Final Groundwater and Surface Water Monitoring Plan

Former Ciba-Geigy Site
Glens Falls, NY

Prepared by:

EHS Support
consider it done

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µm	micrometer
ASP	Analytical Services Protocol
BASF	BASF Corporation
CIBA	Ciba-Geigy Corporation
CM	Corrective Measures
CSM	Conceptual Site Model
DER	Division of Environmental Remediation
DOC	Dissolved Organic Carbon
EC	electrical conductivity
EDD	electronic data deliverable
EDWS	Electronic Data Warehouse Standards ()
ELAP	Environmental Laboratory Accreditation Program
GSMP	groundwater and surface water monitoring plan
GSMR	Groundwater and Surface Water Monitoring Report
GWES	groundwater extraction system
ml/min	milliliters per minute
MPS	Main Plant Site
MS/MSD	matrix spike/matrix spike duplicate
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
POTW	publicly owned treatment works
PTP	Pretreatment Plant
Q3	quarter three
Q4	quarter four
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SCGs	Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Criteria, and Guidance
SVOC	semi-volatile organic compound
TDS	total dissolved solids
TOC	top of casing
VOC	volatile organic compound

1.0 INTRODUCTION

This groundwater and surface water monitoring plan (GSMP) has been prepared for the former Ciba-Geigy Corporation (CIBA) pigments manufacturing facility located at 89 Lower Warren Street in Queensbury, NY (the Site). The Site was purchased by CIBA from Hercules in 1979, and was historically operated as a pigments manufacturing facility until 1989. Since that time, Ashland acquired Hercules and BASF Corporation (BASF) acquired CIBA. Site environmental activities are conducted under a Hazardous Waste Management (HWM) Post Closure Permit issued by the New York State Department of Environmental Conservation (NYSDEC Site No. 557011). Hercules and CIBA are the Site permittees and share responsibility for environmental activities.

This GSMP provides for monitoring in the historical operations area of the Site, referred to as the Main Plant Site (MPS) located on the south side of Lower Warren Street, and for monitoring at the Pretreatment Plant area (PTP) located on the north side of Lower Warrant Street (refer Figures 1 and 11). The monitoring programs proposed in this GSMP include semi-annual sampling at the MPS and annual sampling at the PTP. Data collected will be used to evaluate the effectiveness of the monitoring programs, and to make recommendations for future monitoring events as warranted. This GSMP was developed in concert with NYSDEC and consideration of NYSDEC comments, dated June 25, 2015, regarding the draft GSMP (dated June 2015) submitted to NYSDEC on June 12, 2015.

The monitoring program proposed for the MPS comprises one focused sampling event in quarter three (Q3) 2015 (July) and a standard, semi-annual sampling event to commence in quarter four (Q4) 2015 (December). The focused sampling event is designed to collect data to confirm the Conceptual Site Model (CSM) presented in the Site Conceptualization and Groundwater Corrective Measures Effectiveness Evaluation Report (EHS Support, 2015a). The standard event is designed to collect data for on-going evaluation of groundwater and surface water quality, and groundwater extraction system (GWES) performance. The data from the focused sampling event will be used to further rationalize and confirm the monitoring network and analysis schedule for the standard event, and ultimately the final monitoring program for the Site.

Monitoring proposed for the PTP area includes annual sampling in to commence in July 2015 to monitor groundwater quality in the overburden and adjacent surface water at the PTP, which was identified as a solid waste management unit in the initial 1991 HWM Permit.

1.1 Objectives of GSMP

The overall objectives of this GSMP are:

- To collect information that will validate and further define our understanding of Site conditions with respect to mechanisms of metal species mobility using groundwater sampling and analysis methods that are optimized toward this evaluation, and
- To provide groundwater and surface water quality data to support monitoring of groundwater and surface water conditions, evaluation of the Site GWES performance, and optimization of the groundwater remedy.

This GSMP was designed to support these objectives, and is intended to replace the existing Site groundwater monitoring plan (Brown and Caldwell, 2004).

1.2 Scope of GSMP

This GSMP outlines the rationale for the selection of the groundwater and surface water monitoring locations and sample analysis schedule for the monitoring programs at the MPS and the PTP, and describes the field sampling and analytical methodologies and reporting proposed. The groundwater sampling methods used previously for groundwater monitoring are proposed to be modified (changed from high volume purging/sampling with pumps or bailers to low flow sampling) to provide higher quality groundwater samples. The data collected will be used to define the potential mass fluxes of metal and non-metal species at the Site and refine understanding of the attenuation processes occurring in groundwater and the hyporheic zone prior to discharge to the Hudson River. The monitoring program focuses on the key risk drivers identified in groundwater at the Site (hexavalent chromium and free cyanide) and other metals of interest to aid the assessment of potential mass flux of constituents with potential to discharge to the Hudson River.

The scope of this GSMP includes identification of the following:

- Potential source areas of interest;
- The groundwater monitoring well networks in overburden and bedrock for gauging and sampling to achieve monitoring objectives;
- Purging and sampling methodologies to be employed, including sequential filtering (at select wells) to distinguish between total, colloidal and truly dissolved constituents;
- Sample analytical suites and methods to be employed;
- Monitoring and Reporting Schedules.

An overview of the field monitoring, data evaluation, and reporting proposed under this GSMP is presented in **Table 1-1** with further details provided in following sections of this document. This document is organized as follows:

- Section 1 – Introduces the monitoring programs and objectives
- Section 2 – Provides background on the previous monitoring program and the CSM
- Section 3 - Identifies the proposed sampling program locations and provides the rationale for well selection and proposed analytical suites
- Section 4 – Describes the field sampling methodologies to be employed
- Section 5 – Identifies the laboratory analytical methods to be employed
- Section 6 – Outlines the monitoring and reporting schedule
- Section 7 –References

1.2.1 Standards, Criteria and Guidance

This GSMP was prepared in accordance with the following Standards, Criteria and Guidance:

- Environmental Conservation Law, Article 27 Titles 3, 5, 13 and 14.
- New York State Department of Environmental Conservation (NYSDEC). DER-10 Technical Guidance for Site Investigation and Remediation. May 3, 2010.
- 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations, Criteria and Guidance (SCGs) for Investigation and Remediation of Sites under Remedial Programs. http://www.dec.ny.gov/regs/4590.html.
- USEPA Region II: Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling. March 16, 1998.
- USEPA Region I: Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells. January 19, 2010.
- Program Policy DER-23 *Citizen Participation Handbook for Remedial Programs*. NYSDEC. January 2010.

- Analytical Services Protocol (ASP). NYSDEC.
- Preparation Aids for the Development of Category I Quality Assurance Project Plans. USEPA. EPA/600/8-91/003. February 1991.

Table 1-1 Sampling and Data Evaluation for Proposed Monitoring Events

Work Task	Groundwater	Surface Water
MPS Focused Sampling	Focused Sampling Event: - Gauging (59 wells) - Low flow sampling (38 wells) - Selective sequential filtration study (10 wells) - Extraction Well Sampling (3 wells) for additional assessment of potential river water dilution at wells EW-A9, EW-A10 and EW-A12	Focused Sampling Event: River level gauging at SG-12 Canal level gauging at SG-11 5 sampling points in Hudson River upstream, adjacent, and downstream of Site.
MPS Focused Sampling Preliminary Analysis of Data	Assessment of data against historical dataset to observe any differences in analyte concentrations. Evaluation of sequential filtration event and interpretation of results against potential implications on metal and inorganic species mobility. Calculation of theoretical metal fluxes in groundwater at down gradient boundary of Site. Assessment of potential for river water ingress into bedrock as a result of GWES and recalculation of dilution ratios.	Comparison of surface water quality against Site groundwater quality in on-Site wells and applicable State standards. Assess background metal concentrations and surface water quality upstream, adjacent and downstream of Site source areas.
MPS Standard Semi-Annual Sampling	Semi-Annual Event: - Gauging (52 wells) - Low flow sampling (25 wells)	Semi-Annual Event: River level gauging at SG-12 Canal level gauging at SG-11 4 sampling points in Hudson River upstream, adjacent, and down-stream of Site.
MPS Semi-Annual Sampling Data Analysis	Continued assessment of low flow sampling data and historical groundwater quality dataset to evaluate trends in concentration in response to natural processes and operation of the GWES.	Conduct performance monitoring on the GWES using surface water data. Assess long-term maintenance of surface water quality criteria adjacent to the Site and impacts of potential upstream sources.
PTP Annual Sampling	Annual Event: - Gauging (11 wells/piezometers) - Low flow sampling (6 wells)	PTP Semi-Annual Event: Sampling at SG-7 in stream and SG-11 in canal.
PTP Semi-Annual Data Analysis	Continued assessment of low flow sampling data and historical groundwater quality dataset to evaluate trends in concentration in response to natural processes.	Assess surface water quality adjacent to Site.

2.0 BACKGROUND

This section provides background information on the existing groundwater monitoring program, key findings and recommendations from the Site CSM evaluation (EHS Support 2015a), and identifies areas of interest for the proposed groundwater monitoring program.

2.1 Current Groundwater Monitoring Program

The existing/current groundwater monitoring program is outlined in the Corrective Measures Groundwater Monitoring Plan that was issued in April 2004 (Brown & Caldwell, 2004), around the time the GWES commenced operations. Groundwater monitoring has continued since that time at the MPS and PTP areas with results reported annually.

Under the existing monitoring plan, select groundwater wells at the MPS are sampled on a semi-annual and/or five-year frequency and select wells at the PTP are sampled annually. Wells included in the MPS program are screened in the overburden and bedrock, and wells in the PTP program are screened in the overburden. Groundwater analysis under the existing plan for the MPS includes dissolved chromium, dissolved vanadium, dissolved cyanide, and select volatile organic compounds (VOCs; comprising dichlorobenzenes) at select wells as these constituents were historically detected above groundwater standards during the Site RFI. Groundwater and surface water samples from the PTP are analyzed for cyanide which has been detected above groundwater standards on Site. The locations sampled at the MPS and PTP under the existing plan are identified in Tables 1 and 2, respectively.

The existing sampling program focuses on evaluating groundwater quality and assessing trends in concentrations, with the five-year event at the MPS providing additional data on water quality to support a more data detailed review process. The monitoring programs for both the MPS and PTP also include routine groundwater gauging to assess temporal trends, and the influence of the GWES at the MPS.

Groundwater concentrations at the MPS and PTP have changed significantly since the implementation of the Site corrective measures and with operation of the GWES at the MPS commencing in 2003. The extensive period of monitoring under the existing program has established data to document conditions and trends in groundwater levels and quality. Based on the current Site conditions and reconceptualization of the Site CSM (discussed in Section 2.2) a new monitoring program is being proposed.

2.2 Groundwater Conceptual Site Model

Historically the fate and transport of metals and inorganics was focused entirely on the lateral and vertical distribution of soil and groundwater impacts. Limited consideration was provided for the effects of geochemical reactions on the fate and transport of inorganics at the Site. A focused assessment of Site investigation and monitoring data was conducted for the MPS to aid the conceptualization of sources and the assessment of the fate and transport of site-related chemicals in groundwater and the performance of the Site GWES (EHS Support 2015a). The key findings from the resulting Site reconceptualization are discussed below. The findings and CSM developed are based on review of the Site operations history and available soil and groundwater data. Proposed groundwater areas of interest, which are recommended to be monitored in order to validate the CSM and assess current groundwater conditions and trends, are discussed in Section 2.3.

Extensive remediation has been carried out at the Site including consolidation and capping of impacted soils in the RCRA (regulated unit) area (RCRA cap area) and construction of a permeable cap across the remainder of the MPS area, installation of an overburden and bedrock GWES, and soils removal at the PTP. The current GWES was constructed parallel to the river along the southern boundary of the Site and comprises a French drain, installed to top of a lacustrine clay unit at the base of the overburden groundwater–bearing zone, and a series of 20 groundwater extraction wells installed in the shallow bedrock (EW-A1 through EW-A14) and intermediate bedrock (EW-B1 through EW-B6). The GWES has been in operation for over 12 years and in combination with soil remedial actions, construction of the RCRA cap and permeable cover systems, and termination of Site operations, major changes in groundwater contaminant concentrations have been observed. The combination of the Site conditions and remedial activities have resulted in decreases in the lateral extent and concentrations of key constituents in groundwater.

To better define the fate and transport of constituents in groundwater and assess the performance of the GWES at the MPS, a series of supplemental investigations were completed in 2013 and 2014. Through the assessment of historical Site investigation data and the supplemental data collected, a refined understanding of groundwater movement and the fate and transport of inorganics in soil and groundwater at the Site was developed. Re-evaluation of the Site geology and hydrogeology has determined that the bedrock at the Site can be effectively considered one geologic unit with groundwater head differences in the shallow, intermediate, and deep bedrock, reflecting the absence of inter-granular porosity and with groundwater flow occurring within discrete fractured intervals. Sub-horizontal fractures dominate at the Site with localized areas of sub-vertical fractures. The vertical head differences observed and the communication between groundwater and surface water clearly support the dominance of sub-horizontal fracturing in the hydrogeologic CSM.

Metals were historically detected at elevated concentrations in soils across the Site. Leachability assessments on fill and native soils conducted prior to implementation of Corrective Measures (CM) indicated that these constituents were leachable and had the potential to impact groundwater at concentrations above groundwater quality standards. The leachable concentrations detected, however, were orders of magnitude lower than the total concentrations detected in soil and no consideration was historically provided for the highly conservative nature of the testing. Given the nature of leachability tests and Site conditions (where soil and bedrock are highly buffered by the presence of limestone bedrock) the potential leachability of the majority of metals at the Site is very limited. Hexavalent chromium and free cyanide are not affected by the alkalinity and buffering and as a result are potentially mobile within groundwater.

Major declines in groundwater concentrations have been observed with the termination of Site operations, CM implementation and operation of the GWES. Lead, mercury, molybdenum, zinc, and barium were historically only detected at concentrations slightly above groundwater protection criteria and in limited areas of the Site. Cadmium, while detected widely in groundwater, has shown limited indications of lateral migration. The low concentrations and limited mobility of these constituents has been discussed using geochemical modeling, which indicates that these constituents are not soluble under the prevailing groundwater conditions at the Site.

Dissolved chromium, dissolved vanadium, and total cyanide have been measured routinely since 1992, and concentrations are observed to have decreased both laterally and vertically in the majority of wells. The reduction in concentrations is supported by the expected attenuation of metals in groundwater, the reduction of rainfall infiltration through capped areas of the Site (RCRA cap), the termination of Site operations, and the absence of appreciable contaminant mass within the bedrock matrix. Further, the detection of many of these constituents in groundwater is partly an artifact of the sample acquisition methods utilized (high flow purge/sample) with total and in some cases dissolved metal analyses affected by sub-micron sized colloids of sorbed and complexed metals.

While the GWES has facilitated major decreases in the concentrations of metals and cyanide in groundwater (especially in the southwestern portion of the Site), a number of areas of high concentrations of chromium and cyanide persist in the overburden and bedrock. These areas are proximal to major historical processing areas (former Buildings 56, 45 and 8) and are likely a result of historical discrete releases in these areas. Based on the absence of primary porosity within the bedrock, the mass of mobile constituents is limited and confined to dissolved mass and colloids within secondary porosity fracture zones. Diffusion of mass into the bedrock is not considered a significant mechanism at the Site. This is due to groundwater transport by fracture flow and not intergranular flow, wherein the latter groundwater (and constituents in groundwater) are in contact with a greater surface area of aquifer material and for a longer period of time. On this basis, the presence of mass within the bedrock likely suggests ongoing flux from impacts in the overburden into the underlying bedrock units. Key areas where this flux is potentially important include locations where the lacustrine deposits are absent, areas where sub-vertical fractures are present and areas where remnants of the historical facility sub-surface drainage system exist.

While historically total and dissolved chromium have been measured in groundwater, these data provide limited understanding of the potential mobility of this metal. Historic and more recent speciation of chromium has indicated the presence of elevated trivalent and hexavalent chromium. Under Site conditions, the trivalent chromium detected in groundwater is not expected to be present as a dissolved form. The detection of trivalent chromium is most likely related to the sorption of trivalent chromium associated with mobile colloidal material in groundwater. Hexavalent chromium and free cyanide exhibit limited sorption (as negatively charged CrO_4^{2-} and CN^-) under the mainly alkaline groundwater conditions at the Site and are considered the higher priority chemicals of concern at the Site.

A focused assessment of the distribution and temporal patterns of hexavalent chromium and cyanide in groundwater has also shown major declines in concentrations over the period of groundwater monitoring. This is to be expected given the high solubility and mobility of these constituents, which can be readily flushed from soils and captured by the GWES. However, discrete areas exist where elevated concentrations of hexavalent chromium and cyanide persist in both the overburden and bedrock groundwater. Given the hydrogeologic setting, the persistence of these soluble inorganics suggests both the presence of ongoing sources within the overburden and vertical flux into the bedrock in discrete areas.

The identification of hexavalent chromium as the main constituent of concern at the Site (based on mobility) is supported by the historical observation of this constituent in groundwater production wells at the Site and in seeps near former Buildings 56 and 8. These historical areas of impact in production wells and in seeps correlate well with the areas where this constituent persists in groundwater.

The geochemical assessment (included as Appendix C in EHS Support, 2015a) provided a framework by which the historical and supplemental groundwater monitoring data could be compared and assessed. The major declines in chromium concentrations in groundwater can be attributed to movement of groundwater and capture by the GWES but also to the potential (reductive) conversion of hexavalent chromium into trivalent chromium. The only exception being a discrete area between former Buildings 56 and 8.

Both the hydrogeologic and geochemical assessments demonstrated that the GWES is capturing large volumes of surface water. While the GWES has historically been successful at capturing mass (and facilitating the groundwater concentration declines observed), the operational efficiency of the system has been impacted by a number of processes. These have included historic hydrofracking (which removed fines from fracture sets) in extraction wells and the ingress of surface water and potential dissolution of calcite from fractures over time (increasing lateral communication with the river). The net result of pumping and natural geochemical reactions at the Site is that fractures upgradient of the extraction system have a tendency to infill with calcite while on the down gradient side of the pumping wells dissolution is occurring. The net effect is that in some wells greater than nine parts surface water is being extracted for every part groundwater and this process is likely to be decreasing the efficiency of the GWES. As discussed within the Inorganic Geochemical Analysis Report (an Appendix C in EHS Support 2015a), geochemical modelling was used to explore the low chloride concentrations measured in some of the extraction wells of the GWES. The initial hypothesis was that the extraction system was inducing surface water flow from the river into the extraction wells, which was causing dilution of chloride concentrations and influencing ion exchange reactions between sodium/potassium and calcium/magnesium. This was supported by the outcomes of the geochemical modelling; however, it was recommended that further locations be evaluated to verify the conclusions.

Flux calculations were conducted to identify key areas of hexavalent chromium at the MPS. Calculations were not conducted for trivalent chromium, cyanide or vanadium as they are not in a soluble form and/or do not exist at the boundary of the Site at high concentrations. The flux calculations indicate that the majority of hexavalent chromium flux is occurring within very discrete areas. This flux is generally confined to the overburden and intermediate bedrock; however, in the area of former Buildings 8 and 56, the majority of the flux is occurring in the intermediate bedrock (90% of the contaminant flux). These findings are consistent with hydrogeologic, groundwater quality and hydrogeochemical evaluation and indicate that moving forward investigation and remediation activities at the MPS should be focused on this area.

In summary, the key findings pertaining to the CSM developed for the MPS are as follows:

- Overall, measured concentrations of metals and other Site-related constituents in groundwater have declined over time. The main mechanisms for the observed decreases are the circum-neutral to alkaline nature of groundwater and super-saturation of calcite leading to co-precipitation. Mobility of metals is reduced due to these attenuation mechanisms and the low hydraulic conductivity of the limestone bedrock both horizontally and vertically.
- Groundwater flow within the bedrock is controlled primarily by discrete intervals of open sub-horizontal fractures (orientated parallel to bedding) and discrete areas of vertical fracture zones.
- Two COPCs, hexavalent chromium and cyanide, persist in selected areas of the Site. Horizontal and vertical mobility of cyanide is demonstrated to be low and the elevated concentrations of hexavalent chromium are not reported to persist outside of the existing delineated zones.
- Organics [VOCs and Semi-VOCs (SVOC)] have been reported to be elevated historically, but monitoring has demonstrated that concentrations are currently low and do not appear to be mobile (generally confined to the interior of the Site).
- Operation of the GWES appears to be promoting the flow of river water into the extraction system. The extraction process is also potentially oxygenating the water, promoting ion exchange of calcium for sodium and causing carbon dioxide degassing from the water. These processes result in decreased reduction potential, calcite dissolution and an increase in pH. These conditions enhance the retardation of the majority of metals and metal species, with the exception of negatively charged hexavalent chromium and free cyanide.
- Flux calculations indicate that the majority of flux is occurring in the intermediate bedrock (Horizon B) in the area of former Buildings 8 and 56. As a percentage of the total hexavalent mass flux to the boundary and GWES, this area makes up more than 90% of the contaminant mass flux toward offsite. These findings are consistent with the findings for other key assessments undertaken in development of the CSM and this area should be the key focus area for system optimization and/or assessment of alternatives.

The robust assessment of the Site data has provided new understanding of the fate and transport of constituents in soil and groundwater and has demonstrated that the main constituents of concern in terms of the groundwater flux toward offsite are hexavalent chromium and free cyanide. The mechanisms of vertical and lateral transport and attenuation within the overburden and bedrock have been identified. However, there are a number of uncertainties and data gaps that need be evaluated for finalization of this CSM and evaluation of future management options.

To confirm the findings from the Site reconceptualization and validate the CSM, additional assessments were recommended (EHS Support, 2015) including sampling and analysis of groundwater on Site to further define source areas of persistent hexavalent chromium, and refine our understanding of potential fate and transport mechanisms, groundwater flux, and ingress of surface water resulting from GWES operation. The recommendations for further assessment of groundwater included:

1. Additional groundwater sampling from a broader number of existing wells to:
   - Further define the current lateral and vertical extent of the most mobile constituents in groundwater including hexavalent chromium and free cyanide; and
   - Analysis for geochemical parameters and other metals to confirm the immobility and lateral distribution of constituents of interest in groundwater.
2. To refine the conceptualization of metals fate and transport in groundwater, supplemental groundwater sampling should include:
   - Differentiation between colloidal (>0.45 µm) trivalent chromium (if present) and hexavalent chromium by selective filtering (0.45/0.2 µm filters), to assess mobility of chromium species in groundwater;
   - Analysis of cadmium and vanadium, as dissolved and total concentrations using conventional analytical methods in additional wells and selective filtering (0.45/0.2 µm filters), to assess mobility in groundwater.
3. Reassessment of the preliminary flux calculations to include a broader suite of analytes and validate the conclusions for hexavalent chromium;
4. Further recommendations for consideration in refining understanding of Site conditions and source areas included:
   - Installation of drive point piezometers in the fine overburden materials adjacent to the Site downgradient boundary to confirm the absence or limited transport (and filtering) of fine colloidal materials in groundwater;
   - Completion of supplemental soil sampling in focused areas of the Site to further refine our understanding of leachable fractions and potential flux from unsaturated and saturated soils to overburden groundwater and potentially bedrock groundwater.
5. The potential installation of new groundwater monitoring wells in historical areas of groundwater impact to define current conditions (where historic impacts were identified) and areas of the MPS where limited understanding of groundwater conditions is currently known (north and east of railroad).

