie) using a Jerome mercury vapor analyzer during sample collection. Additionally, mercury was not detected in any of the seven air samples collected.

Fish Tissue

A limited number of fish samples were collected to determine concentrations of Site contaminants in fish species in Wappinger Creek. Bottom feeder (common carp and channel catfish) and predatory fish (largemouth and smallmouth bass) species were collected from eight locations: four in the Industrial Park section, two from the Upper Shoal section, and two from the Embayment section. Only two predator species were collected during the fish sampling program, one from the Upper shoal section and one from the Embayment section. THg and MeHg were detected in all collected fish. Lead, chromium, arsenic, cyanide, BAP, Aroclors 1254 and 1260, select pesticides, and dioxin/furans were also detected; however, these compounds were not detected in every fish.

Interim Remedial Action Remediation Strategy

The RI data conclusions support the premise for taking an IRA for the upper portion of the Site to address risks and prevent source migration of THg in sediment even while some uncertainties remain.

<u>THg Concentrations in Sediment</u>: Owing to the complex behavior, distribution, and toxicity of THg, it has been identified as the primary risk driver at the Site. THg-impacted sediment is particularly extensive in the Upper Shoal and Embayment sections, and areas where shallow sediment are exposed during low tides can potentially provide conditions suitable for mercury methylation. If left untreated, these areas can lead to biotic exposure to the mercury. Streambank soils are also targeted in this IRA due to their potential to erode and re-contaminate the sediment bed after the remedial action is complete.

<u>Impacts from the Hudson River</u>**:** Evidence indicates that flood tides transport contaminated suspended solids from the Hudson River to the Wappinger Creek surface water and sediment bed. One line of evidence evaluated the distribution of Aroclor 1242 as a proxy to estimate the potential areal extent of Hudson River sediment depositing within the Creek. The evaluation indicates that this solids deposition is less pronounced, and recontamination from depositing solids is

less likely to occur in the upper portion of the Site. The extent of this area, and the boundary of this IRA, is marked by the HRL.

Depositional and Erosional Areas of the System**:** While some uncertainties exist in the depositional and erosional nature of all portions of the Site, the embayment and multiple shoals are present above the HRL. These areas are composed of deposits of finer-grained and potentially mobile sediment. Fine-grained particulates are more likely to have sorbed contaminants and to be redistributed within the system, if disturbed within the Site by anthropogenic activities or a high energy episodic flow event. As a result, the embayment and shoals are considered to be depositional areas that may act as source material of THg to other areas of the Site if left untreated.

Current and Potential Future Land and Resource Uses

The current and reasonably anticipated future land uses for this Site are an important consideration for the development of remedial action objectives (RAOs) and remedial criteria. The current land use within the identified Site boundary is predominantly characterized as recreational. The Creek is used by recreational users for activities, including swimming, kayaking, and fishing. Properties adjacent to the Site are zoned for a mix of residential and commercial use. The future land use of the Site is likely to remain similar to current conditions because the nature of the associated activities is not expected to change.

NYSDEC classified Wappinger Creek as a Class C(T) stream, meaning the Creek is an active recreational fishery that may support a trout population and is suitable for contact recreation. The Creek is also stocked with trout annually for recreational fishing. Wappinger Creek is also home to many species of fish, including largemouth bass, bluegill, pumpkinseed, red breasted sunfish, and brown bullhead.

Beyond recreation, the entirety of the Site represents a section of Wappinger Creek that is designated as a Significant Coastal Fish and Wildlife Habitat. This section of the Creek supports protected species, provides habitat for migratory and resident warmwater fisheries and wildlife species, and serves as a fish spawning, nursery, and wintering habitat. According to the United States Fish and Wildlife Service (USFWS), the Site is located within areas that provide habitat for the endangered Indiana bat, threatened northern long-eared bat, and the monarch butterfly. Any in-creek construction will require coordination with EPA, NYSDEC, other federal partners and stakeholders around fish and habitat protection windows.

Potential Site impacts from severe weather events have been assessed, and the performance of the remedy is not expected to be impacted as a result of these events. The locations most prone to flooding are in the low-lying areas by the Industrial Park section and the wetlands adjacent to the Embayment section. While increased flooding may be experienced in these portions of the Site during high tides and from increased severe rain events, the removal of source material would prevent the spread of contaminated sediment across the Site or to inland/upland areas. Flooding events are also not expected to impact future operations and monitoring activities for the Site.

PRINCIPAL THREAT WASTE

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Principal threat wastes (PTW) are those source materials considered to be highly

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

Human Health Risk Assessment: A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases under current- and anticipated future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure (RME) scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (i.e., soil, fish, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants in air, water, soil, etc. that were identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated fish. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" RME scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer risks and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one in ten thousand excess cancer risk;" or one additional cancer may be seen in a population of 10,000 people as a result of exposure to Site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one in ten thousand to a one in a million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a "threshold" (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 for a noncancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at a site and are referred to as chemicals of concern, or COCs, in the final remedial decision document or the Record of Decision.

toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria set forth in the NCP. This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

Site records indicate that mercuric chloride and other similar mercuric salts were used during historical operations along the Creek. Sediment contaminated with mercury acts as a potential reservoir of ongoing contaminant migration and direct exposure to ecological receptors. However, the mercury that is present at the Site is not in its elemental form, which would be considered highly mobile source material. There is no evidence of the import, handling, or conversion of elemental mercury, and the results during the RI revealed no observations of elemental droplets and no vapor detections during coring or air screening. Thus, Site sediment contaminated with mercury is not considered to be PTW.

RISK SUMMARY

As part of the RI/FS, a human health risk assessment (HHRA) and a screening level ecological risk assessment (SLERA) were conducted for the Site to estimate the risks and hazards associated with the current and future effects of contaminants on human health and the environment. A HHRA is an analysis of the potential adverse human health effects of releases of hazardous substances from a site in the absence of any actions or controls to mitigate these exposures under current and future site uses. A SLERA is an analysis to assess the risk posed to ecological receptors, during which some data gaps where identified causing EPA to conclude that further ecological risk evaluation was warranted. Following results of the SLERA, a baseline ecological risk assessment (BERA) was subsequently completed at the Site to refine the evaluation of ecological risks from contaminants at the Site.

Human Health Risk Assessment

In the HHRA, the cancer risk and noncancer health hazard estimates are based on current reasonable maximum exposure scenarios and were developed by taking into account various health protective estimates about the frequency, duration, and concentrations of an individual's exposure to chemicals selected as contaminants of potential concerns (COPCs), as well as the toxicity of these contaminants.

A four-step human health risk assessment process was used for assessing Site-related cancer risks and noncancer health hazards in the absence of any remedial action. The four-step process is comprised of: Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization (see text box "What is Risk and How is it Calculated") for more details on the risk assessment process.

The HHRA began with selecting COPCs in surface water, sediment, and fish tissue that could potentially cause adverse health effects in exposed populations. All identified COPCs can be found in the HHRA. Contaminants at the Site identified as requiring remedial action are referred to as COCs. As discussed in more detail below, the principal COC targeted for OU1 in this interim action is THg.

