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Joe Martens
Commissioner

May 16, 2014

Mr. John P. McAuliffe, P.E.
Honeywell International, Inc.
301 Plainfield Road
Suite 330
Syracuse, NY 13212

Re: SYW-12 Sources of Contamination Investigation Revised Report

Dear Mr. McAuliffe:

The New York State Department of Environmental Conservation (NYSDEC) has reviewed the "SYW-12 Sources of Contamination Investigation Revised Report" (report), submitted with your letter dated March 27, 2014. Based on our review, the report is approved with the following conditions:

- A discussion of the NAPL detected in trenches HB-TP-55 and 55AN will need to be included in future documents including the Feasibility Study.

- In future documents and/or investigations, it will need to be confirmed that the groundwater elevations in Table 8 and Figures 4 and 5 are correct since during both events the groundwater levels in several of the wells are below lake level.

If you have any questions, please contact me at 518-402-9796.

Sincerely,

Tracy A. Smith

Tracy A. Smith
Project Manager

ecc:	J. Gregg, NYSDEC	R. Nunes, USEPA	M. Sergott, NYSDOH
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March 27, 2014

Mr. Tracy A. Smith
New York State Department of Environmental Conservation
Remedial Bureau D
625 Broadway
Albany, New York 12233-7016

Re: SYW-12 Sources of Contamination Investigation Revised Report

Dear Mr. Smith:

The SYW-12 Sources of Contamination Investigation Revised Report, prepared by O'Brien & Gere on behalf of Honeywell, is included for your review. The report has been revised in accordance with your July 17, 2013 comment letter, with the exception of Comment #12 requesting interpretation of the fingerprinting data. This comment is being addressed in a forensic evaluation document to be submitted under separate cover.

Please contact Tom Conklin of O'Brien & Gere (Tom.Conklin@obg.com or 315-956-6408) or me if you have any questions regarding this report.

Sincerely,

John P. McAuliffe by CCC

John P. McAuliffe, P.E.
Syracuse Program Director

Attachments (2 copies, 1 CD)

cc:	William Hague	Honeywell (ec ltr only)
	Maureen Schuck	NYSDOH (ltr only)
	Harry Warner	NYSDEC Region 7 (1 copy, 1 CD)
	Mark Sergott	NYSDOH (1 copy, 1 CD)
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	Margaret A. Sheen, Esq.	NYSDEC, Region 7 (ltr only)
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	Fred Kirschner	AESE, Inc. (ec or CD)
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Ed Glaza	Parsons (ec ltr only)
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Christopher Calkins	O'Brien & Gere (ec or ec ltr only)
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REVISED REPORT

SYW-12 SOURCES OF CONTAMINATION INVESTIGATION

Honeywell

March 2014

O'BRIEN & GERE

1163 | 49362

SYW-12 SOURCES OF CONTAMINATION INVESTIGATION

Prepared for:

Honeywell

CHRISTOPHER C. CALKINS, VP
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1 INTRODUCTION

This report presents the results of the Sources of Contamination Investigation on the SYW-12 property (the Property). The purpose of this work was to delineate the former Onondaga Creek channel on the Property and further evaluate sources of constituents in the former channel.

This work was performed in accordance with the May 4, 2012 work plan and the New York State Department of Environmental Conservation's (NYSDEC) May 8, 2012 work plan acceptance letter.

1.1 PROJECT BACKGROUND

The SYW-12 property is located along the northeastern shoreline of Onondaga Lake and to the north and south of Ley Creek (**Figure 1**). The area is bounded by railroad tracks to the east and the Lake to the west (**Figure 2**). The area is approximately 40.7 acres (approximately 18.4 acres is delineated as wetland) and is currently owned by Onondaga County.

The NYSDEC-approved site specific Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) for the Harbor Brook site dated August 2002 and October 2002 respectively were utilized for this investigation.

2 SYW-12 SOURCES OF CONTAMINATION FIELD INVESTIGATION AND SAMPLING METHODS

2.1 ACCESS AGREEMENTS

The area is currently owned by Onondaga County and is encompassed by CSX railroad tracks. The previous access agreement for the property initiated as part of the Wastebed B/Harbor Brook Remedial Investigation (RI) had expired, and a new agreement was signed into place on May 17, 2012. CSX was notified prior to crossing the railroad tracks, and arrangements for a flagman were made when required.

2.2 MARKING OF SUBSURFACE UTILITIES

Dig Safely New York was contacted prior to the initiation of intrusive work on the Property. The various utility companies met with an O'Brien & Gere representative and marked the locations of the subsurface utilities in the investigation area.

2.3 MARKING OF FINAL SAMPLING LOCATIONS IN THE FIELD

Subsequent to the marking of subsurface utilities, final test trench and boring locations were adjusted to remain clear of investigation area utilites. Locations were adjusted based on field observations, and final soil boring locations were adjusted again based on test trench observations. Sample locations for the investigation are presented on **Figure 3.**

2.4 TEST TRENCHES

A total of six test trenches were advanced to evaluate the horizontal extent of the former Onondaga Creek Channel and the physical and chemical characteristics of shallow subsurface soils/fill material (0 to 15 ft) used to fill the former channel. Six test trenches (HB-TP-54A, HB-TP-55, HB-TP-55AN, HB-TP-55BS, HB-TP-56, and HB-TP-57) were advanced using a tracked excavator between June 4, 2012 and June 12, 2012. Test trench locations are presented on **Figure 3**. Test trenches HB-TP-56 and 57 were not advanced continuously, but were excavated in segments due to test trench length. Test trench logs were completed by an O'Brien & Gere geologist, and are presented in **Appendix A**. A photograph log was compiled and is presented in **Appendix B**. Total test trench dimensions are presented in **Table 1.1**.

Table 1.1 Test Trench Summary

Test Trench	Length x Width (ft)	Terminal Depth (ft bgs)
HB-TP-54A	270 x 4	8-9
HB-TP-55	425 x 4	11
HB-TP-55AN	150 x 4	6
HB-TP-55BS	64 x 4-6	11
HB-TP-56	620 x 4	11
HB-TP-57	560 x 4	13

During test trenching, samples were collected for three different media including soil, groundwater, and polytetrafluoroethylene (PTFE) sheen nets. A summary of sample locations and analyses performed are presented in **Tables 1, 2**, and **3** for test trench soils, test trench groundwater, and test trench PTFE sheen nets, respectively. A total of 13 soil samples (six samples for target compound list/target analyte list [TCL/TAL] analyses and 13 samples for fingerprinting analyses), five groundwater samples, and six PTFE sheen net samples were collected during test trench advancement. Chains of custody were submitted with all samples and are contained in **Appendix C**.

