FIRST FIVE-YEAR REVIEW REPORT FOR QUANTA RESOURCES SUPERFUND SITE OU1 BERGEN COUNTY, NEW JERSEY

Prepared by

U.S. Environmental Protection Agency
Region 2
New York-, New York

Evangelista, Pat

Digitally signed by Evangelista, Pat
Date: 2022.01.19 08:22:25 -05'00'

Pat Evangelista, Director
Superfund & Emergency Management Division

See Signature Block

Date

609915

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AST	Above-ground Storage Tank
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
DNAPL	Dense Non-aqueous Phase Liquid
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
ISS	In-situ Solidification/Stabilization
LNAPL	Light Non-aqueous Phase Liquid
NAPL	Non-aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
RSI	Removal Site Investigation
TBC	To be considered
TI	Technical Impracticability
TPH	Total Petroleum Hydrocarbons
UCS	Unconfined Compressive Strength
UST	Underground Storage Tank

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the first FYR for Operable Unit 1 (OU1) of the Quanta Resources Superfund Site. The triggering action for this statutory review is the on-site construction start date of the OU1 remedial action. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of two Operable Units (OUs). The focus of this FYR is OU1. OU1 addresses areas of contaminated soil on the Quanta property and adjacent properties, soil contamination under River Road, and contaminated groundwater in the High Concentration Arsenic Area. OU2 addresses contamination in the Hudson River surface water and sediment and is not covered in this FYR, as a remedy has not yet been selected for OU2.

The Quanta Resources Superfund Site OU1 FYR was led by Shane Nelson, EPA Remedial Project Manager. Participants included Dr. Lora Smith-Staines, EPA Human Health Risk Assessor; Natalie Loney, EPA Community Involvement Coordinator; Kathryn Flynn, EPA Hydrogeologist; and Dr. Abby DeBofsky, EPA Ecological Risk Assessor. The potentially responsible party (PRP) was notified of the initiation of the FYR, which began on 4/15/2021.

Site Background

The Site is located at the intersection of River Road and Gorge Road in Edgewater, New Jersey, in an area that was historically heavily industrial, but is now mixed-use residential and retail commercial (Figure 1). OU1 of the Site is characterized by contamination from a variety of industries that operated from at least the 1870s to 1981. These industries included coal tar processing, chemical manufacturing, and waste oil storage.

OU1 encompasses 24 acres and is bounded to the west by Old River Road, to the east by the Hudson River, and to the north and south by mixed-use residential and retail commercial developments. The 5.5-acre Quanta property, a remnant of an industrial coal tar facility, is located at the center of OU1. Surrounding the Quanta property are additional properties within OU1 that were contaminated by former Site operations. Properties within OU1 are (Figure 3):

- Block 95, Lot 1 (Quanta property)
- Block 91, Lot 1 (former Celotex property)
- Block 96, Lot 3.01 (115 River Road property)
- Block 99, Lot 1 (former Lever Brothers property)

- River Road and Gorge Road
- Block 93 (North, Central and South)

Groundwater is not used as a drinking water source at the Site or the surrounding properties. Drinking water in Edgewater is provided by a public water supply managed by NJ American Water.

The water table on the Quanta property and 115 River Road is shallow, within approximately two feet of the ground surface. The direction of the shallow unconfined groundwater flow (above the confining unit) is generally to the east and south, with an area of radial flow on the Quanta property. The OU1 portion of the Site is flat with no permanent water bodies other than the adjacent Hudson River.

Three former industrial operations are the primary sources of contamination at the Site: Barrett Manufacturing Company (Barrrett), a manufacturer of coal tar products; General Chemical Company (General), a manufacturer of industrial acids; and Quanta Resources, Inc. (Quanta), a waste oil management operation. From approximately 1878 to when the property was sold in 1974, a large portion of the Site was used to process coal tar and produce paving and roofing materials, first by Barrett and later by Allied Chemical Corporation. General operated a sulfuric acid production plant at the Site from 1903 to 1967. In 1921, Barrett, General, and three other chemical manufacturing companies consolidated to form Allied Chemical & Dye Corporation, which was shortened to Allied Chemical Corporation (now known as Honeywell) in 1958. From 1974 to 1981, the property was operated by multiple oil recycling businesses. In 1977, the former Barrett property was leased to E.R.P. Corporation for the storage and recycling of oil and Quanta purchased the lease in 1979. Products stored at the former Quanta property included coal tar, waste oil, asphalt, ammonia, and roofing materials.

Coal tar processing and subsequent oil-recycling operations contributed to sources of contamination at the Site, including non-aqueous phase liquid (NAPL), an organic liquid contaminant that does not dissolve in or easily mix with water, such as oil, gasoline and petroleum products; pitch, a thick black liquid that remains after the distillation of coal tar; soil impacted with poly cyclic aromatic hydrocarbons (PAHs); and other constituents. The former acid plant on the northern portion of the Quanta property and southern portion of the former Celotex property is the source of the arsenic contamination. Soil and groundwater contamination unrelated to former operations is also found on the Site.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Quanta Resources		
EPA ID: NJD000606442		
Region: 2	**State:** NJ	**City/County:** Edgewater/Bergen
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		

Lead agency: EPA
Author name (Federal or State Project Manager): Shane Nelson
Author affiliation: EPA
Review period: 4/15/2021 - 1/3/2022
Date of site inspection: 8/6/2021
Type of review: Statutory
Review number: 1
Triggering action date: 10/17/2016
Due date *(five years after triggering action date)*: 10/17/2021

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

A Remedial Investigation and Human Health Risk Assessment (HHRA) for OU1 were completed in June 2010. The Remedial Investigation (RI) identified the primary contaminants of concern (COCs) in soil and groundwater as arsenic and semi-volatile organic compounds (SVOCs), primarily the PAHs benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(b)fluoranthene, benzo(a)anthracene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and naphthalene; aromatic volatile organic compounds (VOCs) associated with NAPL (e.g., benzo(a)pyrene, naphthalene, and benzene).

The HHRA conducted for most of OU1 (with the exception of River and Gorge Roads, Block 94, and Block 92.01) identified COCs for three media:

- Surface soil (0 to 2 feet below ground surface (bgs))
- Subsurface soil (2 to 10 feet bgs)
- Groundwater (above and below the silty-clay confining layer)

Exposure pathways and scenarios included incidental ingestion of and dermal contact with contaminated soil, and future ingestion of groundwater as a potable water supply for current and future commercial workers and construction workers and current and potential future residents (adults, adolescents, and children). Because the Palisades Child Care Center was in the former 115 River Road building, a scenario of children in a day care was also evaluated. The former 115 River Road building was demolished in 2018 and 2019.

Risks above acceptable levels for one or more current or future receptors as a result of exposure to soil or groundwater were calculated on all properties evaluated. Primary risk drivers include naphthalene, arsenic, and carcinogenic PAHs. Along with these primary risk drivers, tar boils, which are seeps of coal tar on the ground surface observed at the site, are to be addressed because direct contact with this material is expected to exceed acceptable risk levels.

A Screening-Level Ecological Risk Assessment (SLERA) completed in 2007 for OU1 evaluated potential risk from exposure to compounds detected in surface soil at the Quanta property to the following terrestrial receptors: plants, invertebrates, small mammals (shrew, vole, mouse, and weasel), raccoon, red-tailed hawk, and American robin. Potential ecological risk was evaluated through direct exposure to soil and via the food chain exposure pathway. Using realistic exposure assumptions, results from the SLERA indicated potential risks to terrestrial plants and soil invertebrates from direct exposure to a variety of chemicals in surface soils including VOCs, SVOCs, pesticides, PCBs, and inorganics. Potential risks were also indicated to small mammal receptors from exposure to Aroclor-1248, Aroclor-1260, dieldrin, pyrene, and total PAHs. Overall, the conclusion of the SLERA noted the presence of constituents of potential concern at the Quanta property but stated that the property has been greatly disturbed by historic site activities, provides low quality habitat, is surrounded by commercial properties and the Hudson River, and is slated for redevelopment. Although ecological receptors could potentially use the Quanta property, these conditions would limit exposure to a small number of individual receptors that may not permanently inhabit OU1. Additionally, the isolated nature of the property prevents colonization by other species in the interim. EPA agreed with the overall conclusion of the SLERA that additional characterization of ecological risk at OU1 was not necessary.

Response Actions

From approximately 1974 to 1981, the property was leased by Gaess Environmental Services Corporation, followed by Hudson Oil Refining and Edgewater Terminals. In 1979, Quanta purchased the lease and received a temporary operating permit issued by the New Jersey Department of Environmental Protection (NJDEP). NJDEP inspections revealed the poor condition of the facility and PCBs were discovered in some of the oil stored in tanks at the site. In May 1981, NJDEP issued an administrative order directing Quanta to cease operations and to take measures to prevent spills and start removing surface contamination. On October 6, 1981, Quanta Resources Corporation filed for bankruptcy and ended operations at the Site.

In November 1983, NJDEP issued an administrative order to the property owners to stabilize the Site and develop response actions to address contamination. In 1984, EPA initiated a federally funded removal action after EPA and NJDEP concluded that the property owners could not meet the requirements of the administrative order. Several removal actions conducted at the Site from 1984 to 1988 under EPA oversight focused on the cleaning and decommissioning of the above-ground storage tanks (ASTs) and underground storage tanks (USTs).

In September and October 1985, EPA issued a series of Administrative Orders on Consent (AOC) to the PRPs to perform or fund additional removal actions and reimburse EPA for its past costs.

In 1992 and 1995, EPA assessed its earlier removal actions through the collection and analysis of soil, sediment, and groundwater samples from the Site. Constituents detected included arsenic, asbestos, benzene, metals, PAHs, total petroleum hydrocarbons (TPH), and VOCs. In 1996, EPA and one PRP, the successor to Barrett Manufacturing Company, AlliedSignal (formerly Allied Chemical Company, now Honeywell), entered into an AOC under EPA's removal authority to improve site security, further investigate the Site, and develop additional response actions for the Site. AlliedSignal entered into a second AOC with EPA in 1998 to conduct a Removal Site Investigation (RSI) and identify steps to address the coal tar sheens in the mudflats.

Results of these investigations and an EPA ecological risk assessment of Hudson River sediments led to EPA placing the Site on the National Priorities List (NPL) on September 9, 2002. In 2004, an AOC was

signed between EPA and 23 respondents to conduct an RI/FS to fill data gaps in previous investigations and to provide a basis for a complete evaluation of remedial alternatives.

On September 29, 2011, EPA issued a Record of Decision (ROD) for OU1. OU1 addresses soil contaminated with high concentrations of NAPL and arsenic that constitute a principal threat. Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. OU1 also addresses soil contamination and groundwater contamination attributed to the Site.

The remedial action objectives (RAOs) for OU1 are organized into three categories: principal threat waste, soil and groundwater.

Principal threat waste RAOs

- Remove, treat, or contain principal threat waste, to the extent practicable;
- Prevent exposure to NAPL and arsenic source material that poses an unacceptable human health risk;
- Prevent current or potential future migration of free-phase NAPL to the Hudson River or to areas that would result in direct contact exposure;
- Mitigate free-phase NAPL that poses a potential source of vapor intrusion and resulting inhalation exposure within existing or potential future structures; and
- Mitigate NAPL and arsenic principal threats as a source of groundwater contamination to the extent practicable.

