Draft Wanaque River Corrective Measures Study

Pompton Lakes Works Site
Pompton Lakes, Passaic County, New Jersey

PI #007411

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The Chemours Company FC, LLC
2000 Cannonball Road
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Acronyms

ABS	dermal absorption value
ACO	Administrative Consent Order
BEE	baseline ecological evaluation
BEHI	Bank Erosion Hazard Index
bgs	below ground surface
Chemours	The Chemours Company FC, LLC
CBR	critical body residue
CCME WQG	Canadian Council of Ministers of the Environment Water Quality Guidelines
CGMP	*Comprehensive Groundwater Monitoring Program*
COC	constituents of concern
COPEC	constituent of potential ecological concern
CMIWP	Corrective Measure Implementation Work Plan
CMS	corrective measures study
CSM	conceptual Site model
DuPont	E.I. du Pont de Nemours and Company
EMA	Former Eastern Manufacturing Area
ERG	ecological risk goal
ESC	ecological screening criteria
HSWA	Hazardous and Solid Waste Amendments of 1984
I-287	New Jersey Interstate 287
IRM	interim remedial measure
IRMWP	*Wanaque River Interim Remedial Measure Work Plan*
MeHg	methylmercury
mg/kg	milligrams per kilogram
mm	millimeter
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NMA	Former Northern Manufacturing Area
PCBs	polychlorinated biphenyls

PLW	Pompton Lakes Works
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RDCSRS	Residential Direct Contact Soil Remediation Standards
RI	remedial investigation
RFA	NJDEP Stormwater Construction General Permit
RIR	*Wanaque River Remedial Investigation Report*
SEL	severe effect limit
SWQS	Surface Water Quality Standard
TCLP	toxicity characteristic leaching procedure
Technical Status Report	*Wanaque River Investigation Technical Status Report*
THg	total mercury
TRSR	*Technical Requirements for Site Remediation*
USEPA	U.S. Environmental Protection Agency
WMA	Former Western Manufacturing Area

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1 Introduction

The Pompton Lakes Works (PLW) Site is located at 2000 Cannonball Road in Pompton Lakes, Passaic County, New Jersey (see Figure 1). The Site was historically owned and operated by E.I. du Pont de Nemours and Company (DuPont). On July 1, 2015, DuPont transitioned ownership of the PLW Site to The Chemours Company FC, LLC (Chemours).

1.1 Regulatory Background

In September 1988, DuPont entered into an Administrative Consent Order (ACO) with the New Jersey Department of Environmental Protection (NJDEP). In June 1992, the U.S. Environmental Protection Agency (USEPA) issued DuPont a Hazardous Waste Management Facility Permit under Section 9003 of the Hazardous and Solid Waste Amendments of 1984 (HSWA). The ACO and HSWA permit, which were revised in 1996, required DuPont to conduct a remedial investigation (RI) addressing contamination at, or emanating from, the Site. RI activities and remedial actions have been ongoing, both onsite and offsite, since 1988 to address media potentially impacted by former Site operations.

The *Wanaque River Remedial Investigation Report* (RIR) was submitted to NJDEP and USEPA (hereinafter referred to as the Agencies when referenced together) on July 30, 2010. On October 26, 2010, NJDEP provided comments on the report. Supplemental investigative work was conducted in November 2010 to address these comments and a revised RIR was submitted to the Agencies on August 2, 2011.

The revised RIR recommended an interim remedial measure (IRM) be completed to mitigate potential human health and ecological exposure to mercury in depositional sediments identified north of the former Lake Inez dam. On December 13, 2011, NJDEP provided comments on the revised RIR. Along with requesting a response to their comments, NJDEP also stated in their letter that “DuPont should note that while the NJDEP supports the recommendation to proceed with an IRM in the Wanaque River; the scope of the IRM needs to incorporate the comments provided in this correspondence”. DuPont submitted a response to comments to the Agencies on January 16, 2012. NJDEP comments to DuPont’s January 2012 response to comments were transmitted in correspondence dated March 21, 2012.

The *Wanaque River Sediment and Pore Water Sampling Plan* was submitted to the Agencies on July 2, 2012 and included a response to NJDEP’s March 2012 correspondence (response document was dated June 29, 2012). NJDEP transmitted correspondence on July 24, 2012 approving the sampling plan and the June 2012 response to comments.

Supplemental investigations were completed in 2011 and 2012 to address NJDEP comments and support the development of an IRM. Results were documented in the *Wanaque River Investigation Technical Status Report* (Technical Status Report) submitted to the Agencies on October 12, 2012. NJDEP provided comments on the Technical Status Report on February 21, 2013. In this correspondence, NJDEP requested the submittal of an IRM Work Plan, as recommended in the revised RIR. DuPont submitted a response to comments to the Agencies on May 20, 2013. This submittal was a formalization of discussions during a conference call with NJDEP on March 28, 2013.

The *Wanaque River Interim Remedial Measure Work Plan* (IRMWP) was submitted to the Agencies on May 28, 2013. NJDEP provided comments on the IRMWP on January 23, 2014. A technical meeting was held with NJDEP after receipt of the comments and a series of data collection activities were identified to assist in the design and implementation of the IRM. DuPont submitted a response to these comments to the Agencies on February 12, 2014 and also indicated that additional data collection activities would be completed to assist in the design and implementation of the IRM. Additionally, DuPont informed the Agencies in this letter that the results of the data collection activities would be documented in a report and, upon Agency approval, would be incorporated into a revised IRMWP.

Additional data collection activities were conducted between October 2013 and August 2014. The results of these activities were presented in the *Wanaque River Interim Remedial Measure Data Collection Activities Report* submitted to the Agencies on December 2, 2014. NJDEP provided comments on the report on April 14, 2015. A conference call was held between DuPont and NJDEP on May 7, 2015 to discuss the comments and path forward. A summary of the meeting was submitted to NJDEP via email on May 19, 2015.

A path forward action item from that meeting was that NJDEP and DuPont would both further evaluate scientific literature regarding fish tissue and mercury. It was decided that a formal response to the April 14, 2015 comment letter from NJDEP would be deferred until both parties had completed their evaluations so that any remaining concerns could be resolved and a path forward identified. Since NJDEP never relayed the results of their literature search, Chemours proceeded with submitting a response to comments and their search results to the Agencies on November 9, 2015. As of this date, there has been no response from the Agencies on the November 2015 submittal.

During a conference call in January 2019, the Agencies indicated that a corrective measures study (CMS) should be prepared for Wanaque River to replace the IRMWP and present the proposed corrective measure alternative for implementation. This request was documented by Chemours in a follow-up letter submitted to the Agencies on January 23, 2019 and an email submitted on January 30, 2019.

1.2 Purpose of Corrective Measure Study

NJDEP's *Technical Requirements for Site Remediation* (TRSR) no longer requires that a Remedial Action Selection Report be completed as part of a remedial action. Therefore, as directed by the Agencies, this CMS has been prepared for the

Wanaque River fine-grained sediments and bank soils in accordance with USEPA's May 1994 *RCRA Corrective Action Plan*.

As stated in the first paragraph of the introduction to Chapter IV (Corrective Measures Study) of the *RCRA Corrective Action Plan*, "The purpose of the Corrective Measures Study (CMS) portion of the RCRA corrective action process is to identify and evaluate potential remedial alternatives for the releases that have been identified at a facility. The scope and requirements of the CMS, however, need to be balanced with the expeditious initiation of remedies and rapid restoration of contaminated media, both major goals of the RCRA corrective action program. In keeping with these goals, the implementing agency may allow a streamlined approach to remedy selection, enabling a facility to move from facility investigation to corrective measures implementation more rapidly."

To date, investigation of Wanaque River has been completed (discussed further in Section 2.4.1) and IRMs have been implemented for select offsite areas (discussed further in Section 2.4.2 and depicted on Figure 2). The impacted media evaluated as part of this CMS are fine-grained sediments and bank soils. Onsite soils is being addressed under a separate CMS. Onsite groundwater is currently being addressed under the Agency-approved July 1993 *Groundwater Remedial Action Plan* (implemented in 1998) and the Agency-approved November 1995 *Comprehensive Groundwater Monitoring Program* (CGMP) which has been ongoing at the Site since 1996.

The objective of this CMS is to propose a corrective measure alternative to address impacts to fine-grained sediments and bank soils within specific areas of the Wanaque River, floodplain, and adjacent uplands. The proposed corrective measure alternative will satisfy the requirements of the ACO and HSWA and be protective of human health and the environment.

1.3 Report Organization

The overall organization of this report is consistent with USEPA's CMS process as outlined in Chapter IV of the *RCRA Corrective Action Plan*. Brief summaries of the remaining sections are presented below.

- Section 2: Site Background and Physical Setting – This section provides a description of the Site, operational history, land use, and summary of previous investigations and remedial activities. It also provides a detailed summary of the physical setting of the Site, including a description of the conceptual Site model (CSM).
- Section 3: Applicable Remediation Standards – This section identifies potential receptors and presents the applicable remediation standards for Wanaque River fine-grained sediments and bank soils.
- Section 4: Remedial Action Objectives – This section presents the remedial action objectives (RAOs) for Wanaque River fine-grained sediments and

bank soils. RAOs are developed to protect human health and the environment based on the end-use of the area.

- Section 5: Identification and Screening of Technologies – This section presents the identification and screening of technologies for Wanaque River fine-grained sediments and bank soils. The universe of potentially applicable technologies is reduced by evaluating the options with respect to technical implementability and effectiveness.
- Section 6: Identification of Corrective Measure Alternatives – This section includes a description of each corrective measure alternative developed to address the remediation of Wanaque River fine-grained sediments and bank soils.
- Section 7: Evaluation of Corrective Measure Alternatives – This section presents an analysis of the corrective measure alternatives for with respect to Resource Conservation and Recovery Act (RCRA) evaluation criteria.
- Section 8: Proposed Corrective Measure Alternative – This section presents the proposed corrective measure alternative for Wanaque River fine-grained sediments and bank soils and provides a brief description of other factors associated with its implementation such as pre-design activities and anticipated permitting requirements.
- Section 9: Path Forward – This section discusses the path forward for future work pertaining to the remediation of Wanaque River fine-grained sediments and bank soils.
- Section 10: References – This section lists the references cited in this document.

2 Site Background and Physical Setting

2.1 Site Description and Location

The approximate 580-acre Site consists of northeast/southwest trending ridges and valleys containing two major drainage areas: Wanaque River (former Lake Inez) on the west and Acid Brook on the east. New Jersey Interstate 287 (I-287) crosses the northern and western portions of the Site isolating approximately 70 acres. The Site is bordered to the northeast and east by Ringwood State Park, to the south by the town of Pompton Lakes (industrial, commercial/services, and residential land use) and Pompton Lake, and to the west and northwest by Twin Lake Valley (commercial/services and residential land use) and the Borough of Wanaque.

The Site is divided into the following three former manufacturing areas as shown on Figure 3:

- Eastern Manufacturing Area (EMA) located east of Wanaque River, south of I-287, and west of Ringwood State Park.
- Northern Manufacturing Area (NMA) located north of I-287 along Wanaque River; and
- Western Manufacturing Area (WMA) located south of I-287 along Wanaque River.

2.1.1 Wanaque River

Wanaque River originates in New York State and flows through multiple impoundments, including the Wanaque Reservoir impounded by Raymond Dam, before flowing from north to south through the WMA. Prior to 1984, there was a dam across Wanaque River, located downstream of the southern Site boundary and north of Wanaque Avenue Bridge. This dam formed Lake Inez, which inundated low-lying areas of the Wanaque River Valley. The U.S. Army Corps of Engineers removed a portion of the dam in 1984 which resulted in the draining of Lake Inez and the return of Wanaque River to its channel.

Currently, water flow downstream of Wanaque Reservoir is controlled by Raymond Dam which is located approximately two miles north of the Site. The dam operates as an uncontrolled spillway when the reservoir elevation exceeds an elevation of 302.4 feet above mean sea level. However, a daily minimum volume is discharged from the dam to maintain base flow downstream in Wanaque River. Base flows during minimum maintenance discharge are generally 18 to 20 cubic feet per second, as measured at the U.S. Geological Survey gauging station immediately downstream of Raymond Dam (USGS 01387000 Wanaque River at Wanaque, New Jersey).

Within the Site property boundary, Wanaque River flows through a valley characterized by steep bedrock slopes along the eastern and western banks. Valley topography is relatively flat in the immediate vicinity of the river, with the floodplain widening considerably in the northern portion of the valley. Within the area proposed for remediation in this CMS, the width of Wanaque River is variable, ranging from approximately 40 feet wide in the northern portion to 100 feet wide in the section upstream of the former dam. The river is relatively shallow with depths generally less than two feet at base flow during minimum maintenance discharge from Raymond Dam.

The reach of Wanaque River that flows between Raymond Dam and Wanaque Avenue bridge, which includes the Site, is classified by NJDEP as Category 1 trout production waters [FW2-TP(C1)]. Downstream of Wanaque Avenue bridge, Wanaque River is classified as Category 1 trout maintenance waters [FW2-TM(C1). These classifications are outlined in New Jersey Administrative Code (N.J.A.C.) 7:9B, last amended January 18, 2011 and readopted without change on October 17, 2016.

2.2 Site Operational History

In the late 1800's, the H. Julius Smith Blasting Cap Plant and the American Smokeless Powder Plant operated in the western portion of the Site, and the Metallic Cap Company operated in the eastern portion. In 1902, DuPont purchased the Site and began operation of the DuPont Electric Exploder Company in the WMA. Structures within the WMA consisted of buildings for manufacturing, magazine storage for explosive products and materials, and an engineered tunnel for conducting cladding operations. These structures were primarily located along the banks and ridge slopes of Lake Inez (Wanaque River). In 1908, DuPont opened the DuPont Cap Works in the EMA. DuPont ceased production in the WMA in 1926 and consolidated operations in the EMA. Structures within the EMA consisted of buildings for manufacturing and offices, quality control laboratories, magazine storage for explosive products, and an engineered tunnel for conducting cladding operations. These structures were primarily located in the low-lying lands of the valley. From that time until April 1994 when operations permanently ceased, DuPont production activities manufactured a variety of explosive products. A majority of the structures across the Site have been removed (with the exception of four buildings in the southern portion of the EMA) and the two cladding tunnel entrances have been sealed.

2.3 Site Land Use

The Site totals approximately 580 acres within multiple tax lots. Six tax lots totaling approximately 299 acres are located in the Borough of Wanaque, and three tax lots totaling approximately 289 acres are located in the Borough of Pompton Lakes (see Figure 4).

The existing deed notice for the Site dated April 9, 2015 and filed with the Passaic County Clerk on April 20, 2015 indicates that "*in no event shall the property be used as a daycare or child care facility or for residential purposes*". This deed restriction is consistent with the current and anticipated future land use for the Site as further discussed in the subsections below.

2.3.1 Current Land Use

Borough of Wanaque Parcels

The following six parcels are located within the Borough of Wanaque:

- Block 479, Lot 3 – located north of I-287 and encompassing the western portion of the NMA;
- Block 479, Lot 4 – located north of I-287 and encompassing the eastern portion of the NMA;
- Block 479, Lot 5 – located west of I-287;
- Block 479.01, Lot 1 – located south of I-287 and encompassing the northwestern portion of the WMA;
- Block 479.01, Lot 2 – located south of I-287 and Block 479.01, Lot 1 in the WMA; and
- Block 479.01, Lot 3 – located south of I-287 in the northern portion of EMA, spanning south along the northeastern portion of the WMA, and ending in the western portion of the WMA south of Block 479.01, Lot 2.

Although currently zoned for industrial use, the land located in Wanaque is generally undeveloped and features heavily wooded terrain of varying topography. With the exception of Lots 4 and 5, Wanaque River passes through these parcels.

Currently, adjacent and surrounding properties to the north of Block 479, Lots 3 and 4, and west of Block 479, Lot 3 and Block 479.01, Lot 3 are generally undeveloped. A small number of residential houses are located adjacent to the southwest corner of Block 479.01, Lot 3. Land to the east and south of the Wanaque parcels consists of the remainder of the Site located within the Borough of Pompton Lakes. A majority of the Site located in Wanaque has been designated as a Preservation Area under the New Jersey Highlands Water Protection and Planning Act.

Borough of Pompton Lakes Parcels

The following three parcels are located within the Borough of Pompton Lakes:

- Block 100, Lot 3 – encompasses the majority of the EMA and southeastern portion of the WMA;
- Block 100, Lot 6.01 – portion of Wanaque River; and
- Block 100, Lot 7 – southwestern portion of the WMA.

The two western tax parcels (Block 100, Lots 6.01 and 7) located in Pompton Lakes consist of undeveloped land and Wanaque River. This area of the property is currently undeveloped and features a heavily wooded landscape, waterway, and floodplain. The main parcel (Block 100, Lot 3) located in Pompton Lakes includes approximately 231 acres of land. Features in this main parcel include a mix of open areas and heavily wooded terrain of varying topography. A freight rail is located adjacent to the property along the southeastern border. Various surface water tributaries pass through the parcel. The entire Site located in Pompton Lakes has been designated as a Planning Area under the New Jersey Highlands Water Protection and Planning Act.

Ringwood State Park borders the property to the east. An active industrial facility and a residential area border the property to the south. The only vehicular access to the property is via Cannonball Road, a corridor primarily consisting of industrial, commercial, and multi-family land uses.

2.3.2 Anticipated Future Land Use

A majority of the property contains steep slopes, with intermittent areas of moderately level land, rendering many areas inaccessible. The Site contains intermittent wetlands and two watercourses. These ecological assets, combined with the Site's location within the boundaries of the New Jersey Highlands Act, limit the potential redevelopment of portions of the Site.

Within Wanaque Borough, approximately 70 acres of land north and west of I-287 has been designated for transfer to the State of New Jersey under the previously-negotiated *Natural Resource Damage Settlement for Ground Water Injuries in New Jersey* (between NJDEP and DuPont). Redevelopment of the remaining land within Wanaque Borough would be limited under the New Jersey Highlands Water Protection and Planning Act.

In accordance with the Borough of Pompton Lakes *2017 Master Plan Reexamination Report* and proposed Ordinance No. 19-13 – An Ordinance Amending, Deleting and Adding Certain Provisions of the Borough Land Use Code Dealing with Zoning Changes for the DuPont (Chemours) Tract (Block 100 Lots 3, 6.01 and 7), the portion of the Site located within Pompton Lakes is to be used for low impact, light industrial uses that are sensitive to environmental conditions, the natural landscape, and surrounding residential use and parkland. Ordinance No. 19-13 was approved for First Reading and Introduction at a regular meeting of the Pompton Lakes Mayor and Council held on March 27, 2019. The Ordinance is to be presented for Second Reading and Final Adoption after the Borough of Pompton Lakes Planning Board provides a recommendation to the Mayor and Council. The Planning Board approved Ordinance No. 19-13 on April 16, 2019.

Within the Pompton Lakes portion of the Site, approximately 69 acres in size (in the EMA) has been identified for future redevelopment based on the relatively flat land and its location along an industrial corridor.

2.4 Previous Investigation and Remedial Action

2.4.1 Previous Remedial Investigations

The following subsections provide a brief overview of the historical investigations related to Wanaque River.

Wanaque River Floodplain Remedial Investigation

The Wanaque River floodplain RI, initiated in 1990, was conducted within the floodplain of Wanaque River between the southern Site boundary and the confluence of the Wanaque and Pequannock Rivers. Samples of surface water, floodplain soils, and river sediments were collected to delineate the horizontal and vertical extent of impacted media within the investigation area.

Between 1990 and 1992, over 1,200 samples were collected and analyzed for Site-related constituents of concern (COCs). Six COCs [lead, mercury, copper, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene] were identified at concentrations above NJDEP's Residential Direct Contact Soil Remediation Standard (RDCSRS) in floodplain soils. Along the approximate 1.5-mile stretch of Wanaque River downgradient of the Site, 21 locations were identified as having one or more COCs present at concentrations above RDCSRS. The results of this investigation were documented in the *Wanaque River Investigation Summary* submitted to the Agencies on March 31, 1995.

1990 Initial Investigation

An initial investigation of surface water and sediment in Wanaque River was conducted in April and October 1990 at the southern portion of the Site and south of the Site. Surface water (unfiltered) and sediment samples were collected and analyzed for metals, volatile organic compounds, semivolatile organic compounds, and polychlorinated biphenyls (PCBs). The investigation identified the following:

Surface Water

- Mercury was detected above the freshwater benchmark concentration at one location near the downstream boundary of the Site.
- Acetone, methylene chloride, and bis(2-ethylhexyl)phthalate were the only organic constituents detected and concentrations were below ecological benchmark concentrations.
- No PCBs were detected.

Sediment

- Maximum detected concentrations of copper, lead, and mercury were above conservative ecological benchmark concentrations.

- Bis(2-ethylhexyl)phthalate and di-n-butylphthalate were the only organic constituents detected and concentrations were below ecological benchmark concentrations.
- No PCBs were detected.

Data from the 1990 sampling effort were not sufficient to achieve the objectives of a RI. The 1990 dataset was collected prior to the removal and/or stabilization of adjacent upland soils (see Section 2.4.2 below) that may have potentially contributed to Site-related constituents to the river when the Site was operational and, therefore, were not representative of current conditions. As such, a surface water and sediment sampling program was completed in three river reaches (further described below).

Remedial Investigation (Phase I and II)

The surface water and sediment sampling program was implemented in two phases: Phase I (December 2009) and Phase II (November 2010). Work was conducted in three reaches of the river in the vicinity of the Site as depicted on Figure 5:

- Reach 1: 2 miles north of the Site,
- Reach 2: the 1.5-mile stretch of river between the Site's northern boundary and former dam, and
- Reach 3: 1.3 miles downstream of the former dam.

Phase I sampling was conducted to provide adequate surface water and sediment data to characterize baseline conditions in Wanaque River upstream (Reach 1), adjacent to (Reach 2), and downstream (Reach 3) of the Site. Based on the Phase I results, a baseline ecological evaluation (BEE) was conducted. The findings of the Phase I RI and BEE were used to focus additional data collection during the Phase II program to further refine the CSM and support ecological evaluations. An overview of sample stations/locations from the Phase I and II RIs is presented on Figures 5 and 6 and in Appendix A.

Results from the Phase I and II RIs identified the following:

- Mercury is the primary sediment constituent of potential ecological concern (COPEC) in Wanaque River adjacent to and downstream of the Site.
- Mercury in fine-grained sediments is a potential human health exposure. Concentrations of mercury were reported in samples of fine-grained sediment deposits collected from the river directly north of the former Lake Inez dam to approximately 1,200 feet upstream (identified as the lower portion of Reach 2).
- The primary contaminant transport pathway from former Site operations to Wanaque River is likely historical migration from the adjacent uplands and floodplain. The current conditions of river banks and floodplain/upland areas adjacent to the Site are stable and vegetated, which limits the mobilization of particulate-bound COPECs to the river.

- Surface water concentrations of filtered and unfiltered total mercury (THg) and other Site-related metals are below chronic surface water criteria for the protection of aquatic life; therefore, no unacceptable risks to aquatic life are identified for surface water exposure.
- Mercury concentrations in sediment in the lower portion of Reach 2 (within a zone of sediment deposition approximately 1,200 feet north of the former dam) increased in relation to upstream samples within Reach 1 and upper portion of Reach 2, and then decreased substantially in the spatially limited depositional features downstream of the former dam (Reach 3).
- With the exception of the zone of sediment deposition immediately upstream of the former dam, fine-grained sediment deposits represent a relatively minor component (approximately 5 to 10 percent) of overall habitat availability in Reaches 2 and 3.

Supplemental Investigations

Supplemental investigations were completed in 2011 and 2012 to provide additional information to address NJDEP comments and to support the development of an IRM to address potential exposure to mercury in sediments. The following investigations were completed:

- Supplemental sediment sampling (November/December 2011) – Additional characterization of surficial sediments was conducted to support the development of an IRM to address mercury in sediments in the lower portion of Reach 2; downstream of station WR-16 to the former dam.
- Detailed substrate mapping (February 2012) – A detailed substrate mapping and bank survey effort were conducted to identify areas of fine-grained sediment deposits outside of the potential IRM area to support additional characterizations of mercury exposure in sediments.
- Sediment and pore water investigation (August 2012) – An investigation was conducted outside of the potential IRM area based on the detailed substrate mapping to further define mercury concentrations in sediment and pore water, and to evaluate potential ecological exposure to mercury.

An overview of sample locations from the supplemental investigations is presented on Figure 6 and in Appendix A.

Consistent with the findings of the Phase I and II RIs, results from the supplemental investigations identified the following:

- THg concentrations in surficial sediments are most significant and spatially variable within the proposed IRM area.
- Fine-grained sediment deposits upstream of stations WR-16 to WR-13 and downstream of the former dam to station WR-22 represent a relatively minor component (approximately 5 to 10 percent) of the overall available habitat based on the results of the detailed substrate mapping survey.

- Sample results indicate that elevated THg concentrations in sediments sampled between stations WR-13 and WR-16 are associated with spatially limited fine-grained sediment deposits at the channel margins.
- THg concentrations in sediments below the former dam are substantially lower compared to upstream samples in Reach 2 and are associated with spatially limited fine-grained sediment deposits consistent with backwater areas and obstructions to flow.
- Comparisons of pore water data to aqueous toxicity benchmarks indicate limited potential for adverse direct contact effects to sediment-dwelling receptors in the study area upstream of stations WR-16 to WR-13 and downstream of the former dam to station WR-22.
- The pore water evaluation indicates that the severe effect limit (SEL) is not likely a reliable threshold for mercury-associated direct contact effects to sediment-dwelling receptors in areas upstream of stations WR-16 to WR-13 and downstream of the former dam to station WR-22; therefore, the SEL is not an appropriate basis for a corrective measure.

Pre-IRM Data Collection

The IRMWP identified supplemental field data collection activities to be completed prior to the implementation of the IRM in order to finalize the remediation approach. Additional data were collected between October 2013 and August 2014 to support the design of the IRM. The data collection activities included:

- Topographic survey of river bed,
- Geotechnical investigation,
- Supplemental sediment sampling,
- Bank stability assessment,
- Bank soil sampling, and
- Fish tissue survey of adult forage fish.

An overview of sample locations from the pre-IRM data collection effort is presented on Figure 6 and in Appendix A.

Results from the pre-IRM data collection activities, supporting the design of an IRM to address mercury in fine-grained sediments, identified the following:

- The results of subsurface samples collected during the geotechnical investigation indicate that THg concentrations in the coarse-grained sediment below the overlying fine-grained sediment deposits are lower than or approximate to representative sediment THg concentrations from upstream reference areas;
- Sediment THg datasets generated from sampling events completed between 2009 to August 2014 provide sufficient spatial characterization to define the

extent of fine-grained sediment deposits representing the areas with the greatest exposure risk to potential ecological and human health receptors due to elevated concentrations of mercury;

- River banks within the proposed IRM area are relatively stable with very low to moderate erosion hazards based on the Bank Erosion Hazard Index (BEHI) ratings;
- Some bank segments with moderate BEHI ratings contain elevated geometric mean THg concentrations in bank soils; and
- THg concentrations in sediments, surface water, and fish tissue upstream of station WR-12 are similar to reference area concentrations.

2.4.2 Previous Remedial Actions

Between 1998 and 2004, remediation took place at 21 offsite locations (as identified during the Wanaque River floodplain RI). The following provides a summary of those IRM activities (see also Figure 2):

- Offsite Properties – During 1998 and 1999, a total of 17 of these 21 offsite locations were remediated and consisted of smaller excavations on public and private properties adjacent to Wanaque River. Upland soils on these properties were excavated, post-excavation samples collected, and excavations backfilled and restored.
- Wilderness Island (north and south) – During 1999, soils were excavated to the north and south of the intersection of Wanaque River and Hamburg Turnpike (identified as Wilderness Island). Soils were excavated, post-excavation samples collected, and excavations backfilled and restored.
- West Bank Remediation – During 2000, soils were excavated on the western bank of Wanaque River between the Site's property line and the approximate area of the former dam. Soils were excavated, post-excavation samples collected, and excavations backfilled and restored. Additional restoration work was completed in accordance with the stream encroachment and wetlands permits obtained from NJDEP for the IRM.
- East Bank Remediation – During 2003 and 2004, soils were excavated on the east bank of Wanaque River between the Site's property line and the approximate area of the former dam. Soils were excavated, post-excavation samples collected, and excavations backfilled and restored. Additional restoration work was completed in accordance with the stream encroachment and wetlands permits obtained from NJDEP for the IRM.

Remedial action reports were submitted to the Agencies for each IRM area with approval on the reports received from NJDEP.

2.5 Conceptual Site Model

A CSM is an essential tool that is used to clearly describe and explain site-specific information and conditions within an environmental system. Data collected as part of environmental investigations are used to understand the extent and source(s) of site-specific impacts along with the physical, chemical, and biological processes that determine the fate and transport of these constituents and to understand the potential receptors (human and ecological) that may be potentially exposed. CSMs are continually re-evaluated and refined, as necessary, when new data are collected.

A CSM has been developed for Wanaque River in the vicinity of the Site based on data collected during the various phases of investigative work. The CSM describes and evaluates the physical and chemical attributes of Wanaque River along with potential contaminant migration pathways to the river and potential in-stream fate and transport processes for Site-related constituents that may have migrated to the river. The CSM described in the subsections below provides an updated summary of that presented in the IRMWP.

2.5.1 Surface Water and Sediment Features

As discussed in Section 2.1.1, within the Site, Wanaque River flows through a valley characterized by steep bedrock slopes along the eastern and western banks. Valley topography is relatively flat in the immediate vicinity of the river; the floodplain widening considerably in the northern portion of the valley. Within the corrective measure area the river’s width is variable, ranging from approximately 40 feet wide in the northern portion to 100 feet wide in the section upstream of the former dam. The river is relatively shallow with depths generally less than two feet at base flow during minimum maintenance discharge from Raymond Dam.

Aquatic habitat in Wanaque River varies from Wanaque Reservoir upstream of the Site to the confluence of the Pequannock River downstream of the Site. Based on preliminary habitat characterization/substrate mapping conducted during the RI, Reach 1 and the upper two-thirds of Reach 2 are characterized by riffle/run/pool complexes that are associated with cobble/gravel substrates across most of the channel transect. Fine-grained sediment deposits in the upper portion of Reach 2 are generally limited to the channel margins, particularly in areas where flow is impeded by an obstruction. Flow in the lower third of Reach 2 is reduced by the remnants of the former dam. Within this portion of Reach 2, the channel broadens, water velocity is reduced, and sediments accumulate across the channel resulting in embedded substrates. The area upstream of the former dam represents a zone of sediment deposition, where the most substantial deposits of fine-grained sediments have accumulated. Substrate types in this area range from silt to embedded cobble/gravel. Downstream of the former dam in Reach 3, the river generally returns to the riffle/run/pool structure observed upstream of the Site. Depositional sediment features in Reach 3 are limited to the channel margins and areas where flow is impeded by an obstruction.

