SECOND FIVE-YEAR REVIEW REPORT
HIAWATHA BOULEVARD FORMER MANUFACTURED GAS PLANT SUBSITE OF ONONDAGA LAKE SUPERFUND SITE
CITY OF SYRACUSE, ONONDAGA COUNTY, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
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List of Abbreviations and Acronyms

bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CFR	Code of Federal Regulations
cy	cubic yards
EPA	U.S. Environmental Protection Agency
FYR	Five-Year Review
HHRA	Human-Health Risk Assessment
ICs	Institutional Controls
IRM	Interim Remedial Measure
ISS	*In-situ* Stabilization
MCL	Maximum Contaminant Level
MGP	Manufactured Gas Plant
METRO	Metropolitan Syracuse Sewage Treatment Plant
µg/l	micrograms per liter
mg/kg	milligrams per kilogram
NAPL	Non-Aqueous Phase Liquid
NiMo	Niagara Mohawk Power Corporation
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	Operable Unit
PAHs	Polycyclic Aromatic Hydrocarbons
PFAS	Per- and Poly-Fluoroalkyl Substances
PFOS	Perfluorooctanesulfonic Acid
PRP	Potentially Responsible Party
PSA	Preliminary Site Assessment
RAOs	Remedial Action Objectives
RD	Remedial Design
RfD	Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
SLERA	Screening-Level Ecological Risk Assessment
SMP	Site Management Plan
SVI	Soil Vapor Intrusion
SVOCs	Semi-Volatile Organic Compounds
UU/UE	Unlimited Use and Unrestricted Exposure
VOCs	Volatile Organic Compounds

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy 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 pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Section 300.430(f)(4)(ii), and considering EPA policy.

The Onondaga Lake Superfund site currently includes eleven subsites (subsites are defined as any site that is situated on Onondaga Lake's shores or tributaries that has contributed contamination to or threatens to contribute contamination to Onondaga Lake). Each subsite is an operable unit (OU). This FYR report evaluates OU13, the Hiawatha Boulevard Former Manufactured Gas Plant (MGP) subsite (Subsite).

This is the second FYR for the Subsite. The triggering action for this statutory FYR is the signature date of the last review, May 24, 2017. A FYR is required at this Subsite because hazardous substances, pollutants, or contaminants remain above levels that will allow for unlimited use and unrestricted exposure (UU/UE).

The Subsite's FYR team was led by Mark Granger, the EPA Remedial Project Manager. Participants included Kathryn Flynn (EPA hydrogeologist), Nick Mazziotta (EPA human-health and ecological risk assessor), and Larisa Romanowski (EPA community involvement coordinator (CIC)). The FYR began on September 1, 2021. The owner of the property, Onondaga County, was notified of the initiation of the FYR.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Onondaga Lake Superfund Site (Hiawatha Boulevard Former Manufactured Gas Plant Subsite)		
EPA ID: NYD986913580		
Region: 2	**State:** NY	**City/County:** City of Syracuse, Onondaga County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: State ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal or State Project Manager): Mark Granger
Author affiliation: EPA
Review period: 5/25/2017 - 9/19/2022
Date of site inspection: 7/13/2022
Type of review: Statutory
Review number: 2
Triggering action date: 5/24/2017
Due date *(five years after triggering action date)*: 5/24/2022

Site Background

The Subsite is located in an industrial and commercial area at the southeast end of Onondaga Lake, within the City of Syracuse, Onondaga County, New York (see **Appendix A, Figure 1**). The MGP was located on the northern portion of property currently owned by Onondaga County. The Subsite is currently occupied by the Syracuse Metropolitan Wastewater Treatment Plant's (METRO's) sewage-treatment structures, including clarifiers, aeration tanks, an ammonia and phosphorus removal facility, and secondary bypass disinfection structures. The remainder of the Subsite is primarily covered by driveways and paved parking areas. The existing Subsite layout and limits of the former MGP are shown on **Appendix A, Figure 2**. The former MGP is

approximately twenty acres in area and is bounded to the north by the Barge Canal, to the east by Hiawatha Boulevard, to the south by the remainder of METRO, and to the west by Onondaga Lake.

The property was originally created by filling in low-lying areas with materials associated with the construction of the Erie Canal and with the rerouting of Onondaga Creek. In the late 1800s, the property was used as a fill area for Solvay Process waste.[1] Manufactured gas was produced here from 1925 to 1958. The Subsite property and surrounding area is zoned industrial/commercial. With the strong presence of commercial and industrial infrastructure, future land use is anticipated to remain industrial/commercial. The area where the Subsite is located is not known to contain or impact any ecologically-significant habitat, wetlands, agricultural land, or historic or landmark sites.

The production of manufactured gas and the generation of related by-products resulted in the release of hazardous substances into the soil and groundwater. These wastes contained benzene, toluene, ethylbenzene, and xylenes (BTEX), as well as polycyclic aromatic hydrocarbons (PAHs).

Appendix B, attached, summarizes the documents utilized to prepare this FYR report.

For additional details about the Subsite, please see:

https://semspub.epa.gov/src/collections/02/SC/NYD986913580

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

New York State Department of Environmental Conservation (NYSDEC) and Niagara Mohawk Power Corporation (NiMo) entered into multisite Consent Orders (Orders) in 1992 and 2003. In 2005, NiMo began doing business under the name of its parent company, National Grid. These Orders obligated National Grid to implement a full remedial program for, among other sites, this Subsite.

Pursuant to the 1992 Order, a Preliminary Site Assessment/Interim Remedial Measures (PSA/IRM) study was conducted at the Subsite from 1995 to 1998. The PSA/IRM study characterized subsurface conditions and the nature and occurrence of contaminants in the soil and groundwater, as well as near-shore sediments in Onondaga Lake.

[1] Solvay waste is a waste product associated with the manufacturing of soda ash (sodium carbonate) and related products such as baking soda (sodium bicarbonate) via the Solvay process. It is a white, chalky, calcite-related material primarily composed of calcium carbonate, calcium silicate, and magnesium hydroxide.

Building on the PSA/IRM, a remedial investigation (RI) was subsequently conducted to determine the nature and extent of contamination related to the Subsite. The investigations, conducted in phases between 2000 and 2008, included:

- installation of 64 groundwater monitoring wells;
- collection of 385 subsurface-soil samples from 50 soil borings, 2 test pits, and 16 monitoring wells analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals associated with former MGP residues, particularly BTEX, PAHs, and cyanide;
- collection of several rounds of groundwater samples with analysis for VOCs, SVOCs, and metals;
- collection of sediment samples from seven off-property near-shore sampling locations in Onondaga Lake; and
- a soil-vapor investigation to evaluate the presence, concentration, and distribution of MGP- and non-MGP-related VOCs in on-property soil vapor and to evaluate the potential for soil vapor intrusion (SVI) into existing on-property buildings.

The RI indicated elevated concentrations of BTEX, PAHs, and cyanide are present in the groundwater and subsurface soils. Elevated concentrations of PAHs in Onondaga Lake and Barge Canal sediments were also found, but at levels consistent with the broader legacy of heavy industry surrounding the Subsite (*i.e.,* elevated levels were also found upgradient, side gradient, and downgradient).[2] Based upon the SVI data, it was determined that no further actions relative to SVI were necessary.

The baseline human-health risk assessment (HHRA) conducted as part of the RI concluded that an unacceptable risk existed from exposure to groundwater by hypothetical future residents and future construction and utility workers, driven primarily by BTEX and PAHs. The ecological risk assessment concluded that no habitats or species of special concern would likely be affected by Subsite-related contaminants.

Response Actions

Following the completion of the RI and feasibility study to identify and evaluate remedial alternatives, a Record of Decision (ROD) was signed in March 2010. The ROD addressed contamination present in subsurface soil and groundwater. The remedial action objectives (RAOs) specified in the ROD were:

- prevent ingestion/direct contact with contaminated subsurface soil;
- prevent migration of contaminants that would result in groundwater or surface water contamination;

[2] The noted results are found in the remedial investigation (RI) and are discussed in the "Response Actions" section, below.

- prevent ingestion of groundwater with contaminant levels exceeding drinking water standards;
- prevent contact with contaminated groundwater; and
- prevent discharge of contaminated groundwater to surface water.