Soil RAOs

- Prevent or minimize potential human exposure through direct contact, ingestion, dust inhalation, or vapor intrusion that presents unacceptable risk from exposure to contaminated soil attributable to the site; and
- Prevent or minimize potential erosional transport off site or to the Hudson River of contaminated soils at concentrations posing unacceptable risk.

Groundwater RAOs

- Prevent or minimize potential exposure by contact, ingestion, or inhalation/vapor intrusion that presents unacceptable risk from exposure to contaminated groundwater attributable to the site; and
- Prevent migration and preferential flow of site contaminants in groundwater to sediments and surface water of the Hudson River at levels posing an unacceptable risk to human health or ecological receptors.

The components of the remedy selected in the ROD include (a detailed description of the components of the selected remedy are provided in Appendix E):

Treatment of Source Areas with Solidification/Stabilization (S/S) (Arsenic and Coal Tar NAPL)

On-site solidification/stabilization of an estimated 150,000 cubic yards of contaminated soil containing arsenic and NAPL, primarily by in-situ solidification/stabilization (ISS).

Deep NAPL

Treatment of a portion of the Deep NAPL through ISS, passive NAPL collection for other areas of the Deep NAPL, and long-term monitoring.

Interim Action: 115 River Road Buildings

Installation of a vapor mitigation system and basement sealing at 115 River Road; construction of a temporary barrier wall at 115 River Road along the shoreline to isolate untreated free phase NAPL from the Hudson River and sediments.

Final Action: 115 River Road Buildings

When 115 River Road is demolished or redeveloped in the future, ISS for the untreated free-phase NAPL remaining under the buildings.

Residual Soils

Capping of contaminated soils remaining on site at concentrations greater than the Remediation Goals for residential direct contact with a multilayer cap as approved by EPA.

Groundwater

Installation of a subaqueous reactive barrier (SRB) in Hudson River sediments, coordinated with a future OU2 remedy (Figure 11).

EPA evaluated alternatives for restoration of groundwater to Applicable or Relevant and Appropriate Requirements (ARARs) and concluded that no practicable alternatives could be implemented. Consequently, EPA is invoking an ARAR waiver for the groundwater at the site due to technical impracticability.

Operation and Maintenance of the Remedy, Monitoring, and Institutional Controls

Operation and maintenance for the active components of the remedy, such as the Deep NAPL collection system and vapor intrusion systems, monitoring of the site over the long term to assure the protectiveness of the remedy, and institutional controls; implementation of a long-term sampling and analysis program to monitor the contamination at the site in order to assess groundwater migration, and the effectiveness of the remedy over time.

Status of Implementation

Source Areas

The source areas for OU1 were identified as six discrete NAPL zones (NZ) where the majority of the mass of free-phase NAPL is found, multiple arsenic source areas, and the High Concentration Arsenic Area (HCAA) (Figure 2).

Remedial Action started in 2016 on Block 93, which is west of River Road. 6,625 cubic yards of soil were treated using ISS and the work on Block 93 was completed on November 22, 2017 (Figure 7).

In July 2017, remedial activities started on the east side of River Road for portions of the Quanta, iPark, 115 River Road, and City Place properties. From July 2017 to May 2018, ISS was completed in Areas 3 and 7 on the Quanta property, Area 5A on the iPark development property, Area 5B on the 115 River Road property, and Area 8 on the City Place development property (Figure 8). In addition to the ISS, a cap was constructed for the portion of the work in Area 5 south of the 115 River Road building.

In May 2018, ISS was paused to allow Honeywell to demolish the 115 River Road buildings. This pause was also used to identify and evaluate technologies that would prevent or mitigate releases of naphthalene from areas of active ISS to the surrounding community.

ISS of source areas on the Quanta property and adjacent properties, except for the portions of NZ-1 under River Road, resumed in April 2019 and was completed in May 2021. The majority of the ISS after April 2019 was completed under tents to prevent or mitigate releases of naphthalene. Of the 150,000 cubic yards of soil to be solidified/stabilized that were identified in the ROD, approximately 141,000 cubic yards of soil have been treated to date using ISS (Figure 8). The remaining volume of NAPL requiring treatment lies under River Road and will be treated separately (Figure 5). ISS technologies that could address the remaining source area contamination under portions of River Road are being evaluated.

In late summer 2020, testing of a treatment of the contaminated groundwater in the HCAA was initiated (Figure 6). The testing involves periodically injecting zero-valent iron (ZVI) into the groundwater over a year-long period and evaluating the potential for the ZVI to sequester arsenic in situ to reduce arsenic concentrations and provide a geochemical environment conducive to long-term sequestration of arsenic. Preliminary results indicate variable performance and additional data will be collected during quarterly post-injection sampling events. EPA expects to make a determination of the effectiveness of the ZVI injections within the HCAA is expected in 2022.

In 2015, recovery wells were installed to passively remove NAPL as part of the remedial action (Figure 9). The original NAPL recovery network evolved to address observed conditions at the well locations, to maintain a monitoring network capable of verifying stability of each NAPL zone, and to allow in situ ISS activities as part of the OU1 remedy. MW-402 was originally intended as a sentry well for NZ-4 but is operated as a recovery well (RW4-2) after recoverable NAPL was discovered in the well after installation. A new sentry well (MW-406) was installed downgradient of RW4-2. Recovery wells RW3-2, RW3-3, and RW3-4 were operated as sentry wells because the wells did not contain sufficient NAPL to conduct a bail-down test. Based on the low amounts of NAPL discovered in the wells and ongoing ISS activities at the site, only one recovery well, RW4-2, is active.

Soil Remediation

Soil that exceeds the soil remediation goals, but is not in source areas, will be addressed with engineering controls (capping) and land-use restrictions. A temporary cap consisting of geotextile fabric and dense graded aggregate (DGA) has been installed over the Quanta property. Permanent caps will be constructed as part of the development construction or final restoration activities.

Groundwater

The selected groundwater treatment remedy, a Sub-aqueous Reactive Barrier (SRB), is intended to prevent the release of Site constituents into shallow sediments and surface water of the Hudson River (Figure 10). Remediation goals for SRB performance are New Jersey Groundwater Quality Standards of

6 micrograms per liter (µg/L) for antimony; 3 µg/L for arsenic; 4 µg/L for cadmium; 300 µg/L for iron; 50 µg/L for manganese; 2 µg/L for mercury; 2 µg/L for thallium; 1 µg/L for benzene; 1,000 µg/L for total xylenes; 30 µg/L for 2-methylnaphthalene; 0.1 µg/L for benzo(a)anthracene; 0.1 µg/L for benzo(a)pyrene; 0.2 µg/L for benzo(b)fluoranthene; 0.5 µg/L for benzo(k)fluoranthene; 0.3 µg/L for dibenzo(a,h)anthracene; 0.2 µg/L for indeno(1,2,3-cd)pyrene; 250 µg/L for naphthalene; and 860 µg/L for dibenzofuran. A determination of the applicability of surface water criteria will be part of the OU2 remedy. EPA did not pursue aquifer restoration at this Site because: (1) after the SRB is implemented, additional groundwater treatment will be ineffective due to residual NAPL; (2) the 10 to 15 feet of anthropogenic fill and residual contamination from adjacent remediation sites overseen by the State of New Jersey are persistent sources of contamination that will produce groundwater concentrations in excess of drinking water standards; and (3) though NAPL in the Hudson River sediments will be addressed during an OU2 Remedial Action, complete source mitigation is unlikely. Because no remedy can offer the potential for full aquifer restoration, EPA has invoked an ARAR waiver for the groundwater at this Site due to technical impracticability (Figure 4).

Vapor Intrusion Monitoring

The remedy selected in the 2011 ROD included VI monitoring for three properties located on or near the Site. VI monitoring at the 115 River Road building started in 2006, the restaurant at 163 Old River Road in 2008 and the Medical Arts building at 103 River Road in 2009.

Potential VI pathways and receptors in the 115 River Road building were eliminated when the building was demolished in 2018 - 2019. Prior to demolition, laboratory analysis of subslab soil gas and indoor and outdoor air samples collected over 12 years of monitoring indicated that the VI pathway had not caused indoor air concentrations in exceedance of EPA's guidelines for exposure to indoor air in the occupied tenant spaces of 115 River Road. In addition, laboratory analysis of subslab soil gas and indoor and outdoor air samples collected at 103 River Road and 163 Old River Road over the past 11 years did not indicate that a VI source is present below those two buildings. Data have shown that concentrations of COCs in indoor air at all three buildings were consistent with ambient air in an urban environment. As a result of these findings, EPA approved termination of VI monitoring in February 2021.

Climate Change Assessment

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)

Soil	Yes	Yes	See Appendix D	Owner concurrence with implementation of engineering controls required by ROD. Require EPA consent prior to construction. Restrict future use of the properties. Require owner to monitor, maintain, and certify controls.	Deed Restrictions (December 2022)
Groundwater	Yes	Yes	Sitewide, See Appendix D	Provide notice that there is groundwater contamination in a localized area. Document boundaries of the restricted area and the compounds detected over the applicable cleanup criteria.	Classification Exception Area February 22, 2017

III. PROGRESS SINCE THE LAST REVIEW

This is the first FYR for the Quanta Resources Superfund Site.

IV. FIVE-YEAR REVIEW PROCESS

On Friday, August 6, 2021, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, Puerto Rico and the U.S. Virgin Islands, including the Quanta Resources Superfund Site. The announcement can be found at the following web address: https://www.epa.gov/superfund/R2-fiveyearreviews.

The EPA Community Involvement Coordinator (CIC) for the Site, Natalie Loney, arranged for a notice to be posted on the borough's website, as well as the EPA website, www.epa.gov/superfund/quanta-resources. This notice indicated that a FYR would be conducted at the Quanta Resources Superfund Site to ensure that the Site is protective of human health and the environment. Once the FYR is completed, the results will be made available at the following repository: Edgewater Free Public Library, 49 Hudson Avenue, Edgewater, NJ, 07020. In addition, the final report will be posted on the following website: www.epa.gov/superfund/quanta-resources.

Data Review

The data assessed in this review period is included in the source-area ISS completion reports for Block 93 and ISS East of River Road through May 2018, monthly reports of progress of OU1 RA activities, HCAA

Construction Completion and Data Transmittal Memorandum, NAPL recovery report, and VI monitoring results report.

The ISS completion reports summarize work performed in areas of OU1 on Block 93; Areas 3B, 3C, and 5A; portions of Areas 3A, 5B, 7A, and 8; and a pilot test of treatment of river sediment at the wharf and confirm that the ISS has met the performance criteria of unconfined compressive strength (UCS), permeability and leaching.

Information provided in the monthly progress reports support that the ISS completed since May 2018 has also met the performance criteria of UCS, permeability and leaching. An ISS completion report for work completed after May 2018 will be submitted to EPA in late fall 2021.

