OPERATION, MAINTENANCE, AND MONITORING PLAN FOR THE ONONDAGA LAKE LAKESHORE BARRIER WALL HYDRAULIC CONTAINMENT SYSTEM

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LIST OF ACRONYMS

amsl	above mean sea level
BTEX	benzene, toluene, ethylbenzene, and xylenes
CPOI	chemical parameters of interest
CIP	cast-in-place
CQAP	Construction Quality Assurance Plan
cy	cubic yards
DMP	deflection monitoring points
DNAPL	dense non-aqueous phase liquid
FRP	fiberglass reinforced plastic
ft.	feet/foot
gpm	gallons per minute
GWPS	groundwater pump station
GWTP	groundwater treatment plan
HASP	Health and Safety Plan
HAZWOPER	hazardous waste operations and emergency response
HDPE	high density polyethylene
HSP2	Honeywell Syracuse Portfolio Health & Safety Program
in.	inch
IRM	interim remedial measure
JSA	job safety analysis
LHCS	lakeshore hydraulic containment system
Metro	Onondaga County Metropolitan Wastewater Treatment Plant
MRCE	Mueser Rutledge Consulting Engineers
NAPL	non-aqueous phase liquids
NAVD	North American Vertical Datum
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBG	O’Brien & Gere

LIST OF ACRONYMS (CONTINUED)

OM&M	operations, maintenance and monitoring
PAH	polycyclic aromatic hydrocarbon
PSI	pounds per square inch
PZ	piezometer
SOP	standard operating procedure
SSO	site safety officer
SUNY ESF	State University of New York Environmental Science and Forestry
SVOC	semi-volatile organic compounds
TBD	to be determined
UHB	Upper Harbor Brook
USGS	United Stated Geologic Survey
WBB/HB	Wastebed B/Harbor Brook

SECTION 1

INTRODUCTION

1.1 GENERAL

This Operation, Maintenance and Monitoring Plan (OM&M Plan) provides the anticipated tasks to properly operate, maintain, and monitor the Lakeshore Hydraulic Containment System (LHCS) and has been prepared by Parsons on behalf of Honeywell International Inc. (Honeywell).

This document is organized into nine sections and four appendices (A through D). The appendices contain relevant forms, record drawings, and manuals. Because of the similarities in Standard Operating Procedures (SOPs) between lakeshore area related projects (LHCS, Upper Harbor Brook, Tributary 5a, Willis Treatment Facility), SOPs are being organized into a separate comprehensive reference document. This reference document will be maintained on-site so that it can be used by anyone working at the site.

1.2 PURPOSE

This plan specifically covers the LHCS associated with the Willis-Semet Interim Remedial Measure (IRM) and the Wastebed B/Harbor Brook (WBB/HB) IRM (also referred to as West Wall and East Wall). The purpose of this OM&M Plan is to describe the work tasks including inspections, maintenance activities, and monitoring activities necessary for operation of the system as intended by the applicable Consent Orders. Restrictions on site use designed to ensure wall stability and hydraulic containment are discussed in the context of lake dredging and capping operations, and possible future activities. Proposed modifications to site use in the future will need to be evaluated on a case-by-case basis.

The OM&M Plan cannot replace experience; it is meant as a guide for skilled personnel. This OM&M Plan should be used along with the manuals supplied by the various equipment manufacturers for the equipment and controls (included in Appendix A). The manufacturer’s manuals include details such as recommended maintenance, schedules, lubrication guides, troubleshooting procedures, and shop drawings. Maintenance should be performed using the manufacturer-supplied manuals.

1.3 SITE LOCATION, DESCRIPTION, AND HISTORY

The LHCS is located along approximately 7,600 linear feet of the southwest shore of Onondaga Lake in Onondaga County, New York (Figure 1). The LHCS includes a sheet pile barrier wall system to mitigate the discharge of contaminated shallow and intermediate depth groundwater and non-aqueous phase liquids (NAPL) to Onondaga Lake.

The LHCS and barrier wall are associated directly with the Willis-Semet Barrier Wall IRM and WBB/HB Barrier Wall and Outboard Area IRM, and indirectly with the Upper Harbor Brook (UHB) IRM and remediation and restoration of Onondaga Lake. The IRM objectives directly related to this plan, as presented in the Orders on Consent for Willis-Semet and WBB/HB (Index #'s D7-00004-01-09 and D7-00008-01-09), can be summarized as follows:

- Eliminate, to the extent practicable, within the scope of the IRM, the discharge of contaminated groundwater and NAPL (and collect NAPLs, as feasible) into Harbor Brook and Onondaga Lake.
- Eliminate, to the extent practicable, within the scope of the IRM, direct point source discharges of metals including mercury, semi-volatile organic compounds (SVOC), benzene, toluene, ethylbenzene, and xylenes (BTEX) and chlorobenzene, to Onondaga Lake via stormwater conveyances.
- Eliminate, to the extent practicable, within the scope of the IRM, the potential human health and ecological impacts associated with site constituents of concern.
- Eliminate, to the extent practicable, within the scope of this IRM, potential impacts to fish and wildlife resources associated with on-going discharges of contaminants of concern from the site.

The primary purpose of the LHCS is to prevent contaminants in the shallow (and intermediate groundwater regimes) from reaching Onondaga Lake. The shallow zone consists mainly of various fill materials and Solvay waste (SOLW). The intermediate zone consists of the underlying marl unit. To accomplish this, a sub-surface steel sheet pile barrier wall was installed along approximately 1.5 miles of the lakeshore that effectively blocks the targeted groundwater from entering the lake. The barrier wall also functions to contain impacted soils and NAPL and prevents lake water from entering the site. Preventing lake water from entering the site significantly reduces the amount of water collected for treatment and discharge, particularly during periods of high lake levels.

The groundwater that is contained by the wall is captured by a collection system composed of a collection trench that runs the entire length of the wall. The trench contains perforated collection piping, wick drains to transmit intermediate depth groundwater upward to the collection trench, groundwater conveyance piping, groundwater pump stations, and piezometers for monitoring groundwater levels within the collection trench. The collected groundwater is conveyed to the nearby Honeywell Willis-Semet Groundwater Treatment Plant (GWTP) where it is treated and sent to the Onondaga County Metropolitan Wastewater Treatment Plant (Metro) for ammonia removal and then discharged to Onondaga Lake. The OM&M Plans for the GWTP Phases 1 and 2 are separate documents from this plan (O'Brien and Gere (OBG), 2007; and OBG, 2010).

1.4 STABILITY BASED USE LIMITATIONS

Limitations on the use of the area inboard of the barrier wall during the implementation of the Lake Remedial Action have been established to maintain wall stability during dredging and capping operations and are included in Appendix A of the Lake Dredging and Capping Construction Quality Assurance Plan (CQAP) (Anchor QEA and Parsons, 2012; included as Appendix B of this document). These include restrictions on the stockpiling/staging of materials, building, and vehicle access during outboard operations. The restrictions will likely change after dredging and capping are completed and will need to be evaluated on a case-by-case basis by Honeywell or their designated representative.

SECTION 2

HEALTH, SAFETY & ENVIRONMENTAL COMPLIANCE

Anyone working on-site will follow the Honeywell Syracuse Portfolio Health & Safety Program (HSP2) and is responsible for updating their program specific Health and Safety Plan (HASP) on an annual basis, as may be required. Job Safety Analysis (JSA) which outline safety and health requirements and guidelines developed for specific tasks, will be created and maintained on-site. Tasks outside of the previous field efforts will have a new JSA completed before the task begins. If a subcontractor is performing activities that require specialized training (i.e., confined space entry, excavation/trenching, scaffold use, hazardous waste operations and emergency response [HAZWOPER], etc.), then copies of training certifications will be provided to site personnel for applicable employees and the supervisor.