In the exposure assessment, EPA identified potential human receptors based on a review of current and reasonably foreseeable future land use at the Site. EPA expects that the future land use in this area will remain the same as the current use. Therefore, recreational uses at the Site were evaluated. Several properties adjacent to the Industrial Park section are active commercial facilities. Downstream of the Industrial Park section, residential areas border the Creek. There are some access points (*e.g.*, a boat ramp in the Upper Shoal section) that enable recreational users to launch boats into the Creek or fish along the banks, which have been observed at the Site. Most of the Site is then accessible from a kayak or other small craft. Individuals who work or live near the Creek may have occasional contact with media at the Site, but it is expected that those who actively use the Creek for recreational purposes will have the greatest exposure, including individuals who consume fish caught from the Creek during recreational angling. Young family members of anglers are not expected to fish themselves but may also consume fish caught from the Creek. It should also be noted that there is an existing New York State Department of Health (NYSDOH) Hudson River & Tributaries Fish Advisory, which includes the entirety of the Site.[1]

Exposure point concentrations were estimated using either the maximum detected concentration of a contaminant or the 95% upper confidence limit of the average concentration. Chronic daily intakes were calculated based on the reasonable maximum exposure (RME), which is the highest exposure reasonably anticipated to occur at OU1 of the Site. The RME is intended to estimate a conservative exposure scenario that is still within the range of possible exposures. A complete summary of all exposure scenarios can be found in the baseline human health risk assessment section of the RI report, which can be found in the administrative record for this decision.

In the HHRA, two types of toxic health effects of COPCs were evaluated: cancer risk and noncancer hazard. Calculated cancer risk estimates for each receptor were compared to EPA's target risk range of $1x10^{-6}$ (one-in-one million) to $1x10^{-4}$ (one-in-ten thousand). The calculated noncancer hazard index (HI) estimates were compared to EPA's target threshold value of 1. The following section provides an overview of the cancer risks and noncancer hazard estimates associated with exposure to surface water, sediment, and fish tissue at the Site.

Cancer risks and noncancer hazards for recreators in direct contact with Creek surface water and sediment were all below a level of concern for all ages (adults, adolescents and children). For anglers consuming the fillets of bottom-feeding fish, there was an unacceptable cancer risk for adults, adolescents and children (all 2×10^{-03}) primarily attributable to benzo(a)pyrene, Aroclor 1254 and Aroclor 1260 via the consumption pathway. The noncancer HI for angler adults was 52, adolescents was 57, and children was 92, primarily attributable to BAP, Aroclor 1254, Aroclor 1260,

[1] https://www.health.ny.gov/environmental/outdoors/fish/health_advisories/maps/docs/dutchess_co_final.pdf

and mercury (as MeHg). For anglers consuming the fillets of predatory fish, there was an unacceptable cancer risk for adults, adolescents and children (all 5 x 10^{-04}) primarily attributable to Aroclor 1254 via the consumption pathway. The noncancer HI for angler adults was 25, adolescents was 27 and children was 44, primarily attributable to benzo(a)pyrene, Aroclor 1254, Aroclor 1260, and mercury (as MeHg).

Ecological Risk Assessment

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: *Problem Formulation* - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. *Exposure Assessment*--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. *Ecological Effects Assessment*--literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. *Risk Characterization*--measurement or estimation of both current and future adverse effects.

A SLERA was conducted for OU1 to evaluate the potential for ecological risks from the presence of contaminants in surface water, sediment, and biological tissue. Surface water and sediment concentrations, as well as calculated food chain exposures, were compared to ecological screening values as an indicator of the potential for adverse effects in ecological receptors. The SLERA determined that site-related COPECs in sediment, surface water, and fish tissue pose a risk (i.e., HQs exceeded 1.0 for one or more contaminants) to ecological receptors using the site. The SLERA concluded that additional ecological evaluation was warranted.

WHAT IS ECOLOGICAL RISK AND HOW IS IT CALCULATED?

A Superfund baseline ecological risk assessment is an analysis of the potential adverse health effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

Problem Formulation: In this step, the contaminants of potential ecological concern (COPECs) at the site are identified. Assessment endpoints are defined to determine what ecological entities are important to protect. Then, the specific attributes of the entities that are potentially at risk and important to protect are determined. This provides a basis for measurement in the risk assessment. Once assessment endpoints are chosen, a conceptual model is developed to provide a visual representation of hypothesized relationships between ecological entities (receptors) and the stressors to which they may be exposed.

Exposure Assessment: In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed. This estimation of exposure point concentrations includes various parameters to determine the levels of exposure to a chemical contaminant by a selected plant or animal (receptor), such as area use (how much of the site an animal typically uses during normal activities); food ingestion rate (how much food is consumed by an animal over a period of time); bioaccumulation rates (the process by which chemicals are taken up by a plant or animal either directly from exposure to contaminated soil, sediment or water, or by eating contaminated food); bioavailability (how easily a plant or animal can take up a contaminant from the environment); and life stage (*e.g.,* juvenile, adult).

Ecological Effects Assessment: In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis. To provide upper and lower bound estimates of risk, toxicological benchmarks are identified to describe the level of contamination below which adverse effects are unlikely to occur and the level of contamination at which adverse effects are more likely to occur.

Risk Characterization: In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates the potential for unacceptable risk. The risk is described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

Risks estimated in the SLERA were refined in the subsequent BERA, which further evaluated potential risk to ecological receptors using more realistic exposure scenarios. Results of the BERA indicated that exposure to site-related COPECs in sediment, fish tissue, and benthic macroinvertebrate tissue pose a risk to upper trophic level ecological receptors using the Site. Specifically, the BERA showed that the primary drivers of potential adverse effects were from exposure to:

- Aluminum, antimony, barium, chromium, copper, lead, and mercury in aquatic invertebrate-eating birds (represented by the spotted sandpiper)

- Lead and mercury in fish-eating birds (represented by the great blue heron)
- Aluminum in insect-eating mammals (represented by the little brown bat)
- Aluminum and mercury in mammals that eat both plants and animals (represented by the raccoon)
- Total PCBs and mercury in fish-eating mammals (represented by the mink)

Additionally, the potential impact of site-related contaminants on the benthic invertebrate community (the organisms that live in the sediment) was evaluated, and toxicity tests evaluated the impacts on survival and growth of exposure of benthic invertebrates to sediment from the Site. Results of these evaluations did not indicate any site-related factors impacting community composition or toxicity to benthic invertebrates. A complete summary of all exposure scenarios can be found in the BERA. Based on the results of the ecological risk assessments, mercury is the primary driver of risk, and remedial action is necessary to protect ecological receptors and the environment from actual or threatened releases of hazardous substances.