Detailed substrate mapping was conducted in February 2012 in Reach 2 from stations WR-16 to WR-13 and Reach 3 below the former dam downstream to station WR-22 to define the spatial extent of fine-grained sediment deposits within the channel (see Appendix A – Figures 1 and 2). The findings of the substrate mapping indicated that fine-grained sediments, defined as silts and clays (<0.064 millimeters [mm] particle size), comprise only 5% of the mapped area of the river, with substrates predominated by fine sands representing an additional 5% of the available benthic habitat. Over 83% of the mapped area is predominantly coarse substrates with particle sizes greater than 4 mm.

2.5.2 Potential Migration Pathways to Wanaque River

The CSM indicates that the primary contaminant transport pathway from former Site operations to the river is historical soil migration from the adjacent uplands and floodplain. Extensive investigations of Site-related constituents in upland and floodplain soils within the former manufacturing areas have been conducted as part of the completed soil RIs for the Site. These investigations indicate that Site-related metals, particularly mercury, copper, and lead, were detected in surficial upland and floodplain soils at concentrations above ecological benchmarks and ambient soil concentrations.

The relatively stable condition of the banks identified in the BEHI survey and vegetated adjacent floodplains that currently exist within the Site suggests that the accumulation of particulate-bound COPECs, particularly mercury, upstream of the former dam was predominately associated with historical surface migration pathways during a period of less soil stability or due to different hydrologic conditions influenced by the former dam. Qualitative habitat characterization and substrate mapping surveys were conducted in November 2009, November 2010, and February 2012 to identify important features in potential transport pathways from adjacent upland and floodplain areas. The evaluation of floodplain features indicated that most soil disturbances in the WMA were limited to the upper portion of Reach 2. In the lower section of Reach 2, where the greatest concentrations of mercury and other COPECs were observed in adjacent floodplain and upland soil samples, stream banks were predominately vegetated and stable.

Data from groundwater investigations conducted in the WMA indicate that groundwater is not impacted by mercury concentrations in soil and that the migration of impacted groundwater to Wanaque River is not a significant transport pathway for mercury. Potential migration pathways of mercury-impacted groundwater to Wanaque River were evaluated based on the findings of supplemental groundwater investigations conducted onsite in 2011 and 2012. Mercury concentrations in 10 out of 12 unfiltered shallow groundwater samples (<25 feet below ground surface [bgs]) collected in the WMA, most within 100 feet of the river bank, were below detection limits. None of the filtered samples collected from these shallow groundwater wells contained detectable concentrations of mercury. The absence of detectable mercury concentrations in nearly all unfiltered samples and all filtered samples indicates that groundwater-surface water migration is not a significant transport pathway for mercury from soils in the WMA to Wanaque River.

2.5.3 Potential In-Stream Fate and Transport Processes

Particulate-bound mercury that entered Wanaque River accumulated in the area of low water velocity created by the former dam and along channel margins. Particulate-bound mercury may have also accumulated in bank soils, which may have been subsequently released back to the river during periods of high flows and bank instability. Elevated concentrations of mercury and other COPECs detected in sediments between station WR-16 and the remnants of the former dam are likely attributable to the accumulation of these historically-released fine-grained sediments upstream of the former dam (see Appendix A – Figure 2). These fine-grained sediment deposits represent the area of greatest potential ecological exposure due to the elevated concentrations of COPECs and the potential for mercury methylation, as discussed further below. Upstream of station WR-16, areas of elevated sediment THg concentrations were associated with spatially-limited fine-grained sediment deposits at the channel margins (see Appendix A – Figure 3).

Downstream of the former dam in Reach 3, sediment depositional features are limited (5 to 10 percent of river surface area) as the river returns to the riffle/run/pool structure observed upstream of the Site (see Appendix A – Figures 4 and 5). As illustrated by the results of the detailed mapping survey conducted in February 2012, fine-grained sediment deposits in this reach are generally limited to the channel margins and areas downstream of obstructions. Consistent with the change in sediment depositional patterns, concentrations of mercury in sediment are lower than in sediment upstream of the former dam (see Appendix A – Figures 4 through 6).

In-stream characteristics and processes influence the fate and transport of mercury within Wanaque River, particularly methylation processes associated with mercury bioaccumulation and toxicity. Mercury methylation, a biochemical reaction where inorganic mercury is methylated by anaerobic bacteria, including sulfate-reducing (Compeau and Bartha, 1985) and iron-reducing bacteria (Fleming et al., 2006) in anoxic regions of aquatic systems, is an important component of the fate and transport of mercury in aquatic systems (Benoit et al., 2002). Methylmercury (MeHg) has different chemical, physical, and toxicological properties compared to inorganic mercury; therefore, the form of mercury present in the environment is an important consideration in the evaluation of mercury toxicity and bioaccumulation. In a fluvial system such as Wanaque River, in-stream areas where mercury methylation could potentially occur include fine-grained sediment deposits located within the channel or the hyporheic zone (Stoor et al., 2006).

Evaluation of surface water data collected during RIs indicates that MeHg is present throughout the study area and that mercury methylation may be associated with fine-grained sediment deposits upstream of the former dam. Coincident with the zone of fine-grained sediment deposition upstream of the former dam, concentrations of filtered and unfiltered MeHg in surface water samples collected from stations in the lower section of Reach 2 were elevated relative to upstream stations. Increased

MeHg concentrations in surface water samples collected from the lower section of Reach 2 may be indicative of mercury methylation in fine-grained sediment deposits upstream of the former dam.

2.5.4 Potential Ecological and Human Health Exposures

Ecological investigations conducted in Wanaque River to date indicate that direct contact exposure to mercury in surface water and sediment, as evaluated based on pore water data, are not likely to result in adverse effects to ecological receptors. Concentrations of THg and MeHg measured in multi-phase surface water investigations were below conservative, chronic surface water quality benchmarks for the protection of aquatic life (NJDEP's Surface Water Quality Standards [SWQS] and Canadian Council of Ministers of the Environment Water Quality Guidelines [CCME WQG]), indicating that adverse effects to aquatic organisms through direct contact exposure are not likely.

The evaluation of direct contact exposure to sediment-dwelling receptors indicates that adverse effects due to mercury are not likely. Direct contact exposure of benthic invertebrates to mercury in sediments was evaluated based on exposure to pore water because measurements of constituent concentrations in pore water provide direct information regarding the fraction of sediment-associated constituents that are likely to be most available to ecological receptors (USEPA, 2002). Pore water data collected in August 2012, in areas upstream of station WR-16 and downstream of the former dam, indicate that THg and MeHg concentrations measured in 17 of 18 pore water samples were lower than conservative surface water quality standards established for the general protection of aquatic life (SWQS and CCME WQG). Maximum concentrations of THg and MeHg measured in pore water did not exceed literature-derived aqueous toxicity effects values. Furthermore, pore water concentrations were lower than conservative surface water quality standards in all 16 samples collected from stations with sediment THg concentrations exceeding the SEL of 2 milligrams per kilogram (mg/kg) derived based on direct contact exposure to benthic invertebrates. These findings indicate that THg and MeHg in pore water are not likely to result in adverse effects to sediment-dwelling receptors and that the SEL is not likely a reliable threshold for identifying mercury-associated, direct contact effects to those receptors.

The bioaccumulation of mercury in Wanaque River was evaluated based on fish tissue analyses of mercury concentrations in adult forage fish representing two feeding guilds: benthic invertivores and omnivores. The results of the fish tissue survey indicate that THg and MeHg concentrations in adult forage fish are not elevated relative to reference concentrations at sampling reaches upstream of station WR-12. However, THg and MeHg concentrations increase downstream of station WR-12 and are greater than reference concentrations in sampling reaches immediately upstream and immediately downstream of the former dam. An evaluation of fish tissue results indicates that mercury concentrations measured in sampling reaches immediately upstream and immediately downstream of the former dam are elevated relative to critical body residues (CBRs) for the protection of juvenile and adult fish and tissue residues benchmarks for the protection of avian piscivores.

Potential direct contact exposure is the primary human health exposure pathway to sediments as a result of trespassers entering the area for recreational purposes. Although human-health based direct contact remediation standards are not directly applicable to sediment data, areas with elevated sediment concentrations may represent a potential direct contact exposure. Sediments with elevated THg concentrations are generally limited to the area of sediment deposition downstream of station WR-16 to the former dam and in limited sediment deposits along channel margins upstream of station WR-16. THg concentrations in sediment samples collected downstream of the former dam do not indicate a potential human health direct contact exposure (see Appendix A – Figures 4 and 5).

2.5.5 Summary

The CSM indicates that fine-grained sediment deposits identified during the investigations completed between 2009 and 2014 represent the areas of greatest potential ecological and human health exposure due to elevated concentrations of mercury in fine-grained sediments. Additionally, some bank segments with moderate BEHI ratings and geometric mean THg concentrations above the ecological risk goal (ERG) developed for THg in the WMA (20.4 mg/kg as developed and presented in the onsite soils CMS) represent areas of human health exposure and locations with the potential for future migration of sediments into the river due to elevated concentrations of mercury. These locations are depicted on Figure 6 and in Appendix A.

Evaluation of surface water and sediment pore water data indicate that adverse effects to ecological receptors through direct contact exposure to mercury in surface water and sediments is not likely. Evaluation of the potential bioaccumulative effects of mercury on aquatic and semi-aquatic receptors indicate that THg concentrations in fish tissue samples collected between Sediment Area 1 (see Figure 7) and the former dam are elevated relative to tissue residue benchmarks for the protection of fish and avian piscivores. However, upstream of Sediment Area 1, fish tissue concentrations are similar to reference area concentrations.

The evaluation of surface water data indicates that mercury methylation and potential bioaccumulation may be associated with fine-grained sediment deposits upstream of the former dam. Increased concentrations of MeHg in surface water and fish tissue samples were coincident with the zone of fine-grained sediment deposition upstream of the former dam.

Historical migration of mercury and other COPECs from upland soils impacted by former Site operations was likely the primary contaminant transport pathway to Wanaque River. The stable condition of the banks and vegetated adjacent floodplains that currently exist in Reach 2 suggests that the accumulation of particulate-bound COPECs in the depositional area upstream of the former dam was predominately associated with historical migration pathways during a period of less soil stability. Data from groundwater investigations conducted in the WMA indicate that groundwater is not impacted by mercury concentrations in soil and that the migration of impacted groundwater to Wanaque River is not a significant transport pathway for mercury.

Based on the current CSM, a corrective measure is being proposed to address mercury concentrations in fine-grained sediments that have accumulated in Reach 2 and the adjacent banks between station WR-12 and the former dam. The overall sediment and bank soil areas are depicted on Figure 6 and more detailed views are provided on Figures 7 through 10.

3 Media of Concern and Applicable Remediation Standards

This section discusses the media of concern and applicable remediation standards so that RAOs can be developed and corrective measure alternatives can be evaluated.

3.1 Media of Concern

Fine-grained sediments, bank soils, and surface water are the media of concern that were evaluated for the corrective measure.

3.1.1 Fine-Grained Sediments

Fine-grained sediments are the primary media of concern for the protection of human health and the environment due to elevated mercury concentrations in sediments and the potential for mercury methylation. As identified in the CSM, particulate-bound mercury historically transported from adjacent floodplain and upland soils accumulated in fine-grained sediment deposits and in limited areas along channel margins upstream. Concentrations of mercury associated with these fine-grained sediment deposits represent the greatest area of potential ecological exposure due to the potential for mercury methylation.

An evaluation of sediment data collected between 2009 and 2014 was completed to identify areas of fine-grained sediments within Wanaque River with the highest potential for mercury methylation. The estimated areal extent of these fine-grained sediment areas is presented on Figure 6. More detailed views of these areas are provided on Figures 7 through 10.

The estimated sediment depth for each of the areas is approximately one foot; however, the thickness may vary. Detailed substrate mapping was completed during 2011 and 2012 (mapping results provided in Appendix A). The results will be utilized to complete the design for the proposed corrective measure with supplemental sediment thickness measurements collected, as necessary, to refine these areas prior to implementation of the corrective measure.

Table 3-1 provides the sediment area designation, areal extent, volume in cubic yards, and location of the area on the corresponding figure (e.g., Sediment Area 1 is depicted on Figure 7).

Table 3-1 Summary of Fine-Grained Sediment Removal Areas				
ID	**Area (square feet)**	**Volume (cubic feet)**	**Volume (cubic yard)**	**Figure #**
1	4,212	4,212	156	7
2	1,166	1,166	43	7
3	12,284	12,284	455	7
4	4,024	4,024	149	7 and 8
5	62,298	62,298	2,307	8
6	13,457	13,457	498	8 and 9
7	4,277	4,277	158	9
8	103,348	103,348	3,828	9 and 10
Total	205,066	205,066	7,594	

Sediment depth for each area estimated to be approximately 1 foot.

3.1.2 Bank Soils

The CSM developed for Wanaque River indicated that the primary contaminant transport pathway from former Site operations to the river was historical soil migration from the adjacent uplands and floodplain. Historical investigations have detected mercury in surficial upland and floodplain soils at concentrations above the WMA ERG of 20.4 mg/kg (as developed and presented in the onsite soils CMS). A bank stability assessment was completed during 2013 and 2014 and consisted of a qualitative bank erosion assessment and analytical sampling program. The goals of the assessment were to identify bank soils with the greatest potential to erode and re-deposit particulate-bound mercury within Wanaque River and characterize mercury concentrations within the banks.

The results of the assessment concluded that river banks within the proposed corrective measure area are relatively stable with very low to moderate erosion hazards based on the BEHI ratings and some bank segments with moderate BEHI ratings that contain geometric mean THg concentrations in bank soils above the WMA ERG. The data collected during the bank assessment were incorporated into the historical Site soils dataset and used to develop bank removal areas. The CMS for onsite soils is addressing the onsite portion of banks and uplands soils adjacent to the river. The CMS for Wanaque River (this document) focuses on the banks not included in the CMS for onsite soils.

Banks incorporated into this CMS include locations where the potential for erosion exists and concentrations of mercury in the bank and upland soils exceed the WMA ERG. The bank removal depth is based on historical sampling data for mercury. The current bank soils estimate includes addressing banks 2 to 10 feet horizontally into the bank from the toe of the bank, unless sampling data shows additional removal is necessary (e.g., Bank Area 4). This estimate is based on an evaluation of bank stability based on existing BEHI data, as described below. This distance into the bank has the greatest potential to erode/fail and potentially re-deposit bank soils as sediments in downstream areas of Wanaque River.

For the bank stability evaluation, eight transects were evaluated based on existing BEHI ratings and analytical data where potential for erosion exists and mercury concentrations are above the WMA ERG (see Figure 6). The transects correspond with ten BEHI rated locations. Bank stabilization and stream restoration guidance requires the consideration of bank grading and vegetation planting for bank stabilization (AWRA, 2007). Supplemental sampling for mercury near the bank will aide in evaluating the horizontal extent of soils to be removed from the bank. Based on the supplemental sampling data, two potential bank slopes of 26.5 and 40 degrees will be evaluated. New Jersey guidance considers banks with slopes of less than 26.5 degrees stable, therefore additional stability analysis is not required (NJDA, 2017).

The estimated horizontal removal distance from the toe of the bank for a bank angle of 26.5 are between 3 to 10 feet horizontally into the bank, as presented on Table 3-2. Channel stability analysis (soil analysis, determining flow velocity) is required for a 40 degree slope (NJDA, 2017). The horizontal removal distance from the toe of slope for a bank angle of 40 degrees are between 2 to 6 feet horizontally into the bank, as presented on Table 3-2.

Table 3-2 River Bank Geotechnical Evaluation Summary

Transect	BEHI Reach ID	Bank Height (feet)	Horizontal Removal Distance	
			Bank Angle = 26.5 (feet)	Bank Angle = 40 (feet)
A-A’	W13	5	10	6
	E14	4.5	9	5
B-B’	W12	2.5	5	3
	E13	2.5	5	3
C-C’	W12	2.5	5	3
	E12	2.5	5	3
D-D’	W11	2.5	5	3
	E12	2.5	5	3
E-E’	W10	2	4	2
	E11	1.5	3	2
F-F’	W10	2	4	2
G-G’	E9	3	6	4
H-H’	E8	3	6	4

The bank areas included in the proposed corrective measure are shown on Figures 7 through 10. Table 3-3 provides the bank area designation, areal extent, volume in cubic yards, and location of the area on the corresponding figure.

Table 3-3 Summary of Bank Removal Areas				
West Bank				
ID	**Length of Bank (Feet)**	**Volume (cubic feet)**	**Volume (cubic yard)**	**Figure #**
3	81	595	22	8
4	611	4,152	154	8
6	258	1,705	63	8 and 9
7	355	2,345	87	9 and 10
8	142	885	33	9 and 10
9	50	312	12	9 and 10
11	485	12,091	448	9
	Total	22,085	819	
East Bank				
ID	**Length of Bank (Feet)**	**Volume (cubic feet)**	**Volume (cubic yard)**	**Figure #**
1	36	224	8	7
2	25	156	6	7
5	1,830	11,725	434	8 through 10
10	475	11,842	439	9 and 10
	Total	23,947	887	

The current bank area estimate uses data collected during the BEHI survey and the historical Site soils dataset to define the bank areas. Supplemental sampling data may be required to further refine the bank limits prior to corrective measure implementation. Additional geotechnical data may also be required to refine the distance into the bank face and slope.

3.1.3 Surface Water

Surface water is not considered a media of concern because concentrations of filtered and unfiltered THg, MeHg, and other Site-related metals were below chronic surface water criteria for the protection of aquatic life (NJSWQS, CCME WQG). As such, there are no unacceptable exposure risks to aquatic life for direct contact to surface water. As indicated in the CSM, increased MeHg concentrations in surface water samples collected from the lower section of Reach 2 relative to upstream sample stations may be indicative of mercury methylation in fine-grained sediment deposits upstream of the former dam. The reduction of the mass of mercury available for methylation in sediments from the proposed corrective measure areas will reduce the source of MeHg from sediments to surface water.

3.2 Applicable Remediation Standards

The following sections present the basis for applicable remediation standards for fine-grained sediments and bank soils.

3.2.1 Fine-Grained Sediments

NJDEP does not have promulgated sediment standards for the protection of ecological or human health receptors. Ecological screening criteria (ESC) for sediments that are compiled by NJDEP (NJDEP, 2009; NJDEP, 2018), including the SEL, do not represent remediation standards, but general sediment quality guidelines for evaluating potential direct contact toxicity to sediment-dwelling receptors. As stated in the CSM, direct contact exposure to THg and MeHg concentrations in pore water at stations with sediment concentrations above the mercury SEL were not associated with adverse effects to sediment-dwelling receptors. This finding indicates that the SEL is not a reliable threshold for identifying mercury-associated, direct contact effects to sediment-dwelling receptors. Therefore, the SEL is not an appropriate basis for a remediation standard. In the absence of applicable remediation standards, the extent of remediation in Wanaque River will be established using a weight-of-evidence evaluation of potential ecological exposure based on existing data from previous RIs that support the CSM.

The proposed corrective measure will extend from the former dam upstream to station WR-12 (Figure 6). The ecological basis for the extent of the corrective measure between these two areas is supported by the following lines of evidence:

- Exposure to ecological receptors inhabiting fine-grained sediment deposits is generally greater due to the capacity of fine-grained sediments to retain mercury and other constituents. The zone of deposition upstream of the former dam represents the largest spatial extent of fine-grained sediment deposits and the greatest concentrations of mercury; therefore, this fine-grained deposit represents the area of greatest potential ecological exposure.
- The former dam creates a sediment depositional area at the downstream extent of Reach 2. Downstream of the former dam in Reach 3, fine-grained sediment depositional features represent a relatively minor component (approximately 5 to 10 percent) of the overall available habitat as the river returns to the riffle/run/pool structure observed upstream of the Site.
- Consistent with the change in sediment depositional features, sediment mercury concentrations downstream of the former dam decrease substantially relative to concentrations observed immediately upstream of the former dam.
- Mercury concentrations in sediment samples collected in Reach 2 upstream of station WR-12 are consistent with background concentrations in samples collected upstream of the Site (in Reach 3).
- Mercury concentrations in adult forage fish tissue collected upstream of station WR-12 were not significantly different than background fish tissue concentrations in samples collected upstream of the Site (in Reach 3).
- Mercury concentrations in surface water samples collected upstream of station WR-12 in two comprehensive surface water sampling events (2009

and 2010) were consistent with background concentrations in samples collected upstream of the Site (in Reach 3).

- Evaluation of surface water and fish tissue data indicates that increased mercury methylation may be associated with fine-grained sediment deposits upstream of the former dam to station WR-12:
    - Fine-grained sediment deposits provide favorable geochemical conditions for mercury methylation.
    - Coincident with the zone of fine-grained sediment deposition upstream of the former dam, concentrations of filtered and unfiltered MeHg in surface water samples collected from stations in the lower section of Reach 2 were elevated relative to upstream stations.
    - Mercury concentrations in adult forage fish tissue collected between the former dam and station WR-12 were significantly greater than background fish tissue concentrations in samples collected upstream of the Site, indicating greater exposure and bioaccumulation of MeHg.

There are no promulgated standards in New Jersey for the protection of potential direct contact human health exposure pathways to sediments. However, concentrations of mercury in fine-grained sediments from the former dam upstream to station WR-12 do represent the greatest potential for direct contact exposure due to the potential for river sediments to be re-deposited along the river bank or shoreline during flooding events (where it may then be contacted by potential receptors such as trespassers or recreational users). As such, the proposed corrective measure area (from the former dam upstream to station WR-12) will mitigate the potential human health direct contact exposure to sediments.

To support the protectiveness of the proposed corrective measure, a screening level protective of potential receptors (namely recreational users of the river shoreline) and associated direct contact exposure pathways was developed for THg in fine-grained sediments. The screening level was calculated consistent with procedures found in N.J.A.C. 7:26D and NJDEP's 2008 guidance document *Ingestion-Dermal Exposure Pathway Soil Remediation Standards Basis and Background*. The inhalation pathway was not considered in the calculation as the exposure media (fine-grained sediments) would be submerged.

Table 3-4 details the calculation of the screening level for child and adult recreational users and assumptions used in the derivation. Assumptions used to calculate the screening level are conservative (likely to overestimate actual exposure). As shown in the table, exposure assumptions were based on a combination of NJDEP-recommended values, USEPA-recommended values, and professional judgment considering Site-specific information. For example, default NJDEP or USEPA sediment ingestion rates are not available. Therefore, best professional judgment was utilized to determine the most appropriate Site-specific ingestion rate. For sediment ingestion rates, it was assumed that contact with fine-grained sediments would be much less than contact with soils because the water column above the sediments tends to remove sediments from adhering to the skin. Therefore, less sediment is adhered to the skin that would be available for transfer during incidental hand-to-mouth contact. As a result, sediment ingestion rates were estimated to be one-half the recommended soil ingestion rates for adult and child receptors.

Likewise, conservative estimates of exposure frequency were assumed for recreational users of the Wanaque River shoreline. It was assumed that potential receptors would access the shoreline more frequently in the summer months (5 days per week) and less frequently in the spring and fall months (2 to 3 days per week). This value (90 days per year) is considered consistent with activity patterns discussed in USEPA's *Exposure Factors Handbook* (USEPA, 2011), USEPA Region IV's recommended value for backyard pools and coastal areas (90 days per year) (USEPA Region IV, 2018), and the range of values recommended by other states and regions for recreational land use (such as Maine – 78 days per year) (MEDEP, 2018).

The oral reference dose for mercuric chloride was used to calculate the screening level for THg. Assumptions for the dermal contact route were based on USEPA's 2004 *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*. As described in the guidance, chemical-specific dermal absorption values (ABS) are used to estimate chemical absorption from sediments through the skin. In the absence of chemical-specific ABS values, such as for mercury, USEPA and NJDEP recommends that the dermal pathway not be quantitated since the speciation of the compound is critical to the dermal absorption (USEPA, 2004 and NJDEP, 2008). Therefore, the screening level for THg presented in Table 3-4 is based on the ingestion pathway only.

3.2.2 Bank Soils

Select bank soils will be targeted for remediation to reduce human health and ecological exposure to mercury-impacted soils and to control the potential migration of mercury-impacted bank soils to downstream areas of Wanaque River. The WMA ERG for mercury (20.4 mg/kg), developed as part of the onsite soils CMS for upland soils, will be used as a conservative remediation standard for bank areas identified for remediation to reduce human health and ecological exposure to mercury-impacted bank soils.

Bank soils between station WR-12 and the former dam with the potential to erode into Wanaque River will be remediated to control the potential migration of mercury-impacted bank soils to downstream areas of Wanaque River. Bank soil reaches will be identified based on an evaluation of bank stability (e.g., BEHI survey, geotechnical evaluation).

Table 3-4
Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Constituents in Sediment
Site-Specific Recreational Land Use Scenario - Wanaque Shore (90 days/year)

$$RS\ (mg/kg) = \frac{THQ \times BW \times AT \times 365\ d/yr}{(EF \times ED \times 10^{-6}\ kg/mg) \times [(1/RfDo \times IR) + (1/RfD_{ABS} \times AF \times ABS_d \times EV \times SA)]}$$

Parameter	Definition	Child Value	Adult Value	Source
RS	Remediation Standard (mg/kg)	Calculated	Calculated	
THQ	Target hazard quotient unitless	1	1	NJDEP Default
BW	Body weight (kg)	14.8	80	Child: EFH Table 8-3 M&F; Mean; Original Data Source: U.S. EPA Analysis of NHANES 1999–2006 data (USEPA, 2011). Adult: (USEPA, 2014)
AT	Averaging time (yr)	6	30	NJDEP Default
RfDo	Oral reference dose (mg/kg-day)	Chemical-Specific	Chemical-Specific	
IR	Sediment ingestion rate (mg/day)	100	50	BPJ, Assume one-half residential soil ingestion rate
RfD_{ABS}	Dermally adjusted reference dose (mg/kg-day)	RfDo x ABS_{GI}	RfDo x ABS_{GI}	
ABS_{GI}	Gastrointestinal absorption factor (unitless)	Chemical-Specific	Chemical-Specific	USEPA, 2004
AF	Skin-soil adherence factor (mg/cm^2-event)	Not Applicable	Not Applicable	See note
EF	Exposure frequency (days/yr)	90	90	BPJ and USEPA Region IV recommended value for swimming activities in backyard pools or coastal areas (USEPA Region 4, 2018).
ED	Exposure duration (years)	6	30	NJDEP Default
ABSd	Dermal absorption fraction (unitless)	Chemical-Specific	Chemical-Specific	USEPA, 2004
EV	Event frequency (events/day)	Not Applicable	Not Applicable	See note
SA	Skin Surface Area, cm^2	Not Applicable	Not Applicable	See note

Analyte	RfDo	Source	RfD_{ABS}	ABSd	RS - Child	RS - Adult	
Mercury	3.00E-04	IRIS (a)	2.10E-05	-	180	1900	per RAGs Part E, dermal pathway not assessed without a chemical-specific ABSd

Notes:

IRIS - USEPA's Integrated Risk Information System　　BPJ - Best Professional Judgement

(a) Value for mercuric chloride

References:

USEPA, 2004. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E Supplemental Guidance for Dermal Risk Assessment). Final. EPA/540/R/99/005. July 2004 (with 2007 errata).

USEPA, 2011. Exposure Factors Handbook. Exposure Factors Handbook: 2011 Edition. EPA/ 600/ R-090/052F, September 2011.

USEPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. OSWER Directive 9200.1-120 dated February 6, 2014.

USEPA Region 4, 2018. Region 4 Human Health Risk Assessment Supplement Guidance. Scientific Support Division Superfund Division EPA Region 4. March 2018.

4 Remedial Action Objectives

RAOs are media-specific goals that are aimed at protecting human health and the environment. The overall objective of the corrective measure is to remove mercury impacted fine-grained sediments in the area depicted on Figure 6. The removal will mitigate the potential human health direct contact exposure to mercury in depositional sediments and reduce the exposure area for ecological receptors. Additionally, the corrective measure will address bank soils that have the potential for failure and be deposited back into Wanaque River and potentially re-impact the river with mercury.

Based on the CSM and data collected during historical investigations, the following RAOs were established for the corrective measure:

- RAO #1: Reduce human health and ecological receptor exposure to elevated concentrations of mercury-impacted fine-grained sediment deposits.
- RAO #2: Reduce the mass of mercury available for methylation in mercury-impacted fine-grained sediment deposits and bioaccumulation and biomagnification in biota.
- RAO #3: Reduce human and ecological exposure to mercury-impacted bank soils outside of the proposed sediment remediation area.
- RAO #4: Control the potential migration of erodible, mercury-impacted bank soils to downstream areas of the river.

5 Identification and Screening of Technologies

As stated in the introduction to Chapter IV of USEPA's *RCRA Corrective Action Plan*, "The scope and requirements of the CMS, however, need to be balanced with the expeditious initiation of remedies and rapid restoration of contaminated media, both major goals of the RCRA corrective action program. In keeping with these goals, the implementing agency may allow a streamlined approach to remedy selection, enabling a facility to move from facility investigation to corrective measures implementation more rapidly."

General response actions/remedial technologies were identified and screened to develop a range of potential technically implementable corrective measures for the Wanaque River. The purpose of the technology screening process is to evaluate the suitability of the general response action/remedial technology to meet the RAOs, with effectiveness and implementability criteria being the main factors evaluated for each.

As identified in Section 2, mercury is the only COC in fine-grained sediments and bank soils. As such, the primary remedial technologies identified are established treatment technologies for metals in a solid matrix. Table 5-1 summarizes the general response actions/remedial technologies evaluated during this screening process.

