Groundwater and Surface Water Monitoring Plan

Ciba-Geigy/Hercules Site - NYSDEC Site #557011

Glens Falls, NY

Prepared for:

HERCULES

Prepared by:

EHS Support

May 2021

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Acronyms

µg/L	micrograms per liter
µm	micrometer
bgs	below ground surface
COC	constituent of concern
CSM	Conceptual Site Model
DER	Division of Environmental Remediation
DI	deionized
DO	dissolved oxygen
EC	engineering control
EPS	effluent pumping station
GPS	global positioning system
GSMP	Groundwater and Surface Water Monitoring Plan
GWES	groundwater extraction system
HWM	Hazardous Waste Management
IC	institutional control
IDW	investigation-derived waste
mg/L	milligrams per liter
MPS	Main Plant Site
mS/cm	milliSiemens per centimeter
MS/MSD	matrix spike/matrix spike duplicate
mV	millivolt
NTU	nephelometric turbidity unit
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORP	oxidation-reduction potential
PCP	Post-Closure Plan
POTW	publicly owned treatment works
PPE	personal protective equipment
PTP	Pretreatment Plant
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SB	Statement of Basis
SWQC	surface water quality criteria
TDS	total dissolved solids
TOC	top of casing

TOGS	Technical and Operational Guidance Series
USDOT	United States Department of Transportation
VOC	volatile organic compound
WAD	weak acid dissociable

1 Introduction

On behalf of Hercules Incorporated ("Hercules"; previously acquired by Ashland LLC) and CIBA Corporation ("CIBA") (previously acquired by BASF Corporation), EHS Support LLC ("EHS Support") has prepared this Groundwater and Surface Water Monitoring Plan (GSMP) for groundwater and surface water sample collection and well decommissioning activities associated with the former Ciba-Geigy Corporation pigments manufacturing facility located at 89 Lower Warren Street in the Town of Queensbury near Glens Falls, New York ("the Site"; **Figure 1**). This GSMP was prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) *DER-10 / Technical Guidance for Site Investigation and Remediation*, issued May 3, 2010 (NYSDEC, 2010) and 6 New York Codes, Rules and Regulations (NYCRR) Part 375 Environmental Remediation Programs, effective December 14, 2006 (NYSDEC, 2006).

1.1 Background

Corrective measure operations, maintenance, and monitoring are conducted for the Site under an NYSDEC Hazardous Waste Management (HWM) Post Closure Permit (NYSDEC Site No. 557011). A renewal of the Part 373 HWM Permit #5-5234-00008/00096 was issued by NYSDEC on March 5, 2015. Hercules and CIBA ("the Parties") are the permittees and share responsibility for ongoing environmental activities at the Site.

After the implementation of corrective measures, some contamination was left at the Site, which is hereafter referred to as "remaining contamination." Institutional controls and engineering controls (ICs and ECs) have been incorporated into the remedy to control exposure to the remaining contamination.

Additionally, an active groundwater remedy is in place at the Site that consists of a groundwater extraction system (GWES). Details related to the GWES operation are provided in the *Revised Remedy Optimization Report* (EHS Support, 2019a).

This GSMP details the groundwater and surface water sampling that will be performed as part of post-closure monitoring, to ensure that the remaining contamination does not pose a risk to public health or the environment.

1.2 Objectives

The objectives of the groundwater and surface water monitoring program are:

- Conduct groundwater and surface water elevation monitoring to assess hydraulic conditions, including performance of GWES operations.
- Implement low flow sampling to provide high-quality groundwater samples for the assessment of monitored parameter concentrations against water quality criteria and GWES performance goals and to assess trends in concentrations over time.
- Compare the concentrations of key Site constituents detected in groundwater to Class GA groundwater quality standards protective of fresh groundwater for drinking water sources. Comparison of groundwater data to GA standards is for reference only. Groundwater on-site is not used and use of on-site groundwater for any purpose is precluded (pursuant to the Deed Notice filed with Warren County).

- Conduct surface water sampling in the Hudson River near the Main Plant Site (MPS) to:
    - Assess the potential presence of monitored constituents from possible upstream sources.
    - Demonstrate that potential constituent mass flux from the Site is not leading to exceedances of NYSDEC surface water quality standards.
- Conduct surface water sampling for free cyanide in the Glens Falls Feeder Canal (Feeder Canal) to confirm that cyanide impacts in groundwater at the Pretreatment Plant Area (PTP Area) property are not leading to an exceedance of the applicable NYSDEC surface water quality standard.

The surface water and groundwater quality standards and guidance values referenced for this project are those in Table 1 of 6 NYCRR 703.5 (NYSDEC, 2020) and NYSDEC Technical and Operational Guidance Series (TOGS 1.1.1) (NYSDEC, 1998). The referenced surface water quality criteria (SWQC) are those published for Class C waters, selected based on New York's classification of the Hudson River in the Site vicinity as "Class C" water, including standards/guidance values for protection of human health (based on water supply or fish consumption) and protection of aquatic life from chronic and acute effects (designated as A[C] and A[A], respectively).

2 Environmental Setting

2.1 Site Geology

The unconsolidated and consolidated lithologies beneath the Site consist of glaciolacustrine and fluvial sediments (overburden) and underlying limestone bedrock. The overburden is a combination of industrial fill and fluvial/glaciolacustrine sands (with some silt and clay), with glaciolacustrine clay (and locally glacial till) at its base.

The bedrock is primarily limestone comprising three geologic formations: Glens Falls Limestone, Isle La Motte Formation (predominantly limestone), and Fort Ann Formation (predominantly calcitic dolostone or dolomitic limestone). The limestone bedrock can be characterized as massive, with limited to no intergranular porosity and with groundwater movement concentrated in fracture (secondary) porosity.

The historical structural forces that have acted upon the regional geology in the study area have created an enhanced secondary porosity of the limestone rock in the form of joints and fractures. Structural fractures formed parallel to bedding planes. The sub-horizontal bedding plane fractures are typically the main contributor to active groundwater flow through secondary porosity development. The more open and continuous these features are, the greater the influence they have on groundwater flow direction. Sub-vertical fractures may influence localized groundwater flow. High-angle joints, which formed almost 90 degrees to the bedding planes, also occur and are mostly mineralized; and hydraulic conductivity associated with these features is likely to be low. Relief of lithostatic load due to erosion during uplift (including isostatic uplift following glaciation) is likely to have been a significant contributor to the opening of horizontal or low-angle bedding fractures to form the water-bearing zones.

2.2 Main Plant Site

2.2.1 Summary of Conceptual Site Model

Historical pigment manufacturing operations at the MPS led to releases of constituents to soil and groundwater, with the primary constituents of concern (COCs) being hexavalent chromium and cyanide. The following is a summary of the hydrogeologic setting and contaminant fate and transport at the MPS. Details regarding these topics were most recently presented in the following reports:

- *Site Conceptualization and Groundwater Corrective Measures Effectiveness Evaluation Report* (EHS Support, 2015)
- *Remedy Optimization Plan* (EHS Support, 2016b)
- *Revised Remedy Optimization Report* (EHS Support, 2019a)

The MPS lies on the bank of the Hudson River. Four groundwater units have been characterized at the Site, with groundwater flow in the limestone bedrock controlled primarily by three zones of open, sub-horizontal, bedding-parallel fracture networks. The four groundwater units are listed below, from shallow to deep:

- *Overburden*: unconsolidated sediments
- *Horizon A (shallow)*: limestone – occurring approximately 40 feet below ground surface (bgs)
- *Horizon B (intermediate):* limestone – Horizon B fracture zone occurs approximately 60 feet bgs
- *Horizon C (deep):* limestone – occurring approximately 160 feet bgs

The bedding plane fracture zones generally become shallower towards the east, with Horizons A and B likely intersecting the top of the bedrock surface in the central and eastern parts of the MPS.

The groundwater flow within the four units is described as follows.

- *Overburden*: Groundwater flow in the overburden is to the south towards the Hudson River, with groundwater likely to discharge to the river under natural (pre-remediation) conditions. The overburden material (native lacustrine sediments, till, and fill) is variably saturated. The Overburden water-bearing zone includes the saturated portions of the fill and lacustrine sands and silts situated above the lacustrine clay unit (and local underlying till) or, where the clay unit is absent, above the bedrock surface. The water-bearing zone is locally thin and discontinuous, with unsaturated areas occurring near the Hudson River. The extent and/or existence of these areas varies with seasonal fluctuations in the groundwater table elevation.
- *Horizon A (shallow)*: Groundwater flow within Horizon A is generally in a southerly direction towards the Hudson River.
- *Horizon B (intermediate)*: Groundwater flow within Horizon B is generally in a southerly direction, with groundwater elevations below the elevation of the Hudson River.
- *Horizon C (deep)*: Horizon C groundwater elevations are below the elevation of the Hudson River, with groundwater flow generally to the west-southwest across the Site. There is a possibility that local dewatering of a quarry located southwest of the Site (on the south side of the Hudson River) may influence the direction of groundwater flow within Horizon C.

Groundwater flow is predominantly to the south, except where overburden groundwater is intercepted by the French Drain system, which is part of the GWES. Based on the data, the French Drain operations influence the groundwater gradient and achieve extraction and capture of overburden groundwater in the vicinity of former Buildings 56 and 8.

The vicinity of the former Buildings 56 and 8, referred to as the Central Area, are where the concentrations of hexavalent chromium and cyanide remain the highest in groundwater. Groundwater concentrations above GA standards are limited to the areas of the Site where the GWES (consisting of overburden French Drain Sumps A and B and intermediate bedrock extraction well EW-B5) continue to operate. Groundwater on-site is not used, and usage is precluded via IC (Deed Notice).

Figure 2 illustrates the alignment of the French Drain and the location of well EW-B5, as well as the locations of the monitoring wells currently present at the MPS.

2.2.2 Metals and Cyanide Speciation and Mobility

In 2015, the Parties performed an assessment of the potential fate and transport mechanisms and speciation of metals and cyanide in groundwater (EHS Support, 2016a). The assessment supported the use of filtered groundwater and surface water samples (utilizing 0.45 µm filters) for ongoing routine monitoring activities at the Site.

The additional sampling and analytical testing were completed in 2015 to assess the form and phase of metals and cyanide in groundwater in the Overburden Horizon. The scope entailed filtering groundwater with sequential size filters (1.0, 0.45 and 0.1 µm sizes) to explore the potential for metal species (particularly chromium) and non-metal species (total and weak acid dissociable [WAD] cyanide species) to be present in groundwater in association with colloids of varying sizes. Traditionally, metals are analyzed as 'total' in unfiltered samples or 'dissolved' in filtered samples using 0.45 µm filters. A total metal concentration is representative of the entire mass of the metal in the sample and the dissolved fraction is representative of the mass fraction that has a higher potential for mobility, i.e., the fraction less than 0.45 µm in size. For a more detailed view of fate and transport of metals in groundwater, additional filtered samples were collected using 1.0 and 0.1 µm filters and analyzed to evaluate potential colloidal and dissolved phase concentrations of constituents.

Based on the results of total and dissolved sample analysis for metals (cadmium, chromium, lead, mercury, and vanadium), dissolved metals (where detected) in groundwater, with the exception of chromium and vanadium, were lower than total metals concentrations indicating that mobility is low for these constituents. Vanadium appears to be dominated by the dissolved species, which is expected to be mobile. These data indicate that cadmium, lead, and mercury (where detected) are present in large size colloids and not mobile in groundwater at the site. Cyanide is present in groundwater; however, the potential concentrations of WAD and free cyanide are generally low (comprising less than 10% of the total concentration), and under the site conditions (neutral to alkaline pH) WAD and free cyanide are unlikely to form. Chromium speciation is discussed further below.

Overall, where hexavalent chromium was detected, hexavalent chromium comprised all or nearly all of the chromium detected. This data supports the Conceptual Site Model (CSM) geochemical assessment findings that hexavalent chromium is present as soluble ions and is not precipitating and forming colloids (EHS Support, 2015). With the exception of well MW-OB34, the groundwater analytical results support the CSM finding that trivalent chromium at the site is present as primarily insoluble species and within colloid sizes unlikely to be mobile.

Turbidity levels were significantly lower in samples collected in 2015 compared to historical data with few exceptions. Elevated turbidity levels are associated with suspended solids. Metals adsorbed to suspended solids potentially have a lower mobility in groundwater than dissolved metals species, thus results from previous monitoring events (prior to 2015) likely overestimated the concentrations of metals that are mobile in groundwater at the site. Based on analysis of total and filtered samples, sampling using low flow techniques and 0.45 µm filters was deemed effective for evaluating the potential presence of dissolved phase metals in groundwater and subsequently approved by the NYSDEC for routine monitoring activities.