The groundwater areas of interest identified for monitoring to support validation of the CSM are summarized in Section 2.3. The supplemental sampling and assessments recommended in items 1 through 3 above are incorporated in the focused sampling event proposed for July 2015, and the recommended assessments in item 4 are being addressed under a separate work plan (EHS Support 2015b). The need for additional monitoring wells (item 5) will be evaluated following completion of the supplemental groundwater and soil assessments.

2.2.1 Pretreatment Plant Groundwater Conditions

The PTP was constructed in 1972 to treat wastewater generated by pigment manufacturing operations on the MPS. A major portion of the plant was largely decommissioned in 1990 in conjunction with the decommissioning of the MPS facilities. Subsequently an RFI was completed to evaluate soil and groundwater conditions at the PTP. The results of investigation report that the PTP is underlain by fill material (comprising sand, silt, limestone and occasional concrete fragments) followed by a discontinuous unit of lacustrine sand, silt and thin clay interbeds, and a low permeability lacustrine clay unit which forms the base of the overburden groundwater-bearing unit (Eckenfelder Engineering P.C. 1992a). The clay unit is present across the PTP except in the historical sand filter and clarifier process area where it is believed the clay may have been excavated for construction of the former filter backwash tank. The clay is elevated in the central area of the PTP, exhibiting a downward slope to the southeast and northwest. Due to a combination of the lower permeability of the clay and thin saturated thickness in the overburden, the clay inhibits the downward migration of groundwater and the top of clay elevation influences groundwater flow direction in the more permeable materials above the clay unit.

Groundwater in the overburden unit beneath the PTP generally flows to southeast, following the declining elevation of the top of clay, however a relative mounding of the clay in the center of the PTP appears to result in occasional flow components to the west/southwest in the western area of the Site during low water conditions (Eckenfelder Engineering P.C. 1993). A small stream lies to the north and east of the PTP which flows southward toward the canal and a marsh area to the east and the southeast of the PTP. Overburden groundwater off-site flows southeast beneath the canal as the clay dips below the canal. Groundwater is reportedly separated from the canal water, and levels in the canal do not affect groundwater at the PTP.

Historical investigations of the Site conditions at the PTP determined that shallow soils had been impacted by select metals (primarily lead and cadmium) and cyanide during historical Site operations. The highest concentrations were detected in the southeastern area of the PTP in the vicinity of the waste water holding tank and chemical process buildings. Corrective measures implemented at the PTP comprised removal of shallow soils near the holding tank.

Monitoring of overburden groundwater at the PTP and adjacent surface water has been conducted since 1993. Historical monitoring data indicates that cyanide has been detected above groundwater standards in samples from wells on-site and down-gradient to the southeast. The RFI groundwater investigation determined cyanide to be the only constituent detected in groundwater above applicable groundwater quality standards. The historical monitoring data demonstrate that groundwater concentrations have significantly declined over time, and cyanide concentrations above current groundwater standards (for use as a drinking water source, 6 NYCRR 703.5) are limited to the central area of the PTP, with concentrations at the PTP boundary and off-site below groundwater standards.

Cyanide was also historically detected in surface water samples collected in the stream located north and east of the PTP, which flows to a marsh area at the southeast end of the PTP. Total cyanide concentrations detected in surface water samples are generally stable, and on the order of the current surface water quality standard for fish propagation in Class C waters (6 NYCRR 703.5). It is noted that cyanide analysis historically employed for surface water monitoring at the PTP reported total (including amenable) cyanide. As the surface water quality standard is applicable to free cyanide, comparison of the data to the surface water quality standard is conservative.

As total cyanide is still detected in groundwater on-site above groundwater quality standards, a groundwater monitoring program is being proposed for the PTP.

2.3 Groundwater Areas of Interest

Based on the CSM developed for the MPS (EHS Support, 2015a) and groundwater conditions at the PTP, a number of groundwater areas of interest for monitoring have been identified based on groundwater flow, and the distribution and persistence of metal and cyanide concentrations in groundwater. These areas of interest and groundwater wells located within and downgradient of these areas where constituents of interest have been detected above groundwater standards are summarized in Table 2-1. Existing wells on Site, including those noted in the Table 2-1, were considered in selecting the proposed monitoring well network.

Table 2-1 Groundwater Areas of Interest for Monitoring

Area of Interest	Monitoring well location				Constituents of Interest detected above GA water quality standard[1]
	Overburden	Shallow bedrock	Intermediate bedrock	Deep Bedrock	
RCRA cap area	MW-OB5	AW-A16	MW-36D		Cadmium (MW-OB5), chromium (MW-OB5, AW-A16, MW-36D) and cyanide (MW-OB5, AW-A16, MW-36D), mercury (AW-A16).
Permeable cover area (south of railroad)	IP-4 MW-OB7 MW-26 MW-28	AW-A15 MW-19 MW-25S	AW-B11 AW-B15 AW-B18 MW-25D	AW-C2	Cadmium (MW-OB7, MW-26), chromium (IP-4, MW-OB7, MW-26, MW-28, MW-19, MW-25S, AW-B15, AW-B15, MW-25D, AW-C2), cyanide (IP-4, MW-OB7, MW-26, MW-19, MW-25S, AW-B15, MW-25D), lead (IP-4, MW-OB7), vanadium (AW-C2) and mercury (IP-4, MW-OB7).
Former Building 56 area	AP-2 MW-OB25	AW-A11	AW-B12 AW-B13		Cadmium (AP-2, MW-OB25), chromium (AP-2, MW-OB25), cyanide (AP-2, MW-OB25), lead (AP-2) and mercury (AP-2, MW-OB25).
New/Old Weir Brook area	MW-OB14 MW-OB25	AW-A13 AW-A14	AW-B4	AW-C11	Cadmium (MW-OB25), chromium (MW-OB14, MW-OB25, AW-A13, AW-B4, AW-C11), cyanide (MW-OB14, MW-OB25, AW-A13, AW-B4, AW-C11), vanadium (MW-OB14, AW-C11) and mercury (MW-OB25, AW-A13).
Former Building 8 area	MW-OB13 BP-2 BP-6	No shallow bedrock wells in this area	AW-B16 AW-B17 AW-B20 MW-30D		Cadmium (MW-OB13), chromium (MW-OB13, AW-B17, AW-B20, MW-30D), cyanide (MW-OB13, AW-B20, MW-30D), lead and mercury (MW-OB13).
PTP	MW-OB17MW-OB18				Cyanide (MW-OB17, MW-0B18)

Notes:

1. 6 NYCRR Part 703.5 Table 1 water quality standard for Class GA groundwater as source of drinking water
   It is noted that use of groundwater on Site is restricted, and is not in use.

In addition to groundwater monitoring at the MPS, NYSDEC has requested that surface water sampling in the Hudson River also be incorporated into the monitoring program for the MPS. The geochemical assessment completed by EHS Support (Appendix C in EHS Support, 2015a) also identified the importance of surface water sampling data for validating the CSM and assessing the GWES performance. On this basis, surface water sampling in the river has been incorporated into the monitoring program for the MPS. Given the potential for background and upstream sources of metals and inorganics in the river, surface water sampling proposed includes sampling at locations upstream, adjacent to, and downstream of the Site.

Surface water monitoring in an adjacent stream to the east of the PTP has historically been included in the PTP monitoring program, and sampling of surface water is also proposed for inclusion in this GSMP.

The groundwater well and surface water sampling locations included in the MPS and PTP monitoring programs, and comments regarding the basis for their inclusion in monitoring events are listed in attached Table 1 (MPS) and Table 2 (PTP). The monitoring programs proposed are discussed in Section 3.

3.0 PROPOSED MONITORING LOCATIONS AND ANALYSIS

The proposed Site monitoring programs comprise sampling on a semi-annual frequency in the second and fourth quarters (Q2 and Q4) of the calendar year (typically to occur in June and December) at the MPS, and annual sampling (Q2, typically June) at the PTP. Each event includes gauging, sampling and analysis of groundwater and surface water at and adjacent to the Site. The monitoring locations and analytical schedules for each event are summarized in attached Tables 1 through 5, as referenced below.

For the MPS, the initial sampling event (proposed for July 2015) comprises a one-time, focused and comprehensive event designed to develop data to refine and validate the CSM. The standard events at the MPS and PTP (to commence Q4 2015) are designed for routine monitoring of groundwater and surface water to support evaluation of water quality and GWES performance. The well networks proposed for the focused and standard monitoring events are identified in Table 1 (MPS) and Table 2 (PTP). The monitoring locations for the MPS are illustrated on Figure 1 through Figure 5 (focused event) and Figure 6 through Figure 10 (standard event). The PTP sampling locations are illustrated on Figure 11. Well construction details and recent gauging data for wells proposed in the monitoring programs are provided in Table 7. The basis for selection of the monitoring networks and analysis schedules for the MPS and PTP are discussed below.

3.1 MPS Focused Sampling Program

The monitoring well network for the MPS focused event was selected with the aim of investigating locations identified as having persistently constant and/or elevated concentrations (above groundwater standard) of dissolved chromium and total cyanide, and to provide spatial sampling data to better understand the fate and transport of metals of interest in groundwater at the Site. Additionally, sampling of surface water is proposed at five locations, upstream from the Site and adjacent and downstream from key Site areas of groundwater impacts.

To support the objectives of the monitoring program (Section 1), the following data quality objectives are identified for the MPS focused sampling event:

- Implement low-flow sampling methods to provide for provision of high quality groundwater samples representative of formation conditions, minimize potential absence of data at low yielding wells that purged dry during historical sampling, and minimize waste generated. Historically elevated turbidity has been observed in groundwater samples and could result in a high bias in potential total and dissolved metal analyses.
- Collect representative field parameters of pH, conductivity, turbidity, dissolved oxygen (DO), temperature and oxidation-reduction potential (redox) using a flow through cell to provide a more reliable evaluation of these geochemical parameters and validate the geochemical assessment of Site conditions (EHS Support 2015a).
- Collect groundwater samples representative of in-situ conditions and undertake sequential filtering of samples to determine whether metals are present in complexed or colloidal form or as dissolved constituents in groundwater in order to:
  - Better understand the potential fate and transport in the Site hydrogeologic system, and
  - Verify and validate the assumptions from the geochemical modelling outcomes.
- Facilitate an assessment of potential dissolved phase metal fluxes in groundwater.
- Analyze groundwater samples from select GWES extraction wells to verify and validate that surface water is being captured by the GWES and recalculate dilution rates in key pumping wells.
- Conduct surface water sampling in the Hudson River to:
  - Assess potential presence of inorganic constituents from upstream sources that may be contributing to impacts within the river.

- o Collect dissolved surface water quality data to demonstrate that flux from the Site is not leading to exceedances of NYSDEC SCGs in the immediate vicinity of the Site.
- o Provide geochemical data to facilitate evaluation of surface water capture in the GWES wells.

The proposed monitoring well network, sampling techniques to be employed (use of low flow), field parameters (including pH and ORP) and groundwater and surface analysis proposed for the focused sampling event will provide data to support refinement of the CSM and evaluation of Site conditions and the groundwater remedy.

3.1.1 MPS Focused Event Monitoring Locations

Groundwater monitoring wells selected for sampling during the focused monitoring event include wells screened in the overburden and bedrock in the following areas:

- Vicinity of former Buildings 56 and 8 where chromium processing and acid storage operations historically occurred and Site constituents of interest (cadmium (total only), chromium, lead mercury (total only) and cyanide) have been detected above groundwater criteria
- Within and downgradient of the RCRA cap area where historical wastes and impacted soils/sediment have been disposed
- Wells along the southern end of the Site, downgradient from the historical chromium ore handling/fill and waste incineration/storage areas (western end of Site) and central area of the Site around former Buildings 56 and 8 where hexavalent chromium and free cyanide persist in groundwater and have the highest potential for flux.

Groundwater sampling is focused in the overburden, and shallow and intermediate bedrock zones as these zones have been identified as containing the primary source of contaminants to groundwater (impacted fill materials in the overburden), and/or zones with persistent exceedances of groundwater protection standards, and have the highest potential for flux. Impacts in the deep bedrock unit are limited, stable and potential for flux is minimal. Monitoring in this unit is focused where historical detections have consistently been reported. The monitoring locations for the focused event are shown on Figure 1. The wells for gauging and sampling in each groundwater zone (overburden, and shallow, intermediate and deep bedrock zones) are shown on **Figures 2** through **5**. In addition to well gauging, the water level in the canal at existing gauge SG-11 (refer Figure 11) will be recorded.

Sampling of groundwater from three groundwater extraction wells (EW-A9, EW-A10 and EW-A12; refer to **Figure 3**) is also proposed as part of this event to verify that pumping is capturing surface water as well as groundwater, and to validate the dilution rates calculated for the groundwater CSM (EHS Support, 2015a). These wells were selected as they provide strong indications of surface water mixing with groundwater (based on low chloride, calcium and magnesium and elevated sodium and potassium) and detectable levels of hexavalent chromium and free cyanide during the April 2014 sampling event (EHS Support, 2014 and 2015a).

In conjunction with the groundwater sampling activities, surface water sampling is proposed upstream, adjacent to, and downgradient of the potential high flux groundwater areas (near former Buildings 56 and 8 and area between). Surface water sampling is proposed in the following locations (SW-1 through SW-5 on Figure 1) to assess surface water conditions and support evaluation of the potential for groundwater discharges to affect surface water quality and background conditions:

- Upstream from the Site:
  - o Near the cement company property (SW-4), and further upstream in the vicinity of the publicly owned water treatment facility (SW-5);

- Two locations adjacent to the Site in the vicinity of former Buildings 56 (SW-3) and 8 (SW-2) where chromium processing and acid storage operations historically occurred, and the highest hexavalent chromium concentrations occur in groundwater on Site; and
- Near the downstream end of the Site (SW-1), downstream from the persistent groundwater impact areas with the highest potential for flux (vicinity of former Buildings 56 and 8).

It is noted, that the surface water sampling locations proposed may be slightly modified based on field conditions encountered to ensure safe sampling can be performed.

The specific wells and surface water locations proposed for monitoring during the MPS focused sampling event, and comments regarding the basis for their inclusion in the sampling program are listed in Table 1. The proposed well locations for sampling or for gauging only (to support assessment of groundwater hydraulic conditions), and proposed surface water sampling and guaging locations are identified on Figure 1. The monitoring locations are also illustrated on Figure 2 through Figure 5 respectively for the overburden, and shallow, intermediate and deep bedrock units.

3.1.2 MPS Focused Event Analysis Schedule

The MPS focused sampling event includes a target constituent and geochemical analysis schedule to assess the mobile fraction of metal and non-metal species of interest in groundwater, and to assess surface water quality upstream, adjacent to, and downstream from the Site (Table 3).

Groundwater samples collected will be analyzed for the following:

- Field parameters (pH, redox, electrical conductivity, temperature, DO, turbidity and barometric pressure) – used for quality control/quality assurance, phase distribution of metals and reduction/oxidation potential;
- Major ions (calcium, sodium, potassium, magnesium, chloride, bromide, sulfate) – used as a major ion suite and for recharge and discharge assessment of groundwater;
- Alkalinity (total, bicarbonate, carbonate) – used as a major ion suite and for recharge and discharge assessment of groundwater;
- Chromium, hexavalent chromium, cadmium, lead, mercury, vanadium - total and dissolved (0.45 µm filter) – metals of interest associated with historical Site activities;
- Zinc – total and dissolved (0.45 um filter) will be analyzed pursuant to request by NYSDEC to confirm concentrations in groundwater;
- Free cyanide - total and dissolved (0.45 µm filter) – constituent of interest associated with historical Site activities;
- Chromium, hexavalent chromium, and free cyanide dissolved phases to be assessed with sequential filtering using 1 micrometer (µm), 0.45 µm and 0.1 µm size filters at select wells
- Total dissolved solids (TDS; derived not calculated) – used to give an indication of soluble fraction in groundwater; and
- Total Organic Carbon and Dissolved Organic Carbon (TOC/DOC) – used to give an indication of potential organic colloidal matter;
- Dichlorobenzenes at wells where historically persistent and elevated concentrations have been detected to confirm concentration trends.

Samples for dissolved metals and cyanide analysis will be filtered in the field using 0.45 µm filters. To aid in evaluating colloidal and dissolved species, and assessment of potential mobility of the metals and cyanide, additional samples collected from select wells will be sequentially filtered in the field (using 1 µm, 0.45 µm and 0.1 µm filters) and analyzed by the laboratory for dissolved metals and cyanide species (as noted above). It is noted, in the event filtering with a 0.1 µm filter is not reasonably achievable, a 0.2 µm filter will be used. Wells selected for sampling with sequential filtering are identified in Tables 1 and 3, and include wells screened in the overburden, and shallow, intermediate and deep bedrock zones where total and dissolved metals detections have been reported.

Surface water samples will be analyzed for dissolved metals of interest (chromium, hexavalent chromium, cadmium, lead, mercury and vanadium), total and free cyanide, major ions, hardness, alkalinity, TDS, TOC, DOC and field parameters (noted above). . Hardness values will be used to derive water quality standards for dissolved metals (as outlined in 6 NYCCR Part 703.5) for comparison with sample analytical results. The sample analytical schedule is summarized in tabular format in Table 3. Details regarding field sampling methodologies and laboratory analytical methods are discussed in Sections 4 and 5.

3.2 MPS Standard Event Monitoring Program

The MPS standard monitoring event is designed to provide data to evaluate groundwater and surface water quality in areas downgradient of the waste handling/disposal areas (including RCRA cap area), and the areas of highest hexavalent chromium concentrations and potential for flux of Site-related constituents in groundwater. The standard monitoring event is proposed to initiate in Q4 (December) 2015 and to be conducted on a semi-annual bases (in June and December each year) until such time that revisions to the frequency are proposed to and approved by the NYSDEC, based on a review of Site conditions and available monitoring data.

With consideration of the objectives of the GSMP, the following data quality objectives were developed for the MPS standard groundwater sampling event:

- Conduct groundwater and surface water gauging to assess hydraulic conditions and potential impact/influence of the GWES on water levels in groundwater and surface water. Surface water gauging will include recording the water level in the canal at existing gauge SG-11 (refer Figure 11) for comparison with Site hydraulic data.
- Implement low flow sampling to provide for provision of high quality groundwater samples for assessment of groundwater concentration trends and performance of the GWES.
- Monitor key Site constituents based on mobility (hexavalent chromium and cyanide) in groundwater to assess trends in concentrations.
- Conduct surface water sampling in the Hudson River to:
    - Assess potential presence of inorganic constituents from upstream sources that may be contributing to impacts within the river, and
    - Collect dissolved surface water quality data to demonstrate that flux from the Site is not leading to exceedances of NYSDEC water quality standards in the immediate vicinity of the Site.

The data collected during standard monitoring events will be used to document current conditions and trends in groundwater and surface water quality, and support evaluation of GWES performance.

It is noted that the scope of the standard event (Q4 2015) will be reviewed and may be revised based on the results of the focused sampling event to be conducted in July 2015. Notice of any proposed change to the sampling and analysis schedule will be provided to NYSDEC for approval prior to conducting the event.

3.2.1 MPS Standard Event Sampling Locations

The MPS standard event comprises monitoring of selected wells within and downstream of groundwater impacted areas, and surface water locations upstream, adjacent to, and downstream of the Site key groundwater areas of interest to demonstrate current conditions and trends in water quality, and support evaluation of GWES performance.

The monitoring network for the MPS standard event includes groundwater wells in the overburden, and shallow, intermediate, and deep bedrock zones. Locations are selected for sampling in the following areas:

- Downgradient of the RCRA cap and historical waste handling/fill areas on the western area of the Site;
- Within and downgradient of areas with persistent/elevated hexavalent chromium and/or cyanide in groundwater (historical process/fill areas in central area of Site); and
- In surface water upstream (SW-4), adjacent (SW-3 and SW-2) and downstream (SW-1) of the key groundwater impact areas.

The standard monitoring event proposed for the MPS will provide data to monitor groundwater and surface water quality to assess trends in concentrations, and evaluate GWES performance based on the potential for Site discharges to result in exceedances of applicable SCGs for surface water.

The wells and surface water locations proposed for monitoring during the MPS standard sampling event, and comments regarding the basis for their inclusion in the sampling program are listed in **Table 1**. The proposed well locations for sampling or gauging only (to support assessment of groundwater hydraulic conditions), and surface water sampling and gauging locations are identified on **Figure 6**. The specific monitoring locations for the overburden, and shallow, intermediate and deep bedrock units, respectively are illustrated on **Figure 7** through **Figure 10**.

3.2.2 MPS Standard Event Analysis Schedule

The standard monitoring event is designed to monitor the key Site constituents of concern in groundwater based on mobility (hexavalent chromium and cyanide). Groundwater samples will be analyzed for the following:

- pH, temperature, turbidity, DO, redox potential, electrical conductivity, and barometric pressure (measured in the field at the time samples are collected),
- Dissolved chromium and dissolved hexavalent chromium.
- Total and free cyanide, and
- Dichlorobenzens at select wells.

Surface water samples will be analyzed for the same parameters identified above for groundwater, as well as TDS and hardness to assist in evaluation of GWES influence and for calculation of surface water quality standards/guideline values (as outlined in 6 NYCCR Part 703.5) for comparison with sample analytical results. The sample analytical schedule is summarized in tabular format in Table 3. Details regarding field sampling methodologies and laboratory analytical methods are discussed in Sections 4 and 5.

As previously noted, the proposed monitoring network and analysis schedule may be modified based on the results of the focused sampling event or if (in the future) additional groundwater monitoring wells are installed or data indicates changes in the monitoring network or frequency of sampling is merited. Any change to the program will be proposed in writing to NYSDEC with any reduction in monitoring frequency or analysis subject to approval prior to implementing the change.

3.3 PTP Annual Event Program

The monitoring program proposed for the PTP comprises annual monitoring to commence in July 2015and includes sampling of groundwater in selected wells on Site and immediately downgradient, and surface water sampling in the adjacent stream and canal (refer Figure 11).

The PTP monitoring event will provide data to monitor conditions and trends in groundwater concentrations in the area of the Site where elevated concentrations (above groundwater standards) are detected, at the downgradient boundary to confirm groundwater is not migrating off-site at concentrations above groundwater standards; and concentrations in the adjacent stream and canal are below surface water criteria and concentrations are stable or declining. Historical investigations reported that the canal is not in communication with groundwater from the Site, however sampling in the canal has been included pursuant to NYSDEC's request.

The proposed monitoring network and analysis schedule is described below with the basis for selection of the monitoring locations and sample analysis. Tabular summaries of the monitoring network and analysis schedule are included in attached **Table 2** and **Table 5**, respectively and the monitoring locations are shown on **Figure 11**.