Table 5-1 Screening of General Response Actions/Remedial Technologies

General Response Action/Remedial Technology	**Description**	**Effectiveness and Implementability**	**Retained for Further Evaluation**
No Action	No Action involves deferral of corrective measure of any kind.	Baseline evaluation alternative.	Yes
Limited Action	Offsite impacted fine-grained sediments and bank soils from the former dam north to the Site boundary are excavated and transported to permitted offsite treatment and/or disposal facilities. Monitoring program (sediments, bank soils, pore water, fish tissue) is implemented to assess conditions over time.	Removal and offsite disposal are proven technologies and will reduce the potential for direct contact. Monitoring is effective for evaluating concentrations and effects of COCs over time.	Yes
Containment	Cap/cover sediments and bank soils in place or consolidate and cap/cover material onsite.	• Proven technology. • Readily available. • Reduces direct contact. • Does not reduce toxicity or volume.	No

Table 5-1 Screening of General Response Actions/Remedial Technologies			
General Response Action/Remedial Technology	**Description**	**Effectiveness and Implementability**	**Retained for Further Evaluation**
		• Will reduce storage capacity of river. • While migration and bioavailability are minimized by cap, volume of mercury in material still remains. • Requires long-term maintenance and monitoring.	
Immobilization	Solidify sediments and bank soils by physically locking mercury within solidified matrix or stabilizing material by converting it to more immobile form. Usually involves mixing of reagent with soil.	• Proven technology. • Increases volume. • Mixing may be difficult. • Implementation will take longer than other technologies such as removal. • Although no longer bioavailable, mercury may not be removed from material. • Uncertainties involved with re-establishment of benthic communities.	No
Soil Washing	Extraction of mercury from sediments and bank soils by physical separation or use of washing solution.	• Not extensively demonstrated. • Treatment fluids may not be fully effective on mercury. • Extraction fluid may be toxic or develop toxic characteristics when mixed with constituents. • Implementation will take longer than other technologies such as removal.	No
Removal	Impacted sediments and bank soils are excavated and transported to permitted offsite treatment and/or disposal facilities.	• Proven technology. • Readily implementable. • Transfers impacted material to different location for containment or treatment. • No operation and maintenance required.	Yes

6 Identification of Corrective Measure Alternatives

The primary objective of this CMS is to identify a corrective measure alternative to address mercury-impacted fine-grained sediments and bank soils within specific areas of Wanaque River, floodplain, and adjacent uplands. In accordance with USEPA's *RCRA Corrective Action Plan*, a screening process was used to evaluate the effectiveness and implementability of the proposed corrective measure alternatives.

Based on the screening conducted in Section 5, many of the technology types were eliminated from further consideration since removal of fine-grained sediments and bank soils is the most effective treatment process to address the RAOs presented in Section 4. This also aligns with USEPA's *RCRA Corrective Action Plan* in that a streamlined approach is being used for remedy selection so that an expeditious initiation of remediation and rapid restoration of the affected area can be accomplished. However, the no action alternative was carried through the process for comparison purposes.

6.1 No Action

Under this alternative, no action would be taken to remediate mercury-impacted fine-grained sediments and bank soils. However, this alternative provides the baseline case for comparing corrective measure alternatives.

This alternative would not meet the RAOs established for Wanaque River.

General Description

The fine-grained sediments and bank soils would remain in place and no action would be taken to address the mercury-impacted material. Wanaque River is relatively shallow with lower flow rates and the flow is controlled upstream by Raymond Dam. Also, only a portion of the former dam was removed and water flow is funneled through the removed portion. The water flow rate, upstream control by Raymond Dam, and remaining portion of the former dam would restrict the movement of fine-grained sediment deposits within the river.

The CSM describes the source of the fine-grained sediments as historical migration of upland soils into the river during former Site operations. Previous investigations of the river indicate the banks are relatively stable and vegetated which will restrict the movement of upland soils into the river and minimize the potential for the banks to add to the fine-grained sediments in the river.

Implementation

No implementation would be required under this alternative. An educational program could be established to inform the public about the potential hazards of coming into contact with the impacted sediments and bank soils. Direct contact exposure to humans would likely be limited to trespassers and recreational users of the river while direct contact exposure to aquatic and sediment-dwelling organisms are not likely to result in adverse effects. The educational program would help guide the public away from areas with potential impacts.

6.2 Limited Action

This alternative would consist of removing the offsite fine-grained sediments and bank soils (between former dam and southern Site boundary). The onsite portion of mercury-impacted fine-grained sediments and bank soils would be left in place without conducting any further remediation. However, this alternative would consist of a monitoring program to assess mercury concentrations and river/bank conditions over time.

General Description

The CSM and previous investigations indicate that conditions within Wanaque River are relatively stable and are not changing (i.e., fine-grained sediments not moving and banks stable and vegetated). This alternative would include the following:

- Removal of offsite fine-grained sediments and bank soils between former dam and heading upstream to the southern Site boundary;
- Processing of removed material, as necessary, for offsite disposal;
- Restoration of removal area, as required, by remediation permits;
- Periodic updates to substrate mapping of river completed during the Wanaque River investigation to confirm fine-grained sediments are not migrating past the former dam;
- Periodic updates to bank stability assessment to document conditions of banks, confirm stability, and assess vegetation cover; and
- Periodic sampling of fine-grained sediments, bank soils, pore water, and fish tissue to assess mercury concentrations.

Implementation

Removal would be completed in a similar sequence to the description provided in Section 6.3 below. An educational program could be established to inform the public about the potential hazards of coming into contact with the impacted fine-grained sediments and bank soils that are left in place. Direct contact exposure to humans would likely be limited to trespassers and recreational users of the river while direct contact exposure to aquatic and sediment-dwelling organisms are not likely to result in adverse effects. A monitoring program would be developed for implementation and include a health and safety plan, quality assurance project plan, and monitoring and reporting schedule.

6.3 Fine-Grained Sediments and Bank Soils Removal and Offsite Disposal

Removal of fine-grained sediments and bank soils represents an active corrective measure.

General Description

Fine-grained sediments and bank soils removal would include the excavation of the areas identified in Section 3.1.1 and 3.1.2. The removal action can be completed by mechanical, hydraulic, or other methods. Once the material is removed, it would be processed as necessary for disposal and then transported to an approved, offsite facility.

The removal of fine-grained sediments would re-establish a desirable coarse-grained substrate within the river and limited restoration would likely be required in accordance with remediation permits. The bank soils would be restored at the slope required to prevent future erosion or engineered to be stable and minimally erodible. Vegetation would be established in accordance with remediation permits.

Implementation

Permits would need to be obtained from NJDEP before implementation of the alternative could proceed. Remediation would occur during the timeframe when activities are not restricted in Wanaque River due to its classification as trout production waters. Activities are restricted between September 15^{th} and March 15^{th}.

The anticipated sequence for the corrective measure would consist of the following:

- Obtain required permits – such as wetlands and flood hazard area;
- Pre-design work – surveys and project plan development;
- Mobilization activities – equipment brought to site, facilities set up, and erosion control measures put into place;
- Sediment and soil removal – excavation of impacted material in river and on banks;
- Restoration – completed in accordance with permit requirements;
- Demobilization activities; and
- Reporting and long-term monitoring (if required).

7 Evaluation of Corrective Measure Alternatives

An evaluation was conducted for each of the corrective measure alternatives presented in Section 6 to assess the general effectiveness of the alternative. The following criteria from Chapter IV of USEPA's *RCRA Corrective Action Plan* were used in this evaluation:

1. Protect human health and the environment.
2. Attain media cleanup standards (see Section 3).
3. Control source of releases to reduce or eliminate, to the extent practicable, further releases that may pose threat to human health and the environment.
4. Comply with applicable standards for management of wastes.
5. Other factors such as:
    a. Long-term reliability and effectiveness;
    b. Reduction in mobility, toxicity, and/or volume of wastes;
    c. Short-term effectiveness; and
    d. Implementability.

Implementability of the corrective measure alternative was evaluated against technical and administrative factors such as:

- Engineering and scientific feasibility of technology;
- Availability of services and resources required for implementation;
- Uncertainties associated with construction, operation, and performance; and
- Whether technology can be implemented within reasonable timeframe.

Table 7-1 summarizes the results of the alternatives evaluation.

Table 7-1 Screening of Technology Types

Criteria	Alt.1	Alt. 2	Alt. 3	Comments
Protect Human Health and the Environment	○	◑	●	Removal will reduce potential exposures.
Attain Media Cleanup Standards	○	◑	●	Removal will meet applicable remediation standards developed for corrective measure.
Control Source of Releases	○	◑	●	Removal will eliminate potential for further releases that my pose threat to human health and environment.
Comply with Applicable Standards for Management of Wastes	○	◑	●	Additional testing may be required to evaluate whether pre-treatment is required prior to offsite disposal of removed material.
Long-Term Reliability and Effectiveness	○	◑	●	Removal of fine-grained sediments and bank soils will eliminate potential for migration of constituents.
Reduction in Mobility, Toxicity, and/or Volume	○	◑	●	Removal reduces the mobility, toxicity, and volume of impacted fine-grained sediments and bank soils.
Short-term Effectiveness	●	◑	◑	No action can be implemented with relatively little to no short-term risks to onsite workers. Removal will increase potential exposure risk to workers and surrounding community.
Engineering and Scientific Feasibility	●	●	●	These are proven technologies that can be readily implemented.
Availability of Services and Resources	●	●	●	Alternatives can be implemented with existing contractors and equipment.
Implementation and Performance Uncertainties	●	●	●	Project plans would be developed to confirm appropriate implementation methods are selected.
Implementation Timeframe	●	◑	◑	No action does not require implementation. Limited action and removal would be implemented following completion of design and permitting.

● Meets Evaluation Criteria

◑ Partially Meets Evaluation Criteria

○ Does Not Meet Evaluation Criteria

8 Proposed Corrective Measure Alternative

Based on the corrective measure alternatives evaluation, Alternative 3 – which includes removal of fine-grained sediments and removal/stabilization of bank soils – is being proposed as the corrective measure to address mercury-impacted fine-grained sediments and bank soils within specific areas of the Wanaque River, floodplain, and adjacent uplands. The proposed alternative meets evaluation criteria as follows:

- The alternative will meet RAOs by reducing the potential for human and ecological exposure to mercury-impacted fine-grained sediments and bank soils and preventing future deposition of mercury-impacted sediments into the river from a bank failure.
- Removal will reduce the mass of mercury available for methylation in impacted fine-grained sediments and bioaccumulation/biomagnification in biota. Additionally, offsite disposal of the impacted material will reduce the volume of impacted material in the river.
- Removal of mercury-impacted fine-grained sediments will remove the potential for that material to migrate downstream of the former dam. Also, the bank excavation work includes restoring the bank to a stable condition which will minimize future deposition of sediments into the river.

8.1 Implementation Details

The proposed corrective measure alternative uses conventional technologies that have a demonstrated performance history at other sites. Excavation and offsite disposal are reliable controls that constitute a permanent remedy. The corrective measure is anticipated to consist of fine-grained sediment and bank soil removal during the timeframe when activities are not restricted in Wanaque River (March 15th through September 15th) due to its classification as trout production waters. Also, there is a preference for conducting the corrective measure during periods of low flow within the Wanaque River, typically July and August.

Impacted material will be excavated, managed, and transported to an approved offsite disposal facility. Available data indicate that material excavated from within proposed removal areas may be managed as non-hazardous waste. Samples collected within potential removal areas were analyzed for toxicity characteristic leaching procedure (TCLP) during supplemental investigation activities conducted in December 2011. TCLP results did not indicate concentrations exceeding NJDEP regulatory levels for metals. Additional waste characterization may be conducted on removed material prior to disposal.

To efficiently complete removal activities, it is anticipated that river flow will be bypassed around the removal area. The bypassed area (work zone) will be dewatered, allowing removal activities to be completed in drier conditions. Removal of fine-grained sediments will be completed from within the work zone rather than from the river bank and may require the use of matting and/or temporary stabilization of the river bed for equipment access. Removal will progress in a general north to south direction with any bank excavation completed concurrently with adjacent channel sediments. Water from inside the active removal area will be managed to ensure compliance with applicable permits.

Restoration of the removal areas will be completed based on the classification of each area as a state open water, wetland, wetland transition area, or riparian zone. Fine-grained sediment removal within the river will be completed in an area classified as state open waters. Soil removal from the banks will be completed in areas classified as wetlands, wetland transition areas, and riparian zone.

A long-term monitoring program will be implemented after remediation to evaluate the effectiveness in reducing exposure to ecological receptors.

8.2 Pre-Design Activities

8.2.1 Supplemental Sampling

Historical investigations have detected mercury in fine-grained sediments and surficial upland and floodplain soils. The estimated areal extent, including sampling points, of fine-grained sediments and bank soils removal are shown on Figures 7 through 10. Supplemental sampling of the fine-grained sediments and bank soils will be completed to refine the removal areas. In addition to the collection of these samples, a supplemental geotechnical investigation will be completed. The data collected from this investigation will be used to confirm that the proposed bank removal will be sufficient to prevent future bank failure.

Sediment samples will be collected from fine-grained deposits, where present, using methods consistent with previous phases of sampling which were based on general guidance and principles outlined in USEPA's *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* and NJDEP's *Ecological Evaluation Technical Guidance, Version 2.0*.

Bank soil samples will be collected from the bank face and upland soils to delineate mercury concentrations and refine the removal areas using sampling methods consistent with previous phases of bank sampling. Bank face samples will be collected as a composite "trough" sample vertically along the face of the river bank. Samples will be collected vertically from the edge of the water to the top of the bank.

Additional evaluation of bank stability may be needed for banks remediated to greater than a 26.5-degree slope. Channel stability analyses, including soil analyses and flow velocity analyses will be conducted, as necessary, for banks with greater than a 26.5-degree slope using the Channel Stability Analysis Procedure (NJDA, 2017).

8.2.2 Topographic Survey

A riverbed survey was conducted during the winter of 2013 to provide an accurate topographic river bed map. However, the survey was completed prior to supplemental sediment sampling and only included Sediment Areas 6, 7, and 8.

Additionally, a topographic survey of the Site was completed in 2014 and included the proposed sediment and soil removal areas. Any additional survey data required to establish survey control prior to and during corrective measure implementation will be collected during pre-design activities.

8.2.3 Sediment Thickness Survey

The estimated sediment thickness for each of the removal areas is approximately one foot; however, the thickness may vary. Detailed substrate mapping was completed during 2011 and 2012 (see Appendix A). Supplemental sediment thickness measurements may be collected, as necessary, to refine removal volumes prior to corrective measure implementation.

8.2.4 Debris and Cobble Survey

The detailed substrate mapping and previous investigations of Wanaque River have identified locations where cobbles and debris exist throughout the river. It is anticipated that debris and cobbles will be removed during sediment remediation. The approach will include a debris and cobble survey to assess the need to complete screening and removal of debris and cobbles prior to removal of sediments.

8.2.5 Project Plan Development

A Corrective Measure Implementation Work Plan (CMIWP) would be developed to confirm appropriate implementation methods are selected. The CMIWP would include multiple project plans such as, but are not limited to:

- Health and Safety Plan,
- Contingency Plan,
- Spill Containment and Response Plan,
- Erosion and Sediment Control Plan, and
- Quality Assurance Project Plan.

All project plans would be completed during pre-design activities and submitted to the Agencies for approval prior to obtaining permits for corrective measure implementation.

8.3 Anticipated Permitting Requirements

Corrective measure implementation will require authorizations and approvals from state and local authorities for temporary disturbances within regulated areas. The following list of permits and approvals are anticipated based on a preliminary review of regulatory requirements for the conceptual corrective measure activities described in previous sections of this CMS.

State

- NJDEP Wetlands General Permit #4 – Hazardous Investigation and Clean-Up
- NJDEP Flood Hazard Individual Permit
- NJDEP New Jersey Pollutant Discharge Elimination System Surface Water Discharge Permit (BGR – General Remediation Clean-up Permit Authorization)
- NJDEP Air Quality Permitting Program – General Permit
- NJDEP Highlands Applicability & Water Quality Management Plan Consistency Determination/Preservation Area Exemption
- NJDEP Water Allocation Permit-by-Rule – Determination
- NJDEP Stormwater Construction General Permit (RFA)
- NJDEP Historic Preservation Office Phase 1A Cultural Resources Investigation
- Scientific collection permit (for fish collection)

Local

- Passaic County Soil Erosion and Sediment Control Approval
- Pompton Lakes and Wanaque Borough Soil Removal Permits/Minor Site Plan Approval

A more detailed description of anticipated permit requirements will be presented as part of the CMIWP and after a NJDEP pre-application meeting. These evaluations may result in a modification to this list of permitting requirements and approvals.

9 Path Forward

Preparation of a CMIWP for the proposed corrective measure alternative is contingent on Agency approval of this CMS. Prior to submittal of a CMIWP, pre-design activities will be completed to confirm the removal limits, select an appropriate approach for excavation; evaluate transportation methods; and prepare a restoration plan. Upon approval of this report, the pre-design activities will be completed.

The CMIWP will be submitted to the Agencies for review within 365 days of approval of the RCRA Permit Modification for Wanaque River.

10 References

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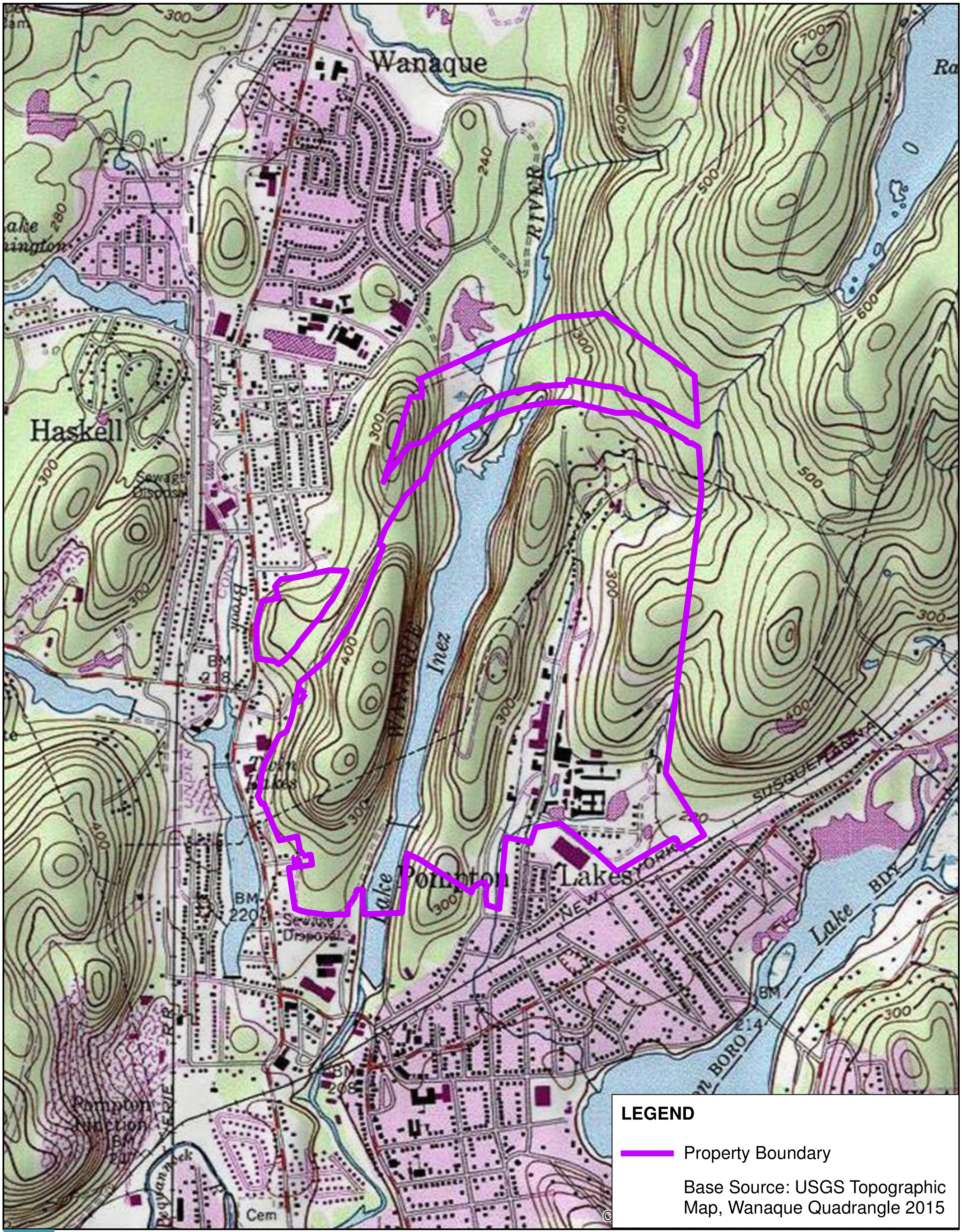
Figures



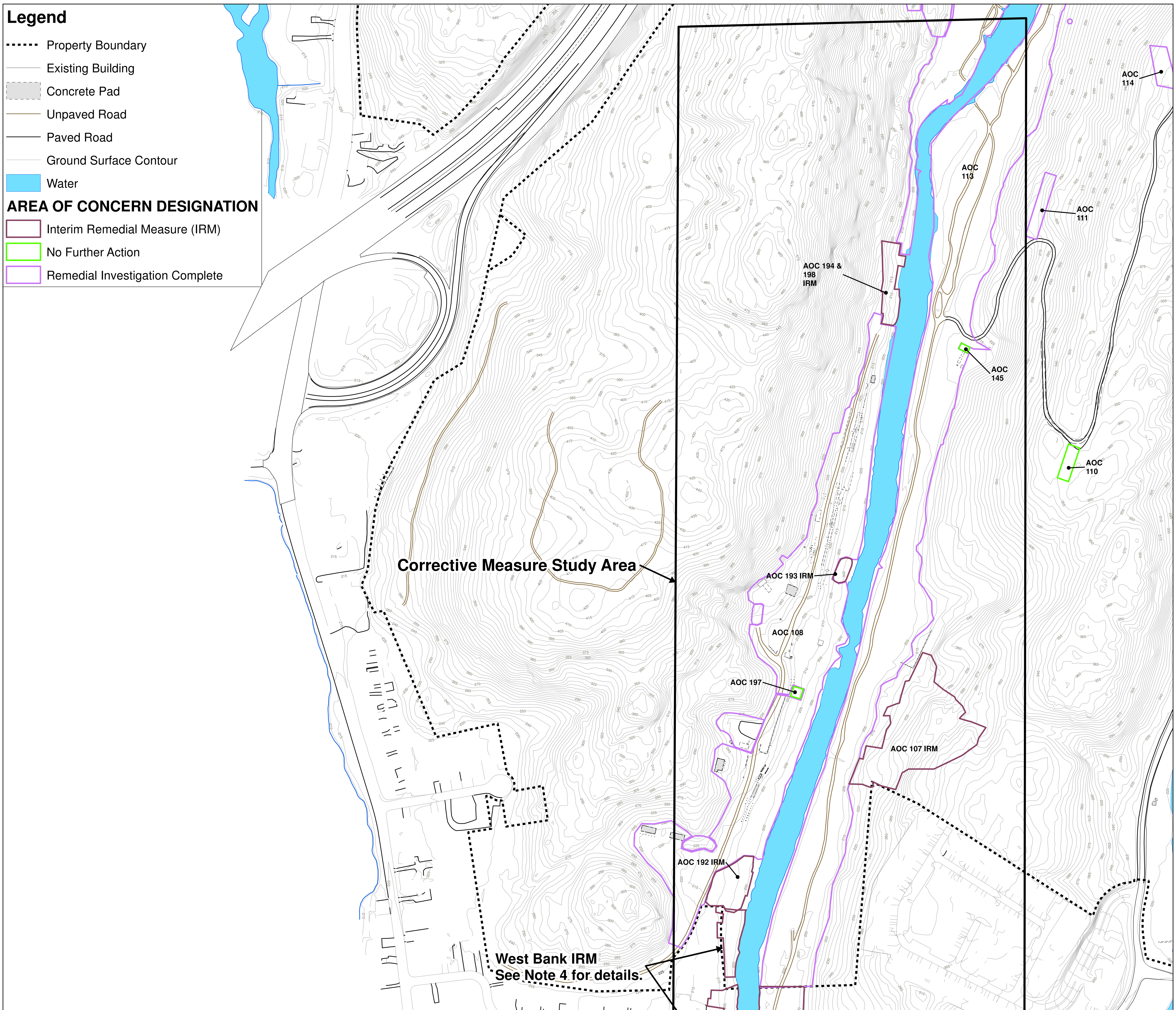
0 750 1,500 3,000 Feet

1 inch = 1,500 feet

SITE LOCATION MAP

FIGURE 1

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507988 - ONSITE REMEDIAL DESIGN\50473.ONSITE REMEDIAL DESIGN-507988\DOCS\DWG\REVISED CMS 2019\FIGURE 1-SITE LOCATION MAP.MXD - USER: CATKINS - DATE: 4/15/2019



Map Inset: Offsite IRMs

Notes:

1. The Wanaque River floodplain located south of the Site boundary was investigated between 1990 and 1992. Over 1,200 samples were collected and analyzed for Site-related constituents of concern.

2. Offsite properties – During 1998 and 1999, a total of 17 of the 21 offsite locations were remediated. These locations consisted of smaller excavations on public and private properties adjacent to Wanaque River. Upland soils on these properties were excavated, post excavation samples collected, and the excavations backfilled and restored.

3. Wilderness Island north and south – During 1999, soils were excavated to the north and south of the intersection of Wanaque River and Hamburg Turnpike. This location is the area identified as Wilderness Island. The soils were excavated, post excavation samples collected, and the excavations backfilled and restored.

4. West Bank Remediation – During 2000, soils were excavated on the western bank of Wanaque River between the Site's property line and the approximate area of the former dam. The soils were excavated, post excavation samples collected, and the excavations backfilled and restored. Additional restoration work was completed in accordance with the stream encroachment and wetlands permits obtained for the remediation.

5. East Bank Remediation – During 2003 and 2004, soils were excavated on the east bank of Wanaque River between the Site's property line and the approximate area of the former dam. The soils were excavated, post excavation samples collected, and the excavations backfilled and restored. Additional restoration work was completed in accordance with the stream encroachment and wetlands permits obtained for the remediation.

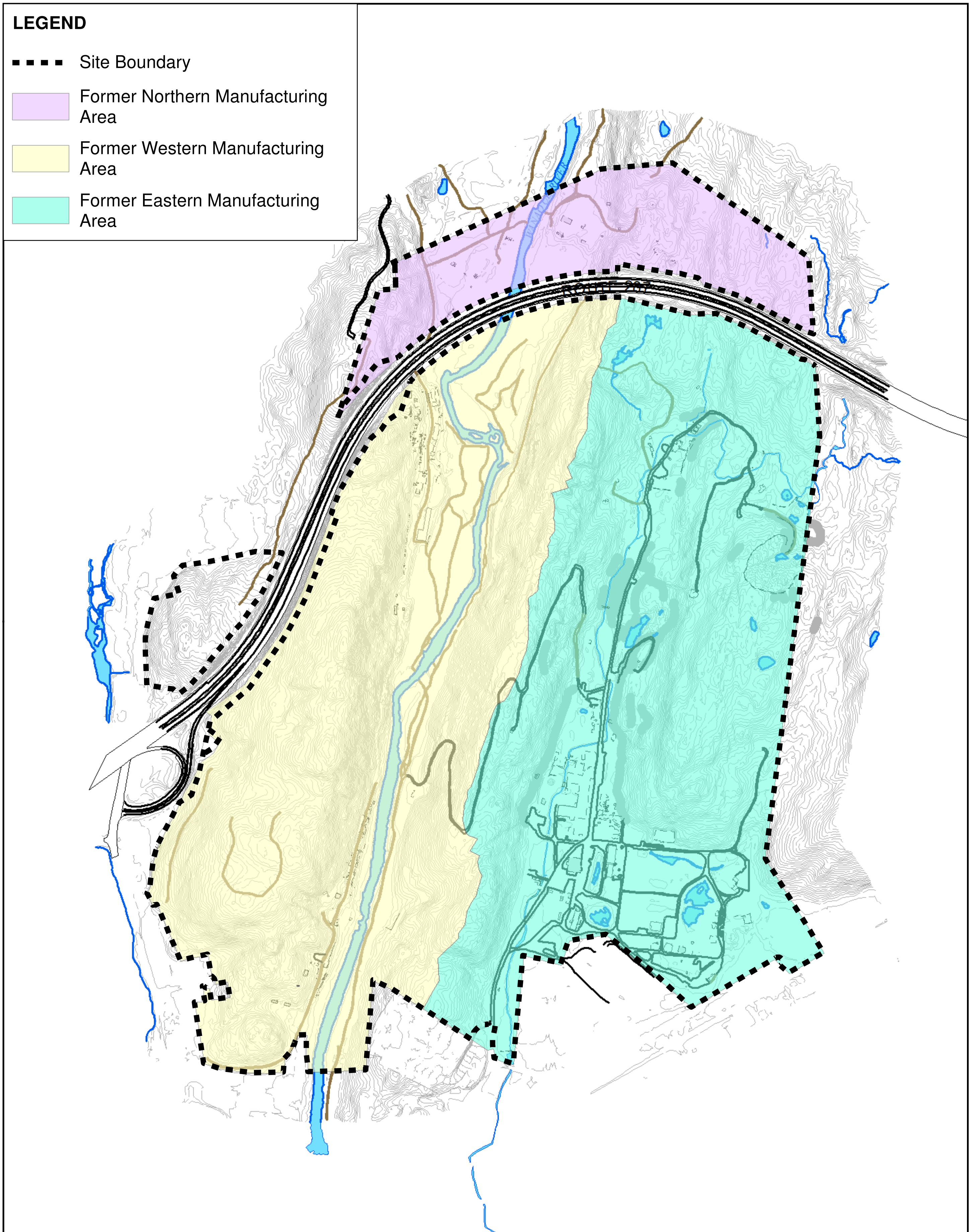
0 150 300 600
Feet

1 inch = 175 feet

IRM LOCATIONS

FIGURE 2

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507844 - WANAQUE RIVER VALLEY RD\48334.WANAQUE RIVER VALLEY RD - 507844\DOCS\DWG\WR CMS\FIGURE 2 WANAQUE RIVER AND HISTORIC IRM LOCATIONS VERSION 2.MXD - USER: CATKINS - DATE: 4/23/2019