2.2.3 Recent Sampling Results

Analytical results for the Hudson River surface water samples show that concentrations are below applicable surface water quality standards. These results are consistent with the Conceptual Site Model, which indicates that attenuation processes are occurring on-site and within the hyporheic zone prior to discharge to the river, such that the potential flux of constituents from groundwater to the river is not sufficient to result in an exceedance of surface water quality standards.

The long-term trend at the MPS has been an overall decline in groundwater concentrations since the Corrective Measures were implemented in 2003. For example, the magnitude of the concentrations of constituents of interest in overburden groundwater at the historical source area well MW-OB14 (see **Figure 2** for well location) are one to two orders of magnitude lower than when sampling began in the early 1990s.

As detailed in the most recent *Groundwater and Surface Water Monitoring Report for the MPS* (EHS Support, 2021a) remaining GA standard exceedances for hexavalent chromium and cyanide are primarily focused in the Central Area of the MPS, including at overburden well MW-OB14; riverbank overburden wells (MW-OB30 through MW-OB34); the active intermediate bedrock extraction well EW-B5; and deep bedrock well AW-C11 (Horizon C). Multiple lines of evidence demonstrate that these concentrations are not adversely impacting surface water quality (EHS Support, 2019a), and groundwater usage is precluded via IC (Deed Notice).

2.3 Pretreatment Plant Area

2.3.1 Summary of Conceptual Site Model

The PTP Area is a property located to the north of the MPS and is the parcel where operational wastewater was treated during the period of historical operations at the MPS. Groundwater and surface water sampling have been conducted at the PTP Area since the mid-1990s, beginning with the Resource Conservation and Recovery Act (RCRA) Facility Investigation (Eckenfelder, 1992; Eckenfelder, 1993; Eckenfelder, 1994). Based on the historical investigations and monitoring data, only cyanide has been detected in overburden groundwater above NYSDEC GA standards. Cyanide concentrations in groundwater have declined significantly over time, and concentrations above the GA standard are limited to the eastern area of the property.

Bordering the PTP Area property are the Feeder Canal (located to the south) and a marsh area (located to the east). Groundwater generally flows to the east across the PTP Area property, with localized southerly flow in the southwest corner of the property. Shallow groundwater (overburden) is perched, occurring in the thin saturated zone above the lacustrine clay, and lateral groundwater flow is influenced by the configuration and undulations of the surface of the lacustrine clay beneath the property.

As described in the 1994 RFI (Eckenfelder, 1994), "*…the surface of the lacustrine clay unit dips to elevations below the base of the Feeder Canal east of the Pretreatment Plant beneath the marsh area. Thus, groundwater flowing toward the stream and marsh can either discharge to the surface water and eventually flow to the Feeder Canal, or flow under the canal."*

As further described in the 1996 Statement of Basis (SB) (NYSDEC, 1996), *"…the results from the temporary well points along the south side of the canal support the hydrogeologic model of the site. Here groundwater above the clay was absent from the area around the pipe bridge over the canal and to the west. Concentrations of cyanide were detected in the temporary well points installed further to the east indicating that the groundwater was passing beneath the canal in this area*."

2.3.2 Recent Sampling Results

As detailed in the most recent annual *Groundwater and Surface Water Monitoring Report for the PTP Area* (EHS Support, 2020), concentrations of cyanide in groundwater declined following cessation of the historical operations and have been stable to declining for more than a decade. Central area well MW-OB23 continues to have the highest concentration of cyanide detected at the property; however, Mann-Kendall calculations performed for this well demonstrate a declining trend in cyanide concentrations over the past 20 years.

Groundwater sampling data further demonstrates that cyanide concentrations detected in groundwater at the PTP Area property boundary and downgradient of the property have been below the GA standard of 200 micrograms per liter (µg/L) for at least a decade, including:

- MW-OB18 since 2002 (eastern property line)
- MW-OB21 since 2010 (off-Property, south of the Feeder Canal)
- MW-OB22 since 2006 (off-Property, south of the Feeder Canal)

It is noted that comparison of groundwater data to the GA standard is for reference, per DER-10 Guidelines (NYSDEC, 2010). The GA standard was established for the protection of fresh groundwater use as a drinking water source. However, groundwater on-site is not in use, and the use of groundwater for any purpose is precluded (pursuant to the Deed Notice filed with Warren County).

Free cyanide concentrations in surface water samples collected from within the Feeder Canal to the south and the marsh area to the east have routinely been in compliance with the applicable NYSDEC surface water criterion.

3 Monitoring Locations and Sample Analytes

The Site monitoring program is comprised of sampling activities on a semi-annual basis at the MPS (in the spring and fall) and on an annual basis at the PTP (in the fall). Each event includes the collection and analysis of groundwater samples and the gauging of groundwater levels at the sampled wells. The fall events also include the sampling and analysis of surface water samples adjacent to the Site, as well as gauging at a broader network of MPS monitoring wells representing each groundwater horizon (overburden, Horizon A, Horizon B, and Horizon C).

The sampling and analytical programs are summarized in **Table 1** and **Table 2,** and well construction details are provided in **Table 3**.

The locations of monitoring wells and surface water samples included in the monitoring program at the MPS are illustrated on **Figure 2** through **Figure 4**. **Figure 5** illustrates the locations of the monitoring wells and the surface water location that are included in the monitoring program at the PTP Area.

The basis for selection of the monitoring networks and analysis schedules for the MPS and PTP are discussed below. Details regarding field sampling methodologies and laboratory analytical methods are discussed in **Section 4**. Details regarding quality assurance (QA) and quality control (QC) measures, data quality objectives, data validation, and electronica data deliverables are provided in the *Quality Assurance Project Plan* for this Site (EHS Support, 2021b).

The monitoring network and analysis schedule may be modified based on the results of samples and measurements collected over time. Any change to the program will be proposed in writing to NYSDEC, with any reduction in monitoring frequency or scope subject to approval prior to implementing the change.

3.1 Fall Monitoring Program

3.1.1 Main Plant Site

The comprehensive monitoring events conducted at the MPS each fall include the sampling of wells in each area of the MPS (Western, Central, and Eastern) and in each groundwater horizon (overburden, Horizon A, Horizon B, and Horizon C), for the Site COCs in order to demonstrate current conditions and trends in water quality. Fall monitoring events also include water level gauging at a broader network of monitoring wells to support preparation of potentiometric surface maps and to support the evaluation of GWES performance. Finally, fall monitoring events at the MPS include sampling surface water in the Hudson River at locations upstream, adjacent to, and downstream of the MPS.

The sampling locations cover the following areas:

- Downgradient of the RCRA cap and historical waste handling/fill areas in 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 the Central Area of the Site)
- Shallow groundwater in the Eastern Area of the Site where French Drain Sump C is no longer operated, per the NYSDEC-approved Remedy Optimization Plan (EHS Support, 2016b)

- Surface water upstream (SW-4), adjacent (SW-3 and SW-2), and downstream (SW-1) of the key groundwater impact areas (note that the surface water sampling locations proposed may be slightly modified based on field conditions encountered to ensure safe sampling can be performed)

Groundwater and surface water samples will be collected at the locations summarized in **Table 1.** The fall monitoring event includes the analysis of key Site COCs in groundwater based on mobility (hexavalent chromium and cyanide), along with the analysis of dichlorobenzenes at one well. Surface water samples are analyzed for dissolved chromium and vanadium, hexavalent chromium, and free cyanide. Surface water samples are also analyzed for total dissolved solids (TDS) and hardness to assist in the documentation of GWES influence and for calculation of surface water quality standards/guideline values (as outlined in 6 NYCRR Part 703.5 [NYSDEC, 2020]) for comparison with sample analytical results.

3.1.2 Pretreatment Plant Area

Approximately 35 rounds of sampling have been performed at the PTP Area property. Historically, sampling was performed as often as semi-annually; the frequency of sampling and reporting has been annual since 2010. The last remaining aboveground historical wastewater treatment structures (i.e., the former PTP Building and tank T-110) were demolished and removed from the PTP Area in March 2018. Post-demolition soil and groundwater sampling were performed in May 2019, with the results provided to the NYSDEC in the *Soil and Groundwater Sampling Report for the Pretreatment Plant Area* (EHS Support, 2019b). The soil and groundwater samples collected at the PTP Area in May 2019 showed no evidence of a release of constituents of potential concern from former tank T-110 or from the sumps in the former PTP building.

The central area well MW-OB23 continues to have the highest concentration of cyanide on the property; however, Mann-Kendall calculations performed for this well demonstrate a declining trend in cyanide concentrations over the past 20 years.

A focused approach to sampling at the PTP Area will be performed during fall sampling events, with gauging and groundwater sample collection at well MW-OB23 and a downgradient well (MW-OB19) for cyanide analysis. A surface water sample will also be collected at one location in the Feeder Canal (SG-11) along the southern property boundary for free cyanide analysis, to confirm the continued compliance with the applicable NYSDEC surface water criterion. SG-11 is located near an opening in the north wall of the Feeder Canal that allows the stream east of the PTP to enter the canal; therefore, this is a more conservative sampling location than a sample location within the canal walls or in the marsh area to the east.

3.2 Spring Monitoring Program

Five wells at the MPS will be sampled during spring monitoring events to provide additional data to support the assessment of long-term concentration trends at those locations. The five monitoring wells for these focused events were selected because the wells either have persistently elevated concentrations of COCs (i.e., well EW-B5) or show a higher degree of variability than other wells at the Site, such that semi-annual groundwater monitoring is warranted (i.e., wells MW-OB14, MW-OB30, MW-OB32, and AW-C11).

4 Field Sampling Methodology

Water level gauging, groundwater sampling, and surface water sampling will be performed at the locations summarized in **Table 1** and analyzed using the laboratory methods summarized in **Table 2. Appendix 1** contains a template of the Site-specific purge/sample log.

4.1 Water Level Gauging

Water levels will be measured at the groundwater wells and staff gauges detailed in **Table 1.** In summary, the water level gauging program includes:

- Groundwater levels in monitoring wells prior to sampling (spring and fall events)
- Surface water level at staff gauge SG-12 in the Hudson River adjacent to the MPS (spring and fall events)
- Groundwater levels in additional monitoring wells at the MPS to support preparation of updated potentiometric surface maps for all groundwater horizons (fall events)

Well construction details for the wells included in the gauging programs for the MPS and PTP Area are provided in **Table 3**.

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 at the marked reference point (survey point). If a reference mark is not found on the top of casing, measurement will be referenced to the north side of the top of casing (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 the potential for disturbing the bottom sediments. The interface probe (and probe measure tape line that was introduced into the well) will be cleaned prior to use in each well.

The date, time, and depth to water and total depth measurements (to the nearest 0.01 foot) will be recorded in field logbooks. The depth to water data will be used in conjunction with top of casing 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 and/or conditions that may affect function will be recorded in field logbooks, along with any other observations (e.g., blockage/other issues encountered during gauging) that indicate repair and/or maintenance may be needed. Daily observations of general ambient weather conditions (e.g., sunny, rainfall, temperature) 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. Barometric pressure will be measured by a transducer probe, with data recorded electronically.

4.2 Groundwater Sampling

4.2.1 Grab Sampling

Low-flow sampling cannot be performed at well EW-B5, which is an active groundwater extraction well screened in the intermediate bedrock groundwater horizon, or at active Sumps A and B in the French Drain; therefore, grab samples will be collected at these locations.

The sampling methodology for groundwater grab samples will be as follows:

1. The well or sump ID, date, time, name of personnel conducting sampling, and Site conditions (weather, barometric pressure) will be recorded on a field sampling log. Details regarding sampling equipment used (e.g., pump type, field parameter instruments, filters), field measurements made, sample names, and QC sample information (i.e., 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 cover will be removed, and a water level probe will be lowered into the well or sump until the water surface is detected, and the depth to water (relative to the top-of-casing [TOC] for monitoring wells or the top-of-vault for the French Drain sumps) will be recorded.
3. Grab groundwater samples will be collected using either a clean bailer or clean tubing and a pump appropriate for the depth of the well or sump.

4.2.2 Low-Flow Sampling

For all other groundwater wells included in the monitoring program, 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 – Low Stress (low flow) Purging and Sampling Procedure* (USEPA, 2017). The goal of the low flow sampling is to collect samples that reflect inorganic loads (dissolved and colloidal-sized fractions) that are transported in groundwater through the subsurface under ambient flow conditions with minimal chemical and physical alterations due to sampling.

This sampling methodology aims to minimize hydraulic stress at the well/formation interface by maintaining low water level draw-downs and using low pumping rates during purging and sampling. Indicator field parameters (i.e., turbidity, dissolved oxygen [DO], specific conductivity, temperature, pH, and oxidation-reduction potential [ORP]) will be used to assess stabilization in water quality and determine when sampling will begin.