Test trench soil samples were obtained using the excavator. The soils were transferred from the excavator to a dedicated aluminum pan and homogenized using a dedicated plastic scoop. Prior to homogenization, a sample was collected and containerized for volatile organic compound (VOC) analysis. Subsequent to homogenization, soils were transferred to the appropriate laboratory containers for the remainder of the analyses, placed in a cooler containing ice, and shipped to the laboratory with a completed chain of custody.

Soil samples were submitted to Accutest Laboratories for TCL/TAL and fingerprinting analyses using USEPA SW846 methods (USEPA, 2004). The samples were analyzed using methods 8260B, 8270D, 8082, 6010C, 7471A, 9010C/9014, and Lloyd Kahn for VOCs, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, mercury, cyanide, and total organic carbon (TOC), respectively. In addition to the TCL/TAL analyses, samples were submitted for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers, and method 8015C for total petroleum hydrocarbons and non-halogenated organics.

Test trench groundwater samples were obtained in one of two manners. Samples HB-TP-55-356, HB-TP-55-(50), and HB-TP-56-228 were collected using the excavator. Groundwater was allowed to fill the excavator bucket, and then a closed laboratory provided container was completely immersed in the groundwater, opened, and filled with groundwater from the water column. Effort was taken not to include surface water with possible sheen and lighter than water organics in the sample. Samples HB-TP-55AN-72 and HB-TP-55-(50)PAN were collected by placing soil from the sample interval in a dedicated aluminum pan and pouring laboratory provided deionized (DI) water into the pan, submersing the soil. The DI water was allowed to interact with the material for a period of time simulating groundwater interacting with the impacted soil. The DI interacted with soil from sample HB-TP-55AN-72 for two hours and HB-TP-55-(50)PAN for 30 minutes. After the interaction period, the DI water was passed through a PTFE sheen net, and collected in a laboratory provided container. Subsequent to collection in the laboratory container, the sample was placed in a cooler containing ice, and shipped to the laboratory with a completed chain of custody.

Test trench groundwater samples were submitted to Accutest Laboratories for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers, and method 8015C for total petroleum hydrocarbons and non-halogenated organics.

Test trench PTFE sheen net samples were collected from six locations including HB-TP-54A-85, HB-TP-55-356, HB-TP-55-(50)PAN, HB-TP-55-(50), HB-TP-55AN-72PAN, AND HB-TP-55AN-152 (**Figure 3 and Table 3**). These samples were also collected in one of two manners. One group of samples (HB-TP-54A-85, HB-TP-55-356, HB-

TP-55-(50), and HB-TP-55AN-152) was collected using the excavator. Groundwater was allowed to fill the excavator bucket, and then a PTFE sheen net was sifted back and forth through the surface of the water collecting sheen. A second group of samples (HB-TP-55-(50)PAN and HB-TP-55AN-72PAN) were collected by placing soil from the sample interval in a dedicated aluminum pan and pouring laboratory provided DI water into the pan, submersing the soil. The DI water was allowed to interact with the material simulating groundwater interacting with the impacted soil. The DI interacted with soil from sample HB-TP-55AN-72PAN for two hours, and HB-TP-55-(50)PAN for 30 minutes. After the interaction period, the DI water was passed through a PTFE sheen net collecting sheen generated on the DI water from the soil. The sheen net was then put in a laboratory provided container, placed in a cooler containing ice, and shipped to the laboratory with a completed chain of custody.

Test trench PTFE sheen net samples were submitted to Accutest Laboratories for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers and method 8015C for total petroleum hydrocarbons and non-halogenated organics. The PTFE samples were processed according to the specifications of EPA 3546 utilizing microwave extraction of solid samples. The entire PTFE sheen net was placed in the extraction vessel with some drying agent (sodium sulfate) to remove water present on the net. The Teflon net was spiked with appropriate extraction surrogates and finally, the organic extraction solvent (dichloromethane) was added to the extraction vessel. The vessel was sealed, and the sample was extracted per the proper microwave extraction program, with the extract concentrated to a final volume of 2.0 mL and internal standards added as appropriate. These samples were processed as solid samples, and the analytical results were reported in solids units (*e.g.*, µg/kg).

2.5 SOIL BORINGS

A total of 14 soil borings were advanced to evaluate the vertical extent of fill material within the former channel and characterize subsurface geologic strata and subsurface soil constituent concentrations. One soil boring, initially proposed to be outboard of the channel on the northeastern side, was not advanced due to its position in Onondaga Lake. The terminal depth for each of the borings was within the native material (marl). From the 14 soil borings, a total of 16 soil samples were collected with 13 samples for TCL/TAL parameters and three samples for fingerprinting analyses. Soil boring location IDs, terminal depths, and soil sample intervals are presented below in **Table 1.2.** Sample locations are presented on **Figure 3**.

Table 1.2 Soil Boring Summary

Soil Boring	HB-SB-251	HB-SB-252	HB-SB-253	HB-SB-254	HB-SB-255	HB-SB-256	HB-SB-257	HB-SB-258	HB-SB-259	HB-SB-260	HB-SB-261	HB-SB-262	HB-SB-263	HB-SB-264
Terminal Depth (ft bgs)	20	20	22	22	20	24	24	20	20	20	24	20	20	20
Sample Interval (ft bgs)	10-12	10-12 and 18-20 (F)	11.5-12	9-10 (F) and 10-12	10-12	14-16 and 22-24 (F)	10-12	10-12	9.5-10	8-8.5	9-10	6-8	---	4-6
Notes: F – denotes that sample collected for fingerprinting analyses only														

In addition to the soil samples, one PTFE sheen net sample was collected from location HB-SB-256. A summary of sample locations and analyses performed are presented on **Tables 4 and 5** for soil boring soil samples and soil boring PTFE sheen net samples, respectively.