3.3.1 PTP Annual Monitoring Locations

Based on the historical monitoring data, monitoring locations selected for sampling during the annual PTP monitoring event include the following:

- The central area of the Site using wells MW-OB23 and MW-OB17 where cyanide has consistently been detected near or above the groundwater standard during recent monitoring events.
- At the downgradient southeast and southwest boundary of the Site where groundwater concentrations are stable or declining and below the groundwater standard.
- In surface water in the adjacent stream southeast of the Site (SG-7) to assess trends in concentration as recent data collection has been limited.
- In surface water in the canal at SG-11, located southwest of the Site to assess concentrations of cyanide.

3.3.2 PTP Annual Event Analysis Schedule

Groundwater and surface water samples are proposed to be analyzed for total cyanide and free cyanide for comparison respectively to groundwater and surface water quality standards. The groundwater analysis schedule for the PTP is summarized in **Table 5**.

4.0 FIELD SAMPLING METHODOLOGY AND CHEMICAL ANALYSES

The monitoring programs proposed in this GSMP include gauging and sampling of groundwater and surface water. The methodologies proposed for field monitoring activities, including quality assurance/quality control (QA/QC) procedures are discussed below.

4.1 Water Level Gauging

Prior to sampling, water levels will be measured in all groundwater wells and surface water gauges identified for gauging during the monitoring event. If possible, gauging will be completed within one 24-hour period (or as soon as achievable) at all wells scheduled for monitoring (including MPS and PTP wells when events are concurrent). Gauging will be conducted using an electronic level meter/interface probe that emits an audible/visual signal when in contact with water. At each location, the well/gauge cap will be removed and any pressure/vacuum in the casing will be allowed to equilibrate prior to water level measurement. The gauge will be slowly lowered into the casing, avoiding contact with the casing wall until reaching the water surface. The depth to water will be measured relative to the top of casing (TOC) at the marked reference point (survey point). If a reference mark is not found on the TOC, the measurement will be referenced to the north side of the TOC (standard reference for survey). The total well depth will also be measured by lowering the probe to the bottom of the well, making gentle contact to minimize potential for disturbance of bottom sediments. The interface probe (and probe measure tape line) will be cleaned prior to use in each well (refer Section 4.6)

The date, time, and depth to water and total depth measurements (to the nearest 0.01 foot) will be recorded in field log books. The depth to water data will be used in conjunction with TOC survey data to evaluate water potentiometric surface levels and groundwater flow direction. The total well depths will be compared to well construction data to assess changes in well conditions (e.g., accumulation of sediment).

During the gauging program, visual observations of on-grade facilities (e.g., risers, monuments, well pads) will be made and signs of damage/conditions that may affect function will be recorded in field log books, along with any other observations (e.g., blockage/other issues encountered during gauging) that indicate repair/maintenance may be needed. Daily observations of general ambient weather conditions (e.g., sunny, rainfall, temperature, barometric pressure) during the field activities will also be recorded in the field log books. The occurrence of rain events in the week prior to and during the sampling activities will also be recorded.

4.2 Groundwater Sampling

To meet the GSMP data quality objectives, samples representative of in-situ groundwater conditions are needed. To achieve this, low flow sampling methods will be employed to minimize disturbance, turbidity, and changes in water chemistry during sample collection, filtering and bottling. Low flow sampling will be conducted in accordance with US Environmental Protection Agency – Region II Low Stress Groundwater Sampling Protocol (January 19, 2010). The goal of the low flow sampling is to collect samples that reflect inorganic loads (dissolved and colloidal sized fractions) that are transported through the subsurface under ambient flow conditions with minimal chemical and physical alterations due to sampling. The sampling methodology aims to minimize hydraulic stress at the well aquifer interface by maintaining low water level draw-downs and using low pumping rates during purging and sampling. Indictor field parameters (turbidity, dissolved oxygen, specific conductivity, temperature, pH and oxidation-reduction potential (Redox)) will be used to assess stabilization in water quality and determine when sampling will begin.

Wells to be sampled to support assessment of river water capture by the GWES system are active pumping wells. Samples will be collected from these wells using in-line sample ports in the well head discharge piping with water pumped directly to sample containers.

Low flow purging and sampling will be conducted using bladder pumps (with adjustable flow control), and disposable bladders and polyethylene tubing. The clean tubing placed in a given well may be left in-place (dedicated) for use in future sampling events. Monitoring of field parameters will be conducted using a flow through cell (closed system) and multi-parameter meter. Filtration will be conducted using disposable in-line filters. Thus, the only non-disposable/non-dedicated equipment used at each well will be the bladder pump, which will be cleaned prior to use in each well (refer Section 4.4).

Groundwater purging and sampling will be conducted as follows.

1. The well ID, date, time, name of personnel conducting sampling and site conditions (weather, barometric pressure) will be recorded on a field purging and sampling log. Details regarding sampling equipment used (e.g., pump type, field parameter instruments, filters), field measurements made, sample names, and QC sample information [data for duplicate or matrix spike/matrix spike duplicate (MS/MSD) samples collected, and equipment blank samples collected before or after well samples] will also be recorded.
2. The well cap will be removed and a water level probe will be lowered into the well until the water surface is detected, and the depth to water (relative to TOC) will be recorded. The level probe will remain in the well throughout purging and sampling.
3. The bladder pump with a clean, disposable bladder and tubing will be slowly lowered into the well to a depth at which the pump intake is at approximately the mid-level of the water column (calculated based on the depth to water and the total well depth measured during pre-sample gauging (refer Section 4.1)). Where the water column is above the well screen, the pump will be located at the mid-point of the screened/open bore interval. The pump intake shall be at least two feet above the bottom of the well.
    a. The pump will be secured to the well casing (or other non-movable fixed point) using the safety cable and the depth to the pump intake (relative to TOC) recorded on the sampling log. The pump will remain in the well throughout purging and sampling.
4. The pump discharge tubing shall be connected to the flow through cell, and the discharge tubing from the cell set to discharge to a bucket/other container for purge water collection. Tubing length from the well to monitoring equipment shall be minimized to reduce impact of the ambient environment (e.g., temperature variance from downhole conditions). Connection to the flow through cell may be delayed as appropriate to minimize potential for significant particulate/sediment discharge into the cell.
5. Start the pump, operating at a low rate, increasing speed until discharge is achieved at a target rate within approximately 100-250 milliliters per minute (mL/min)). Monitor the tubing to ensure pump suction is not broken and to avoid kinking the line. Record pumping rate adjustments and time made.
    a. Actively monitor the water level for drawdown, and adjust the pumping rate to achieve steady pumping and stable drawdown of less than 0.3 feet; reduce the pump rate if needed to minimize/achieve stable drawdown. If drawdown at the minimum flow rate achievable exceeds 0.3 feet, continue to monitor for stable drawdown. Record any pumping rate adjustments.
    b. Confirm flow rates using a timer and graduated cylinder/bucket to collect purged.
    c. Where stable drawdown cannot be achieved/insufficient yield conditions are encountered protocols in Section 4.2.1 will be considered.
6. Record water level at maximum intervals of 2-3 minutes during first 10 minutes of pumping, and at approximately 5-10 minute (or as appropriate) intervals thereafter to assess drawdown stability.
7. During purging, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, DO, Redox) at approximately 5-minute intervals (or such interval that allows complete flow-through cell volume change-out based on pump rate and cell volume).

   a. During purging the flow-through cell should remain full (no draining/entrainment of air to ensure proper probe function).
   b. Conditions will be considered stabilized and ready for sample collection when the indicator parameters are stabilized over three consecutive readings as follows (Puls and Barcelona, 1996):
      i. ±0.1 for pH
      ii. ±3% for specific conductance (conductivity)
      iii. ±10 mv for redox potential
      iv. ±10% for DO and turbidity
   c. Observations for stabilization should follow stabilization of drawdown. Final purge volume should be greater than the stabilized drawdown plus the pump's tubing volume.
8. Once stabilization is established, sample collection should occur at the same rate as purging. The time and depth to water should be recorded when sample collection begins.
   a. Samples will be collected directly from the pump tubing line (after disconnection from the flow-through cell), and containers should be filled with minimal turbulence by allowing the water to flow from the tubing gently down the inside of the container. The bottom of the tubing should be held near the base/side of the sample container to minimize oxygenation and splashing of the sample, taking care not to bring the tubing in contact with the bottle or preservative that may be present in the bottle. Upon sample collection, sample containers will be sealed, labeled and stored in a cooler with ice for transport to the laboratory under chain-of-custody (COC) documentation.
   b. Sample filtering will be conducted using disposable in-line cartridge filters, connected directly to the pump discharge line, and the sample filtrate will be discharged directly (via tubing) into sample containers (as noted above). Alternatively, if in-line filtration cannot be achieved vacuum assist filters (hand pump and cylinder apparatus) may be used. Further details regarding sample filtration methodology are provided in Section 4.3.
9. When sampling is completed, the time and depth to water will be recorded and the level meter and pump will be removed from the well, and the well cap closed. If desired the tubing may be disconnected from the pump remain in the well (hung by securing the top end to the well casing/cap) for re-use in future sampling events.

4.2.1 Response to Low Well Yield and Absence of Stabilization

If a well exhibits low/insufficient yield (recharge rate less than minimum achievable pump rate), drawdown may exceed 0.3 feet and the well may dewater to a level approaching the pump intake during purging. Where insufficient yield is encountered, pumping will cease, and the pump depth will be adjusted to a maximum depth of two feet above the measured bottom, and pumping will recommence when sufficient water for sampling is recovered. Pumping a well dry will be avoided to the extent possible (by pumping at the lowest rate achievable and actively monitoring drawdown). Where minimal water column (less than 2 feet) is encountered pumps will be held above the bottom of the well as near to the water surface as practicable in an attempt to complete purging and sampling.

If one or more key indicator parameters fails to stabilize after 90 minutes or there is insufficient yield to achieve stabilization and then sampling, the following options will be considered in consultation with the EHS Support Project Manager:

- Continue purging in an attempt to achieve stabilization;
- Discontinue purging, do not collect samples, and document attempts to reach stabilization in the log book;
- Discontinue purging, collect samples, and document attempts to reach stabilization in the log book;
- Secure the well, and collect samples the next day if the well has sufficiently recharged to allow sample collection (sufficient volume available for collection),

- Discontinue purging and collect samples over next 48 hours, as sufficient water is recharged for collection of required volumes for a given analysis, and water quality is of sufficiently low turbidity based on field visual observation (color, cloudiness) and field measurement using flow-through cell.
  - Priority for sample collection will be total metals, dissolved metals (0.45 um filter), total cyanide, WAD and free cyanide, hardness, major ions, alkalinity, TDS, TOC, DOC, and VOC as applicable for each location.

The response to low yield/insufficient water conditions will be determined based on field observations of drawdown, field parameter water quality measurements and rate of recharge for each well circumstance.

4.3 Surface Water Sampling

Surface water sampling for the MPS program will be collected from shore or a boat as required to gain access to sample locations. Sampling logs will be completed to document the sample location, field sampling personnel, date and time of collection, field monitoring parameters, and sample IDs (for original and any duplicate/MS/MSD samples). Samples will be collected using a peristaltic pump and disposable tubing. The tubing will be secured to a PVC pipe (or other stable fixed point) lowered into the water and attached to the boat (or held in place if sampled by personnel in-stream). The boat will be positioned at the sample location such that the sample equipment is upstream of the boat engine. The tubing will be lowered into the water to a depth within 6 to 12 inches below the water, and a minimum of 1 foot above the river bottom. The pump line will be started, and water will be pumped through the tubing to a flow-through cell to measure field parameters (DO, temperature, conductivity, pH, redox potential, and turbidity), and observations recorded on the field sampling log. Immediately following field parameter measurement the discharge tubing will be disconnected from the flow-through cell and water will be pumped directly through the line into sample containers. Sample disturbance will be minimized by allowing the water to flow from the tubing gently down the inside of the container. The bottom of the tubing will be held near the base/side of the sample container to minimize oxygenation and splashing of the sample, taking care not to bring the tubing in contact with the bottle or preservative that may be present in the bottle.

Samples for dissolved metals and cyanide analysis will be filtered in the field using disposable in-line cartridge filters (0.45 um) connected directly to the pump discharge line, and the sample filtrate will be discharged directly (via pump tubing) into sample containers. Further details regarding sample filtration methodology are provided in Section 4.4.

Samples will be collected as near to shore as possible and where safe to conduct work. The sample location will be documented using a field GPS unit to measure location coordinates. The location coordinates and visual observations of physical aspects/features on-shore and in the river that help describe the location will be recorded on the sample log. In addition relevant observations regarding weather and other concurrent activities in the vicinity that may affect sampling conditions will be recorded.

Surface water samples collected for the PTP program will be collected as grab samples from the stream using clean dip sample containers. The samples will be transferred from the dip to the laboratory-supplied sample containers, pouring slowly to minimize agitation. Upon sample collection the samples containers will be sealed, labeled and placed in a cooler with ice for transport to the laboratory under COC documentation. A split of the sample will be monitored for field parameters (DO, turbidity, pH, temperature, conductivity and redox potential) using field meters. Sampling data (personnel, date, time, field parameter measurements, sample visual observations and general field conditions observations) will be recorded on field sampling logs.

4.4 Field Filtering for Dissolved Analysis

The common standard for field filtering to prepare samples for dissolved analysis uses a 0.45 µm filter. The goal of filtering is to remove all particulates and yield a filtered portion of the sample that is representative of the mobile and biologically available phases of inorganics. This assumes that all particulates are greater than 0.45 µm, which is not always the case. The filtered dissolved fraction can be comprised of colloidal mass, which behaves differently to truly dissolved ionic species (for which a chemical potential can be defined). Colloids are dynamic particles that are continuously generated and removed, and undergo compositional changes within groundwater (and surface water) by physical chemical and biochemical reactions. Thus filtration can underestimate mobility and overestimate the truly dissolved species (Puls and Powell, 1992; Horowitz et al, 1994; Saar, 1997).

If colloidal transport is suspected to have an influence on the transport of a particular metal or metal species, a sequential filtering process can be carried out at locations where the metal is detected or elevated in concentration. As colloids are generally expected to range in size from 1 µm to 0.001 µm, a two-step sequential filtering process could be used to explore this distribution. This would incorporate a standard filtration step (0.45 µm) and incorporation of a coarser filtration step (1 µm) and a finer filtration step (ideally 0.01 µm but for field practicality 0.1 µm) to understand the distribution of solids and colloids within water samples.

For the purposes of this study standard filtering (0.45 µm) is proposed for all groundwater samples, and additional filtering with 1 µm and 0.1 µm filters will be conducted on select samples (refer **Table 4-1**) during the MPS focused event. It is unlikely that filtering through 0.01 µm filters under field conditions would be feasible. Thus the filter sizes proposed and composition and mobility considerations for the focused groundwater study are summarized in Table 4.2.

Table 4-1 Sequential Filtration and Influence on Sample Composition

Representative Solution	Filter Size		
	> 1 µm	1 – (0.45) – 0.01 µm	< 0.01 µm (practically 0.1 µm)
Composition	Suspended particles (including large colloids or aggregated colloids)	Majority of mobile colloidal species[1]	Truly dissolved[1]
Mobility	Negligible, unlikely to be mobile due to size	High for sorbed anionic metal species Moderate to low for sorbed cationic metal cations due to solubility constraints under oxidizing and circum-neutral conditions	Low for metal cations under oxidizing and moderately alkaline conditions High for anionic metal species under oxidizing and circum-neutral conditions

1) Stumm and Morgan, 1996
2) In reality, truly dissolved species and polynuclear species are expected to be < 1 nm

4.4.1 Filtering for Focused MPS Sampling Event

As described above, filtering with 1 µm, 0.45 µm and 0.1 µm is proposed for selected wells (identified in Table 4-2) for the focused MPS sampling event. Groundwater samples from all wells will be field filtered with 0.45 µm filters and submitted for dissolved metal and cyanide analysis. Additional samples from selected wells with elevated chromium and cyanide concentrations will be subjected to the following sequential filtering and analysis process:

1. Filtering of groundwater samples with 1.0 µm filters only and submission of the filtrate for analysis of dissolved chromium, dissolved hexavalent chromium, dissolved weak acid dissociable (WAD) cyanide and dissolved free cyanide;
2. Sequential filtering of groundwater samples with a 0.45 µm filter and submission of the filtrate for analysis of dissolved chromium, dissolved hexavalent chromium, dissolved WAD cyanide and dissolved free cyanide; and followed by
3. Adding a 0.1 µm filter after the 0.45 µm filter and submission of the resultant filtrate for analysis of dissolved chromium, dissolved hexavalent chromium, dissolved WAD cyanide and dissolved free cyanide.

For the initial assessment of the potential of colloidal mobility in groundwater, wells selected for sequential sample filtering are those where primarily hexavalent chromium and free cyanide were reported in groundwater at elevated concentrations during the December 2013 and April 2014 supplementary groundwater sampling events. In addition, a select number of wells with elevated trivalent chromium have been selected for sequential filtering to explore the mobility of this ion in groundwater. Based on sample data for wells listed in **Table 4-2**, reported concentrations of total and dissolved chromium were very similar in MW-OB14, AW-B20 and AW-C11 suggesting that concentration of trivalent chromium within these analyses is also dissolved and potentially mobile. This observation will be explored in more detail using the results of the sequential filtering sampling event. WAD cyanide in addition to free cyanide analysis is an analyte of interest for the sequential filtering study. WAD cyanide represents a form of cyanide that has the potential to liberate free cyanide under certain conditions especially where the metal-cyanide is weakly bonded.

Table 4-2 Selected Well Locations for Sequential Filtering

Groundwater Monitoring Well	Aquifer Lithology	Analyte Concentration reported Dec 2013 and Apr 2014 (µg/L)		
		Total Hexavalent Chromium	Total Trivalent Chromium	WAD and Free Cyanide
AP-2	Overburden	-	10,000	270
MW-OB13	Overburden	-	310	8,000
MW-OB14	Overburden	260	12,740	1,100
MW-OB25	Overburden	680	920	-
AW-A6	Shallow Bedrock	<10	970	170
AW-B4	Intermediate Bedrock	260	110	-
AW-B15	Intermediate Bedrock	38	3	
AW-B16	Intermediate Bedrock	240	5,160	-
AW-B20	Intermediate Bedrock	-	790	280
AW-C11	Deep Bedrock	640	460	-

4.4.2 Field Filtering Methodology

Direct in-line filtering of groundwater from the low flow pump discharge line is preferred. For in-line filtering pump flow rates should be as low as possible (based on the well purge methodology in Section 4.2). Sequential filtering has been described although it may not be possible to undertake both filtration steps using a single in-line filter array. This will depend on the observed turbidity of the groundwater and will vary from location to location. Disposable Millipore vacuum pump filtration units should be available if in-line filtration is not feasible. At least two filters of each size should be allocated for every well location where sequential filtering is to occur. If turbidity levels are elevated the filter may need to be changed before the required amount of groundwater sample is collected. Polyethylene or polypropylene tubing should be used for the collection of samples for inorganics analysis.

- When groundwater field parameters have stabilized the filter in-line assembly is attached to the pump discharge line
- Ensure the filters are pre-rinsed with groundwater and there are no air bubbles within the tubing or filter
- Samples for the 1 µm filtration step should be collected first
- After the 1 µm samples have been collected, the 0.45 µm filter assembly replaces the 1 µm filter
- Samples for the 0.45 µm filtration step are collected
- After the 0.45 µm samples have been collected, the tubing and 0.1 µm filter assembly is added after the 0.45 µm filter – this is to prevent early clogging of the 0.1 µm filter
- Samples for the 0.1 µm filtration step are collected
- Ensure sample bottles have preservative as required per analyte/analysis
- Each sample container is overfilled and immediately sealed with no air bubbles
- All sample containers filled with filtered groundwater will be labelled with the sample location, date, time and filtration size
- The samples will be placed in a cooler with ice for transport to the laboratory under COC documentation.
- Filters (or filtration units) are to be used at one location only and disposed appropriately

All sample collection and filtering activities are to be undertaken using the above methodology in conjunction with the USEPA low flow purging and sampling guidelines (1998, 2010) and the USGS Protocol for the collection of Filtered Samples (1994).

Groundwater and surface water sample containers will be pre-preserved as required to retard chemical and biological changes that may occur in response to changes in physical conditions. The chemical preservative will be added to the sample containers by the laboratory prior to shipment to the field. Once samples are collected in the pre-preserved containers, the containers will be checked for tightness, labeled, placed in re-sealable plastic storage bags, and stored in a cooler containing ice/ice packs pending transport to the laboratory.

4.5 Quality Assurance/Quality Control (QA/QC)

The sampling program will incorporate the following QA/QC procedures.

- Field instruments will be calibrated daily (at the start of field activities) in accordance with the manufacturer's directions. The make and model number of the equipment, date, time and calibration data will be recorded in field log books.
- At least one equipment blank will be collected daily to assess the effectiveness of decontamination procedures. Following decontamination of the bladder pump, a clean bladder and tubing will be installed and a blank will be collected by submerging the pump into laboratory grade water in a clean container, and pumping water through the sample train (to comprise tubing only for total

metals sample and tubing plus a 0.45 um filter as a representative sample of a clean filter for dissolved analysis) into sample containers provided by the laboratory. The blank sample ID, date and time of collection, and note of the wells in which the pump was used before and after the blank collection will be recorded in the field logbook. As this blank will be collected in the field, it will also serve as a field blank.

- One equipment blank (also to serve as a field blank) will be collected from the surface water sampling train (peristaltic pump with tubing and in-line filter) prior to collection of surface water samples during the sampling event. The blank will be collected using laboratory grade water and the same type of equipment, process and handling procedures used to collect the surface water samples (pump laboratory grade water through sample train to laboratory supplied containers). The date, time and identity of the blank will be included on the sample label and recorded in the field logbook along with details regarding how the blank was collected It is anticipated that the field blanks will be collected at the start of the sampling event, prior to surface water sample collection.
- Duplicate groundwater and surface water samples will be collected at a frequency of 5 percent (one per 20 sampling locations) for each sample type (groundwater and surface water). Duplicate samples will be collected and handled using the same methodology employed for original samples, and will be analyzed for the same suite of analytes as the original samples.
- MS/MSD samples will be collected at a frequency of one per 20 sample locations for each media sampled (surface water and groundwater). The samples will be collected, handled and analyzed the same as original samples. In the event that insufficient sample volumes can be achieved for MS/MSD sample collection (due to low yield of groundwater), a request will be submitted to the laboratory to prepare and analyze a MS/MSD sample from existing original sample volumes if possible.
- Personnel will don clean gloves prior to collection of samples in each location (and as needed during sampling process to avoid contamination of samples). Samples will be collected in clean containers provided by the laboratory. Required preservative will be included in the bottles prepared by the laboratory.
- Sample containers will be filled such that no air remains in the container and capped. Immediately following collection, the containers will be sealed (lids closed), labeled with the sample ID, date, time, and filter size (as applicable), put in a resealable plastic bag, and placed in a cooler with ice/ice packs for storage and transport to the laboratory. A temperature blank will be included with each cooler of samples for use by the laboratory to document temperature upon receipt.
- Chain-of-custody (COC) documents will be prepared for each container (cooler) of samples transported to the laboratory. The COC will be completed in the field and will accompany the samples from the time of collection through shipment and receipt by the laboratory. Copies of completed COCs will be included in the laboratory reports.