Low flow purging and sampling will be conducted using polyethylene tubing and either bladder pumps with adjustable flow control and disposable bladders or peristaltic pumps. The clean tubing placed in a given well may be left in-place for use in future sampling events. Monitoring of field parameters will be conducted using a flow through cell (closed system cell) and multi-parameter meter. Filtration will be conducted using disposable in-line 0.45 micrometer (µm) pore size filters. Thus, the only non-disposable/non-dedicated equipment used at each well will be the bladder pump (where applicable).

The bladder pump will be cleaned and have a new disposable bladder installed prior to use in each well (refer to **Section 4.6**).

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 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 the TOC) will be recorded. The level probe will remain in the well throughout purging and sampling.
3. The depth to the pump intake (relative to the TOC) will be recorded on the sampling log.
4. Whether using a bladder pump or a peristaltic pump, the depth to the pump intake should be at the mid-level (approximate) of the water column (calculated based on the depth to water and the total well depth measured during pre-sample gauging, refer to **Section 4.1**). Where the water column is above the well screen, the pump intake should be located at the mid-point of the screened/open bore interval. The pump intake shall be at least 2 feet above the bottom of the well.
5. The pump discharge tubing shall be connected to the flow through cell, and the discharge tubing from the cell shall be set to discharge to a bucket or other container for purge water collection. Tubing length from the well to the flow through cell and associated 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 and/or sediment discharge into the cell.
6. The pump will be started at a low rate. The operating speed will be increased until discharge is achieved at a target rate within approximately 100 to 250 milliliters per minute (mL/min). The tubing will be monitored to ensure pump suction is not broken and to avoid kinking the line. Pumping rate adjustments and the corresponding time they are made will be recorded.
    a. The water level drawdown will be monitored and pumping rate adjusted to achieve steady pumping and stable drawdown of less than 0.3 feet; the pumping rate will be reduced if needed to minimize and 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. Flow rates will be confirmed using a timer and graduated cylinder/bucket to collect purged water.
7. The water level will be recorded at maximum intervals of 2 to 3 minutes during the first 10 minutes of pumping, and at approximately 5 to 10-minute (or as appropriate) intervals thereafter to assess drawdown stability.
8. During purging, the field indicator parameters (i.e., turbidity, temperature, specific conductance, pH, DO, ORP) will be read and recorded 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 (USEPA, 2017):
      i. ±0.1 for pH
      ii. ±3% for conductivity (mS/cm)
      iii. ±10 millivolts (mV) for ORP
      iv. ±10% for DO (10% for values greater than 0.5 milligrams per liter [mg/L]; however, if three DO values are less than 0.5 mg/L, readings will be considered stabilized)
      v. Turbidity is ±10% (10% for values greater than 5 nephelometric turbidity units [NTU], if three values are less than 5 NTU, readings will be considered stabilized)
   c. Observations for parameter stabilization will follow stabilization of drawdown. Final purge volume should be greater than the stabilized drawdown volume plus the pump's tubing volume.
9. Once stabilization is established, sample collection should occur at the same rate as purging. The time and depth to water will 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 documentation.
   b. Sample filtering will be conducted using disposable in-line cartridge filters (0.45 µm), 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 4.4**.
10. Where stabilization cannot be achieved or insufficient yield conditions are encountered, purging may be suspended, with the well allowed to recharge overnight and grab samples collected the following day (within 24 hours of purging). Such conditions and the associated rationale will be noted on the purge/sample log.

Groundwater sampling will be performed using the laboratory-supplied sample containers summarized in **Table 2**. Upon sample collection the sample containers will be sealed, labeled, and placed in a cooler with ice for transport to the laboratory under chain-of-custody documentation.

When sampling is completed, the time and depth to water will be recorded, the level meter and pump will be removed from the well, and the well cap will be closed. If desired, the tubing may be disconnected from the pump and left to remain in the well (hung by securing the top end to the well casing/cap) for re-use in future sampling events.

4.3 Surface Water Sampling

Surface water samples will be monitored for field parameters (DO, turbidity, pH, temperature, conductivity, and ORP) using field meters. Sampling data (personnel, date, time, field parameter measurements, and sample visual observations) will be recorded on field sampling logs. In addition, relevant observations regarding weather and other concurrent activities in the vicinity that may affect sampling conditions will be recorded. After sample collection, the sample containers will be sealed, labeled, and placed in a cooler with ice for transport to the laboratory under chain-of-custody documentation.

4.3.1 Main Plant Site

Surface water samples at the MPS will be collected from shore using a peristaltic pump and disposable tubing. The tubing will be secured to a polyvinyl chloride (PVC) pipe (or other stable fixed point) lowered into the water and held in place. The tubing will be lowered into the water to a depth within 6 to 12 inches below the water, but above the river bottom.

The pump will be started and water will be pumped through the tubing to a flow-through cell to measure field parameters. Observations will be recorded on the field sampling log. Immediately following the 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 chromium, hexavalent chromium, and vanadium analysis will be filtered in the field using disposable in-line cartridge filters (0.45 µm) 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**.

4.3.2 Pretreatment Plant Area

Surface water samples collected at the PTP will be collected as grab samples from the canal using clean dip sample containers. The samples will be transferred from the dip to the laboratory-supplied sample containers, pouring slowly to minimize agitation. Field parameters will be measured on a split of the sample, and observations will be recorded on the field sampling log.

4.4 Field Filtering for Dissolved Analysis

Samples for dissolved metals analysis will be filtered in the field using 0.45 µm filters. Direct in-line filtering of groundwater and surface water 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**). Polyethylene or polypropylene tubing should be used for the collection of samples. Field filtering steps will include:

- Attach the filter in-line assembly to the pump discharge line when groundwater field parameters have stabilized.

- Ensure the filters are pre-rinsed with groundwater and there are no air bubbles within the tubing or filter prior to sample collection.
- Ensure sample bottles have preservative as required per the analyte and analysis.
- Ensure each sample container is slightly overfilled and immediately sealed with no air bubbles.
- Label all sample containers filled with filtered groundwater with the sample location, date, time, and filter size.
- Place the samples in a cooler with ice for transport to the laboratory under chain-of-custody documentation.
- Use filters (or filtration units) at one location only and dispose of 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 (USEPA, 2017) and the USGS Protocol for the Collection of Filtered Samples (USGS, 1994).

4.5 Sample Preparation and Shipment

Table 2 details the sample container requirements for each laboratory method. 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, stored in a cooler containing ice/ice packs, and shipped to the laboratory under chain-of-custody documentation.

4.6 Quality Assurance/Quality Control

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 logbooks.
- 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 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.
- One equipment 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.
- Duplicate groundwater and surface water samples will be collected at a frequency of 5 percent (1 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 1 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 an MS/MSD sample from existing original sample volumes if possible.
- A trip blank will accompany all shipments of volatile organic compound (VOC) samples.
- 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. The 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 then 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 the temperature upon receipt.
- Chain-of-custody documents will be prepared for each container (cooler) of samples transported to the laboratory. The chain-of-custody form 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 chain-of-custody forms will be included in the laboratory reports.

4.7 Decontamination and Water Management

Decontamination procedures for field personnel and equipment will be followed to protect the health and safety of those present, to maintain sample integrity, and to minimize the movement of potential constituents between the work area and off-site locations. Non-dedicated (reusable) equipment used on-site will be decontaminated prior to beginning work, between sampling locations and/or uses, and prior to demobilizing from the Site.

4.7.1 Personal Decontamination

To avoid cross-contamination, disposable nitrile gloves will be worn by the sampling team and changed between sampling points.

4.7.2 Small Equipment Decontamination

Non-dedicated small groundwater sampling equipment may include, but is not limited to, water level meters or oil/water interface probes and pumps. Non-dedicated small equipment will be decontaminated at the sample locations. When possible, dedicated, pre-cleaned or disposable sampling equipment will be used down-hole (e.g., tubing).

The required decontamination tools and supplies are:

- Potable water
- Phosphate-free detergent (such as Alconox)

- Deionized (DI) distilled water
- Aluminum foil
- Plastic/polyethylene sheeting
- Plastic buckets and brushes
- Personal protective equipment (PPE) in accordance with the Health and Safety Plan procedures

Non-dedicated equipment will be decontaminated prior to initial use, between locations, and before leaving the Site using a non-phosphate detergent wash, potable water rinse, and a DI/distilled water rinse.

The decontamination procedure described above is summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. DI/distilled water rinse

Disposable equipment and other trash generated during these activities will be contained and managed as solid waste.

4.7.3 Management of Investigation-Derived Waste

The following are types of investigation-derived waste (IDW) that will be containerized and discharged to the on-site effluent pumping station (EPS) for discharge to the publicly owned treatment works (POTW) along with groundwater pumped via the GWES:

- Decontamination fluids
- Purge water
- Groundwater displaced during well decommissioning

The following types of IDW will be containerized in United States Department of Transportation (USDOT)-approved 55-gallon steel drums and disposed of off-site as municipal waste:

- PPE
- Disposable sampling equipment
- Well construction debris (protective covers, concrete pads, and/or PVC casing, etc.)

The drums will be labeled with the type of IDW, locations collected, and date, and will be temporarily stored on-site. IDW will then be disposed of per the requirements of Section 3.3(e) of DER-10 (NYSDEC, 2010).

4.8 Well Decommissioning Procedures

Well decommissioning will follow procedures to satisfactorily decommission a groundwater monitoring well per *CP-43 Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, 2009). Well decommissioning will be completed after the assessment of well construction information and current subsurface conditions. The appropriate decommissioning method(s) will be selected to protect groundwater and suit the conditions and circumstances, as outlined below.

The overburden monitoring wells at the Site monitor a single, unconfined water-bearing zone and are generally shallower than 25 feet bgs. Bedrock wells at the Site generally range in depth from 30 feet bgs to 160 feet bgs. The soil and groundwater in the vicinity of the wells are potentially contaminated.

The expected method for decommissioning wells at the Site is grouting in-place. Wells will be tremie grouted in-place to 5 ft bgs with the appropriate grout mixture. Once grouted, the PVC casing will be cut at 5 ft bgs.

Prior to decommissioning, the total well depth will be measured to verify location and to approximate the grout mixture amount. Grouting will take place before removing the protective casing to ensure no materials collapse into the well. The protective casing materials will be removed and the area will be backfilled and restored to match the surrounding ground surface (topsoil and grass, asphalt, concrete, etc.). Waste will be managed as described in **Section 4.7.3.**

The NYSDEC and property owners will be notified prior to any well decommissioning activities.

5 POTW Discharge Sampling

Groundwater is pumped as part of the corrective measures at the Main Plant Site utilizing sumps in the French drain (Sump A and Sump B) and an extraction well (well EW-B5). The groundwater is discharged to a wet well at the effluent pumping station (EPS) building at the Site to be equilibrated before being pumped to the City of Glens Falls POTW. After equilibration, the water is monitored for pH and flow in accordance with the POTW Industrial User Permit (City of Glens Falls, 2017). The pH meter and flow meter are calibrated annually.

The water quality is sampled on a quarterly basis from a port located at the POTW in accordance with the permit requirements. **Table 4** summarizes the POTW discharge sampling program, including the sampling frequency, the laboratory analytical parameters, and the permit limits.

6 Reporting Schedule

6.1 Groundwater and Surface Water Reporting

An annual groundwater and surface water monitoring report will be prepared and submitted to NYSDEC on March 1 of each year. The report will detail all groundwater and surface water sampling conducted at the MPS and PTP in the previous calendar year and will contain all information required under NYSDEC DER-10 (NYSDEC, 2010).

6.2 POTW reporting

The POTW discharge sampling results are reported quarterly to POTW. POTW sampling results are also included in the annual Operations and Maintenance Report submitted to NYSDEC on March 1 of each year.