Boreholes were advanced using conventional hollow stem auger drilling techniques. Samples were collected continuously throughout the borings in accordance with ASTM Method D1586-84 using a 140-lb hammer and 2-inch diameter split barrel sampler. Boring logs were completed by an O'Brien & Gere geologist for each location and are presented in **Appendix D.**

Once collected, soil boring samples were transferred to a dedicated aluminum pan and homogenized using a dedicated plastic scoop. Prior to homogenization, a sample was collected and containerized for VOC analysis. Subsequent to homogenization, soils were transferred to the appropriate laboratory containers for the remainder of the analyses, placed in a cooler containing ice, and shipped to the laboratory with a completed chain of custody.

Soil samples were submitted to Accutest Laboratories for TCL/TAL and fingerprinting analyses using USEPA SW846 methods (USEPA, 2004). The samples were analyzed using methods 8260B, 8270D, 8082, 6010C, 7471A, 9010C/9014, and Lloyd Kahn for VOCs, SVOCs, PCBs, metals, mercury, cyanide, and TOC, respectively. In addition to the TCL/TAL analyses, samples were submitted for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers and method 8015C for total petroleum hydrocarbons and non-halogenated organics.

A soil boring PTFE sheen net sample was collected at HB-SB-256 (HB-SB-256PAN) by placing soil from the sample interval in a dedicated aluminum pan and pouring laboratory provided DI water into the pan, submersing the soil. The DI water was allowed to interact with the material simulating groundwater interacting with the impacted soil. After the 30-minute interaction period, the DI water was passed through a PTFE sheen net collecting any sheen generated on the DI water from the soil. The sheen net was then put in a laboratory provided container, placed in a cooler containing ice, and shipped to the laboratory with a completed chain of custody.

The soil boring PTFE sample was submitted to Accutest Laboratories for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers and method 8015C for total petroleum hydrocarbons and non-halogenated organics. This sample was processed by the laboratory as described in Section 2.4.

2.6 MONITORING WELL INSTALLATION

Two monitoring wells (HB-MW-28 and HB-MW-29) were installed to evaluate the hydraulic potential of shallow groundwater in the buried former Onondaga Creek channel and to assess the shallow groundwater chemistry in the former channel. The well locations are presented on **Figure 3.** The screen depths of the wells were selected based on the depth of the first encountered groundwater. Monitoring well HB-MW-28 is screened from 6 to 16 ft below ground surface (bgs), and HB-MW-29 is screened from 4.5 to 14.5 ft bgs. Complete well construction details are noted on the monitoring well logs included in **Appendix D**. The wells were drilled directly adjacent to soil borings HB-SB-252 and HB-SB-264, respectively. The geologic strata for the wells are noted on these boring logs in **Appendix D**. The wells were constructed in the field using the method described below.

The wells were blind drilled to terminal depths pre-determined from adjacent soil borings, as noted above. When the terminal depths for the boreholes were reached, 2-inch diameter wells consisting of 10-ft lengths of 0.020-inch slot screens flush-threaded to riser casings were lowered through the 4¼-inch auger string. Polyvinyl chloride (PVC) was used for the well screens and riser casings. The riser casings extend approximately 2 ft above ground surface and the PVC wells are protected by steel guard pipes. A sandpack suitable for use with the screen slot size were installed in the annular space between the boreholes and the wells. The sandpack extends from the bottom of the well approximately 2 ft above the top of both well screens. A bentonite seal, approximately 3 ft thick, was installed in the annular space above the sand pack to prevent water from moving vertically along the boreholes. The remaining annular space was filled with a Portland cement/bentonite grout through a tremie pipe to a maximum depth of 5 ft below grade. The steel guard pipes were mounted with covers, and pad locks were installed on the covers of each well. Concrete pads were installed around the guard pipes to direct precipitation away from the boreholes. Vented caps were added to the wells.

Following installation of the wells and prior to collection of groundwater samples, each well was developed to remove material which had settled in and around the well screen. Development consisted of the removal of ten well volumes using either a bailer or centrifugal pump. A goal of 50 Ntu was established and met at both wells. Development water was contained in a 55-gallon polyethylene drum located on-site for subsequent off-site disposal.

During development special emphasis was placed on determining the presence of non-aqueous phase liquid (NAPL) in the wells. During development the pump was placed near the bottom of the well to collect and dense NAPL, and a bailer was used to collect water from the surface of the water column to collect light NAPL. NAPL was not found at either location in the water column. In addition to collecting water from different points in the water column, a Solinist-122 Oil/Water Interface Meter was employed to detect stratification between NAPL and water in the wells. Like the physical sampling methods, no NAPL stratification was detected in the wells. Monitoring well development logs are presented in **Appendix E.**

2.7 GROUNDWATER SAMPLING

One round of groundwater sampling was conducted on August 7, 2012 in order to evaluate site constituents present in the former channel in dissolved form, mobility, and potentially impacting down gradient areas. Samples were collected from the two newly installed wells HB-MW-28 and HB-MW-29 and existing well HB-MW-26. **Table 6** lists the monitoring wells sampled, the screen intervals, and the laboratory analyses performed for these samples.

Groundwater samples were collected from all three locations using low flow purging techniques. Low flow purging involves inserting dedicated polyethylene tubing within the screened interval of the well and purging at a maximum rate of 0.5 L/min using a peristaltic pump. During purging, groundwater levels were monitored to ensure stabilization. Groundwater quality parameters were monitored continuously using a Horiba U-52 in-line meter, and included pH, conductivity, temperature, eH, turbidity, and dissolved oxygen. Once the groundwater quality parameters stabilized, samples were collected directly from the tubing. Specific gravity was measured in the field via hydrometer. Groundwater sampling logs are included in **Appendix F**.

Samples were submitted to Accutest Laboratories for TCL/TAL and fingerprinting analyses using USEPA SW846 methods (USEPA, 2004). The samples were analyzed using methods 8260B, 8270D, 6010C, 1631, 9010C/9014, and 6010C/E300/2320B for VOCs, SVOCs, metals, high resolution mercury, cyanide, and major anions/cations (Ca, Mg, Na, K, Cl, Br, SO_4, CO_3, and HCO_3). In addition to the TCL/TAL analyses, samples were submitted for fingerprinting analyses using methods 8270M for extended SVOCs and petroleum biomarkers and method 8015C for total petroleum hydrocarbons and non-halogenated organics.