The remedy components included:

- *in-situ* solidification (ISS) treatment of subsurface soils from the northeastern portion of the Subsite where non-aqueous phase liquid (NAPL) was identified and where PAHs were identified at concentrations greater than 500 milligrams per kilogram (mg/kg) to depths of 22 to 24 feet below ground surface (bgs);
- exposed surface soil will be covered with either: a one-foot-thick soil cover consisting of clean soil underlain by a demarcation layer; or buildings, treatment structures, pavement, *etc*.;
- enhanced biodegradation of groundwater through the injection of nutrients, sources of oxygen, and/or other amendments. This will occur along the northern property boundary between the Barge Canal and areas where the highest concentrations of BTEX and PAHs were found in groundwater. Modifications to the enhanced bioremediation treatment will be made, as needed, based on monitoring results. Residual groundwater contamination outside of these areas will be allowed to attenuate naturally;
- development of institutional controls (ICs) in the form of an environmental easement that limits the property to industrial use, requires compliance with an approved Site Management Plan (SMP), restricts the use of groundwater as a source of potable or process water without necessary water-quality treatment as determined by the New York State Department of Health (NYSDOH), and requires the completion and submittal of periodic certifications of institutional and engineering controls; and
- development of an SMP which will: (1) identify known locations of MGP-impacted soil and groundwater at the property; (2) establish appropriate controls for future disturbances of soil and management of impacted groundwater; (3) set forth the inspection and maintenance activities for the perimeter fencing and vegetation/cover materials; and (4) include a provision to evaluate the potential for vapor intrusion for any buildings developed on the Subsite, including a provision for mitigation of any impacts identified, and a provision to evaluate the potential for soil vapor intrusion for existing buildings if building use changes significantly or if a vacant building becomes occupied;

Response Action Implementation

In-Situ Solidification of Subsurface Soil

The remedial design (RD) of the soil remedy began shortly after the successful completion of an ISS bench-scale treatability study in 2011. Following the approval of the RD, subsurface soil remedial activities were performed in 2012. These efforts included the removal of surface cover materials (asphalt pavement, subbase course, and topsoil) and the underlying shallow soil to a depth of approximately 4 feet bgs within the excavation/ISS area. This area is in the northeastern

portion of the Subsite where NAPL was identified and where PAHs were identified at concentrations greater than 500 mg/kg in subsurface soil at depths generally greater than 4 feet bgs. Soil and groundwater areas of concern are illustrated on **Appendix A, Figure 3**. Excavation was performed to allow for volume expansion during the subsequent ISS implementation. The ISS extended to depths of 22 to 24 feet bgs within the excavation/ISS area. Approximately 9,700 cubic yards (cy) of contaminated soil were solidified. Sampling was performed to verify that the solidified monolith met the performance criteria. A cover was placed over the treated area pursuant to the ROD.

Enhanced Biodegradation of Groundwater

Based upon the results of a pilot study, which was completed in 2015, it was determined that a sulfate amendment resulted in the stimulation of the indigenous sulfate-reducing microbial community capable of enhanced degradation of MGP-related contaminants in the groundwater. Additionally, the use of a lower-solubility (slow-release) form of sulfate amendment (*e.g.,* gypsum) was supported by the pilot study results, based on the relatively-slow groundwater velocity observed in the pilot study area.

Following the completion of the RD for the deployment of the slow-release sulfate amendment along transects perpendicular to groundwater flow between the Subsite and the Barge Canal, construction and full-scale deployment were successfully implemented in 2018. The remedy involved the direct-push emplacement of gypsum mixed with water into the subsurface along the Barge Canal transects to provide a sustained source of sulfate to facilitate anaerobic biological oxidation (ABOx) of BTEX and PAHs. Gypsum slurry was emplaced over an approximately 10-foot depth interval within the sand unit beneath the fill/Solvay waste layer. The sand unit was targeted because it had generally higher concentrations of BTEX and naphthalene than the overlying fill/Solvay waste layer and is where the primary groundwater flow to the Barge Canal occurs. Approximately 221,350 pounds of gypsum were mixed with 236,745 gallons of water, creating a slurry that was emplaced into a total of 211 borings.

Status of Subsite Reuse/Redevelopment

The MGP operations at the Subsite ended in 1958. The entire Subsite has since been successfully redeveloped as part of the METRO expansions. It is anticipated that any further development or change in use will be related to METRO operations. The current subsite development is illustrated on **Appendix A, Figure 4**.

Institutional Controls Summary Table

The ROD called for the implementation of ICs to, among other things, limit the property to industrial use and restrict the use of groundwater for potable or process-water purposes without necessary water-quality treatment. **Table 1**, below, summarizes the status of the ICs.

Table 1: **Summary of Institutional Controls**

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(s)	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	Subsite property	Restrict the Subsite property to industrial use; require compliance with an approved SMP including, among other things, provisions for a vapor intrusion investigation or installation of a vapor mitigation system if any new enclosed structures are built over areas containing MGP residual contamination or any existing building undergoes significant structural changes; and require the submittal of periodic certifications of institutional and engineering controls.	Environmental Easement planned for late 2023
Groundwater	Yes	Yes	Subsite property	Restrict groundwater use on the Subsite property without treatment.	

Systems Operation/Operation & Maintenance

Operation and maintenance activities began with the completion of the soil ISS (October 2012) and incorporated the groundwater bioremediation components of the remedy in October 2018. The Subsite is inspected at least annually as follows:

- the Subsite property to ensure that remedial-related facilities (monitoring wells, fencing, sulfate-emplacement zone, *etc.*) are secure and have not been subjected to damage or vandalism; and
- groundwater monitoring wells for ease of locating, accessibility, operation of locks, and the condition of the surface seals.

Sulfate concentrations are monitored annually and standard groundwater-chemistry parameters (pH, alkalinity, *etc.*) and MGP-related constituent concentrations (BTEX, naphthalene, *etc.*) are

evaluated twice every FYR period. The performance of the remedy will continue to be evaluated as data becomes available.

Potential impacts on the Subsite from climate change were assessed. The performance of the remedy is currently not at risk due to the expected effects of climate change in the region near the Subsite. While the Subsite is, as noted above, adjacent to Onondaga Lake and the Barge Canal (see **Appendix A, Figure 1**), the topography is such that the Subsite is elevated above any expected affects from climate change (*e.g.,* flooding, *etc.*).

III. PROGRESS SINCE THE LAST REVIEW

The protectiveness determinations from the last FYR are summarized in **Table 2,** below**.**

Table 2: **Protectiveness Determinations/Statements From 2017 Five-Year Review**

OU	Protectiveness Determination	Protectiveness Statement
13	**Will be Protective**	The remedy for OU13 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

There were no recommendations or follow-up actions resulting from the 2017 FYR.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification & Involvement

On 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 Virgin Islands, including the Subsite. The announcement can be found at the following web address: https://www.epa.gov/superfund/R2-fiveyearreviews.

In addition to this notification, the EPA CIC for the Subsite, Larisa Romanowski, posted a public notice on the EPA site webpage (www.epa.gov/superfund/onondaga-lake) and provided the notice to the city of Syracuse on April 11, 2022, with a request that the notice be posted in municipal offices and on the city's webpage. In addition, on the same date, the notice was distributed via the NYSDEC's Onondaga Lake News email listserv, which includes approximately 10,000 subscribers. This notice indicated that a FYR would be conducted at the Subsite to ensure that the cleanup continues to be protective of human health and the environment. Once the FYR is completed, the results will be made available at the following repositories: NYSDEC Albany and

Syracuse offices; Onondaga County Public Library, Syracuse Branch at the Galleries, 447 South Salina Street, Syracuse New York; Atlantic States Legal Foundation, 658 West Onondaga Street, Syracuse, New York; and EPA Region 2's Superfund Records Center, 290 Broadway, 18th Floor, New York, New York. In addition, the final report will be posted on the following webpage: www.epa.gov/superfund/onondaga-lake. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

The data review is based on information obtained from investigations performed during the review period, including water-level measurements and groundwater-quality data from monitoring events. Monitoring discussed in this review includes an October 2018 baseline-VOC/sulfate event and an October 2019 sulfate-only event. Additional monitoring data was received late in the review period, which is currently being reviewed and will be evaluated as part of the next FYR. A monitoring network was established along the Barge Canal/Onondaga Lake shore areas consisting of 57 wells to monitor groundwater that flows into the canal and lake. The monitoring-well network and treatment-area locations are presented on **Appendix A, Figure 5**.