7 References

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Tables

Table 1
Sampling and Gauging Summary - Groundwater and Surface Water Monitoring
Former Ciba-Geigy Facility, Glens Falls, NY

Gauge & Sample	Area of the Property	Sampling Frequency	Total Cyanide[1]	Chromium and Hexavalent Chromium[2]	Free Cyanide[3]	Vanadium[2]	1,2-, 1,3-, and 1,4-Dichlorobenzenes	Total Dissolved Solids[4]	Hardness	Sampling Pump
Overburden Groundwater Wells										
IP-4	MPS - Western	Annual	1	1						0.75" Bladder or Peristaltic Pump
MW-26 or MW-28 [5]	MPS - Western	Annual	1	1						Peristaltic Pump
MW-31	MPS - Eastern	Annual	1	1						1.75" Bladder Air Tank or Peristaltic Pump
MW-OB14	MPS - Central	Semi-Annual	1	1						1.75" Bladder Pump or Peristaltic Pump
MW-OB25	MPS - Central	Annual	1	1						1.75" Bladder Pump or Peristaltic Pump
MW-OB26	MPS - Central	Annual	1	1						1.75" Bladder Pump or Peristaltic Pump
MW-OB30	MPS - Central	Semi-Annual	1	1						Peristaltic Pump
MW-OB31	MPS - Central	Annual	1	1						Peristaltic Pump
MW-OB32	MPS - Central	Semi-Annual	1	1						Peristaltic Pump
MW-OB33	MPS - Central	Annual	1	1						Peristaltic Pump
MW-OB34	MPS - Central	Annual	1	1						Peristaltic Pump
MW-OB19	PTP	Annual	1							Peristaltic Pump
MW-OB23	PTP	Annual	1							Peristaltic Pump
AP-2										
BP-6										
BP-9										
MW-9										
MW-26										
MW-OB2										
MW-OB5						MPS - Annual Gauging Only				
MW-OB7										
MW-OB13										
MW-OB15										
MW-OB24										
MW-OB27										
WP-CC-12										
Sumps - Groundwater										
Sump A	MPS - Central	Annual	1	1						Grab
Sump B	MPS - Central	Annual	1	1						Grab
Shallow Groundwater Bedrock Wells										
AW-A11	MPS - Central	Annual	1	1						1.75" Bladder Normal
AW-A14	MPS - Central	Annual	1	1						1.75" Bladder Normal
MW-25S	MPS - Western	Annual	1	1						1.75" Bladder Normal
AW-A2										
AW-A4										
AW-A10										
AW-A15						MPS - Annual Gauging Only				
MW-19										
MW-27S										
MW-36S										
P-A1										

Table 1
Sampling and Gauging Summary - Groundwater and Surface Water Monitoring
Former Ciba-Geigy Facility, Glens Falls, NY

Gauge & Sample	Area of the Property	Sampling Frequency	Total Cyanide[1]	Chromium and Hexavalent Chromium[2]	Free Cyanide[3]	Vanadium[2]	1,2-, 1,3-, and 1,4-Dichlorobenzenes	Total Dissolved Solids[4]	Hardness	Sampling Pump
Intermediate Groundwater Bedrock Wells										
AW-B4	MPS - Central	Annual	1	1						0.75" Bladder
EW-B5	MPS - Central	Semi-Annual	1	1						Grab
AW-B18	MPS - Western	Annual	1	1			1			1.75" Bladder Normal
AW-B2	MPS - Annual Gauging Only									
AW-B3										
AW-B11										
AW-B17										
AW-B19										
AW-B20										
MW-10B										
MW-20D										
MW-25D										
MW-30D										
MW-36D										
MW-40B										
Deep Groundwater Bedrock Wells										
AW-C2	MPS - Western	Annual	1	1						1.75" Bladder Air Tank
AW-C11	MPS - Central	Semi-Annual	1	1						1.75" Bladder Air Tank
AW-C1	MPS - Annual Gauging Only									
AW-C7										
AW-C8										
AW-C9										
AW-C10										
MW-20C										
MW-36C										
Surface Water Samples										
SW-01	MPS - Downriver	Annual		1	1	1		1	1	Grab
SW-02	MPS - Central	Annual		1	1	1		1	1	Grab
SW-03	MPS - Central	Annual		1	1	1		1	1	Grab
SW-04	MPS - Upriver	Annual		1	1	1		1	1	Grab
SG-11	PTP	Annual			1					Grab
SG-12	MPS	Semi-Annual	Gauging Only							

Notes:
MPS = Main Plant Site
PTP = Pretreatment Plant Site
1 = Total cyanide is an unfiltered sample.
2 = Chromium, hexavalent chromium, and vanadium samples filtered in the field using 0.45 micrometer (µm) filters
3 = Free Cyanide is an unfiltered sample. Free Cyanide samples are to be collected per lab instructions.
4 = Total Dissolved Solids are to be laboratory-derived, not calculated.
5 = MW-28 has produced insufficient water for sampling during some previous groundwater sampling events. If well MW-28 is unable to be sampled, well MW-26 will be sampled as a substitute.

Table 2
Laboratory Method Summary - Groundwater and Surface Water Monitoring
Former Ciba-Geigy Facility, Glens Falls, NY

Analyte	Groundwater Quality Standard GA standard[1] (µg/L)	Surface Water Quality Standard[1] Class A, B, C (µg/L)	Method Number	Media	Anticipated Reporting Limit (µg/L)	Sample Container Type	Container Volume (each in mL)*	No. Containers per sample	Preservation	Holding Time
Geochemistry Parameters										
Total Dissolved Solids	not screened	not screened	SM2540C	Water	10,000	Plastic	500	1	Cool, < 6 deg. C.	7 days
Hardness	not screened	not screened	SM2340C	Water	2,000	Plastic	250	1	HNO3 to pH<2	6 Months
Dissolved Metals										
Chromium	50	calculated*	SW846 6020A	Water	1.5	Plastic	250	1	Filtration + HNO_3 to pH<2	6 Months
Vanadium	n/a	190 A(A) 14 A(C)			2					
Hexavalent Chromium	50	16 A(A) 11 A(C)	EPA 218.6	Water	0.3	Plastic	125	1	Filtration + NH4OH/(NH4)2SO4	28 days
Cyanide										
Total Cyanide	200	9000 H(FC)	SW846 9012B	Water	10	Plastic	250	1	NaOH to pH>12, Cool, < 6 deg. C.	14 Days
Volatile Organic Compounds										
Dichlorobenzenes (1,2-; 1,3-; and 1,4-)**	3	5	SW846 8260C	Water	1	Glass VOA	40	3	HCl to pH<2, Cool, < 6 deg. C.	14 Days
Free Available Cyanide										
Free Cyanide	n/a	5.2 A(C) 22 A(A)	OIA-1677	Water	2	Glass VOA	40	1	lead-acetate strip test for sulfide 40 mL VOA with NaOH or if sulfide detected 40 mL VOA no preservative	14 Days or 24 hrs

Notes:
* = indicates A(A) and A(C) values are calculated based on hardness
** = 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.
µg/L = micrograms per liter
A(C) = protective of fish propagation 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)
DCB method will allow reporting to less than 3 µg/L with applicable qualification
deg C = degrees Celsius
GA = protective of fresh groundwaters for drinking water source
H(FC) = protective of human health for fish consumption
HCl = hydrochloric acid
HNO3 = nitric acid
mL = milliliters
n/a indicates no screening value available. Total metals criteria may be used for screening dissolved metals that have no screening value available.
NaOH = sodium hydroxide
NH4OH = ammonium hydroxide
(NH4)2SO4 = ammonium sulfate
not screened = indicates not a site-related constituent; data used for geochemical assessment/developing surface water criteria only
NYCCR = New York Codes, Rules and Regulations
NYS = New York State
TOGS = Technical and Operational Guidance Series
VOA = volatile organic analysis
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.

Table 3
Well Construction Details
Former Ciba-Geigy Facility, Glens Falls, NY

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)	Ground Surface Elevation (ft amsl)	Northing (NAD27)	Easting (NAD27)
MAIN PLANT SITE WELLS														
AP-2	Overburden	10/12/10	10/12/10	Flushmount	1	20	10	0.010	10 - 20	PVC	240.04	--	1205985.945	691911.996
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
MW-26	Overburden	--	--	Stick-up	2	~8	5	unknown	3 - 8	PVC	242.10	235.90	1205830.160	691363.760
MW-28	Overburden	--	--	Stick-up	2	~12	5	unknown	7 - 12	PVC	240.20	239.40	1205892.940	691578.260
MW-31	Overburden	--	--	Stick-up	2	15	5	unknown	10 - 15	PVC	217.58	214.80	1206244.860	692844.890
MW-9	Overburden	--	--	Flush	2	unknown	unknown	unknown	unknown	PVC	246.25	240.30	1205999.240	691365.340
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
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
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
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
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
MW-OB25	Overburden	05/11/01	05/11/01	Flushmount	2	10	5	0.010	5 - 10	PVC	238.45	--	1206066.740	692184.620
MW-OB26	Overburden	05/17/01	05/17/01	Flushmount	2	14	5	0.010	9 - 14	PVC	238.45	--	1206174.22	692443.87
MW-OB27	Overburden	05/10/01	05/10/01	Flushmount	2	11	5	0.010	6 - 11	PVC	239.15	--	1206466.500	693086.000
MW-OB30	Overburden	11/16/15	11/16/15	Stick-up	2	16	12	0.060	4 - 16	PVC	225.71	--	1205935.600	691967.128
MW-OB31	Overburden	11/16/15	11/16/15	Stick-up	2	12	8	0.060	4 - 12	PVC	226.02	--	1205956.300	692033.440
MW-OB32	Overburden	11/17/15	11/17/15	Stick-up	2	10	5	0.060	5 - 10	PVC	227.96	--	1205981.314	692116.749
MW-OB33	Overburden	11/18/15	11/18/15	Stick-up	2	15	10	0.060	5 - 15	PVC	224.03	--	1206045.434	692328.241
MW-OB34	Overburden	11/18/15	11/18/15	Stick-up	2	15	10	0.060	5 - 15	PVC	223.58	--	1206103.083	692448.917
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
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
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
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
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
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
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
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
BP-6	Overburden	10/08/10	10/08/10	Stick-up	1	23	10	0.010	13 - 23	PVC	236.74	--	1206206.698	692602.828
BP-9	Overburden	10/08/10	10/08/10	Stick-up	1	16	10	0.010	6 - 16	PVC	232.52	--	1206036.644	692275.949
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
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
MW-25S	shallow bedrock	--	--	Stickup	3	39.4	9.8	OPEN	29.6-39.4	NA	241.55	235.60	1205843.010	691392.960
MW-27S	shallow bedrock	--	--	Stickup	2	42.5	9.5	unknown	33-42.5	PVC	240.80	239.00	1205890.120	691556.690
MW-36S	shallow bedrock	--	--	Stickup	3	33	9.4	OPEN	23.6-33	NA	264.85	260.80	1206384.456	691185.694
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
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
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
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
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
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
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
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
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
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
MW-20D	Intermediate Bedrock	--	--	Stickup	3	55.1	10	OPEN	45.1-55.1	NA	266.90	261.30	1206402.750	691574.660
MW-25D	Intermediate Bedrock	--	--	Stickup	3	60.7	10	OPEN	50.7-60.7	NA	241.55	234.70	1205843.460	691403.630
MW-30D	Intermediate Bedrock	--	--	Stickup	3	51.5	9.7	OPEN	41.8-51.5	NA	217.10	215.00	1206255.380	692861.820

Table 3
Well Construction Details
Former Ciba-Geigy Facility, Glens Falls, NY

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)	Ground Surface Elevation (ft amsl)	Northing (NAD27)	Easting (NAD27)
MW-36D	Intermediate Bedrock	--	--	Stickup	3	57.2	10	OPEN	47.2-57.2	NA	266.40	261.00	1206366.574	691189.387
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
AW-C1	Deep Bedrock	07/25/88	08/03/88	Flush	2	144	10	unknown	133-143	PVC	283.50	--	1206757.457	691227.682
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
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
AW-C2	Deep Bedrock	08/04/88	08/12/88	Flush	2	169	10	unknown	156-166	PVC	241.10	--	1205830.970	691387.530
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
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
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
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
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
GWES FEATURES														
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
Sump A	Overburden	--	--	NA	NA	NA	NA	NA	NA	NA	239.89	--	1205951	691848
Sump B	Overburden	--	--	NA	NA	NA	NA	NA	NA	NA	236.39	--	1206176	692528
PREATREATMENT PLANT														
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
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

Notes:
-- = not available
amsl = above mean seal level
bgs = below ground surface
ft = feet
GWES = groundwater extraction system
NA = not applicable
NAD27 = North American Datum of 1927
PVC = polyvinyl chloride

Table 4
Sampling Event Summary - POTW Discharge Sampling
Former Ciba-Geigy Facility, Glens Falls, New York