During the ongoing pilot testing in the HCAA, decreases in concentrations of dissolved arsenic in all injection wells ranged from 64.3 to 99.9 percent from July 2020 to February 2021. Beyond the injection points, decreases in arsenic concentrations between 31.4 and 96.8 percent were observed in five of the eight monitoring wells. Generally, the observed decreases in arsenic concentrations at the monitoring wells have been accompanied by decreases in sulfate and dissolved iron, suggesting that sulfate reduction and precipitation and co-precipitation of arsenic with metal iron sulfides may be an important mechanism in reducing arsenic concentrations. The three wells that did not show similar results are located in the fill material. One of these wells did have a decline in arsenic concentrations, but this reduction was accompanied by an increase in dissolved iron and a decrease in alkalinity. These results suggest that achieving the desired geochemical changes in the heterogeneous fill deposits, where high concentrations and high levels of natural organics are present, may prove more challenging than in the native sand. Future monitoring events will show whether arsenic concentrations in the fill decline and confirm the results in the native sand unit.

The major components of the NAPL recovery well system were installed in 2015 during implementation of the ISS. Since November 2015, 2,739 gallons of NAPL have been recovered. The remaining components of the well recovery system will be installed when the cap is constructed as part of the development construction or final restoration activities. When completed, the NAPL monitoring and recovery well system will consist of 11 sentry wells and four passive recovery wells (Figure 12). All four recovery wells have been installed and recovery is ongoing. Five of the sentry wells have been installed and are currently monitored. Six sentry wells will be installed during cap construction. Historical and more recent data demonstrate that the mobility of deep recoverable NAPL at OU1 remains stable or is decreasing:

- During the 2019 – 2020 monitoring period, measurable NAPL was not found in well MW-121B in NZ-3. NAPL was found in MW-121B during the August – October 2016 monitoring period, but the maximum thickness of NAPL was 1.26 feet, which is below the bottom of the well screen/top of the sump.
- During the 2019 – 2020 monitoring period, the maximum thickness of NAPL found in well TW-01R in NZ-3 was 1.20 feet, approximately four feet below the base of the well screen. The majority of NAPL measurements in TW-01R during this monitoring period were either trace, which is disconnected blobs of NAPL staining the probe's measuring tape without a uniform, measurable NAPL thickness; or less than one foot of NAPL.
- During system startup in 2015, recoverable NAPL was observed in RW4-2 in NZ-4. Because recoverable NAPL was found in RW4-2, a new sentry well MW-406A was installed downgradient of NZ-4. To date, no NAPL has been observed in MW-406A.

- No measurable thickness of NAPL has been found in well MW-126 in NZ-6 during its operation.

Indoor and outdoor air samples collected over 12 years of monitoring at 115 River Road indicated that the VI pathway had not caused indoor air concentrations to exceed EPA's guidelines for exposure to indoor air in the occupied spaces. Laboratory analysis of subslab soil gas and indoor and outdoor air samples collected at 103 River Road and 163 Old River Road over 11 years did not indicate that a VI source is present below those two buildings. Data have shown that concentrations of COCs in indoor air at all three buildings were consistent with ambient air in an urban environment.

During soil remediation an extensive air monitoring and sampling program was implemented to determine the potential impacts of remedial activities on air quality surrounding the Site. Daily real-time monitoring for dust and total VOCs was conducted using fixed and mobile air monitors around the perimeter of the Site. In addition, air samples were collected along the perimeter of the Site and in residential/retail developments north and south of the Site on days that soil solidification was occuring. Initially, air samples were collected over a 10-hour period but increased to a 24-hour period to provide more comprehensive air quality data. The data generated were compiled into running averages of naphthalene concentrations over the duration of the remedial action. The running averages were compared to the project-specific residential Risk Screening Level (RSL) for naphthalene of 3.13 $\mu g/m^3$, which is an average over the duration of the OU1 remedial action. The running averages for concentrations of naphthalene through March 13, 2021, at each of the 24-hour sample locations were 1.57 $\mu g/m^3$ at City Place, 1.32 $\mu g/m^3$ at iPark, 1.32 $\mu g/m^3$ at The Promenade, 1.35 $\mu g/m^3$ at The Metropolitan, and 0.76 $\mu g/m^3$ at Independence Harbor. These concentrations are well below the 3.13 $\mu g/m^3$ project-specific RSL for naphthalene.

FYR Site Inspection

The Site inspection was conducted on 8/6/2021. In attendance were Shane Nelson and Kathryn Flynn representing EPA; Helen Fahy, Fahy Associates, representing Honeywell; and Joseph Corrado representing Jacobs, the managing contractor for Honeywell at the Quanta Site. The purpose of the inspection was to assess the progress and protectiveness of the remedy.

Honeywell is in the process of installing the remaining section of the temporary cap on one small area of ISS in front of the Pier 115 Building. The temporary cap over the rest of the ISS areas on the Site was found to be intact and in good condition. The bulkhead wall has been maintained and no safety issues were identified. The Site fence and gates are well maintained and in good condition. No evidence of trespassing or other unauthorized access was observed and nothing was noted on the Site or adjacent properties that might change exposure scenarios.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

The remedy has not yet been fully implemented. The in situ solidification/stabilization (ISS) portion of the OU1 remedy to address source areas has been implemented throughout most of the Site, except for the areas under River Road. Areas of completed ISS have met the established performance criteria for UCS, permeability, and leaching. EPA is reviewing Honeywell's proposal to use alternative ISS technologies to address the remaining source area contamination under portions of River Road and anticipates the work to be completed in late 2022. Other aspects of the selected OU1 remedy have not yet been implemented including the selected remedies to address soil outside of the source areas

(capping) and groundwater (SRB). Institutional controls have been implemented or are in the process of being implemented at all properties and a CEA is in place to prevent unacceptable use of the groundwater within the TI zone.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The exposure assumptions and toxicity values are still valid. In addition, the cleanup values and RAOs remain valid. A majority of the soil remedy has been completed which has eliminated almost all of the incidental ingestion and direct contact exposure pathways to contaminated surface and subsurface soils and tar boils. The only remaining soil/tar boil contamination is beneath River Road, where the roadway interrupts the incidental ingestion and direct contact pathways until the remedy can be completed. Site groundwater is not used for drinking water and the CEA precludes its use as drinking water in the future. As previously noted, after 12 years of monitoring, EPA determined that the vapor intrusion pathway is incomplete.

RAOs associated with ecological receptors include controlling principal threat wastes and to prevent or minimize potential erosion of contaminated soils off site or to the Hudson River at concentrations posing unacceptable risk remain valid.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: OU1	*Protectiveness Determination:* Will be Protective
Protectiveness Statement: The OU1 remedy is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have addressed exposure pathways that could result in unacceptable risks in the areas that have been remediated.	

VIII. NEXT REVIEW

The next FYR report for the Quanta Resources Superfund Site is required five years from the completion date of this review.

APPENDIX A – Reference List

Document Title, Author	Submittal Date
Remedial Investigation Report Quanta Resources Superfund Site Operable Unit 1; CH2MHill	2008
Technical Impracticability Evaluation, Operable Unit 1, Quanta Resources Superfund Site, Edgewater, N.J.; CH2MHill	2010
Record of Decision, Operable Unit 1, Quanta Resources Corporation Site, Edgewater Borough, Bergen County, New Jersey; EPA	2011
Remedial Design Report, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, NJ; CH2M HILL/Honeywell	2016
Remedial Action Work Plan, Quanta Resources Corporation Superfund Site, Operable Unit 1, Edgewater, NJ; CH2M HILL/Honeywell	2016
ISS Completion Package for Block 93; CH2M/Honeywell	2018
ISS Completion Package, Quanta Resources Corporation Superfund Site, East of River Road through May 2018; Jacobs/Honeywell	2019
Quanta Resources Corporation Superfund Site Operable Unit 1 (OU1), 103 River Road Vapor Intrusion 2018/2019 Results Report; Jacobs/Honeywell	2019
2020 Annual Nonaqueous Phase Liquid Recovery Report, Quanta Resources Corporation Superfund Site, Edgewater, New Jersey; Jacobs/Honeywell	2020
Construction Completion and Data Transmittal Memorandum, OU1 HCAA, Quanta Resources Corporation Superfund Site, Edgewater, New Jersey; Jacobs/Honeywell	2021
Quanta Resources Corporation Superfund Site, Operable Unit 1 (OU1), Edgewater, New Jersey, [Monthly] Progress Reports	2019 - 2021

APPENDIX B – Site Chronology

Event	Date(s)
Hudson River Chemical Works (HRCW) opens a sulfuric acid plant adjacent to and north of the property that will be the site for the Barrett Manufacturing Company (Barrett).	1862
Barrett opens a coal tar processing and roofing tar manufacturing business on the property.	1876
HRCW renamed and operates as the Hudson River Chemical and Dyewood Co., then the General Chemical Company.	1900 - 1967
Barrett becomes part of Allied Chemical and Dye Corporation.	1920
Allied Chemical and Dye Corporation ends operations at the Site.	1971
Allied Chemical's remaining land holdings in Edgewater, NJ, are purchased and leased to several oil recycling businesses, the last of which was Quanta Resources, Inc.	1974 - 1981
NJDEP issues administrative order directing Quanta Resources to cease operations, prevent spills, and start removing surface contamination.	1981
Quanta Resources ceases operations after filing for bankruptcy.	1982
NJDEP issues administrative order directing owners to stabilize the Site and address on-site contamination.	1983
EPA becomes lead agency for the Site and initiates a federally funded Removal Action.	1984
EPA issues a series of Administrative Orders on Consent (AOCs) to PRPs to perform or fund additional removal actions and reimburse EPA for past costs.	1985
EPA oversees several Removal Actions to stabilize and dismantle the Site.	1984 - 1988
Preliminary Site assessments/inspections.	1981 and 1985
EPA discovers coal tar in the subsurface soils under the 115 River Road building and in the Hudson River.	1991
River Road constructed over portions of site contamination.	1995

EPA and AlliedSignal (now Honeywell) enter into an AOC to secure and investigate the Site.	1996
A second AOC is signed designating steps to investigate and address coal tar sheens in the mudflats of the Hudson River.	1998
High Concentration Arsenic Area discovered.	2000
Quanta Site placed on the National Priority List.	2002
PRP Remedial Investigation/Feasibility Study.	2003
Remedial Design.	2016
Source area Remedial Action (ISS) starts.	2017
ISS paused to evaluate technologies to control naphthalene emissions.	2018
115 River Road building demolished.	2018
Source area ISS resumes	2019
Pilot for ISS treatment of High Concentration Arsenic Area starts.	2020
EPA approves ISS completion packages for Block 93 and East of River Road through May 2018.	2021
Source area ISS completed, except for areas under River Road.	2021