Communications – The response for anyone from the general public (e.g. media, workers from adjacent properties, etc.) inquiring about the project is: “Please contact Craig Milburn at Honeywell, (315) 552-9784.”

Spill Containment Program – Spill Containment programs will be in compliance with all state, federal, and local regulations and will be dictated by each individual company. Report all spills immediately to the Site Safety Officer (SSO).

SECTION 3

FORMS AND DOCUMENTATION

Forms and any other information generated during regular monitoring events and inspections will be filed on-site.

3.1 INSPECTION, OPERATION, AND MAINTENANCE FORM

During routine inspections, an Inspection, Operation, and Maintenance form (Appendix C), or equivalent will be completed. This form provides a detailed inspection checklist, groundwater collection/storage system operational information, including static water level measurements in piezometers, and maintenance descriptions. The records should be filed in an orderly manner (i.e., topic, chronological, alphabetical). The records should be reviewed on a regular basis to identify possible trends in process operation. Significant non-routine events observed during the inspection will be reported to Honeywell and NYSDEC at the end of each inspection period. These forms, or equivalent, will be maintained as part of the permanent site record.

The information recorded will include, at a minimum, the following:

- General site information: date, inspector’s name/company, weather, general site condition
- Site condition inspection checklist: security fence/gates, access roads, evidence of settlement/subsidence, and evidence of damage to the barrier wall
- Groundwater collection/storage system checklist: transfer pumps, monitoring wells, and concrete wale
- Restoration area checklist: vegetation, site drainage

3.2 REPORTING

Periodic reports prepared by Honeywell will be submitted to the New York State Department of Environmental Conservation (NYSDEC) and will summarize inspections, maintenance, monitoring, and notification of any unexpected events that have occurred since the last report. Monthly reports will be submitted while dredging and capping operations are underway in front of the wall and for one year afterwards. Wall stability monitoring data will be submitted as part of the dredging and capping submittals until dredging and capping are completed after which they will be included in OM&M submittals covered by this plan. The operations record and schedule will be reviewed at that time with the intent of integrating all information into an annual reporting schedule if no significant issues have been noted.

3.3 ANNUAL REPORTS

Annual progress reports summarizing the previous twelve months of OM&M at the site will be prepared and submitted to NYSDEC by Honeywell. The annual report will focus on data results in terms of the site monitoring plan and maintenance program success and will include appendices containing all monitoring data collected during the previous year.

SECTION 4

ENGINEERING CONTROLS

The LHCS includes the following primary components:

- A sheet pile barrier wall approximately 7,600 linear feet (ft.) long
- A barrier wall tie back and linear system composed of a reinforcing geogrid, whaler system, and High Density Polyethylene (HDPE) membrane system
- A collection trench running the entire length of the wall with 6-inch (in.) diameter perforated collection pipe installed at elevation 358.00 ft.
- Site restoration

Each of these components is described below.

4.1 BARRIER WALL

The barrier wall is an integral part of the hydraulic control system that includes an extensive groundwater collection and treatment system that is intended to eliminate, to the extent practicable, the discharge of contaminated groundwater and NAPL to Onondaga Lake along approximately 1.5 miles of the southwest shore (Figure 1). The wall consists of approximately 1,600 interlocking steel sheet pile pairs and is installed a minimum of 3 ft. into the underlying clay aquitard that is present across the site at depths ranging from 35 to 70 ft. below ground surface. Every other interlock was factory seal welded to reduce the number of joints that required a field application of sealant and to minimize the potential for interruptions in the hydraulic barrier. The sealed interlocks are sufficient to ensure hydraulic separation between groundwater and the lake.

The hydraulic barrier is intended to provide long-term effectiveness; therefore, pre-design testing was conducted to determine if exposure to subsurface conditions would have a significant effect on the integrity of the barrier wall. Pre-design compatibility tests and observation of the former causeway steel piles during demolition of the causeway have shown that the steel would be unaffected by subsurface conditions and that additional mitigation measures were likely not needed. However, conservative measures to prevent corrosion were included in the barrier wall design as an extra safety factor. These measures include providing cathodic protection by installing zinc anodes approximately every 15 ft. on alternating sides of the barrier wall and coating the upper portion of the sheet piles (13 ft. minimum) with Carboline Bitumastic® 300 M Coal Tar Epoxy to provide additional protection in the zone where a greater likelihood for oxidation exists.

The barrier wall was constructed over a seven-year period beginning in 2006 and finishing in 2012. Construction of the wall proceeded from west to east starting in the vicinity of Tributary 5A and extending to the area adjacent to the CSX Rail Line east of Harbor Brook. The construction was accomplished in three phases:

- *Phase 1* – Semet Wall. Construction of a work platform, installation of 1,612 linear ft. of barrier wall and groundwater collection system was completed from August 2008 to October 2009.
- *Phase 2* – Willis Wall. Installation of 1,288 linear ft. of barrier wall and groundwater collection system, and placement of approximately 43,000 cubic yards (cy) of light-weight aggregate behind the barrier wall to an elevation of 365.5 ft. was completed from October 2006 to May 2007. Installation of an HDPE liner system along portions of the barrier wall subject to flooding during high lake water events, and installation of a tie-back anchorage system to mitigate deflection of the barrier wall in areas with deep water present outboard of the wall was completed from January 2012 to May 2012.
- *Phase 3* – West/East Wall. Construction of a work platform, installation of a total of 4,678 linear ft. of barrier wall and a groundwater collection system (1,630 ft. for the East Wall and 3,048 ft. for the West Wall), realignment of the lower reach of Harbor Brook, and replacement of the lower Harbor Brook culvert were completed from December 2009 to March 2012. The Phase 3 construction of the barrier wall required the demolition and replacement of the downstream Harbor Brook culvert. The new culvert is composed of segmented pre-cast reinforced concrete with pre-cast wing walls and has interior dimensions of 20 ft. (w) x 6 ft.-10 in. (h). An approximately 40 ft. section of open channel exists between the outlet of the culvert and the wall. This section has a channel lining composed of HDPE geomembrane, geotextile and rip-rap channel substrate.

4.2 BARRIER WALL TIE BACK AND LINER SYSTEM

The Barrier Wall tie back is an anchoring system that provides geotechnical support for areas of the Willis portion of the barrier wall that will be used during support of the Onondaga Lake dredging operations. The anchoring system uses anchor tendons that connect to the existing sheeting via a concrete wale and terminate at a row of segmented sheet piling deadmen approximately 100 ft. south of the barrier wall.

The liner system maintains separation of surface and groundwater allowing surface water to discharge directly to Onondaga Lake while minimizing infiltration into the site and reducing the volume of groundwater requiring collection and treatment. The liner system consists of a 60-mil HDPE membrane and reinforcing grid system over portions of the site subject to inundation during periods of high lake levels.

Both the liner and anchoring systems have been designed to function without interference with the previously installed groundwater and dense non-aqueous phase liquid (DNAPL) collection systems on the site. Record drawing depicting the location and layout of the anchor system as it relates to the existing site systems is provided in Appendix D.

4.2.1 Waler System

A reinforced cast-in-place (CIP) concrete wale system installed along the inboard face of the existing sheet piling provides a connection point for the liner and reinforcing grid system. The waler was cast with Portland Cement Type II air-entrained concrete with a minimum 28-day compressive strength of 4,000 pounds per square inch (PSI). The wale includes 1.5-in. diameter weep holes, evenly spaced every 10 ft. above the liner connection point to allow surface water to discharge to the lake.