2.8 HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivity tests were conducted in the two newly installed (HB-MW-28 and HB-MW-29) and one existing monitoring well (HB-MW-26) to estimate the horizontal hydraulic conductivity of materials surrounding the well screen. Rising and falling head measurements were obtained following both insertion and removal of a PVC slug into the well. The groundwater measurements were recorded using an electronic data logger. The data were analyzed using the Bouwer and Rice (1976) method with the software AquiferWin©. Graphs of the K-test curves are included in **Appendix G**. The K-test values represent either rising or falling head measurement data.

2.9 SITE SURVEY

A sample location survey was completed on August 16 and 17, 2012 by Richard M. Rybinski, a New York State licensed land surveyor. The survey included all new sample locations. The New York State Plane coordinates (NAD 83) were determined, and the ground surface elevations were surveyed to a vertical accuracy of 0.01 ft.

3 DATA MANAGEMENT AND VALIDATION

Analytic results were received from Accutest Laboratory in hard copy and electronic formats. Electronic data received from the laboratories were uploaded to the Locus Technologies EIM™ environmental data management system. This data management system was used to develop summary reports for this report and as the comprehensive database for all project deliverables. These data have been validated in accordance with applicable United States Environmental Protection Agency (USEPA) and NYSDEC guidance, and a data validation report is included in **Appendix H.**

4 INVESTIGATION AREA PHYSICAL CHARACTERISTICS

4.1 EXCAVATION AND BORING OBSERVATIONS

Test trench logs and soil boring logs are contained in **Appendix A** and **Appendix D**, respectively. These logs contain observations made during the investigation, and a summary of pertinent field observations from test trenches and soil borings is presented in **Table 7**. **Figure 3** presents sample locations, and a more detailed description of test trench and soil boring observations is summarized below.

Test trench HB-TP-54A was largely outside the footprint of the former Onondaga Creek channel. The test trenching showed that the portion of the trench from stations 250 ft to 270 ft (stationing shown on **Figure 3**) was likely within the original mouth of the former Onondaga Creek channel. The maximum depth excavated through this section (6 ft) was above channel infrastructure and stained soil found in and near the channel at other test trenches on the Property. Throughout HB-TP-54A, the top 6.5 ft bgs was silt fill with some organic matter. Encountered in pockets throughout the test trench below the silt layer was an approximately 1-ft layer of cinders, boiler slag, coal, shells and wood fragments. Below this layer, brownish black peat with organic debris was encountered above the native marl unit.

Test trench HB-TP-55 straddled the former Onondaga Creek channel. Test Trench HB-TP-55 was initially advanced 420 ft to the southwest and then another 100 ft to the northeast. Channel and harbor infrastructure was encountered in the test trench at stations 286 ft and 413 ft (**Figure 3**). This infrastructure was likely associated with the former channel. Infrastructure encountered included large pilings and milled lumber that likely acted as shoring along the former channel bank. Stained soil with coal tar/petroleum like odor was also encountered continuously in two different areas during advancement of HB-TP-55. Stained soil with coal tar/petroleum like odor were encountered from stations (-100) ft to 60 ft and 235 ft to 425 ft. Pockets and thin bands of stained soil were encountered between stations 60ft and 235 ft. The stained soil layer varied in thickness and depth, but was typically encountered between 6 ft and 7ft bgs. The stained soil was often found layered with silt and organic material including leaf matter, twigs, and pine needles. Above the stained soil was approximately 6 ft of varied silty fill, and marl was encountered below the coal tar stained soil layer.

Test trench HB-TP-55AN was advanced northwest from test trench HB-TP-55 at station 286 ft (**Figure 3**). Test trench HB-TP-55AN followed the northern bank of the former Onondaga Creek channel. During advancement of this test trench, a total of 17 pilings, which were likely used as channel bank shoring, were encountered. The first and last encountered pilings and test trench path are presented on **Figure 3.** A complete list of pilings encountered and their positions along the test trench path are presented on the test trench log in **Appendix A**. Substrate encountered along the first 130 ft of this test trench resembled that near the former creek channel in HB-TP-55, with a distinct layer of coal tar/petroleum impacted silt and organic material. Substrate from approximately 130 ft to the terminal distance of 150 ft resembled that encountered during test trench HB-TP-54A, with little to no stained soil or impacted material observed.

Test trench HB-TP-55BS was advanced following the southern bank of the former Onondaga Creek channel. The trench was advanced to the east from the piling exposed at station 413 ft. During advancement of this test trench, a total of six pilings, including the initial piling in HB-TP-55, were encountered, which confirmed that the test trench was following the channel bank. These pilings were likely used as channel bank shoring. The first and last encountered pilings and test trench path are presented on **Figure 3.** A complete list of pilings encountered and their positions along the test trench path are presented on the test trench log in **Appendix A.** Substrate encountered along this trench resembled that near the former creek channel in HB-TP-55. A distinct layer of stained soil with coal tar/petroleum like odor in impacted silt and organic material was present but thinner and less pronounced than that encountered within the former channel footprint.

Test trench HB-TP-56 likely straddled the former Onondaga Creek channel. Channel and harbor infrastructure was encountered at stations 30 ft, 145 ft, and 162 ft. Infrastructure encountered included a large concrete or slag like feature with rebar at 30 ft, a metal bracing with milled wood at 145 ft, and a large flat feature that could not be excavated (possibly wood) at 162 ft. Coal tar like material, stained soils, and odor were observed throughout the test trench starting approximately at station 40 ft. The first portion between stations 40 ft and 275 ft was

dark stained soil with moderate coal tar like odor. The stained soil layer ranged from a few inches to almost a 1.5 ft in thickness, with the thickest bands being found between stations 145 ft and 275 ft. The strongest coal tar odors were associated with the thicker layers, and sheen was observed on the material at station 258 ft. Progressing to the northeast from station 275 ft, the stained soil band became thinner as the trench approached station 403 ft. The stained soil band became thicker and more pronounced from station 403 ft to 620 ft, with increasing coal tar/petroleum like odors. Across the entire stretch between stations 275 ft and 620 ft, a petroleum-like odor increased in intensity and accompanied the coal tar like odor present in earlier sections of the test trench. The stained soil layer was found progressively deeper below ground surface as the test trench progressed to the northeast. The layer was initially encountered at approximately 6.5 ft bgs, and was encountered at 10 ft bgs by the northeast end of the test trench. Above the stained soil, a layer of gray silt with little sand was encountered. Gravel and cobble, along with coarser sand, were also encountered near the southwestern starting point of the test trench. Below the stained soil layer, marl was encountered.