Summary of Human Health and Ecological Risks

In summary, elevated cancer risks and/or noncancer hazards, along with unacceptable ecological risks, were identified for the Site. Based on the results of the RI and the risk assessments, EPA has determined that the actual or potential migration of source materials from OU1 of the Site, if not addressed by the preferred remedy or one of the other active measures considered, may present a threat to human health or welfare and/or the environment. It is EPA's current judgment that the preferred remedial alternative identified in this Proposed Plan is necessary to protect human health or welfare and the environment.

REMEDIAL ACTION OBJECTIVES

RAOs are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements (ARARs), to-be-considered (TBC) advisories, criteria and guidance, and site-specific risk-based levels and background concentrations.

The following RAOs have been established for OU1:

Exposure-Related RAOs

RAO 1: Control contaminated sediment that is a source of unacceptable human health risks from ingestion of contaminated fish by addressing THg at levels above the remedial action level (RAL) in sediment and streambank soils at locations upstream or above the HRL.

RAO 2: Control contaminated sediment that is a source of unacceptable ecological risk (via direct contact, ingestion, or uptake into the food chain) by addressing THg at levels above the RAL in sediment and streambank soils at locations upstream or above the HRL.

Migration-Related RAO

RAO 3: Control contaminated sediment that is a source to Wappinger Creek and could migrate to downstream environmental media by addressing THg at levels above the RAL in sediment and streambank soils located upstream or above the HRL.

To achieve the RAOs, EPA has identified a RAL of 1.1 mg/kg for THg to define source materials that require remediation. RALs are commonly used at sediment sites to develop remedial alternatives and delineate areas exceeding a defined concentration threshold. They can be utilized for source reduction remedies prior to final risk-based preliminary remediation goals (PRGs) being developed for the site. The RAL of 1.1 mg/kg was derived as a multiple of a risk-based level developed using background information from Wappinger Lake. This level is intended to identify the most significant sources of THg that could be targeted as part of an IRA to reduce risk to human and ecological receptors. It is also anticipated that it would reduce migration concerns within sediment and to other environmental media. The RAL of 1.1 mg/kg is also consistent with the NYSDEC "Technical Guidance for Screening Sediment and Assessment of Contaminated Sediment," which defines sediment concentrations above 1 mg/kg for mercury as being "highly contaminated and likely to pose a risk to aquatic life."[2]

The practical outcome of applying the RAL approach to this site is that a large mass of material that is acting as a continuing source to the rest of the Site will be addressed. In addition, given the widespread presence of THg, addressing THg above the RAL is also expected to address other site-related contaminants. Streambank soils above the RAL will also be remediated so they do not serve as an ongoing source to sediment and to reduce the potential for recontamination of remediated sediment. However, it should be noted that this RAL is not a final remediation goal for Site sediment or streambank soils. A subsequent or final remedy will identify the final remediation goals for sediment and streambank soil contaminant levels, along with other Site media, for the entire length of the Site. Additional discussion of how the RAL was developed can be found in the FFS Report.

SUMMARY OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of CERCLA requires that remedial actions must be protective of human health and the environment, be cost-effective, and utilize permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions that employ, as a principal element, treatment to reduce permanently and significantly the volume, toxicity, or mobility of the hazardous substances, pollutants, and/or contaminants at a site. Section 121(d) further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and/or contaminants that at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to Section 121(d)(4) of CERCLA.

Potential technologies applicable to sediment remediation were identified and screened using the effectiveness, implementability, and cost criteria, with emphasis on effectiveness. Those technologies that passed the initial screening were assembled into alternatives. Detailed descriptions of the remedial alternatives for addressing the contamination associated with OU1 of the Site can be found in the FFS Report, dated July 2026, which is in the Administrative Record for this decision. The FFS Report presents four alternatives, including a required "no action" alternative.

The duration for each alternative reflects only the time required to construct or implement the remedy and does not include the time that may be required to negotiate with any responsible parties, obligate funding, design the remedy, procure contracts for design and construction, or conduct operation and maintenance post-construction at the Site.

[2] https://extapps.dec.ny.gov/docs/fish_marine_pdf/screenasssedfin.pdf

Common Elements

With the exception of the No Action alternative (Alternative 1), all the alternatives include the following common components:

Dredging: Each of the active remedial alternatives includes various amounts of dredging that will reduce the volume of contaminated sediment in Wappinger Creek. Dredging of sediment could be implemented through various methods, including mechanical dredging methods, *e.g.*, barge-mounted excavators. The exact methodology for dredging and in-water transport of contaminated sediment would be further evaluated and determined in the future during the remedial design.

Excavation of Streambank Soils: Each of the active remedial alternatives includes excavation of streambank soils that will reduce their volume in Wappinger Creek. Based on currently available data, excavation depths are specified to a maximum depth of 0.5 feet, with an estimate of 10% of the streambank length and a width of 50 feet for each alternative. The remedial extent of streambank soils was developed using the 100-year floodplain in the vicinity of the remedial areas as a guide. The exact boundaries will be refined with additional sampling as part of the pre-design investigation (PDI).

Capping: Alternatives 2 and 3 include placement of reactive caps to control the migration of THg and prevent methylation of THg into MeHg. Alternative 4 includes the placement of backfill materials without the use of a reactive cap as sediments are dredged to below the RAL under this alternative. For streambank soils, it is assumed that once excavated, only backfill will be needed since there is less potential for underlying contamination (if it remains) to migrate upward to the soil surface; however, the need for reactive caps or soil cover for the streambank soils will be evaluated during PDI and RD.

Sediment and Streambank Soil Management, Treatment, and Disposal: Each active alternative includes the management, treatment, and disposal of removed materials. Dredged sediment and excavated streambank soils will be off-loaded and managed in an area near the creek. After removal, dewatering will be required to reduce the amount of water and prepare the contaminated materials for transport and treatment or disposal. It is assumed that wastewater generated during the dewatering process would require treatment prior to discharge to Wappinger Creek. The water from the dewatering process is assumed to be pumped through an on-site temporary water system prior to discharge. It is expected that treated water would meet discharge standards. Details regarding the dewatering process and wastewater treatment requirements would be further developed as part of the RD.

Following the dewatering process, sediment and streambank soils would be transported off-site and disposed of at a facility approved for receiving such contaminated materials. The approved facilities must be in compliance with the Off-Site Rule as established in the NCP. The type and location of the disposal facility will depend on the nature and concentrations of the waste materials. The disposal options being considered include both Subtitle C and D landfills. This could be a hazardous waste landfill, municipal solid waste landfill, construction and demolition debris landfill or industrial non-hazardous waste landfill, depending on the results of waste characterization during remedial action.

Restoration of Remediated Areas: Each of the active alternatives will require restoration of streambank soils after the remedial action is completed. The excavated areas would be backfilled with clean material and restored to their original grade. Additional data may be collected to support vegetative restoration of remediated areas.

All remedial alternatives would most likely disturb contaminated sediments in wetlands. A field delineation of the wetlands will need to be performed to determine the extent of actual wetland areas and types. Additional data collection may also be necessary to support habitat restoration of remediated areas. Disturbance during remediation is considered temporary, and no permanent wetland loss is anticipated. It is assumed that each of the alternatives will include wetland mitigation in an area equivalent to the area of wetland disturbed by the remedial action, ensuring there would be no net change in overall acreage of wetlands. If reduction of wetlands is unavoidable, a third-party compensatory mitigation option would be considered to the extent necessary to meet ARARs.