APPENDIX C – Figures

Figure 1 – Site location

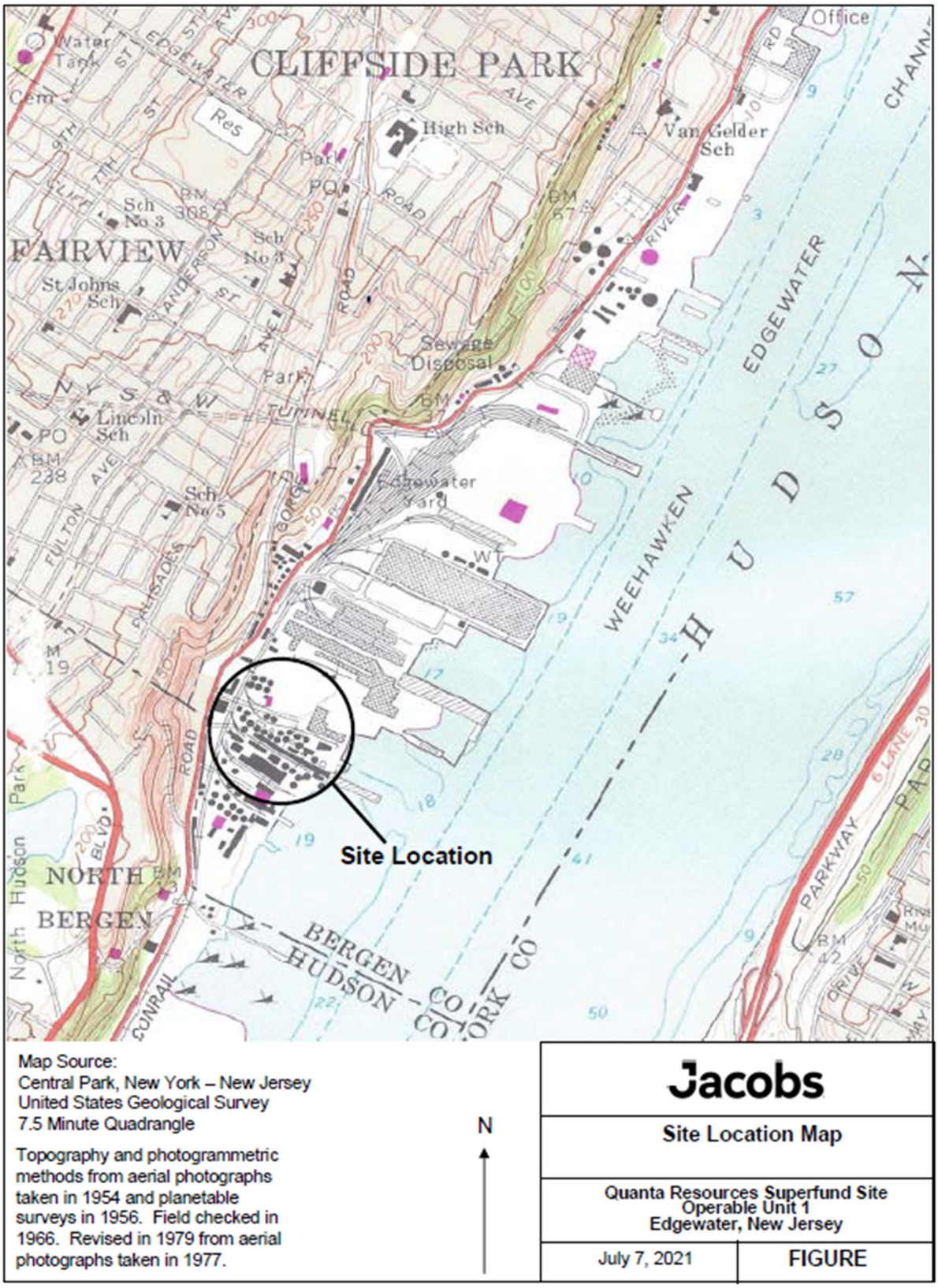


Figure 2 – Extent of OU1 and Source Principal Threat Waste and NAPL Zones

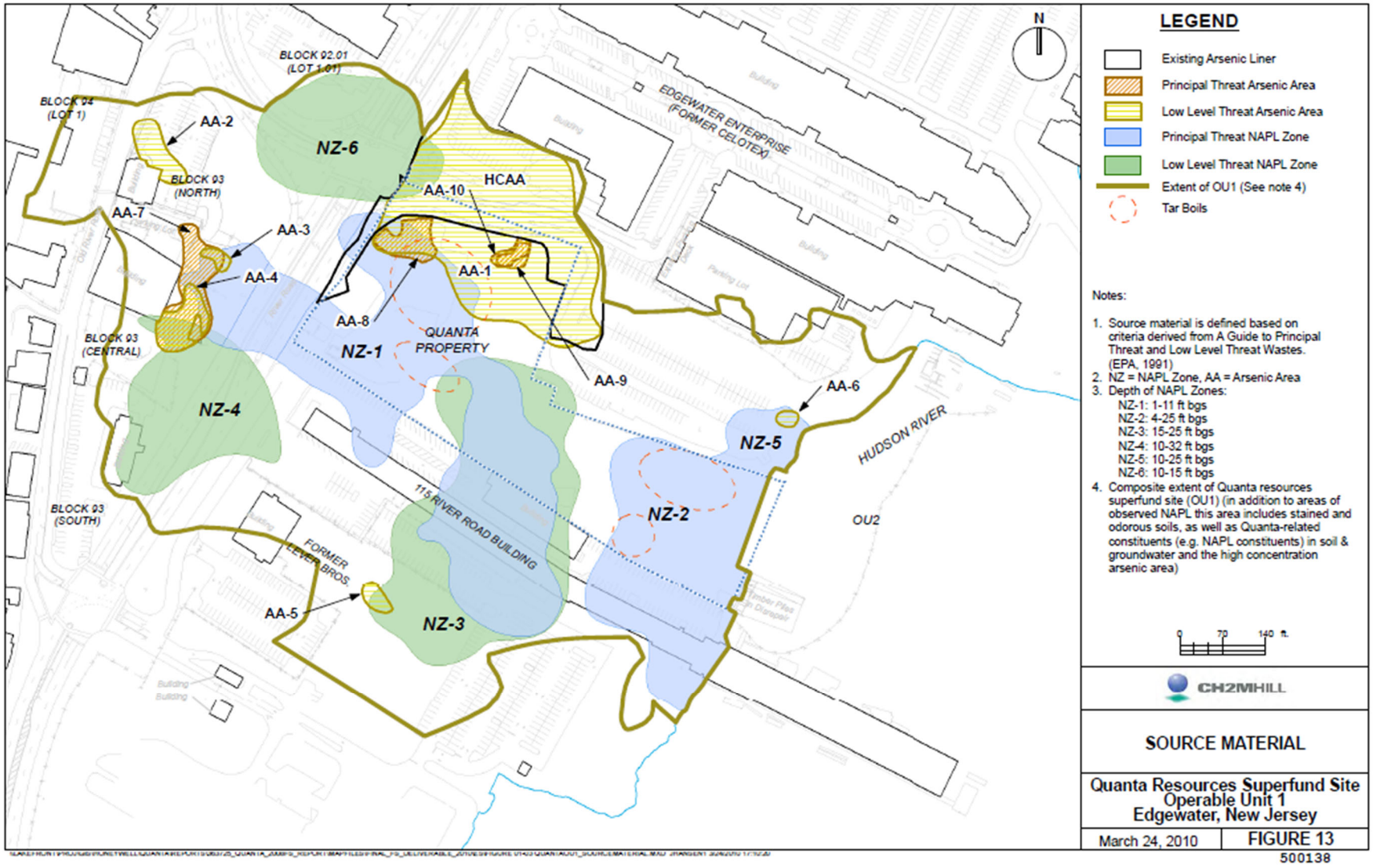


Figure 3 - Property boundaries and tax map

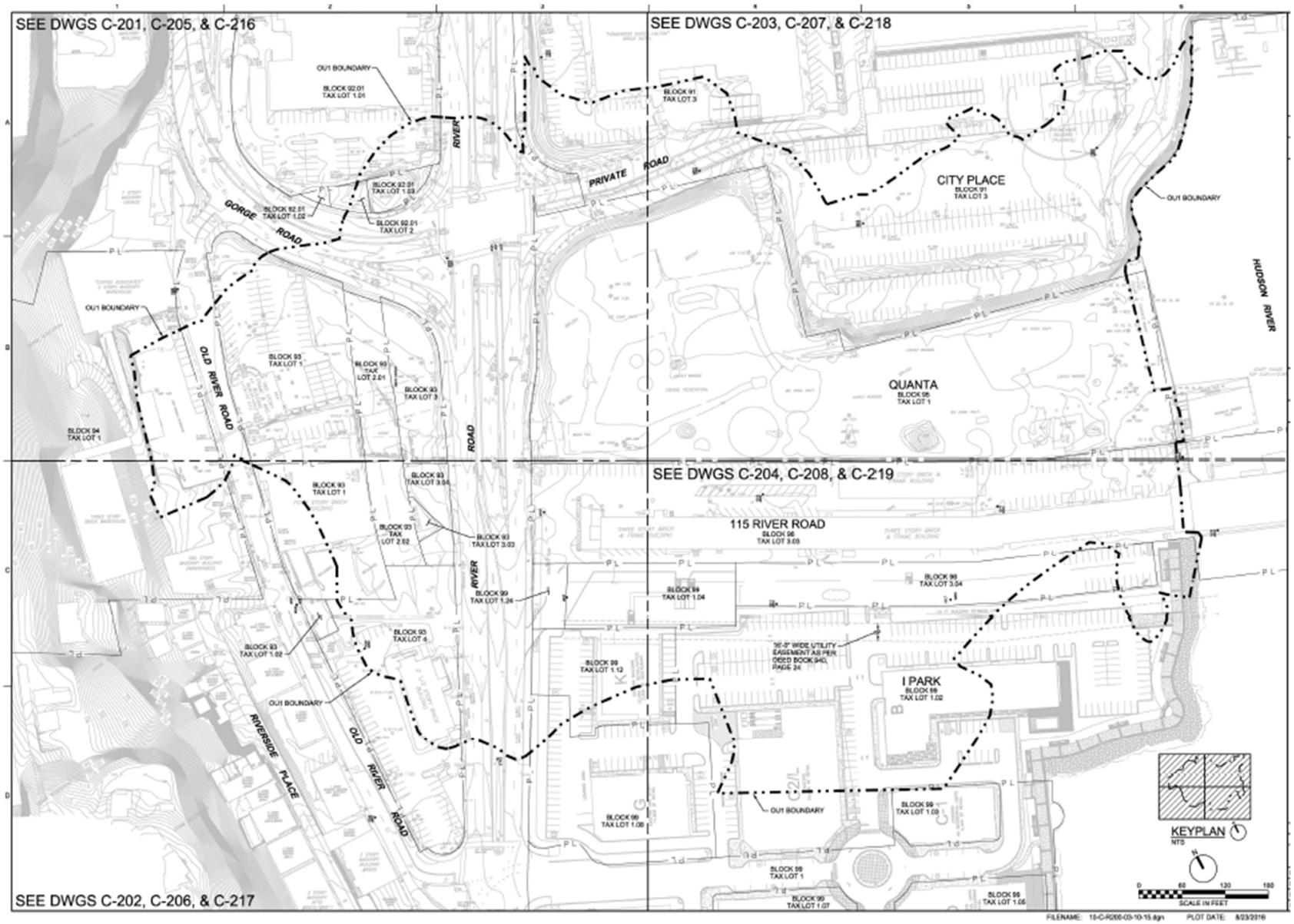


Figure 4 – Technical Impracticability (TI) Boundary for Groundwater

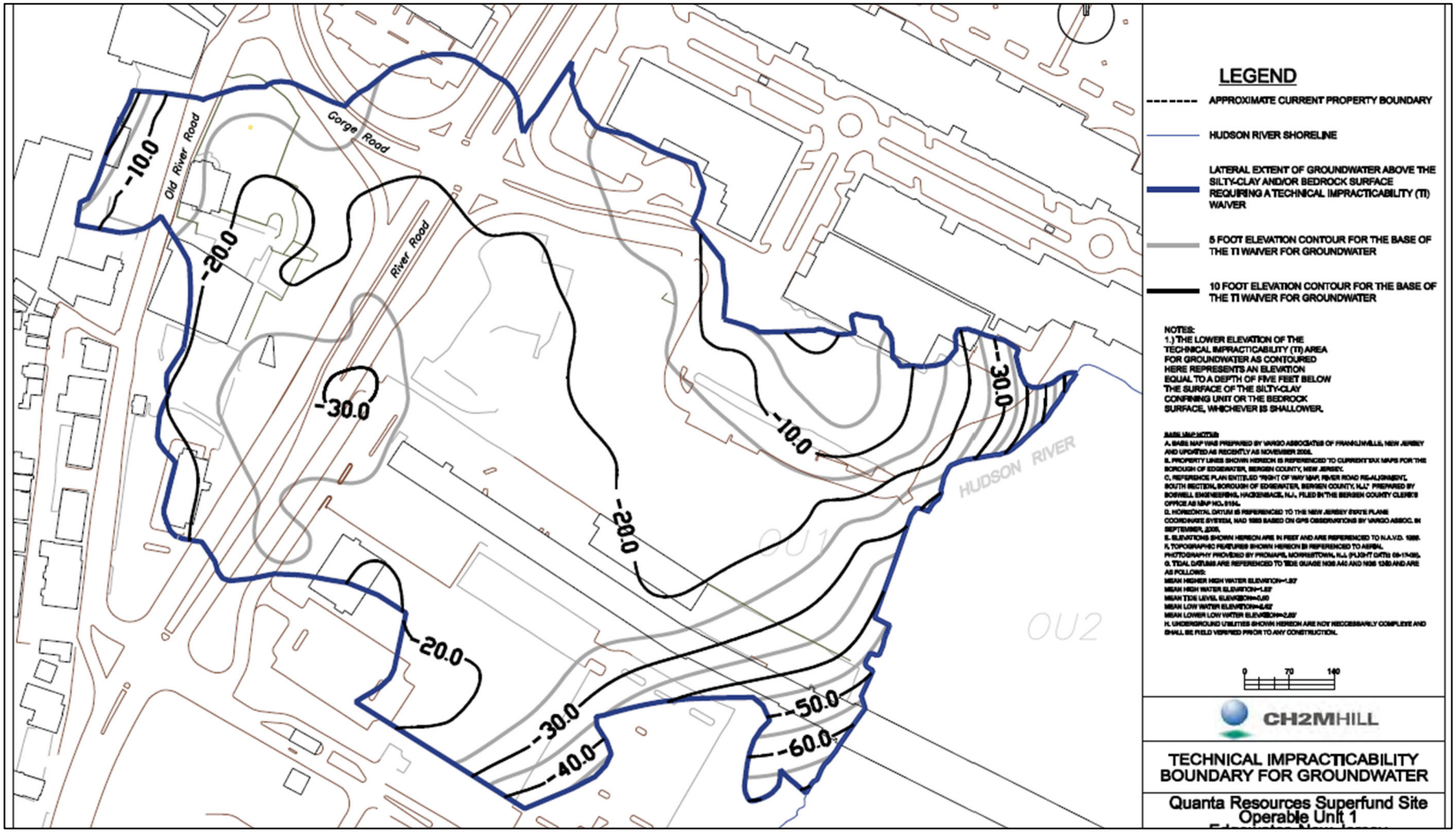


Figure 5 – Areas under River Road requiring ISS

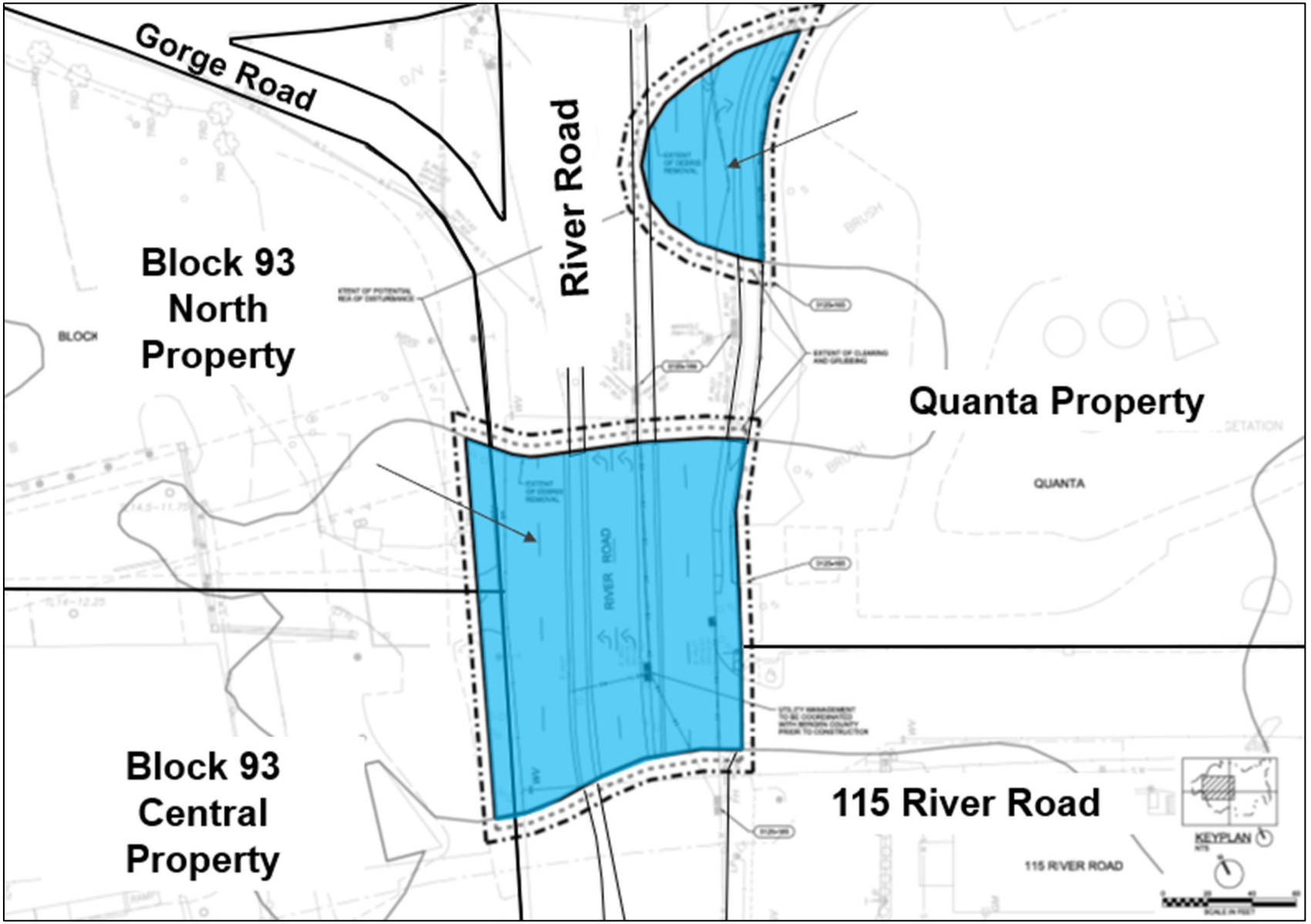


Figure 6 – High Concentration Arsenic Area

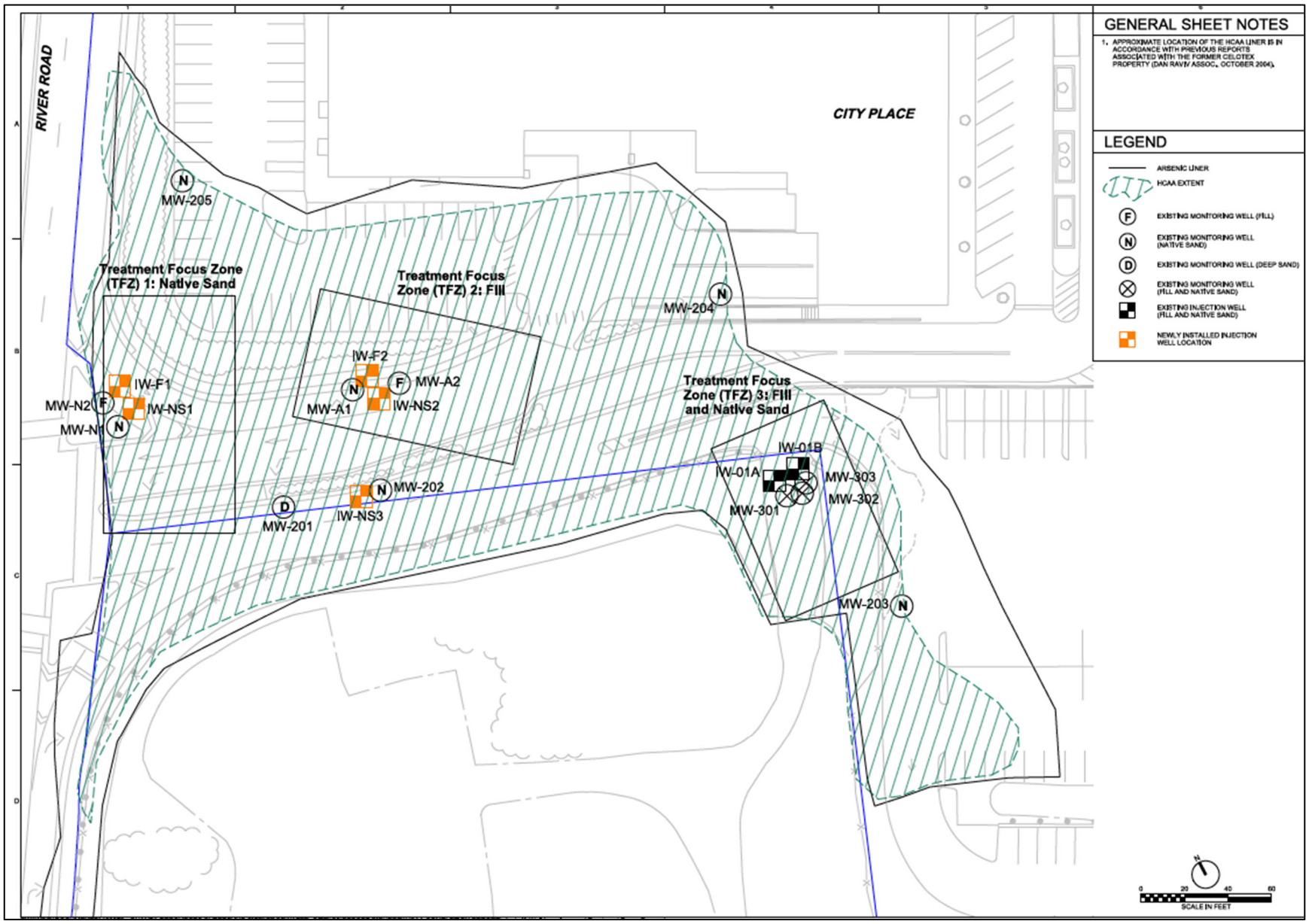


Figure 7 – Areas of ISS at Blocks 93 North and Central

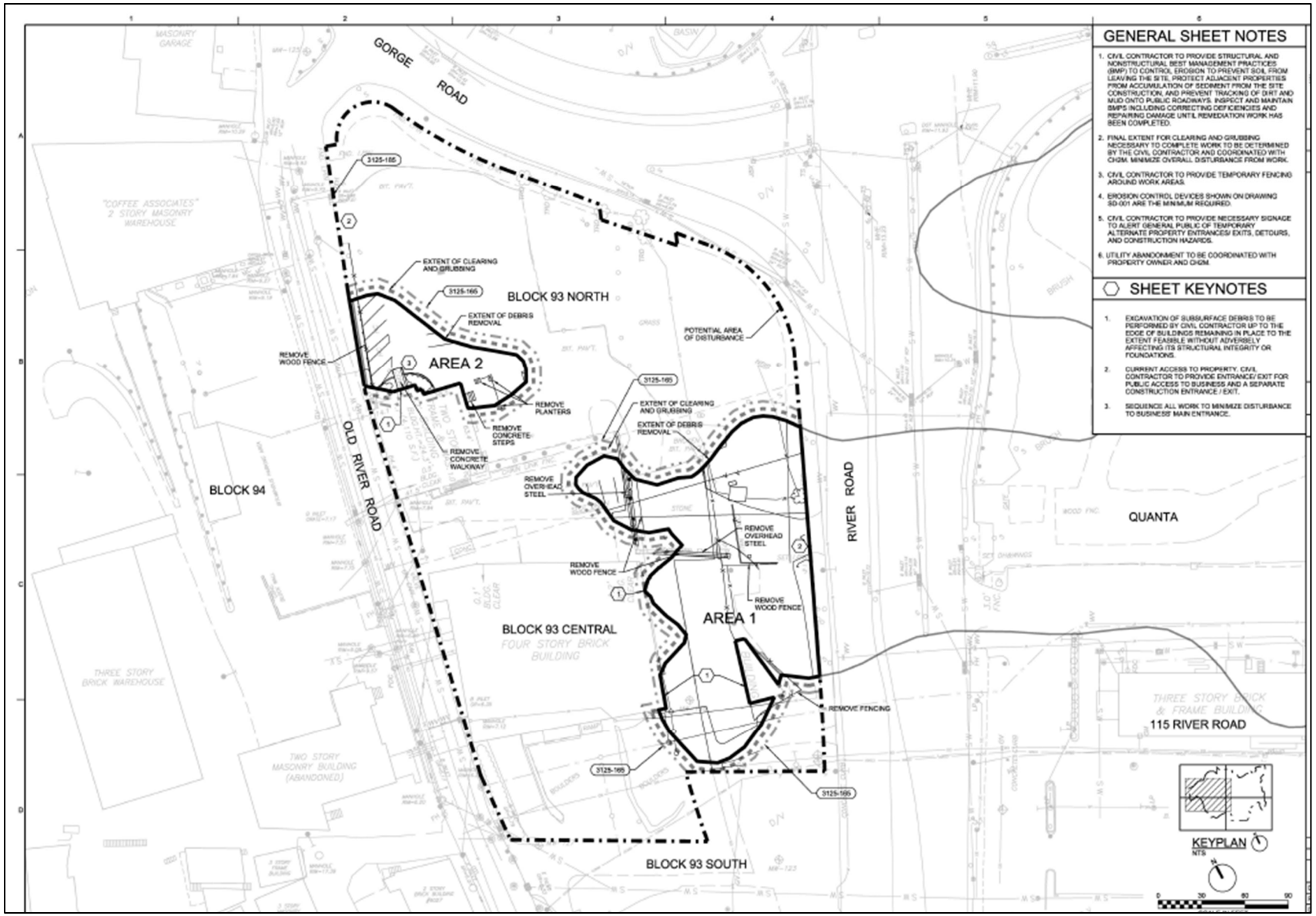


Figure 8 – Areas of completed ISS at the Quanta Site

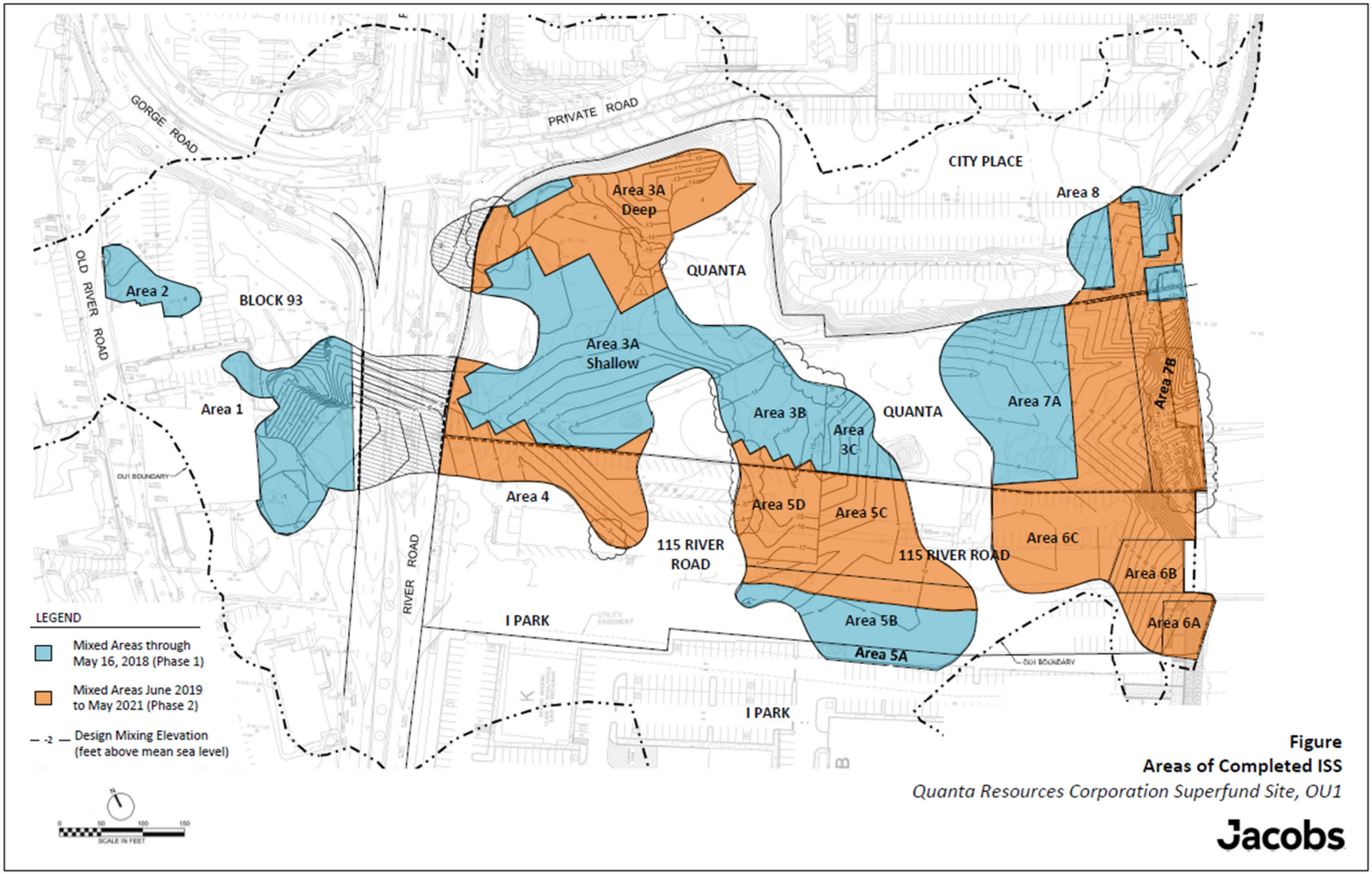


Figure 9 - NAPL Recovery Network

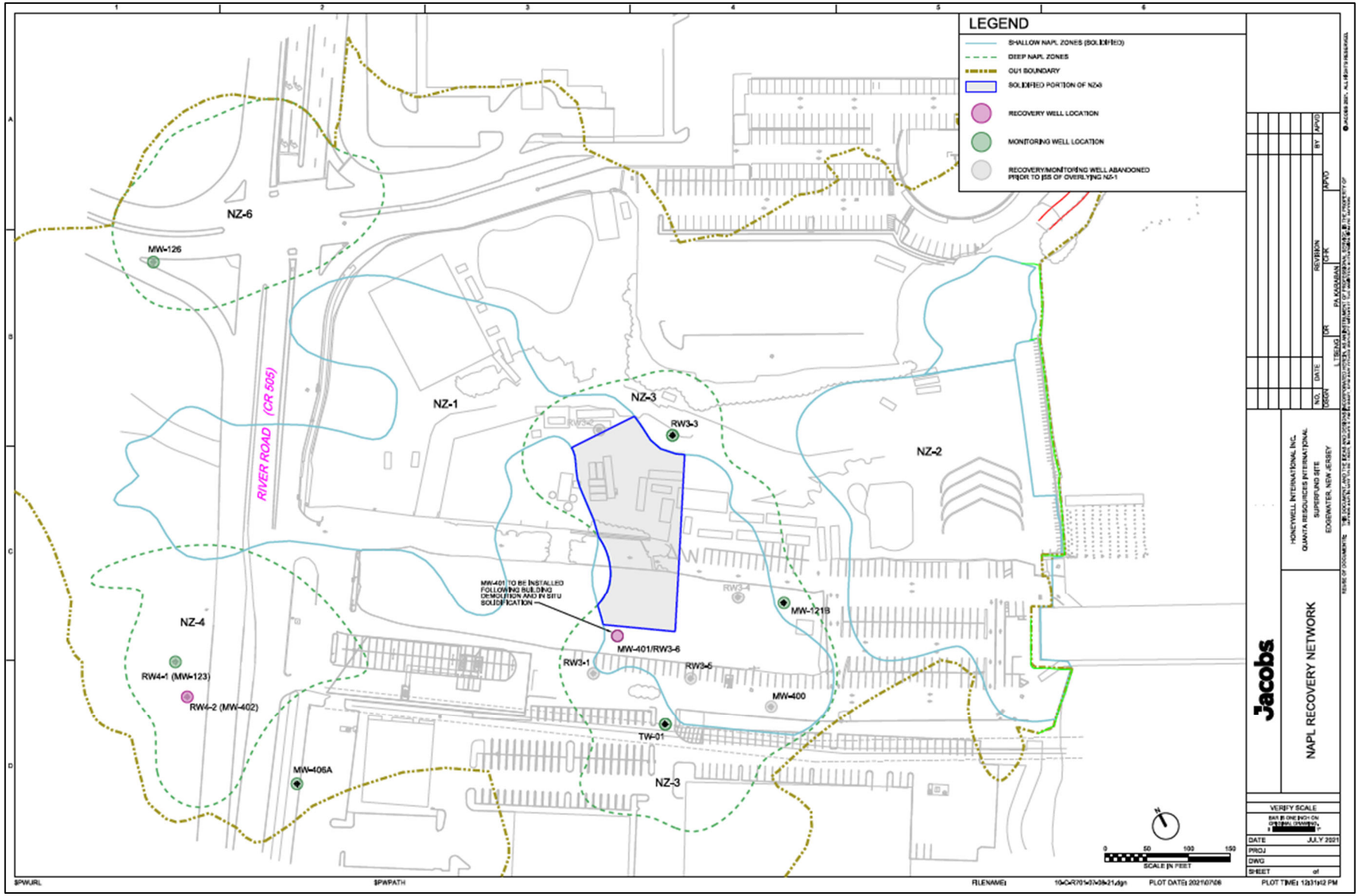
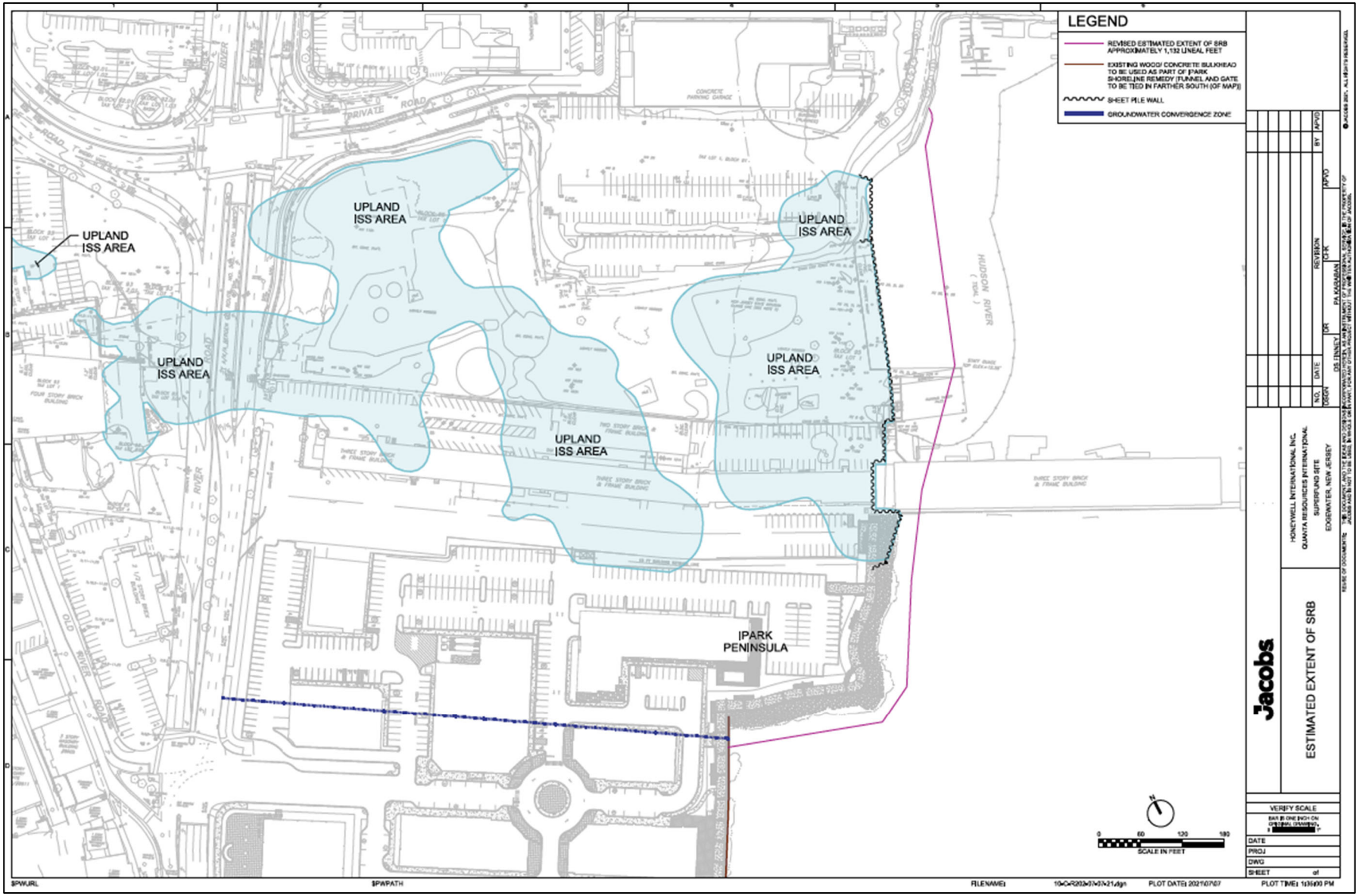


Figure 10 – Proposed location of Subaqueous Reactive Barrier



APPENDIX D – Property Ownership and Institutional Controls Table

Parcel within or Partially within OU1 (per 2019 Edgewater Tax Map)	**Owner Listed in Bergen County Database** (**http://bcgisweb.co.bergen.nj.us/parcelviewer** accessed May 27, 2021)	**Address and/or Common Name(s) of Parcel**	**Institutional Control(s)**		
			Recorded Deed Restriction Needs Update following Remedial Action	**Deed Restriction to Be Recorded following Remedial Action**	**Included in Groundwater CEA**
Block 91, Lot 1	VARIOUS	City Place (including driveway)		X	X
Block 93 Lot 1.01	MB EDGEWATER LLC C/O MAY BAO LTD	143 Old River Road		X	X
Block 93 Lot 2.02					X
Block 93 Lot 3.03					X
Block 93, Lot 3.04	METROPOLITAN CONSOM LLC	108 River Rd	X		X