4.2.2 Reinforcing Grid

A reinforcing grid of geogrid was cast into the concrete wale and extends 45 ft. inboard of the wale to provide lateral support to the existing barrier wall. The inboard edge of the geogrid was cast into a concrete anchorage block to increase anchor capacity and to provide a visual indicator if the loading on the grid exceeds the expected load. The grid was designed to provide support during the dredging outboard of the wall. Once the dredging/capping operations are complete, the wall will receive adequate lateral support from the earthen materials placed on the outboard side of the wall placed to establish a naturalized shoreline.

4.2.3 HDPE Membrane System

A 60 mil HDPE membrane was installed over a 7 ounce non-woven separation geotextile above the geogrid inboard of the barrier wall. Drainage net was installed immediately over the HDPE membrane to enhance the drainage of surface water towards the lake.

The HDPE membrane is attached to the concrete wale using a termination bar, or batten, and is sealed to the wale with a Bituthene® strip on the bottom and a liquid membrane seal at the top. All penetrations (e.g., well casings, manholes, etc.) of the liner are sealed using HDPE boots to minimize potential infiltration of surface water.

4.3 GROUNDWATER COLLECTION

A groundwater collection system was installed roughly parallel to the lakeshore and barrier wall to collect the groundwater that was blocked from entering Onondaga Lake by the barrier wall. The collection system has been conservatively designed to achieve a maximum capacity of approximately 140 gallons per minute (gpm) (60-70 gpm from the Willis-Semet portions and 60-70 gpm from East and West Wall portions). The long-term flow rates are expected to vary seasonally and from time-to-time will be much less.

The collection system consists of the following components:

- A collection trench running the entire length of the wall with 6-in. diameter perforated collection pipe installed at elevation 358.00 ft. (North American Vertical Datum [NAVD] 88)
- Wick drains to transmit intermediate depth groundwater vertically to the collection piping
- Groundwater conveyance piping
- Groundwater pump stations
- Shallow piezometers for monitoring groundwater levels within the collection trench

The lakeshore groundwater collection system currently receives water from the Willis, Semet, and WBB sites. Groundwater collected as part of the UHB IRM is being discharged to the collection system. The groundwater from the UHB IRM is collected in a separate collection system and then pumped via two pump stations through a force main to the east conveyance piping along the East Wall. All groundwater collected by the lakeshore system is pumped by groundwater pump stations through conveyance piping to the Groundwater Pump Station (GWPS) and then to the Honeywell Willis-Semet GWTP where it is treated prior to discharge to Metro.

4.3.1 Groundwater Collection Trench

With the exception of the East Flume area, the groundwater collection trench is generally located within 20 ft. inboard of the sheet pile barrier wall and collects shallow and intermediate groundwater. The trench includes a 6-in. diameter 0.015-in. slotted fiberglass reinforced plastic (FRP) collector pipe with a pipe invert of 358.00 ft. above mean sea level (amsl) (NAVD 88). The collection piping terminates at approximately 160 ft. from the western limit and approximately 100 ft. from the eastern limit of the barrier wall. The trenches are referred to by number; Trench 1 is associated with the Semet Wall and contains Sump #1, Trench 2 is associated with the Willis Wall and contains Sump #2, Trench 3 was a temporary trench installed up gradient of Trench 2 and the western end of Trench 4 and contains Sump #3 (neither the temporary trench or the sump is currently in use or planned to be used in the future), and Trench 4 is associated with the West and East Walls and contains Sump #'s 4, 5, 6, and 7 (Figure 1).

4.3.2 Wick Drains

Amerdrain 607 wick drains were installed generally at 3 ft. horizontal spacing along the entire alignment of the groundwater collection trench. The wick drains terminate at the top of the clay layer at an average elevation of 332.0 ft. The purpose of the wick drains is to facilitate movement of deeper groundwater to the collection trench resulting in an inward gradient across the hydraulic barrier over the depth of the wick drains without the need for a deep collector trench.

4.3.3 Groundwater Conveyance Piping

The collection trench includes a 6-in. diameter slotted FRP collection pipe and a 4 in. solid wall FRP force main. Groundwater gravity flows within the collection trench and slotted pipe to collection sumps located along the length of the trench. Water is pumped from the sumps by way of the 4 in. solid pipe. Cleanout risers are installed at 100-ft. intervals along the collection pipe except for the Trench 2 collection pipe, which has no cleanouts.

4.3.4 Collection Sumps

Six active collection sumps are installed inboard to the wall; CS-1 (Semet Wall), CS-2 (Willis Wall), CS-4, 5, 6 (West Wall), and CS-7 (East Wall) (Figures 2 through 4). CS-3 (Willis Wall) is a temporary sump installed during the Willis Wall project and has not been used since installation and is not anticipated to be used in the future.

The sump systems are epoxy-coated 4-ft. diameter pre-cast sanitary manholes equipped with a Goulds Model 3885 WE1534H submersible effluent pumps capable of pumping 60 gpm at 65 ft. of head. Valve vaults are located adjacent to the collection sumps and house all valves and controls, which eliminate the need to enter the sumps for routine maintenance (entry would require confined space entry procedures). Water is discharged from the manholes into the existing FRP force main which then conveys the water to the GWPS.

The pump and control system is comprised of a collection sump control panel, a master telemetry panel that provides remote monitoring of the system at the GWTP, and a series of associated field devices. The control system provides automatic and manual control of the collection sump pumps as well as alarm monitoring and data collection.

4.3.5 Monitoring System

The trench monitoring system consists of a series of piezometers equipped with pressure transducers that are installed within the collection trench at approximately 300 to 500 ft. intervals along the alignment of the trench to verify that the collection system is maintaining an inward hydraulic gradient from the lake (Figure 2 through 4). Comparative lake level measurements will be obtained from the United States Geological Survey (USGS) surface water gauge (USGS 04240495) located on the west shore of Onondaga Lake in the Onondaga Park Marina basin.

4.4 RESTORATION

Restoration along the shoreline was performed in three areas following construction; along Design Section 4 and the former causeway area of the Willis portion of the site and along the Semet shoreline area. The restoration plan was developed in consultation with State University of New York Environmental Science and Forestry (SUNY ESF) faculty to ensure sufficient growth medium is provided to sustain growth of the selected plant species.

4.4.1 Willis-Semet Restoration Area

Restoration in both the Willis and Semet areas consisted of placement of topsoil over the existing embankment and the installation of native tree and shrub species. Following completion of the tree and shrub plantings, the entire area was fertilized and seeded with the conservation seed mix. Following seeding, mulch was applied and an interim grain rye cover crop used to minimize the loss of topsoil by erosion while the specified species were established.

4.4.2 Restoration of Areas Disturbed During Construction

Temporary access roads, staging areas, and lay down areas were covered with topsoil and seeded to minimize the potential for erosion and maintenance of the restored area. Some areas that will be used to support dredging and capping operations were not restored after completion of the LHCS, but will be restored after dredging and capping are completed.

4.5 CONTAMINATION REMAINING AT THE SITE

Contaminated groundwater flows to the collection system. Contaminated material is isolated but could be encountered during excavations, maintenance, or repairs. The following provides an overview of contamination associated with each of the sections.

Semet and Willis Avenue Sections

As described in the construction completion reports for the Semet and Willis IRMs (Parsons, 2008 and 2012, respectively), the barrier walls along this section of lakeshore were constructed to eliminate the discharge of contaminated groundwater and NAPL material remaining at the Willis Avenue Chlorobenzene site and the Semet Residue Ponds site to Onondaga Lake. Contaminated media at these sites include wastes, groundwater, soils, surface water and sediment. Site-related chemical parameters of interest (CPOI) for these sites include metals (including mercury); SVOCs (including chlorinated benzene compounds, naphthalene and other polycyclic aromatic hydrocarbon (PAH) compounds); BTEX; and chlorobenzene.