The water-level data from the monitoring events continue to indicate that the water table beneath the site is generally at a depth of approximately 5 to 10 feet bgs (an illustration of the water level in the context of stratigraphy (2014) is provided in **Appendix A, Figure 6)**. More recent water levels (2018) were used to construct a water-table contour map for the sand unit (see **Appendix A, Figure 7**). Based on these and the contour maps developed previously for the Subsite, the data indicate that the groundwater flow pattern is consistent with historical patterns, that the horizontal direction of groundwater flow is from the southeastern corner of the Subsite to the northeast toward the Barge Canal and to the northwest toward Onondaga Lake, and that flow directions continue to diverge along a groundwater divide that trends northwest-southeast.

While all 57 of the monitoring wells remain available for monitoring, 23 were selected for post-ROD sampling (monitoring was not required in the 34 wells where contaminant levels were consistently below cleanup goals). Groundwater monitoring was performed following the sulfate-emplacement (October 2018) at the 23 monitoring wells to identify baseline concentrations of sulfate and MGP-related constituents. Annual monitoring for sulfate followed the 2018 baseline-sampling effort in 2019, 2020, and 2021.

The sulfate analytical data from the 2018 baseline groundwater monitoring event and the first annual performance groundwater monitoring event (2019) show that the large amount of gypsum slurry emplaced into the sand unit in 2018 as part of the groundwater-bioremediation remedy is dissolving and resulting in elevated sulfate concentrations within and downgradient from the emplacement area. The 2019 sulfate data generally reflected a severalfold increase in sulfate concentrations as compared to the 2018 baseline data. The groundwater analytical results for sulfate are presented in **Appendix A, Table 1.**

The effectiveness of the sulfate emplacement in sustaining geochemical conditions conducive to ABOx is being evaluated by monitoring standard groundwater-chemistry parameters as well as BTEX and PAH concentrations hydraulically downgradient from the emplacement locations. This monitoring was performed in 2020 and 2021; however, the associated data sets were received late in the review period and will be evaluated as part of the next FYR.

As stated previously, chemical data for BTEX and PAHs collected during the baseline sampling event in 2018, prior to implementing the full sulfate emplacement at the Subsite, is included for this FYR period. Additional data received late in the review period will be evaluated in the next FYR. Based on this data, one or more BTEX compounds were identified in the groundwater samples collected from each of the 23 wells at concentrations exceeding their respective groundwater quality standards, which are 1 microgram per liter (µg/l) for benzene and 5 µg/l for the other constituents. Despite collection prior to full-scale emplacement, the 2018 baseline-monitoring BTEX concentrations in seven monitoring wells (MW-3D, MW-5D, MW-12D, MW-18D, MW-19D, MW-22D, MW-27D) were the lowest of any of the BTEX concentrations identified in those wells to date. The BTEX concentrations in two monitoring wells (MW-8D and MW-37D) were also the lowest identified to date, except for the ethylbenzene concentration in monitoring well MW-8D and the xylenes concentration in monitoring well MW-37D, which were the second lowest identified in those wells to-date. BTEX concentrations in the nine remaining wells were within the range of or slightly lower than the BTEX concentrations previously identified at the same wells during the previous sampling events.

Naphthalene was identified in the groundwater samples collected from 12 of the 23 monitoring wells at concentrations exceeding the 10 µg/l groundwater-quality standard. The 2018 naphthalene concentrations in four monitoring wells (MW-5D, MW-8D, MW-19D, and MW-22D) were the lowest of any of the naphthalene concentrations identified in those wells to-date. In addition, the naphthalene concentrations in the baseline samples from monitoring wells MW-19D and MW-22D were less than the 10 µg/l groundwater quality guidance value for the first time. The naphthalene concentrations in two monitoring wells (MW-23D and MW-32D, both located in the eastern portion of the site) were slightly higher than the naphthalene concentrations previously identified in these wells. The naphthalene concentrations in the remaining wells were within the range of the naphthalene concentrations previously identified at the same wells during the previous sampling events.

Additional consideration of BTEX and PAH trends will be evaluated as further data becomes available. The groundwater analytical results for BTEX and naphthalene are presented on **Appendix A, Figure 8.**

Emerging Contaminants

Samples were collected and analyzed for per- and polyfluoroalkyl substances (PFAS), as well as 1,4-dioxane, in 2019 by the Potentially Responsible Party's contractor. Sampling was performed at four on-site monitoring wells--MW-3S, MW-4S, MW-7S, and MW-8S. 1,4-Dioxane was not detected at any well and the reporting limits for each sample were below the NYSDEC Maximum

Contaminant Level (MCL) of 1 µg/L established in 2021. Perfluorooctanoic acid (PFOA) was detected above the state MCL of 10 nanograms per liter (ng/L) at monitoring wells MW-3S (1,300 ng/L) and MW-4S (95,000 ng/L). Perfluorooctanesulfonic acid (PFOS) was also detected in monitoring well MW-4S at 51 ng/L and, marginally above the state MCL of 10 ng/L, in monitoring well MW-7S (12 ng/L). Due to the significantly elevated PFOA result at monitoring well MW-4S, another round of sampling was performed at this well in 2021. This sampling event yielded a PFOA concentration of 2.6 ng/L, four orders of magnitude below the concentration identified in 2019. Because the 2019 PFOA sample result in monitoring well MW-4S is suspect, additional sampling for PFAS is advised. PFOS in this well remained slightly elevated, at 12 ng/L, but was also reduced from the 51 ng/L reported in 2019.

Site Inspection

An inspection of the Subsite was conducted on July 13, 2022. In attendance were Mark Granger; Kathryn Flynn, and Nick Mazziotta (representing EPA); Hazel Powless (representing the Onondaga Nation); Steve Beam (representing National Grid); and John Brussel and Matt Hysell of Arcadis (National Grid's environmental consultant). The property, former treatment areas, roadways, monitoring wells, and other closure-related facilities were all in satisfactory condition at the time of the inspection.

V. TECHNICAL ASSESSMENT

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

The ROD called for ISS of an estimated 14,500 cy of contaminated soil; enhanced bioremediation of contaminated groundwater along portions of the New York State Barge Canal and Onondaga Lake; and ICs.

The ISS remedy was completed in 2012 and has effectively immobilized the contaminants in the source-area's subsurface soil, preventing them from further impacting the groundwater downgradient of this area and preventing ingestion/direct contact. Groundwater trends in the area treated by ISS will continue to be monitored in the future under the SMP.

Construction and full-scale deployment of slow-release sulfate amendment along transects perpendicular to groundwater flow between the Subsite and the Barge Canal were completed in 2018. Baseline groundwater conditions were evaluated at that time, which generally identified lower BTEX and PAH concentrations compared to historical results. Additional sulfate data has been collected annually thereafter and will be further evaluated in the next FYR period.

Groundwater samples collected in 2019 identified the presence of PFOA at considerably elevated concentrations on-site. Because the maximum concentration of 95,000 ng/L at monitoring well MW-4S in 2019 is suspect, additional sampling for PFAS is advised. In addition, PFOA was

detected at 1,300 ng/L (as noted above, the state MCL is 10 ng/L) in monitoring well MW-3S in 2019, but was not resampled in 2021; additional sampling is recommended.

ICs to, among other things, limit the use of the property to industrial use and restrict the use of groundwater are being incorporated into an environmental easement. It is anticipated that the ICs will be in place in late 2023 (see **Table 1**, above). In the interim, the property is secured by fencing and is completely occupied by METRO-related buildings, process-facilities, and related infrastructure (fencing, signs, roadways, parking spaces, curbing, landscaping, *etc.*), such that exposure to subsurface soils is obviated (see **Appendix A, Figure 4**). There are no residential receptors on or near the Subsite and the area is served by public water. Due to natural saline conditions, it is unlikely that the groundwater would be used for any potable purposes, as well. On-property ICs will further restrict the use of untreated groundwater.

QUESTION B: *Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?*

The HHRA concluded that exposure to contaminated Subsite groundwater (via direct contact during construction activities and residential-potable uses) and sediment (via recreational wading) would result in human health risks and hazards exceeding EPA threshold criteria. Exposure to subsurface soils did not present a risk and/or hazard above EPA benchmarks. The contaminated surface soils have been excavated and regraded. The chemicals that contributed most significantly to risk and hazard were benzene, PAHs (specifically benzo(a)pyrene and naphthalene), and arsenic. The land-use assumptions, exposure assumptions and pathways, and clean-up levels considered in the decision document followed the *Risk Assessment Guidance for Superfund* used by EPA and remain valid. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used also remains valid.