Parameter	CAS Number	Media	Sampling Frequency	Laboratory Method	MRLs (mg/L)	MDLs (mg/L)	POTW Effluent Limitations[1] (mg/L)
Antimony	7440-36-0	W	Annual	EPA 200.8	0.005	0.0005	10
Ammonia	7664-41-7	W	Annual	EPA 350.1	0.25	0.1	40
Arsenic	7440-38-2	W	Annual	EPA 200.8	0.003	0.0015	0.25
Benzene	71-43-2	W	Annual	EPA 624	0.001	0.00043	0.1
Biochemical Oxygen Demand (BOD)	STL00311	W	Annual	SM 5210B	2	2	-
Boron	7440-42-8	W	Annual	EPA 200.7	0.1	0.036	5
Cadmium	7440-43-9	W	Annual	EPA 200.8	0.0005	0.00015	0.25
Calcium	7440-70-2	W	Annual	EPA 200.7	0.5	0.025	500
Chloroform	67-66-3	W	Annual	EPA 624	0.001	0.0005	1
Chromium, total	7440-47-3	W	Quarterly	EPA 200.8	0.005	0.0016	*See below 2*
Copper	7440-50-8	W	Annual	EPA 200.8	0.005	0.0017	1
Cyanide, total	57-12-5	W	Quarterly	EPA 335.4	0.1	0.025	3
Ethylbenzene	100-41-4	W	Annual	EPA 624	0.001	0.00033	0.1
Iron	7439-89-6	W	Annual	EPA 200.8	0.1	0.025	50
Lead	7439-92-1	W	Quarterly	EPA 200.8	0.0025	0.00098	0.8
Manganese	7439-96-5	W	Annual	EPA 200.8	0.005	0.0018	5
Mercury	7439-97-6	W	Quarterly	EPA 245.1	0.0002	0.00008	0.005
Methylene Chloride	75-09-2	W	Annual	EPA 624	0.005	0.0025	1
Naphthalene	91-20-3	W	Annual	EPA 625	0.01	0.0007	1
Nickel	7440-02-0	W	Annual	EPA 200.8	0.005	0.0019	2.3
Oil & Grease	STL00181	W	Annual	EPA 1664A	5.00	1.40	50
Pentachlorophenol	87-86-5	W	Annual	EPA 625	0.05	0.0018	-
2,4,6-Trichlorophenol	95-95-4	W	Annual	EPA 625	0.01	0.01	-
2,4,5-Trichlorophenol	88-06-2	W	Annual	EPA 625	0.01	0.00082	-
Phenols	STL00166	W	Quarterly	EPA 420.1	0.05	0.025	5
Silver	7440-22-4	W	Annual	EPA 200.8	0.001	0.0001	0.2
Toluene	108-88-3	W	Annual	EPA 624	0.001	0.00048	0.1
Total Suspended Solids	STL00161	W	Annual	SM 2540D	2.50	2.5	-
1,1,1 - Trichloroethane	71-55-6	W	Annual	EPA 624	0.001	0.00037	1
Xylene	1330-20-7	W	Annual	EPA 624	0.002	0.00057	0.1
Zinc	7440-66-6	W	Annual	EPA 200.8	0.02	0.0096	1.5

Notes:
- = No standard value
CAS = Chemical Abstracts Service
DQO = data quality objective
lb/day = pounds per day
MDL = method detection limit
mg/L = milligrams per liter
MRL = minimum reporting limit
POTW = publicly owned treatment works
W = water
1 = POTW Effluent Limitations are instantaneous maximums, except for mercury.
2 = Discharge for total chromium is 3.1 lb/day and will be based on the average of chromium sampling data and the quarterly average flow.
3 = The POTW Effluent Limitation for mercury is calculated as a quarterly average.

Figures

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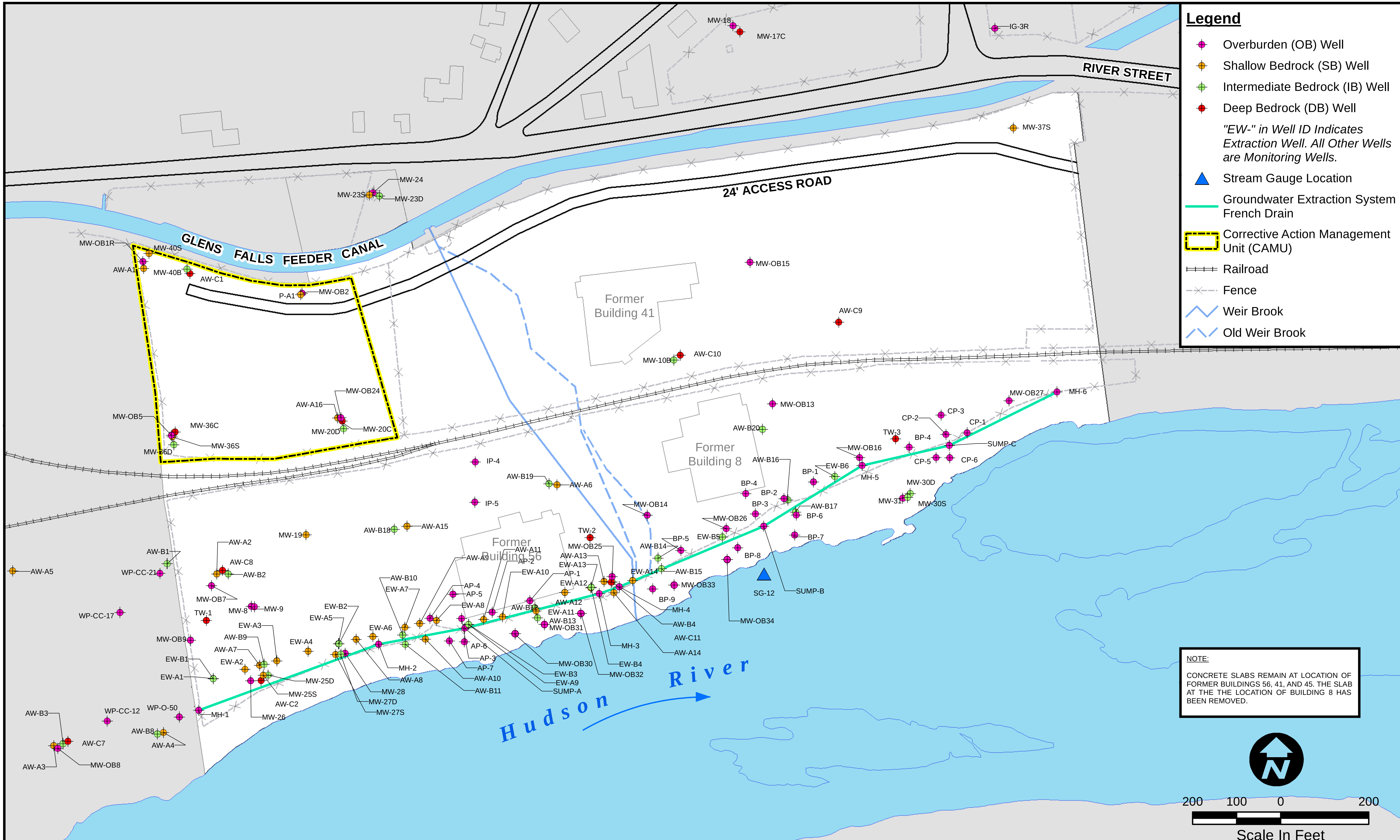
Reviewed By: C. Reuter

EHS Support	FORMER CIBA-GEIGY / HERCULES SITE GLENS FALLS, NY	SITE MAP	FIGURE 1



EHS Support	FORMER CIBA-GEIGY / HERCULES SITE GLENS FALLS, NY	MAIN PLANT SITE - WELL AND STAFF GAUGE LOCATIONS	FIGURE 2

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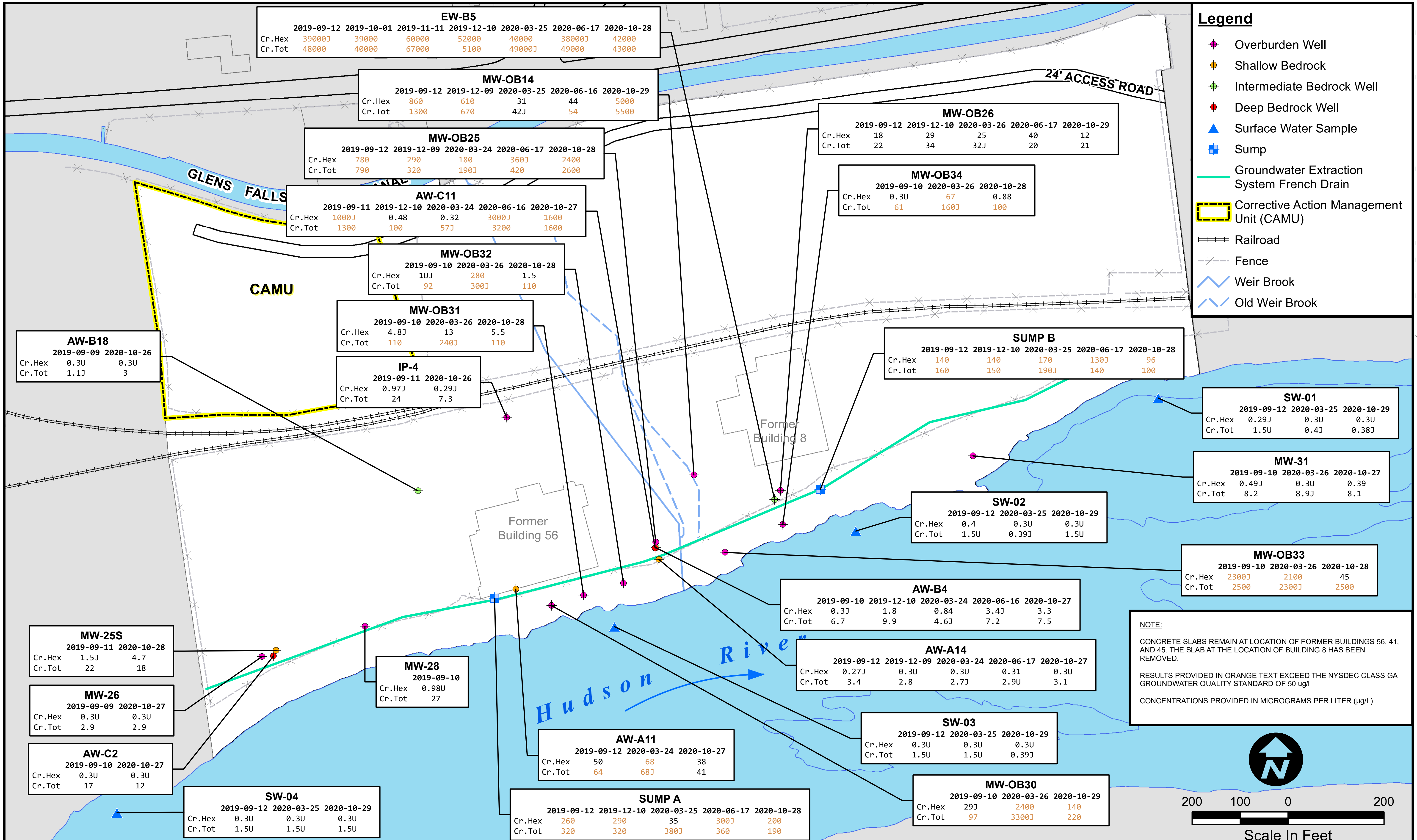
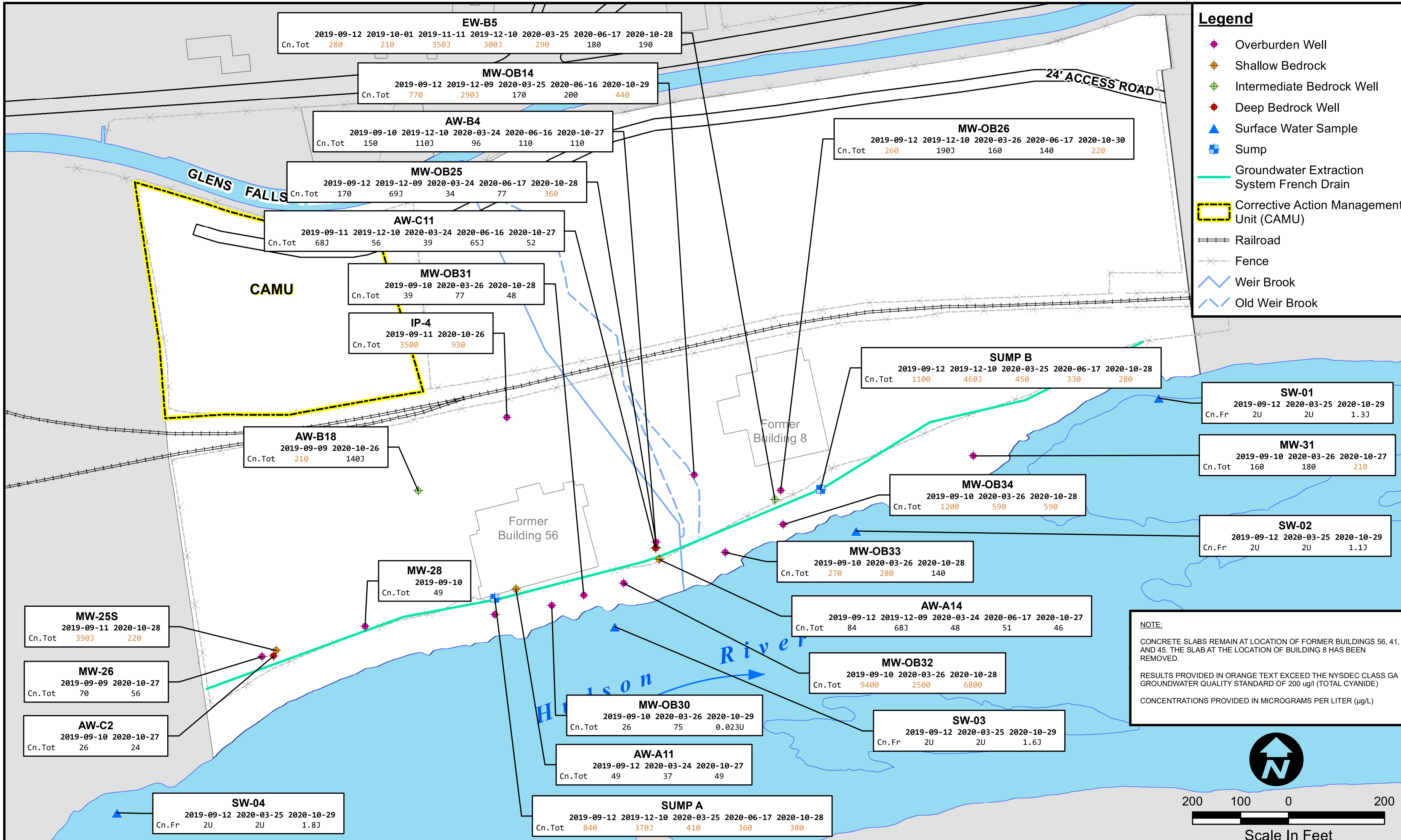