West Wall and East Wall Sections (Wastebed B/Harbor Brook)

The barrier walls along this section of lakeshore were constructed to eliminate the discharge of contaminated groundwater and NAPL material remaining at the WBB/HB site to Onondaga Lake and Harbor Brook (Parsons, 2009). Contaminated media at this site include wastes, groundwater, soils, surface water and sediment. Site-related CPOIs associated with this site include metals (including mercury); SVOCs (including chlorinated benzene compounds, naphthalene and other PAH compounds); BTEX; and chlorobenzene.

SECTION 5

OPERATION

5.1 OPERATION DESCRIPTION

The LHCS is a relatively simple system with few operational components. Groundwater is collected in the collection trench and conveyed through a force main to the GWPS by a series of pumps.

5.2 GROUNDWATER COLLECTION

The groundwater collection system is designed to establish and maintain an inward gradient from the lake by intercepting groundwater in the shallow and intermediate units and redirecting it to the GWTP. The water level in the trench is designed to be 0.5 ft. below the mean elevation of Onondaga Lake (362.9 ft.). The collection system has a maximum capacity of approximately 140 gpm (60-70 gpm from the Willis-Semet portions and 60-70 gpm from East and West Wall portions). A short-term shut down of the collection system can occur without concern of groundwater overtopping the wall and reaching Onondaga Lake. The duration that the system can be inoperable depends on the conditions that exist during the shutdown period (e.g., high or low water levels); therefore, water levels will be evaluated prior to planned shutdowns for routine maintenance. In the event of an unplanned or planned shutdown lasting more than one day, NYSDEC will be notified.

5.3 PUMPS

Intercepted groundwater is carried via gravity flow from the wick drains and collection trench into the collection sumps composed of an epoxy-coated 4-ft. diameter pre-cast manhole equipped with a submersible effluent pump. The submersible pumps automatically transfer the groundwater to the GWPS via the FRP force main where it is then conveyed to the Willis-Semet GWTP. The sumps operate independent of one another to allow for maintenance activities to be completed as needed.

Three float switches (on, off, and high water alarm) automatically control each submersible pump in the system to maintain the groundwater level at or below the designed operating elevation of approximately 362.4 ft. When on and in the automatic mode, the pumps maintain the sump at the designated operating level. If necessary, the pumps can be manually controlled by switches located in the DNAPL building (Willis-Semet system) or the pump house adjacent to the former East Flume (West and East Wall systems). The pumps do not need to be operated continuously for the hydraulic gradient to be maintained. The status of the pumps and water level in the collection sumps associated with the Willis-Semet section is communicated, via radio, to the GWTP computer system where it is continuously monitored. Flow rates entering the groundwater treatment plant are used to indirectly ascertain status of pumps associated with the East and West Wall sections. Information regarding Collection Sump Control System monitoring via the GWTP computer system can be found in the GWTP OM&M Plan (OBG, 2010).

The groundwater conveyance system controls include an alarm circuit linked to the water level in the GWPS that will stop the transfer of groundwater in the event of a high water condition at the pump station. Refer to Appendix D for additional information regarding operation and settings related to the collection system.

5.4 COLLECTION PIPE

The collection pipe is a passive system that provides a pathway for groundwater to flow to the pump stations. The collection pipe in Trench 1 and 4 have cleanouts to provide a means for access during maintenance and cleaning activities. The clean-outs are 6-inch FRP pipe containing a 45 degree elbow that is connected to the collection pipe through a wye fitting. The top of the clean-out pipe terminates at a cleanout ferrule and is covered by a curb box integrated into a concrete collar. The drawings in Appendix D show the locations and detail of cleanouts for each portion of the collection system.

SECTION 6

INSPECTION AND MAINTENANCE

6.1 INSPECTIONS

6.1.1 Routine Site Inspections

Routine inspections of the site will be conducted as part of the OM&M program, including collection of the information discussed in Section 3.1. Site inspections will focus on four primary areas: 1) general site conditions (e.g., access roads, security fence/gates, signs, erosion control measures, ground cracks/wall movement, concrete wale distress, condition of the Harbor Brook culvert, condition of equipment, presence of standing water, etc.); 2) groundwater collection/storage system condition (i.e., building structure, piezometers, vaults and sumps, pumps, and instrumentation); 3) restoration area condition (i.e., vegetated topsoil, drainage system, settlement and subsidence); and 4) static water level measurements within the groundwater piezometers upgradient of the wall.

The inspections will be conducted weekly while dredging and capping operations are underway in front of the wall and for three months afterwards. The site inspection schedule and operational history will be reviewed at that time with the intent of reducing to a monthly schedule if no significant issues have been noted. The inspection schedule will be reviewed annually and any recommendations to modify the program discussed with NYSDEC. The NYSDEC and the other agencies will be free to conduct their own inspections during any work hour period.

6.1.2 Sump and Pump Inspections

Visual inspections of sumps and pumps will be conducted at a minimum annually, and if operating conditions change. Inspections will include; checking that the housing is undamaged, that significant solids have not accumulated, and that the float is free to move by manually lifting the float to initiate an alarm. In addition, pump controls and power feeds will be inspected including: visual inspection of panels for evidence of damage, measurement of feed voltage, testing continuity of control wiring, and measurements of pump output. If inspections note damage that inhibits operation, the damaged part(s) will be repaired or replaced. If significant accumulation of solids is noted, then a cleaning will be scheduled (additional details provided in SOPs).

6.1.3 Barrier Wall Corrosion Inspection

Based on site-specific compatibility test results and the extensive technical literature on the subject, the anoxic subsurface conditions are expected to have minimal impacts on the integrity of the subsurface portion of the barrier wall. Nonetheless, conservative measures to prevent corrosion both above and below the surface were included in the barrier wall design including a protective coal tar epoxy coating and installation of a cathodic protection system.

Cathodic Protection

The cathodic protection system consists of a series of zinc anodes installed approximately every 15 ft. along the entire length of the wall. The anodes use the natural potential difference that exists between the steel piles and zinc anodes to provide a driving voltage. As the anode is consumed, it provides a source of electrons that prevents corrosion of the steel sheet piles. The anodes continue producing protective current until complete consumption occurs at which time they require replacement. When attached to unprotected steel, they have a life expectancy in sea water of approximately 20 years but are anticipated to last much longer on coated sheet piles in freshwater. Since the anodes generate their own electrical current, they operate without the need for routine monitoring beyond periodic inspections to ensure complete consumption has not occurred.

A subset of anodes along the outboard section of the Willis Wall were chosen to act as representative monitoring locations since the large number and generally inaccessible location of anodes precludes inspection in other sections. Inspecting anodes from one area is likely not a concern since, in an electrically connected system, anodes contribute equally to cathodic protection. Therefore, inspection of anodes from the Willis Section will be representative of all anodes in the system. The outboard section of the Willis Wall also offers several advantages, including:

- Risk of anode or wall damage is minimized because anodes are visible from the surface and do not need to be excavated in order to be inspected
- The anodes are the oldest in the system and therefore should exhibit the greatest amount of consumption
- This area is where the greatest corrosion potential is expected (lake splash zone) so that if electrical continuity is not present the results will still be conservative

Inspection of visible anodes along the Willis Wall outboard section will be conducted by a qualified engineer or their designated agent once every five years starting in 2015. If the inspection is conducted by anyone other than the engineer, then the results of the inspection will be reviewed by the engineer. During inspection, the anodes will be visually evaluated from the surface and any evidence of corrosion, damage, fouling, or other unusual occurrences will be documented and photographs taken when possible. In addition, the length and width of each inspected anode will be measured to the nearest millimeter when possible. The interval between inspections will be changed to ten years if no substantial consumption of anodes has occurred after four inspections (after the 2030 inspection). Inspection results will be reported in the annual report of the year the inspection took place.