4.5.1 Decontamination and Waste Management

Non-disposable/non-dedicated equipment that will be used down-hole and/or come in contact with groundwater or surface water to be sampled will be cleaned prior to use at each sample locations. Cleaning/decontamination will comprise a pre-rinse in potable water, followed by washing in non-phosphate detergent solution (e.g., Alconox wash), and rinsing in clean (potable or laboratory grade) water, and air drying (or wiped dry using clean paper towels).

Purged water and decontamination water will be collected and transferred to the on-site wastewater treatment system where it will be treated and discharged under the Site publicly owned treatment works (POTW) permit. Solid waste (packaging material, spent gloves) will be disposed as municipal waste.

5.0 LABORATORY ANALYSIS AND DATA DELIVERABLES

A suite of specific metal (and metal species), cyanide (and cyanide species), dichlorobenzenes, and geochemical analytes has been proposed for groundwater and surface water sampling with justification for inclusion of the specific analytes in the focused and standard monitoring programs at the MPS and PTP discussed in the GSMP. It should be noted that the analytical suites for the focused and standard monitoring programs for the MPS are different with a more extensive suite of analytes included in the focused sampling program. Also, the analytical suites for standard (semi-annual/annual events) at the MPS and PTP differ. The analysis schedules are reflective of the key constituents requiring monitoring/assessment based on historical data and current groundwater and surface water quality standards. The differences in the monitoring programs support assessment of the conditions in the given area and support the overall objectives of the GSMP and data quality objectives for each event program.

The analytical methods to be used for the sample analyses proposed in the GSMP are listed in Table 6. Details regarding sample container types, preservation, hold times and reporting limits achievable for the methods are also included in Table 6. Available groundwater and surface water standards (6 NYCRR 703.5) for the analytes to be monitored are also listed in the table for comparison with the reporting limits. It should be noted that the reporting limits listed do not account for potential dilution or other interferences (e.g., sample matrix) that may result in elevated reporting limits for actual analysis completed.

Sample analysis will be performed by laboratories accredited pursuant to the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) for the category of parameters analyzed. The laboratory method used will be in accordance with the current NYSDEC Analytical Services Protocol (ASP). The QA/QC program will include collection and analysis of field QC samples (as discussed in Section 4.5), as well as internal laboratory QC procedures as required by the analytical methods and certification/accreditation.

Due to the short holding time for hexavalent chromium (24 hours, refer Table 6), it is anticipated that samples will be collected from the Site by courier daily and delivered to the laboratory. As discussed in Section 4, upon collection samples will be stored in coolers with ice for transport to the laboratory. The cooler will be sealed with tape and transported under COC documentation. Copies of the COC will be included in the laboratory analytical reports.

For each monitoring event, laboratory report deliverables will comprise a Category B deliverable. The laboratory will also provide an electronic data deliverable (EDD) that complies with NYSDEC's Electronic Data Warehouse Standards (EDWS). For the focused, comprehensive sampling event at the MPS, the laboratory deliverable will meet NYSDEC ASP Category B Data Deliverable requirements, and the data will be reviewed and a Data Usability Summary Report (DUSR) will be prepared by a third party qualified and approved by NYSDEC pursuant to DER-10, Appendix 2B, Guidance for Data Deliverables and Development of Data Usability Summary Reports.

6.0 SAMPLING AND REPORTING SCHEDULE

Groundwater and surface water monitoring as described in this GSMP is proposed to commence in July 2015 and be conducted on the following schedule:

- July 2015 Focused Sampling Event at MPS
- July 2015 Standard Annual event at PTP.
- December 2015 Standard Semi-Annual Event at MPS

It is anticipated that the first sampling events at the MPS and PTP under this GSMP will be conducted concurrently or sequentially, commencing in July 2015. Future events are anticipated to be conducted in the second quarter (semi-annual event at MPS and annual event at PTP) and the fourth quarter (MPS semi-annual event) of each calendar year. The scope of these events will be reviewed and confirmed based on the results of prior sampling events with any proposed changes to monitoring to be provided in writing to NYSDEC for approval prior to modifying the program.

Groundwater Monitoring Reporting

Subsequent to the completion of the one-time MPS focused sampling event (July 2015), a Groundwater and Surface Water Monitoring Report (GSMR) is proposed to be completed and submitted to NYSDEC. The focused sampling event report will be completed within 90 days following receipt of all laboratory analytical reports for the event.

For the MPS semi-annual monitoring events, one Annual GSMR is proposed to be completed and submitted to NYSDEC by March 1st in the following year. The Annual GSMR will incorporate the results of groundwater and surface water monitoring completed during both semi-annual events in the previous calendar year (Q2 and Q4 events). The 2015 Annual GSMR for the MPS will include results from the July focused event as well as the standard event to be completed at the MPS in December.

For the PTP annual monitoring program, an Annual GSMR will be completed and submitted to NYSDEC by December 1st in the year sampling is completed.

The GSMRs will summarize the monitoring activities completed, describe the data evaluation and assessments conducted, present results and conclusions, and provide recommendations for future monitoring (as applicable). At a minimum, the GSRs will include the following:

- Description of weather conditions, field activities and any variance in the planned and completed scope of work;
- Discussion of the analysis and findings of the assessments completed to address the overall project objectives and data quality objectives for the monitoring event(s);
- Tabular summaries of monitoring measurements and sample analytical data;
- Graphical presentation of sampling locations, groundwater potentiometric surfaces, and groundwater and surface water analytical results for key constituents monitored;
- QA/QC review of monitoring data collected (gauging and analytical data);
- Discussion of results of groundwater and surface water monitoring data collected;
- Recommendations for future monitoring based on the results;
- Laboratory analytical reports for the sampling events; and
- Copies of field log books and monitoring sheets documenting data collection activities.

For the July 2015 focused MPS event, in addition to the information identified above a Data Use Summary Report (DUSR) will be prepared by a third party, qualified and approved by NYSDEC in accordance with

DER-10, Appendix 2B. The DUSR will be submitted with the GSMR for the focused monitoring event or may be submitted under separate cover to the NYSDEC.

All GSMRs will be submitted to NYSDEC in electronic format (in a form compliant with the NYSDEC electronic deliverable standards) via uploading to the NYSDEC website (https://fts.dec.state.ny.us/fts/). Hard copies or other formats will be submitted only if specifically requested. In addition, laboratory data generated will be submitted as an EDD that complies with NYSDEC's EDWS.

GWES Operations Report

An annual letter report summarizing the MPS GWES operations will be prepared and submitted to NYSDEC by March 1st each year. The GWES operations report will include a summary of key operations data including the volume of water extracted, operations run-time, and results of discharge monitoring, and will document any non-compliance with the POTW permit conditions. Copies of the discharge monitoring reports will be included as attachments.

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TABLES

Table 1
Main Plant Site (MPS) Monitoring Program Well Networks

Well Map Grid ID	Existing Plan Semi-Annual Sampling	Existing Plan 5-Year Sampling	Proposed Focused Sampling Q3 2015		Proposed Standard Semi-Annual Sampling Q4 2015		Proposed Event Networks Rationale and Comments
	Gauge & Sample	Gauge & Sample	Gauge & Sample	Gauge Only	Gauge & Sample	Gauge Only	
Overburden Wells							
D-5			AP-2		AP-2		Monitoring well location around Building 56 to define area of interest
F-4			BP-2				Monitoring well location near sewer west of Building 6
F-4			BP-6		BP-6		Monitoring well location near sewer west of Building 6, and on downgradient boundary
E-5			BP-9		BP-9		Located southeast of former building 8, near south boundary of Site
D-4			IP-4		IP-4		Location upgradient of former building 56 and downgradient of RCRA Unit
B-4		MW-9		MW-9		MW-9	Retained for gauging only with MW-OB7 providing water quality data
B-5	MW-26	MW-26	MW-26		MW-26		Defines western-most extent of water quality
B-5		MW-28	MW-28		MW-28		Perimeter to define mass flux
G-4		MW-31	MW-31		MW-31		Located in eastern area that is not area of major constituent concentrations; retained in program to support assessment of site remedy.
C-1				MW-OB2		MW-OB2	Upgradient control on groundwater gradients
B-3		MW-OB5	MW-OB5			MW-OB5	Retained for focused geochemical assessment; downgradient well MW-OB7 retained for semi-annual monitoring
B-4			MW-OB7		MW-OB7		Retained as downgradient well for RCRA unit
B-5		MW-OB9					Near MW-9 which is gauged and MW-OB7 which is sampled
F-3		MW-OB13	MW-OB13			MW-OB13	Will be assessed during focused sampling as a key interior well in area of persistent groundwater impacts
E-4	MW-OB14		MW-OB14			MW-0B14	Focused sampling key interior well near Weir Brook, and down-gradient of MW-OB13
F-1				MW-OB15		MW-OB15	Retained for gauging only; not an area of significant impact
C-3		MW-OB24	MW-OB24			MW-OB24	Well within RCRA unit with typically limited/absent water volume; Included in focused sampling event to confirm conditions. Replaced by downgradient well for semi-annual events.
E-5			MW-OB25		MW-OB25		Perimeter well to define flux
H-3	MW-OB27			MW-OB27		MW-OB27	Retained for gauging only; not an area of significant impact
A-5	WP-CC-12			WP-CC-12		WP-CC-12	Offsite well not in an area of groundwater impacts; Gauging only
A-5	WP-0-50						Offsite well and next to WP-CC-12 which is gauged
Shallow Bedrock Wells							
B-4	AW-A2				AW-A2		Downgradient of RCRA unit
A-5	AW-A4			AW-A4		AW-A4	Offsite well not in an area of groundwater impacts; Gauging only
E-4	AW-A6		AW-A6				Dissolved hexavalent chromium nroth of Bldg 56; not a downgradient well for standard monitoring
C-5			AW-A10		AW-A10		located southwest of former building 57
D-5			AW-A11		AW-A11		Key well location at site boundary adjacent to Building 56
E-5			AW-A13				Upgradient of AW-A14 and used for focused sampling event
E-5			AW-A14		AW-A14		Key well location of site boundary adjacent to Weir Brook and Buildings 56 and 8
C-4		AW-A15	AW-A15		AW-A15		Downgradient monitoring well for RCRA unit. Replaces AW-A16 further upgradient
C-3		AW-A16	AW-A16				Location adjacent to RCRA unit; replaced by AW-A15 in semi-annual monitoring
B-4		MW-19	MW-19			MW-19	Included in focused sampling; sufficient other wells in area for semi-annual monitoring program
B-5			MW-25S		MW-25S		Key boundary location well at western end of site
B-5		MW-27S		MW-27S		MW-27S	Replaced by MW-25S in sampling program; gauge only
B-3		MW-36S		MW-36S		MW-36S	Replaced by AW-A2 and AW-A15 downgradient of RCRA unit
C-1				P-A1		P-A1	Northwest area of site; for gauging only

Table 1
Main Plant Site (MPS) Monitoring Program Well Networks

Well Map Grid ID	Existing Plan Semi-Annual Sampling	Existing Plan 5-Year Sampling	Proposed Focused Sampling Q3 2015		Proposed Standard Semi-Annual Sampling Q4 2015		Proposed Event Networks Rationale and Comments
	Gauge & Sample	Gauge & Sample	Gauge & Sample	Gauge Only	Gauge & Sample	Gauge Only	
D-5			EW-A9				GWES extraction well for river water ingress evaluation; sampled, not gauged
D-5			EW-A10				GWES extraction well for river water ingress evaluation; sampled, not gauged
E-5			EW-A12				GWES extraction well for river water ingress evaluation; sampled, not gauged
			Intermediate Bedrock Wells				
B-4	AW-B2		AW-B2		AW-B2		Downgradient of RCRA unit
A-5	AW-B3			AW-B3		AW-B3	Offsite well not in an area of groundwater impacts. Gauging only
E-5		AW-B4	AW-B4		AW-B4		Key well located near Weir Brook
off map	AW-B5						Well historically destroyed; was located south across river
unk	AW-B7						Well historically destroyed
C-5			AW-B11		AW-B11		Well located on boundary of the site to define flux
D-5			AW-B12				Well located downgradient of Building 56.
D-5			AW-B13				Well located downgradient of Building 56
E-5			AW-B15				Well located on east side of Weir Brook on site boundary
F-4			AW-B16				Eastern area of the site; Not area of major groundwater impacts; AW-B17 further downgradient
F-4			AW-B17		AW-B17		Eastern area of site, on site boundary to define flux
C-4		AW-B18	AW-B18		AW-B18		Interior area of site; not an area of major groundwater impacts but downgradient of RCRA unit; AW-B11 further downgradient nearer Site boundary; Review of results will confirm if included in semi-annual event.
E-4		AW-B19		AW-B19		AW-B19	Interior and adjacent to Weir Brook; Not a major area of impacts; Gauging only
F-4			AW-B20			AW-B20	Interior area of persistent hexavalent chrome impacts indicative of source area
F-2	MW-10B			MW-10B		MW-10B	Interior area with no major impacts; Gauging only
C-3		MW-20D		MW-20D		MW-20D	Well within RCRA cap area; replaced by wells further downgradient
B-5			MW-25D		MW-25D		Key well location on downgradient boundary in western-most area of site
B-5		MW-27D					Located between MW-25D and AW-B11 which are included in semi-annual monitoring
G-4	MW-30D	MW-30D	MW-30D		MW-30D		Well in eastern-most area of downgradient boundary of site
G-4	MW-30S	MW-30S					Adjacent to MW-30D which has higher concentrations
B-3		MW-36D	MW-36D		MW-36D		Retained for dichlorobenzene concentration trend analysis.
B-1				MW-40B		MW-40B	Northwest area of site; for gauging only
	Annual		**Deep Bedrock Wells**				
B-1				AW-C1		AW-C1	Northwest area of site; for gauging only
B-5	AW-C2		AW-C2		AW-C2		Groundwater impacts and stable cyanide concentrations inferring source area
A-5	AW-C7			AW-C7		AW-C7	Gauge only; no major impacts in deep bedrock
B-4	AW-C8			AW-C8		AW-C8	Gauge only; no major impacts in deep bedrock
G-2	AW-C9			AW-C9		AW-C9	Gauge only; no major impacts in deep bedrock
F-2	AW-C10			AW-C10		AW-C10	Gauge only; no major impacts in deep bedrock
E-5	AW-C11		AW-C11		AW-C11		Key area of groundwater impacts
C-3	MW-20C			MW-20C		MW-20C	Gauge only; no major impacts in deep bedrock
B-3	MW-36C			MW-36C		MW-36C	Gauge only; no major impacts in deep bedrock

Table 1
Main Plant Site (MPS) Monitoring Program Well Networks

Well Map Grid ID	Existing Plan Semi-Annual Sampling Gauge & Sample	Existing Plan 5-Year Sampling Gauge & Sample	Proposed Focused Sampling Q3 2015 Gauge & Sample	Proposed Focused Sampling Q3 2015 Gauge Only	Proposed Standard Semi-Annual Sampling Q4 2015 Gauge & Sample	Proposed Standard Semi-Annual Sampling Q4 2015 Gauge Only	Proposed Event Networks Rationale and Comments
Surface Water Monitoring Locations							
I-4			SW-01		SW-01		Investigate surface water conditions near downstream end of Site
F-5			SW-02		SW-02		Assess surface water conditions adjacent to Site focus area of groundwater impact (former bldg 8 vicinity) and high flux area (EW-B5 vicinity)
E-5			SW-03		SW-03		Assess surface water conditions adjacent to Site focus area of groundwater impact (former bldg 56 vicinity)
A-5			SW-04		SW-04		Assess upstream background/potential for impact from other sources
north			SW-05				Assess upstream background/potential for impact from other sources
Fig 11				SG-11		SG-11	Assess canal water level
F-5				SG-12		SG-12	Asses river water level

Table 2
Pretreatment Plant (PTP) Monitoring Program Well Networks

Existing Plan Semi-Annual	Existing Plan Annual	Proposed Standard Annual Event Q2 2015		Proposed Event Networks Rationale and Comments
Gauge Only	Gauge & Sample	Gauge & Sample	Gauge Only	
Overburden Wells				
MW-OB17	MW-OB17	MW-OB17		Onsite well with historical cyanide detections above groundwater protection concentration (GPC)
MW-OB18	MW-OB18	MW-OB18		Site boundary well, downgradient of area with elevated (above GPC) cyanide
MW-OB19	MW-OB19	MW-OB19		Site boundary well, downgradient of area with elevated (above GPC) cyanide
MW-OB20	MW-OB20	MW-OB20		Site boundary well, downgradient of area with elevated (above GPC) cyanide
MW-OB21	MW-OB21	MW-OB21		Off-site well downgradient of site and canal with highest historical off-site concentrations
MW-OB22	MW-OB22			Downgradient conditions documented by well MW-OB21
MW-OB23	MW-OB23	MW-OB23		Onsite well with historical cyanide detections above groundwater protection concentration
P-1	P-1		P-1	Concentrations below GPC; source area monitored by MW-OB17 and MW-OB23
P-3				other wells sufficient to establish hydrologic conditions
P-6				No longer exists
P-7				other wells sufficient to establish hydrologic conditions
P-8				other wells sufficient to establish hydrologic conditions
P-10				No longer exists
P-11			P-11	gauging only
P-12			P-12	gauging only
P-14				other wells sufficient to establish hydrologic conditions
P-16				No longer exists
IG-1			IG-1	gauging only
IG-2			IG-2	gauging only
IG-4				
Surface Water Monitoring Locations				
	SG-6			surface water stream north of site; flows east/south to marsh area at SG-7
	SG-8			surface water stream northwest corner of site; flows east/south to marsh area at SG-7
	SG-7	SG-7		surface water stream southwest (downgradient) of site in stream marsh area near canal
		SG-11		surface water gauge in canal, south of site and adjacent to marsh area

Table 3
Focused Sampling Event Analysis Schedule
Main Plant Site (MPS)

Focused Event Gauge Only Q3 2015	Focused Sampling Event Gauge & Sample Q3 2015	Field Parameters[1]	Major Ions and Alkalinity[2]	Total Dissolved Solids[3]	Total and Dissolved Organic Carbon	Hardness	Total Metals[4] (unfiltered)	Total, WAD and Free Cyanide[4] (unfiltered)	Dissolved Metals[5] (0.45 um filter)	Total, WAD and Free Cyanide[5] (0.45 um filter)	Dissolved Chromium, Hexavalent Chromium, WAD and free Cyanide[6] (1, 0.45 + 0.1 um filters)	Zinc total (unfiltered) and dissolved (0.45 um filter)	Dischlorobenzenes
Overburden Wells													
	AP-2*	1	1	1	1		1	1	1		1	1	
	BP-2	1	1	1	1		1	1	1				
	BP-6	1	1	1	1		1	1	1				
	BP-9	1	1	1	1		1	1	1				
	IP-4	1	1	1	1		1	1	1				
	MW-26	1	1	1	1		1	1	1				
	MW-28	1	1	1	1		1	1	1				
	MW-31	1	1	1	1		1	1	1			1	
	MW-OB5	1	1	1	1		1	1	1				
	MW-OB7	1	1	1	1		1	1	1			1	
	MW-OB13*	1	1	1	1		1	1	1		1		
	MW-OB14*	1	1	1	1		1	1	1		1		
	MW-OB24	1	1	1	1		1	1	1				
	MW-OB25*	1	1	1	1		1	1	1		1		
MW-9													
MW-OB2													
MW-OB15	Wells to be gauged only												
MW-OB27													
WP-CC-12													
Shallow Bedrock Wells													
	AW-A6*	1	1	1	1		1	1	1		1		
	AW-A10	1	1	1	1		1	1	1				
	AW-A11	1	1	1	1		1	1	1				
	AW-A13	1	1	1	1		1	1	1			1	
	AW-A14	1	1	1	1		1	1	1				
	AW-A15	1	1	1	1		1	1	1			1	
	AW-A16	1	1	1	1		1	1	1				
	MW-19	1	1	1	1		1	1	1			1	
	MW-25S	1	1	1	1		1	1	1				
	EW-A9**	1	1	1	1		1	1	1				
	EW-A10**	1	1	1	1		1	1	1				
	EW-A12**	1	1	1	1		1	1	1				
AW-A4													
MW-27S	Wells to be gauged only												
MW-36S													
PA-1													

Table 3
Focused Sampling Event Analysis Schedule
Main Plant Site (MPS)

Focused Event Gauge Only Q3 2015	Focused Sampling Event Gauge & Sample Q3 2015	Field Parameters[1]	Major Ions and Alkalinity[2]	Total Dissolved Solids[3]	Total and Dissolved Organic Carbon	Hardness	Total Metals[4] (unfiltered)	Total, WAD and Free Cyanide[4] (unfiltered)	Dissolved Metals[5] (0.45 um filter)	Total, WAD and Free Cyanide[5] (0.45 um filter)	Dissolved Chromium, Hexavalent Chromium, WAD and free Cyanide[6] (1, 0.45 + 0.1 um filters)	Zinc total (unfiltered) and dissolved (0.45 um filter)	Dischlorobenzenes
Intermediate Bedrock Wells													
	AW-B2	1	1	1	1		1	1	1				
	AW-B4*	1	1	1	1		1	1	1		1		
	AW-B11	1	1	1	1		1	1	1				
	AW-B12	1	1	1	1		1	1	1				
	AW-B13	1	1	1	1		1	1	1				
	AW-B15*	1	1	1	1		1	1	1		1		
	AW-B16*	1	1	1	1		1	1	1		1	1	
	AW-B17	1	1	1	1		1	1	1				
	AW-B18	1	1	1	1		1	1	1				1
	AW-B20*	1	1	1	1		1	1	1		1		
	MW-25D	1	1	1	1		1	1	1				
	MW-30D	1	1	1	1		1	1	1				
	MW-36D	1											1
AW-B3 AW-B19 MW-10B MW-20D MW-40B	Wells to be gauged only												
Deep Bedrock Wells													
	AW-C2	1	1	1	1		1	1	1				
	AW-C11*	1	1	1	1		1	1	1		1		
AW-C1 AW-C7 AW-C8 AW-C9 AW-C10 MW-20C MW-36C	Wells to be gauged only												
Surface Water Samples													
	SW-01	1	1	1	1	1		1	1				
	SW-02	1	1	1	1	1		1	1				
	SW-03	1	1	1	1	1		1	1				
	SW-04	1	1	1	1	1		1	1				
	SW-05	1	1	1	1	1		1	1				
SG-11 SG-12	Surface water gauging only												

Table 3
Focused Sampling Event Analysis Schedule
Main Plant Site (MPS)

Focused Event Gauge Only Q3 2015	Focused Sampling Event Gauge & Sample Q3 2015	Field Parameters[1]	Major Ions and Alkalinity[2]	Total Dissolved Solids[3]	Total and Dissolved Organic Carbon	Hardness	Total Metals[4] (unfiltered)	Total, WAD and Free Cyanide[4] (unfiltered)	Dissolved Metals[5] (0.45 um filter)	Total, WAD and Free Cyanide[5] (0.45 um filter)	Dissolved Chromium, Hexavalent Chromium, WAD and free Cyanide[6] (1, 0.45 + 0.1 um filters)	Zinc total (unfiltered) and dissolved (0.45 um filter)	Dischlorobenzenes

Notes:

* Sequential filtering sample location (sequential filtration of two additional samples collected using 1.0 um filter and 0.45 um + 0.1 um filters)

** Extraction well to be sampled for river water dilution assessment (active pumping wells).

um - micrometer

1 - Field parameters to include pH, temperature, dissolved oxygen, redox potential, electrical conductivity, turbidity and barometric pressure

2 - Major ions to include calcium, sodium, potassium, magnesium, chloride, bromide, and sulfate. Alkalinity reported as total, bicarbonate and carbonate alkalinity

3 - Total dissolved solids (laboratory derived not calculated)

4 - Totals analysis on unfiltered samples. Metals to include chromium, hexavalent chromium, cadmium, lead, mercury and vanadium
Total cyanide, weak acid dissociable (WAD) cyanide, and free cyanide on unfiltered samples (free cyanide sample treated using kit provided by laboratory)

5 - Dissolved analysis on 0.45 um filtered samples for chromium, hexavalent chromium, cadmium, lead, mercury and vanadium
Cyanide, WAD and free cyanide analysis on 0.45 um filtered sample

6 - Sequential filter study samples: one collected using 1 um filter, and one collected using 0.45 um and 0.1 um filters in-line/sequentially for analysis of dissolved chromium, hexavalent chromium*, cyanide, WAD cyanide and free cyanide*
*Hexavalent chromium analysis method includes filtration with a 0.8 um filter, therefore only a 0.1 um filter sample is needed for hexavalent chromium.
Free cyanide sample collection kit incorporates a 0.45 um filter. Therefore only 0.1 um sample will be collected.
In the event 0.1 um filtration cannot be reasonably achieved in the field, 0.2 um filters will be used. The 0.45 um filter in-line with 0.1. um will be used only if needed to achieve 0.1 um filtering.