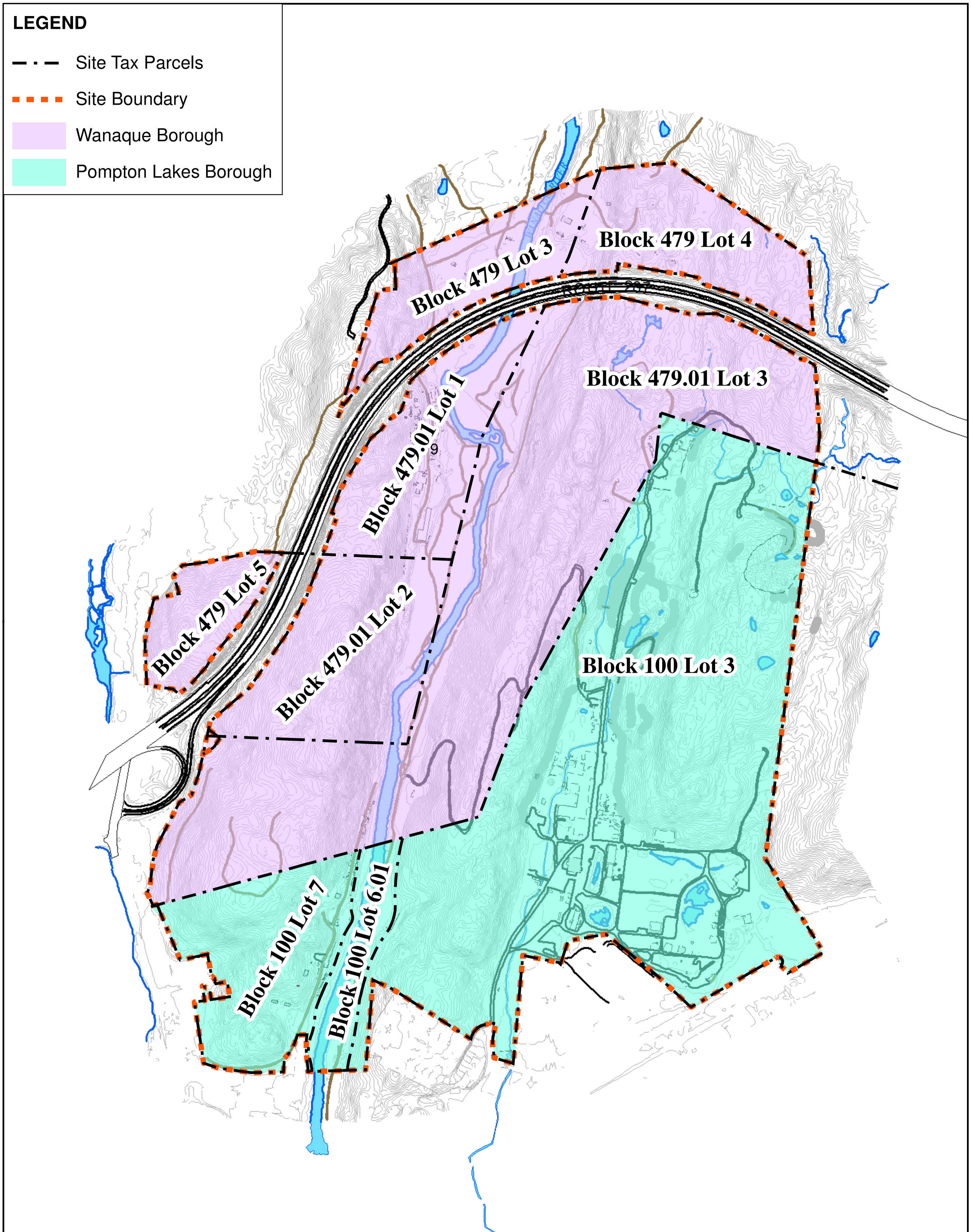


0 500 1,000 2,000
Feet

1 inch = 1,000 feet

FORMER MANUFACTURING AREAS

FIGURE 3

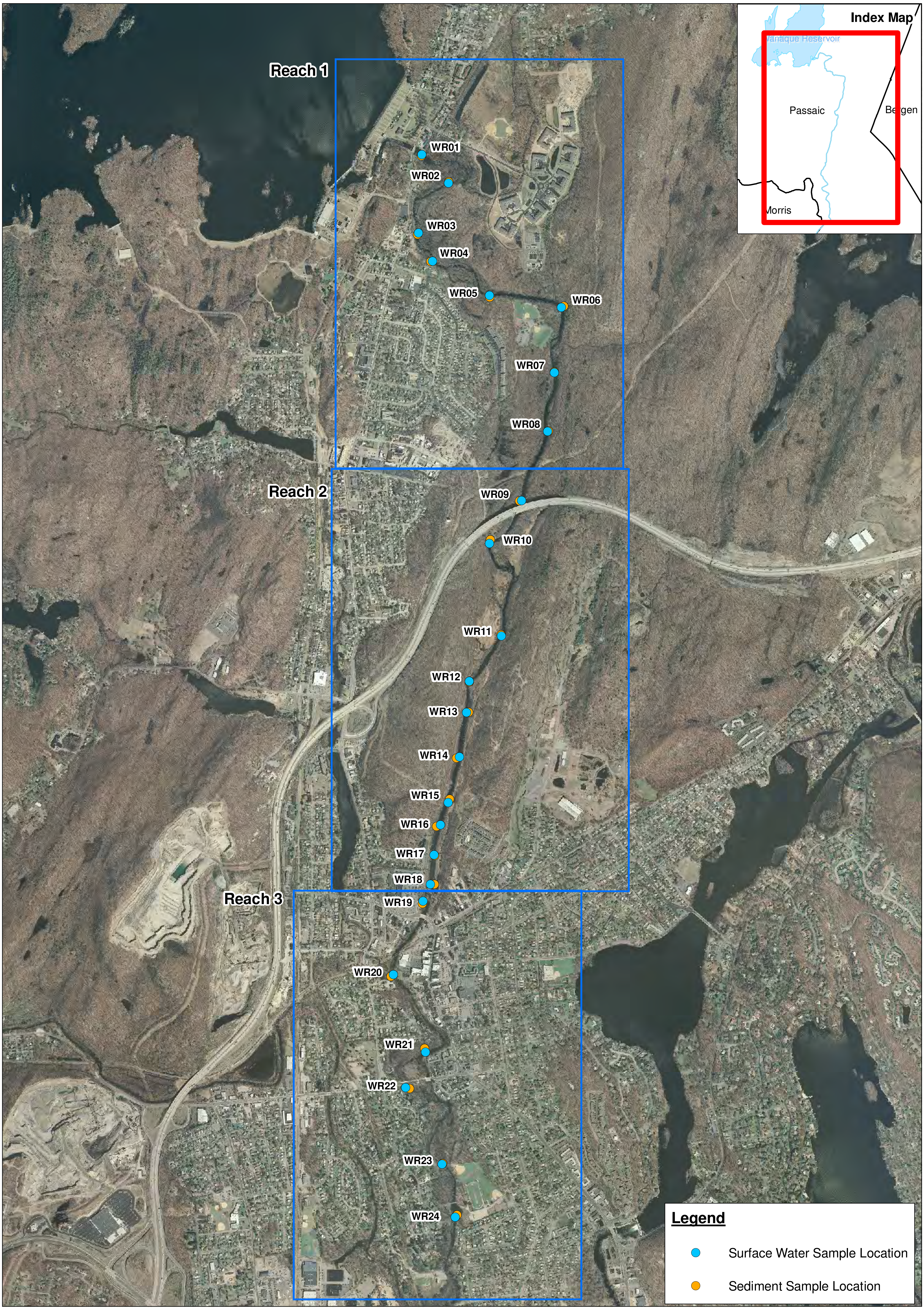


HDR

TAX PARCELS

FIGURE 4

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507988 - ONSITE REMEDIAL DESIGN\50473.ONSITE REMEDIAL DESIGN-507988\DOCS\DWG\REVISED CMS 2019\FIGURE 4 TAX PARCELS.MXD - USER: CATKINS - DATE: 4/15/2019



Source: Aerial Photography - NJDEP 2007

PROJECT NO. 18985452.00004

0 800 1,600 3,200 Feet

1 in = 1,600 ft

Figure 5

Investigation Reaches and Sampling Stations

0 150 300 600 Feet

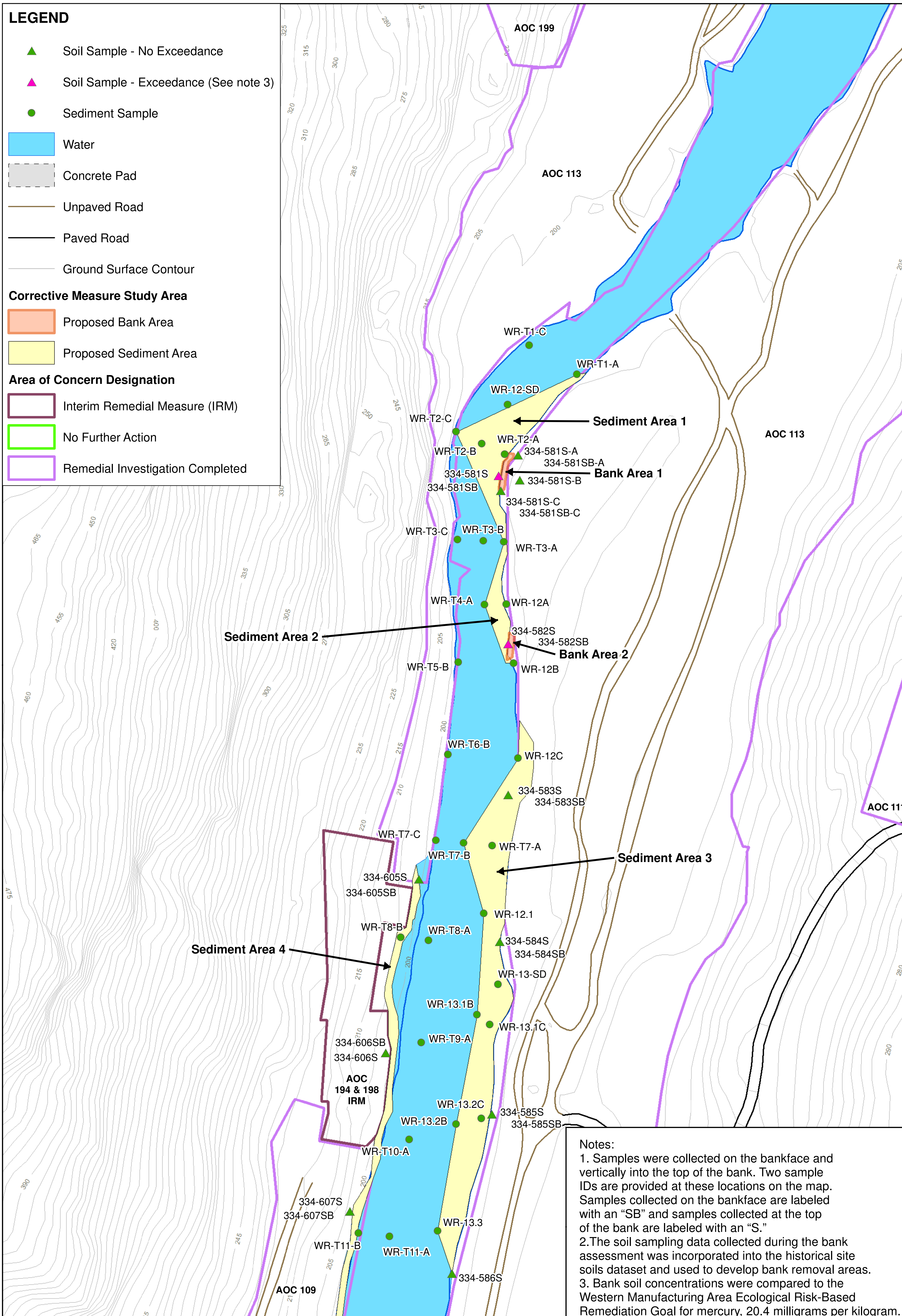
1 inch = 150 feet

HDR

SEDIMENT AND BANK CORRECTIVE MEASURE AREAS

FIGURE 6

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507844 - WANAQUE RIVER VALLEY RD\48334.WANAQUE RIVER VALLEY RD - 507844\DOCS\DWG\WR CMS\FIGURE 6 WANAQUE RIVER CORRECTIVE MEASURE AREAS.MXD - USER: CATKINS - DATE: 4/24/2019



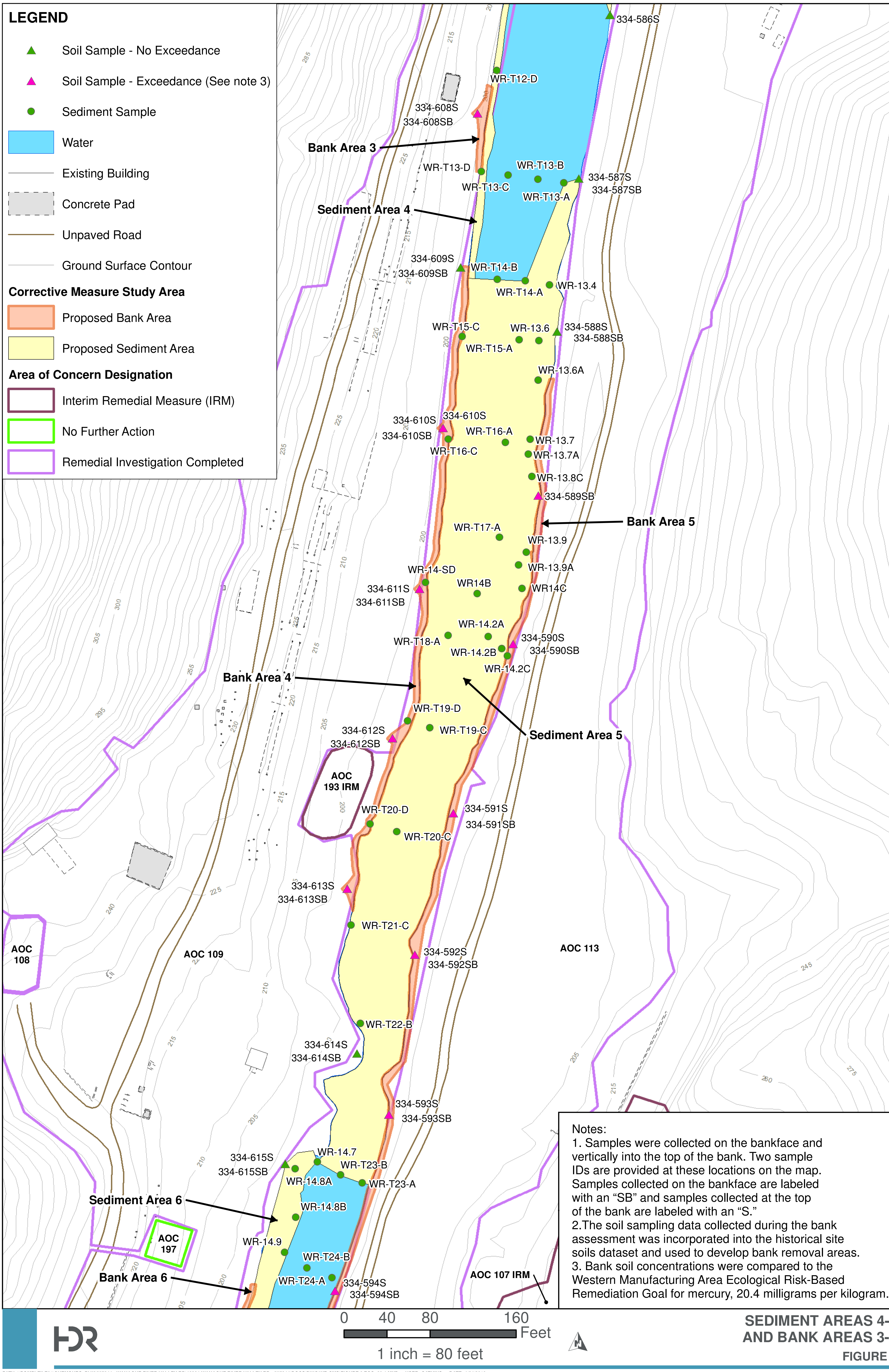
Notes:
1. Samples were collected on the bankface and vertically into the top of the bank. Two sample IDs are provided at these locations on the map. Samples collected on the bankface are labeled with an "SB" and samples collected at the top of the bank are labeled with an "S."
2. The soil sampling data collected during the bank assessment was incorporated into the historical site soils dataset and used to develop bank removal areas.
3. Bank soil concentrations were compared to the Western Manufacturing Area Ecological Risk-Based Remediation Goal for mercury, 20.4 milligrams per kilogram.

FDR

SEDIMENT AREAS 1-4 AND BANK AREAS 1 AND 2

FIGURE 7

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507844 - WANAQUE RIVER VALLEY RD\48334.WANAQUE RIVER VALLEY RD - 507844\DOCS\DWG\WR CMS\FIGURE 7 ECO=20.4.MXD - USER: CATKINS - DATE: 4/24/2019

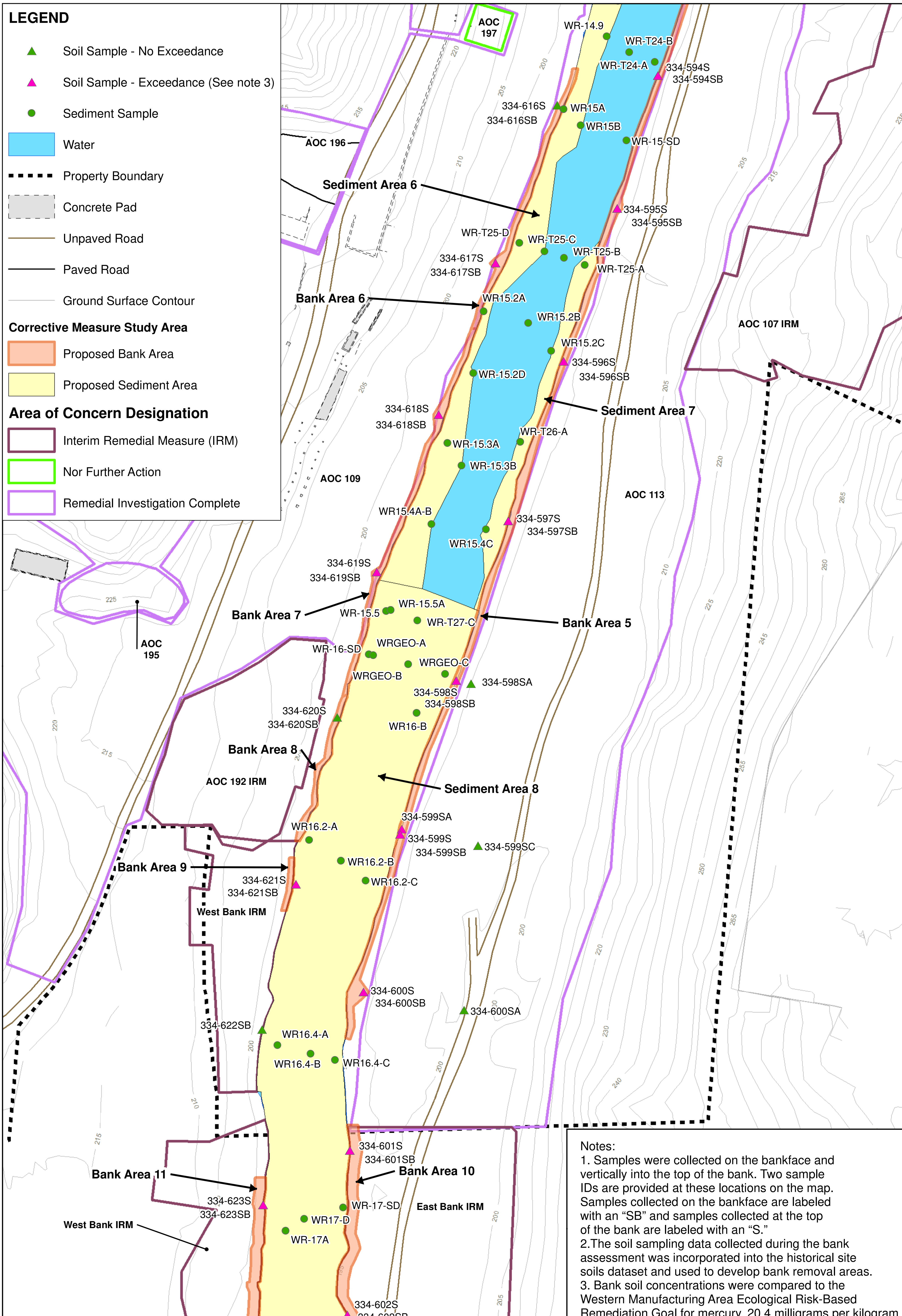


Notes:
1. Samples were collected on the bankface and vertically into the top of the bank. Two sample IDs are provided at these locations on the map. Samples collected on the bankface are labeled with an "SB" and samples collected at the top of the bank are labeled with an "S."
2.The soil sampling data collected during the bank assessment was incorporated into the historical site soils dataset and used to develop bank removal areas.
3. Bank soil concentrations were compared to the Western Manufacturing Area Ecological Risk-Based Remediation Goal for mercury, 20.4 milligrams per kilogram.

FDR

SEDIMENT AREAS 4-6 AND BANK AREAS 3-6

FIGURE 8



Notes:
1. Samples were collected on the bankface and vertically into the top of the bank. Two sample IDs are provided at these locations on the map. Samples collected on the bankface are labeled with an "SB" and samples collected at the top of the bank are labeled with an "S."
2.The soil sampling data collected during the bank assessment was incorporated into the historical site soils dataset and used to develop bank removal areas.
3. Bank soil concentrations were compared to the Western Manufacturing Area Ecological Risk-Based Remediation Goal for mercury, 20.4 milligrams per kilogram.

0 40 80 160 Feet

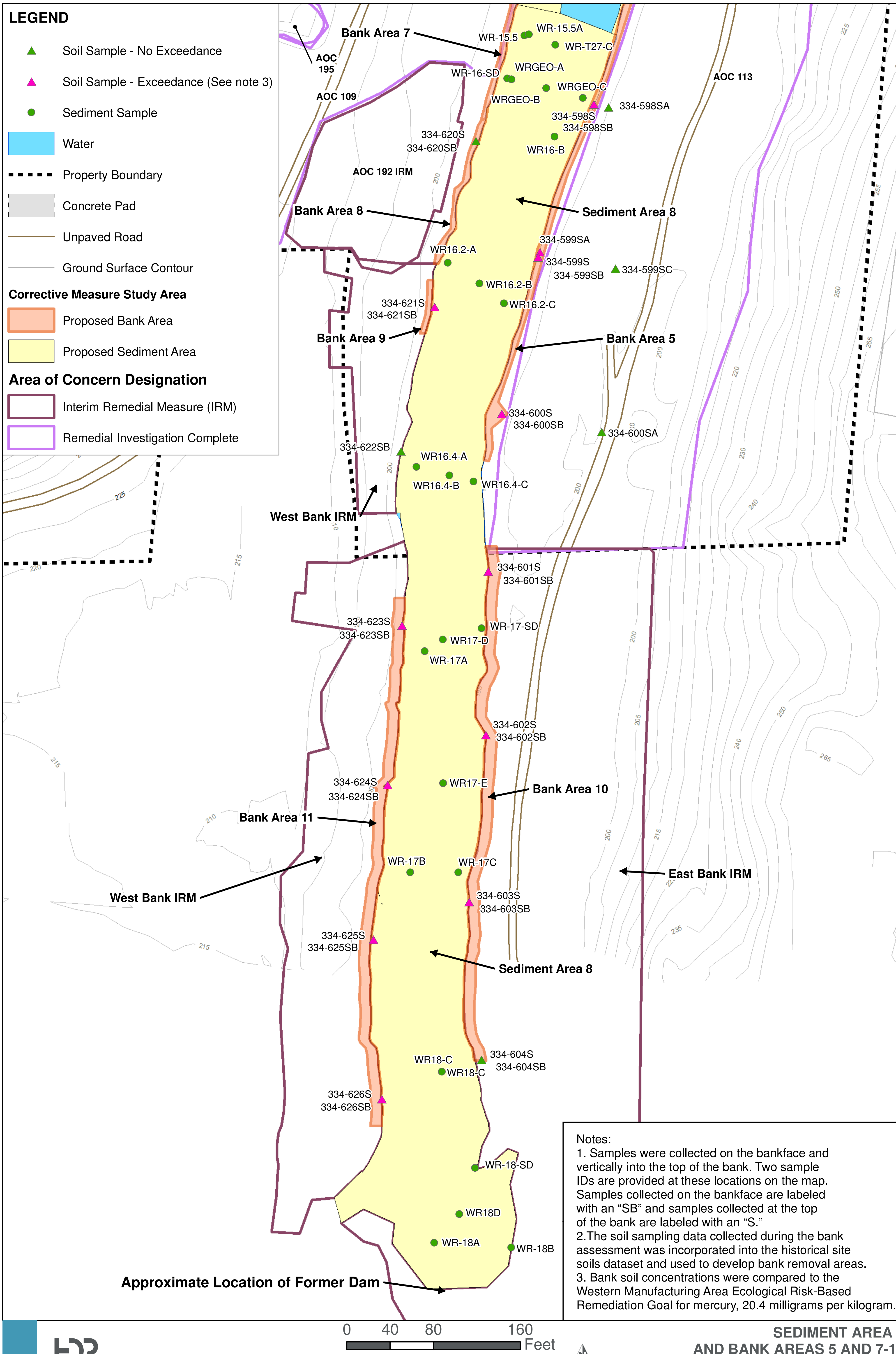
1 inch = 80 feet

HDR

SEDIMENT AREAS 6-8 AND BANK AREAS 5-11

FIGURE 9

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507844 - WANAQUE RIVER VALLEY RD\48334.WANAQUE RIVER VALLEY RD - 507844\DOCS\DWG\WR CMS\FIGURE 9 ECO=20.4.MXD - USER: CATKINS - DATE: 4/24/2019



Notes:
1. Samples were collected on the bankface and vertically into the top of the bank. Two sample IDs are provided at these locations on the map. Samples collected on the bankface are labeled with an “SB” and samples collected at the top of the bank are labeled with an “S.”
2. The soil sampling data collected during the bank assessment was incorporated into the historical site soils dataset and used to develop bank removal areas.
3. Bank soil concentrations were compared to the Western Manufacturing Area Ecological Risk-Based Remediation Goal for mercury, 20.4 milligrams per kilogram.