Evaluation Monitoring: An evaluation monitoring program will be developed that includes baseline monitoring, construction-phase monitoring, and long-term monitoring. This program will assess the performance of the remedy, whether the RAOs have been achieved, the impact from ongoing sources post-implementation and evaluate the potential for natural recovery in the system. Sampling will include biotic (*e.g*., fish tissue) and abiotic (*e.g*., sediment, soil, surface water, porewater) media. Results will be used to support future decisions on the final remedy for OU2.

Pre-Design Investigation: A robust PDI will be conducted to fill the data gaps and collect necessary information for the RD. The data gaps include, but may not be limited to, potential upland sources that could re-contaminate Creek sediment; refinement of lateral and vertical extent for remediation; assessing multiple lines of evidence to determine the extent of Hudson River impacts; a second bathymetric survey to support analysis of net deposition and erosion areas; and full characterization of all the potential mercury methylation pathways. The PDI will also collect the information necessary for wetland delineation and habitat restoration activities following remedial action.

Institutional Controls: Since contaminated materials that do not allow for unlimited use and exposure will remain onsite below the HRL, ICs would be developed to protect the receptors to Wappinger Creek. ICs would involve administrative and legal measures, *i.e.*, legal controls, and/or informational measures, *e.g.*, risk communication programs, intended to inform activities within the Creek that could pose unacceptable risks to human health and the environment. EPA will work with local and state authorities to implement ICs, which could include notification programs to inform the community of the NYSDOH Hudson River & Tributary fish advisory already in place for the Creek, and/or other environmental and health advisories. The existing fish advisory may also be updated, or a waterbody-specific fish advisory for the Creek may be enacted. For areas where caps are implemented, waterway use restrictions, signage, or regulated navigation and land use restrictions would likely be implemented pursuant to ICs to prevent damage to the cap, *e.g.*, no boat anchoring. The specific categories and types of IC instruments to be used would be determined during the RD phase of the project.

Five-Year Reviews: The CERCLA statutorily requires reviews of remedies where hazardous substances will remain onsite above levels that would otherwise permit unlimited use and exposure to ensure continued protectiveness. Such reviews must occur no less often than every five years. While this statutory requirement is independent of, and thus not an element of, any remedial alternative considered, this review would occur at this Site under all the alternatives. As such, the protection that such a review provides can be relied upon during the evaluation of CERCLA remedial alternatives, and the acknowledgment of this protection is understood in the following descriptions of all the alternatives.

Alternative 1: No Action

Capital Cost:	$0
Annual O&M Costs:	$0
Present-Worth Cost:	$0
Construction Time:	Not Applicable
Estimated time to reach RAOs:	Not Applicable

The NCP requires that a “No Action” alternative be developed as a baseline for comparing other remedial alternatives. Under this alternative, there would be no remedial action conducted at the Site to remediate contaminated media or otherwise mitigate the migration of contamination that poses unacceptable risks to human health and the environment. This alternative does not include monitoring or institutional controls.

Alternative 2: Dredge to Depth of One Foot; Capping of Underlying Contamination

Capital Cost: $68,281,000
Annual O&M Costs: $828,000
Present-Worth Cost: $77,298,000
Construction Time: 12 months (spread over 2 years)
Estimated time to reach RAOs: 2 years

Alternative 2 focuses on targeted removal and in-place containment of contaminated sediment and streambank soils in conjunction with ICs, access controls, and monitoring. This alternative would remove a significant amount of THg mass in sediment followed by placement of an amended cap to reduce/eliminate exposure of benthic organisms to THg contamination.

Alternative 2 would consist of removing levels of THg greater than the RAL of 1.1 mg/kg in surface sediment within the remedy footprint to a depth of 1 foot. In addition to the 1-foot dredge, an over-dredge thickness of 6 inches (*i.e.*, 1.5 feet total depth) is estimated based on Site conditions and cap constructability assumptions and will be refined during RD. There may be instances where the over-dredge depth will be more or less than 6 inches.

Following dredging, a reactive cap (e.g., sand and activated carbon) would be needed to provide a physical barrier to contain the THg contamination from migrating from deeper sediment to the post-remedy surface sediment. Once bound to the activated carbon, contaminants are effectively isolated, reducing their bioavailability and associated risks. EPA expects that the total thickness of the cap will match the depth of dredge to ensure that the post-remediation surface does not exceed the pre-existing bathymetric surface. A suitable habitat layer will be placed above the reactive cap to create conditions for the re-establishment of natural conditions in the Creek. An erosion protection layer to maintain the stability of the cap surface may also be required.

Operations and maintenance (O&M) activities will be necessary to ensure that the alternative is functioning as intended and protective of human health and the environment. Anticipated activities include periodic inspections of the reactive cap, bathymetric surveys to evaluation the condition of the reactive cap, and sampling to support post-construction monitoring.

Alternative 3: Dredge to Depth of Two Feet Maximum; Capping of Underlying Contamination

Capital Cost: $89,568,000
Annual O&M Costs: $816,000
Present-Worth Cost: $98,472,000
Construction Time: 14 months (spread over 2 years)
Estimated time to reach RAOs: 2 years

Alternative 3 focuses on removal and in-place containment of contaminated sediment and streambank soils in conjunction with ICs, access controls, and monitoring. This alternative removes more THg mass in the sediment than Alternative 2. Similar to the previous alternative, Alternative 3 includes the placement of a reactive cap to reduce/eliminate exposure of benthic organisms to THg contamination.

Alternative 3 would consist of removing levels of THg greater than the RAL of 1.1 mg/kg to a depth of 2 feet within select portions of the proposed remedy footprint, and to a removal depth of 1 foot in the remainder of the proposed remedy footprint. The targeted depth of removal is based on the depth of the RAL exceedance. If the concentration of THg exceeds the RAL between at a depth of 1 to 2 feet, then that location will be dredged to 2 feet. In areas where dredging is limited to 1 foot, an additional over-dredge thickness of 6 inches (*i.e.*, 1.5 feet total depth) is estimated based on Site conditions and cap constructability assumptions and will be refined during RD. There may be instances where the over-dredge depth is more or less than 6 inches.

Following dredging, a reactive cap (e.g., sand and activated carbon) would be needed to provide a physical barrier to contain the THg contamination from migrating from deeper sediment to the post-remedy surface sediment. Once bound to the activated carbon, contaminants are effectively isolated, reducing their bioavailability and associated risks. EPA expects that the total thickness of the cap will match the depth of dredge to ensure that the post-remediation surface does not exceed the pre-existing bathymetric surface. A suitable habitat layer will be placed above the reactive cap to create conditions for the re-establishment of natural conditions in the Creek. An erosion protection layer to maintain the stability of the cap surface may also be required.