Block 93, Lot 4		Medical Arts Bldg. or 125 Old River Rd		X	X
Block 94, Lot 1	COFFEE ASSOCIATES, LLC	Coffee Associates		X	X
Block 93, Lot 1	THREE Y LLC	Block 93 North	X		X
Block 93, Lot 2.01					X
Block 93, Lot 3	66 KING AVENUE LLC % THOMAS HEAGNEY				X
Block 95, Lot 1	HUDSON RIVER ASSOC LLC	Quanta property	X		X
Block 96 Lot 3.03*		115 River Road			X
Block 96 Lot 3.04*	115 RIVER ROAD, LLC	115 River Road south parking lot and Pier Building		X	X
Block 99 Lot 1**	EAGLE ROCK GROUP LLC% SCOTT HEAGNEY	Small parcel between 115 River Road south parking lot and River Road			X
Block 99 Lot 1.02	ONE MAIN ST EDGEWATER LLC	45 River Road: Home Goods		X	X
Block 99 Lot 1.04	NORTH BUILDING EDGEWATER I, LLC	45 River Road: Building B, The Oyster			X
Block 99 Lot 1.06	iPARK EDGEWATER LLC	45 River Road: private streets			X
Block 99 Lot 1.08	H.K. EDGEWATER LLC%CVS #8924-01	65 River Road: CVS			X

Parcel within or Partially within OU1 (per 2019 Edgewater Tax Map)	**Owner Listed in Bergen County Database** (**http://bcgisweb.co.bergen.nj.us/parcelviewer** accessed May 27, 2021)	**Address and/or Common Name(s) of Parcel**	**Institutional Control(s)**		
			Recorded Deed Restriction Needs Update following Remedial Action	**Deed Restriction to Be Recorded following Remedial Action**	**Included in Groundwater CEA**
Block 99, Lot 1.12	ONE MAIN ST EDGEWATER LLC	75 River Road			X
Block 92.01, Lot 1.03	EDGEWATER RESIDENTIAL COMM III, LLC	The Metropolitan	N/A; groundwater only		X
Block 92.01, Lot 2					X
Block 92.01, Lot 1.01					X
New and Old River Road, Gorge Road, intersection and right-of-way	Parcels not listed	New and Old River Road, Gorge Road, intersection and right-of-way		Notice in Lieu of Deed to be Recorded	X