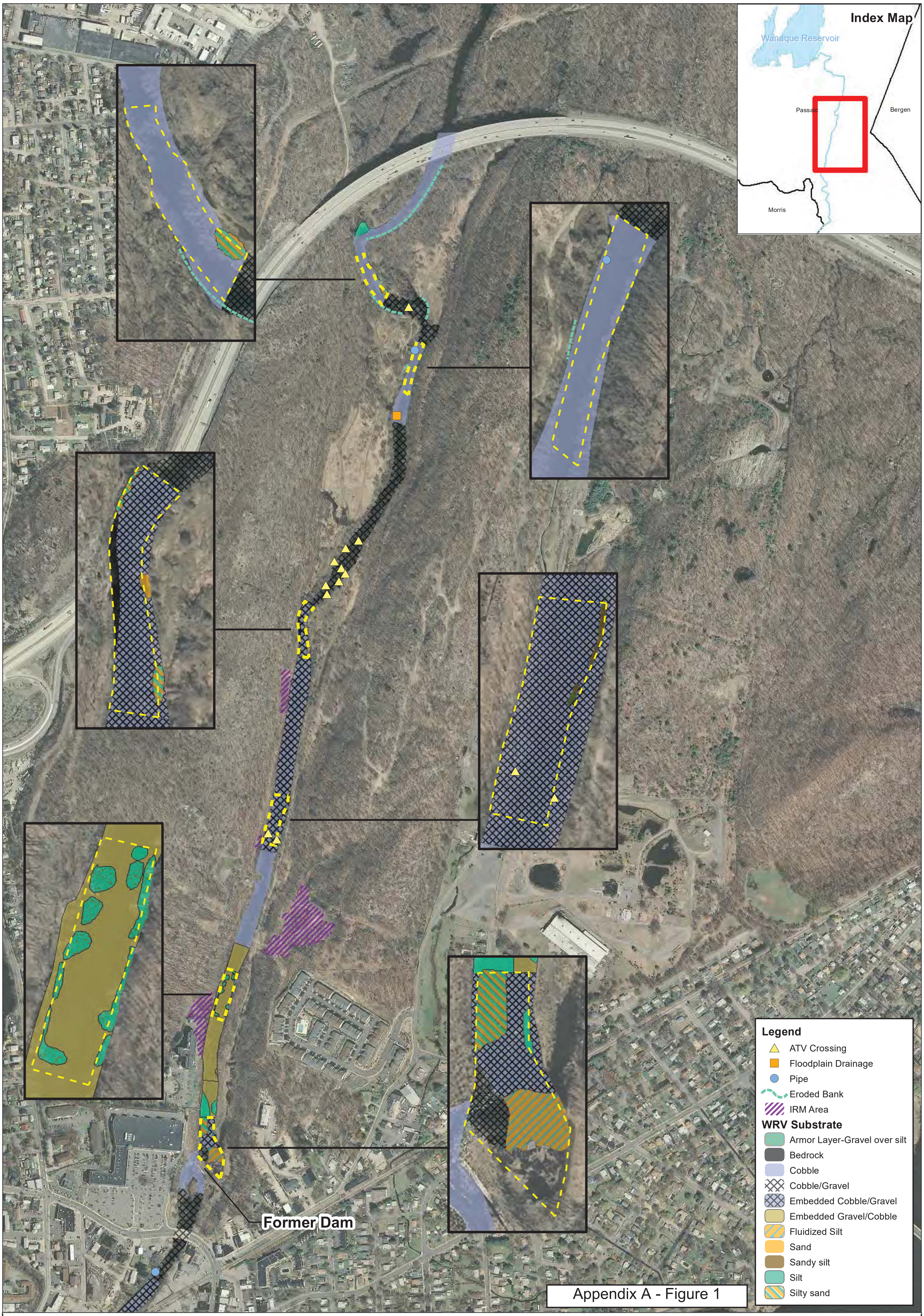
SEDIMENT AREA 8 AND BANK AREAS 5 AND 7-10

FIGURE 10

PATH: \\POMPI-FILE01\CHEMOURS_PLW\507844 - WANAQUE RIVER VALLEY RD\48334.WANAQUE RIVER VALLEY RD - 507844\DOCS\DWG\WR CMS\FIGURE 10 ECO=20.4.MXD - USER: CATKINS - DATE: 4/24/2019

Appendix A

Historical Investigation Figures within Study Area Boundaries



Source: Aerial Photography - NJDEP 2007

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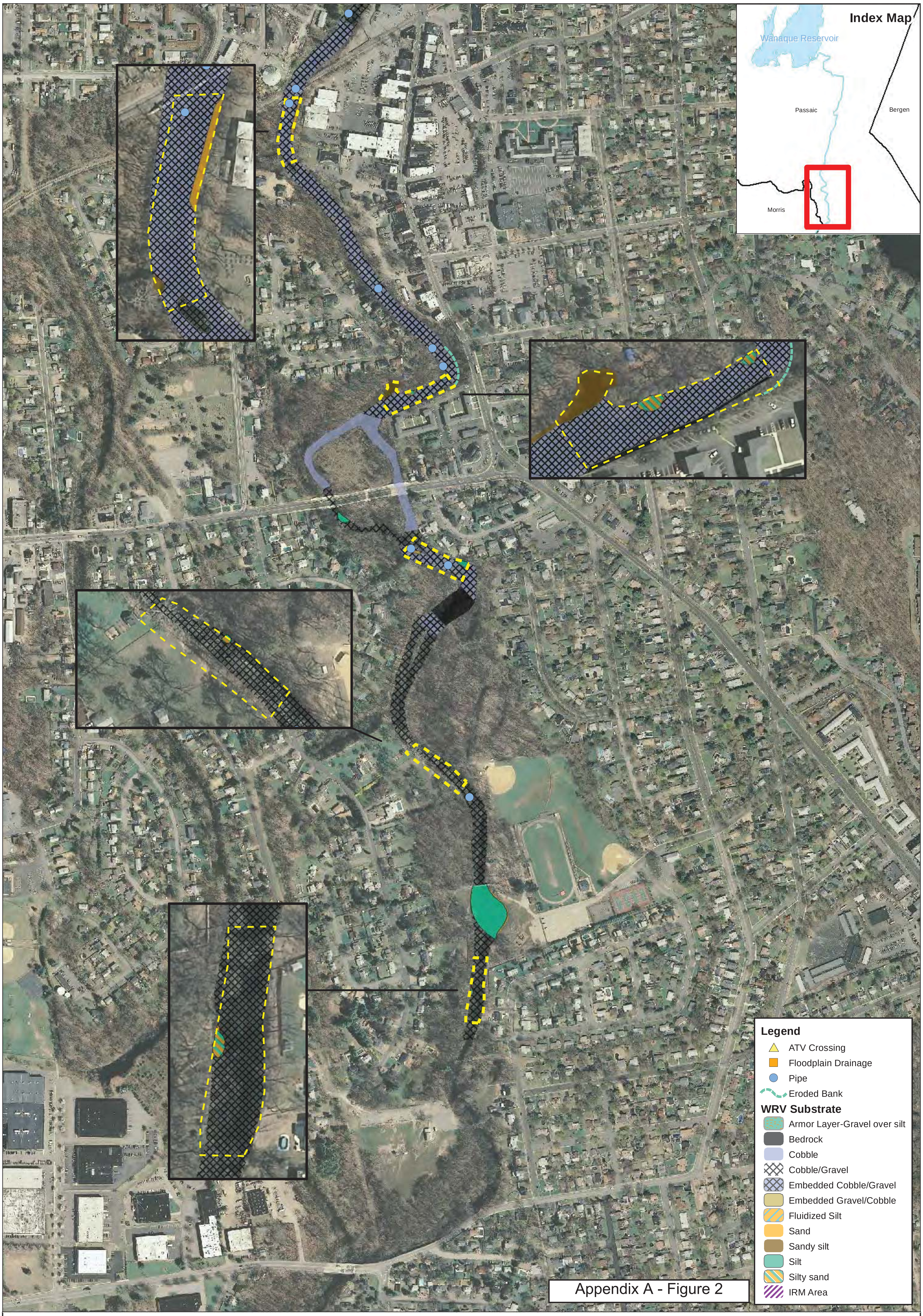
PROJECT NO. 18985452.00004

0 300 600 1,200 Feet

1 in = 600 ft

Note: Inset Maps Not to Scale

Figure 3
Reach 2 - Bank Disturbance and Substrate Mapping
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Source: Aerial Photography - NJDEP 2007

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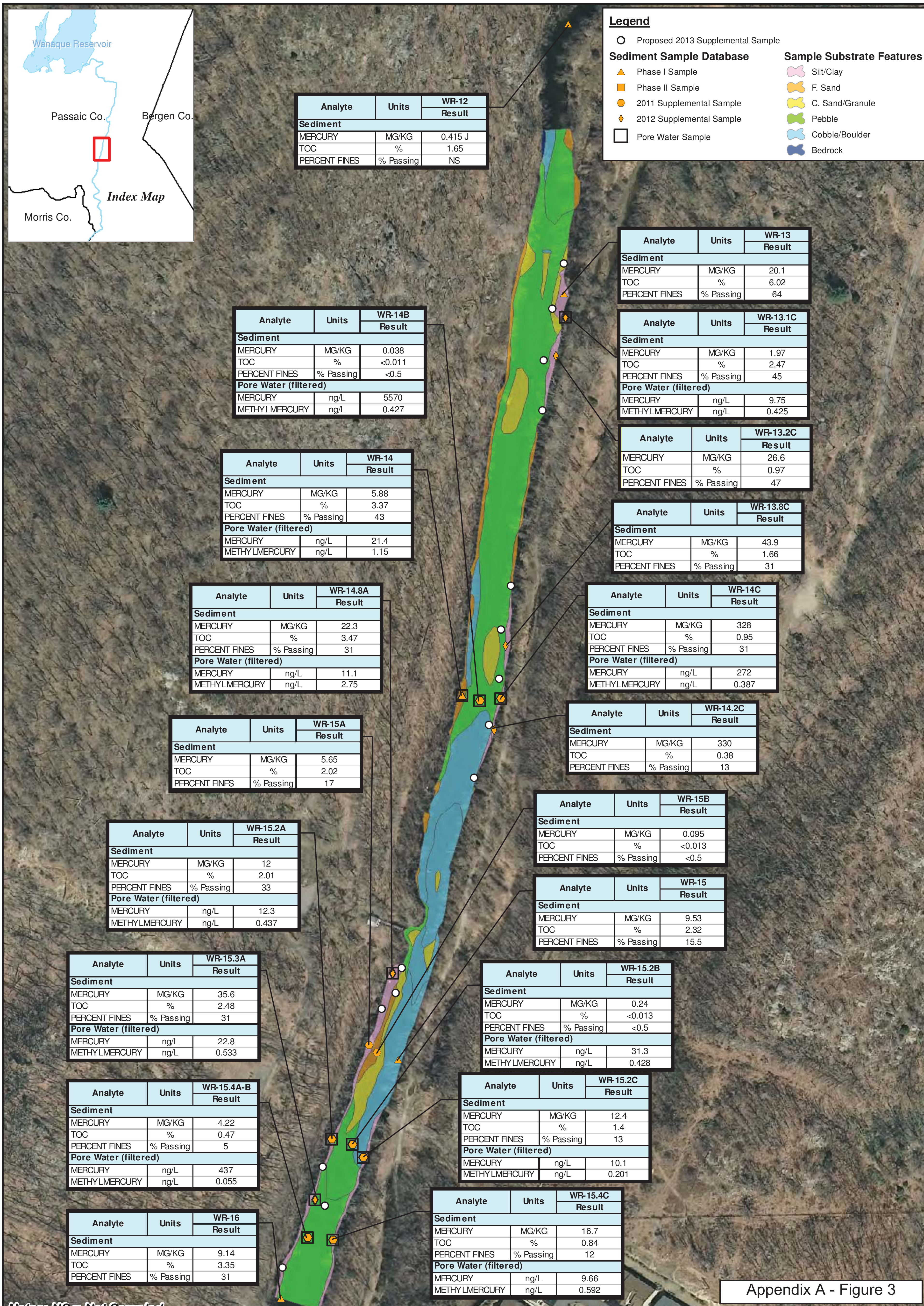
PROJECT NO. 18985452.00004

0 250 500 1,000 Feet

1 in = 500 ft

Note: Inset Maps Not to Scale

Figure 4
Reach 3 - Bank Disturbance and Substrate Mapping
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte	Units	WR-12 Result
Sediment		
MERCURY	MG/KG	0.415 J
TOC	%	1.65
PERCENT FINES	% Passing	NS

Analyte	Units	WR-13 Result
Sediment		
MERCURY	MG/KG	20.1
TOC	%	6.02
PERCENT FINES	% Passing	64

Analyte	Units	WR-14B Result
Sediment		
MERCURY	MG/KG	0.038
TOC	%	<0.011
PERCENT FINES	% Passing	<0.5
Pore Water (filtered)		
MERCURY	ng/L	5570
METHYLMERCURY	ng/L	0.427

Analyte	Units	WR-13.1C Result
Sediment		
MERCURY	MG/KG	1.97
TOC	%	2.47
PERCENT FINES	% Passing	45
Pore Water (filtered)		
MERCURY	ng/L	9.75
METHYLMERCURY	ng/L	0.425

Analyte	Units	WR-13.2C Result
MERCURY	MG/KG	26.6
TOC	%	0.97
PERCENT FINES	% Passing	47

Analyte	Units	WR-14 Result
Sediment		
MERCURY	MG/KG	5.88
TOC	%	3.37
PERCENT FINES	% Passing	43
Pore Water (filtered)		
MERCURY	ng/L	21.4
METHYLMERCURY	ng/L	1.15

Analyte	Units	WR-13.8C Result
Sediment		
MERCURY	MG/KG	43.9
TOC	%	1.66
PERCENT FINES	% Passing	31

Analyte	Units	WR-14.8A Result
Sediment		
MERCURY	MG/KG	22.3
TOC	%	3.47
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	11.1
METHYLMERCURY	ng/L	2.75

Analyte	Units	WR-14C Result
Sediment		
MERCURY	MG/KG	328
TOC	%	0.95
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	272
METHYLMERCURY	ng/L	0.387

Analyte	Units	WR-15A Result
Sediment		
MERCURY	MG/KG	5.65
TOC	%	2.02
PERCENT FINES	% Passing	17

Analyte	Units	WR-14.2C Result
Sediment		
MERCURY	MG/KG	330
TOC	%	0.38
PERCENT FINES	% Passing	13

Analyte	Units	WR-15B Result
Sediment		
MERCURY	MG/KG	0.095
TOC	%	<0.013
PERCENT FINES	% Passing	<0.5

Analyte	Units	WR-15.2A Result
Sediment		
MERCURY	MG/KG	12
TOC	%	2.01
PERCENT FINES	% Passing	33
Pore Water (filtered)		
MERCURY	ng/L	12.3
METHYLMERCURY	ng/L	0.437

Analyte	Units	WR-15 Result
Sediment		
MERCURY	MG/KG	9.53
TOC	%	2.32
PERCENT FINES	% Passing	15.5

Analyte	Units	WR-15.3A Result
Sediment		
MERCURY	MG/KG	35.6
TOC	%	2.48
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	22.8
METHYLMERCURY	ng/L	0.533

Analyte	Units	WR-15.2B Result
Sediment		
MERCURY	MG/KG	0.24
TOC	%	<0.013
PERCENT FINES	% Passing	<0.5
Pore Water (filtered)		
MERCURY	ng/L	31.3
METHYLMERCURY	ng/L	0.428

Analyte	Units	WR-15.4A-B Result
Sediment		
MERCURY	MG/KG	4.22
TOC	%	0.47
PERCENT FINES	% Passing	5
Pore Water (filtered)		
MERCURY	ng/L	437
METHYLMERCURY	ng/L	0.055

Analyte	Units	WR-15.2C Result
Sediment		
MERCURY	MG/KG	12.4
TOC	%	1.4
PERCENT FINES	% Passing	13
Pore Water (filtered)		
MERCURY	ng/L	10.1
METHYLMERCURY	ng/L	0.201

Analyte	Units	WR-16 Result
Sediment		
MERCURY	MG/KG	9.14
TOC	%	3.35
PERCENT FINES	% Passing	31

Analyte	Units	WR-15.4C Result
Sediment		
MERCURY	MG/KG	16.7
TOC	%	0.84
PERCENT FINES	% Passing	12
Pore Water (filtered)		
MERCURY	ng/L	9.66
METHYLMERCURY	ng/L	0.592

Source: Aerial Photography - NJDEP 2007

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Figure 5
Reach 2 Sediment and Pore Water Sampling Stations
Upstream of the Proposed IRM Area to WR-12
Wanaque River Investigation
Interim Remedial Measure Work Plan
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

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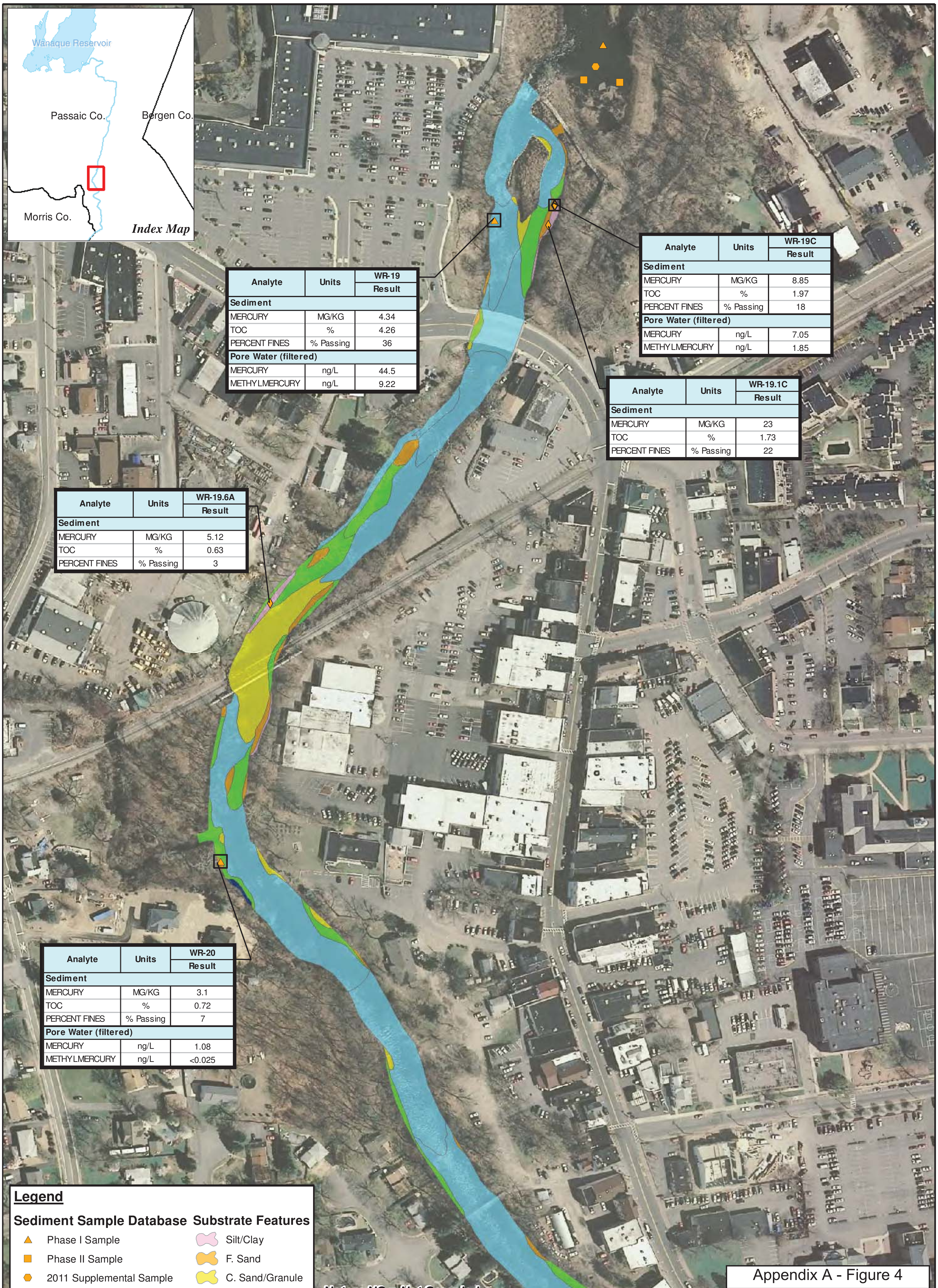

Analyte	Units	WR-19 Result
Sediment		
MERCURY	MG/KG	4.34
TOC	%	4.26
PERCENT FINES	% Passing	36
Pore Water (filtered)		
MERCURY	ng/L	44.5
METHYLMERCURY	ng/L	9.22

Analyte	Units	WR-19C Result
Sediment		
MERCURY	MG/KG	8.85
TOC	%	1.97
PERCENT FINES	% Passing	18
Pore Water (filtered)		
MERCURY	ng/L	7.05
METHYLMERCURY	ng/L	1.85

Analyte	Units	WR-19.1C Result
Sediment		
MERCURY	MG/KG	23
TOC	%	1.73
PERCENT FINES	% Passing	22

Analyte	Units	WR-19.6A Result
Sediment		
MERCURY	MG/KG	5.12
TOC	%	0.63
PERCENT FINES	% Passing	3

Analyte	Units	WR-20 Result
Sediment		
MERCURY	MG/KG	3.1
TOC	%	0.72
PERCENT FINES	% Passing	7
Pore Water (filtered)		
MERCURY	ng/L	1.08
METHYLMERCURY	ng/L	<0.025

Appendix A - Figure 4

Legend

Sediment Sample Database
- Phase I Sample
- Phase II Sample
- 2011 Supplemental Sample
- 2012 Supplemental Sample
- Pore Water Sample

Substrate Features
- Silt/Clay
- F. Sand
- C. Sand/Granule
- Pebble
- Cobble/Boulder
- Bedrock

Source: Aerial Photography - NJDEP 2007

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0 100 200 400
Feet

Figure 6
Reach 3 Sediment and Pore Water Sampling Stations
Downstream of the Proposed IRM Area to WR-20
Wanaque River Investigation
Interim Remedial Measure Work Plan
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

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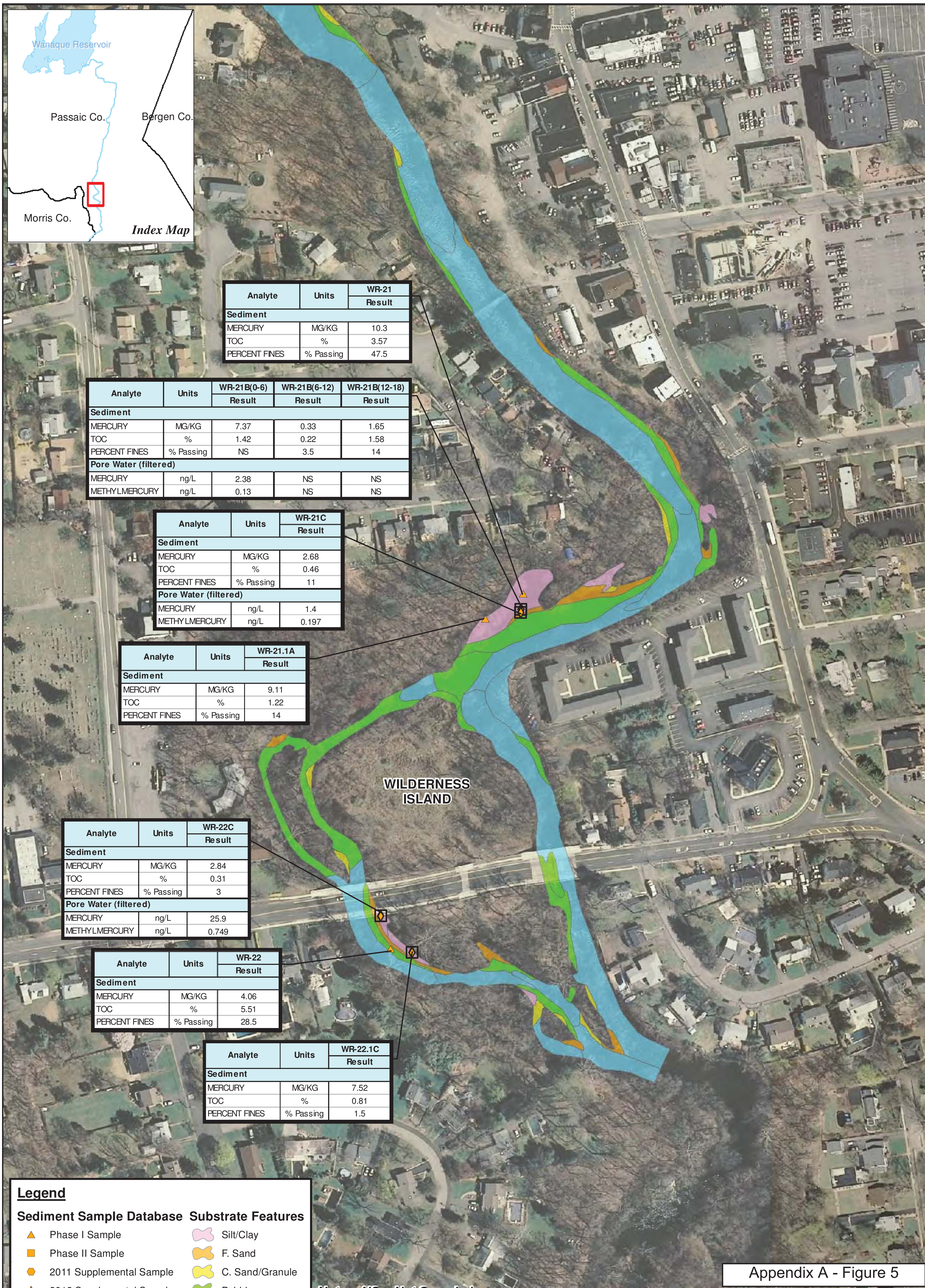

Analyte	Units	WR-21 Result
Sediment		
MERCURY	MG/KG	10.3
TOC	%	3.57
PERCENT FINES	% Passing	47.5

Analyte	Units	WR-21B(0-6) Result	WR-21B(6-12) Result	WR-21B(12-18) Result
Sediment				
MERCURY	MG/KG	7.37	0.33	1.65
TOC	%	1.42	0.22	1.58
PERCENT FINES	% Passing	NS	3.5	14
Pore Water (filtered)				
MERCURY	ng/L	2.38	NS	NS
METHYLMERCURY	ng/L	0.13	NS	NS

Analyte	Units	WR-21C Result
Sediment		
MERCURY	MG/KG	2.68
TOC	%	0.46
PERCENT FINES	% Passing	11
Pore Water (filtered)		
MERCURY	ng/L	1.4
METHYLMERCURY	ng/L	0.197

Analyte	Units	WR-21.1A Result
Sediment		
MERCURY	MG/KG	9.11
TOC	%	1.22
PERCENT FINES	% Passing	14

Analyte	Units	WR-22C Result
Sediment		
MERCURY	MG/KG	2.84
TOC	%	0.31
PERCENT FINES	% Passing	3
Pore Water (filtered)		
MERCURY	ng/L	25.9
METHYLMERCURY	ng/L	0.749

Analyte	Units	WR-22 Result
Sediment		
MERCURY	MG/KG	4.06
TOC	%	5.51
PERCENT FINES	% Passing	28.5

Analyte	Units	WR-22.1C Result
Sediment		
MERCURY	MG/KG	7.52
TOC	%	0.81
PERCENT FINES	% Passing	1.5

Legend

Sediment Sample Database
- ▲ Phase I Sample
- ■ Phase II Sample
- ⬢ 2011 Supplemental Sample
- ◆ 2012 Supplemental Sample

Substrate Features
- Silt/Clay
- F. Sand
- C. Sand/Granule
- Pebble

Source: Aerial Photography - NJDEP 2007

URS

N

0 100 200 400
Feet

Figure 7
Reach 3 Sediment and Pore Water Sampling Stations from WR-20 to WR-22
Wanaque River Investigation
Interim Remedial Measure Work Plan
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

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Analyte	Units	WR-16.2A Result
Sediment		
MERCURY	MG/KG	43.3
TOC	%	3.81
PERCENT FINES	% Passing	54

Analyte	Units	WR-16.2B Result	WR-16.2B * Result
Sediment			
MERCURY	MG/KG	393	416
TOC	%	0.38	NS
PERCENT FINES	% Passing	34	NS

Analyte	Units	WR-16.2C Result
Sediment		
MERCURY	MG/KG	17
TOC	%	0.03
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-16B Result	WR-16B* Result
Sediment			
MERCURY	MG/KG	132	92.9
TOC	%	1.59	NS
PERCENT FINES	% Passing	39	NS

Analyte	Units	WR-16.4C Result
Sediment		
MERCURY	MG/KG	12.4
TOC	%	0.13
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-17 Result
Sediment		
MERCURY	MG/KG	52.6
TOC	%	0.94
PERCENT FINES	% Passing	11

Analyte	Units	WR-16.4B Result
Sediment		
MERCURY	MG/KG	12.4
TOC	%	0.03
PERCENT FINES	% Passing	1

Analyte	Units	WR-17D Result
Sediment		
MERCURY	MG/KG	1.48
TOC	%	0.02
PERCENT FINES	% Passing	1.5

Analyte	Units	WR-16.4A Result
Sediment		
MERCURY	MG/KG	8.99
TOC	%	1.74
PERCENT FINES	% Passing	2

Analyte	Units	WR-17A Result
Sediment		
MERCURY	MG/KG	86.3
TOC	%	1.91
PERCENT FINES	% Passing	16

Analyte	Units	WR-17E Result	WR-17E* Result
Sediment			
MERCURY	MG/KG	1430	10.3
TOC	%	0.09	NS
PERCENT FINES	% Passing	2	NS

Analyte	Units	WR-17B Result
Sediment		
MERCURY	MG/KG	72.1
TOC	%	4.11
PERCENT FINES	% Passing	43

Analyte	Units	WR-17C Result
Sediment		
MERCURY	MG/KG	102
TOC	%	2.67
PERCENT FINES	% Passing	31

Analyte	Units	WR-18C Result
Sediment		
MERCURY	MG/KG	10.7
TOC	%	0.11
PERCENT FINES	% Passing	1

Analyte	Units	WR-18 Result
Sediment		
MERCURY	MG/KG	57.4
TOC	%	4.84
PERCENT FINES	% Passing	41

Analyte	Units	WR-18D(0-6) Result	WR-18D(14-18) Result
Sediment			
MERCURY	MG/KG	9.75	27.5
TOC	%	1.94	NS
PERCENT FINES	% Passing	67	NS

Analyte	Units	WR-18A Result
Sediment		
MERCURY	MG/KG	30.5
TOC	%	1.62
PERCENT FINES	% Passing	73.5

Analyte	Units	WR-18B Result
Sediment		
MERCURY	MG/KG	23.2
TOC	%	3.62
PERCENT FINES	% Passing	68

Source: Aerial Photography - NJDEP 2007

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PROJECT NO. 18985748.00004

0 100 200
Feet

Figure 4
Reach 2 Sediment Sampling Stations within the Proposed IRM Area

Wanaque River Investigation
Technical Status Report
DuPont Pompton Lakes Works

Pompton Lakes, New Jersey

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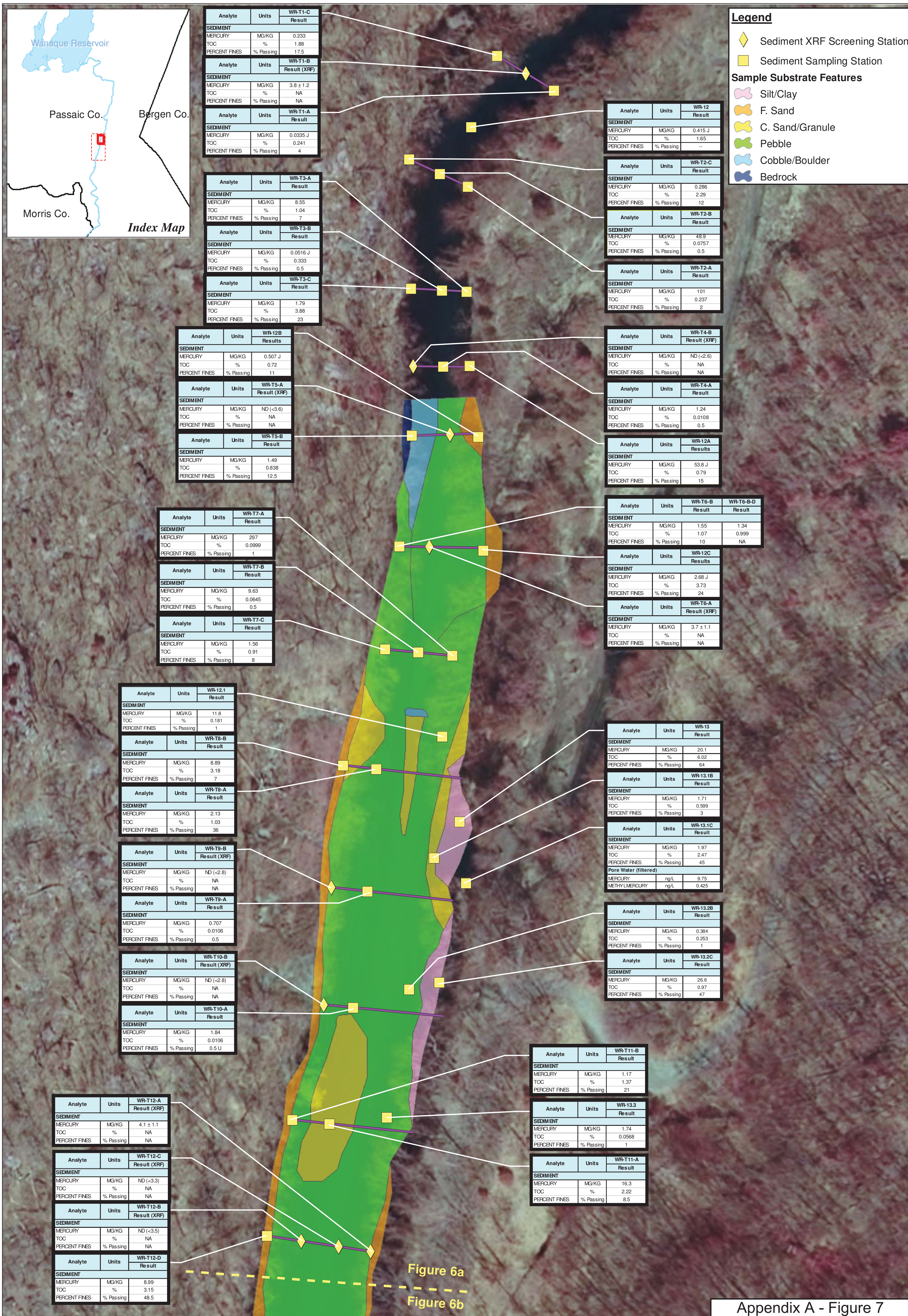