O&M activities will be necessary to ensure that the alternative is functioning as intended and protective of human health and the environment. Anticipated activities include periodic inspections of the reactive cap, bathymetric surveys to evaluate the condition of the reactive cap, and sampling to support post-construction performance monitoring.

Alternative 4: Dredge to Remove Any RAL Exceedance; Backfill to Grade in the Dredge Footprint

Capital Cost: $83,072,000
Annual O&M Costs: $464,000
Present-Worth Cost: $88,098,000
Construction Time: 19 months (spread over 3 years)
Estimated time to reach RAOs: 3 years

Alternative 4 consists of removing sediment and streambank soils followed by the associated backfill in conjunction with ICs, access controls, and monitoring. This alternative removes the greatest amount of THg mass by removing all RAL exceedances of 1.1 mg/kg. Alternative 4 focuses primarily on removal of contaminant mass by removing sediment from areas where there are exceedances of the RAL. Containment and treatment are not the primary focus of this alternative, and this alternative will not require a reactive cap.

Under this alternative, sediment with THg concentrations exceeding the RAL of 1.1 mg/kg will be dredged. Based on contaminant levels, dredge depths for this alternative will vary between 1 foot to 5.5 feet.

For Alternative 4, a clean backfill layer (*e.g.*, sand) will be placed with a suitable habitat layer to create conditions for the re-establishment of natural conditions in the Creek. The total thickness of these layers will match the depth of dredge to ensure that the post-remediation Creek bottom level matches the pre-existing bathymetric surface. Since this alternative does not use a reactive cap, O&M activities would be limited to periodic Site inspections and post-construction performance monitoring to evaluate the effectiveness of the remedial action.

EVALUATION OF ALTERNATIVES

During the detailed evaluation of remedial alternatives, each alternative is assessed against the nine evaluation criteria set forth in the NCP, namely, overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, cost, and state and community acceptance. Refer to the text box for a description of the evaluation criteria.

This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how each compares to the other alternatives under consideration. A more detailed analysis of alternatives can be found in the FFS Report.

Overall Protection of Human Health and the Environment

Alternative 1 (No Action) is not protective of human health and the environment because it does not eliminate, reduce, or control risk of exposure to contaminated sediment. Alternatives 2, 3, and 4 were given a rating of adequate. Since this is an IRA, the alternatives presented are not required to reach protective levels for human health and the environment until a final remedy is selected. However, they are considered to be adequate exposure and migration control in the short term.

Alternatives 2, 3, and 4 each include removal of contaminated sediment but vary in the depth of sediment removal. By reducing concentrations of THg, these alternatives would reduce contributions to human exposure that would otherwise occur through ingestion of contaminated fish from recreational fishing as well as ecological exposure (through dietary exposure and direct contact) with contaminated sediment. In addition, all three of these alternatives would reduce migration of mercury from sediment in the upstream portion of the site to downstream media (sediment, streambank soils, and surface water) through reactive capping of areas above the RAL following targeted removal for Alternatives 2 and 3, or the removal of all sediments above the RAL in Alternative 4.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

<u>Threshold Criteria</u>

Overall Protectiveness of Human Health and the Environment evaluates whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified.

<u>Primary Balancing Criteria</u>

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

<u>Modifying Criteria</u>

Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

State/Support Agency Acceptance considers whether the State agrees with EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Under Alternative 1 (No Action), contaminants would continue to be left in the Creek sediment. Because no remedial activities would be conducted, no ARARs would be triggered or pertinent to have to be attained.

Under CERCLA, remedial actions must comply with all federal and state environmental requirements, standards, criteria, and limitations, unless such ARARs are waived under certain specific conditions. Because the remedy for OU1 is an IRA, identification of final ARARs is not necessary at this time. It is nonetheless expected that each of the active alternatives could be designed in such a way that it attains location- and action-specific ARARs and TBC advisories, criteria, and guidance. Chemical-specific ARARs would be addressed by the eventual, final remedy selected for OU2 and thus have not been identified for this IRA.

Alternatives 2, 3, and 4 are expected to comply with location- and action-specific ARARs for water quality monitoring during excavation of sediment and wastewater discharge resulting from sediment dewatering. Erosion and sediment controls would be implemented to protect water quality and maintain a stable Creek system, thus complying with New York State Environmental Conservation Law and Clean Water Act discharge limitations. Compliance with the New York Solid Waste and Hazardous Waste Management regulations, as well as the federal Resource Conservation and Recovery Act and Toxic Substances Control Act requirements will be maintained through characterization of sampling and proper management of removed materials. Wastewater discharges from dewatering activities to surface water and coastal zones will be in compliance with Clean Water Act and New York's SPDES requirements.

Alternatives 2, 3 and 4 may also impact water bodies, essential fish habitats, wetlands, floodplains, and other sensitive areas that are part of the Site. These alternatives may affect endangered species, migratory birds, and archaeological resources. Consultations with federal agencies, NYSDEC, and other state agencies such as the State Historic Preservation Office will be conducted to identify the substantive requirements of these requirements to protect these resources, and steps would be taken to implement measures that ensure compliance with the pertinent ARARs.

There are currently no federal or state promulgated environmental standards for contaminant levels in sediment. There are, however, other federal or state advisories, criteria, or guidance. Any final remedy considered by EPA must comply with all federal and state environmental standards, requirements, criteria, or limitations unless they are waived under certain specific conditions. Compliance with federal water quality criteria, state water quality standards, and soil cleanup objectives are expected to be achieved with the final remedy for OU2.

Long-Term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence, as no remedial activities would be conducted. In addition, no controls would be put in place to limit exposure of human or ecological receptors to unacceptable risks, and contaminants could continue to migrate within the upper portion of the Site and to downstream media.

Alternatives 2 and 3 would provide long-term effectiveness and permanence through a similar combination of targeted removal and off-site disposal, containment, ICs, monitoring, and access controls. These alternatives rely on in-place containment, through reactive capping, to manage residual contamination by reducing the mass of mercury in the system available to receptors, thereby reducing human health and ecological exposures. The effectiveness of the ICs is dependent on the legal and administrative enforcement of these controls, and EPA will work with state and local authorities to ensure these controls are in place and enforced.

For Alternatives 2 and 3, long-term effectiveness and permanence would be highly dependent on the integrity and design life of the cap, periodic inspection, post-construction monitoring and maintenance, and enforcement of ICs to ensure adequate protection in the interim until a final remedy for the Site is selected. If the engineered caps were compromised, contaminated sediment left in place could pose a risk of exposure or migration. Alternative 3 is expected to offer greater long-term effectiveness and permanence than Alternative 2 because of several factors, including the following: (a) additional source removal through deeper excavation of contaminated sediment, (b) reducing the volume of material requiring long-term containment, (c) reduction in the long-term flux of THg, and (d) provision of a thicker physical barrier to erosive forces potentially exposing underlying contaminated sediment. As a result, Alternative 3 is subject to fewer long-term concerns related to potential breach of containment than Alternative 2.