EHS Support	FORMER CIBA-GEIGY / HERCULES SITE GLENS FALLS, NY	MAIN PLANT SITE - RECENT CHROMIUM DATA	FIGURE 3



EHS Support

FORMER CIBA-GEIGY / HERCULES SITE
GLENS FALLS, NY

MAIN PLANT SITE - RECENT CYANIDE DATA

FIGURE 4

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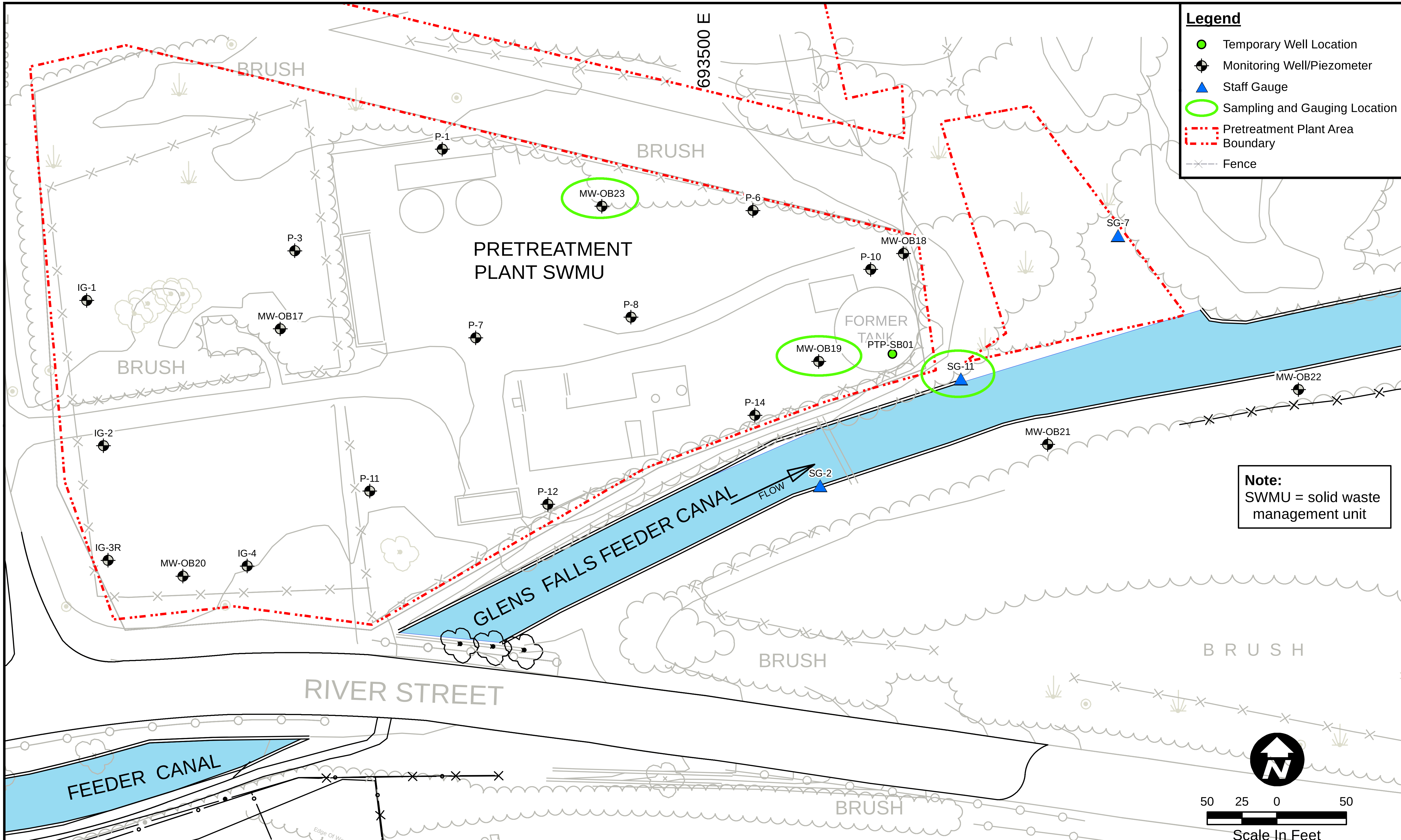

EHS Support	FORMER CIBA-GEIGY/HERCULES SITE GLENS FALLS, NY	PRETREATMENT PLANT AREA - WELL AND STAFF GAUGE LOCATIONS	FIGURE 5

Appendix 1 Purge/Sample Log

GROUNDWATER SAMPLING LOG

Ashland Glens Falls, NY

Routine Groundwater & Surface Water Sampling Event

Sampling Personnel:	**Well ID:**			
Date:	**Original Install Depth:**		feet	
Weather:	**Screen Length:**		feet	
Time In: **Time Out:**	**Well Diameter:**		inches	

WELL INFORMATION

Depth to Water (from TOC):	(feet)		**Well Type:**	Flushmount ☐	Stick-Up ☐
Depth to Water(From TOC) With Pump in place:	(feet)		**Well Locked:**	Yes ☐	No ☐
Total Depth (from TOC):	(feet)		**Measuring Point Marked:**	Yes ☐	No ☐
Length of Water Column :	(feet)		**Well Condition:**	Good ☐	Poor ☐
			Well Condition Comments:		

WELL WATER INFORMATION			
Volume of Water in Well:	(mL or gal)		
Pumping Rate of Pump:	(mL/min)		
Total Volume Removed:	(mL or gal)		
Volume Measurements	**(gal)**	**(ml)**	**Tubing/Well Size**
Tubing Volume per foot	**0.003**	**11.36**	**1/4" ID tubing**
Well Volume per foot	**0.041**	**155.18**	**1" diam. well**
	0.163	**616.95**	**2" diam. well**
	0.653	**2,471.60**	**4" diam. well**

EVACUATION INFORMATION

Pump ID:	**Pump Size:**	**Depth of Pump Intake:**		
Evacuation Method:	Bailer ☐	Peristaltic ☐	Bladder ☐	Other ☐
Tubing Used:	Teflon ☐	Polyethylene ☐	N/A ☐	
Water Quality Meter (type/Serial Number):				
Sampling Method:	Bailer ☐	Peristaltic ☐	Bladder ☐	Other ☐
Did well go dry?	Yes ☐	No ☐		
Final Depth to Water (prior to turning off pump):				
Barometric Pressure (At time of sampling) in mm/Hg:				

FIELD PARAMETER READINGS:

Time														
Rate (ml/min)														
Depth to Water (ft. TOC)														
Temperature (°C)														
pH														
Conductivity (mS/cm)														
Dissolved Oxygen (mg/L)														
Turbidity (NTU)														
ORP (mV)														

SAMPLE INFORMATION

Sample List:	**Sample ID:**	**Duplicate ID:**
Diss. Chromium & Vanadium ☐	**Start Time:**	**Sample Time:**
Diss. Hexavalent Chromium ☐	**End Time:**	**Total Bottles:**
Total Cyanide ☐	**MS/MSD:** Yes ☐ No ☐	**Sampled By:**
Free Cyanide ☐	**Duplicate:** Yes ☐ No ☐	**MS/MSD ID:**
Total Dissolved Solids ☐	**Total Bottles:**	**Sample Time:**
Hardness ☐	**Sampled By:**	**Total Bottles:**
VOCs (Dichlorobenzenes) ☐		**Sampled By:**

Observations (water color, clarity, etc.):

Free Cyanide Sulfide Test Strip: Positive (Black) / Negative (No change)

UNIT STABILITY

pH	**DO**	**Turb.**	**Cond**	**ORP**
± 0.1	± 10%	± 10%, <10NTU	± 3%	± 10 mV

Enclosure B Quality Assurance Project Plan

Quality Assurance Project Plan

Former Ciba-Geigy/Hercules Site – NYSDEC Site #557011 Glens Falls, New York

Prepared for:

HERCULES

Prepared by:

EHS Support

May 2021

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Acronyms

ASP	Analytical Services Protocol
CLP	Contract Laboratory Program
DER	Division of Environmental Remediation
DER-10	Technical Guidance for Site Investigation and Remediation
DMM	Division Materials Management
DQO	data quality objective
EC	engineering control
ECL	Environmental Conservation Law
EDD	electronic data deliverable
EDP	EQuIS Data Processor
EIMS	Environmental Information Management System
ELAP	Environmental Laboratory Approval Program
EPS	effluent pumping station
GSMP	Groundwater and Surface Water Monitoring Plan
HWM	Hazardous Waste Management
IC	institutional control
LIMS	laboratory information management system
MDL	method detection limit
MRL	minimum reporting limit
MS/MSD	matrix spike/matrix spike duplicate
NELAP	National Environmental Laboratory Accreditation Program
NTU	nephelometric turbidity unit
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PID	photoionization detector
POTW	publicly owned treatment works
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SWQC	surface water quality criteria
TOGS	Technical and Operational Guidance Series
USEPA	United States Environmental Protection Agency

1 Introduction

On behalf of Hercules Incorporated (previously acquired by Ashland LLC) and CIBA Corporation (“CIBA”) (previously acquired by BASF Corporation), EHS Support LLC (“EHS Support”) has prepared this Quality Assurance Project Plan (QAPP) for data collection activities associated with the former Ciba-Geigy Corporation pigments manufacturing facility located at 89 Lower Warren Street in the Town of Queensbury near Glens Falls, New York (“the Site”). This QAPP was prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10), issued May 3, 2010 (NYSDEC, 2010) and 6 New York Codes, Rules and Regulations (NYCRR) Part 375 Environmental Remediation Programs, effective December 14, 2006 (NYSDEC, 2006).

1.1 Background

Corrective measure operations, maintenance, and monitoring are conducted for the Site under an NYSDEC Hazardous Waste Management (HWM) Post Closure Permit (NYSDEC Site No. 557011). A renewal of the Part 373 HWM Permit #5-5234-00008/00096 was issued by the NYSDEC on March 5, 2015. Hercules and CIBA (“the Parties”) are the permittees and share responsibility for ongoing environmental activities at the Site.

After the implementation of corrective measures, some contamination was left at the Site, which is hereafter referred to as “remaining contamination.” Institutional controls and engineering controls (ICs and ECs) have been incorporated into the remedy to control exposure to the remaining contamination.

This QAPP details the performance objectives for ongoing monitoring. Groundwater and surface water sampling are performed to ensure that the remaining contamination does not pose a risk to public health or the environment. Additionally, groundwater that is pumped from the Site as part of the corrective measures is sampled to demonstrate compliance with the publicly owned treatment works (POTW) Industrial User Permit for the Site (City of Glens Falls, 2017).