HB-TP-57 likely straddled the former channel based on the position of former Onondaga Creek channel infrastructure in the other test trenches on the Property. However, no infrastructure was encountered during the advancement of this test trench. General strata in the test trench were coarser than in other test trenches, which made the trench walls less stable and lead to cave-ins along the trench. The cave-ins made it more difficult to visually establish depths and thicknesses of layers observed. Stained soil with coal tar like odor, and in places petroleum like odor were observed dispersed throughout the trench. This material was also encountered at a greater depth below ground surface than in the previous trenches near the extent of the test trenching capabilities that further made accurate delineation difficult in this trench. Stained soil in a dark vegetative mat with slight coal tar/petroleum like odor was encountered during the first 50 ft of the trench. The stained vegetative mat was not observed between stations 50 ft and 70 ft, and little to no stained soil or coal tar/petroleum odor was observed in this interval. In excavated reaches between stations 157 ft and 560 ft, dark stained sand with coal tar/petroleum like odor was observed above the stained vegetative mat where the excavation allowed deeper depths to be reached. Above the stained soil layer was brown silt. Marl was found below the stained soil layer in areas where its depth bgs was obtainable.

Of the fourteen borings advanced during the investigation, potential former creek channel infrastructure was observed only in HB-SB-262. Potentially milled wood was observed in the 12 to 14 ft bgs interval at this location. This boring was advanced in close proximity to infrastructure observed in test trench HB-TP-55BS. Stained soil with a coal tar like and or petroleum like odor was observed in borings except for HB-SB-258, HB-SB-260, and HB-SB-263. In addition to stained soil with odor, NAPL or a discernable sheen was observed in borings HB-SB-253, HB-SB-254, HB-SB-256, HB-SB-259, and HB-SB-262.

4.2 INVESTIGATION AREA HYDROLOGY AND GROUNDWATER FLOW

Groundwater elevation measurements were collected on August 10, 2012 for seven of the eight wells on the Property and on October 17, 2012 for all eight wells to create groundwater contour maps and groundwater flow direction. The groundwater elevation at monitoring well HB-MW-25 was not measured during the August event, because it could not be located. Groundwater elevation maps were generated for both events and are presented on **Figures 4 and 5**, and the data are also summarized on **Table 8**. The limited size of the investigation area and monitoring locations preclude any conclusions on the direction of groundwater flow at the Property. The groundwater elevations measured within the monitoring wells during both events were too similar to allow for accurate delineation of groundwater contours. However, based on work completed during the draft Wastebed B/Harbor Brook RI (O'Brien & Gere, 2007), the general trend for groundwater flow through the shallow silt unit at the Property appears to the northwest in the direction of Onondaga Lake.

Hydraulic conductivity testing was completed on two new monitoring wells and one existing well on January 24, 2013. The geometric means of the rising and falling head tests ranged from 1.54×10^{-02} cm/sec (43.75 ft/d) at well HB-MW-28 to 3.82×10^{-03} cm/sec (10.81 ft/d) at well HB-MW-26. **Table 9** summarizes the hydraulic conductivity testing performed as part of the investigation; graphs of the K-test curves are included in **Appendix G**. The difference in hydraulic conductivity values between the locations is related to the amount of clay and/or sand content present around the screen interval. The range of values across the project area is consistent with what is expected for fine grained silts with sand (10^{-3} cm/sec) and sandy materials (10^{-2} cm/sec).

5 ANALYTICAL RESULTS

5.1 TEST TRENCHES

Analytical results for test trenches advanced during the investigation are presented on **Tables 10 through 14** for VOCs, SVOCs, PCBs, inorganic and other data, respectively. Thirteen VOCs were detected in test trench samples, including acetone, o-xylene, m&p-xylenes, ethylbenzene, and isopropyl benzene. The highest VOC detection was for isopropyl benzene at location HB-TP-55-255, with a concentration of 1260 µg/kg. The highest total xylene concentration of 933 µg/kg was also detected at this location. The highest detected acetone concentration of 301 µg/kg was at location HB-TP-54A-85.

TCL SVOCs detected using method in test trenches were made up mostly of assorted polycyclic aromatic hydrocarbons (PAHs). Of the PAHs detected in test trenches, fluoranthene and pyrene were detected in all samples and also detected at the highest concentration of the SVOCs. The highest detections were at location HB-TP-57-160 with concentrations of 21,800 and 24,600 µg/kg, respectively. Total PAHs detected in the six SVOC test trench samples are presented in **Table 1.3** below.

Table 1.3 Test Trench Total PAH Concentrations

Location	Depth bgs	Total PAHs (µg/kg)
HB-TP-54A-85	7 ft	55,072
HB-TP-55-(100)	10 ft	97,960
HB-TP-55-255	9.5 ft	31,939
HB-TP-56-148	12 ft	66,957
HB-TP-57-160	11 ft	149,957
HB-TP-57-560	10 ft	117,232

PCBs were not detected in test trenches advanced on the Property.

Inorganics detected in the test trench soil samples included mercury, lead, calcium, copper, zinc, and nickel. The highest mercury detection was at location HB-TP-54A-85 with a concentration of 2.8 mg/kg. The highest inorganic detect was for calcium at location HB-TP-57-560 with a concentration of 123,000 mg/kg. Of these six metals, mercury, lead, copper, zinc, and nickel exceeded their Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs) in at least five of the six samples, and calcium was detected at concentrations higher than typical soils.