Alternative 4 would provide the highest long-term effectiveness and permanence among the alternatives evaluated, as it would involve removal of all contaminated sediment and streambank soils in exceedance of the THg RAL and off-site disposal at a permitted facility. By eliminating the need for long-term containment and minimizing residual risk, Alternative 4 offers the most reliable long-term protection.

Based on the considerations above, Alternative 1 is the least satisfactory for long-term effectiveness and permanence. Alternative 2 is rated moderate, Alternative 3 is rated moderate to high, and Alternative 4 is rated high for long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment

For Alternative 1, only natural recovery processes would potentially reduce contaminant concentrations in sediment and surface water because it does not include any affirmative remedial activities. Under this alternative, there would be no reduction of toxicity, mobility, or volume through treatment.

Alternatives 2 through 4 would partially meet the statutory preference for treatment as a principal element of the remedial alternative. These alternatives involve ex-situ treatment of dredged sediment and streambank soils using stabilization amendments to facilitate transportation for off-site disposal. Dewatering liquids would be treated on-site, with contaminants captured in media such as granular activated carbon, which would be regenerated (a form of treatment) or disposed of (with treatment as needed to meet disposal facility requirements). In addition to the ex-situ treatment of dredged sediment, sediment exceeding the RAL that remains in place for Alternatives 2 and 3 following the targeted removal would be managed with a reactive cap. While the reactive cap would not directly treat underlying contaminated sediment, it would employ passive treatment to any aqueous media that may contain dissolved phase contamination moving through the cap layers.

Alternative 2 would provide a moderate reduction in toxicity, mobility, or volume through treatment. The shallow depth of dredging and smaller volume of treated sediment reduces the overall treatment volume and long-term contaminant reduction potential. Alternatives 3 and 4 would provide a moderate to high reduction in toxicity, mobility, or volume through treatment. Alternative 3 involves a smaller quantity of dredged sediment and streambank soils that would be treated to facilitate off-site disposal than Alternative 4. However, Alternative 3 does include the addition of a reactive cap to passively treat potential dissolved contaminants in porewater, enhancing long-term contaminant mobility reduction through treatment. Under Alternative 4, the combination of dredging to remove all RAL exceedances, a large volume of treated sediment, and treatment of dewatering liquids is expected to result in significant reductions in toxicity and mobility through treatment.

Short-Term Effectiveness

Alternative 1 would cause the fewest short-term impacts, as no remedial activities would be conducted. Because no construction activities would occur, there would be no short-term risks to workers, the community, or the environment associated with this alternative. Alternatives 2 through 4 would involve construction activities and dredging of contaminated sediment and streambank soils, resulting in temporary impacts to the community, workers, and the surrounding environment. Alternatives 2 and 3 are estimated to take approximately 2 years to complete, and Alternative 4 is expected to take approximately 3 years because of the larger volume of sediment to be removed and backfilled.

Community impacts for Alternatives 2 through 4 include increased traffic, potential nuisance odors and noise, dust generation, and temporary restricted use of Wappinger Creek. These impacts would be most significant under Alternative 4 because of the higher volume of sediment and streambank soils excavation and material transport. Careful selection of haul routes, time-of-day restrictions, signage, and flaggers would help mitigate traffic-related safety hazards. Additional mitigation measures would include dust suppression, perimeter air monitoring, and restricting work hours to reduce community disruption.

Risks to workers would be present owing to the need to excavate, handle, and manage contaminated sediment and streambank soils. Alternative 2 would have the lowest risk to workers because it has the shallowest excavation depth. Alternative 3 would increase risk slightly with deeper excavation, while Alternative 4 would pose the greatest risk owing to the full excavation of contaminated sediment. Proper work procedures would be established and implemented to protect workers. Adherence to appropriate health and safety plans and Site management protocols would be required to mitigate risks. Safety measures may include dust suppression, use of personal protective equipment, and establishment of work zones would protect workers during remedy implementation.

Short-term environmental impacts are expected for Alternatives 2 through 4 because of in-water dredging and disturbance of contaminated sediment and streambank soils. These impacts include increased turbidity, resuspension of contaminated material, temporary habitat loss, and impacts on aquatic species. Alternative 4 would have the greatest environmental impact as it involves the most extensive dredging and backfill.

Based on these considerations, Alternatives 2 and 3 are rated moderate for short-term effectiveness owing to lower extent of excavation and disruption, and shorter implementation time. Alternative 4 is rated low to moderate owing to the highest level of construction activity and associated impacts on the community, workers, and environment.

Implementability

There are no implementability issues for Alternative 1 because it does not involve active remediation.

Alternatives 2, 3, and 4 involve dredging and in-place containment of contaminated sediment and streambank soils in Wappinger Creek using well-established technologies. Construction of reactive caps (Alternatives 2 and 3) and backfilling (Alternative 4) are relatively straightforward activities. However, each of these alternatives face similar site-specific technical challenges. These include restricted access for dredging equipment owing to shallow water depths, tidal conditions, fixed bridges with limited clearance, and overhead utilities. Equipment mobilization is complicated by the absence of waterway access from the Hudson River, requiring all machinery to be trucked in and launched via limited shoreline entry points. It is assumed that a temporary water treatment system may be required for treatment and discharge of wastewater collected from dewatering processes. Staging/processing area(s) would be required to facilitate dewatering and loading for off-site transportation and disposal. Finding suitable staging areas would be challenging given the limited space available near the Site.

Alternatives 2, 3, and 4 would also require coordination with multiple regulatory agencies. Coordination with NYSDEC would be needed for dredging within FEMA-designated floodways and for disturbance to wetlands. Coordination with State Historic Preservation Office would be required for any cultural resource surveys, and USFWS or state agency for threatened and endangered species would also be required. Approvals and permitting for off-site transportation of dredged material must be secured through the New York State Department of Transportation, with possible involvement from other state and local agencies. ICs would need to be developed and coordinated with relevant regulatory entities. Additionally, approval from permitted facilities meeting EPA's Off-Site rule would be required for the acceptance of contaminated sediment, including hazardous waste where applicable.

Based on these considerations, Alternatives 2 and 3 have a rating of moderate and Alternative 4 has a rating of low to moderate for implementability owing to increased complexity from the more extensive dredging.

Cost

The estimated capital, operation and maintenance, periodic, and present worth costs are presented in the table below and discussed in detail in the FFS Report. The costs were calculated assuming a 7% discount rate over a period of 20 years. Alternative 1 has no cost because no activities are implemented.

Alternative	Capital Cost	Annual O&M Costs	Periodic Cost*	Present Worth Cost
Alternative 1 – No Action	$0	$0	$0	$0
Alternative 2 – Dredge to Depth of 1 Foot; Capping of Underlying Contamination	$68,281,000	$828,000	$532,000	$77,298,000
Alternative 3 – Dredge to Depth of 2 Feet; Capping of Underlying Contamination	$89,568,000	$816,000	$564,000	$98,472,000
Alternative 4 – Dredge to Remove Any RAL Exceedance; Backfill to Grade	$83,072,000	$464,000	$240,000	$88,098,000

*Periodic costs are assumed to occur every 5 years.