*Lots comprising 115 River Road property and Pier Building to be verified by surveyor prior to deed restriction preparation

**Lot labeled as Block 99 Lot 1.24 in Bergen County parcel viewer

APPENDIX E – Components of the OU1 Remedy

Treatment of Source Areas with Solidification/Stabilization (S/S) (Arsenic and Coal Tar NAPL)

On-site solidification/stabilization of an estimated 150,000 cubic yards of contaminated soil containing arsenic and NAPL, primarily by in-situ solidification/stabilization (ISS).

Remedial Components:

- The following Source Areas will be subject to treatment:
    - For Coal Tar NAPL
        - All of NZ-1, including areas beneath River Road and beneath the buildings at 115 River Road;
        - All of NZ-2 and NZ-5;
        - Portions of NZ-3 contiguous with (adjacent to or separated by no more than five feet from) NZ-1 or NZ-2 and NZ-5.
    - For Arsenic:
        - All of the High Concentration Arsenic Area;
        - Other shallow arsenic hotspots (within the first four feet of ground surface) exceeding 390 ppm and deeper hotspots exceeding 1,000 ppm total arsenic.
- Free-phase NAPL present at NZ-1, NZ-2/5, portions of NZ-3 and tar boils, and arsenic hotspots that constitute a principal threat will be solidified/stabilized and the treated soils will then remain on site or be excavated for disposal off site. The majority of the site will be treated with in-situ solidification/stabilization (ISS).
- Prior to in-situ treatment, the area subject to ISS will be cleared of vegetation and excavated for surface and subsurface debris removal not compatible with ISS treatment (e.g., large boulders, tank pads, conduits, and concrete). These materials will be transported and disposed of off-site.
- EPA expects that portland cement-based solidification will be the primary ISS method for the site. EPA will require that material solidified through this method satisfies the following performance measures: minimum unconfined compressive strength (UCS) of 40 pounds per square inch (40 PSI); maximum permeability of 1x10-6 centimeters per second; and leachability testing using EPA's Synthetic Precipitation Leaching Procedure, the ANSI/ANS 16.1 method, or other appropriate methods. EPA will develop leaching levels and select a specific analysis in the design phase pending results of the treatability studies.
- During Remedial Design, specific leaching levels for site related constituents will be developed. EPA expects to achieve a 90 percent or greater reduction in leachability for the majority of the site constituents (Arsenic, Benzene, Toluene, Ethylbenzene, Total Xylenes, Naphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene); however, this remediation goal is not applicable to all constituents. EPA will consider the following factors when evaluating leachability as a criterion for remedial performance:
    - during remedial design, representative baseline concentrations of site constituents will be established, against which performance will be measured;
    - a percent reduction criteria is not appropriate for constituents with low baseline concentrations;
    - the ability to consistently achieve the leaching remediation goal for certain low molecular weight and high vapor pressure organic constituents may be limited, whereas reduction in permeability for the solidified soil matrix can still demonstrate acceptable reduction in mobility;