Table 4
Standard (Semi-Annual) Sampling Event Analysis Schedule
Main Plant Site (MPS)

Gauge Only Q4 2015	Standard Semi-Annual Gauge & Sample Q4 2015	Field Parameters[1]	Total Cyanide and Free Cyanide[2]	Dissolved Chromium and Hexavalent Chromium (0.45 um filter)[3]	Total Dissolved Solids[4]	Hardness	Dischlorobenzenes
Overburden Wells							
	AP-2	1	1	1			
	BP-6	1	1	1			
	BP-9	1	1	1			
	IP-4	1	1	1			
	MW-26	1	1	1			
	MW-28	1	1	1			
	MW-31	1	1	1			
	MW-OB7	1	1	1			
	MW-OB25	1	1	1			
MW-9	Wells to be gauged only						
MW-OB2							
MW-OB5							
MW-OB13							
MW-OB14							
MW-OB15							
MW-OB24							
MW-OB27							
WP-CC-12							
Shallow Bedrock Wells							
	AW-A2	1	1	1			
	AW-A10	1	1	1			
	AW-A11	1	1	1			
	AW-A14	1	1	1			
	AW-A15	1	1	1			
	MW-25S	1	1	1			
AW-A4	Wells to be gauged only						
MW-19							
MW-27S							
MW-36S							
P-A1							
Intermediate Bedrock Wells							
	AW-B2	1	1	1			
	AW-B4	1	1	1			
	AW-B11	1	1	1			
	AW-B17	1	1	1			
	AW-B18	1	1	1			1

Table 4
Standard (Semi-Annual) Sampling Event Analysis Schedule
Main Plant Site (MPS)

Gauge Only Q4 2015	Standard Semi-Annual Gauge & Sample Q4 2015	Field Parameters[1]	Total Cyanide and Free Cyanide[2]	Dissolved Chromium and Hexavalent Chromium (0.45 um filter)[3]	Total Dissolved Solids[4]	Hardness	Dischlorobenzenes
	MW-25D	1	1	1			
	MW-30D	1	1	1			
	MW-36D						1
AW-B3	Wells to be gauged only						
AW-B19							
AW-B20							
MW-10B							
MW-20D							
MW-40B							
Deep Bedrock Wells							
	AW-C2	1	1	1			
	AW-C11	1	1	1			
AW-C1	Wells to be gauged only						
AW-C7							
AW-C8							
AW-C9							
AW-C10							
MW-20C							
MW-36C							
Surface Water Samples							
	SW-01	1	1	1	1	1	
	SW-02	1	1	1	1	1	
	SW-03	1	1	1	1	1	
	SW-04	1	1	1	1	1	
SG-11 SG-12	Surface water gauging only						

Notes:
um - micrometer
1 - Field parameters to include pH, temperature, dissolved oxygen, redox potential, electrical conductivity, turbidity and barometric pressure.
2 - Total cyanide and free cyanide (unfiltered samples; free cyanide sample treated using kit provided by laboratory)
3 - Dissolved chromium and hexavalent chromium samples filtered in the field using 0.45 um filters
4 - Total Dissolved Solids (TDS) to be laboratory derived, not calculated

Table 5
Annual Sampling Event Analysis Schedule
Pretreatment Plant (PTP)

Annual Gauge Only Q4 2015	Annual Gauge & Sample Q2 2015	Field Parameters[1]	Total Cyanide and Free Cyanide[2]
Overburden Wells			
	MW-OB17	1	1
	MW-OB18	1	1
	MW-OB19	1	1
	MW-OB20	1	1
	MW-OB21	1	1
	MW-OB23	1	1
IG-1	Wells to be gauged only		
IG-2			
P-1			
P-11			
P-12			
Surface Water Samples			
	SG-7	1	1
	SG-11	1	1

Notes:
um - micrometer
1 - Field parameters to include pH, temperature, dissolved oxygen, redox potential, electrical conductivity, turbidity and barometric pressure
2 - Total cyanide cyanide and free cyanide conducted on unfiltered samples (free cyanide sample treated in field using kit provided by laboratory).

EHS Support consider it done

Table 6
Laboratory Analytical Method Summary

Analyte	Groundwater Quality Standard GA standard[1] (µg/L)	Surface Water Quality Standard[1] Class A, B, C (µg/L)	Method Number	Anticipated Reporting Limit (µg/L)	Sample Container Type	Container Volume (each in ml)	No. Containers per sample	Preservation	Holding Time
Major Ions and Geochemistry Parameters									
Calcium	not screened	not screened	SW846 6020A	110	Plastic	in total metals bottle		HNO_3 to pH<2	6 Months
Sodium	not screened	not screened		110					
Potassium	not screened	not screened		110					
Magnesium	not screened	not screened		110					
Chloride	not screened	not screened	SW846 9056A	1,000	Plastic	500	1	Cool, < 6 deg. C	28 Days
Bromide	not screened	not screened		300				Cool, < 6 deg. C	28 Days
Sulfate	not screened	not screened		1,000				Cool, < 6 deg. C	28 Days
Total Dissolved Solids	not screened	not screened	SM2540C	5,000				Cool, < 6 deg. C.	7 days
Total Organic Carbon	not screened	not screened	SM 5310B	1,000	Amber Glass	250	1	HCl 4 to pH<2, Cool, < 6 deg. C.	28 Days
Dissolved Organic Carbon	not screened	not screened		1,000	Amber Glass	250	1	Filtration + HCl 4 to pH<2, Cool, < 6 deg. C.	
Alkalinity (total, bicarbonate, carbonate)	not screened	not screened	SM2320 B-11	2,000	Plastic	250	1	Cool, < 6 deg. C, no headspace	14 Days
Hardness	not screened	not screened	SM2340C	5,000	Plastic	in total metals bottle		HNO3 to pH<2	6 Months
Total Metals									
Chromium	50	n/a	SW846 6020A	2.2	Plastic	500	1	HNO_3 to pH<2	6 Months
Cadmium	5	n/a		1.1					
Lead	25	n/a		2.2					
Vanadium	n/a	n/a		2.2					
Zinc	2000 H(WS)	2000 H(WS)		5.6					
Mercury	0.7	n/a	SW846 7470A	0.5					28 Days
Dissolved Metals									
Chromium	50	calculated*	SW846 6020A	2.0	Plastic	500	1	Filtration + HNO_3 to pH<2	6 Months
Cadmium	n/a	calculated*		1.0					
Lead	n/a	calculated*		2.0					
Vanadium	n/a	190 A(A) 14 A(C)		2.0					
Zinc	2000 H(WS)	2000 H(WS)		5.6					
Mercury	n/a	7x10^{-4} H(FC) 1.4 A(A) 0.77 A(C)	SW846 7470A	0.5					28 Days
Hexavalent Chromium	50	16 A(A) 11 A(C)	SW846 7199	10	Plastic	250	1	Filtration + Cool, < 6 deg. C	24 hrs

Table 6
Laboratory Analytical Method Summary

Analyte	Groundwater Quality Standard GA standard[1] (µg/L)	Surface Water Quality Standard[1] Class A, B, C (µg/L)	Method Number	Anticipated Reporting Limit (µg/L)	Sample Container Type	Container Volume (each in ml)	No. Containers per sample	Preservation	Holding Time
Cyanide									
Total Cyanide	200	9000 H(FC)	SW846 9012B	10	Plastic	250	1	NaOH to pH>12, Cool, < 6 deg. C.	14 Days
Weak Acid Dissociable (WAD) Cyanide	n/a	n/a	SM 4500 CN-I	10					14 Days
Free Cyanide	n/a	5.2 A(A) 22 A(C)	OIA-1677	2	Plastic	250	1	Pre-treatment (kit), NaOH to pH>12, Ascorbic Acid, Cool, < 6 deg. C.	14 Days
Volatile Organic Compounds									
Dichlorobenzenes**	3	5	SW846 8260C	5	Glass VOA	40	3	HCl to pH<2, Cool, < 6 deg. C.	14 Days

Notes:
Notes:
1) 6 NYCCR 703.5, Table 1 Water Quality Standards Surface Waters (or Water Quality Guidance Values from NYS Dept. of Water TOGS 1.1.1 as noted).
not screened - indicates not a site-related constituent; data used for geochemical assessment/developing surface water criteria only
n/a indicates no screening value available. Total metals criteria may be used for screening dissolved metals that have no screening value available.
A(C) - protective of fish propogation in fresh waters - applicable to dissolved phases only (acid soluble phase for vanadium)
A(A) - protective of fish survival in fresh waters - applicable to dissolved phases only (acid soluble phase for vanadium)
* indicates A(A) and A(C) values are calculated based on hardness
GA - protective of fresh groundwaters for drinking water source
H(WS) protective of health for water drinking water source (groundwater and surface water values for zinc are TOGS 1.1.1 water quality guidance values)
H(FC) - protective of human health for fish consumption
** GA standard for dichlorobenzenes (DCB) applies individually to isomers (1,2-DCB 1,3-DCB and 1,4-DCB). Surface water A(C) value applies to the sum of the isomers.
DCB method will allow reporting to less than 3 ug/L with applicable qualification
µg/L - micrograms per liter
ml - milliliters

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Installation Date(s)		Flushmount/ Stick-up	Well Diameter (inches)	Installed Depth (ft. bgs)	Screen Length (ft.)	Screen Slot Size (inches)	Screened Interval (ft bgs)	Screen Type	Top of Casing Elevation (ft amsl)	TOC Survey Date	Ground Surface Elevation (ft amsl)	Northing	Easting
	MAIN PLANT SITE WELLS															
D-5	AP-1	Overburden	10/12/10	10/12/10	Flushmount	1	16	5	0.010	6 - 16	PVC	239.92	Dec-10	--	1206010.209	691998.203
D-5	AP-2	Overburden	10/12/10	10/12/10	Flushmount	1	20	10	0.010	10 - 20	PVC	240.04	Dec-10	--	1205985.945	691911.996
D-5	AP-3	Overburden	10/11/10	10/11/10	Flushmount	1	20	10	0.010	10 - 20	PVC	239.69	Dec-10	--	1205969.876	691841.849
C-5	AP-4	Overburden	10/11/10	10/11/10	Flushmount	1	15	10	0.010	5 - 15	PVC	241.38	Dec-10	--	1205970.658	691770.188
D-5	AP-6	Overburden	10/07/10	10/07/10	Stick-up	1	28.5	10	0.010	18.5 - 28.5	PVC	231.81	Dec-10	--	1205916.804	691848.282
D-5	AP-7	Overburden	10/07/10	10/07/10	Stick-up	1	27.5	10	0.010	17.5 - 27	PVC	236.86	Dec-10	--	1205918.864	691814.468
B-1	AW-A1	shallow bedrock	08/12/91	08/22/91	Stickup	2	31.5	10	0.010	20.5-30.5	PVC	281.10	--	278.00	1206768.534	691123.2395
B-4	AW-A2	shallow bedrock	09/19/91	09/27/91	Stickup	2	32	10	0.010	22-32	PVC	249.10	--	241.30	1206072.739	691286.621
A-5	AW-A3	shallow bedrock	10/07/91	11/04/91	Stickup	2	38	10	0.010	28-38	PVC	244.45	--	242.30	1205682.502	690917.1839
A-5	AW-A4	shallow bedrock	07/10/91	07/29/91	Stickup	2	37	10	0.010	26.5-36.5	PVC	238.43	--	236.70	1205712.973	691165.645
E-4	AW-A6	shallow bedrock	06/23/91	08/04/91	Stickup	2	29	10	0.010	18-28	PVC	245.60	--	239.60	1206275.210	692059.801
B-5	AW-A7	shallow bedrock	10/14/00	10/17/00	Stickup	2	48	10	0.010	35-45	PVC	243.05	--	--	1205864.35	691384.23
C-5	AW-A8	shallow bedrock	10/17/00	10/19/00	Stickup	2	46.5	10	0.010	34-44	PVC	242.30	--	--	1205922.9	691603.2
C-5	AW-A9	shallow bedrock	10/25/00	10/27/00	Stickup	2	45	10	0.010	31-41	PVC	241.25	--	--	1205959.1	691747
C-5	AW-A10	shallow bedrock	10/31/00	11/03/00	Stickup	2	46	10	0.010	34-44	PVC	239.05	--	--	1205923.430	691760.190
D-5	AW-A11	shallow bedrock	05/17/01	05/22/01	Stickup	2	58	10	0.010	46-56	PVC	239.60	--	--	1205969.800	691892.700
E-5	AW-A13	shallow bedrock	05/14/01	05/18/01	Stickup	2	31.5	10	0.010	20-30	PVC	238.50	--	--	1206055.700	692166.100
E-5	AW-A14	shallow bedrock	05/22/01	05/24/01	Stickup	2	34.5	10	0.010	23-33	PVC	237.10	--	--	1206030.300	692188.600
C-4	AW-A15	shallow bedrock	06/06/00	06/13/00	Stickup	2	31	10	0.010	20-30	PVC	246.90	--	--	1206181.500	691718.800
C-3	AW-A16	shallow bedrock	06/02/00	06/13/00	Stickup	2	32	11	0.010	20-31	PVC	270.85	--	--	1206427.200	691561.400
A-4	AW-B1	Intermediate Bedrock	10/09/91	12/02/91	Stickup	2	74	10	0.010	64-74	PVC	259.20	--	257.30	1206097.029	691175.0729
B-4	AW-B2	Intermediate Bedrock	07/24/91	09/25/91	Stickup	6	55	24	OPEN	31-55	NA	248.80	--	241.80	1206072.759	691312.794
A-5	AW-B3	Intermediate Bedrock	10/03/91	11/05/91	Stickup	2	58.5	10	0.010	48-58	PVC	244.70	--	242.90	1205687.431	690937.954
E-5	AW-B4	Intermediate Bedrock	07/08/91	07/18/91	Stickup	2	47.5	10	0.010	35-45	PVC	238.25	--	235.30	1206055.126	692184.766
A-5	AW-B8	Intermediate Bedrock	07/08/92	07/29/92	Stickup	2	58	10	0.010	46-56	PVC	239.53	--	237.50	1205709.444	691152.2445
B-5	AW-B9	Intermediate Bedrock	10/24/00	10/30/00	Stickup	2	67	14	0.010	53-67	PVC	242.75	--	--	1205867	691394.5
C-5	AW-B10	Intermediate Bedrock	11/09/00	11/15/00	Stickup	2	62	10	0.010	49-59	PVC	240.75	--	--	1205934	691709.4
C-5	AW-B11	Intermediate Bedrock	11/01/00	11/08/00	Stickup	2	67	10	0.010	50-60	PVC	238.65	--	--	1205912.700	691715.300
D-5	AW-B12	Intermediate Bedrock	11/16/00	11/29/00	Stickup	2	61	10	0.010	49-59	PVC	239.00	--	--	1205996.000	692009.300
D-5	AW-B13	Intermediate Bedrock	06/14/01	06/26/01	Stickup	2	62	10	0.010	50-60	PVC	234.90	--	--	1205973.500	692015.200
E-5	AW-B14	Intermediate Bedrock	05/24/00	05/29/00	Stickup	2	48	10	0.010	35-45	PVC	238.10	--	--	1206107.4	692288.2
E-5	AW-B15	Intermediate Bedrock	06/05/00	06/06/00	Stickup	2	47	10	0.010	35-45	PVC	236.75	--	--	1206084.900	692296.600
F-4	AW-B16	Intermediate Bedrock	06/11/00	06/13/00	Stickup	2	46	10	0.010	35-45	PVC	238.30	--	--	1206213.300	692584.900
F-4	AW-B17	Intermediate Bedrock	06/27/00	06/28/00	Stickup	2	47.7	10	0.010	36-46	PVC	238.70	--	--	1206213.300	692601.100
C-4	AW-B18	Intermediate Bedrock	06/09/00	06/15/00	Stickup	2	50.5	10	0.010	39-49	PVC	247.30	--	--	1206174.500	691689.500
E-4	AW-B19	Intermediate Bedrock	06/14/00	06/20/00	Stickup	2	46.9	10	0.010	36-46	PVC	245.75	--	--	1206278.000	692041.000
F-4	AW-B20	Intermediate Bedrock	06/19/00	06/21/00	Stickup	2	31	10	0.010	21-31	PVC	243.65	--	--	1206401.200	692526.100
B-1	AW-C1	Deep Bedrock	07/25/88	08/03/88	Flush	2	144	10	unknown	133-143	PVC	283.50	--	--	1206757.457	691227.682
B-5	AW-C2	Deep Bedrock	08/04/88	08/12/88	Flush	2	169	10	unknown	156-166	PVC	241.10	--	--	1205830.970	691387.530
A-5	AW-C7	Deep Bedrock	10/02/91	12/02/91	Flush	2	155	10	0.010	145-155	PVC	245.31	--	--	1205692.720	690948.816
B-4	AW-C8	Deep Bedrock	07/23/91	09/11/91	Flush	2	162	15	0.010	147-162	PVC	249.10	--	--	1206081.308	691299.720
G-2	AW-C9	Deep Bedrock	08/12/92	08/15/92	Flush	2	127	10	0.010	117-127	PVC	251.60	--	--	1206645.020	692699.420
F-2	AW-C10	Deep Bedrock	06/23/92	08/06/92	Flush	2	137	10	0.010	126-136	PVC	254.95	--	--	1206570.019	692339.381