State/Support Agency Acceptance

NYSDEC concurs with the preferred alternative.

Community Acceptance

Community acceptance will be evaluated after the public comment period ends and will be described in the Responsiveness Summary section of the ROD for this OU at the Site. Based on public comment, the preferred alternative could be modified from the version presented in this Proposed Plan, or another alternative could be selected.

PREFERRED REMEDY

Based upon an evaluation of the remedial alternatives, EPA, in consultation with NYSDEC, proposes Alternative 4: **Dredge to Remove Any RAL Exceedance; Backfill to Grade in the Dredge Footprint** as the preferred interim remedy for OU1. An overview of Alternative 4 is provided in **Figure 2**.

The preferred remedy has the following key components:

- Dredging of contaminated sediment and excavation of streambank soils that exceed the RAL of 1.1 mg/kg for THg, followed by placement of clean backfill;
- Management, treatment, and disposal of removed materials;
- Restoration of remediated areas;

- Implementation of monitoring programs, which include baseline, construction-phase, and long-term monitoring, to establish initial and long-term environmental conditions, track progress towards achieving RAOs, verify remedy implementation, and assess performance of the remedy;
- Implementation of a robust PDI will be conducted to fill the data gaps and collect necessary information for the RD; and
- Institutional controls in the form of administrative and/or informational measures to limit exposure to Site contamination, including outreach programs to inform the public of the existing NYSDOH fish advisory for Wappinger Creek.

The total estimated present-worth cost for the Preferred Alternative is $88,098,000. This is an engineering cost estimate that is expected to be within the range of plus 50 percent to minus 30 percent of the actual project cost. Further detail on the cost is presented the FFS Report.

Green remediation techniques, as detailed in NYSDEC's Green Remediation Program Policy DER-31, will be considered during the implementation of the selected remedy to reduce short-term environmental impacts.[3]

Basis for the Remedy Preference

Alternative 4 was selected as the preferred alternative because it is expected to achieve the greatest levels of protection, risk reduction, and long-term effectiveness with comparable short-term impacts and costs to the other active alternatives. This alternative permanently removes the highest volume of contaminated sediment that is considered source material, thereby preventing migration over time to other portions of the Site. Since all exceedances of THg above the RAL would be removed, this alternative does not require continual monitoring of a reactive cap system to maintain protectiveness. It is expected that Alternative 4 would reduce risk and achieve all RAOs within a reasonable timeframe.

Based upon the information currently available, EPA, in conjunction with NYSDEC, believes that **Alternative 4: Dredge to Remove Any RAL Exceedance; Backfill to Grade in the Dredge Footprint** would meet the threshold criteria and would provide the best balance of tradeoffs among the alternatives with respect to the balancing criteria. The preferred alternative would satisfy the statutory requirements of Section 121 of CERCLA: (1) be protective of human health and the environment; (2) comply with location and action-specific ARARs; (3) be cost-effective; and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The preferred alternative would partially meet the statutory preference for the use of treatment as a principal element because dredged sediment would be treated prior to disposal. With respect to the two modifying criteria, state acceptance and community acceptance, NYSDEC concurs with the preferred alternative, and community acceptance will be evaluated upon the close of the public comment period.

[3] https://extapps.dec.ny.gov/docs/remediation_hudson_pdf/der31.pdf

For further information on the Wappinger Creek Superfund Site, please contact:

Emily Wong
Remedial Project Manager
(212) 637-4303
Wong.emily@epa.gov

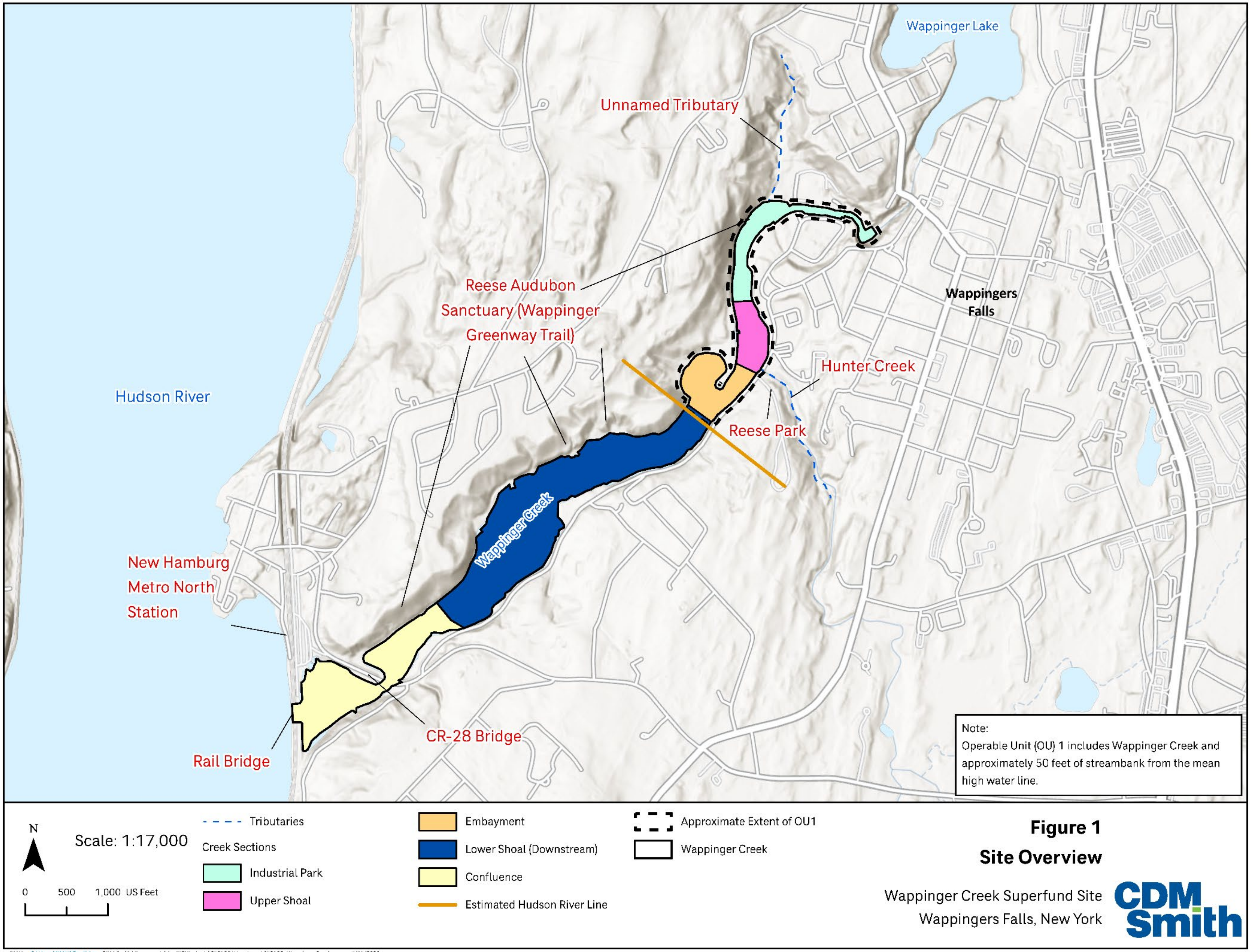
Olivia Cappo
Community Involvement Coordinator
212-637-3532
cappo.olivia@epa.gov