5.2 SOIL BORINGS

Analytical results for the soil borings advanced during the investigation are presented in **Tables 15 through 19** for VOCs, SVOCs, PCBs, inorganic and other data, respectively. Twelve different VOCs were detected in soil boring samples, including acetone, o-xylene, m&p-xylenes, ethylbenzene, and isopropyl benzene. The highest VOC detection was for ethylbenzene at location HB-SB-253 (11.5 to 12 ft bgs) and HB-SB-259 (9.5 to 10 ft bgs) with a concentration of 11,200 µg/kg. The highest total xylene and isopropyl benzene concentrations of 15,300 µg/kg and 4,090 µg/kg, respectively, were also detected at this location.

TCL SVOCs detected using method 8270D in soil borings were made up mostly of assorted PAHs. Of the PAHs detected in soil borings, 2-methylnaphthalene, naphthalene, and phenanthrene were detected in all samples and also detected at the highest concentration of all SVOCs. The highest 2-methylnaphthalene, naphthalene, and phenanthrene concentrations of 310,000 µg/kg, 274,000 µg/kg, and 256,000 µg/kg, respectively, were all detected at location HB-SB-253 (11.5-12 ft bgs). Total PAHs concentrations in thirteen soil boring SVOC samples are presented in **Table 1.4** below.

Table 1.4 Soil Boring Total PAH Concentrations

Location	Depth (bgs)	Total PAHs (µg/kg)
HB-SB-251	10-12 ft	67,911

Table 1.4 Soil Boring Total PAH Concentrations

Location	Depth (bgs)	Total PAHs (µg/kg)
HB-SB-252	10-12 ft	126,700
HB-SB-253	11.5-12 ft	1,596,410
HB-SB-254	10-12 ft	633,110
HB-SB-255	10-12 ft	19,069
HB-SB-256	14-16 ft	133,453
HB-SB-257	10-12 ft	29,254
HB-SB-258	10-12 ft	2,685.5
HB-SB-259	9.5-10 ft	86,133
HB-SB-260	8-8.5 ft	99,721
HB-SB-261	9-10 ft	139,523
HB-SB-262	6-8 ft	164,079
HB-SB-264	4-6 ft	105,305

PCBs were not detected in soil borings advanced on the Property.

Inorganics detected in the soil boring samples included mercury, lead, calcium, cadmium, chromium, copper, zinc, silver and nickel. The highest mercury detection was at location HB-SB-260 with a concentration of 4.2 mg/kg. The highest inorganic detect was for calcium at location HB-SB-251 with a concentration of 136,000 mg/kg.

5.3 MONITORING WELLS

Analytic results for monitoring well samples are presented in **Tables 20 through 23** for VOCs, SVOCs, inorganic data, and other data, respectively. VOC detections in groundwater consisted of o-xylene, m&p-xylenes, ethylbenzene, isopropyl benzene, toluene, and benzene. VOCs were not detected at location HB-MW-26. The highest VOCs detected were total xylenes and ethyl benzene at location HB-MW-29 with concentrations of 9.9 µg/L and 7µg/L, respectively.

TCL SVOCs detected using method 8270D consisted mainly of assorted PAHs. The highest detected SVOC in groundwater was naphthalene at location HB-MW-29 with a concentration of 36.8 µg/L. The highest non-PAH SVOC detection for 1,1'-biphenyl was also observed at this location and had a concentration of 1.9 µg/L. Total PAHs concentrations in monitoring wells are presented on **Table 1.5** below:

Table 1.5 Groundwater Total PAH Concentrations

Location	Well Screen Depth (bgs)	Total PAHs (µg/L)
HB-MW-26	6-16 ft	10.93
HB-MW-28	8-18 ft	27.56
HB-MW-29	4.5-14.5 ft	70.96

Inorganics detected in monitoring well groundwater samples were barium, calcium, iron, magnesium, manganese, mercury, potassium, and sodium. In general the highest inorganic detects occurred at location HB-MW-29. The highest detection for mercury was 0.0000172 mg/L at this location. The highest inorganic detection was sodium at HB-MW-28 with a concentration of 2,210 mg/L. Additional anion/cation data were collected in groundwater monitoring wells and included carbonate alkalinity, bicarbonate alkalinity, bromide, chloride, and sulfate. Chloride had the highest detection of these constituents with a concentration of 5,200 mg/L at location HB-MW-28.

5.4 FINGERPRINTING DATA

Fingerprinting data were collected for soils from test trenches and soil borings, groundwater entering the test trenches, PTFE sheen nets from groundwater and generated sheens, and monitoring well groundwater samples. Fingerprinting soils data for test trenches and soil borings are presented in **Tables 24 through 26** for forensic PAHs/petroleum biomarkers, non-halogenated organics and total petroleum hydrocarbons, and percent moisture data, respectively. Test trench groundwater fingerprinting data are presented in **Tables 27 and 28** for forensic PAHs/petroleum biomarkers and non-halogenated organics/total petroleum hydrocarbons, respectively. Test trench and soil boring PTFE sheen net fingerprinting data are presented in **Tables 29 and 30** for forensic PAHs/petroleum biomarkers and non-halogenated organics/total petroleum hydrocarbons, respectively. Groundwater monitoring well fingerprinting data are presented in **Tables 31 and 32** for forensic PAHs/petroleum biomarkers and non-halogenated organics/total petroleum hydrocarbons, respectively.

6 DISCUSSION

Similar geologic conditions were observed throughout test trenching and soil boring advancement on the Property. Typically, unconsolidated reworked fill deposits were encountered in the first 2 to 4 ft bgs immediately adjacent to the lake shore and at 6 to 10 ft bgs as locations progressed away from the lake shore. The fill unit consists of sand, silt, gravel, shell material, and concretions with the occasional piece of anthropogenic debris such as plastic pieces, metal pieces, and concrete and brick fragments. A stained layer, approximately several inches to 1 ft thick, is typically encountered below the reworked fill at approximately 8 to 10 ft bgs. This stained layer is generally found in two different materials. The first stained layer material is comprised of course cinders, coal slag, fine sand, fine gravel, and washed shells. The second stained layer material occurs as a mat of natural, vegetative matter including buried leaves, pine needles, twigs, and reed material. The stained material typically has a coal tar and/or petroleum odor. The stained layer typically marks the transition from the reworked fill to the buried lakebed sediments or marl unit. The marl unit is comprised of sandy or silty, shell rich calcareous lake sediment.