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Installation Date(s)		Flushmount/ Stick-up	Well Diameter (inches)	Installed Depth (ft. bgs)	Screen Length (ft.)	Screen Slot Size (inches)	Screened Interval (ft bgs)	Screen Type	Top of Casing Elevation (ft amsl)	TOC Survey Date	Ground Surface Elevation (ft amsl)	Northing	Easting
E-5	AW-C11	Deep Bedrock	05/30/01	06/08/01	Flush	2	158	10	0.010	143-153	PVC	238.45	--	--	1206054.500	692182.800
G-4	BP-1	Overburden	10/14/10	10/14/10	Flushmount	1	11	5	0.010	6 - 11	PVC	238.80	Dec-10	--	1206279.44	692641.763
F-4	BP-2	Overburden	10/14/10	10/14/10	Flushmount	1	12	6	0.010	6 - 12	PVC	238.72	Dec-10	--	1206243.902	692574.914
F-4	BP-3	Overburden	10/13/10	10/13/10	Flushmount	1	18	10	0.010	8 - 18	PVC	238.41	Dec-10	--	1206207.869	692509.287
F-4	BP-4	Overburden	10/12/10	10/12/10	Flushmount	1	10	5	0.010	5 - 10	PVC	240.05	Dec-10	--	1206253.252	692487.494
E-5	BP-5	Overburden	10/12/10	10/12/10	Flushmount	1	16	10	0.010	6 - 16	PVC	238.36	Dec-10	--	1206123.769	692340.412
F-4	BP-6	Overburden	10/08/10	10/08/10	Stick-up	1	23	10	0.010	13 - 23	PVC	236.74	Dec-10	--	1206206.698	692602.828
F-5	BP-7	Overburden	10/06/10	10/06/10	Stick-up	1	19	10	0.010	9 - 19	PVC	230.41	Dec-10	--	1206156.409	692602.828
F-5	BP-8	Overburden	10/06/10	10/06/10	Stick-up	1	19	10	0.010	9 - 19	PVC	231.75	Dec-10	--	1206130.627	692469.651
E-5	BP-9	Overburden	10/08/10	10/08/10	Stick-up	1	16	10	0.010	6 - 16	PVC	232.52	Dec-10	--	1206036.644	692275.949
H-4	CP-1	Overburden	10/15/10	10/15/10	Flushmount	1	17	10	0.010	7 - 17	PVC	236.62	Dec-10	--	1206390.842	692990.401
H-4	CP-2	Overburden	10/14/10	10/14/10	Flushmount	1	14	7	0.010	7 - 14	PVC	238.39	Dec-10	--	1206387.522	692943.191
H-3	CP-3	Overburden	10/14/10	10/14/10	Flushmount	1	11	5	0.010	6 - 11	PVC	238.81	Dec-10	--	1206431.578	692931.865
H-4	CP-5	Overburden	10/05/10	10/05/10	Stick-up	1	24	10	0.010	14 - 24	PVC	235.09	Dec-10	--	1206335.128	692919.848
H-4	CP-6	Overburden	10/05/10	10/05/10	Stick-up	1	24	10	0.010	14 - 24	PVC	229.75	Dec-10	--	1206334.385	692951.576
D-4	IP-4	Overburden	05/14/92	05/14/92	Stick-up	1	8.5	3.5	0.010	5 - 8.5	PVC	249.40	--	245.30	1206327.230	691873.870
D-4	IP-5	Overburden	05/14/92	05/14/92	Stick-up	1	4	3	0.010	1 - 4	PVC	246.50	--	240.60	1206236.73	691875.05
E-5	MW-8	shallow bedrock	03/18/80	03/18/80	Stickup	3	45	25	OPEN	20-45	NA	246.00	--	241.70	1205998.8	691370.24
B-4	MW-9	Overburden	--	--	Flush	2			Unknown		PVC	246.25	--	240.30	1205999.240	691365.340
F-2	MW-10B	Intermediate Bedrock	06/25/92	08/04/92	Stickup	2	35	10	0.010	24-34	PVC	254.70	--	254.00	1206558.714	692324.894
G-1	MW-17C	Deep Bedrock	06/25/92	07/20/92	Flush	2	107	10	0.010	96-106	PVC	287.19	--	284.60	1207306.49	692477
F-1	MW-18	Overburden	07/18/80	07/18/80	Stick-up	2	10.8	~5	No info	5.8 - 10.8	PVC	286.20	--	284.90	1207302.63	692458.31
B-4	MW-19	shallow bedrock	05/18/80	05/19/80	Stickup	3	41.5	31.5	OPEN	10-41.5	NA	249.10	--	243.30	1206162.060	691489.790
C-3	MW-20C	Deep Bedrock	07/12/91	09/13/91	Flush	2	160	10	0.010	150-160	PVC	269.25	--	262.00	1206420.236	691571.525
C-3	MW-20D	Intermediate Bedrock	--	--	Stickup	3	55.1	10	OPEN	45.1-55.1	NA	266.90	--	261.30	1206402.750	691574.660
D-1	MW-23D	Intermediate Bedrock	--	--	Stickup	3	47.9	10	OPEN	37.9-47.9	NA	283.58	--	281.50	1206933.16	691657.65
D-1	MW-23S	shallow bedrock	--	--	Stickup	3	26.5	10	OPEN	16.5-26.5	NA	282.88	--	281.40	1206936.91	691636.01
D-1	MW-24	Overburden	--	--	Stick-up	2	10	5	No info	5 - 10	PVC	283.31	--	281.50	1206941.85	691642.89
B-5	MW-25D	Intermediate Bedrock	--	--	Stickup	3	60.7	10	OPEN	50.7-60.7	NA	241.55	--	234.70	1205843.460	691403.630
B-5	MW-25S	shallow bedrock	--	--	Stickup	3	39.4	9.8	OPEN	29.6-39.4	NA	241.55	--	235.60	1205843.010	691392.960
B-5	MW-26	Overburden	--	--	Stick-up	2	~8	5	No info	3 - 8	PVC	242.10	--	235.90	1205830.160	691363.760
B-5	MW-27D	Intermediate Bedrock	--	--	Stickup	3	66	10	OPEN	56-66	NA	240.25	--	239.10	1205890.93	691568.11
B-5	MW-27S	shallow bedrock	--	--	Stickup	2	42.5	9.5	unknown	33-42.5	PVC	240.80	--	239.00	1205890.120	691556.690
B-5	MW-28	Overburden	--	--	Stick-up	2	~12	5	No info	7 - 12	PVC	240.20	--	239.40	1205892.940	691578.260
G-4	MW-30D	Intermediate Bedrock	--	--	Stickup	3	51.5	9.7	OPEN	41.8-51.5	NA	217.10	--	215.00	1206255.380	692861.820
G-4	MW-30S	Intermediate Bedrock	--	--	Stickup	3	32.1	10.2	OPEN	21.9-32.1	NA	216.80	--	214.90	1206244.87	692855.82
G-4	MW-31	Overburden	--	--	Stick-up	2	15	5	No info	10 - 15	PVC	217.58	--	214.80	1206244.860	692844.890
B-3	MW-36C	Deep Bedrock	07/26/91	09/17/91	Flush	2	160	10	0.010	148.5-158.5	PVC	266.60	--	261.70	1206395.425	691192.224
B-3	MW-36D	Intermediate Bedrock	--	--	Stickup	3	57.2	10	OPEN	47.2-57.2	NA	266.40	--	261.00	1206366.574	691189.387
B-3	MW-36S	shallow bedrock	--	--	Stickup	3	33	9.4	OPEN	23.6-33	NA	264.85	--	260.80	1206384.456	691185.694
B-1	MW-40B	Intermediate Bedrock	06/29/92	08/03/92	Stickup	2	53	10	0.010	42-52	PVC	284.55	--	281.80	1206767.035	691221.750
C-1	MW-OB2	Overburden	07/25/91	07/25/91	Stick-up	2	17	10	0.010	7 - 17	PVC	284.70	--	281.20	1206710.310	691480.847
B-3	MW-OB5	Overburden	09/28/91	09/28/91	Stick-up	2	12	7	0.010	7 - 12	PVC	263.70	--	260.70	1206387.986	691183.691
B-4	MW-OB7	Overburden	07/26/91	07/26/91	Stick-up	2	9	5	0.010	4 - 9	PVC	249.20	--	241.40	1206046.175	691274.606

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Installation Date(s)		Flushmount/ Stick-up	Well Diameter (inches)	Installed Depth (ft. bgs)	Screen Length (ft.)	Screen Slot Size (inches)	Screened Interval (ft bgs)	Screen Type	Top of Casing Elevation (ft amsl)	TOC Survey Date	Ground Surface Elevation (ft amsl)	Northing	Easting
A-5	MW-OB8	Overburden	09/30/91	09/30/91	Stick-up	2	12.5	5	0.010	7.5 - 12.5	PVC	244.55	--	241.90	1205676.379	690925.1436
B-5	MW-OB9	Overburden	08/23/91	08/23/91	Stick-up	2	8	4	0.010	4 - 8	PVC	240.40	--	239.60	1205923.148	691229.5012
F-3	MW-OB13	Overburden	07/15/92	07/15/92	Stick-up	2	8	5	0.010	3 - 8	PVC	244.50	--	237.90	1206459.260	692548.536
E-4	MW-OB14	Overburden	07/10/92	07/10/92	Stick-up	2	18	10	0.010	8 - 18	PVC	241.65	--	237.90	1206206.404	692264.168
F-1	MW-OB15	Overburden	07/08/92	07/08/92	Stick-up	2	8	5	0.010	3 - 8	PVC	262.35	--	262.30	1206780.937	692497.482
G-4	MW-OB16	Overburden	07/09/92	07/09/92	Stick-up	2	14	10	0.010	4 - 14	PVC	239.75	--	237.90	1206337.304	692748.0692
B-1	MW-OB1R	Overburden	08/09/91	08/09/91	Stick-up	2	15	8	0.010	7 - 15	PVC	283.22	--	--	1206785.769	691122.5461
C-3	MW-OB24	Overburden	05/17/01	05/17/01	Flushmount	2	10.5	5	0.010	5.5 - 10.5	PVC	270.55	--	--	1206427.760	691568.480
E-5	MW-OB25	Overburden	05/11/01	05/11/01	Flushmount	2	10	5	0.010	5 - 10	PVC	238.45	--	--	1206066.740	692184.620
F-4	MW-OB26	Overburden	05/17/01	05/17/01	Flushmount	2	14	5	0.010	9 - 14	PVC	238.45	--	--	1206174.22	692443.87
H-3	MW-OB27	Overburden	05/10/01	05/10/01	Flushmount	2	11	5	0.010	6 - 11	PVC	239.15	--	--	1206466.500	693086.000
C-1	P-A1	shallow bedrock	07/25/91	08/16/91	Stickup	2	34.5	10	0.010	24-34	PVC	283.30	--	280.50	1206716.004	691486.5279
A-5	WP-CC-12	Overburden	04/28/00	04/28/00	Stick-up	1	21.2	5	0.010	16.2 - 21.2	PVC	251.64	--	--	1205738.923	691038.272
A-4	WP-CC-17	Overburden	04/28/00	04/28/00	Stick-up	1	17.7	10	0.010	7.7 - 17.7	PVC	255.80	--	--	1205986.026	691068.2912
A-4	WP-CC-21	Overburden	04/28/00	04/28/00	Stick-up	1	18.4	10	0.010	8.4 - 18.4	PVC	257.84	--	--	1206074.68	691157.9713
A-5	WP-O-50	Overburden	04/28/00	04/28/00	Stick-up	1	11.7	5	0.010	6.7 - 11.7	PVC	240.82	--	--	1205746.676	691201.6982
D-5	AP-5	Overburden	10/11/10	10/11/10	Flushmount	1	13	7	0.010	6 - 13	PVC	240.02	Dec-10	--	1206026.775	691822.990
	EXTRACTION WELLS AND FEATURES															
B-5	EW-A1	shallow bedrock	09/13/00	09/15/00	Flush	8	43.2	18.2	OPEN	25-43.2	NA	241.01	--	--	1205832	691280
B-5	EW-A2	shallow bedrock	09/15/00	09/18/00	Flush	8	48.3	20.8	OPEN	27.5-48.3	NA	240.24	--	--	1205855	691348
B-5	EW-A3	shallow bedrock	09/18/00	09/20/00	Flush	8	48.3	18.3	OPEN	30-48.3	NA	240.53	--	--	1205875	691420
B-5	EW-A4	shallow bedrock	09/25/00	09/26/00	Flush	8	47.3	19.3	OPEN	28-47.3	NA	240.45	--	--	1205896	691492
B-5	EW-A5	shallow bedrock	09/27/00	09/28/00	Flush	8	48.1	19.6	OPEN	28.5-48.1	NA	239.86	--	--	1205912	691566
C-5	EW-A6	shallow bedrock	10/03/00	10/05/00	Flush	8	47.6	20.6	OPEN	27-47.6	NA	238.70	--	--	1205929	691638
C-5	EW-A7	shallow bedrock	10/05/00	10/11/00	Flush	8	47.4	21.7	OPEN	26-47.4	NA	238.95	--	--	1205951	691711
C-5	EW-A8	shallow bedrock	10/12/00	10/13/00	Flush	8	48.1	19.1	OPEN	29-48.1	NA	238.63	--	--	1205966	691783
D-5	EW-A9	shallow bedrock	12/14/00	01/30/01	Flush	12	59.5	22.5	OPEN	37-59.5	NA	236.78	--	--	1205957.700	691858.600
D-5	EW-A10	shallow bedrock	11/30/00	12/06/00	Flush	8	50.3	16.3	OPEN	34-50.3	NA	236.47	--	--	1205976.000	691935.800
D-5	EW-A11	shallow bedrock	12/01/00	12/06/00	Flush	8	44.6	18.6	OPEN	26-44.6	NA	236.45	--	--	1205993	692010
E-5	EW-A12	shallow bedrock	12/08/00	12/12/00	Flush	8	41.4	21.4	OPEN	20-41.4	NA	236.24	--	--	1206031.100	692077.300
E-5	EW-A13	shallow bedrock	12/07/00	12/11/00	Flush	8	31.8	15.8	OPEN	16-31.8	NA	236.07	--	--	1206042	692133
E-5	EW-A14	shallow bedrock	2/1/0001	02/05/01	Flush	8	34.4	11.4	OPEN	23-34.4	NA	235.95	--	--	1206059	692190
B-5	EW-B1	Intermediate Bedrock	09/06/00	09/13/00	Flush	8	68.9	24.9	OPEN	44-68.9	NA	241.13	--	--	1205833	691275
B-5	EW-B2	Intermediate Bedrock	09/28/00	10/03/00	Flush	8	76.5	28.5	OPEN	48-76.5	NA	239.82	--	--	1205915	691566
D-5	EW-B3	Intermediate Bedrock	01/03/01	01/11/01	Flush	8	84.4	36	OPEN	48.4-84.4	NA	236.74	--	--	1205959	691864
E-5	EW-B4	Intermediate Bedrock	12/18/00	01/03/01	Flush	8	57.1	25.1	OPEN	32-57.1	NA	235.05	--	--	1206043	692137
F-5	EW-B5	Intermediate Bedrock	01/05/01	01/10/01	Flush	8	51.8	15.8	OPEN	36-51.8	NA	235.75	--	--	1206155	692432
G-4	EW-B6	Intermediate Bedrock	01/31/01	02/02/01	Flush	8	66.3	33.8	OPEN	32.5-66.3	NA	236.25	--	--	1206291	692690
	PREATREATMENT PLANT															
Fig 11	MW-OB17	Overburden	05/25/93	05/25/93	Stick-up	2	11	6	0.010	5 - 11	PVC	289.91	--	287.07	1207465.180	693176.950
Fig 11	MW-OB18	Overburden	05/26/93	05/26/93	Stick-up	2	9	5	0.010	4 - 9	PVC	287.69	--	285.00	1207539.460	693627.040
Fig 11	MW-OB19	Overburden	05/25/93	05/25/93	Stick-up	2	10	5	0.010	5 - 10	PVC	287.82	--	284.83	1207461.900	693566.140
Fig 11	MW-OB20	Overburden	12/18/96	12/18/96	Flushmount	2	8.5	4	0.020	4.5 - 8.5	PVC	290.36	--	286.80	1207307.540	693109.010
Fig 11	MW-OB21	Overburden	12/16/96	12/16/96	Flushmount	2	14.5	10	0.020	4.5 - 14.5	PVC	284.03	--	281.53	1207402.100	693730.630

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Installation Date(s)		Flushmount/ Stick-up	Well Diameter (inches)	Installed Depth (ft. bgs)	Screen Length (ft.)	Screen Slot Size (inches)	Screened Interval (ft bgs)	Screen Type	Top of Casing Elevation (ft amsl)	TOC Survey Date	Ground Surface Elevation (ft amsl)	Northing	Easting
Fig 11	MW-OB22	Overburden	12/18/96	12/18/96	Flushmount	2	14	10	0.020	4 - 14	PVC	283.99	--	281.58	1207441.57	693910.97
Fig 11	MW-OB23	Overburden	12/18/96	12/18/96	Flushmount	2	6.5	4	0.020	3 - 6.5	PVC	287.05	--	285.10	1207573.450	693410.210
Fig 11	P-1	Overburden	11/07/91	11/07/91	Stick-up	1	8	5	0.010	3 - 8	PVC	287.73	--	284.68	1207614.310	693295.450
Fig 11	P-3	Overburden	11/13/91	11/13/91	Stick-up	1	8	5	0.010	3 - 8	PVC	287.28	--	285.50	1207541.49	693189.47
Fig 11	P-7	Overburden	11/06/91	11/06/91	Stick-up	1	7	4	0.010	3 - 7	PVC	288.18	1991	285.80	1207476.84	693319.95
Fig 11	P-8	Overburden	11/07/91	11/07/91	Stick-up	1	6	3	0.010	3 - 6	PVC	286.95	1991	284.80	1207493.57	693431.1
Fig 11	P-11	Overburden	11/05/91	11/05/91	Stick-up	1	11	5	0.010	6 - 11	PVC	290.37	--	288.27	1207477.090	693319.640
Fig 11	P-12	Overburden	11/06/91	11/06/91	Stick-up	1	8	5	0.010	3 - 8	PVC	287.91	--	285.43	1207493.650	693431.030
Fig 11	P-14	Overburden	11/21/91	11/21/91	Stick-up	1	8	8	0.010	3 - 8	PVC	287.50	--	285.20	1207368.6	693243.14
Fig 11	P-7R	Overburden	11/06/91	11/06/91	Stick-up	1	7	4	0.010	3 - 7	PVC	288.24	2013	--	1207359.48	693371.25
Fig 11	P-8R	Overburden	11/07/91	11/07/91	Stick-up	1	6	3	0.010	3 - 6	PVC	288.04	2013	--	1207423.36	693520.2
Fig 11	IG-1	Overburden	--	--	stickup	--	--	--	--	--	PVC	288.79	--	285.61	1207497.910	693040.720
Fig 11	IG-2	Overburden	--	--	stickup	--	--	--	--	--	PVC	289.77	--	287.01	1207394.580	693052.900
Fig 11	IG-3R	Overburden	--	--	stickup	--	--	--	--	--	PVC	289.27	--	--	1207310	693154
Fig 11	IG-4	Overburden	--	--	stickup	--	--	--	--	--	PVC	291.74	--	288.41	1207313	693056

Notes:
ft amsl - feet above mean sea level
ft bgs - feet below ground surface
ft btoc - feet below top of well casing
TOC - top of well casing
-- data not available at this time

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Mar-15 Depth to Water (ft)	Mar-15 Well Depth (ft)	Mar-15 Groundwater Elevation (ft amsl)
	MAIN PLANT SITE WELLS				
D-5	AP-1	Overburden	10.40	11.15	229.52
D-5	AP-2	Overburden	15.67	19.65	224.37
D-5	AP-3	Overburden	15.82	19.25	223.87
C-5	AP-4	Overburden	10.45	14.64	230.93
D-5	AP-6	Overburden	23.90	30.28	207.91
D-5	AP-7	Overburden	23.66	28.78	213.2
B-1	AW-A1	shallow bedrock	19.83	55.29	261.27
B-4	AW-A2	shallow bedrock	30.20	NM	218.9
A-5	AW-A3	shallow bedrock	21.99	40.3	222.46
A-5	AW-A4	shallow bedrock	22.18	38.85	216.25
E-4	AW-A6	shallow bedrock	33.58	34.21	212.02
B-5	AW-A7	shallow bedrock	NM	NM	NM
C-5	AW-A8	shallow bedrock	36.92	45.68	205.38
C-5	AW-A9	shallow bedrock	36.56	NM	204.69
C-5	AW-A10	shallow bedrock	34.26	45.38	204.79
D-5	AW-A11	shallow bedrock	41.55	56.25	198.05
E-5	AW-A13	shallow bedrock	19.35	30.8	219.15
E-5	AW-A14	shallow bedrock	17.74	33	219.36
C-4	AW-A15	shallow bedrock	18.30	35.5	228.6
C-3	AW-A16	shallow bedrock	35.43	38.5	235.42
A-4	AW-B1	Intermediate Bedrock	41.09	76.55	218.11
B-4	AW-B2	Intermediate Bedrock	31.53	NM	217.27
A-5	AW-B3	Intermediate Bedrock	28.08	60.37	216.62
E-5	AW-B4	Intermediate Bedrock	34.90	47.85	203.35
A-5	AW-B8	Intermediate Bedrock	36.82	58.45	202.71
B-5	AW-B9	Intermediate Bedrock	43.72	65.3	199.03
C-5	AW-B10	Intermediate Bedrock	46.45	NM	194.3
C-5	AW-B11	Intermediate Bedrock	44.13	58.58	194.52
D-5	AW-B12	Intermediate Bedrock	39.15	58.74	199.85
D-5	AW-B13	Intermediate Bedrock	32.77	55.87	202.13
E-5	AW-B14	Intermediate Bedrock	32.75	46.58	205.35
E-5	AW-B15	Intermediate Bedrock	30.51	44.79	206.24
F-4	AW-B16	Intermediate Bedrock	26.02	47.9	212.28
F-4	AW-B17	Intermediate Bedrock	25.49	47.1	213.21
C-4	AW-B18	Intermediate Bedrock	41.08	54.8	206.22
E-4	AW-B19	Intermediate Bedrock	39.80	52.2	205.95
F-4	AW-B20	Intermediate Bedrock	17.96	31.15	225.69
B-1	AW-C1	Deep Bedrock	36.52	100+	246.98
B-5	AW-C2	Deep Bedrock	50.07	NM	191.03
A-5	AW-C7	Deep Bedrock	79.10	100+	166.21
B-4	AW-C8	Deep Bedrock	57.21	NM	191.89
G-2	AW-C9	Deep Bedrock	45.18	100+	206.42
F-2	AW-C10	Deep Bedrock	51.46	100+	203.49

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Mar-15 Depth to Water (ft)	Mar-15 Well Depth (ft)	Mar-15 Groundwater Elevation (ft amsl)
E-5	AW-C11	Deep Bedrock	41.53	NM	196.92
G-4	BP-1	Overburden	1.40	10.15	237.4
F-4	BP-2	Overburden	8.23	10.3	230.49
F-4	BP-3	Overburden	13.89	17.18	224.52
F-4	BP-4	Overburden	4.65	9.9	235.4
E-5	BP-5	Overburden	9.35	15.72	229.01
F-4	BP-6	Overburden	24.89	24.5	211.85
F-5	BP-7	Overburden	10.73	21.06	219.68
F-5	BP-8	Overburden	18.70	20.75	213.05
E-5	BP-9	Overburden	12.68	18.27	219.84
H-4	CP-1	Overburden	11.16	16.28	225.46
H-4	CP-2	Overburden	8.81	13.3	229.58
H-3	CP-3	Overburden	0.75	10.26	238.06
H-4	CP-5	Overburden	25.68	25.87	209.41
H-4	CP-6	Overburden	20.88	25.78	208.87
D-4	IP-4	Overburden	4.54	12.75	244.86
D-4	IP-5	Overburden	DRY	10.31	NM
E-5	MW-8	shallow bedrock	20.03	49.12	225.97
B-4	MW-9	Overburden	6.38	15.8	239.87
F-2	MW-10B	Intermediate Bedrock	27.29	34.8	227.41
G-1	MW-17C	Deep Bedrock	77.76	100+	209.43
F-1	MW-18	Overburden	3.05	11.75	283.15
B-4	MW-19	shallow bedrock	NM	NM	NM
C-3	MW-20C	Deep Bedrock	73.24	100+	196.01
C-3	MW-20D	Intermediate Bedrock	45.30	60.75	221.6
D-1	MW-23D	Intermediate Bedrock	21.31	NM	262.27
D-1	MW-23S	shallow bedrock	14.50	NM	268.38
D-1	MW-24	Overburden	5.85	NM	277.46
B-5	MW-25D	Intermediate Bedrock	37.42	59.21	204.13
B-5	MW-25S	shallow bedrock	38.13	41.75	203.42
B-5	MW-26	Overburden	10.17	13.02	231.93
B-5	MW-27D	Intermediate Bedrock	43.67	62.65	196.58
B-5	MW-27S	shallow bedrock	27.47	33.95	213.33
B-5	MW-28	Overburden	1.64	11.5	238.56
G-4	MW-30D	Intermediate Bedrock	10.41	44.2	206.69
G-4	MW-30S	Intermediate Bedrock	13.30	33.4	203.5
G-4	MW-31	Overburden	9.15	16.9	208.43
B-3	MW-36C	Deep Bedrock	74.93	100+	191.67
B-3	MW-36D	Intermediate Bedrock	47.66	62.6	218.74
B-3	MW-36S	shallow bedrock	25.30	37	239.55
B-1	MW-40B	Intermediate Bedrock	49.83	55.29	234.72
C-1	MW-OB2	Overburden	18.23	20.59	266.47
B-3	MW-OB5	Overburden	9.32	15	254.38
B-4	MW-OB7	Overburden	10.32	NM	238.88