The RAOs discussed in Section II and implemented at the time of remedy selection remain valid, as well. The remedial goals established in the ROD included the containment and control of contaminants of concern in Subsite soils that contact groundwater and the restoration of groundwater quality to levels which meet state and federal drinking water standards. The soil and groundwater remedial goals selected at the time of the ROD remain protective of human health and the environment. In addition, there have been no changes in the physical conditions of the Subsite over the past five years that would change the protectiveness of the remedy. The Subsite is secured by fencing and there are no residential receptors on or near the Subsite. The area is served by public water and any intrusive activities performed must also comply with the SMP being developed for the Subsite (expected in late 2022). Thus, all potential exposure pathways have been interrupted. Furthermore, implementation of the groundwater bioremediation remedial action was completed in 2018 and concentrations of BTEX and PAH compounds are expected to decrease over time. ICs that will formally limit the property to industrial use and restrict use of groundwater are also expected to be established in late 2023.

Changes in Toxicity and Other Contaminant Characteristics

The 2009 HHRA concluded that exposure to benzo(a)pyrene in nearshore sediments adjacent to the Subsite via recreational wading slightly exceeded the EPA target risk range ($1x10^{-6}$ to $1x10^{-4}$). In 2017, however, a revised toxicological review of benzo(a)pyrene was incorporated into the EPA Integrated Risk Information System. The review included updates to the cancer oral slope factor and inhalation unit risk, as well as the development of an oral reference dose (RfD) and inhalation reference concentration for noncancer assessment, which were unavailable when the HHRA was completed. As discussed in the previous (2017) FYR, application of the updated cancer toxicity values resulted in risk estimates within the EPA acceptable risk range for all exposures to sediment. Furthermore, use of the updated RfD for the ingestion of, and dermal contact with, Subsite contaminated sediment did not result in a hazard above the EPA threshold, thereby eliminating sediment exposure as a pathway of concern. Application of these toxicity factors to the soil and groundwater pathways did not significantly impact previously-reported estimates of risk and hazard. As such, there have been no changes in toxicity values that would adversely affect the protectiveness of the remedy.

Vapor Intrusion

The results from the 2008 SVI investigation indicated the presence of BTEX and other VOCs typically associated with MGP sites at low levels in soil vapor. The compounds detected were commonly found in products related to ongoing petroleum and solvent use necessary for normal facility operations in on-site buildings. NYSDEC and NYSDOH subsequently determined that no further actions related to SVI were necessary. Because impacted soils have been treated and VOC concentrations in the groundwater across the Subsite are generally consistent with, or less than, the concentrations from previous sampling events, additional SVI investigations are not considered necessary at this time. Nevertheless, the SMP developed for the Subsite, expected in late 2022, will require a vapor intrusion investigation or installation of a vapor mitigation system if any new enclosed structures are built over areas containing MGP residual contamination or any existing building undergoes significant structural changes.

Ecological Risk

With respect to ecological risk characterization, a screening-level ecological risk assessment (SLERA) was performed for the Subsite. The Subsite is located in an urban industrial setting, including industrial and commercial properties which are associated with large, paved parking lots. The SLERA concluded that ecological risks at the Subsite are negligible. There is limited vegetation and little to no viable habitat to support ecological receptors. Future land use will remain industrial for the foreseeable future. Due to the industrial nature of this Subsite and the lack of adequate habitat, there are no complete terrestrial exposure pathways to ecological receptors. Therefore, the Subsite does not appear to provide any appreciable ecological attractiveness and no ecological function is expected. The assumptions used at the time of the remedy remain valid and no further ecological investigation is warranted to evaluate the potential risks to ecological receptors from exposure to contaminants at this Subsite.

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

There is no new information that could call into question the protectiveness of this remedy.

VI. ISSUES/RECOMMENDATIONS

Table 3, below, presents the recommendations and follow-up actions for this FYR.

Table 3: Issues and Recommendations

Issues/Recommendations				
OU(s) without Issues/Recommendations Identified in the Five-Year Review:				
None				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 13	**Issue Category:** Monitoring			
	Issue: Post-emplacement data for BTEX and PAHs in groundwater were received late in the review period and were not reviewed in this FYR period.			
	Recommendation: Review the post-emplacement data to assess the effect of increased sulfate concentrations on BTEX and PAHs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State	06/30/2023
OU(s): 13	**Issue** Category**:** Institutional Controls			
	Issue: Institutional controls are not in place to restrict the Subsite to industrial use, require compliance with an SMP, provide provisions for vapor mitigation, and restrict the use of groundwater.			
	Recommendation: Institutional controls should be put into place.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	State	12/31/2023

OTHER FINDINGS

Based upon an orders-of-magnitude reduction in the maximum PFAS concentration detected in monitoring well MW-4S in 2021 as compared to the maximum concentration detected in 2019 and because an elevated concentration of PFOA was detected in monitoring well MW-3S in 2019,

but the well was not resampled in 2021, additional PFAS sampling in these two monitoring wells is suggested.

VII. PROTECTIVENESS STATEMENT

Table 4, below, provides the OU protectiveness statement.

Table 4: Protectiveness Statement

Protectiveness Statement	
Operable Unit:	*Protectiveness Determination:*
OU13	**Short-term Protective**
Protectiveness Statement:	
The remedy for OU13 is protective of human health and the environment in the short-term as the implemented remedial actions have adequately addressed all exposure pathways that could result in unacceptable risks in these areas. For the remedy to be protective in the long-term, ICs need to be implemented and post-emplacement groundwater data needs to be reviewed.	

VIII. NEXT REVIEW

The next FYR report for the Hiawatha Boulevard Former MGP Subsite of the Onondaga Lake Superfund site is required five years from the completion date of this review.