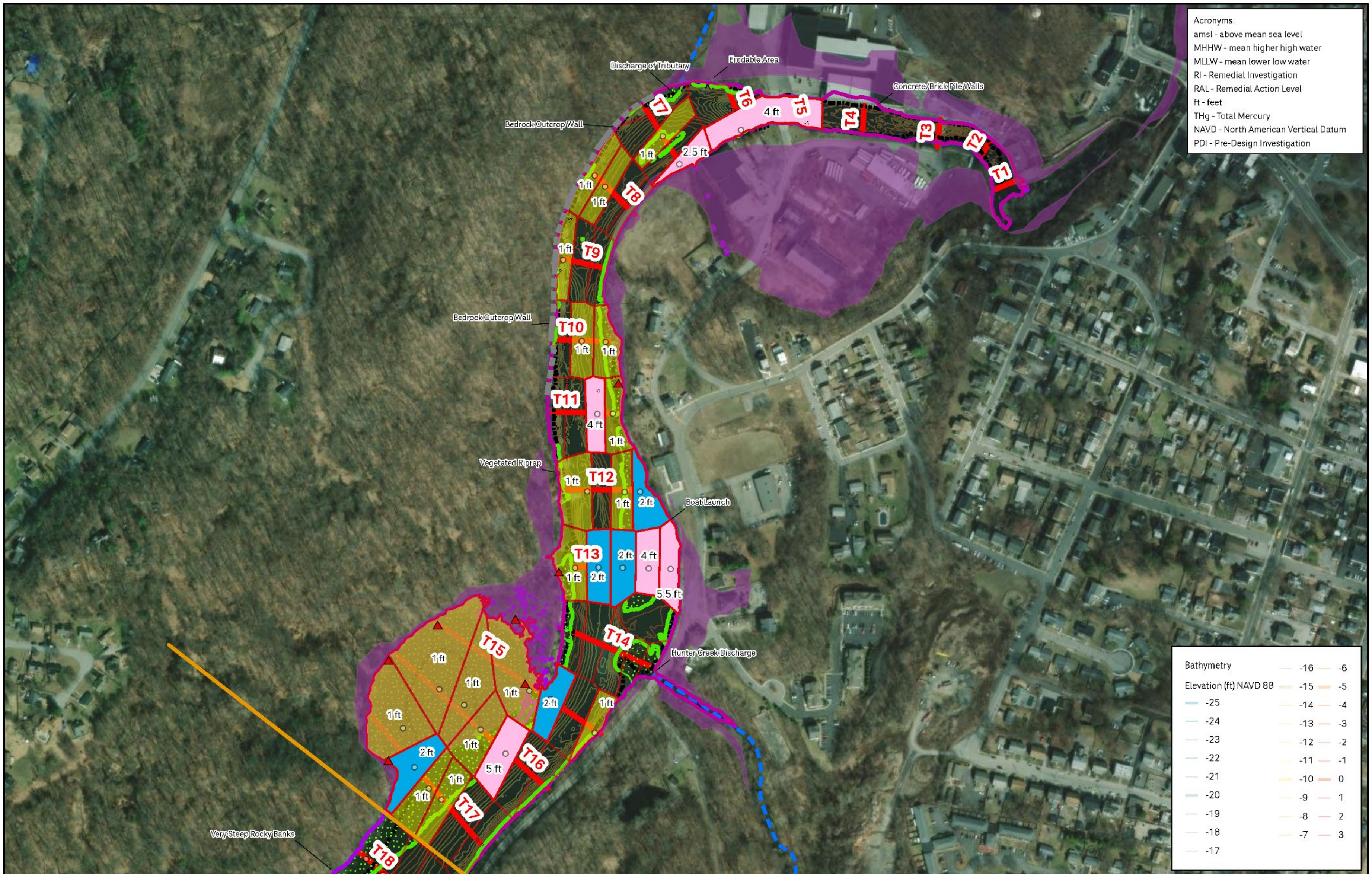
The administrative record file, which contains copies of this Proposed Plan and support documentation, is available online at http://www.epa.gov/superfund/wappinger-creek and at the following location:

USEPA – Region 2
Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007
(212) 637-4308
Hours: Monday – Friday: 9AM – 5PM (by appointment)

Written comments on this Proposed Plan should be mailed to Emily Wong by August 21, 2026 at the address below or sent via email.

Emily Wong
U.S. Environmental Protection Agency
290 Broadway
New York, New York 10007-1866
Telephone: (212) 637-4303


Wappinger Lake
Unnamed Tributary
Reese Audubon Sanctuary (Wappinger Greenway Trail)
Wappingers Falls
Hunter Creek
Reese Park
Hudson River
Wappinger Creek
New Hamburg Metro North Station
CR-28 Bridge
Rail Bridge
Note:
Operable Unit (OU) 1 includes Wappinger Creek and approximately 50 feet of streambank from the mean high water line.
N
Scale: 1:17,000
0 500 1,000 US Feet
Tributaries
Creek Sections
Industrial Park
Upper Shoal
Embayment
Lower Shoal (Downstream)
Confluence
Estimated Hudson River Line
Approximate Extent of OU1
Wappinger Creek
Figure 1
Site Overview
Wappinger Creek Superfund Site
Wappingers Falls, New York
CDM Smith



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Scale: 1:5,300

0 200 400 US Feet

Intertidal Zone
Mean Lower Low Water (-1.67 ft NAVD88)
Mean Higher High Water (-2.22 feet NAVD88)
Tributaries
RI Sampling Transects
Creek Shoreline
Estimated Hudson River Line
> RAL sample location (All Depth)
Streambank Sample > RAL (All Depths)
1% Annual Chance Flood Hazard area immediately outside floodway
Area not targeted for sediment removal
Area targeted for one foot of sediment removal
Area targeted for two feet of sediment removal
Area targeted for deeper than 2 feet of sediment removal
Bedrock Outcrop Wall

Notes:
1. MHHW calculated to be 2.22 ft NAVD88.
2. MLLW calculated to be -1.74 ft NAVD88.
3. Intertidal zone - the area between MHHW and MLLW. This zone is intermittently exposed to the atmosphere at lower tides and inundated at higher tides.
4. Bathymetric contours ae presented in feet amsl in NAVD88.
5. Reactive cap thickness assumed to be full sediment removal depth to maintain existing bathymetry.
6. Streambank soil removal will be generally in the vicinity of the streambank RAL exceedances and will be refined as part of the PDI.

2 ft Depth of removal below sediment surface

Figure 2

Alternative 4 Extent of Remediation Area

Wappinger Creek Superfund Site
Wappingers Falls, New York

CDM Smith

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