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Mar-15 Depth to Water (ft)	Mar-15 Well Depth (ft)	Mar-15 Groundwater Elevation (ft amsl)
A-5	MW-OB8	Overburden	DRY	14.8	NM
B-5	MW-OB9	Overburden	4.85	9.05	235.55
F-3	MW-OB13	Overburden	10.41	15	234.09
E-4	MW-OB14	Overburden	11.28	NM	230.37
F-1	MW-OB15	Overburden	NM	NM	NM
G-4	MW-OB16	Overburden	10.54	15.74	229.21
B-1	MW-OB1R	Overburden	DRY	17.51	NM
C-3	MW-OB24	Overburden	17.02	18	253.53
E-5	MW-OB25	Overburden	7.63	11.3	230.82
F-4	MW-OB26	Overburden	12.41	17.74	226.04
H-3	MW-OB27	Overburden	9.32	11.35	229.83
C-1	P-A1	shallow bedrock	13.40	36.71	269.9
A-5	WP-CC-12	Overburden	DRY	19.72	NM
A-4	WP-CC-17	Overburden	14.44	18.02	241.36
A-4	WP-CC-21	Overburden	7.70	13.4	250.14
A-5	WP-O-50	Overburden	11.13	13.41	229.69
D-5	AP-5	Overburden	8.55	12.2	231.47
	EXTRACTION WELLS AND FEATURES				
B-5	EW-A1	shallow bedrock	38.52	44.06	202.49
B-5	EW-A2	shallow bedrock	41.57	46.83	198.67
B-5	EW-A3	shallow bedrock	39.58	44.98	200.95
B-5	EW-A4	shallow bedrock	38.68	45.78	201.77
B-5	EW-A5	shallow bedrock	41.24	46.37	198.62
C-5	EW-A6	shallow bedrock	36.30	44.95	202.4
C-5	EW-A7	shallow bedrock	34.79	46.06	204.16
C-5	EW-A8	shallow bedrock	40.58	46.51	198.05
D-5	EW-A9	shallow bedrock	48.83	NM	187.95
D-5	EW-A10	shallow bedrock	41.37	46.93	195.1
D-5	EW-A11	shallow bedrock	34.00	55.9	202.45
E-5	EW-A12	shallow bedrock	26.65	40.35	209.59
E-5	EW-A13	shallow bedrock	24.40	29.4	211.67
E-5	EW-A14	shallow bedrock	24.90	29.12	211.05
B-5	EW-B1	Intermediate Bedrock	42.02	68.85	199.11
B-5	EW-B2	Intermediate Bedrock	60.04	75.31	179.78
D-5	EW-B3	Intermediate Bedrock	68.50	NM	168.24
E-5	EW-B4	Intermediate Bedrock	47.80	55.18	187.25
F-5	EW-B5	Intermediate Bedrock	43.05	53.9	192.7
G-4	EW-B6	Intermediate Bedrock	43.88	64.1	192.37
	PREATREATMENT PLANT				
Fig 11	MW-OB17	Overburden	6.77	13.55	283.14
Fig 11	MW-OB18	Overburden	8.65	12.15	279.04
Fig 11	MW-OB19	Overburden	7.44	11.8	280.38
Fig 11	MW-OB20	Overburden	--	--	--
Fig 11	MW-OB21	Overburden	NM	NM	NM

Table 7 - Well Construction and Recent Gauging Details

Well MAP Grid ID	Well ID	Horizon	Mar-15 Depth to Water (ft)	Mar-15 Well Depth (ft)	Mar-15 Groundwater Elevation (ft amsl)
Fig 11	MW-OB22	Overburden	9.32	13.42	274.67
Fig 11	MW-OB23	Overburden	4.02	8.5	283.03
Fig 11	P-1	Overburden	4.14	11	283.59
Fig 11	P-3	Overburden	3.75	9.68	283.53
Fig 11	P-7	Overburden	--	--	--
Fig 11	P-8	Overburden	--	--	--
Fig 11	P-11	Overburden	7.07	13.1	283.3
Fig 11	P-12	Overburden	5.45	10.55	282.46
Fig 11	P-14	Overburden	6.51	10.29	280.99
Fig 11	P-7R	Overburden	4.41	NM	283.83
Fig 11	P-8R	Overburden	3.13	NM	284.91
Fig 11	IG-1	Overburden	5.46	8.54	283.33
Fig 11	IG-2	Overburden	7.16	11.51	282.61
Fig 11	IG-3R	Overburden	7.71	17.25	281.56
Fig 11	IG-4	Overburden	11.07	11.57	280.67

Notes:

ft amsl - feet above mean sea level

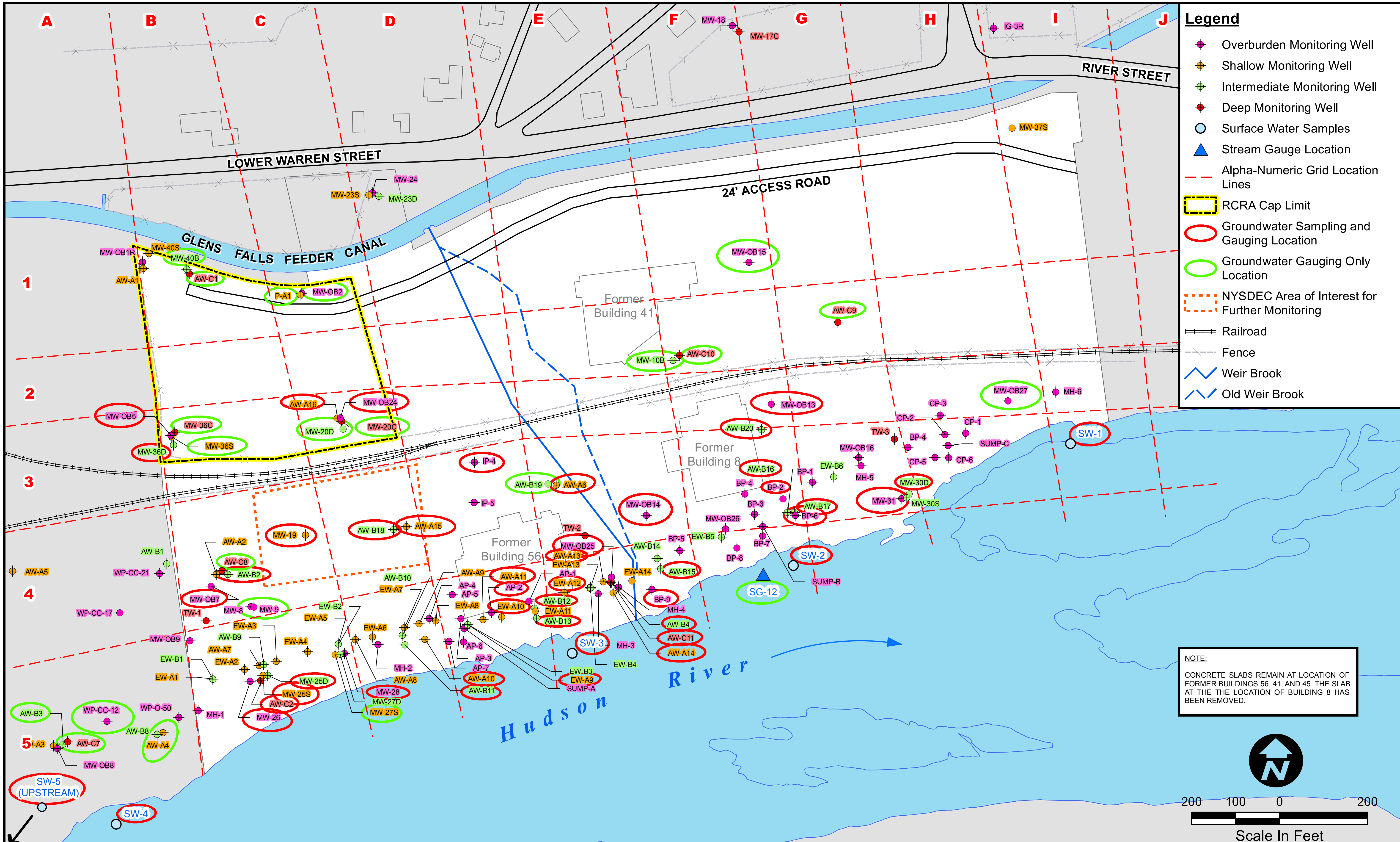
ft bgs - feet below ground surface

ft btoc - feet below top of well casing

TOC - top of well casing

-- data not available at this time

FIGURES



EHS Support *consider it done*

ASHLAND
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

FOCUSED SAMPLING EVENT MONITORING LOCATIONS

Figure 1

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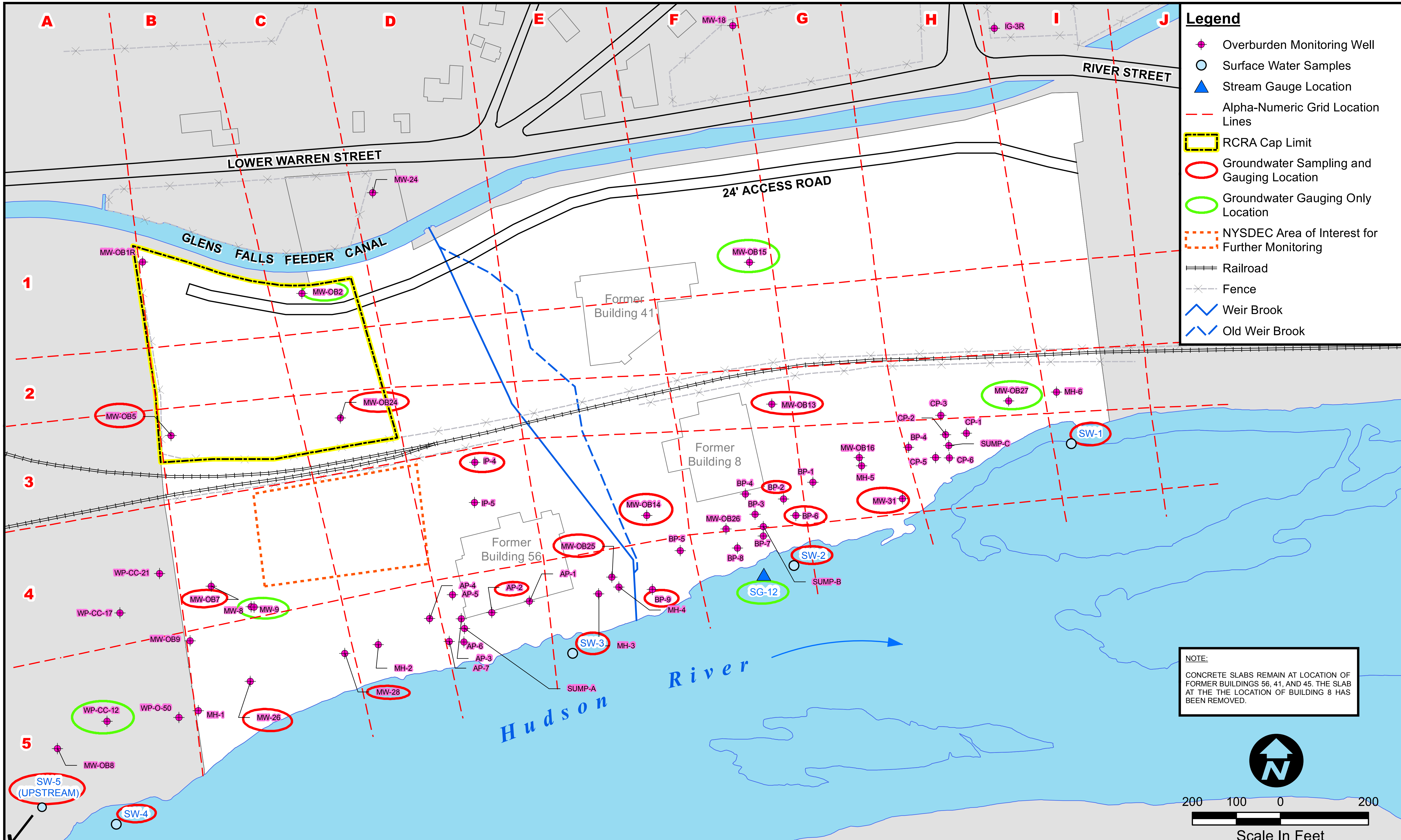

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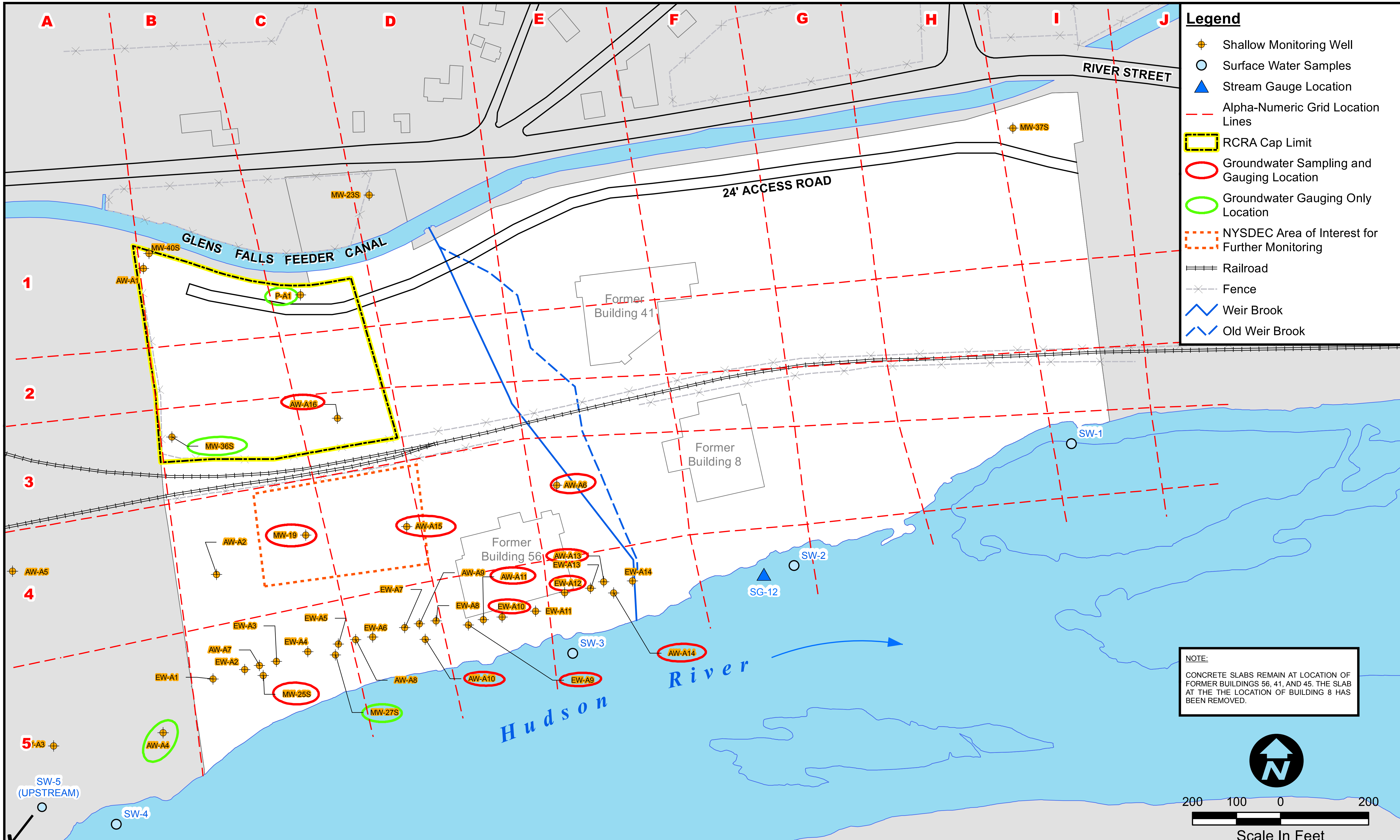
ASHLAND
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

FOCUSED SAMPLING EVENT - OVERBURDEN GROUNDWATER MONITORING LOCATIONS

Figure 2



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FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

FOCUSED SAMPLING EVENT - SHALLOW GROUNDWATER MONITORING LOCATIONS

Figure 3

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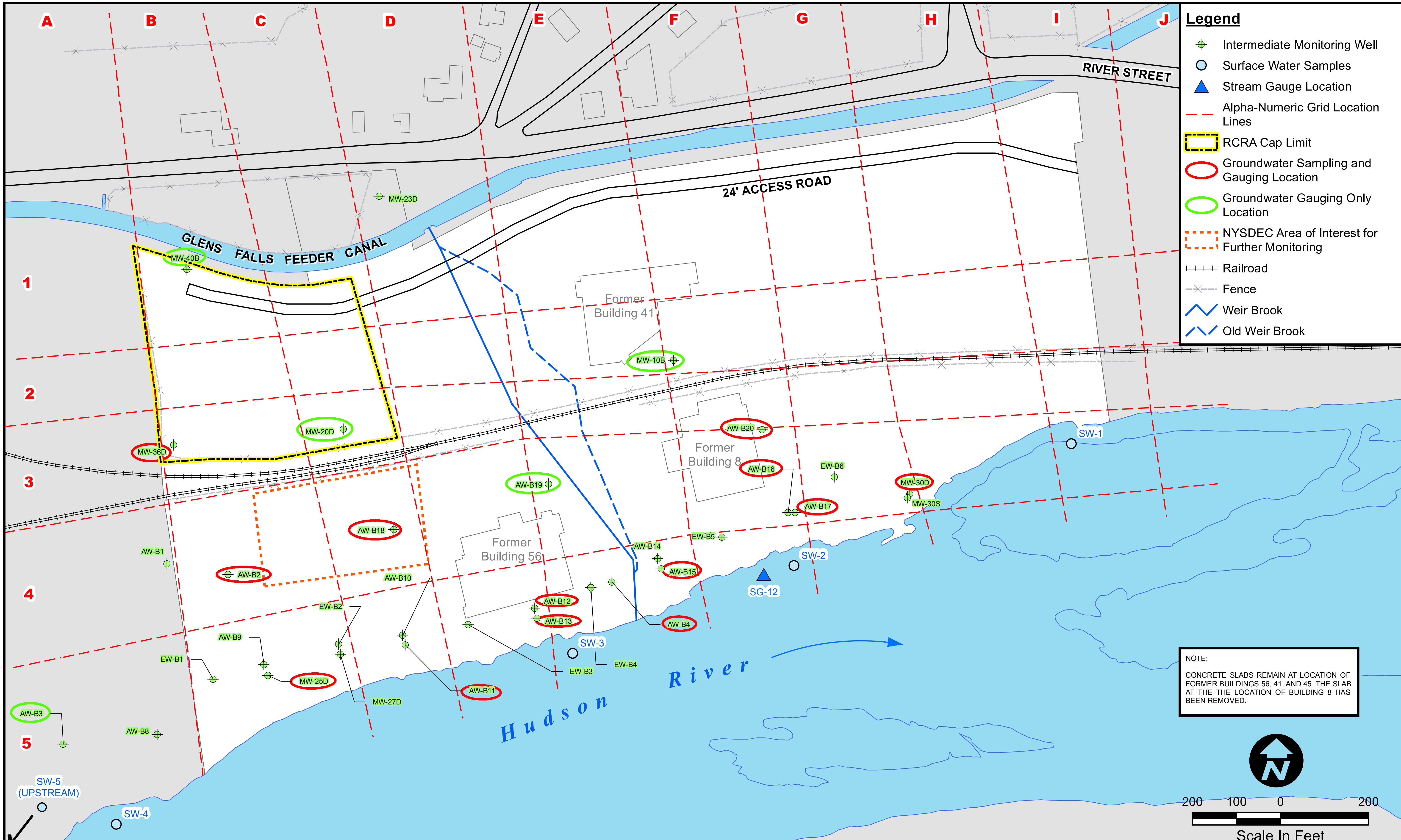

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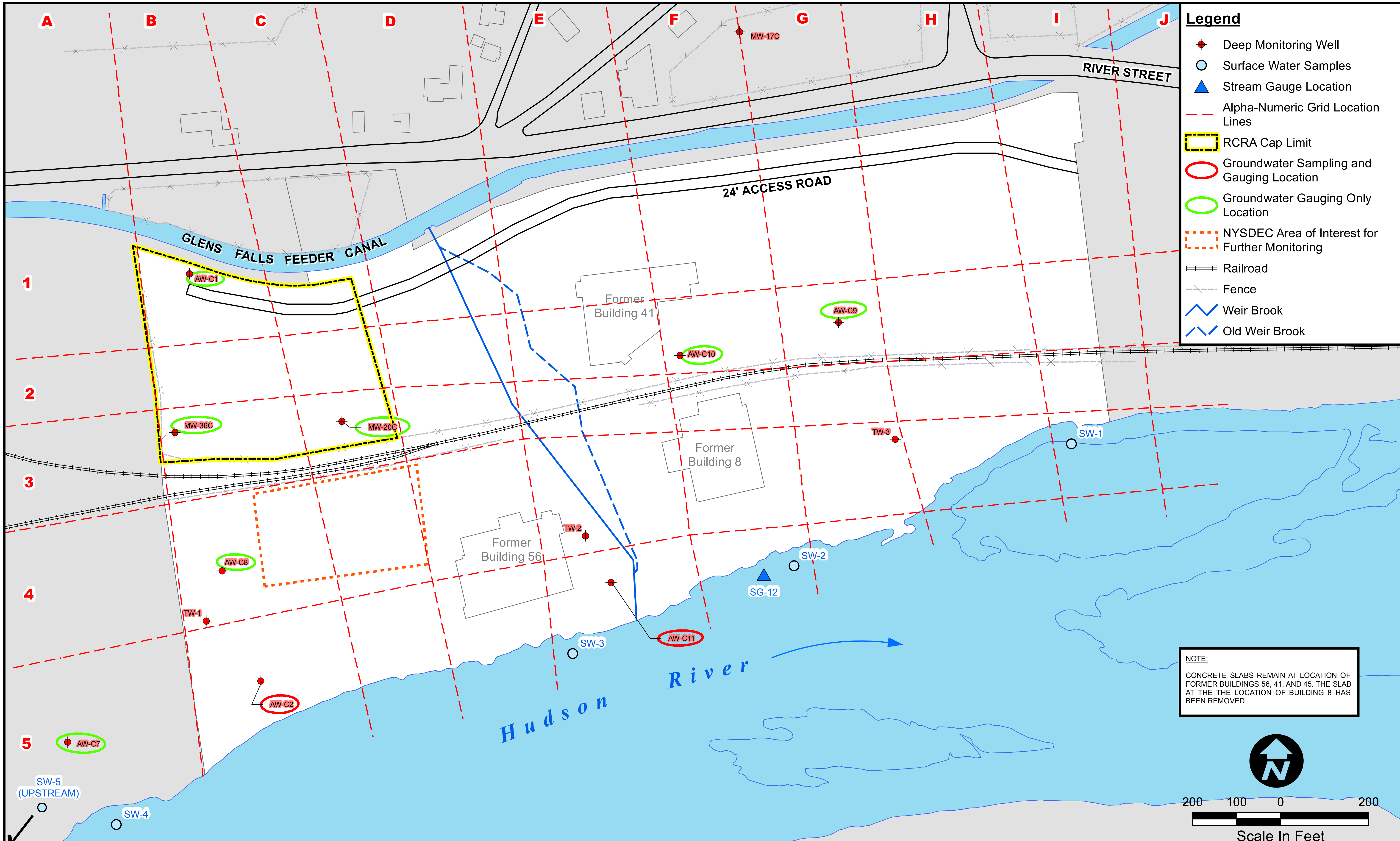
ASHLAND
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