APPENDIX A: FIGURES

Figure 1: Subsite Location

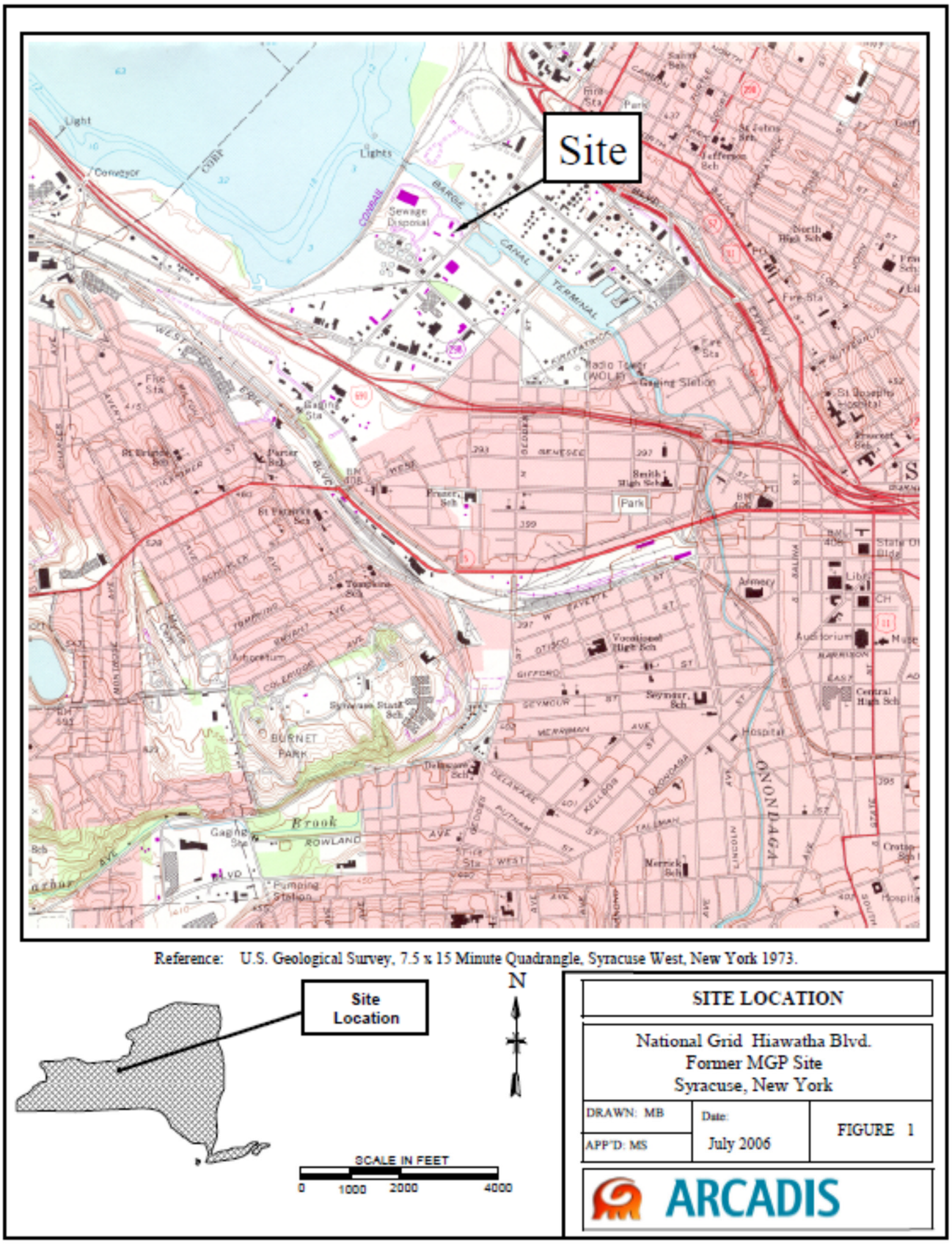


Figure 2: Current Subsite Layout with Superimposed Former MGP Structures

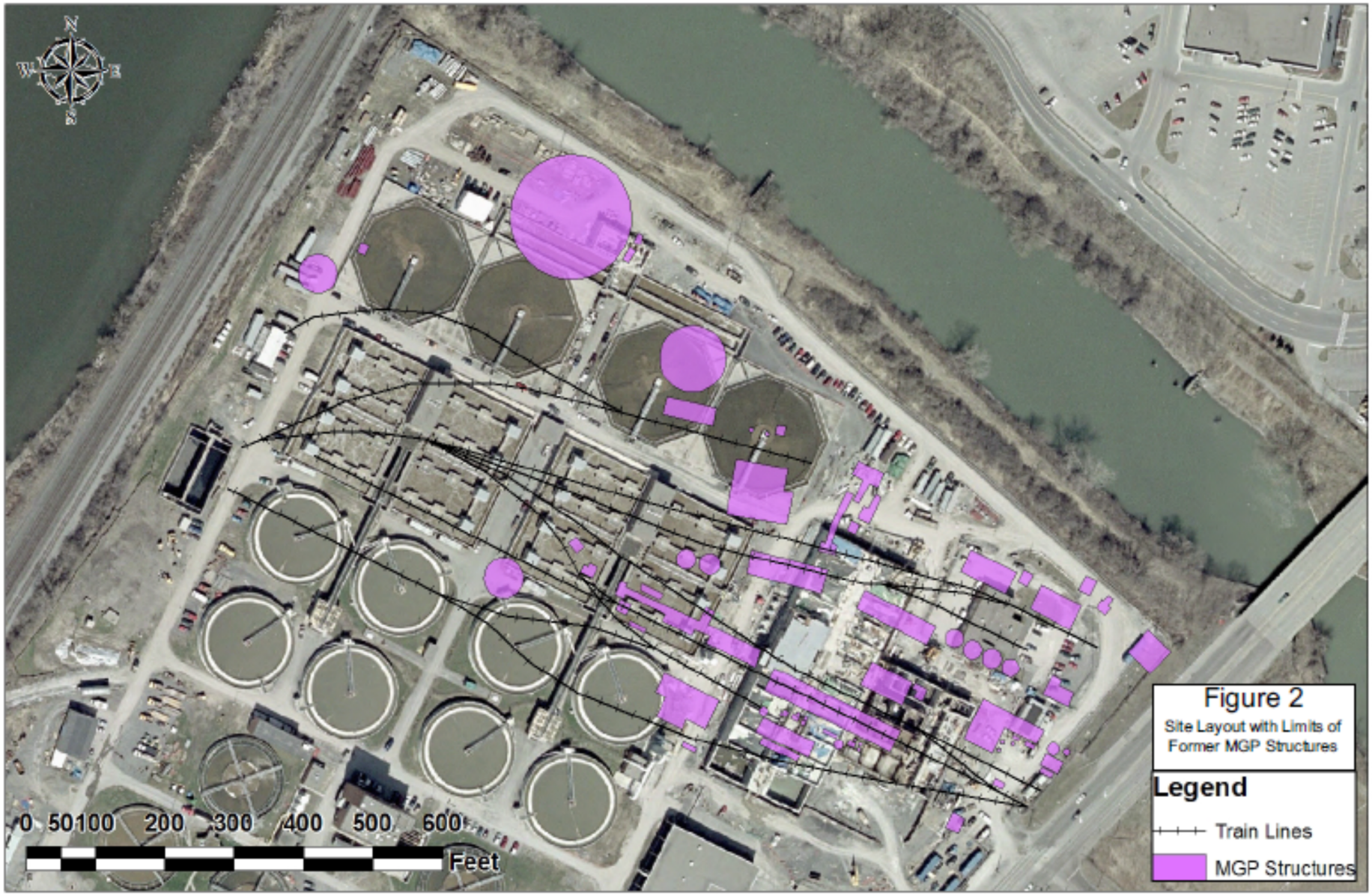


Figure 3: Soil and Groundwater Areas of Concern

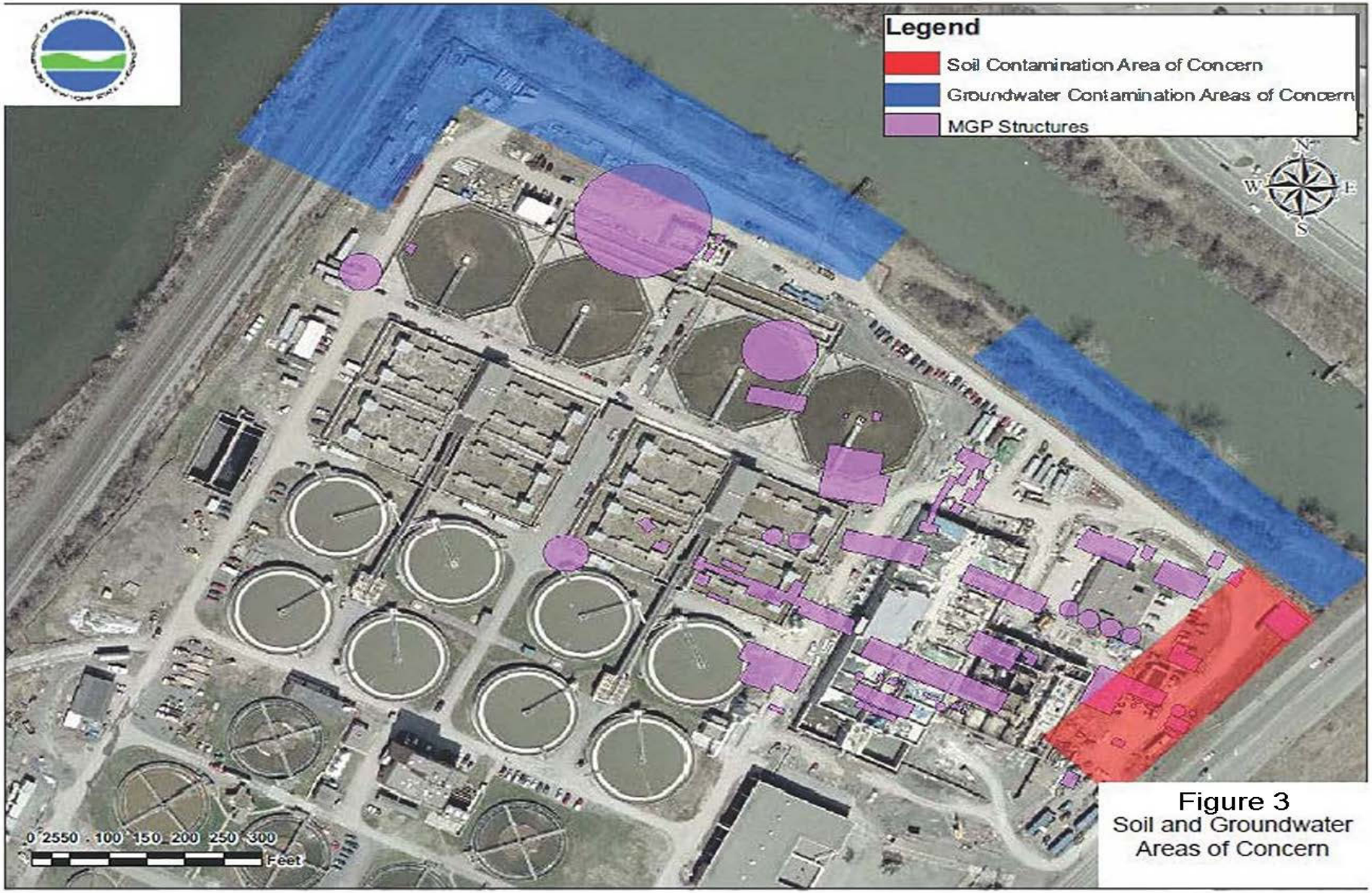


Figure 4: Current Subsite Development

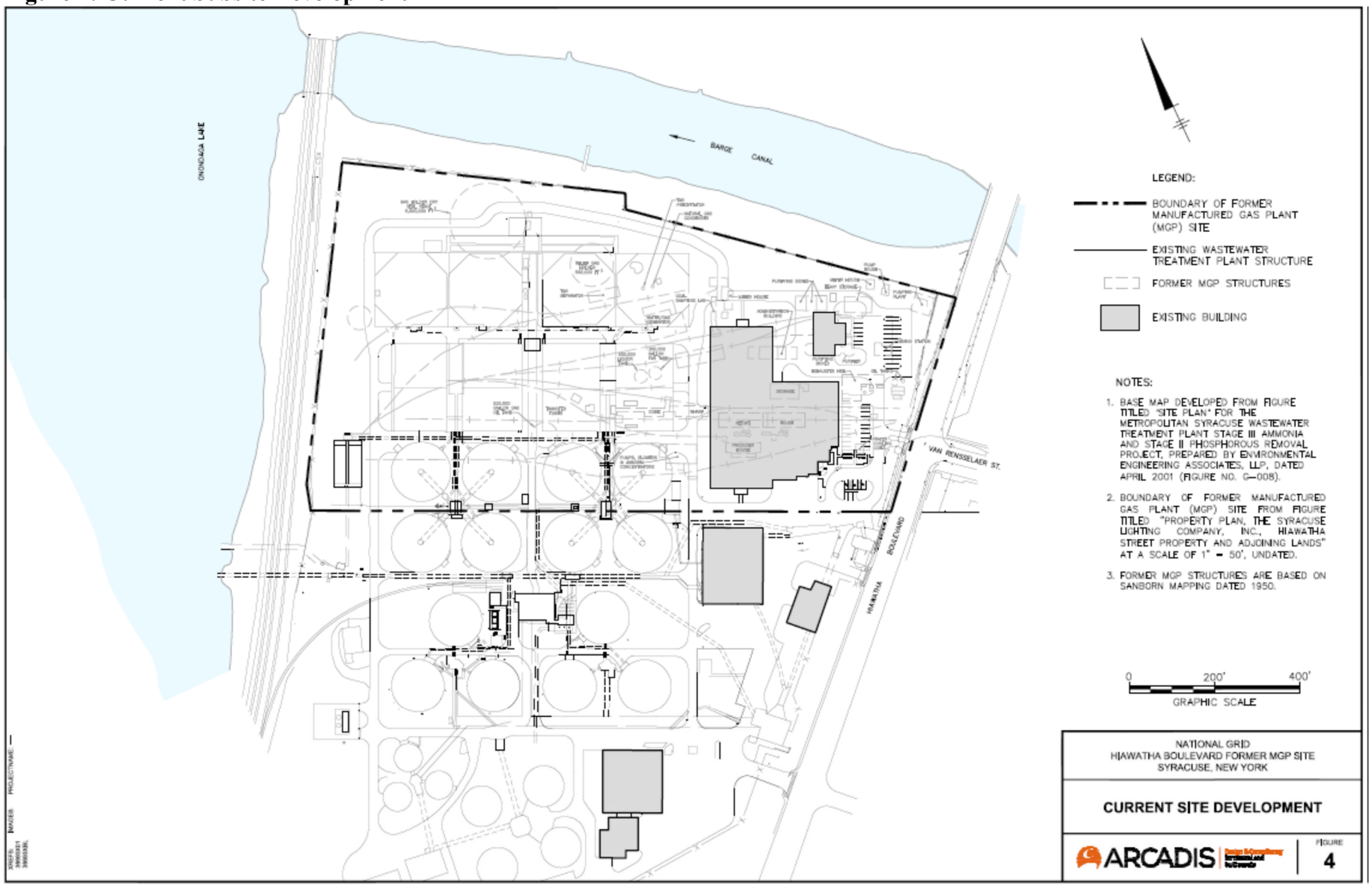


Figure 5: Monitoring-Well Network and Treatment Area Locations