Analyte	Units	WR-T1-C Result
SEDIMENT		
MERCURY	MG/KG	0.233
TOC	%	1.88
PERCENT FINES	% Passing	17.5

Analyte	Units	WR-T1-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	3.8 ± 1.2
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T1-A Result
SEDIMENT		
MERCURY	MG/KG	0.0335 J
TOC	%	0.241
PERCENT FINES	% Passing	4

Analyte	Units	WR-T3-A Result
SEDIMENT		
MERCURY	MG/KG	8.55
TOC	%	1.04
PERCENT FINES	% Passing	7

Analyte	Units	WR-T3-B Result
SEDIMENT		
MERCURY	MG/KG	0.0516 J
TOC	%	0.333
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T3-C Result
SEDIMENT		
MERCURY	MG/KG	1.79
TOC	%	3.88
PERCENT FINES	% Passing	23

Analyte	Units	WR-12B Results
SEDIMENT		
MERCURY	MG/KG	0.507 J
TOC	%	0.72
PERCENT FINES	% Passing	11

Analyte	Units	WR-T5-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<3.6)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T5-B Result
SEDIMENT		
MERCURY	MG/KG	1.49
TOC	%	0.838
PERCENT FINES	% Passing	12.5

Analyte	Units	WR-T7-A Result
SEDIMENT		
MERCURY	MG/KG	297
TOC	%	0.0999
PERCENT FINES	% Passing	1

Analyte	Units	WR-T7-B Result
SEDIMENT		
MERCURY	MG/KG	9.63
TOC	%	0.0645
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T7-C Result
SEDIMENT		
MERCURY	MG/KG	1.56
TOC	%	0.91
PERCENT FINES	% Passing	8

Analyte	Units	WR-12.1 Result
SEDIMENT		
MERCURY	MG/KG	11.8
TOC	%	0.181
PERCENT FINES	% Passing	1

Analyte	Units	WR-T8-B Result
SEDIMENT		
MERCURY	MG/KG	8.89
TOC	%	3.18
PERCENT FINES	% Passing	7

Analyte	Units	WR-T8-A Result
SEDIMENT		
MERCURY	MG/KG	2.13
TOC	%	1.03
PERCENT FINES	% Passing	36

Analyte	Units	WR-T9-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<2.8)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T9-A Result
SEDIMENT		
MERCURY	MG/KG	0.707
TOC	%	0.0106
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T10-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<2.8)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T10-A Result
SEDIMENT		
MERCURY	MG/KG	1.84
TOC	%	0.0106
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T12-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	4.1 ± 1.1
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T12-C Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<3.3)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T12-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<3.5)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T12-D Result
SEDIMENT		
MERCURY	MG/KG	8.99
TOC	%	3.15
PERCENT FINES	% Passing	48.5

Analyte	Units	WR-12 Result
SEDIMENT		
MERCURY	MG/KG	0.415 J
TOC	%	1.65
PERCENT FINES	% Passing	--

Analyte	Units	WR-T2-C Result
SEDIMENT		
MERCURY	MG/KG	0.286
TOC	%	2.29
PERCENT FINES	% Passing	12

Analyte	Units	WR-T2-B Result
SEDIMENT		
MERCURY	MG/KG	48.9
TOC	%	0.0757
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T2-A Result
SEDIMENT		
MERCURY	MG/KG	101
TOC	%	0.237
PERCENT FINES	% Passing	2

Analyte	Units	WR-T4-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<2.6)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T4-A Result
SEDIMENT		
MERCURY	MG/KG	1.24
TOC	%	0.0108
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-12A Results
SEDIMENT		
MERCURY	MG/KG	53.8 J
TOC	%	0.79
PERCENT FINES	% Passing	15

Analyte	Units	WR-T6-B Result	WR-T6-B-D Result
SEDIMENT			
MERCURY	MG/KG	1.55	1.34
TOC	%	1.07	0.999
PERCENT FINES	% Passing	10	NA

Analyte	Units	WR-12C Results
SEDIMENT		
MERCURY	MG/KG	2.68 J
TOC	%	3.73
PERCENT FINES	% Passing	24

Analyte	Units	WR-T6-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	3.7 ± 1.1
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-13 Result
SEDIMENT		
MERCURY	MG/KG	20.1
TOC	%	6.02
PERCENT FINES	% Passing	64

Analyte	Units	WR-13.1B Result
SEDIMENT		
MERCURY	MG/KG	1.71
TOC	%	0.599
PERCENT FINES	% Passing	3

Analyte	Units	WR-13.1C Result
SEDIMENT		
MERCURY	MG/KG	1.97
TOC	%	2.47
PERCENT FINES	% Passing	45
Pore Water (filtered)		
MERCURY	ng/L	9.75
METHYLMERCURY	ng/L	0.425

Analyte	Units	WR-13.2B Result
SEDIMENT		
MERCURY	MG/KG	0.384
TOC	%	0.253
PERCENT FINES	% Passing	1

Analyte	Units	WR-13.2C Result
SEDIMENT		
MERCURY	MG/KG	26.6
TOC	%	0.97
PERCENT FINES	% Passing	47

Analyte	Units	WR-T11-B Result
SEDIMENT		
MERCURY	MG/KG	1.17
TOC	%	1.37
PERCENT FINES	% Passing	21

Analyte	Units	WR-13.3 Result
SEDIMENT		
MERCURY	MG/KG	1.74
TOC	%	0.0568
PERCENT FINES	% Passing	1

Analyte	Units	WR-T11-A Result
SEDIMENT		
MERCURY	MG/KG	16.3
TOC	%	2.22
PERCENT FINES	% Passing	8.5

Appendix A - Figure 7

Notes:
1. J - Analyte present. Reported value may not be accurate or precise
2. ND - Analyte not detected, result value is XRF reporting limit.
3. U - Analyte not detected, result value is laboratory reporting limit.
4. THg: Total Mercury; Ft: Feet; TOC: Total Organic Carbon; MG/KG: Milligrams per Kilogram; ng/L: Nanograms per Liter; NA: Not Analyzed

URS Corporation November, 2014

N

0 30 60 120
Feet

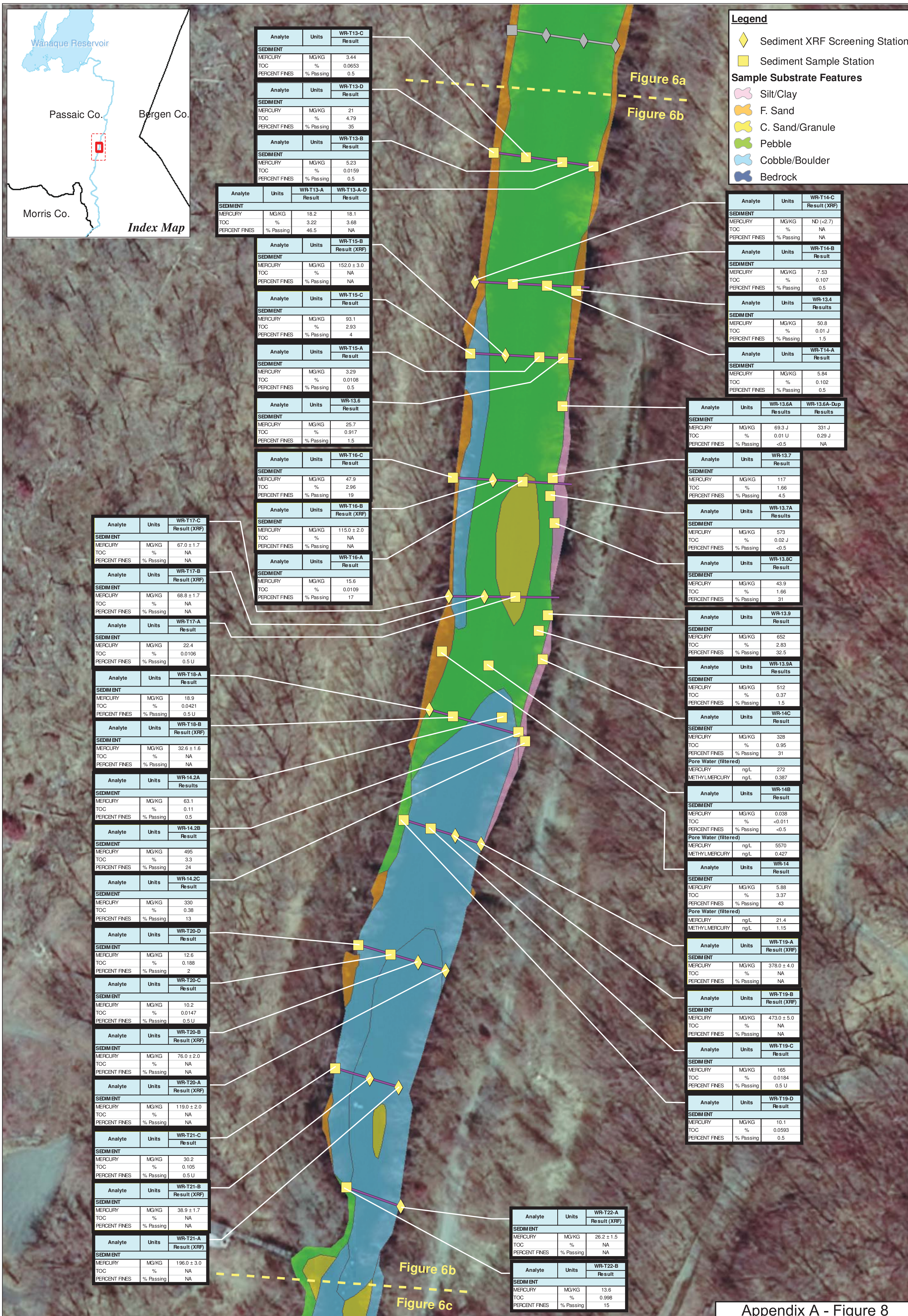
NAD 1983 State Plane New Jersey
Projection: Transverse Mercator
Units: Feet

Reference:
URS Custom Data
URS Field Reconnaisance Data (January 2014)
NJDEP Imagery (2007)

Figure 6a
Summary of Reach 2 Sediment and Pore Water Sampling Results
Wanaque River Interim Remedial Measure
Data Collection Activities Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

URS

Path: S:\Projects\IMS\DUPONT\PMPTNLKS\Projects\Bank Evaluation\Data Collection Report 2014\11212014\Figure 6a Sediment Sampling Stations Proposed Samples.mxd



Analyte	Units	WR-T13-C Result
SEDIMENT		
MERCURY	MG/KG	3.44
TOC	%	0.0653
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T13-D Result
SEDIMENT		
MERCURY	MG/KG	21
TOC	%	4.79
PERCENT FINES	% Passing	35

Analyte	Units	WR-T13-B Result
SEDIMENT		
MERCURY	MG/KG	5.23
TOC	%	0.0159
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T13-A Result	WR-T13-A-D Result
SEDIMENT			
MERCURY	MG/KG	18.2	18.1
TOC	%	3.22	3.68
PERCENT FINES	% Passing	46.5	NA

Analyte	Units	WR-T15-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	152.0 ± 3.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T15-C Result
SEDIMENT		
MERCURY	MG/KG	93.1
TOC	%	2.93
PERCENT FINES	% Passing	4

Analyte	Units	WR-T15-A Result
SEDIMENT		
MERCURY	MG/KG	3.29
TOC	%	0.0108
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-13.6 Result
SEDIMENT		
MERCURY	MG/KG	25.7
TOC	%	0.917
PERCENT FINES	% Passing	1.5

Analyte	Units	WR-T16-C Result
SEDIMENT		
MERCURY	MG/KG	47.9
TOC	%	2.96
PERCENT FINES	% Passing	19

Analyte	Units	WR-T16-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	115.0 ± 2.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T16-A Result
SEDIMENT		
MERCURY	MG/KG	15.6
TOC	%	0.0109
PERCENT FINES	% Passing	17

Analyte	Units	WR-T17-C Result (XRF)
SEDIMENT		
MERCURY	MG/KG	67.0 ± 1.7
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T17-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	68.8 ± 1.7
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T17-A Result
SEDIMENT		
MERCURY	MG/KG	22.4
TOC	%	0.0106
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T18-A Result
SEDIMENT		
MERCURY	MG/KG	18.9
TOC	%	0.0421
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T18-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	32.6 ± 1.6
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-14.2A Results
SEDIMENT		
MERCURY	MG/KG	63.1
TOC	%	0.11
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-14.2B Result
SEDIMENT		
MERCURY	MG/KG	495
TOC	%	3.3
PERCENT FINES	% Passing	24

Analyte	Units	WR-14.2C Result
SEDIMENT		
MERCURY	MG/KG	330
TOC	%	0.38
PERCENT FINES	% Passing	13

Analyte	Units	WR-T20-D Result
SEDIMENT		
MERCURY	MG/KG	12.6
TOC	%	0.188
PERCENT FINES	% Passing	2

Analyte	Units	WR-T20-C Result
SEDIMENT		
MERCURY	MG/KG	10.2
TOC	%	0.0147
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T20-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	76.0 ± 2.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T20-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	119.0 ± 2.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T21-C Result
SEDIMENT		
MERCURY	MG/KG	30.2
TOC	%	0.105
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T21-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	38.9 ± 1.7
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T21-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	196.0 ± 3.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T14-C Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<2.7)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T14-B Result
SEDIMENT		
MERCURY	MG/KG	7.53
TOC	%	0.107
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-13.4 Results
SEDIMENT		
MERCURY	MG/KG	50.8
TOC	%	0.01 J
PERCENT FINES	% Passing	1.5

Analyte	Units	WR-T14-A Result
SEDIMENT		
MERCURY	MG/KG	5.84
TOC	%	0.102
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-13.6A Results	WR-13.6A-Dup Results
SEDIMENT			
MERCURY	MG/KG	69.3 J	331 J
TOC	%	0.01 U	0.29 J
PERCENT FINES	% Passing	<0.5	NA

Analyte	Units	WR-13.7 Result
SEDIMENT		
MERCURY	MG/KG	117
TOC	%	1.66
PERCENT FINES	% Passing	4.5

Analyte	Units	WR-13.7A Results
SEDIMENT		
MERCURY	MG/KG	573
TOC	%	0.02 J
PERCENT FINES	% Passing	<0.5

Analyte	Units	WR-13.8C Result
SEDIMENT		
MERCURY	MG/KG	43.9
TOC	%	1.66
PERCENT FINES	% Passing	31

Analyte	Units	WR-13.9 Result
SEDIMENT		
MERCURY	MG/KG	652
TOC	%	2.83
PERCENT FINES	% Passing	32.5

Analyte	Units	WR-13.9A Results
SEDIMENT		
MERCURY	MG/KG	512
TOC	%	0.37
PERCENT FINES	% Passing	1.5

Analyte	Units	WR-14C Result
SEDIMENT		
MERCURY	MG/KG	328
TOC	%	0.95
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	272
METHYLMERCURY	ng/L	0.387

Analyte	Units	WR-14B Result
SEDIMENT		
MERCURY	MG/KG	0.038
TOC	%	<0.011
PERCENT FINES	% Passing	<0.5
Pore Water (filtered)		
MERCURY	ng/L	5570
METHYLMERCURY	ng/L	0.427

Analyte	Units	WR-14 Result
SEDIMENT		
MERCURY	MG/KG	5.88
TOC	%	3.37
PERCENT FINES	% Passing	43
Pore Water (filtered)		
MERCURY	ng/L	21.4
METHYLMERCURY	ng/L	1.15

Analyte	Units	WR-T19-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	378.0 ± 4.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T19-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	473.0 ± 5.0
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T19-C Result
SEDIMENT		
MERCURY	MG/KG	165
TOC	%	0.0184
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-T19-D Result
SEDIMENT		
MERCURY	MG/KG	10.1
TOC	%	0.0593
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T22-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	26.2 ± 1.5
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T22-B Result
SEDIMENT		
MERCURY	MG/KG	13.6
TOC	%	0.998
PERCENT FINES	% Passing	15

Notes:

1. J - Analyte present. Reported value may not be accurate or precise
2. ND - Analyte not detected, result value is XRF reporting limit.
3. U - Analyte not detected, result value is laboratory reporting limit.
4. THg: Total Mercury; Ft: Feet; TOC: Total Organic Carbon; MG/KG: Milligrams per Kilogram; ng/L: Nanograms per Liter; NA: Not Analyzed

URS Corporation November, 2014

N

0 30 60 120

Feet

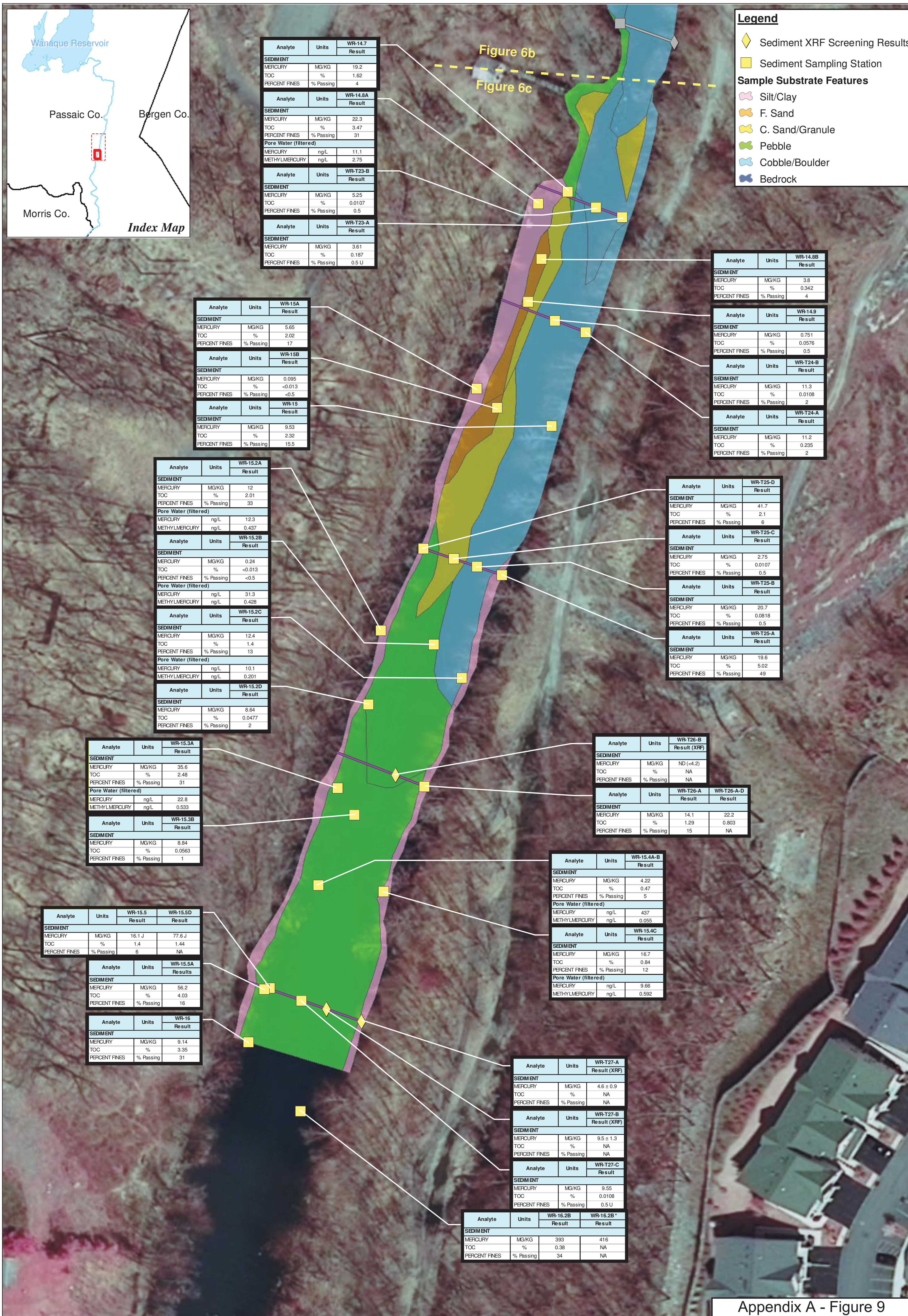
NAD 1983 State Plane New Jersey
Projection: Transverse Mercator
Units: Feet

Reference:
URS Custom Data
URS Field Reconnaissance Data (January 2014)
NJDEP Imagery (2007)

Figure 6b
Summary of Reach 2 Sediment and Pore Water Sampling Results
Wanaque River Interim Remedial Measure
Data Collection Activities Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

URS

Path: S:\Projects\IMS\DUPONT\PMPTNLKS\Projects\Bank Evaluation\Data Collection Report 2014\11212014\Figure 6b Sediment Sampling Stations Proposed Samples.mxd



Analyte	Units	WR-14.7 Result
SEDIMENT		
MERCURY	MG/KG	19.2
TOC	%	1.62
PERCENT FINES	% Passing	4

Analyte	Units	WR-14.8A Result
SEDIMENT		
MERCURY	MG/KG	22.3
TOC	%	3.47
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	11.1
METHYLMERCURY	ng/L	2.75

Analyte	Units	WR-T23-B Result
SEDIMENT		
MERCURY	MG/KG	5.25
TOC	%	0.0107
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T23-A Result
SEDIMENT		
MERCURY	MG/KG	3.61
TOC	%	0.187
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-14.8B Result
SEDIMENT		
MERCURY	MG/KG	3.8
TOC	%	0.342
PERCENT FINES	% Passing	4

Analyte	Units	WR-14.9 Result
SEDIMENT		
MERCURY	MG/KG	0.751
TOC	%	0.0576
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T24-B Result
SEDIMENT		
MERCURY	MG/KG	11.3
TOC	%	0.0108
PERCENT FINES	% Passing	2

Analyte	Units	WR-T24-A Result
SEDIMENT		
MERCURY	MG/KG	11.2
TOC	%	0.235
PERCENT FINES	% Passing	2

Analyte	Units	WR-15A Result
SEDIMENT		
MERCURY	MG/KG	5.65
TOC	%	2.02
PERCENT FINES	% Passing	17

Analyte	Units	WR-15B Result
SEDIMENT		
MERCURY	MG/KG	0.095
TOC	%	<0.013
PERCENT FINES	% Passing	<0.5

Analyte	Units	WR-15 Result
SEDIMENT		
MERCURY	MG/KG	9.53
TOC	%	2.32
PERCENT FINES	% Passing	15.5

Analyte	Units	WR-15.2A Result
SEDIMENT		
MERCURY	MG/KG	12
TOC	%	2.01
PERCENT FINES	% Passing	33
Pore Water (filtered)		
MERCURY	ng/L	12.3
METHYLMERCURY	ng/L	0.437

Analyte	Units	WR-15.2B Result
SEDIMENT		
MERCURY	MG/KG	0.24
TOC	%	<0.013
PERCENT FINES	% Passing	<0.5
Pore Water (filtered)		
MERCURY	ng/L	31.3
METHYLMERCURY	ng/L	0.428

Analyte	Units	WR-15.2C Result
SEDIMENT		
MERCURY	MG/KG	12.4
TOC	%	1.4
PERCENT FINES	% Passing	13
Pore Water (filtered)		
MERCURY	ng/L	10.1
METHYLMERCURY	ng/L	0.201

Analyte	Units	WR-15.2D Result
SEDIMENT		
MERCURY	MG/KG	8.64
TOC	%	0.0477
PERCENT FINES	% Passing	2

Analyte	Units	WR-T25-D Result
SEDIMENT		
MERCURY	MG/KG	41.7
TOC	%	2.1
PERCENT FINES	% Passing	6

Analyte	Units	WR-T25-C Result
SEDIMENT		
MERCURY	MG/KG	2.75
TOC	%	0.0107
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T25-B Result
SEDIMENT		
MERCURY	MG/KG	20.7
TOC	%	0.0818
PERCENT FINES	% Passing	0.5

Analyte	Units	WR-T25-A Result
SEDIMENT		
MERCURY	MG/KG	19.6
TOC	%	5.02
PERCENT FINES	% Passing	49

Analyte	Units	WR-T26-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	ND (<4.2)
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T26-A Result	WR-T26-A-D Result
SEDIMENT			
MERCURY	MG/KG	14.1	22.2
TOC	%	1.29	0.803
PERCENT FINES	% Passing	15	NA

Analyte	Units	WR-15.3A Result
SEDIMENT		
MERCURY	MG/KG	35.6
TOC	%	2.48
PERCENT FINES	% Passing	31
Pore Water (filtered)		
MERCURY	ng/L	22.8
METHYLMERCURY	ng/L	0.533

Analyte	Units	WR-15.3B Result
SEDIMENT		
MERCURY	MG/KG	8.84
TOC	%	0.0563
PERCENT FINES	% Passing	1

Analyte	Units	WR-15.4A-B Result
SEDIMENT		
MERCURY	MG/KG	4.22
TOC	%	0.47
PERCENT FINES	% Passing	5
Pore Water (filtered)		
MERCURY	ng/L	437
METHYLMERCURY	ng/L	0.055

Analyte	Units	WR-15.4C Result
SEDIMENT		
MERCURY	MG/KG	16.7
TOC	%	0.84
PERCENT FINES	% Passing	12
Pore Water (filtered)		
MERCURY	ng/L	9.66
METHYLMERCURY	ng/L	0.592

Analyte	Units	WR-15.5 Result	WR-15.5D Result
SEDIMENT			
MERCURY	MG/KG	16.1 J	77.6 J
TOC	%	1.4	1.44
PERCENT FINES	% Passing	6	NA

Analyte	Units	WR-15.5A Results
SEDIMENT		
MERCURY	MG/KG	56.2
TOC	%	4.03
PERCENT FINES	% Passing	16

Analyte	Units	WR-16 Result
SEDIMENT		
MERCURY	MG/KG	9.14
TOC	%	3.35
PERCENT FINES	% Passing	31

Analyte	Units	WR-T27-A Result (XRF)
SEDIMENT		
MERCURY	MG/KG	4.6 ± 0.9
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T27-B Result (XRF)
SEDIMENT		
MERCURY	MG/KG	9.5 ± 1.3
TOC	%	NA
PERCENT FINES	% Passing	NA

Analyte	Units	WR-T27-C Result
SEDIMENT		
MERCURY	MG/KG	9.55
TOC	%	0.0108
PERCENT FINES	% Passing	0.5 U

Analyte	Units	WR-16.2B Result	WR-16.2B * Result
SEDIMENT			
MERCURY	MG/KG	393	416
TOC	%	0.38	NA
PERCENT FINES	% Passing	34	NA

Notes:

1. J - Analyte present. Reported value may not be accurate or precise
2. ND - Analyte not detected, result value is XRF reporting limit.
3. U - Analyte not detected, result value is laboratory reporting limit.
4. * - Sample Reanalysis
5. THg: Total Mercury; Ft: Feet; TOC: Total Organic Carbon; MG/KG: Milligrams per Kilogram; ng/L: Nanograms per Liter; NA: Not Analyzed

URS Corporation November, 2014

N

0 30 60 120

Feet

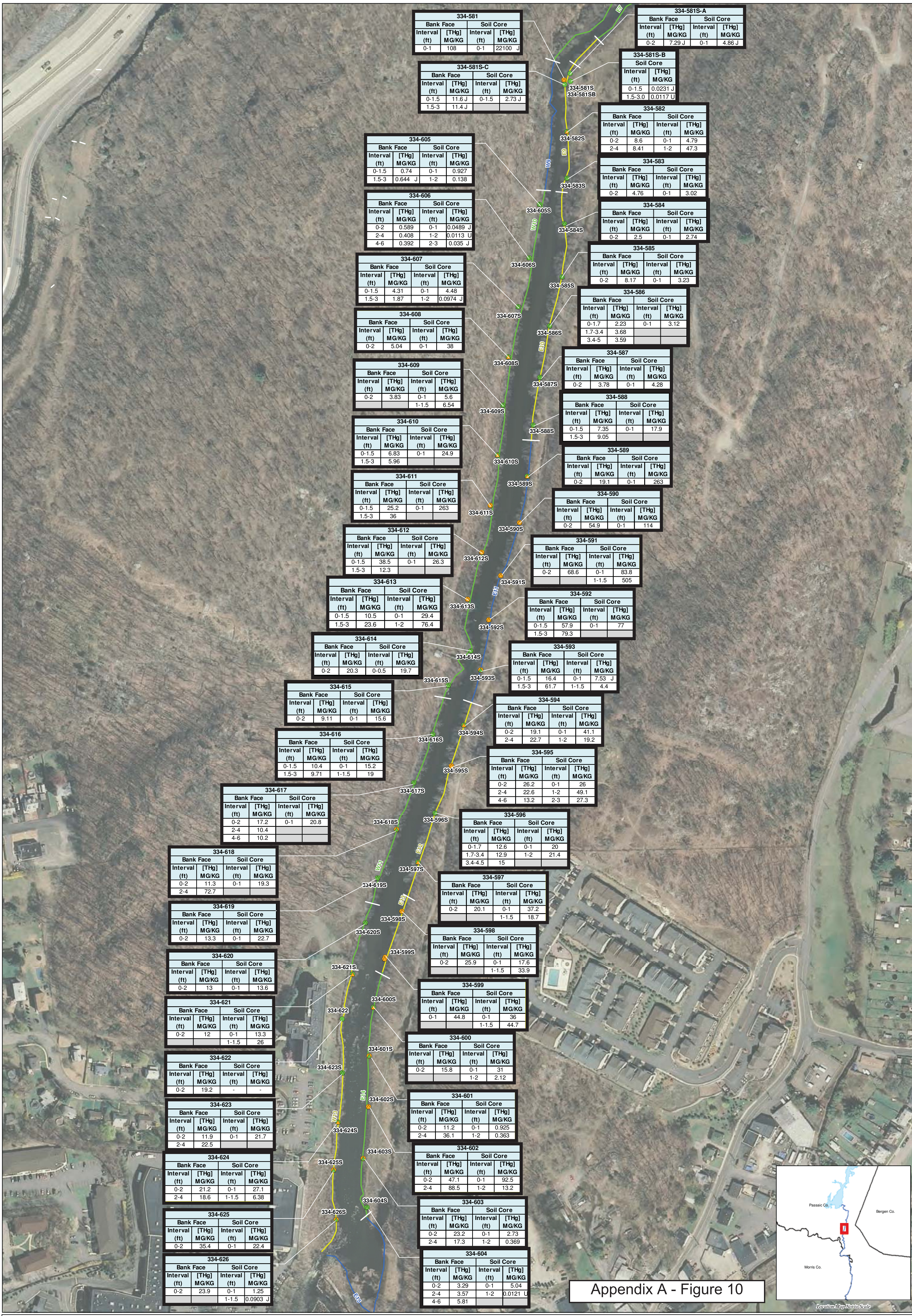
NAD 1983 State Plane New Jersey
Projection: Transverse Mercator
Units: Feet