Individual anodes that are damaged do not require replacement since the other anodes will compensate by providing increased current. The natural consumption of anode mass that occurs while providing cathodic protection may eventually require that some or all anodes along the wall be replaced; although the timeframe for replacement is likely measured in hundreds of years. Considerations for anode replacement will begin once 90 percent consumption has occurred based on comparison of anode dimensions at the time of installation to measurements made during the inspections. Depending on the length of time it takes for 90 percent consumption to occur, replacement of anodes may or may not begin immediately (e.g., if 90 percent consumption doesn't occur for 100+ years, then the effective remaining life of the anodes would still be a decade or greater).

Coal Tar Epoxy

The coal tar epoxy is an impermeable sealant that limits exposure to moisture and oxygen preventing electrochemical oxidation (corrosion) from taking place. The epoxy was applied so that it extended from the top of the welded sheetpile pairs to 3 ft. below the groundwater table (upper 13 to 30 ft. depending on the area of installation), which is where moisture and oxygen are most likely to both occur simultaneously. Most of the coated sections will not be routinely inspected because they are buried and thus protected. However, the exposed portion of the Willis Wall is visible from the lake side of the wall and will be visually inspected by a qualified engineer or their designated agent on the same schedule as the cathodic protection system. If the inspection is conducted by anyone other than the engineer, then the results of the inspection will be reviewed by the engineer. The inspection will note any areas where the coating is not substantially intact. If damage to the coating is observed, then further investigation will be required to determine if corrective action is necessary.

6.1.4 Barrier Wall Tie Back And Linear System

A continuous concrete anchor trench is attached to the liner system geogrid under the access road and is designed to result in visible changes to surface topography should the wall shift significantly. These changes include: significant cracking or buckling of the access road where it crosses the tie back system and significant cracking of the concrete whaler near the wall. Inspection of the access road and whaler are part of the routine site inspections conducted as discussed in Section 6.1.1.

6.1.5 Willis-Semet Floodplain Drain Inspection

With the exception of the dredge/cap support crane pad area, the Willis floodplain contains drains that empty through the top portion of the barrier wall to prevent surface water from inundating the area (see drawings in Appendix D). Visual inspections of drain discharge points will occur monthly and any debris obstructing drains will be removed. Prolonged periods of standing water on the floodplain will trigger a special inspection event to determine if drains are obstructed. If drains appear clear of debris but water does not drain, then additional investigations will be undertaken by Honeywell to determine if drains are functioning as designed and corrective action conducted as needed. The sheet pile wall in front of the crane pad area was left at a higher elevation to minimize potential for lake levels/wave action overtopping the wall since there is no liner material in this area to reduce flow directly to the collection trench. Wall cuts above an elevation of 365 ft. were made at several locations to facilitate dredge/cap operations. Lake levels will be monitored and the penetrations will be closed off with sand bags if elevated lake levels occur (to minimize lake overflow into the collection trench).

6.2 PREVENTIVE MAINTENANCE

6.2.1 Barrier Wall System Maintenance

The barrier wall sheet piles, seals, and coating are designed to last the life of the remedy without the need for routine maintenance. The zinc anodes that compose the cathodic protection are slowly consumed over time, however, and although they do not require routine maintenance, at some time in the future they will require replacement (but not likely for decades or hundreds of years; see Section 6.1.3).

6.2.2 Vaults and Sumps Maintenance

The sumps require little routine maintenance beyond periodically cleaning of accumulated solids. It is anticipated that cleaning will be required periodically. General visual site inspections (Section 6.1.2) will include looking for accumulation of solids in the vaults and sumps. If significant solids are observed, then cleaning will be scheduled and carried out.

6.2.3 Pumps Maintenance

The pumps are sealed submersible units and little routine maintenance is required unless reduced flows are noted. Initial operation of the system has found that reduced flows are an indication that the pump is likely fouled and requires de-scaling. De-scaling has been successfully accomplished by adding a muriatic acid solution to the collection trench in the past. Acid washes will continue to be conducted when reduced flow is noted and/or at the OM&M Contractors discretion.

6.2.4 Force Main and Collection Pipes

Operation of the system to date has shown that reduced flow rates are often caused by calcareous fouling. An acid-wash has been found to be an effective method to de-scale the pumps and return flow rates to normal and will be the first response to reduced flow rates unless an alternative cause is suspected. In the event that the acid wash fails to return flow rates to normal, then additional actions that can be undertaken include; visual inspection of sumps, pumps and cleanouts, and cleaning and/or remote viewing of suspect areas, which may include lengths of suspect force main and collection pipe. If the problem is still not identified, then a more intensive investigation will be undertaken that is tailored to the specific circumstance of the event.

6.2.5 Wick Drain Maintenance

Wick drains were installed vertically from within the trench to the top of the silt and clay layer. The purpose of the wick drains is to facilitate vertical movement of deeper groundwater to the collection trench resulting in an inward gradient across the hydraulic barrier over the depth of the wick drains without the need for a deep collection trench. Although compatibility studies conducted as part of the predesign effort to assess long-term durability indicated some clogging and reduction in flow is likely through the wick drains following exposure to subsurface conditions (i.e., Solvay waste and NAPL-impacted soil), the design factored in the reduced flow rate potential by incorporating adequate wick drains to achieve the minimum flow rate required.

The wick drain system is inaccessible and intended to be maintenance free. The design incorporated additional wick drains beyond what was required to ensure long-term function. In the event that groundwater collection flow rates are not being achieved in the future (i.e., insufficient drawdown of the groundwater table behind the wall) Honeywell will evaluate the need to replace or add wick drains or institute alternative collection methods (e.g., wells), and options will need to be discussed with NYSDEC and approved by NYSDEC.

6.2.6 Instrumentation Maintenance

Regular inspection and maintenance will be performed to ensure that the instrumentation systems remain in a satisfactory operating condition during their service lives. The maintenance will be performed in accordance with the manufacturer's recommendations and procedures. General requirements for the maintenance of the major components of the instrumentation system are discussed below:

- *Portable readout units:* Portable readout units will be protected from mishandling. The units should be kept clean and dry and checked routinely for damage. Batteries should be replaced as needed. In addition, the units should be recalibrated regularly following the manufacturer's instructions or returned to the manufacture for calibration, adjustment, and/or repair.
- *Retrievable components:* Retrievable components, including in-place inclinometer sensors, wires, tubes, cables, data loggers, data controllers, and communications systems should be protected from rodents, vandals, and transient voltage surges. All plugs, caps, and covers should be maintained in good condition.
- *Embedded components:* Embedded components are normally inaccessible and maintenance is not possible. Embedded components that are accessible, such as inclinometer casings, can be inspected by down-hole video cameras to determine if maintenance is required, on an as-needed basis.

6.2.7 Willis-Semet Vegetation Restoration Area Maintenance

The maintenance program described in the Final Restoration/Mitigation Design Report (Honeywell, June 26, 2009) will be followed. The time period for the maintenance program will be five years from the time the site was initially restored in 2010. The maintenance program will include the following:

- Maintaining a minimum of 85 percent of the tree (including willow) and shrub species. If a single species makes up a substantial portion of the failed vegetation a new species will be selected.
- Re-seeding select conservation and wetland seed mix areas where coverage is below 85 percent as determined during annual monitoring.
- Mowing of the interim cover crop, if required, the following spring after seeding.
- Removal of erosion control structures once plants have become established.
- Installation of herbivory controls as required ensuring successful establishment of the tree and shrub species.