FOCUSED SAMPLING EVENT - INTERMEDIATE GROUNDWATER MONITORING LOCATIONS

Figure 4



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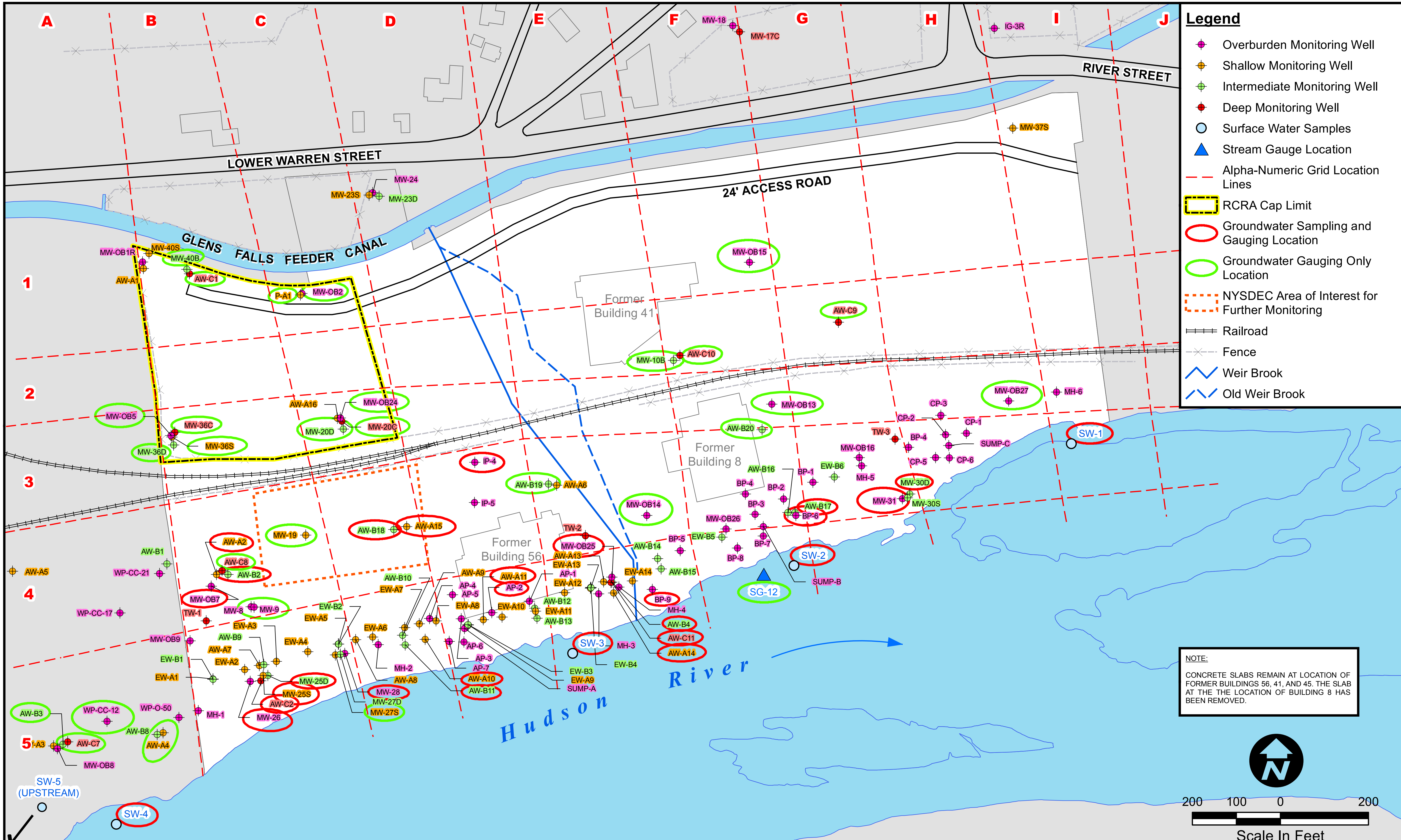
GLENS FALLS, NY

FOCUSED SAMPLING EVENT - DEEP GROUNDWATER MONITORING LOCATIONS

Figure 5



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FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

SEMI-ANNUAL EVENT MONITORING LOCATIONS

Figure 6

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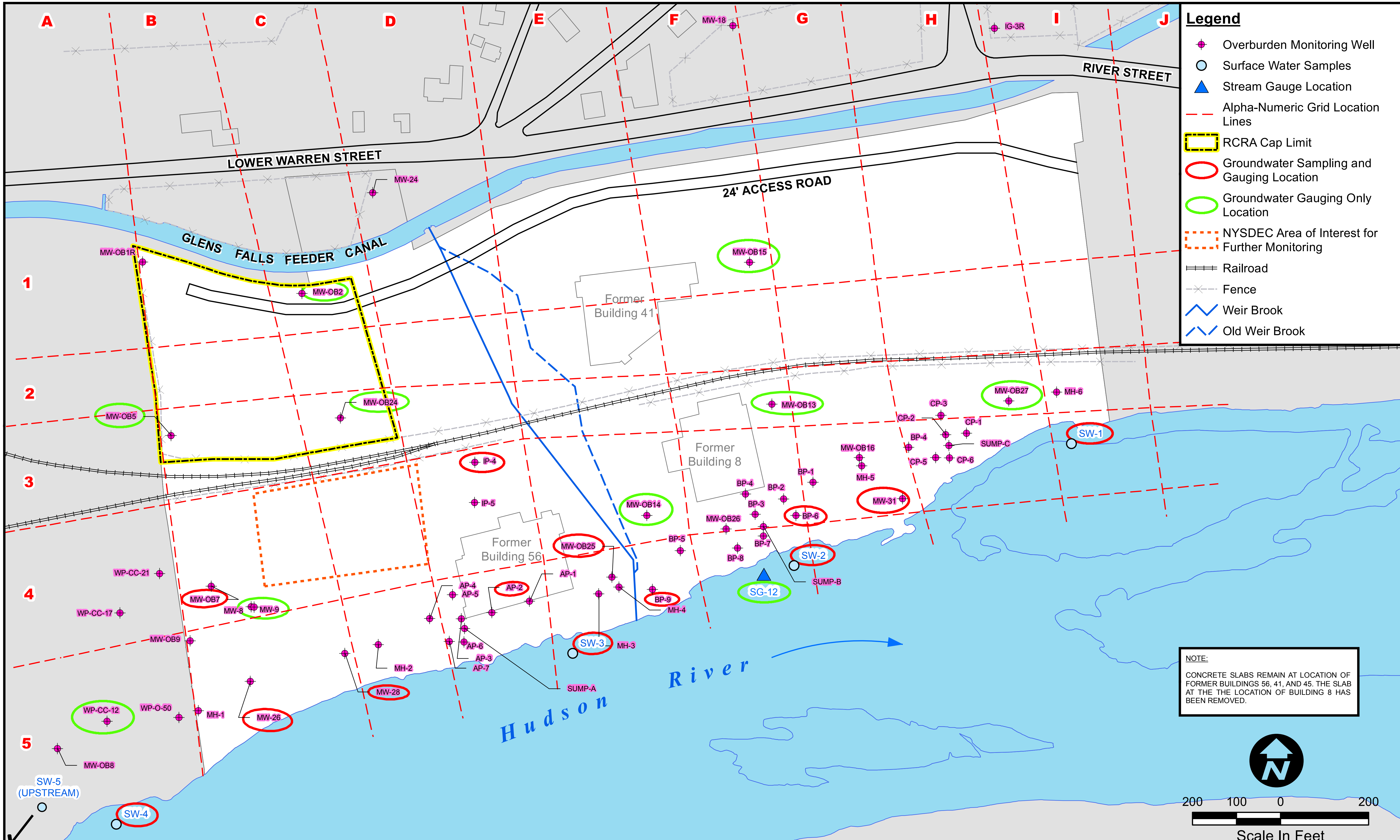

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ASHLAND
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

SEMI-ANNUAL EVENT - OVERBURDEN GROUNDWATER MONITORING LOCATIONS

Figure 7

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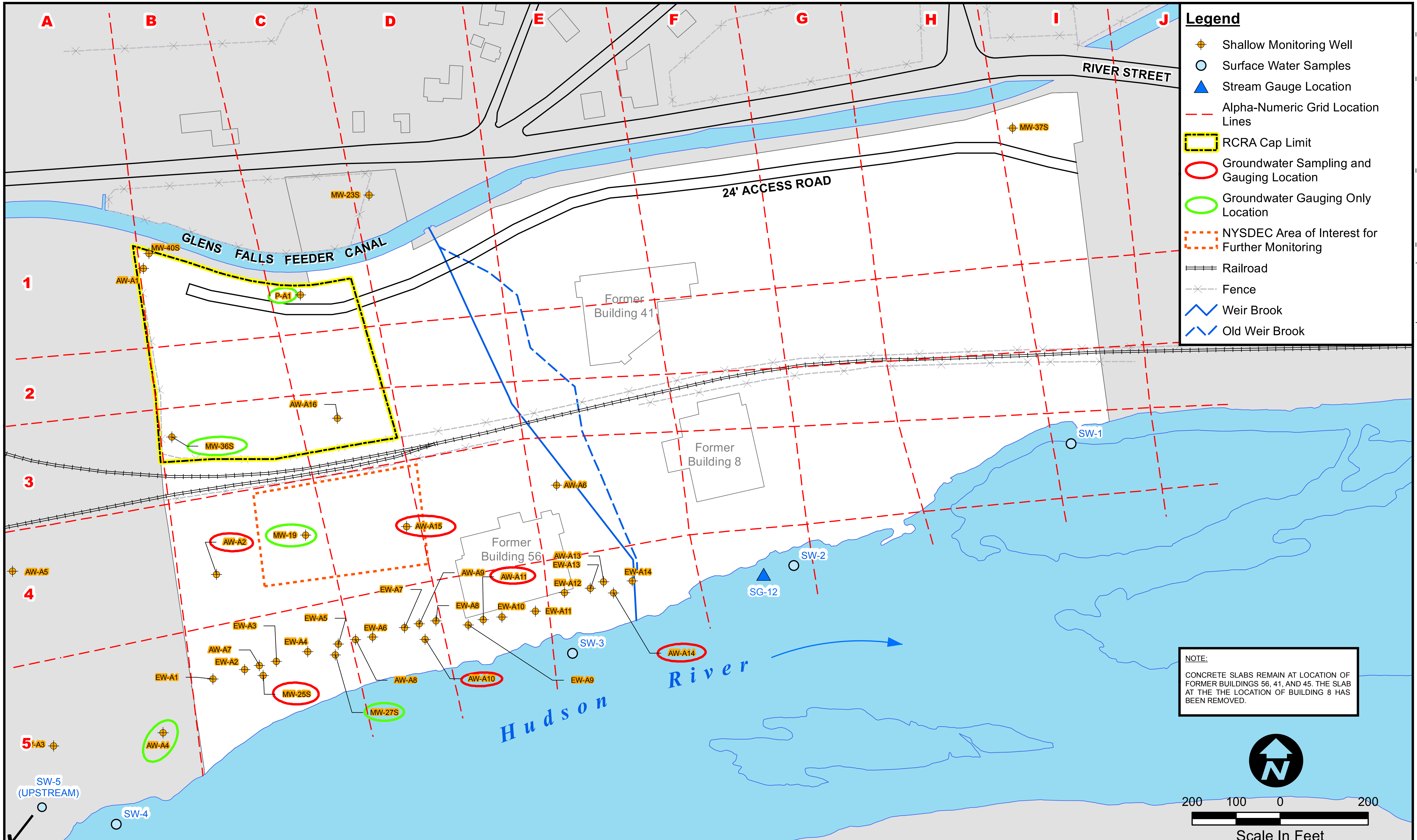

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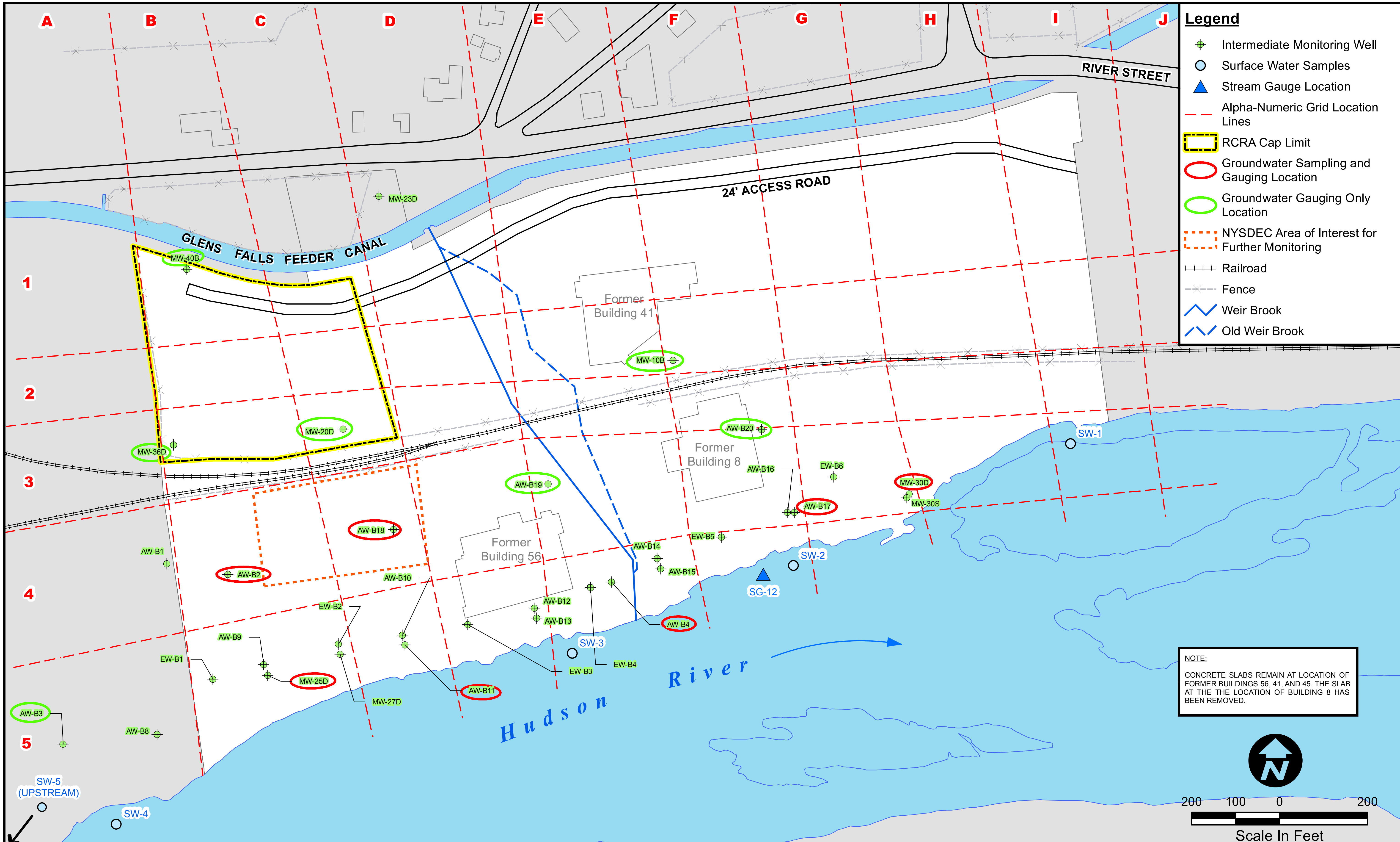
ASHLAND
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

SEMI-ANNUAL EVENT - SHALLOW GROUNDWATER MONITORING LOCATIONS

Figure 8



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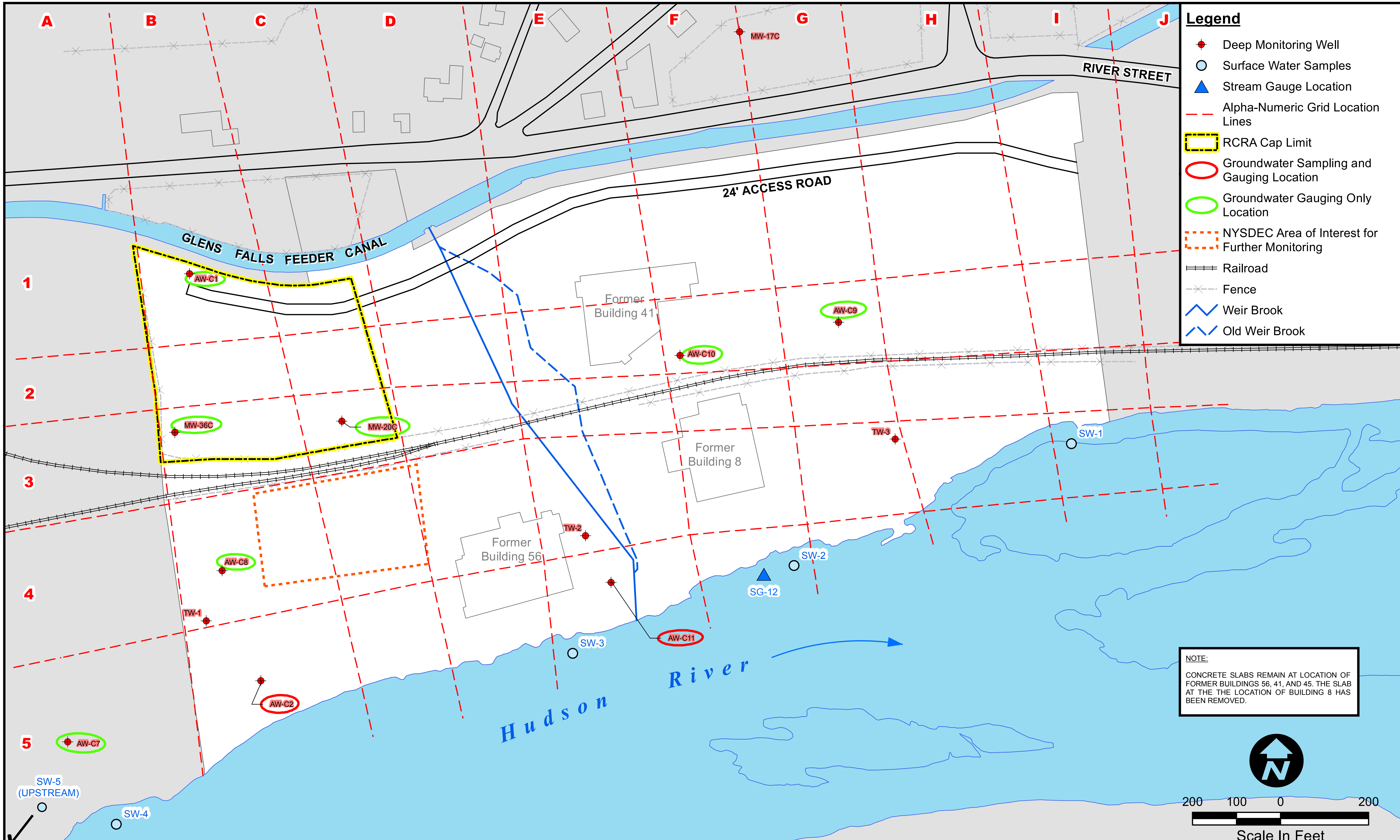
FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

SEMI-ANNUAL EVENT - INTERMEDIATE GROUNDWATER MONITORING LOCATIONS

Figure 9



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GLENS FALLS, NY

SEMI-ANNUAL EVENT - DEEP GROUNDWATER MONITORING LOCATIONS

Figure 10

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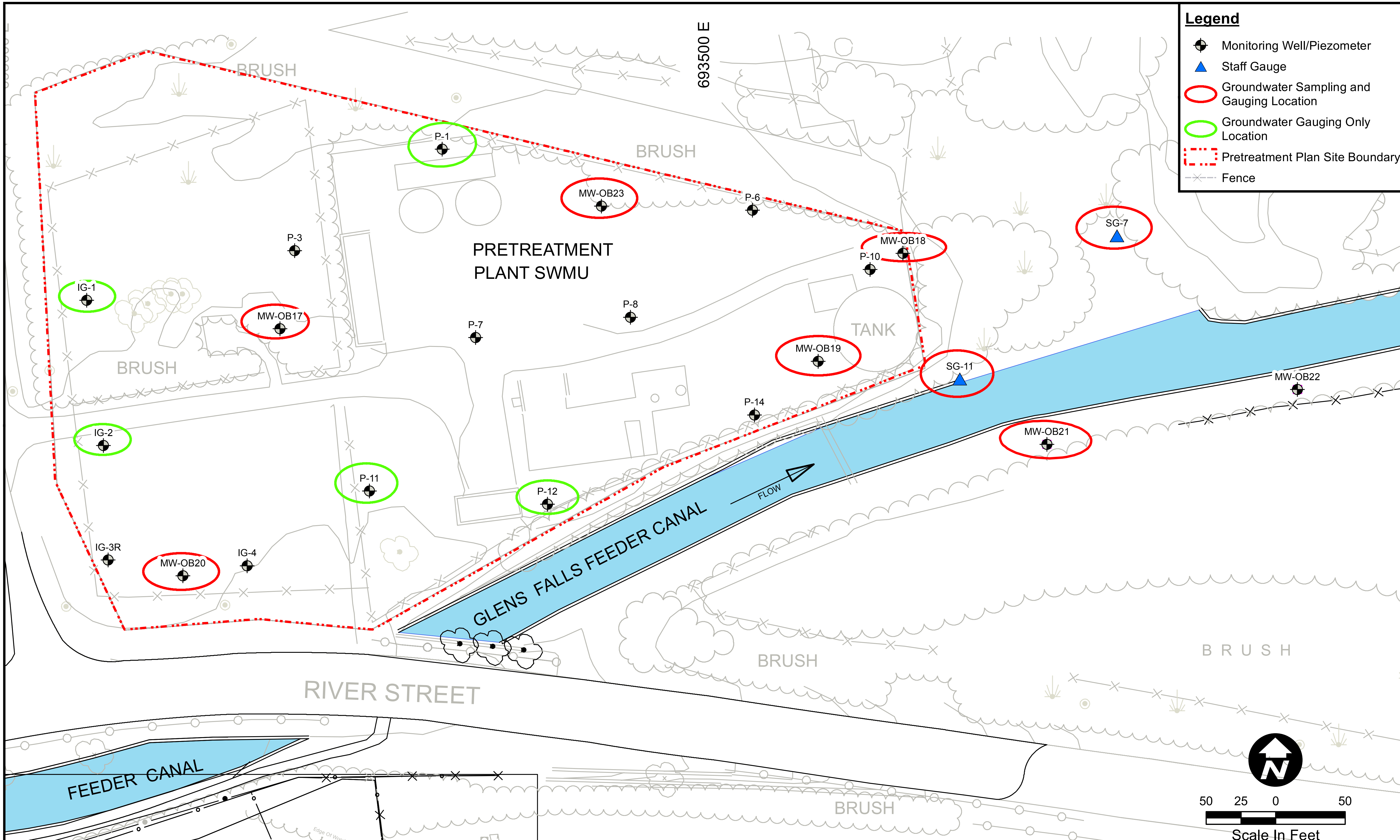

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GLENS FALLS, NY

PRETREATMENT PLANT ANNUAL EVENT MONITORING LOCATIONS

FIGURE 11