Reference:
URS Custom Data
URS Field Reconnaissance Data (January 2014)
NJDEP Imagery (2007)

Figure 6c
Summary of Reach 2 Sediment and Pore Water Sampling Results
Wanaque River Interim Remedial Measure
Data Collection Activities Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

URS

Path: S:\Projects\IMS\DUPONT\PMPTNLKS\Projects\Bank Evaluation\Data Collection Report 2014\11212014\Figure 6c Sediment Sampling Stations Proposed Samples.mxd



Appendix A - Figure 10

334-581

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1	108	0-1	22100 J

334-581S-A

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	7.29 J	0-1	4.86 J

334-581S-B

Soil Core	
Interval (ft)	[THg] MG/KG
0-1.5	0.0231 J
1.5-3.0	0.0117 U

334-581S-C

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	11.6 J	0-1.5	2.73 J
1.5-3	11.4 J		

334-582

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	8.6	0-1	4.79
2-4	8.41	1-2	47.3

334-605

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	0.74	0-1	0.927
1.5-3	0.644 J	1-2	0.138

334-583

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	4.76	0-1	3.02

334-606

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	0.589	0-1	0.0489 J
2-4	0.408	1-2	0.0113 U
4-6	0.392	2-3	0.035 J

334-584

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	2.5	0-1	2.74

334-585

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	8.17	0-1	3.23

334-607

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	4.31	0-1	4.48
1.5-3	1.87	1-2	0.0974 J

334-586

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.7	2.23	0-1	3.12
1.7-3.4	3.68		
3.4-5	3.59		

334-608

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	5.04	0-1	38

334-587

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	3.78	0-1	4.28

334-609

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	3.83	0-1	5.6
		1-1.5	6.54

334-588

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	7.35	0-1	17.9
1.5-3	9.05		

334-610

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	6.83	0-1	24.9
1.5-3	5.96		

334-589

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	19.1	0-1	263

334-611

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	25.2	0-1	263
1.5-3	36		

334-590

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	54.9	0-1	114

334-612

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	38.5	0-1	26.3
1.5-3	12.3		

334-591

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	68.6	0-1	83.8
		1-1.5	505

334-613

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	10.5	0-1	29.4
1.5-3	23.6	1-2	76.4

334-592

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	57.9	0-1	77
1.5-3	79.3		

334-614

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	20.3	0-0.5	19.7

334-593

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	16.4	0-1	7.53 J
1.5-3	61.7	1-1.5	4.4

334-615

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	9.11	0-1	15.6

334-594

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	19.1	0-1	41.1
2-4	22.7	1-2	19.2

334-616

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.5	10.4	0-1	15.2
1.5-3	9.71	1-1.5	19

334-595

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	26.2	0-1	26
2-4	22.6	1-2	49.1
4-6	13.2	2-3	27.3

334-617

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	17.2	0-1	20.8
2-4	10.4		
4-6	10.2		

334-596

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1.7	12.6	0-1	20
1.7-3.4	12.9	1-2	21.4
3.4-4.5	15		

334-618

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	11.3	0-1	19.3
2-4	72.7		

334-597

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	20.1	0-1	37.2
		1-1.5	18.7

334-619

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	13.3	0-1	22.7

334-598

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	25.9	0-1	17.6
		1-1.5	33.9

334-620

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	13	0-1	13.6

334-599

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-1	44.8	0-1	36
		1-1.5	44.7

334-621

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	12	0-1	13.3
		1-1.5	26

334-600

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	15.8	0-1	31
		1-2	2.12

334-622

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	19.2	-	-

334-601

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	11.2	0-1	0.925
2-4	36.1	1-2	0.363

334-623

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	11.9	0-1	21.7
2-4	22.5		

334-602

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	47.1	0-1	92.5
2-4	88.5	1-2	13.2

334-624

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	21.2	0-1	27.1
2-4	18.6	1-1.5	6.38

334-603

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	23.2	0-1	2.73
2-4	17.3	1-2	0.369

334-625

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	35.4	0-1	22.4

334-626

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	23.9	0-1	1.25
		1-1.5	0.0903 J

334-604

Bank Face		Soil Core	
Interval (ft)	[THg] MG/KG	Interval (ft)	[THg] MG/KG
0-2	3.29	0-1	5.04
2-4	3.57	1-2	0.0121 U
4-6	5.81		

Legend

Soil Core Sample
Bankface Soil Sample

URS Corporation December, 2014

Bank Erosion Hazard Index (BEHI) Rating

- Extreme
- High
- Moderate
- Low
- Very Low

N

100 50 0 100 Feet

Created in ArcGIS 10.1 using ArcMap
NAD 1983 State Plane New Jersey
Projection: Transverse Mercator
Units: Feet

Reference:
URS Custom Data
URS Field Reconnaisance Data

Notes:

1. J - Analyte present. Reported value may not be accurate or precise
2. U - Analyte not detected, result value is laboratory reporting limit.
3. Gray Boxes - No proposed sample/collected
4. Dash - Sample not collected
5. THg: Total Mercury; Ft: Feet; MG/KG: Milligrams per Kilogram

Figure 8
Reach 2 Bank Soil Sampling Locations
Wanaque River Interim Remedial Measure
Data Collection Activities Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey

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Analyte	Units	WR-07 Result
Sediment		
MERCURY	MG/KG	0.084
Pore Water (filtered)		
MERCURY	ng/L	0.96
METHYLMERCURY	ng/L	<0.023

Analyte	Units	WR-07.1B Result
Pore Water (filtered)		
MERCURY	ng/L	1.29
METHYLMERCURY	ng/L	<0.024

Analyte	Units	WR-08.1B Result
Pore Water (filtered)		
MERCURY	ng/L	2.64
METHYLMERCURY	ng/L	0.038

Analyte	Units	WR-08 Result
Sediment		
MERCURY	MG/KG	0.33
Pore Water (filtered)		
MERCURY	ng/L	1.49
METHYLMERCURY	ng/L	0.048

Source: Aerial Photography - NJDEP 2007

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PROJECT NO. 18985748.00004

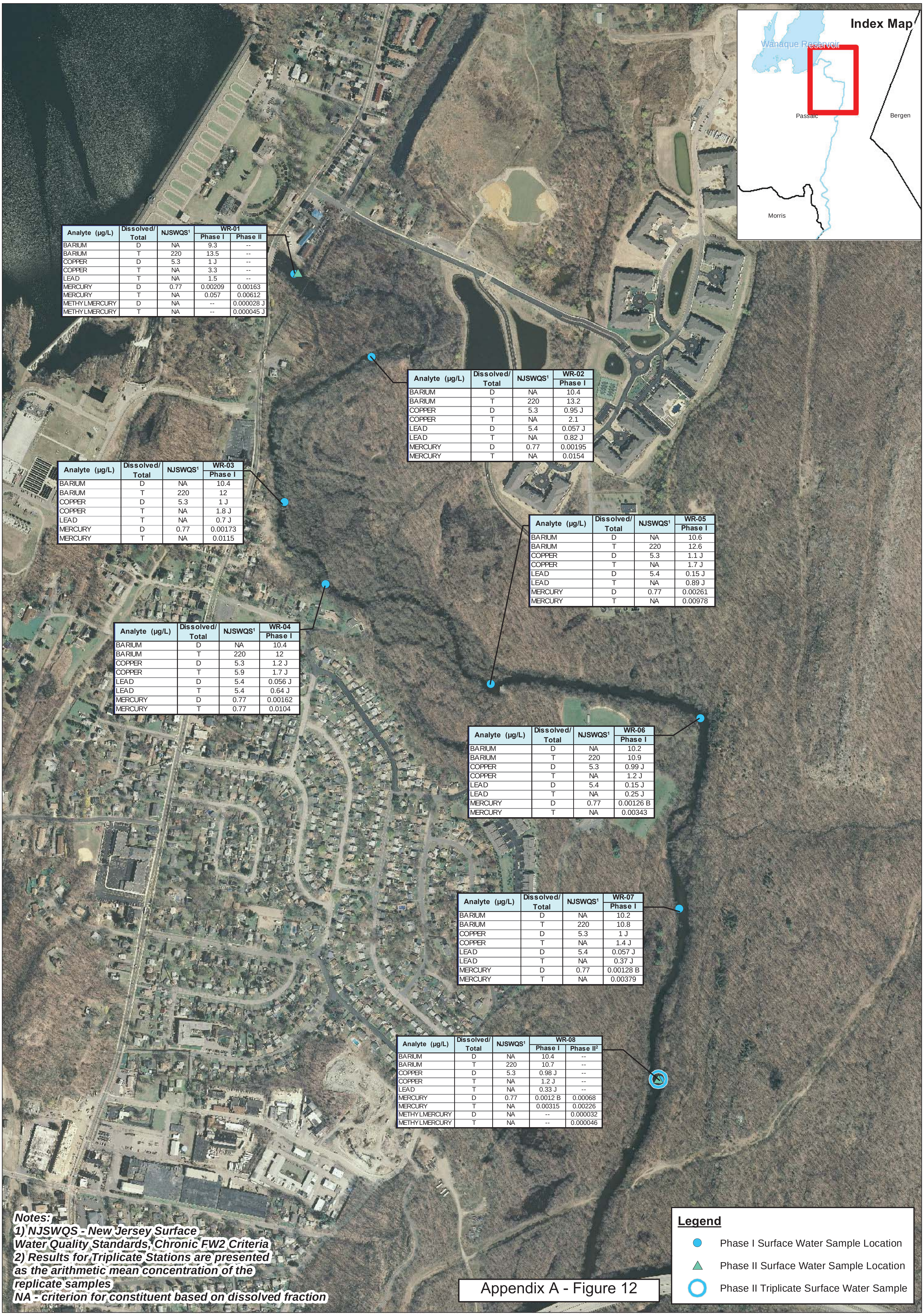
0 220 440
Feet

Figure 8
Reach 1 Sediment and Pore Water Sampling Stations

Wanaque River Investigation
Technical Status Report
DuPont Pompton Lakes Works

Pompton Lakes, New Jersey

Path: S:\Projects\IMS\DUPONT\PMPTNLKS\Projects\WanaqueRiverRIR\2012\10102012\Fig 8 DuPont Wanaque River Reach 1 Sampling.mxd



Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-01 Phase I	WR-01 Phase II
BARIUM	D	NA	9.3	--
BARIUM	T	220	13.5	--
COPPER	D	5.3	1 J	--
COPPER	T	NA	3.3	--
LEAD	T	NA	1.5	--
MERCURY	D	0.77	0.00209	0.00163
MERCURY	T	NA	0.057	0.00612
METHYLMERCURY	D	NA	--	0.000028 J
METHYLMERCURY	T	NA	--	0.000045 J

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-02 Phase I
BARIUM	D	NA	10.4
BARIUM	T	220	13.2
COPPER	D	5.3	0.95 J
COPPER	T	NA	2.1
LEAD	D	5.4	0.057 J
LEAD	T	NA	0.82 J
MERCURY	D	0.77	0.00195
MERCURY	T	NA	0.0154

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-03 Phase I
BARIUM	D	NA	10.4
BARIUM	T	220	12
COPPER	D	5.3	1 J
COPPER	T	NA	1.8 J
LEAD	T	NA	0.7 J
MERCURY	D	0.77	0.00173
MERCURY	T	NA	0.0115

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-05 Phase I
BARIUM	D	NA	10.6
BARIUM	T	220	12.6
COPPER	D	5.3	1.1 J
COPPER	T	NA	1.7 J
LEAD	D	5.4	0.15 J
LEAD	T	NA	0.89 J
MERCURY	D	0.77	0.00261
MERCURY	T	NA	0.00978

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-04 Phase I
BARIUM	D	NA	10.4
BARIUM	T	220	12
COPPER	D	5.3	1.2 J
COPPER	T	5.9	1.7 J
LEAD	D	5.4	0.056 J
LEAD	T	5.4	0.64 J
MERCURY	D	0.77	0.00162
MERCURY	T	0.77	0.0104

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-06 Phase I
BARIUM	D	NA	10.2
BARIUM	T	220	10.9
COPPER	D	5.3	0.99 J
COPPER	T	NA	1.2 J
LEAD	D	5.4	0.15 J
LEAD	T	NA	0.25 J
MERCURY	D	0.77	0.00126 B
MERCURY	T	NA	0.00343

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-07 Phase I
BARIUM	D	NA	10.2
BARIUM	T	220	10.8
COPPER	D	5.3	1 J
COPPER	T	NA	1.4 J
LEAD	D	5.4	0.057 J
LEAD	T	NA	0.37 J
MERCURY	D	0.77	0.00128 B
MERCURY	T	NA	0.00379

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-08 Phase I	WR-08 Phase II[2]
BARIUM	D	NA	10.4	--
BARIUM	T	220	10.7	--
COPPER	D	5.3	0.98 J	--
COPPER	T	NA	1.2 J	--
LEAD	T	NA	0.33 J	--
MERCURY	D	0.77	0.0012 B	0.00068
MERCURY	T	NA	0.00315	0.00226
METHYLMERCURY	D	NA	--	0.000032
METHYLMERCURY	T	NA	--	0.000046

Notes:
1) NJSWQS - New Jersey Surface Water Quality Standards, Chronic FW2 Criteria
2) Results for Triplicate Stations are presented as the arithmetic mean concentration of the replicate samples
NA - criterion for constituent based on dissolved fraction

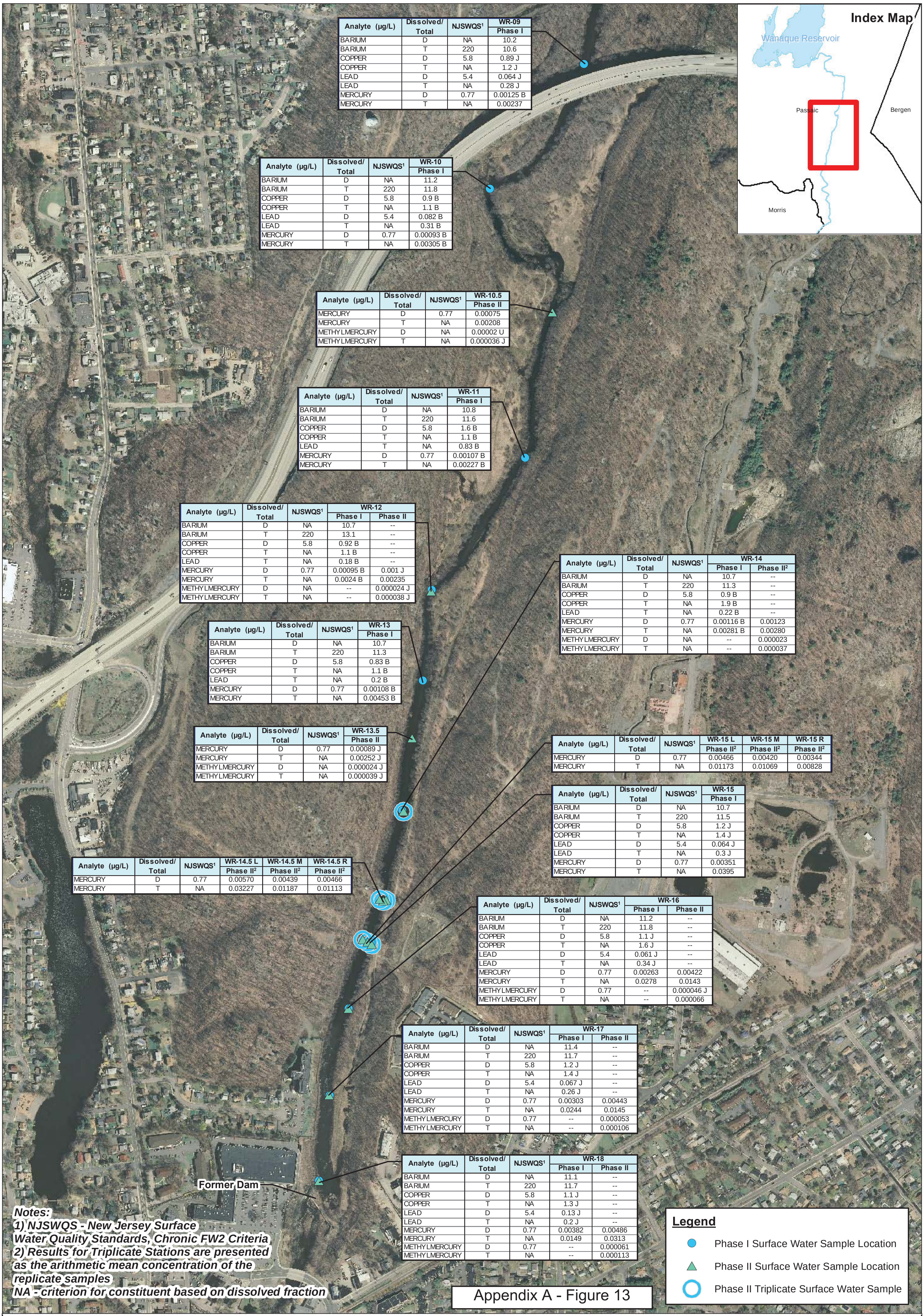
Source: Aerial Photography - NJDEP 2007

PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 8
Detected Constituents in Surface Water- Reach 1
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-09 Phase I
BARIUM	D	NA	10.2
BARIUM	T	220	10.6
COPPER	D	5.8	0.89 J
COPPER	T	NA	1.2 J
LEAD	D	5.4	0.064 J
LEAD	T	NA	0.28 J
MERCURY	D	0.77	0.00125 B
MERCURY	T	NA	0.00237

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-10 Phase I
BARIUM	D	NA	11.2
BARIUM	T	220	11.8
COPPER	D	5.8	0.9 B
COPPER	T	NA	1.1 B
LEAD	D	5.4	0.082 B
LEAD	T	NA	0.31 B
MERCURY	D	0.77	0.00093 B
MERCURY	T	NA	0.00305 B

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-10.5 Phase II
MERCURY	D	0.77	0.00075
MERCURY	T	NA	0.00208
METHYLMERCURY	D	NA	0.00002 U
METHYLMERCURY	T	NA	0.000036 J

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-11 Phase I
BARIUM	D	NA	10.8
BARIUM	T	220	11.6
COPPER	D	5.8	1.6 B
COPPER	T	NA	1.1 B
LEAD	T	NA	0.83 B
MERCURY	D	0.77	0.00107 B
MERCURY	T	NA	0.00227 B

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-12 Phase I	WR-12 Phase II
BARIUM	D	NA	10.7	--
BARIUM	T	220	13.1	--
COPPER	D	5.8	0.92 B	--
COPPER	T	NA	1.1 B	--
LEAD	T	NA	0.18 B	--
MERCURY	D	0.77	0.00095 B	0.001 J
MERCURY	T	NA	0.0024 B	0.00235
METHYLMERCURY	D	NA	--	0.000024 J
METHYLMERCURY	T	NA	--	0.000038 J

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-14 Phase I	WR-14 Phase II[2]
BARIUM	D	NA	10.7	--
BARIUM	T	220	11.3	--
COPPER	D	5.8	0.9 B	--
COPPER	T	NA	1.9 B	--
LEAD	T	NA	0.22 B	--
MERCURY	D	0.77	0.00116 B	0.00123
MERCURY	T	NA	0.00281 B	0.00280
METHYLMERCURY	D	NA	--	0.000023
METHYLMERCURY	T	NA	--	0.000037

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-13 Phase I
BARIUM	D	NA	10.7
BARIUM	T	220	11.3
COPPER	D	5.8	0.83 B
COPPER	T	NA	1.1 B
LEAD	T	NA	0.2 B
MERCURY	D	0.77	0.00108 B
MERCURY	T	NA	0.00453 B

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-13.5 Phase II
MERCURY	D	0.77	0.00089 J
MERCURY	T	NA	0.00252 J
METHYLMERCURY	D	NA	0.000024 J
METHYLMERCURY	T	NA	0.000039 J

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-15 L Phase II[2]	WR-15 M Phase II[2]	WR-15 R Phase II[2]
MERCURY	D	0.77	0.00466	0.00420	0.00344
MERCURY	T	NA	0.01173	0.01069	0.00828

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-15 Phase I
BARIUM	D	NA	10.7
BARIUM	T	220	11.5
COPPER	D	5.8	1.2 J
COPPER	T	NA	1.4 J
LEAD	D	5.4	0.064 J
LEAD	T	NA	0.3 J
MERCURY	D	0.77	0.00351
MERCURY	T	NA	0.0395

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-14.5 L Phase II[2]	WR-14.5 M Phase II[2]	WR-14.5 R Phase II[2]
MERCURY	D	0.77	0.00570	0.00439	0.00466
MERCURY	T	NA	0.03227	0.01187	0.01113

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-16 Phase I	WR-16 Phase II
BARIUM	D	NA	11.2	--
BARIUM	T	220	11.8	--
COPPER	D	5.8	1.1 J	--
COPPER	T	NA	1.6 J	--
LEAD	D	5.4	0.061 J	--
LEAD	T	NA	0.34 J	--
MERCURY	D	0.77	0.00263	0.00422
MERCURY	T	NA	0.0278	0.0143
METHYLMERCURY	D	0.77	--	0.000046 J
METHYLMERCURY	T	NA	--	0.000066

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-17 Phase I	WR-17 Phase II
BARIUM	D	NA	11.4	--
BARIUM	T	220	11.7	--
COPPER	D	5.8	1.2 J	--
COPPER	T	NA	1.4 J	--
LEAD	D	5.4	0.067 J	--
LEAD	T	NA	0.26 J	--
MERCURY	D	0.77	0.00303	0.00443
MERCURY	T	NA	0.0244	0.0145
METHYLMERCURY	D	0.77	--	0.000053
METHYLMERCURY	T	NA	--	0.000106

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-18 Phase I	WR-18 Phase II
BARIUM	D	NA	11.1	--
BARIUM	T	220	11.7	--
COPPER	D	5.8	1.1 J	--
COPPER	T	NA	1.3 J	--
LEAD	D	5.4	0.13 J	--
LEAD	T	NA	0.2 J	--
MERCURY	D	0.77	0.00382	0.00486
MERCURY	T	NA	0.0149	0.0313
METHYLMERCURY	D	0.77	--	0.000061
METHYLMERCURY	T	NA	--	0.000113

Notes:
1) NJSWQS - New Jersey Surface Water Quality Standards, Chronic FW2 Criteria
2) Results for Triplicate Stations are presented as the arithmetic mean concentration of the replicate samples
NA - criterion for constituent based on dissolved fraction

Source: Aerial Photography - NJDEP 2007

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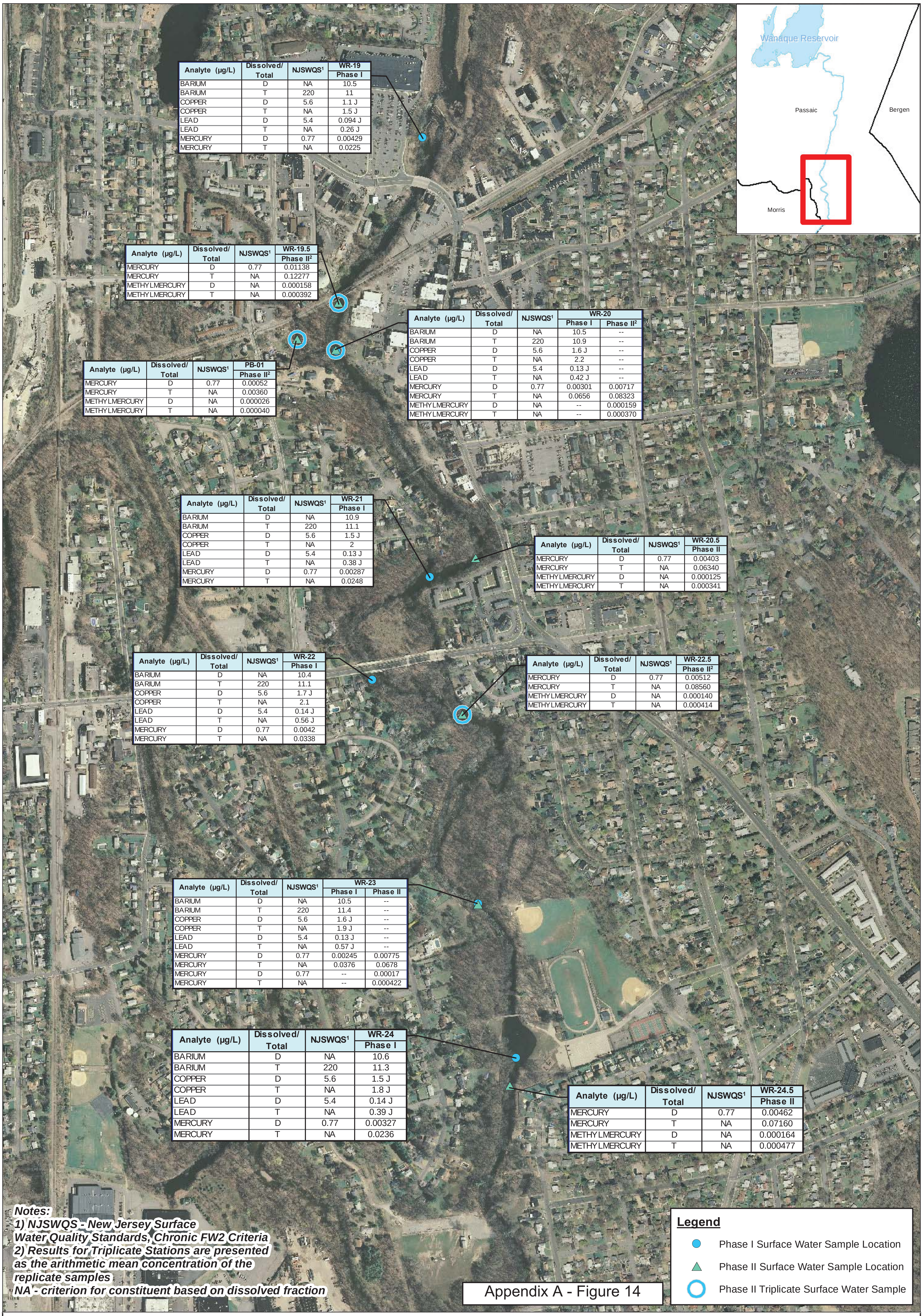
PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 9
Detected Constituents in Surface Water- Reach 2
Wanaque River
Remedia Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-19 Phase I
BARIUM	D	NA	10.5
BARIUM	T	220	11
COPPER	D	5.6	1.1 J
COPPER	T	NA	1.5 J
LEAD	D	5.4	0.094 J
LEAD	T	NA	0.26 J
MERCURY	D	0.77	0.00429
MERCURY	T	NA	0.0225

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-19.5 Phase II[2]
MERCURY	D	0.77	0.01138
MERCURY	T	NA	0.12277
METHYLMERCURY	D	NA	0.000158
METHYLMERCURY	T	NA	0.000392

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-20	
			Phase I	Phase II[2]
BARIUM	D	NA	10.5	--
BARIUM	T	220	10.9	--
COPPER	D	5.6	1.6 J	--
COPPER	T	NA	2.2	--
LEAD	D	5.4	0.13 J	--
LEAD	T	NA	0.42 J	--
MERCURY	D	0.77	0.00301	0.00717
MERCURY	T	NA	0.0656	0.08323
METHYLMERCURY	D	NA	--	0.000159
METHYLMERCURY	T	NA	--	0.000370

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	PB-01 Phase II[2]
MERCURY	D	0.77	0.00052
MERCURY	T	NA	0.00360
METHYLMERCURY	D	NA	0.000026
METHYLMERCURY	T	NA	0.000040

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-21 Phase I
BARIUM	D	NA	10.9
BARIUM	T	220	11.1
COPPER	D	5.6	1.5 J
COPPER	T	NA	2
LEAD	D	5.4	0.13 J
LEAD	T	NA	0.38 J
MERCURY	D	0.77	0.00287
MERCURY	T	NA	0.0248

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-20.5 Phase II
MERCURY	D	0.77	0.00403
MERCURY	T	NA	0.06340
METHYLMERCURY	D	NA	0.000125
METHYLMERCURY	T	NA	0.000341

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-22 Phase I
BARIUM	D	NA	10.4
BARIUM	T	220	11.1
COPPER	D	5.6	1.7 J
COPPER	T	NA	2.1
LEAD	D	5.4	0.14 J
LEAD	T	NA	0.56 J
MERCURY	D	0.77	0.0042
MERCURY	T	NA	0.0338

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-22.5 Phase II[2]
MERCURY	D	0.77	0.00512
MERCURY	T	NA	0.08560
METHYLMERCURY	D	NA	0.000140
METHYLMERCURY	T	NA	0.000414

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-23	
			Phase I	Phase II
BARIUM	D	NA	10.5	--
BARIUM	T	220	11.4	--
COPPER	D	5.6	1.6 J	--
COPPER	T	NA	1.9 J	--
LEAD	D	5.4	0.13 J	--
LEAD	T	NA	0.57 J	--
MERCURY	D	0.77	0.00245	0.00775
MERCURY	T	NA	0.0376	0.0678
MERCURY	D	0.77	--	0.00017
MERCURY	T	NA	--	0.000422

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-24 Phase I
BARIUM	D	NA	10.6
BARIUM	T	220	11.3
COPPER	D	5.6	1.5 J
COPPER	T	NA	1.8 J
LEAD	D	5.4	0.14 J
LEAD	T	NA	0.39 J
MERCURY	D	0.77	0.00327
MERCURY	T	NA	0.0236

Analyte (µg/L)	Dissolved/ Total	NJSWQS[1]	WR-24.5 Phase II
MERCURY	D	0.77	0.00462
MERCURY	T	NA	0.07160
METHYLMERCURY	D	NA	0.000164
METHYLMERCURY	T	NA	0.000477

Notes:
1) NJSWQS - New Jersey Surface Water Quality Standards, Chronic FW2 Criteria
2) Results for Triplicate Stations are presented as the arithmetic mean concentration of the replicate samples
NA - criterion for constituent based on dissolved fraction