The time period for the maintenance program will be five years.

SECTION 7

PERFORMANCE VALIDATION MONITORING

7.1 ASSESSMENT OF FLOW RATES

Flow rates are monitored remotely from the GWTP and are one of the primary mechanisms for determining if the hydraulic containment system is operating properly. If unexpected changes in flow rates are observed, then a series of steps that are tailored to the specific circumstance of the event will be implemented to determine the location and cause.

7.2 LAKE LEVELS

The effectiveness of the collection trench system will be confirmed by comparing lake level and groundwater level inboard of the barrier wall. Groundwater level data will be collected hourly by data loggers from piezometers PZ-1 to 8 on the Willis-Semet Wall, PZ-9 to 15 on the West Wall and PZ-16 to 19 on the East Wall.

Piezometer data will be downloaded from the data loggers on a weekly basis. These data will be used to produce monthly summaries that compare the weekly average water levels from piezometers to Onondaga Lake water level provisional data obtained from the USGS Onondaga Lake Marina surface water gage (USGS 04240495) web site (http://waterdata.usgs.gov/ny/nwis/uv/?site_no=04240495). In the event that weekly average groundwater water levels unexpectedly exceed the lake level, or if an unexpected change in groundwater levels occurs, NYSDEC will be notified and an investigation will be initiated within 24 hours by Honeywell to determine the cause(s). The initial investigation will include the following steps:

1. Conduct manual data recording on piezometers to verify reading and conduct visual checks including determining if surface water has accumulated behind wall and checking water level in cleanouts.
2. Compare/evaluate water level data against pumping rates, pump cycles, and precipitation.
3. If pump(s) are cycling off and on when piezometer water levels are high, then float settings and flow to sumps will be checked.
4. If no issues with floats or pumps are detected, then the possibility of a flow issue in the trench will be explored by using cleanout water level readings to narrow down the potential problem area(s) and jet cleaning the collection pipe line to determine if blockage is the cause.
5. If the steps above do not alleviate the issue, then a more thorough investigation will be conducted. The scope of such an effort will be determined based upon information obtained during the initial investigation and after discussions with NYSDEC.

7.3 BARRIER WALL MONITORING

Wall monitoring includes monitoring a series of deflection monitoring points (DMPs) that are referenced in baseline GPS surveys to identify horizontal/vertical deflection or movement and a series of instruments located in clusters spaced approximately every 300 to 500 ft. along the wall (Figures 2 through 4). The clusters include inclinometers, piezometers, and associated data collection instrumentation, as detailed below:

Monitoring Components

A summary of the monitoring components for each wall section is included below. Additional details, such as instrument cluster locations for each section, can be found in Appendix D.

- The Willis Wall section has nine instrument clusters each containing one inclinometer attached to the sheet piles, one borehole extensometer, and four vibrating wire piezometers installed inboard of the wall. In addition, DMPs were established on the barrier wall at every ten pairs of sheets.
- The West Wall section has 13 instrument clusters each containing an inclinometer attached to the sheet piles and another inclinometer installed inboard of the wall. Vibrating wire piezometers are installed inboard of the wall at six of the clusters. In addition, DMPs were established (northing, easting, and elevation) every 50 ft. along the wall alignment (DMP coordinates included in Appendix B).
- The East Wall section has 13 inclinometers attached to the wall, 4 inclinometers installed near the wall (inboard), 7 inclinometers installed next to the railroad, and 4 piezometers installed near the wall (inboard). In addition, DMPs were established (northing, easting, and elevation) every 30 ft. along the wall alignment (DMP coordinates included in Appendix B).

Instrumentation Monitoring During Dredging and Capping:

The monitoring program is intensive while dredging and capping activities are occurring near the wall and declines thereafter. The monitoring frequencies during dredging and capping differ depending on wall segment and construction phase. The detailed plan for Barrier Wall monitoring during dredging and capping was included in the approved Lake Dredging and Capping CQAP (Anchor QEA and Parsons, 2012) and is included as Appendix B of this document.

Long-Term Instrumentation Monitoring:

Preliminary long-term monitoring requirements were included in the CQAP. These requirements are repeated below, with minor revision for clarity. An addendum to this OM&M Plan, which further refines the long-term scope, will be submitted for NYSDEC approval based upon the results and observations from the monitoring of all wall sections completed during dredging and capping.

1) Willis-Semet Walls
    a. DMPs, Inclinometers, and Piezometers – In deep water areas, a visual inspection will be performed at least once each summer. In addition, a minimum of one set of instrument readings will be taken annually (i.e., piezometers, DMPs, and inclinometers) until no significant movement is detected. Thereafter, instrument readings will be taken every two years unless visual inspections indicate that interim readings are necessary. In areas where naturalized shoreline currently exists, or is established during capping operations, post capping monitoring is not required.
2) East and West Walls – The long-term monitoring for the East and West Walls will be determined based on observations made during dredging and capping.

7.4 WILLIS-SEMET RESTORATION MONITORING

Monitoring of vegetation in the Willis-Semet restoration area will be conducted according to the Final Restoration/Mitigation Design Report (Honeywell, June, 2009). Monitoring will include a yearly monitoring event conducted at approximately the same time each fall, for a minimum of five years. The need for continued monitoring after 2015 will be discussed in the 2015 Restoration Monitoring Summary Report to be submitted separately from LHCS monitoring reports. Components of monitoring events will include:

- Photographs taken from standard monitoring stations using the same viewpoint (NW, E, etc.)
- Qualitative vegetation assessment including:
  - Condition of tree and shrub species
  - Assessment of conservation seed mix species and wetland seed mix species (species present, relative dominance, approximate percent cover)
- Documentation of invasive species (species, location and approximate size of patch)
- Wildlife usage

A short letter report will be prepared subsequent to the annual monitoring event that will include the information outlined above and discuss the success of the restoration areas and recommendations to correct deficiencies.

SECTION 8

CONTACTS

For additional information regarding the LHCS OM&M program, the public is encouraged to contact any of the following project staff.

Environmental Concerns
Tracy A. Smith (East Wall and West Wall); Richard Mustico (Willis-Semet Walls)
NYSDEC
625 Broadway
Albany, NY 12233-7015
(518) 402-9767
(800) 342-9262

Project -Related Health Concerns
Mark Sergott
New York State Department of Health (NYSDOH)
Flanigan Square
547 River Street
Troy, NY 12180-7860
(518) 402-7860

Citizen Participation
Stephanie Harrington or Diane Carlton
NYSDEC
615 Erie Boulevard West
Syracuse, NY 13204
(315) 426-7400

Document repositories for the Semet Ponds site project are as follows:
Robert P. Kinchen Central Library, Onondaga County Public Library
The Galleries of Syracuse
447 South Salina Street
Syracuse, NY 13202
(315) 435-1900

NOTE: The repositories include the Onondaga County Library (at the Galleries), the Village of Solvay Library, ASLF, Region 7 NYSDEC office, and the Albany NYSDEC office.

NYSDEC Regional Hazardous Waste Engineer
Harry Warner
615 Erie Boulevard West
Syracuse, NY 13204
(315) 426-7400

SECTION 9

REFERENCES

Anchor QEA and Parsons, 2012. *Construction Quality Assurance Plan for Onondaga Lake Capping, Dredging, and Habitat.* Prepared by Anchor QEA and Parsons for Honeywell, August 2012.