Non-fingerprinting soils data were compared to NYSDEC Part 375.6 Unrestricted Use Soil Cleanup Objectives (soil criteria). Summary statistics for detected constituents and comparison to cleanup objectives for test trenches and soil borings advanced as part of the investigation are presented in **Table 33**. Five VOCs were detected above soil criteria and included acetone, o-xylene, m&p-xylenes, ethylbenzene, and total xylenes. The majority of the exceedances were observed in soil borings and were dispersed across the property with no discernable trend or pattern.

Thirteen SVOCs were detected above soil criteria in soil samples collected during the investigation. Assorted PAHs made up the majority of exceedances, with 18 of 19 soil samples exceeding soil criteria for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. Dibenzo(a,h)anthracene and naphthalene also exceeded soil criteria in 16 and four samples out of the 19 samples, respectively. Considering the high ratio of exceedances to numbers of samples, SVOCs, and especially PAHs, were widely dispersed on the Property. The highest concentrations were typically encountered transecting the center of the Property in the area of HB-TP-56 and surrounding borings but are not limited to this area.

Nine inorganics were detected above criteria in soil samples collected during the investigation. For the 19 soil samples analyzed for inorganics, the parameters detected at the highest frequency above soil criteria included mercury (in 18 samples), lead (in 17 samples), copper (in 16 samples), zinc (in 16 samples), nickel (in 15 samples), chromium (in 10 samples), silver (in 10 samples), and cadmium (in 7 samples). Inorganic compound exceedances were dispersed across the property, with the southwest corner of the property having the lowest detected metal concentrations and fewest exceedances of criteria.

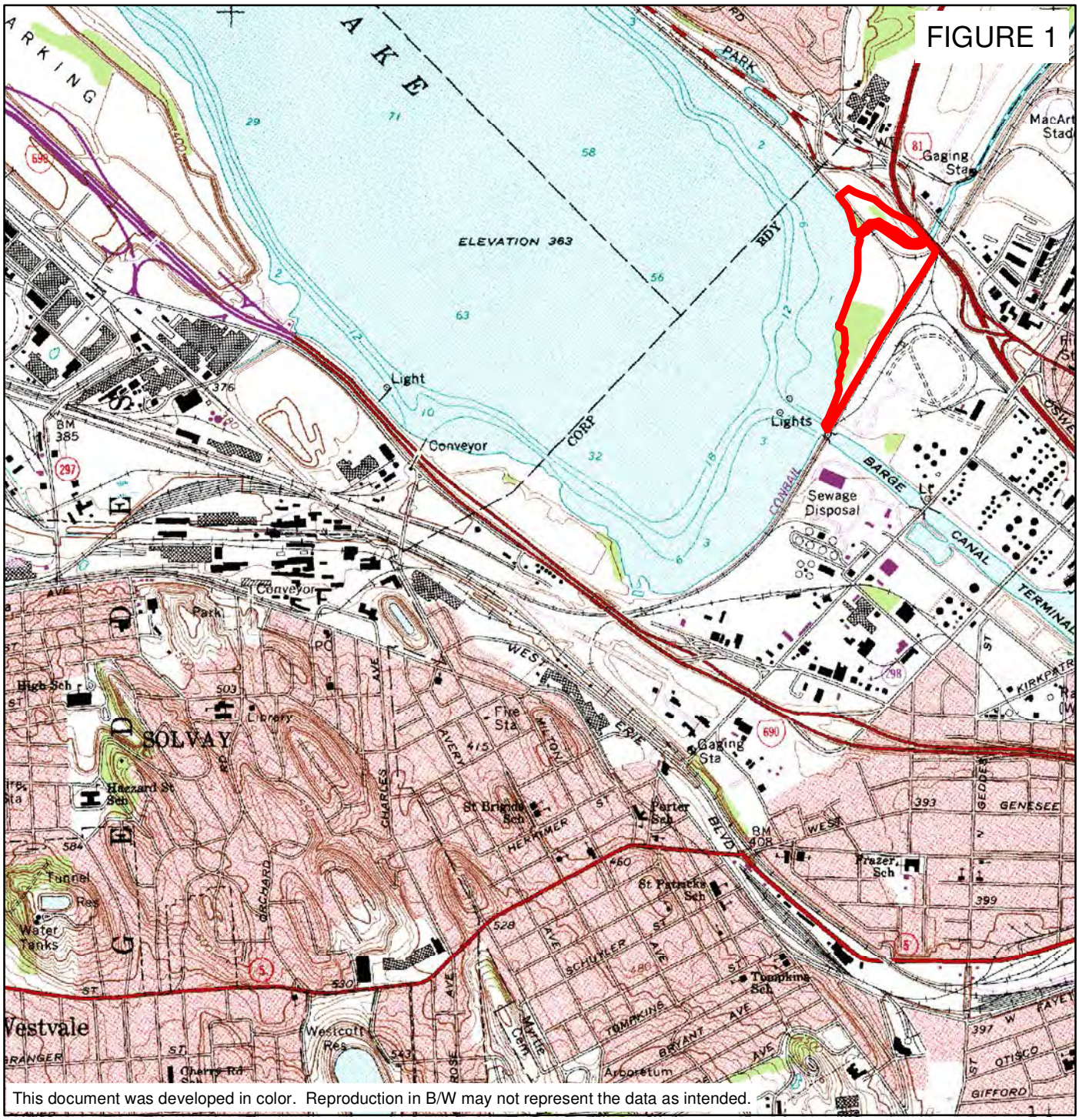
Non-fingerprinting monitoring well groundwater data were compared to NYSDEC Class GA Groundwater Standards and Guidance (groundwater criteria). Summary statistics for detected constituents and comparison to groundwater criteria are presented on **Table 34**. Three VOCs (ethylbenzene, o-xylene, and total xylenes) were

detected above groundwater criteria. All three exceedances occurred at HB-MW-29. There were no VOC detected at HB-MW-26.

Monitoring well groundwater samples were similar to soils in that assorted PAHs made up the bulk of the detections. The only exceedance to groundwater criteria was naphthalene at location HB-MW-29. As discussed above, there is a distinct but gradual increase in SVOC concentrations in groundwater as they approach the lake.