    - broader contaminant groupings for benchmarking leachability reduction, such as total hydrocarbons, may more appropriately reflect a percentage-reduction based remediation goal for total NAPL, rather than specific constituents within the NAPL;
    - given the heterogeneity of the NAPL, metals and site geology, no single leaching test result can be considered representative, and statistical methodology and multiple tests will be needed to assess the variability of leaching results; and the effectiveness of leachability improvement additives needs to be balanced against the primary performance criteria of the solidified mass (i.e., unconfined compressive strength and permeability).
- Treatability testing will be conducted prior to full-scale implementation to optimize the ISS mixes and demonstrate a correlation between leachability and UCS and permeability performance criteria. Once this correlation is established, UCS and permeability will be used as the primary performance measurement methods and to demonstrate that S/S meets the remediation goals during implementation. Leachability testing will be performed periodically during the Remedial Action to maintain the integrity of the remedy. Areas that fail to meet the performance criteria will be excavated and disposed of off-site.
- ISS of NAPL in NZ-2 and NZ-5 requires treatment behind and around the bulkhead, essentially encasing it in a solidified matrix. This work will be performed in a sequenced or alternating pattern to protect bulkhead tie backs and prevent shoreline instability during cement curing. Because in-situ auger mixing cannot be used around the bulkhead, resulting in a less homogeneous solidified matrix, a vertical barrier, consisting of either a sheet pile cut-off wall or a slurry wall is needed as an additional barrier between the solidified NAPL and the Hudson River and sediments. Isolating the site from the shoreline by driving sheet piles on the river side of the bulkhead is also required to prevent loss of ISS materials into the river prior to cement curing.
- Away from the bulkhead area, augers or other mixing equipment will be advanced to the target depths below ground surface, based on NAPL zone characterization. Upon target depths being reached, reagents will be injected and mixed within the soil column to treat the material between the ground surface and the target depth.
- Certain areas of the site requiring solidification or stabilization treatment are isolated from the bulk of the site requiring treatment. During remedial design, EPA may conclude that the long-term management of the site will be improved by consolidating these areas, primarily on the Quanta property. Thus, portions of the principal-threat NAPL and arsenic on the Block 93 will be solidified/stabilized either in situ or ex situ on the main part of the site.
- Principal-threat NAPL (portions of NZ-1) under River Road will be addressed up to the right-of-way to the extent practicable independent of Bergen County, and then further response actions would be coordinated with Bergen County, to be performed in collaboration with the County when future repairs or maintenance of the River Road are called for. Thus, ISS will be performed under River Road, but the work will be performed in stages and in such a way to minimize traffic congestion on River Road, to the extent practicable.
- Arsenic contamination in the HCAA will also be treated with ISS or, if ISS fails to meet the performance measures established for ISS, as a contingency, a vertical cutoff wall with extraction wells for hydraulic containment of the HCAA will be installed. Treating HCAA soils with ISS requires a different approach from other places on the site due to the active roadway to City Place. Horizontal drilling from the Quanta property would be employed to inject stabilization amendments into the soils to stabilize and render insoluble the arsenic and other metals in the HCAA. Vertical drilling may also be necessary to achieve the performance measures for ISS.

- During Remedial Design, stabilization technologies will be subjected to further site-specific testing to simulate existing and future site conditions, to demonstrate that HCAA stabilization can be shown to irreversibly mitigate the mobility and toxicity of the arsenic. Furthermore, arsenic soil contamination that presents an acute threat in the event of direct contact exposure as defined by New Jersey's Immediate Environmental Concern (IEC) Guidance 6, will be treated in such a way that it reduces the toxicity to below non-acute levels, as defined by the IEC Guidance.
- Different ISS methods, including stabilization of the HCAA, will need to meet similar leaching performance criterion to portland cement-based solidification set by EPA during remedial design.
- The Selected Remedy requires excavation and transportation of contaminated soil and debris not suitable for on-site solidification/stabilization treatment to an off-site facility for disposal, with treatment as necessary prior to disposal.
- If, during Remedial Design or Remedial Action, components of free-phase NAPL or arsenic-contaminated soil are shown to be incompatible with solidification/stabilization, these wastes will be excavated for transportation and off-site disposal, with treatment as necessary to meet land disposal requirements. EPA has concluded that hard tars/tar boils are not suitable for S/S and need to be excavated and removed from the site for disposal.
- EPA anticipates redevelopment of the site with construction that requires supporting piles or columns that need to be placed through solidified material. Construction pile installation can only take place in such a way that it does not compromise the long-term protectiveness of the remedy, does not exacerbate or spread residual contamination at the site, and requires prior review and approval from the Agency. With the exception of construction piles, EPA expects that subsequent site uses will have no contact with solidified/stabilized material.

Deep NAPL

Treatment of a portion of the Deep NAPL through ISS, passive NAPL collection for other areas of the Deep NAPL, and long-term monitoring.

Remedial Components:

- As described under Treatment of Source Areas, portions of NZ-3 that are at close proximity to NZ-1 and that are accessible to ISS (in areas not obstructed by surface impediments and NZ-1 and NZ-3 are five feet or less vertical distance from each other), ISS auger mixing will be used to treat these areas. With the removal of the 115 River Road buildings in the final remedy, EPA expects that this will solidify the majority of the mass of NZ-3.
- For remaining areas of NZ-3 and NZ-4, free-phase NAPL collection from recovery wells or recovery trenches will be performed, to the extent practicable. For purposes of the FS, the NAPL recovery system was assumed to be 10 vertical recovery wells installed at locations where free-phase NAPL has been identified. Recovered NAPL will be collected and stored. The remediation goal for NAPL extraction will be to reach a point at which no measurable free-phase NAPL collects in the well or trench; however, over time, NAPL collection systems can stop producing extractable quantities of NAPL, yet there can still be measurable quantities of NAPL in the vicinity of the collection system, so an alternative remedial endpoint may ultimately be necessary. This remediation goal will be refined during remedial design testing. In addition, methods for enhancing the performance of a NAPL recovery system will be evaluated during remedial design, to determine whether the use of heating, surfactants, or other enhancements would improve the performance of the collection network. The goal of the enhancement methods

is to achieve significant mass reduction over a shorter period of time than would be expected from the extraction tests performed during the RI/FS.

- NAPL collection may also be considered as a preliminary treatment for areas of the NAPL zones identified for ISS, if removing extractable NAPL aids in the long-term effectiveness of the ISS remedy.
- The FS assumed that NAPL collection can take place in the deep NAPL independent of ISS (e.g., before, during or after ISS implementation). Testing during Remedial Design will determine an appropriate implementation sequence, to assure that ISS is not an impediment to NAPL collection.
- Off-site disposal options for collected NAPL may include recycling or treatment as necessary prior to land disposal. For cost-estimating purposes, off-site disposal of NAPL was assumed to be via recycling. Testing will be required to determine if this waste stream constitutes a hazardous waste.
- No free-phase NAPL collection is anticipated for NZ-6, because no free-phase liquids have been observed that could be collected. If monitoring of NZ-6 identifies free-phase NAPL in the future, EPA will reevaluate the need for adding this deep NAPL remedy component in NZ-6.
- Long-term monitoring will be required for all the Deep NAPL.

Interim Action: 115 River Road Buildings

Installation of a vapor mitigation system and basement sealing at 115 River Road; construction of a temporary barrier wall at 115 River Road along the shoreline to isolate untreated free-phase NAPL from the Hudson River and sediments.

Remedial Components:

- A barrier wall, constructed through jet grouting or installing steel sheeting at the shoreline, to isolate the untreated NAPL and constituents from the Hudson River and sediments.
- Solidification/stabilization will be implemented close to the building foundations to leave as little untreated source material as possible without compromising the structural integrity of the buildings. The results of a stability analysis during Remedial Design will determine the distance required to be maintained between the treatment zone and the existing buildings.
- A vapor mitigation system, such as a sub-slab depressurization system, and other building modifications will be implemented to ensure that the buildings remain protective for continued occupancy. This may include the installation of a sump system, if needed to maintain the vapor mitigation system, prevent NAPL infiltration, or otherwise maintain the protectiveness of the remedy. New construction or improvements to the existing buildings will need to be assessed for their effect on the protectiveness of the remedy, and EPA will have a long-term oversight function at these buildings.
- As part of the interim action for 115 River Road, the day care center at 115 River Road will be relocated prior to implementation of the Remedial Action.
- Relocation of occupants in 115 River Road during ISS is not anticipated for health and safety reasons; however, during remedy implementation, the performing party may conclude that temporary relocation of certain tenants in 115 River Road could result in a quicker, more efficient implementation of the remedy.
- Continued vapor intrusion monitoring will be performed for 115 River Road buildings as part of the interim action

Final Action: 115 River Road Buildings

When 115 River Road is demolished or redeveloped in the future, ISS for the untreated free-phase NAPL remaining under the buildings.

Residual Soils

Capping of contaminated soils remaining on site at concentrations greater than the Remediation Goals for residential direct contact with a multilayer cap as approved by EPA.

Remedial Components:

- Hardscape (*i.e.*, that part of the site consisting of structures, parking areas and walkways, made with hard materials) used for capping.

Groundwater

Installation of a subaqueous reactive barrier (SRB) in Hudson River sediments, coordinated with a future OU2 remedy.

Remedial Components:

- The action will treat contaminated groundwater as it flows through a horizontally placed SRB before being discharged to the surface water of the Hudson River. Implementation of Alternative G3 will take place in Hudson River sediments, coordinated with a remedial action to address contaminated sediments. It will not be implemented until after selection of the OU2 remedy;
- The SRB would consist of a permeable subaqueous reactive mat to treat aqueous-phase contamination in groundwater before it reaches the shallow sediments and surface water;
- During Remedial Design, a groundwater model will be developed to predict the expected effectiveness and operation and maintenance (O&M) requirements of the SRB, along with bench-scale testing to assess the sorptive capacity of the core material. The final design of the SRB, including the size and material, would be highly dependent on the upwelling zones and the pore water concentrations, along with other requirements of an SRB that may be part of the OU2 remedy. The SRB can be thought of as a stand-alone action installed independent of the OU2 sediment remedy; however, a concurrent sediment action that might also use the SRB is likely; and
- The SRB may need to be secured in place by a layer of sand or sand-gravel mix, along with an armor layer to protect the SRB from hydraulic scour conditions due to storm surge flows, if deemed necessary based on the results of the OU2 sediment stability study. The SRB will be covered with a biotic sediment layer to support the biologically active zone of shallow Hudson River sediments.

Operation and Maintenance of the Remedy, Monitoring, and Institutional Controls

Operation and maintenance for the active components of the remedy, such as the Deep NAPL collection system and vapor intrusion systems, monitoring of the site over the long term to assure the protectiveness of the remedy, and institutional controls; implementation of a long-term sampling and analysis program to monitor the contamination at the site in order to assess groundwater migration, and the effectiveness of the remedy over time.

Remedial Components:

- The Selected Remedy requires engineering controls that would mitigate the potential for exposure through vapor intrusion for future construction, along with institutional controls to prevent exposures to soil or groundwater;

- In addition to the Deep NAPL collection system, in the event that HCAA stabilization cannot be demonstrated and hydraulic containment is implemented for the HCAA, this alternative will require the long-term O&M of the groundwater treatment system installed for the hydraulic containment of the HCAA;
- An OU1 monitoring plan will confirm the continued effectiveness of the remedy to protect human health and the environment, including the Hudson River. This monitoring plan will include ISS-treated areas, the deep NAPL and, in particular, the NAPL zones isolated beneath the 115 River Road buildings as part of the interim remedy;
- The SRB will require monitoring to verify that site-related groundwater contamination is being captured prior to discharge to surface water, and to predict when replacement would be required;
- Continued vapor intrusion monitoring will be performed for 115 River Road buildings and other affected properties.
- Additional vapor intrusion mitigation systems at the other properties would be implemented as indicated by the monitoring data;
- Institutional controls such as a deed notice or restrictive covenant on affected properties will be required to aid in the long-term protectiveness of the remedy;
- Institutional controls, including a Classification Exception Area, to restrict the installation of wells and the use of groundwater in an area of groundwater contamination will be required; and
- Implementation of a long-term groundwater sampling and analysis program to monitor the nature and extent of groundwater contamination at the site, in order to confirm that footprint of the site-related groundwater contamination is not increasing.