Honeywell, 2009. *Willis Avenue Lakeshore Barrier Wall IRM (Site No.: 734026) Restoration/Mitigation Design Document.* Honeywell International, Inc., Morristown, NJ.

O'Brien & Gere, 2010. *Operation & Maintenance Manual*. Willis/Semet Phase 2 Groundwater Treatment Plant, Syracuse, New York. Prepared by O'Brien & Gere Engineers for Honeywell, June 2010.

O'Brien & Gere, 2007. *Operation & Maintenance Manual Willis Avenue/Semet Tar Beds Site Groundwater Treatment Plant, Syracuse, New York*. Prepared by O'Brien & Gere Engineers for Honeywell, August 2007.

Parsons, 2012. *Interim remedial Measure Construction Completion Report. Willis Portion Willis Avenue/Semet Tar Beds Sites IRM*. Prepared for Honeywell. February 2012.

Parsons. 2009. *West Wall Portion of the Wastebed B/Harbor Brook IRM Final Design Report. November 2009*. Prepared for Honeywell, November 2009.

Parsons, 2008. *Final Interim Remedial Measure Engineering Report And Certification. Semet Portion Willis Avenue/Semet Tar Beds Sites IRM*. Prepared for Honeywell, Syracuse, NY. June 2008.

FIGURES

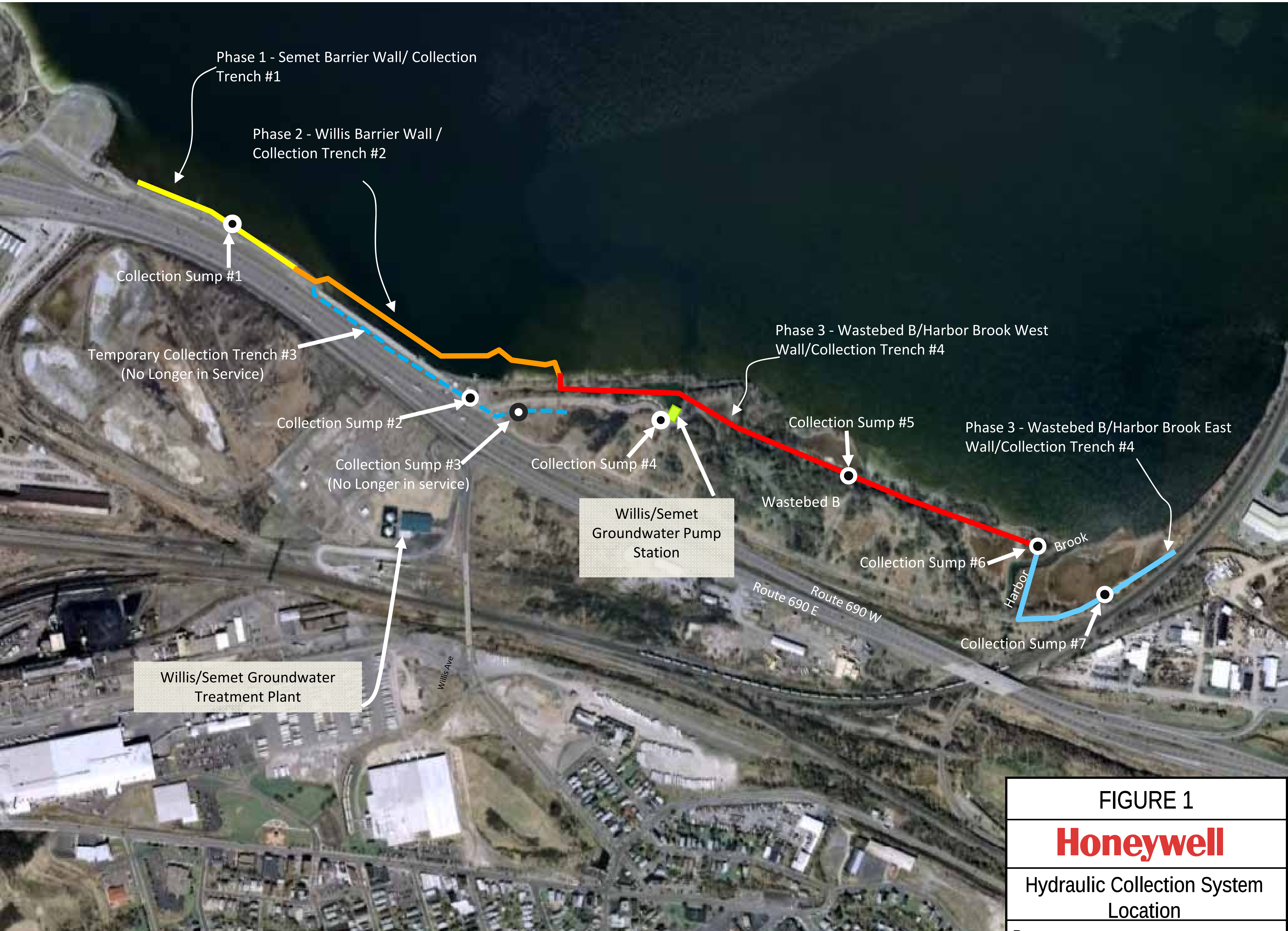

FIGURE 1

Honeywell

Hydraulic Collection System Location

Parsons

301 Plainfield Road, Suite 350, Syracuse, NY 13212

P:\HONEYWELL-SYR\447618\09\OM&M PLAN\DRAFT\HONEYWELL LAKESHORE REV1.PPTX

Note: Locations approximate.

LEGEND:

- ONONDAGA LAKE
- WALL
- TRENCH
- ACCESS ROAD
- PIEZOMETER
- SUMP
- CO CLEAN OUT
- COLLECTION SUMP
- TEMPORARY COLLECTION TRENCH (NO LONGER IN SERVICE)
- LIMIT OF LIGHTWEIGHT FILL

200 100 0 200 400

SCALE: 1"=200'

FIGURE 2

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

WILLIS–SEMET WALL AND COLLECTION TRENCH LOCATION

PARSONS
301 PLAINFIELD ROAD, SUITE 350, LIVERPOOL, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\447618- LAKESHORE GW CONTAINMENT SYSTEM\10 TECHNICAL CATEGORIES\NEW FOLDER\10.1 CAD\FIGURES\447618-SK001.DWG
PLOT DATE: 11/3/2014 11:18 AM PLOTTED BY: RUSSO, JILL