Inorganics were detected exceeding groundwater criteria at all three monitoring wells sampled. Iron, manganese, and sodium exceeded at all three locations, magnesium exceeded at HB-MW-28 and 29. In addition to these inorganic compounds, bromide and chloride were detected above groundwater criteria at all three locations.

Figures



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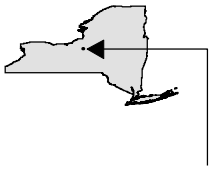

QUADRANGLE LOCATION

HONEYWELL
SYW-12
SYRACUSE, NY

SITE LOCATION PLAN

N

SYW-12 Area

0 1,000 2,000 4,000 6,000 8,000

Feet

1:24,000

1163.39597

MARCH 2012

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FIGURE 2

LEGEND

- FORMER ONONDAGA CREEK CHANNEL LOCATION ADJUSTED BASED ON TEST TRENCHES
- FORMER ONONDAGA CREEK CHANNEL LOCATION (Source: USGS Topo map 1898)

HONEYWELL
SYRACUSE, NY

SYW-12
SITE AREA

0 100 200 400
Feet

FEBRUARY 2013
1163.49362

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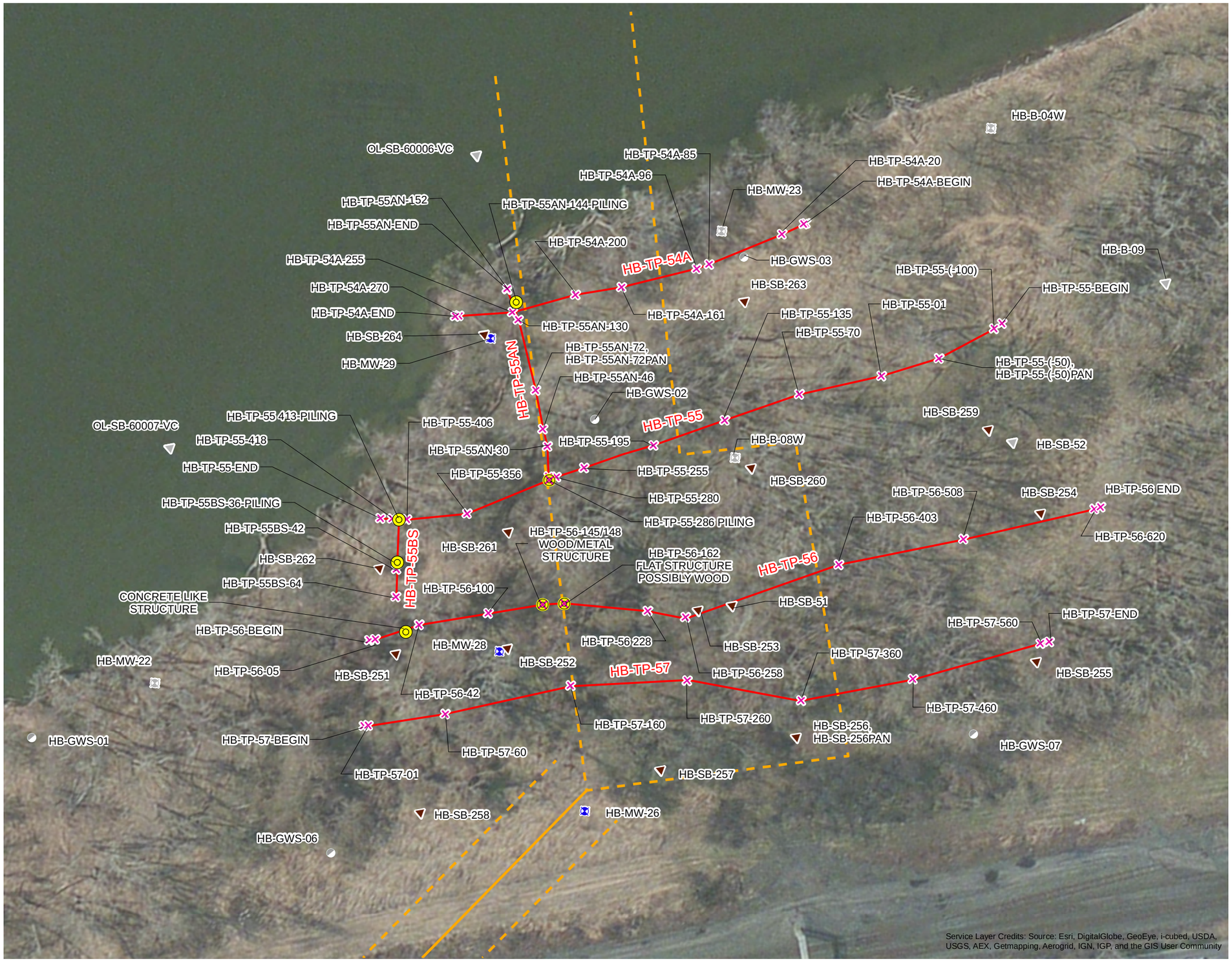
FIGURE 3



LEGEND

- GROUND WATER SCREENING
- MONITORING WELL
- SOIL BORING
- FORMER ONONDAGA CREEK INFRASTRUCTURE
- TEST PIT SAMPLE LOCATION
- TEST PIT
- FORMER ONONDAGA CREEK CHANNEL LOCATION (Source: USGS Topo map 1898)
- EXISTING LOCATIONS

HONEYWELL
SYRACUSE, NY

SYW-12 SAMPLE LOCATIONS

0 40 80 160
Feet

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FIGURE 4

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N

LEGEND

MONITORING WELL

LOCATION ID

HB-MW-27
(362.69)

GRW ELEVATION

HONEYWELL
SYRACUSE, NY

SYW-12 GROUNDWATER ELEVATION 8/10/12

0 100 200 400
Feet

OCTOBER 2012
1163.49362

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FIGURE 5

LEGEND

MONITORING WELL

LOCATION ID

HB-MW-27
(362.69)

GRW ELEVATION

HONEYWELL
SYRACUSE, NY

SYW-12 GROUNDWATER ELEVATION 10/17/12

0 100 200 400
Feet

OCTOBER 2012
1163.49362

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