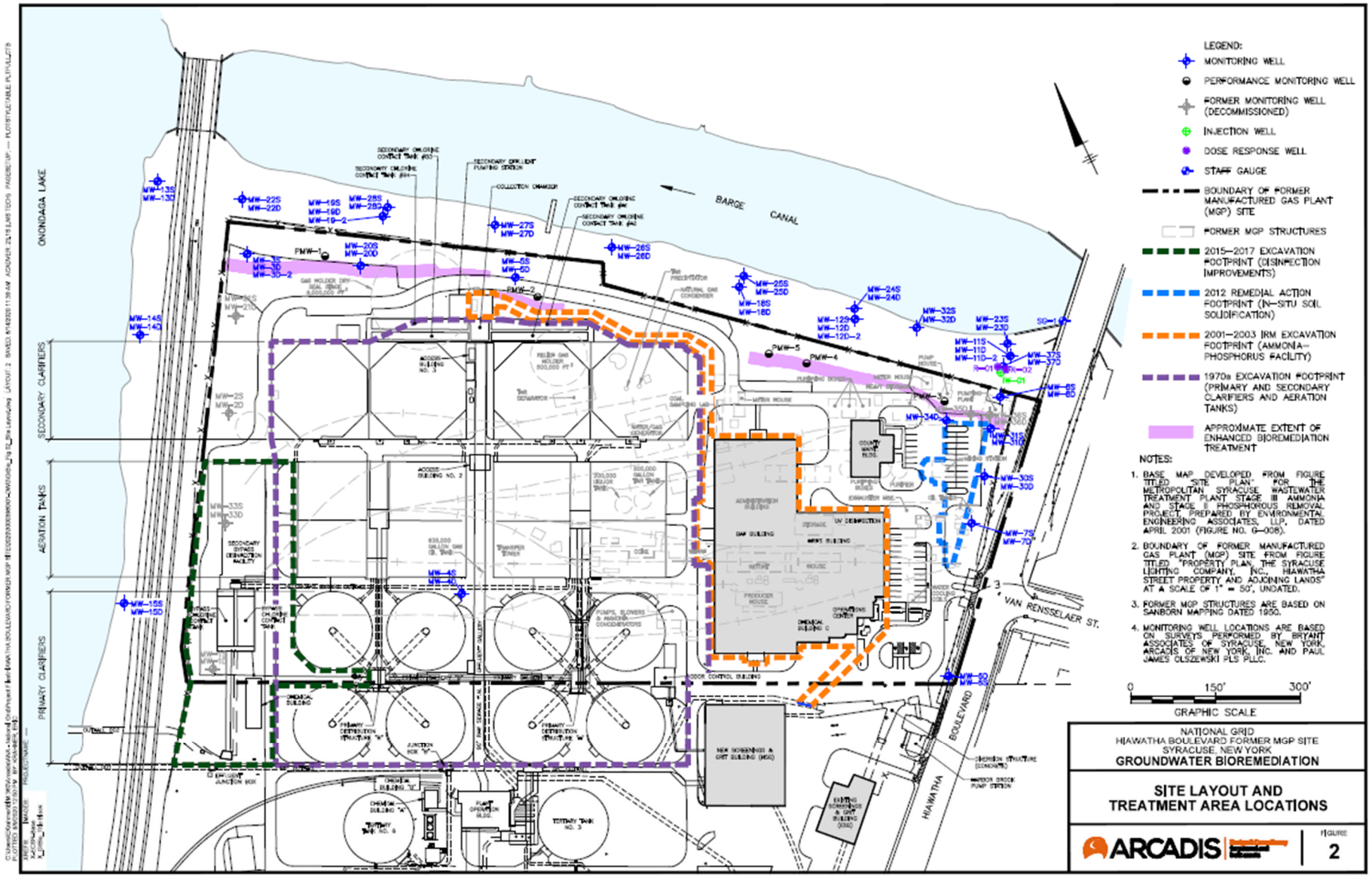
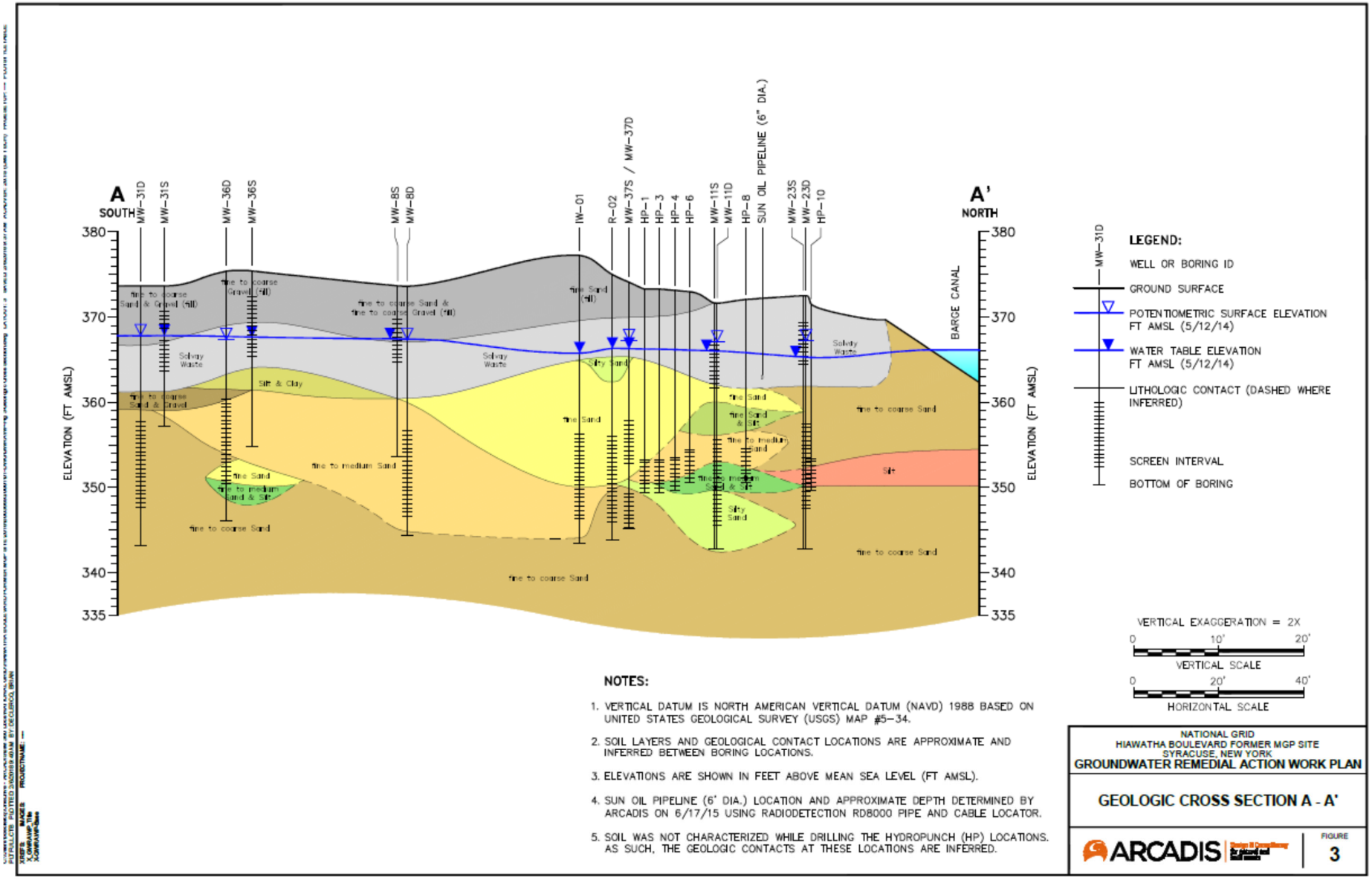


Figure 6: Geologic Cross Section with Water Level (2014)



NOTES:

1. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM (NAVD) 1988 BASED ON UNITED STATES GEOLOGICAL SURVEY (USGS) MAP #5-34.
2. SOIL LAYERS AND GEOLOGICAL CONTACT LOCATIONS ARE APPROXIMATE AND INFERRED BETWEEN BORING LOCATIONS.
3. ELEVATIONS ARE SHOWN IN FEET ABOVE MEAN SEA LEVEL (FT AMSL).
4. SUN OIL PIPELINE (6' DIA.) LOCATION AND APPROXIMATE DEPTH DETERMINED BY ARCADIS ON 6/17/15 USING RADIODETECTION RD8000 PIPE AND CABLE LOCATOR.
5. SOIL WAS NOT CHARACTERIZED WHILE DRILLING THE HYDROPUNCH (HP) LOCATIONS. AS SUCH, THE GEOLOGIC CONTACTS AT THESE LOCATIONS ARE INFERRED.

NATIONAL GRID
HIAWATHA BOULEVARD FORMER MGP SITE
SYRACUSE, NEW YORK
GROUNDWATER REMEDIAL ACTION WORK PLAN

GEOLOGIC CROSS SECTION A - A'

ARCADIS

FIGURE
3

Figure 7: Water-Table Contour Map for the Sand Unit (2018)