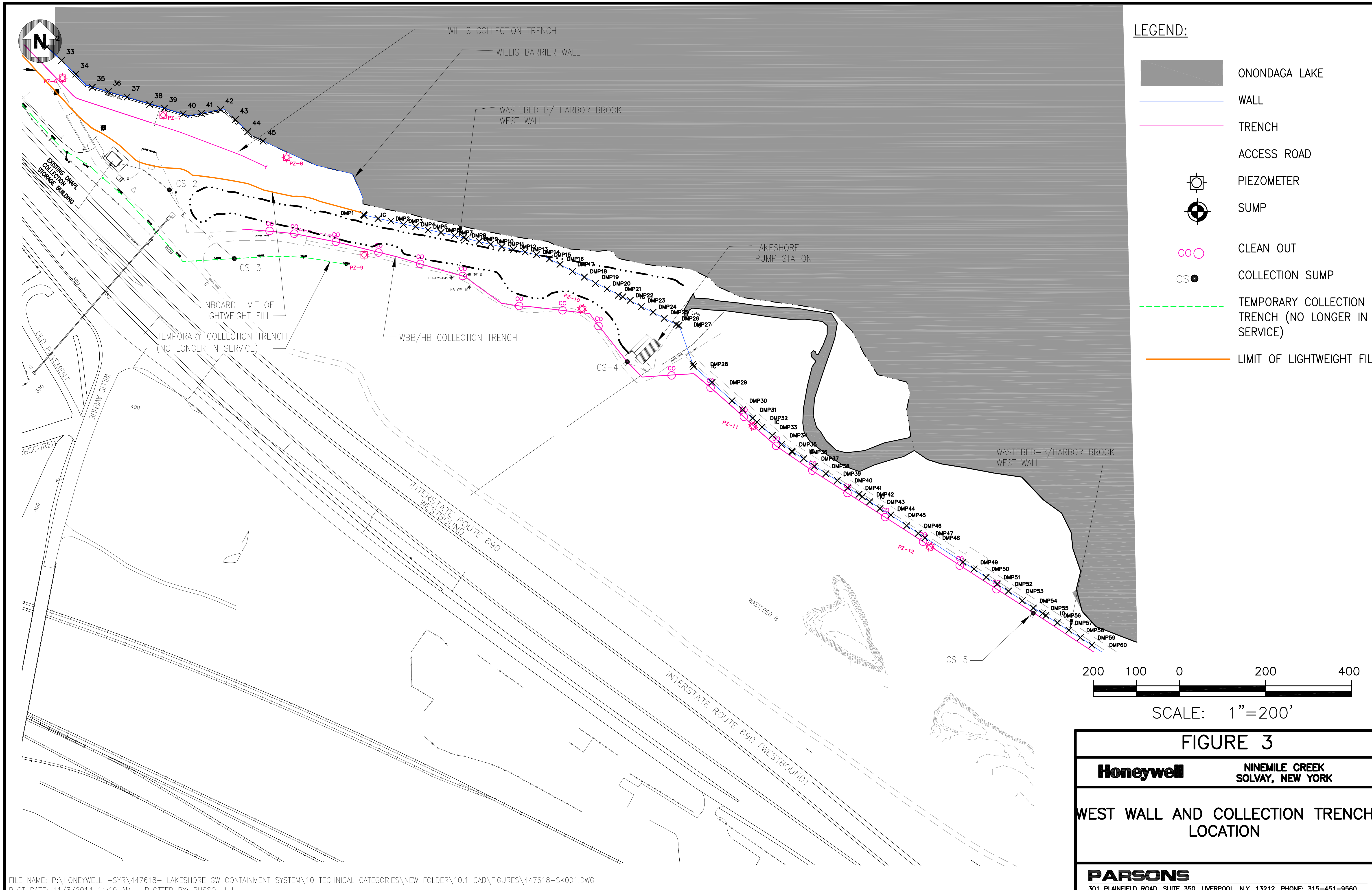

FIGURE 3

Honeywell

NINEMILE CREEK
SOLVAY, NEW YORK

WEST WALL AND COLLECTION TRENCH LOCATION

PARSONS
301 PLAINFIELD ROAD, SUITE 350, LIVERPOOL, N.Y. 13212, PHONE: 315-451-9560

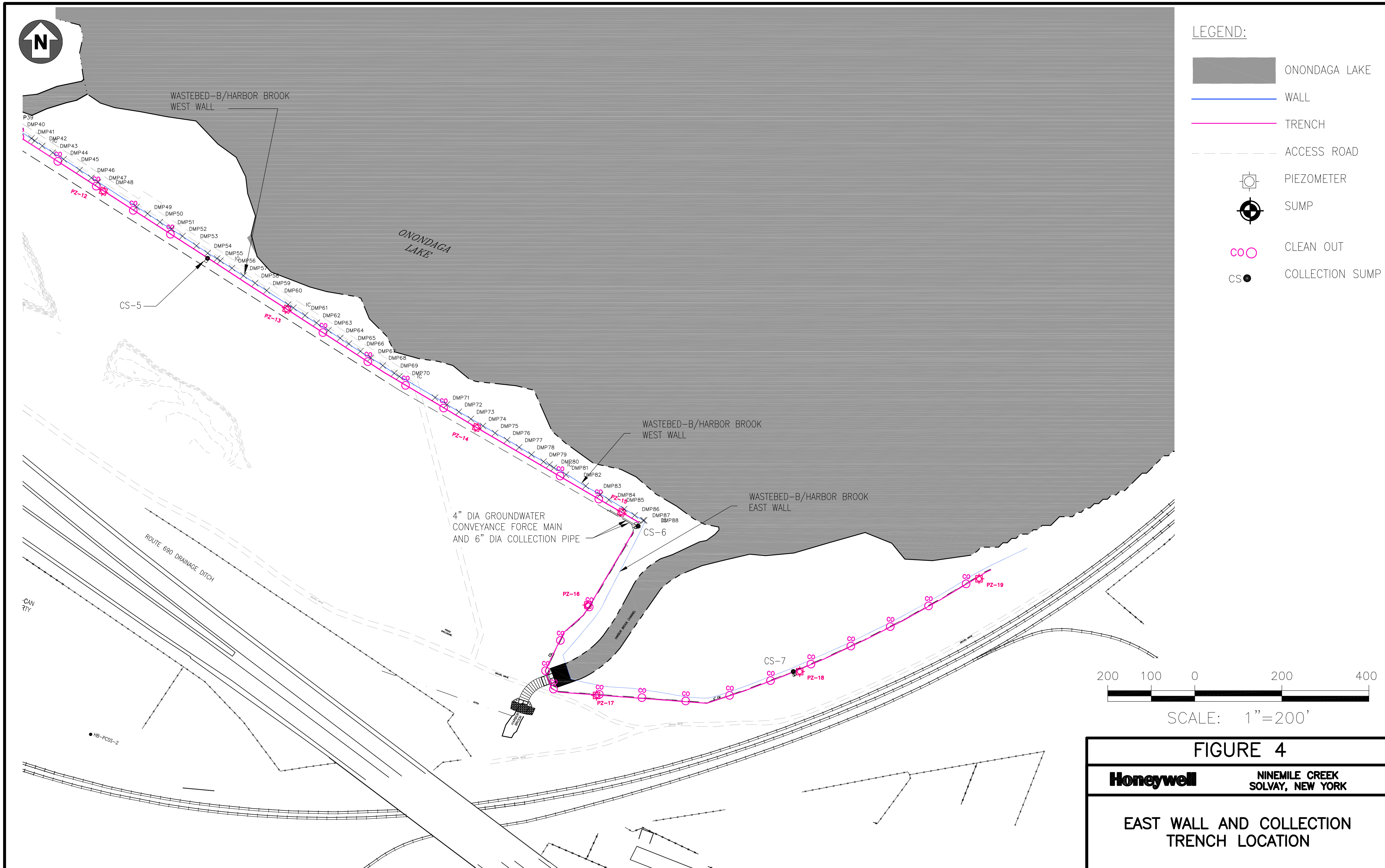

FIGURE 4

Honeywell NINEMILE CREEK
SOLVAY, NEW YORK

EAST WALL AND COLLECTION TRENCH LOCATION

PARSONS
301 PLAINFIELD ROAD, SUITE 350, LIVERPOOL, N.Y. 13212, PHONE: 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\447618- LAKESHORE GW CONTAINMENT SYSTEM\10 TECHNICAL CATEGORIES\NEW FOLDER\10.1 CAD\FIGURES\447618-SK001.DWG
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APPENDIX A

EQUIPMENT MANUALS

(See CD on Appendices Tab)

APPENDIX B

MONITORING DURING DREDGING AND CAPPING SOP

(See CD on Appendices Tab)

APPENDIX C

FORMS

(See CD on Appendices Tab)

APPENDIX D

RECORD DRAWINGS

(See CD on Appendices Tab)