1.2 Objective

The objective of the environmental data collection and this QAPP is to collect data that adequately addresses NYSDEC requirements for ongoing groundwater and surface water sampling at the Site and demonstrates compliance with the City of Glens Falls POTW Industrial User Permit for the Site. The data quality objectives (DQOs) established for this project are based on the standards and guidance values established in the documents listed below:

- Surface water and groundwater quality standards and guidance values from Table 1 of 6 NYCRR 703.5 and NYSDEC Technical and Operational Guidance Series (TOGS 1.1.1) (NYSDEC, 1998), including:
    - Class GA groundwater quality standards protective of fresh groundwater for drinking water sources; and
    - Surface water quality criteria (SWQC) for Class C waters, selected based on New York’s classification of the Hudson River in the Site vicinity as “Class C” water, including standards/guidance values for protection of human health (based on water supply or fish

consumption) and protection of aquatic life from chronic and acute effects (designated as A[C] and A[A], respectively).

- POTW Industrial User Permit limits (City of Glens Falls, 2017)

It is noted that comparison of groundwater data to GA standards is for reference only. Groundwater on-site is not used and use of on-site groundwater for any purpose is precluded (pursuant to the Deed Notice filed with Warren County).

1.3 Project Organization

The project team consists of clients, consultants, subcontractors, laboratories, property owners, and public agencies. Team members are illustrated in the project organization chart provided as **Figure 1**. Primary team members for the execution of this QAPP are also summarized below.

The **Consultant Project Manager** (Cassie Johnson, EHS Support) will manage personnel involved in the project and will be responsible for scope of work execution, cost tracking, and schedule tracking. The consultant project manager will also oversee the preparation of project deliverables and provide certification of documents as a Qualified Environmental Professional where required under NYSDEC DER-10 guidelines.

The **NYS Professional Engineer** (Kristin VanLandingham, PE, EHS Support) will provide final technical review of project deliverables, overall direction on the technical aspects of the project, and certification of documents as a New York State (NYS) Professional Engineer where required under NYSDEC DER-10 guidelines.

The **Field Project Manager** (Cody Hume, Antea Group) will manage the field operation, maintenance, and monitoring teams. The Field Project Manager will oversee operations and maintenance for all corrective measures; field sampling efforts; implementation of health and safety procedures; and will update the Hercules Project Manager and Consultant Project Manager on project progress. Specific responsibilities of the Field Project Manager are as follows:

- Ensure proper operation and maintenance of the Site's corrective measures.
- Organize and coordinate the activities of subcontractor(s), field crew, and sampling activities.
- Arrange for permits, utility clearances, and surveying, when required.
- Coordinate with the Project Chemist as needed for ordering of the appropriate number of sample containers and coolers from the analytical laboratory.
- Provide the Consultant Project Manager with a copy of the chain-of-custody form within one working day of sample delivery to the analytical laboratory.
- Deliver copies of all logbook pages and sample collection forms completed during each phase of the delineation to the Consultant Project Manager at the end of each phase of the investigation.
- Prepare project deliverables during the reporting phase of the project.

The **Laboratory Project Manager** will oversee performance of all analytical tests conducted as part of the project. The Laboratory Project Manager is responsible for (1) providing a confirmation of sample receipt within one working day of sample receipt and (2) notifying the Consultant Project Manager of any sample integrity issues (e.g., holding time exceedance, chain-of-custody discrepancies) promptly when discovered. The confirmation of sample receipt will include the following:

- Sample login sheet that summarizes sample identifications, as entered into the laboratory information management system (LIMS), and the analyses requested for each sample.
- Summary of the target analytes to be reported for each analysis requested.
- Summary of any discrepancies or sample integrity issues noted during sample login.

The Laboratory Project Manager is also responsible for submitting the final data package, including a hard copy deliverable and electronic data deliverable (EDD), within the requested turnaround time. Laboratory analyses will be performed by Eurofins TestAmerica, Inc. of Savannah, Georgia. Eurofins TestAmerica, Savannah, is an analytical laboratory certified by the State of New York and participates in the National Environmental Laboratory Accreditation Program (NELAP) (Laboratory Certification ID # 10842). The laboratory contact information is listed below:

Eurofins TestAmerica Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Phone: 912-250-0280
Contact: Eddie Barnett
Email: Eddie.Barnett@Eurofinset.com

The **Project Chemist** (Amy Coats, EHS Support) will complete data validation in accordance with this QAPP and communicate with the Consultant Project Manager on the project. Specific responsibilities of the Project Chemist are as follows:

- Verify completeness of the data packages (via "hard copy" and EDD) and verify that the hard copy and EDD match.
- Notify the Field Team Project Managers and Consultant Project Manager of sample integrity issues and data package deliverable issues; all members of the project team will be copied on any of these notifications.
- Notify the Laboratory Project Managers of sample receipt issues, data turnaround issues, and data package discrepancies or omissions.
- Evaluate if sampling procedures, laboratory analyses, and project documentation conducted as part of the project are in accordance with this QAPP and NYSDEC requirements.
- Provide a data review summary in conformance with NYSDEC Data Validation guidance.
- Serve as the official contact for all quality assurance (QA) matters.
- Respond to QA needs, resolve problems, and answer requests for guidance or assistance.
- Review the implementation of the DQOs and the adequacy of the data or products generated based on quality objectives, as necessary.
- As applicable and appropriate, coordinate and conduct internal and subcontractor audits of selected project and program activities for adherence to the project and program plans.
- Confer with the project team on the steps to be taken for corrective actions, and track items of nonconformance until corrected; confer with the Consultant Project Manager to resolve an inadequate corrective action.
- Review audit and nonconformance reports to determine areas of poor quality or failure to adhere to established procedures.

Resumes for personnel can be supplied as requested.

1.4 Quality Assurance Glossary

The following terms are defined in DER-10 and used in this QAPP document.

- "Analytical Services Protocol" or "ASP" means NYSDEC's compilation of approved United States Environmental Protection Agency (USEPA) laboratory methods for sample preparation, analysis, and data handling procedures.
- "ELAP" (Environmental Laboratory Approval Program) means a program conducted by the New York State Department of Health (NYSDOH) which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing. Information regarding ELAP is available at the NYSDOH Wadsworth Laboratory website.
- "Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.
- "Method reporting limit" or "MRL" means the lowest concentration at which an analyte can be detected and which can be reported with a reasonable degree of accuracy. It is the lowest concentration that can be measured, a lab-specific number, developed from minimum detection limits.
- "Nephelometric Turbidity Unit" or "NTU" is the unit by which turbidity in a sample is measured.
- "Preservation" means preventing the degradation of a sample due to precipitation, biological action, or other physical/chemical processes between the time of sample collection and analysis.

2 Project Scope

This section provides a general outline of the scope of groundwater and surface water sampling discussed in the *Groundwater and Surface Water Monitoring Plan* (GSMP) (EHS Support, 2021) and POTW discharge sampling that is required for the Site. A summary of the sampling program is provided below.

2.1 Groundwater and Surface Water Sampling

A table summarizing the groundwater and surface water sampling program, including the groundwater well and surface water sample identification numbers, sampling frequency, and laboratory analytical parameters, is provided in **Table 1**. The locations of groundwater wells and surface water sampling locations are provided in the GSMP.

2.2 POTW Discharge Sampling

Groundwater is pumped as part of the corrective measures at the Main Plant Site utilizing sumps in a French drain (Sump A and Sump B) and an extraction well (well EW-B5). The groundwater is discharged to a wet well at the effluent pumping station (EPS) building at the Site to be equilibrated before being pumped to the City of Glens Falls POTW. After equilibration, the water is monitored for pH and flow in accordance with the POTW Industrial User Permit (City of Glens Falls, 2017). The pH meter and flow monitor are calibrated annually where they discharge to the POTW.

The water quality is sampled on a quarterly basis from a port located at the POTW in accordance with the permit requirements. **Table 2** summarizes the POTW discharge sampling program, including the sampling frequency and the laboratory analytical parameters.

3 Analytical Methods

3.1 Groundwater and Surface Water Samples

Groundwater samples collected from permanent monitoring wells will be collected in accordance with the USEPA Low Flow Purging and Sampling Guidelines (USEPA, 2017) and the GSMP for the Site (EHS Support, 2021). Groundwater samples collected from active sumps and the active groundwater extraction well (well EW-B5) and surface water samples will be collected as grab samples.

Refer to **Table 1** for the following details for each sample location, including:

- Sampling frequency
- Analytical parameters to be measured at each location

Refer to **Table 3** for the following details for each sample location, including:

- Analytical methods to be used per matrix with minimum reporting requirements
- Sample preservation to be used per analytical method and sample matrix
- Sample container volume and type to be used per analytical method and sample matrix (sample containers will be properly washed, decontaminated, and appropriate preservative will be added [if applicable] prior to their use by the analytical laboratory; containers with preservative will be tagged as such)
- Sample holding time to be used per analytical method and sample matrix, in accordance with the NYSDEC ASP requirements

Field measurements will be collected and recorded at each sampling location for pH, dissolved oxygen, turbidity, specific conductivity, temperature, and oxidation-reduction potential. For permanent monitoring wells, a minimum of three measurements will be recorded in accordance with the purging and sampling requirements.

3.2 POTW Discharge Samples

Table 2 provides for the following details for POTW discharge sampling:

- Sampling frequency for each laboratory analyte
- Analytical methods to be used per matrix with minimum reporting requirements

4 Quality Assurance Sampling

Pursuant to DER-10 Technical Guidance for Site Investigation and Remediation, QA samples will be collected as described in the following sections.

4.1 Duplicate Samples

Duplicate samples will be collected during groundwater and surface water sampling at a frequency of 1 per 20 samples per media per sampling event. Duplicate samples will be identified as DUP-## (i.e., DUP-01). The corresponding sample will be recorded on the field notebook and/or sample log for later data verification and validation.

4.2 Matrix Spike, Matrix Spike Duplicate, and Equipment Blank Samples

Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected during groundwater and surface water sampling at a frequency of 1 per 20 samples per media per sampling event. The MS/MSD indicates the sample will be collected in triplicate. Each sample will be given the same name; however, a note for the lab to run the samples as MS and MSD will be written on the chain-of-custody form.

Equipment blank samples will also be collected during groundwater and surface water sampling at a frequency of 1 per media per day. They are collected by using laboratory provided de-ionized water. The de-ionized water is rinsed over or through decontaminated field sampling equipment and analyzed at the laboratory for the constituents of concern. Equipment blank samples will be identified as EB-## (i.e., EB-01). The corresponding sample will be recorded on the field notebook and/or sample log for later data verification and validation.

4.3 Trip Blank Samples

Trip blanks are prepared in the laboratory and must accompany all samples required for analysis of VOCs (1 trip blank sample per cooler containing VOC samples). Trip blanks must be recorded on the chain-of-custody form. The trip blank will be recorded with the date prepared by the laboratory and will be identified as TB-## (i.e., TB-01).

A trip blank sample will accompany each cooler containing a POTW discharge sample that will be analyzed for VOCs. A trip blank sample will also accompany each cooler containing a groundwater sample that will be analyzed for dichlorobenzenes.

4.4 Sample Custody

The DER-10 guidance indicates that field samples must be sent to the laboratory as soon as practicable. Samples shall not be left unattended or out of the custody of the sampler. Samples shall remain in the possession of the field personnel or within a locked vehicle or job trailer prior to shipment to the laboratory.

Each shipment should contain a chain-of-custody form for the sample contents. Refer to the detailed scope of work provided in the SMP for sample packing procedures.

For groundwater samples, a custody seal must be securely affixed to the outside of each cooler being shipped to the laboratory to verify samples have not been tampered with during transit.

5 Data Quality Objectives

This section outlines the site-specific DQOs. The DQOs are provided in **Table 2** (for POTW discharge sampling) and **Table 4** (for groundwater and surface water samples).

5.1 Laboratory Data Quality Objectives

5.1.1 POTW Discharge Samples

The analytical DQOs for POTW discharge samples are the limits necessary to demonstrate compliance with the POTW Industrial User Permit (City of Glens Falls, 2017). The DQOs, minimum reporting limits (MRLs), and MDLs for POTW discharge samples are summarized on **Table 2.**

5.1.2 Groundwater and Surface Water Samples

The analytical DQOs for groundwater are the Class GA Groundwater Standards published in NYSDEC Environmental Conservation Law (ECL) Regulation Chapter 10, Division of Water, Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations.

The analytical DQOs for surface water are SWQC for Class C waters, selected based on New York's classification of the Hudson River in the Site vicinity as "Class C" water, including standards/guidance values for protection of human health (based on water supply or fish consumption) and protection of aquatic life from chronic and acute effects (designated as A[C] and A[A], respectively).

Table 4 compares these DQOs to the laboratory MRLs and MDLs.

5.2 Field Data Quality Objectives

5.2.1 Decontamination

In addition to the QA sampling described in **Section 4**, additional precautions will be taken to ensure sampling devices are free from contaminants. A designated decontamination area will be established prior to commencing field activities.

All sampling equipment will be decontaminated prior to the start of field implementation and after each sampling event to minimize the risk of cross contamination. The decontamination chain will generally consist of a four-step process that includes a non-phosphate detergent washing station (e.g., Alconox), tap water rinse, distilled water rinse station, and air-drying station.