Source: Aerial Photography - NJDEP 2007

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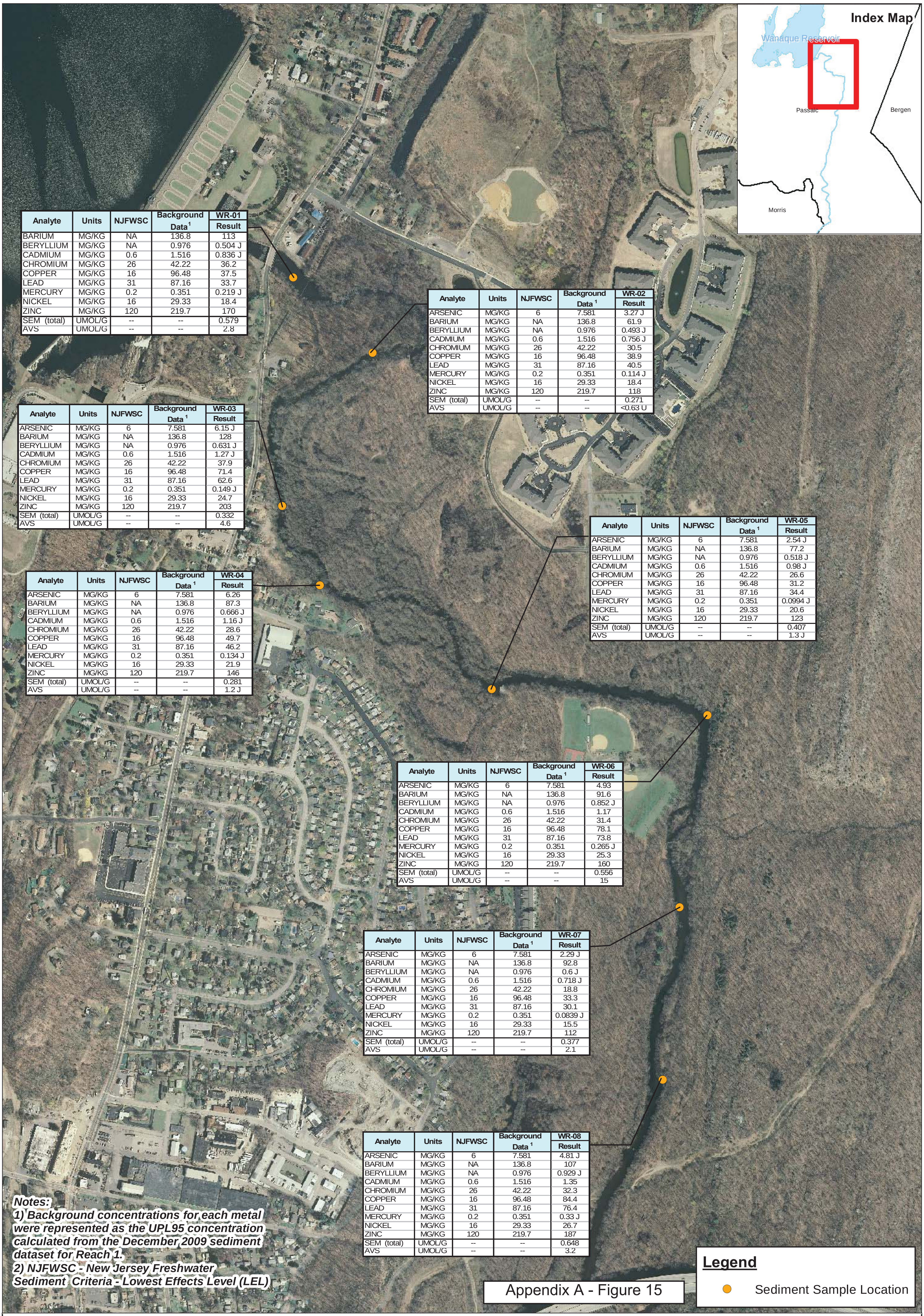
PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 10
Detected Constituents in Surface Water- Reach 3
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte	Units	NJFWSC	Background Data [1]	WR-01 Result
BARIUM	MG/KG	NA	136.8	113
BERYLLIUM	MG/KG	NA	0.976	0.504 J
CADMIUM	MG/KG	0.6	1.516	0.836 J
CHROMIUM	MG/KG	26	42.22	36.2
COPPER	MG/KG	16	96.48	37.5
LEAD	MG/KG	31	87.16	33.7
MERCURY	MG/KG	0.2	0.351	0.219 J
NICKEL	MG/KG	16	29.33	18.4
ZINC	MG/KG	120	219.7	170
SEM (total)	UMOL/G	--	--	0.579
AVS	UMOL/G	--	--	2.8

Analyte	Units	NJFWSC	Background Data [1]	WR-02 Result
ARSENIC	MG/KG	6	7.581	3.27 J
BARIUM	MG/KG	NA	136.8	61.9
BERYLLIUM	MG/KG	NA	0.976	0.493 J
CADMIUM	MG/KG	0.6	1.516	0.756 J
CHROMIUM	MG/KG	26	42.22	30.5
COPPER	MG/KG	16	96.48	38.9
LEAD	MG/KG	31	87.16	40.5
MERCURY	MG/KG	0.2	0.351	0.114 J
NICKEL	MG/KG	16	29.33	18.4
ZINC	MG/KG	120	219.7	118
SEM (total)	UMOL/G	--	--	0.271
AVS	UMOL/G	--	--	<0.63 U

Analyte	Units	NJFWSC	Background Data [1]	WR-03 Result
ARSENIC	MG/KG	6	7.581	6.15 J
BARIUM	MG/KG	NA	136.8	128
BERYLLIUM	MG/KG	NA	0.976	0.631 J
CADMIUM	MG/KG	0.6	1.516	1.27 J
CHROMIUM	MG/KG	26	42.22	37.9
COPPER	MG/KG	16	96.48	71.4
LEAD	MG/KG	31	87.16	62.6
MERCURY	MG/KG	0.2	0.351	0.149 J
NICKEL	MG/KG	16	29.33	24.7
ZINC	MG/KG	120	219.7	203
SEM (total)	UMOL/G	--	--	0.332
AVS	UMOL/G	--	--	4.6

Analyte	Units	NJFWSC	Background Data [1]	WR-04 Result
ARSENIC	MG/KG	6	7.581	6.26
BARIUM	MG/KG	NA	136.8	87.3
BERYLLIUM	MG/KG	NA	0.976	0.666 J
CADMIUM	MG/KG	0.6	1.516	1.16 J
CHROMIUM	MG/KG	26	42.22	28.6
COPPER	MG/KG	16	96.48	49.7
LEAD	MG/KG	31	87.16	46.2
MERCURY	MG/KG	0.2	0.351	0.134 J
NICKEL	MG/KG	16	29.33	21.9
ZINC	MG/KG	120	219.7	146
SEM (total)	UMOL/G	--	--	0.281
AVS	UMOL/G	--	--	1.2 J

Analyte	Units	NJFWSC	Background Data [1]	WR-05 Result
ARSENIC	MG/KG	6	7.581	2.54 J
BARIUM	MG/KG	NA	136.8	77.2
BERYLLIUM	MG/KG	NA	0.976	0.518 J
CADMIUM	MG/KG	0.6	1.516	0.98 J
CHROMIUM	MG/KG	26	42.22	26.6
COPPER	MG/KG	16	96.48	31.2
LEAD	MG/KG	31	87.16	34.4
MERCURY	MG/KG	0.2	0.351	0.0994 J
NICKEL	MG/KG	16	29.33	20.6
ZINC	MG/KG	120	219.7	123
SEM (total)	UMOL/G	--	--	0.407
AVS	UMOL/G	--	--	1.3 J

Analyte	Units	NJFWSC	Background Data [1]	WR-06 Result
ARSENIC	MG/KG	6	7.581	4.93
BARIUM	MG/KG	NA	136.8	91.6
BERYLLIUM	MG/KG	NA	0.976	0.852 J
CADMIUM	MG/KG	0.6	1.516	1.17
CHROMIUM	MG/KG	26	42.22	31.4
COPPER	MG/KG	16	96.48	78.1
LEAD	MG/KG	31	87.16	73.8
MERCURY	MG/KG	0.2	0.351	0.265 J
NICKEL	MG/KG	16	29.33	25.3
ZINC	MG/KG	120	219.7	160
SEM (total)	UMOL/G	--	--	0.556
AVS	UMOL/G	--	--	15

Analyte	Units	NJFWSC	Background Data [1]	WR-07 Result
ARSENIC	MG/KG	6	7.581	2.29 J
BARIUM	MG/KG	NA	136.8	92.8
BERYLLIUM	MG/KG	NA	0.976	0.6 J
CADMIUM	MG/KG	0.6	1.516	0.718 J
CHROMIUM	MG/KG	26	42.22	18.8
COPPER	MG/KG	16	96.48	33.3
LEAD	MG/KG	31	87.16	30.1
MERCURY	MG/KG	0.2	0.351	0.0839 J
NICKEL	MG/KG	16	29.33	15.5
ZINC	MG/KG	120	219.7	112
SEM (total)	UMOL/G	--	--	0.377
AVS	UMOL/G	--	--	2.1

Analyte	Units	NJFWSC	Background Data [1]	WR-08 Result
ARSENIC	MG/KG	6	7.581	4.81 J
BARIUM	MG/KG	NA	136.8	107
BERYLLIUM	MG/KG	NA	0.976	0.929 J
CADMIUM	MG/KG	0.6	1.516	1.35
CHROMIUM	MG/KG	26	42.22	32.3
COPPER	MG/KG	16	96.48	84.4
LEAD	MG/KG	31	87.16	76.4
MERCURY	MG/KG	0.2	0.351	0.33 J
NICKEL	MG/KG	16	29.33	26.7
ZINC	MG/KG	120	219.7	187
SEM (total)	UMOL/G	--	--	0.648
AVS	UMOL/G	--	--	3.2

Notes:
1) Background concentrations for each metal were represented as the UPL95 concentration calculated from the December 2009 sediment dataset for Reach 1.
2) NJFWSC - New Jersey Freshwater Sediment Criteria - Lowest Effects Level (LEL)

Source: Aerial Photography - NJDEP 2007

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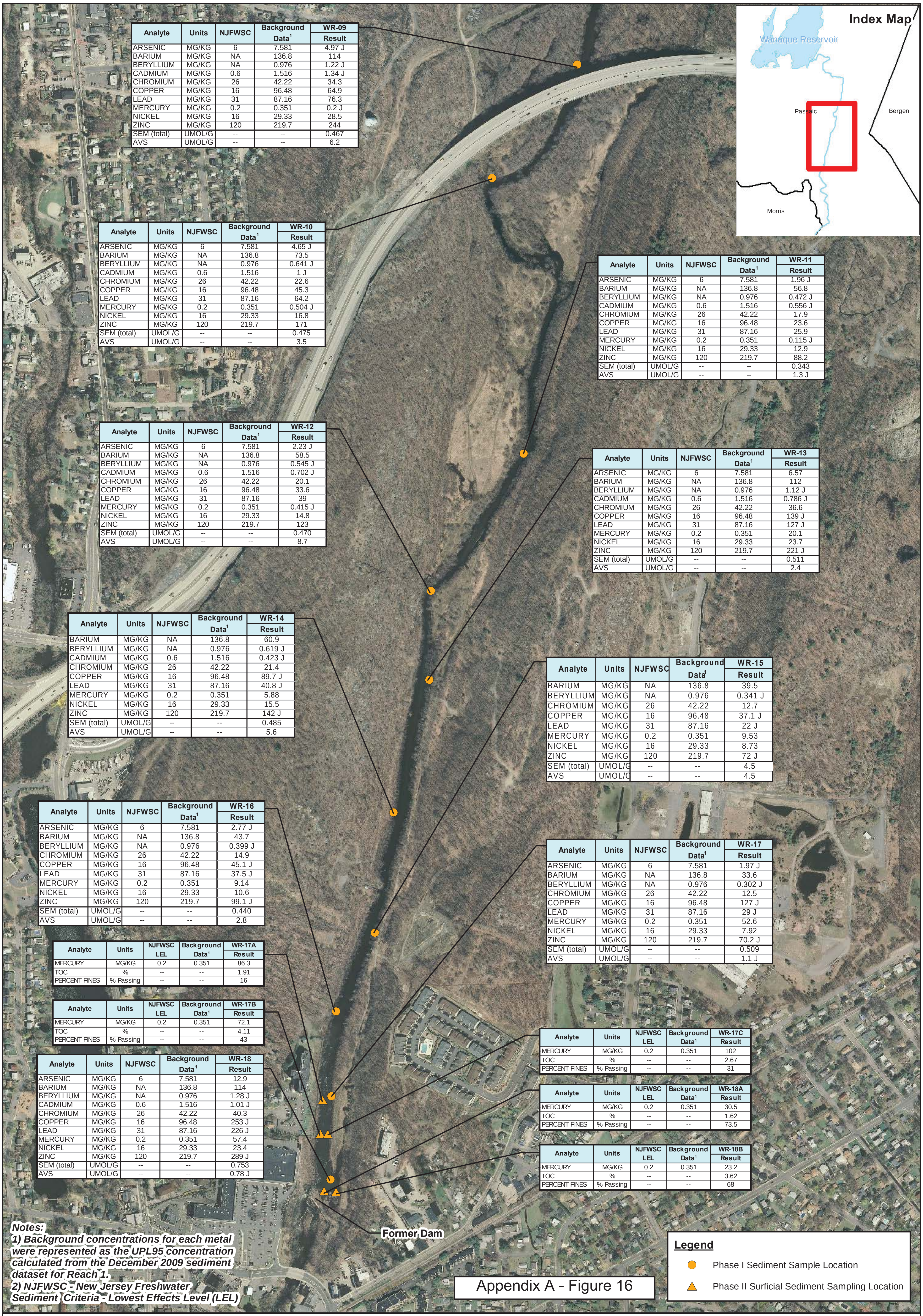
PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 11
Detected Constituents in Sediment- Reach 1
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte	Units	NJFWSC	Background Data[1]	WR-09 Result
ARSENIC	MG/KG	6	7.581	4.97 J
BARIUM	MG/KG	NA	136.8	114
BERYLLIUM	MG/KG	NA	0.976	1.22 J
CADMIUM	MG/KG	0.6	1.516	1.34 J
CHROMIUM	MG/KG	26	42.22	34.3
COPPER	MG/KG	16	96.48	64.9
LEAD	MG/KG	31	87.16	76.3
MERCURY	MG/KG	0.2	0.351	0.2 J
NICKEL	MG/KG	16	29.33	28.5
ZINC	MG/KG	120	219.7	244
SEM (total)	UMOL/G	--	--	0.467
AVS	UMOL/G	--	--	6.2

Analyte	Units	NJFWSC	Background Data[1]	WR-10 Result
ARSENIC	MG/KG	6	7.581	4.65 J
BARIUM	MG/KG	NA	136.8	73.5
BERYLLIUM	MG/KG	NA	0.976	0.641 J
CADMIUM	MG/KG	0.6	1.516	1 J
CHROMIUM	MG/KG	26	42.22	22.6
COPPER	MG/KG	16	96.48	45.3
LEAD	MG/KG	31	87.16	64.2
MERCURY	MG/KG	0.2	0.351	0.504 J
NICKEL	MG/KG	16	29.33	16.8
ZINC	MG/KG	120	219.7	171
SEM (total)	UMOL/G	--	--	0.475
AVS	UMOL/G	--	--	3.5

Analyte	Units	NJFWSC	Background Data[1]	WR-11 Result
ARSENIC	MG/KG	6	7.581	1.96 J
BARIUM	MG/KG	NA	136.8	56.8
BERYLLIUM	MG/KG	NA	0.976	0.472 J
CADMIUM	MG/KG	0.6	1.516	0.556 J
CHROMIUM	MG/KG	26	42.22	17.9
COPPER	MG/KG	16	96.48	23.6
LEAD	MG/KG	31	87.16	25.9
MERCURY	MG/KG	0.2	0.351	0.115 J
NICKEL	MG/KG	16	29.33	12.9
ZINC	MG/KG	120	219.7	88.2
SEM (total)	UMOL/G	--	--	0.343
AVS	UMOL/G	--	--	1.3 J

Analyte	Units	NJFWSC	Background Data[1]	WR-12 Result
ARSENIC	MG/KG	6	7.581	2.23 J
BARIUM	MG/KG	NA	136.8	58.5
BERYLLIUM	MG/KG	NA	0.976	0.545 J
CADMIUM	MG/KG	0.6	1.516	0.702 J
CHROMIUM	MG/KG	26	42.22	20.1
COPPER	MG/KG	16	96.48	33.6
LEAD	MG/KG	31	87.16	39
MERCURY	MG/KG	0.2	0.351	0.415 J
NICKEL	MG/KG	16	29.33	14.8
ZINC	MG/KG	120	219.7	123
SEM (total)	UMOL/G	--	--	0.470
AVS	UMOL/G	--	--	8.7

Analyte	Units	NJFWSC	Background Data[1]	WR-13 Result
ARSENIC	MG/KG	6	7.581	6.57
BARIUM	MG/KG	NA	136.8	112
BERYLLIUM	MG/KG	NA	0.976	1.12 J
CADMIUM	MG/KG	0.6	1.516	0.786 J
CHROMIUM	MG/KG	26	42.22	36.6
COPPER	MG/KG	16	96.48	139 J
LEAD	MG/KG	31	87.16	127 J
MERCURY	MG/KG	0.2	0.351	20.1
NICKEL	MG/KG	16	29.33	23.7
ZINC	MG/KG	120	219.7	221 J
SEM (total)	UMOL/G	--	--	0.511
AVS	UMOL/G	--	--	2.4

Analyte	Units	NJFWSC	Background Data[1]	WR-14 Result
BARIUM	MG/KG	NA	136.8	60.9
BERYLLIUM	MG/KG	NA	0.976	0.619 J
CADMIUM	MG/KG	0.6	1.516	0.423 J
CHROMIUM	MG/KG	26	42.22	21.4
COPPER	MG/KG	16	96.48	89.7 J
LEAD	MG/KG	31	87.16	40.8 J
MERCURY	MG/KG	0.2	0.351	5.88
NICKEL	MG/KG	16	29.33	15.5
ZINC	MG/KG	120	219.7	142 J
SEM (total)	UMOL/G	--	--	0.485
AVS	UMOL/G	--	--	5.6

Analyte	Units	NJFWSC	Background Data[1]	WR-15 Result
BARIUM	MG/KG	NA	136.8	39.5
BERYLLIUM	MG/KG	NA	0.976	0.341 J
CHROMIUM	MG/KG	26	42.22	12.7
COPPER	MG/KG	16	96.48	37.1 J
LEAD	MG/KG	31	87.16	22 J
MERCURY	MG/KG	0.2	0.351	9.53
NICKEL	MG/KG	16	29.33	8.73
ZINC	MG/KG	120	219.7	72 J
SEM (total)	UMOL/G	--	--	4.5
AVS	UMOL/G	--	--	4.5

Analyte	Units	NJFWSC	Background Data[1]	WR-16 Result
ARSENIC	MG/KG	6	7.581	2.77 J
BARIUM	MG/KG	NA	136.8	43.7
BERYLLIUM	MG/KG	NA	0.976	0.399 J
CHROMIUM	MG/KG	26	42.22	14.9
COPPER	MG/KG	16	96.48	45.1 J
LEAD	MG/KG	31	87.16	37.5 J
MERCURY	MG/KG	0.2	0.351	9.14
NICKEL	MG/KG	16	29.33	10.6
ZINC	MG/KG	120	219.7	99.1 J
SEM (total)	UMOL/G	--	--	0.440
AVS	UMOL/G	--	--	2.8

Analyte	Units	NJFWSC	Background Data[1]	WR-17 Result
ARSENIC	MG/KG	6	7.581	1.97 J
BARIUM	MG/KG	NA	136.8	33.6
BERYLLIUM	MG/KG	NA	0.976	0.302 J
CHROMIUM	MG/KG	26	42.22	12.5
COPPER	MG/KG	16	96.48	127 J
LEAD	MG/KG	31	87.16	29 J
MERCURY	MG/KG	0.2	0.351	52.6
NICKEL	MG/KG	16	29.33	7.92
ZINC	MG/KG	120	219.7	70.2 J
SEM (total)	UMOL/G	--	--	0.509
AVS	UMOL/G	--	--	1.1 J

Analyte	Units	NJFWSC LEL	Background Data[1]	WR-17A Result
MERCURY	MG/KG	0.2	0.351	86.3
TOC	%	--	--	1.91
PERCENT FINES	% Passing	--	--	16

Analyte	Units	NJFWSC LEL	Background Data[1]	WR-17B Result
MERCURY	MG/KG	0.2	0.351	72.1
TOC	%	--	--	4.11
PERCENT FINES	% Passing	--	--	43

Analyte	Units	NJFWSC LEL	Background Data[1]	WR-17C Result
MERCURY	MG/KG	0.2	0.351	102
TOC	%	--	--	2.67
PERCENT FINES	% Passing	--	--	31

Analyte	Units	NJFWSC	Background Data[1]	WR-18 Result
ARSENIC	MG/KG	6	7.581	12.9
BARIUM	MG/KG	NA	136.8	114
BERYLLIUM	MG/KG	NA	0.976	1.28 J
CADMIUM	MG/KG	0.6	1.516	1.01 J
CHROMIUM	MG/KG	26	42.22	40.3
COPPER	MG/KG	16	96.48	253 J
LEAD	MG/KG	31	87.16	226 J
MERCURY	MG/KG	0.2	0.351	57.4
NICKEL	MG/KG	16	29.33	23.4
ZINC	MG/KG	120	219.7	289 J
SEM (total)	UMOL/G	--	--	0.753
AVS	UMOL/G	--	--	0.78 J

Analyte	Units	NJFWSC LEL	Background Data[1]	WR-18A Result
MERCURY	MG/KG	0.2	0.351	30.5
TOC	%	--	--	1.62
PERCENT FINES	% Passing	--	--	73.5

Analyte	Units	NJFWSC LEL	Background Data[1]	WR-18B Result
MERCURY	MG/KG	0.2	0.351	23.2
TOC	%	--	--	3.62
PERCENT FINES	% Passing	--	--	68

Notes:
1) Background concentrations for each metal were represented as the UPL95 concentration calculated from the December 2009 sediment dataset for Reach 1.
2) NJFWSC - New Jersey Freshwater Sediment Criteria - Lowest Effects Level (LEL)

Source: Aerial Photography - NJDEP 2007

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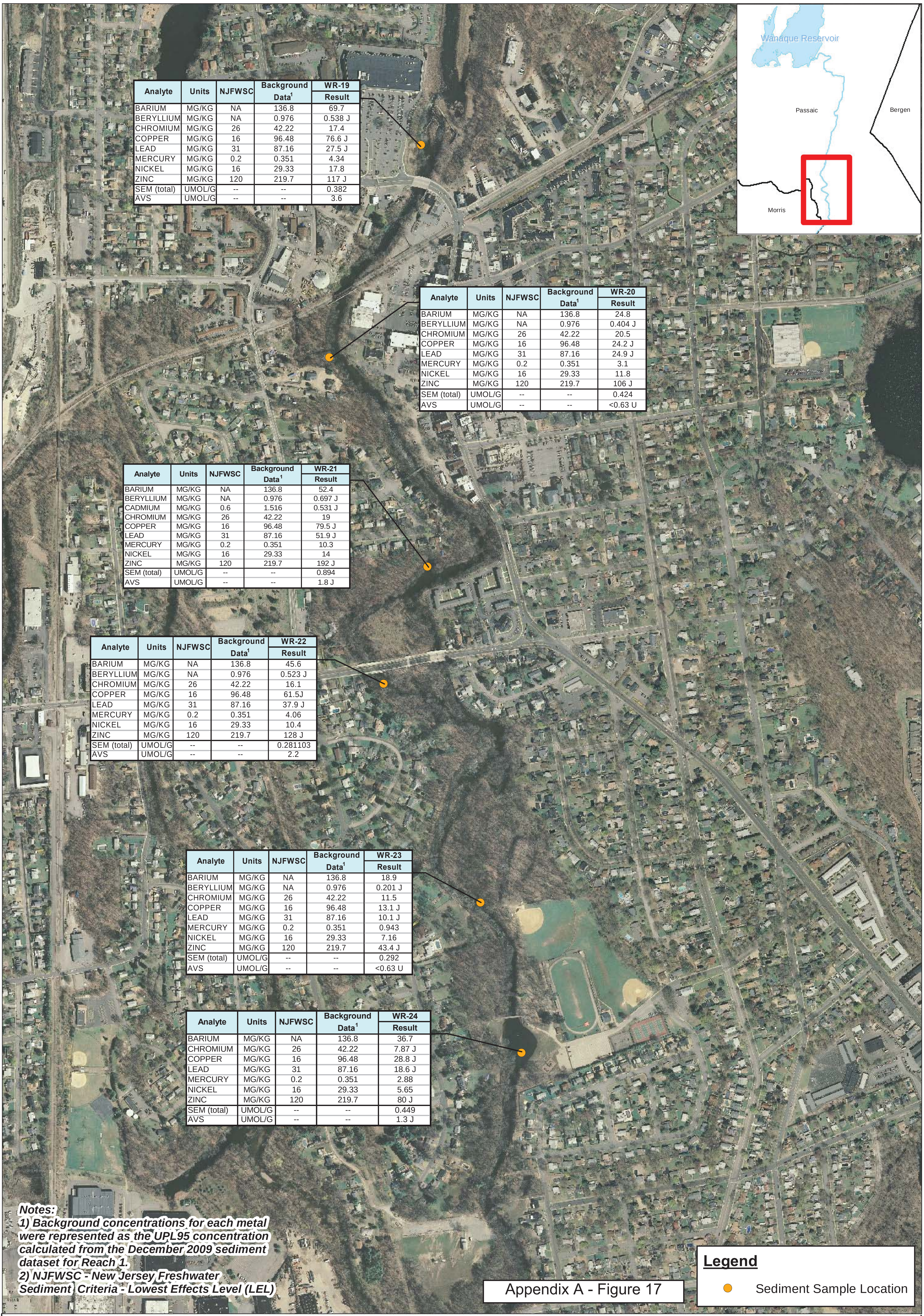
PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 12
Detected Constituents in Sediment - Reach 2
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey



Analyte	Units	NJFWSC	Background Data[1]	WR-19 Result
BARIUM	MG/KG	NA	136.8	69.7
BERYLLIUM	MG/KG	NA	0.976	0.538 J
CHROMIUM	MG/KG	26	42.22	17.4
COPPER	MG/KG	16	96.48	76.6 J
LEAD	MG/KG	31	87.16	27.5 J
MERCURY	MG/KG	0.2	0.351	4.34
NICKEL	MG/KG	16	29.33	17.8
ZINC	MG/KG	120	219.7	117 J
SEM (total)	UMOL/G	--	--	0.382
AVS	UMOL/G	--	--	3.6

Analyte	Units	NJFWSC	Background Data[1]	WR-20 Result
BARIUM	MG/KG	NA	136.8	24.8
BERYLLIUM	MG/KG	NA	0.976	0.404 J
CHROMIUM	MG/KG	26	42.22	20.5
COPPER	MG/KG	16	96.48	24.2 J
LEAD	MG/KG	31	87.16	24.9 J
MERCURY	MG/KG	0.2	0.351	3.1
NICKEL	MG/KG	16	29.33	11.8
ZINC	MG/KG	120	219.7	106 J
SEM (total)	UMOL/G	--	--	0.424
AVS	UMOL/G	--	--	<0.63 U

Analyte	Units	NJFWSC	Background Data[1]	WR-21 Result
BARIUM	MG/KG	NA	136.8	52.4
BERYLLIUM	MG/KG	NA	0.976	0.697 J
CADMIUM	MG/KG	0.6	1.516	0.531 J
CHROMIUM	MG/KG	26	42.22	19
COPPER	MG/KG	16	96.48	79.5 J
LEAD	MG/KG	31	87.16	51.9 J
MERCURY	MG/KG	0.2	0.351	10.3
NICKEL	MG/KG	16	29.33	14
ZINC	MG/KG	120	219.7	192 J
SEM (total)	UMOL/G	--	--	0.894
AVS	UMOL/G	--	--	1.8 J

Analyte	Units	NJFWSC	Background Data[1]	WR-22 Result
BARIUM	MG/KG	NA	136.8	45.6
BERYLLIUM	MG/KG	NA	0.976	0.523 J
CHROMIUM	MG/KG	26	42.22	16.1
COPPER	MG/KG	16	96.48	61.5J
LEAD	MG/KG	31	87.16	37.9 J
MERCURY	MG/KG	0.2	0.351	4.06
NICKEL	MG/KG	16	29.33	10.4
ZINC	MG/KG	120	219.7	128 J
SEM (total)	UMOL/G	--	--	0.281103
AVS	UMOL/G	--	--	2.2

Analyte	Units	NJFWSC	Background Data[1]	WR-23 Result
BARIUM	MG/KG	NA	136.8	18.9
BERYLLIUM	MG/KG	NA	0.976	0.201 J
CHROMIUM	MG/KG	26	42.22	11.5
COPPER	MG/KG	16	96.48	13.1 J
LEAD	MG/KG	31	87.16	10.1 J
MERCURY	MG/KG	0.2	0.351	0.943
NICKEL	MG/KG	16	29.33	7.16
ZINC	MG/KG	120	219.7	43.4 J
SEM (total)	UMOL/G	--	--	0.292
AVS	UMOL/G	--	--	<0.63 U

Analyte	Units	NJFWSC	Background Data[1]	WR-24 Result
BARIUM	MG/KG	NA	136.8	36.7
CHROMIUM	MG/KG	26	42.22	7.87 J
COPPER	MG/KG	16	96.48	28.8 J
LEAD	MG/KG	31	87.16	18.6 J
MERCURY	MG/KG	0.2	0.351	2.88
NICKEL	MG/KG	16	29.33	5.65
ZINC	MG/KG	120	219.7	80 J
SEM (total)	UMOL/G	--	--	0.449
AVS	UMOL/G	--	--	1.3 J

Notes:
1) Background concentrations for each metal were represented as the UPL95 concentration calculated from the December 2009 sediment dataset for Reach 1.
2) NJFWSC - New Jersey Freshwater Sediment Criteria - Lowest Effects Level (LEL)

Source: Aerial Photography - NJDEP 2007

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PROJECT NO. 18985748.00004

0 275 550 1,100 Feet

1 in = 550 ft

Figure 13
Detected Constituents in Sediment- Reach 3
Wanaque River
Remedial Investigation Report
DuPont Pompton Lakes Works
Pompton Lakes, New Jersey