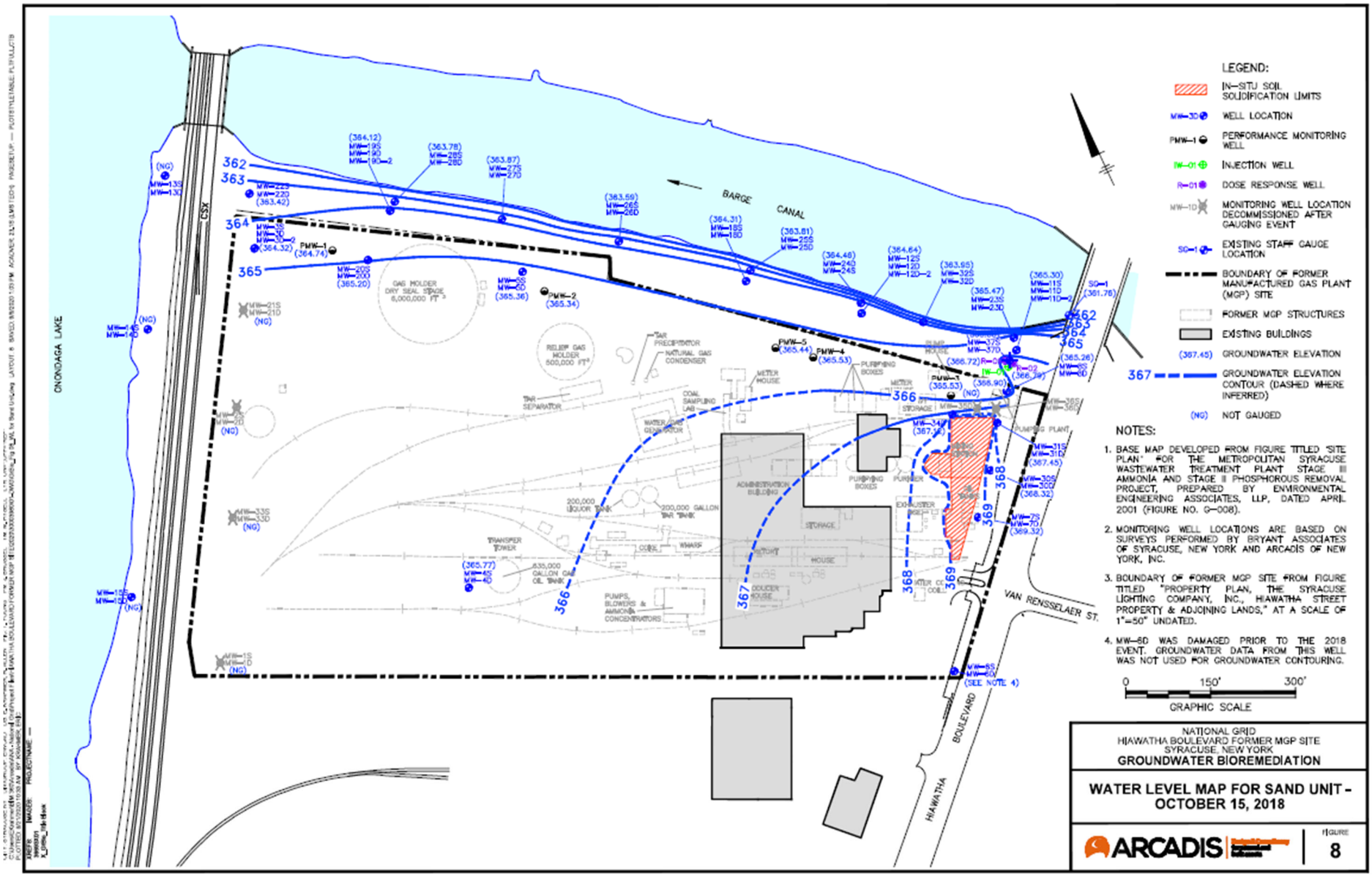


Figure 8: Groundwater Analytical Results for BTEX and Naphthalene

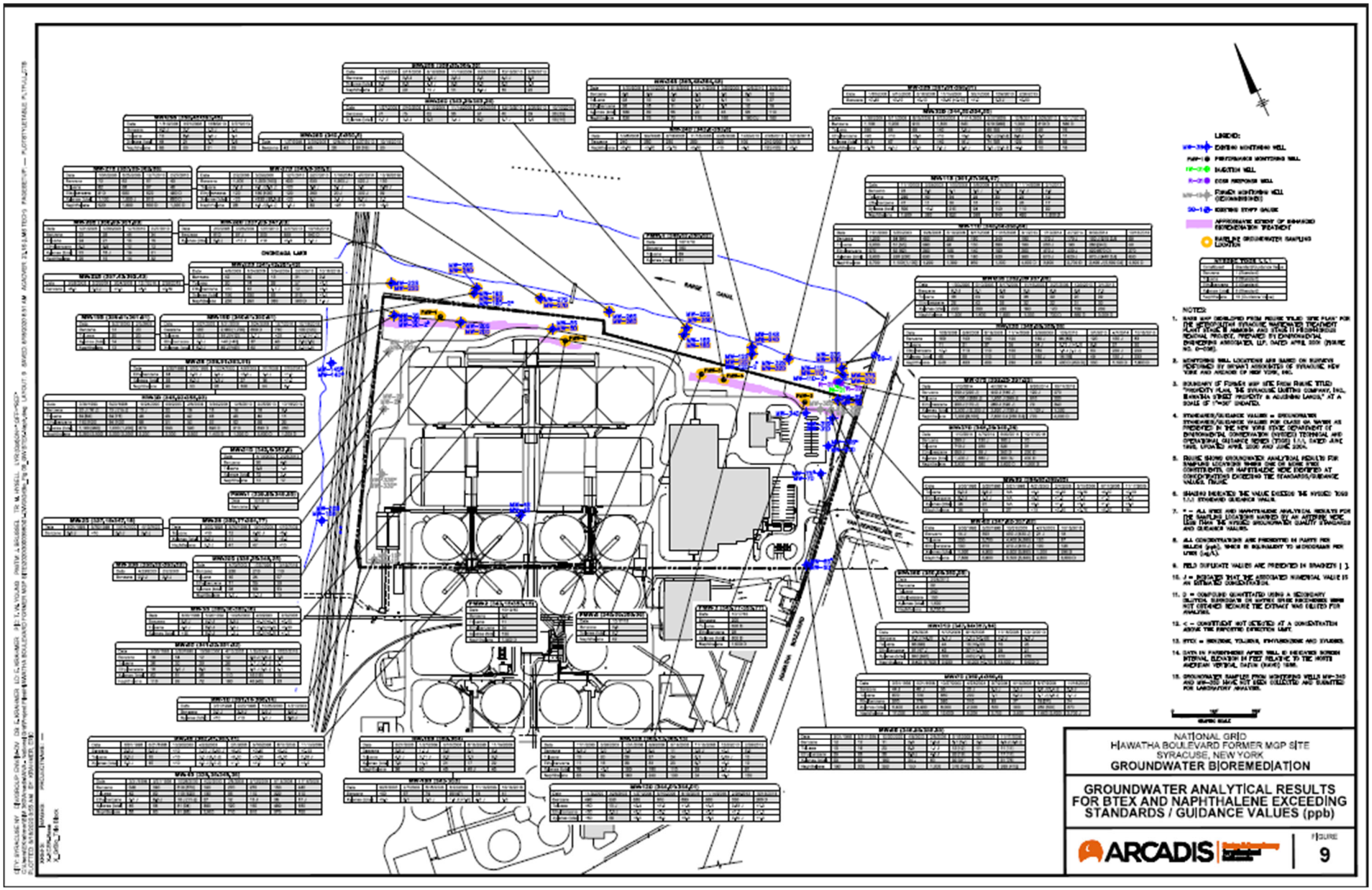


Table 1: Pre- vs. Post-Remediation Sulfate Groundwater Analytical Results (ppb)

Location ID	Sample Date	Sulfate Concentrations (ug/L)
MW-3D	03/30/98	83,700 [80,000]
	05/20/98	87,800 [91,400]
	10/24/00	92,700
	04/09/03	100,000
	02/06/06	64,700
	02/25/13	88,500
	10/19/18	552,000
	10/23/19	276,000
MW-5D	03/30/98	226,000
	05/20/98	97,100
	10/26/00	250,000
	04/10/03	140,000
	01/25/06	210,000 [224,000]
	10/23/18	97,800
	10/24/19	602,000
MW-20D	04/23/03	130,000
	01/25/06	13,500
	10/19/18	1,600,000
	10/23/19	1,210,000
PMW-1	10/19/18	183,000
	10/23/19	587,000
PMW-2	10/19/18	109,000
	10/25/19	558,000
PMW-3	10/17/18	19,800
	10/24/19	653,000
PMW-4	10/17/18	100,000
	10/24/19	98,500 [99,200]
PMW-5	10/17/18	66,700
	10/24/19	519,000

Notes:

1. All concentrations reported micrograms per liter (µg/L), which is equivalent to parts per billion (ppb).
2. Values in brackets [ ] indicate a duplicate sample.
3. Shaded values are post-remediation groundwater analytical results (orange-shaded results are baseline results; gray-shaded results are first annual performance monitoring results) .

APPENDIX B: REFERENCES

Arcadis. 2003. *Remedial Investigation Report, Hiawatha Boulevard former MGP Site, Syracuse, New York*, prepared for National Grid (July 2003).

Arcadis. 2009. *Feasibility Study Report, Hiawatha Boulevard former MGP Site, Syracuse, New York*, prepared for National Grid (October 2009).

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Arcadis, 2011b. *Remedial Design, Hiawatha Boulevard former MGP Site, Syracuse, New York*, prepared for National Grid (September 2011).

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Arcadis. 2013b. *Construction Completion Report for In-Situ Stabilization of Soils, Hiawatha Boulevard Former MGP Site, Syracuse, New York*, prepared for National Grid (September 2013).

Arcadis. 2016. *Enhanced Groundwater Bioremediation Pilot Study Report, Hiawatha Boulevard Former MGP Site, Syracuse, New York*, prepared for National Grid (August 2016).

Arcadis. 2020. *Groundwater Bioremediation Performance Monitoring Update/Summary, Hiawatha Boulevard Former MGP Site, Syracuse, New York*, prepared for National Grid (September 2020).

New York State Department of Environmental Conservation (NYSDEC). 2003. *Order on Consent Index No. A4-0473-0000*, signed by NYSDEC on November 7, 2003.

NYSDEC. 2010. *Record of Decision, Niagara Mohawk (NM) – Hiawatha Boulevard – Syracuse Former MGP Site, Subsite of the Onondaga Lake Site, City of Syracuse, Onondaga County, New York, Site No. 7-34-059*. (March 2010).