5.2.2 Field Calibration and Maintenance

Field equipment will be calibrated to the manufacturer's specifications on a daily basis at the beginning of the day. This information will be recorded in a calibration logbook.

Field equipment will be inspected prior to each sampling event and at the end of each day (i.e., water level meter, sampling pump, photoionization detector [PID], etc.) for needed maintenance.

5.2.3 Sample Packaging and Shipment

The general sample packing and shipment procedures are summarized as follows:

- Pack the ice in zip-locked type, double plastic bags. Seal the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler. The field crew could also request coolers without drain plugs from the laboratory.
- Line the bottom of the cooler with bubble wrap to prevent breakage during shipment.
- Check screw caps on sample containers for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample containers with indelible ink.
- Affix sample labels onto the containers.
- Wrap all glass sample containers with bubble wrap (or heavy-duty paper towels) to prevent breakage.
- Place samples in a sturdy cooler(s). Pack cooler with ice.
- Line the sample cooler with a laboratory supplied plastic liner, or a clean disposable plastic garbage bag.
- Enclose chain-of-custody documentation within a zip-locked type plastic bag affixed to the underside of the cooler lid.
- Fill the empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and possible breakage during shipment.
- Secure the custody seal on the outside of each cooler using clear tape.

5.2.4 Field Notes

The following information will be recorded in a field logbook and/or on appropriate field forms:

- Sample location and description
- Site or sampling area sketch showing sample location and measured distances to fixed locations
- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Sample matrix (e.g., groundwater)
- Type of sampling equipment used
- Field instrument readings and calibration
- Field observations and details related to analysis
- Locations of duplicate, MS/MSD, and field blanks/equipment blank samples
- Integrity of samples (e.g., weather conditions, noticeable odors, colors)
- Pertinent sample/lithology descriptions
- Sample preservation
- Shipping arrangements (delivery, pickup, or ship)
- Name of recipient laboratory

5.2.5 Daily Field Reports

A daily field activity report will be prepared for each day of sampling. This report will include:

- Project name
- Facility name and location
- Name of sampler

- Names of other personnel on-site and responsibilities
- Date and time
- Weather conditions
- Time started and ended
- Health and safety notations
- Field calibration information for any field equipment employed during sampling
- Description of the sampling activities by location and sampling interval
- Visitors on-site during sampling
- Departures from the sampling plan and other miscellaneous problems or information pertinent to the project

Daily reports will be signed with the date and time by the person collecting the samples and will be submitted at the end of the sampling event to the EHS Support Consultant Project Manager. These reports will be archived in the project files.

6 Data Deliverables and Validation Reports

Category B data reports will be produced by the laboratories for all groundwater and surface water samples, and data validation will be performed by the Project Chemist for these samples pursuant to the details indicated in this section.

6.1 Data Deliverables

All laboratory data deliverables for groundwater and surface water sampling will be prepared in accordance with Category B data deliverable as defined by NYSDEC ASP. Each report will contain at a minimum the following:

- Sample Delivery Group Narrative
- Name and address of laboratories performing analysis as well as certification summaries
- Chain-of-custody forms
- Test analyses results
- Calibration reports
- Surrogate recoveries when applicable
- Blank results
- Spike recoveries
- Duplicate results when applicable
- Internal standard area and retention time summary
- Chromatograms
- Raw data files
- Any other specific information as described in the most current NYSDEC ASP

6.2 Data Validation

Category B deliverables will be provided by the laboratory for groundwater and surface water samples, and a limited data validation review will be performed. Validation reports will be prepared for all laboratory analysis and will provide an evaluation of the analytical data to determine if the data meets the site-specific criteria for data quality and data use. Each validation report will be completed by a designated environmental professional who is fully capable of conducting the validation. Preparation of a validation report will include a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

Validation reports will be developed by reviewing and evaluating each analytical data package. In order for the validation report to be acceptable, the following questions will be considered:

- Is the data package complete as defined under the requirements for the most current NYSDEC ASP Category B or USEPA Contract Laboratory Program (CLP) data deliverables?
- Have all holding time criteria been met?
- Do the QC data (i.e., blanks, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls, and sample data) fall within the protocol-required limits and specifications?
- Have the data been generated using established and agreed upon analytical protocols?
- Have the correct data qualifiers been used and are they consistent with the most current NYSDEC ASP?

- Have any QC exceedances been specifically noted in the validation report and have the corresponding results been updated in the database to reflect validated data?

Once the data package has been reviewed and the above questions answered, the validation report will describe the samples and the analytical parameters, including data deficiencies, analytical protocol deviations, and any QC problems having an effect on the data quality or usability.

7 Electronic Data Deliverables

The NYSDEC's DER and the Division Materials Management (DMM) have adopted a standardized EDD format for all data submitted to NYSDEC. EDDs will be prepared in accordance with the NYSDEC EDD Manual, most recent version v.4, dated November 2018.

The NYSDEC has implemented an Environmental Information Management System (EIMS). The EIMS uses the database software application EQuIS™ from EarthSoft® Inc. ("EarthSoft"). Hercules has identified a database manager to ensure laboratory data will be formatted to meet the guidelines specified by NYSDEC prior to submitting the complete data packages, including ensuring the supporting tables are complete.

For guidance purposes, the following steps are provided to assist in submitting data in the EDD format and are from the NYSDEC website.

7.1 Step 1: Initial Setup

Download the following files to prepare the data submission to produce a properly formatted EDD. User manuals are available to provide detailed instructions on data preparation as well as identification of data fields that NYSDEC requires for data submittals.

- The EDD Quickstart Guide (PDF) provides concise steps for preparing the EDD. The user manual is more detailed and provides additional information.
- The Electronic Data Deliverable Manual (PDF) (November 2018) details the steps and procedures to prepare an EDD and contains table and field header definitions. Note that this manual will continue to be updated. Updates will be incorporated, as applicable.
- NYSDEC format files are templates in Microsoft Excel that are used to prepare the data submittal in the EDD format. The database manager will download and submit the template appropriate to the type of data.
- The Valid Value files are tables in Microsoft Excel that provide data for a number of the fields that make up the EDD format. If there is no appropriate value on the list of valid values, the database manager will request that it be added by sending an email to the NYSDEC EIMS Administrator at NYENVDATA@gw.dec.state.ny.us. The request will include the company contact information, the name of the valid value reference list, the new value needed, and any other helpful information.

7.2 Step 2: Check your EDD

The database manager will download and install the EQuIS Data Processor (EDP) to check their properly NYSDEC DER EDD formatted file. EDP's software was created by EarthSoft and the database manager will be redirected to their site to download the EDP and NYSDEC EDD format file. EarthSoft's EDP user guide (PDF) and NYSDEC's EDP Quickstart guide (PDF) are available to guide users through the installation of EDP.

EDP performs a series of formatting checks on the EDD and identifies a select group of errors in the data file prior to submission. After completing the EDP review, data providers will review the Final Checklist for Submission of EDDs to NYSDEC which documents various items that are not yet checked and detected automatically using EDP but refer to critical fields required by NYSDEC to be populated in the

EDD. Without completing these fields, the EDD will not load into the database. Compliance with this checklist will expedite a successful EDD submission to NYSDEC.

The database manager will register the EDP software with EarthSoft (this is free); instructions on this are located in the EDP guide. The DEC EIMS Administrator typically provides an email within 2 business days confirming the software registration, along with a user login id and password to submit the checked EDD. If the DEC EIMS Administrator does not provide a confirmation email within 2 days, the database manager will contact the DEC EIMS Administrator at NYENVDATA@gw.dec.state.ny.us, rather than attempt to reregister.

The valid values used by EIMS are periodically updated for the EDP; therefore, it is important to use the most recent version of the EDP and NYSDEC format file. The DEC website in conjunction with the EarthSoft website will have the most up-to-date EDP and format file. The database manager will periodically check this website to verify that the most current version of the EDP and format file are being used.

7.3 Step 3: Submit your EDD

When the EDD has cleared the EDP checker, the database manager will select the Sign and Submit option in the EDP software and use the NYSDEC user id and password to produce a properly named and formatted .ZIP file. If the submission package is less than 25 MB in size, the database manager will email the zipped file to NYENVDATA@gw.dec.state.ny.us or if the file is larger than 25 MB it will be submitted via a web link or CD-ROM to the NYSDEC project manager.

8 References

EHS Support. 2021. Groundwater and Surface Water Monitoring Plan. March.

City of Glens Falls. 2017. Industrial User Permit No. 002F. Issued to Hercules LLC and BASF Corporation by the City of Glens Falls, Water and Sewer Board of Commissioners. April 21.

NYSDEC. 1998. Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (October 22, 1993, Reissue Date June 1998, as modified and supplemented by the January 1999 Errata Sheet and the April 2000 and June 2004 Addenda).

NYSDEC. 2006. Title 6 of the Official Compilation of the New York Codes, Rules, and Regulations, Part 375, Environmental Remediation Programs (6 NYCRR Part 375). December.

NYSDEC. 2010. Program Policy, Division of Environmental Remediation (DER), Technical Guidance for Site Investigation and Remediation (DER-10). May 3.

USEPA. 2017. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. September 19.

Tables

Table 1
Sampling Event Summary - Groundwater and Surface Water Monitoring
Former Ciba-Geigy Facility, Glens Falls, NY

Gauge & Sample	Area of the Property	Sampling Frequency	Total Cyanide[1]	Dissolved Chromium and Hexavalent Chromium[2]	Free Cyanide[3]	Dissolved Vanadium[2]	1,2-, 1,3-, and 1,4-Dichlorobenzenes	Total Dissolved Solids[4]	Hardness
Overburden Groundwater Wells									
IP-4	MPS - Western	Annual	1	1					
MW-28 [5]	MPS - Western	Annual	1	1					
MW-31	MPS - Eastern	Annual	1	1					
MW-OB14	MPS - Central	Semi-Annual	1	1					
MW-OB25	MPS - Central	Annual	1	1					
MW-OB26	MPS - Central	Annual	1	1					
MW-OB30	MPS - Central	Semi-Annual	1	1					
MW-OB31	MPS - Central	Annual	1	1					
MW-OB32	MPS - Central	Semi-Annual	1	1					
MW-OB33	MPS - Central	Annual	1	1					
MW-OB34	MPS - Central	Annual	1	1					
MW-OB19	PTP	Annual	1						
MW-OB23	PTP	Annual	1						
Sumps - Groundwater									
Sump A	MPS - Central	Annual	1	1					
Sump B	MPS - Central	Annual	1	1					
Shallow Groundwater Bedrock Wells									
AW-A11	MPS - Central	Annual	1	1					
AW-A14	MPS - Central	Annual	1	1					
MW-25S	MPS - Western	Annual	1	1					
Intermediate Groundwater Bedrock Wells									
AW-B4	MPS - Central	Annual	1	1					
EW-B5	MPS - Central	Semi-Annual	1	1					
AW-B18	MPS - Western	Annual	1	1			1		
Deep Groundwater Bedrock Wells									
AW-C2	MPS - Western	Annual	1	1					
AW-C11	MPS - Central	Semi-Annual	1	1					
Surface Water Samples									
SW-01	MPS - Downriver	Annual		1	1	1		1	1
SW-02	MPS - Central	Annual		1	1	1		1	1
SW-03	MPS - Central	Annual		1	1	1		1	1
SW-04	MPS - Upriver	Annual		1	1	1		1	1
SG-11	PTP	Annual			1				

Notes:
µm = micrometer
MPS = Main Plant Site
PTP = Pretreatment Plant Site
1 = Total cyanide is an unfiltered sample.
2 = Chromium, hexavalent chromium, and vanadium samples filtered in the field using 0.45 µm filters
3 = Free Cyanide is an unfiltered sample. Free Cyanide samples are to be collected per lab instructions.
4 = Total Dissolved Solids are to be laboratory-derived, not calculated.
5 = MW-28 has produced insufficient water for sampling during some previous groundwater sampling events. If well MW-28 is unable to be sampled, well MW-26 will be sampled as a substitute.

Table 2
Sampling Event Summary and DQOs - POTW Discharge Sampling
Former Ciba-Geigy Facility, Glens Falls, New York

Parameter	CAS Number	Media	Sampling Frequency	Laboratory Method	MRLs (mg/L)	MDLs (mg/L)	POTW Effluent Limitations[1] (mg/L)
Antimony	7440-36-0	W	Annual	EPA 200.8	0.005	0.0005	10
Ammonia	7664-41-7	W	Annual	EPA 350.1	0.25	0.1	40
Arsenic	7440-38-2	W	Annual	EPA 200.8	0.003	0.0015	0.25
Benzene	71-43-2	W	Annual	EPA 624	0.001	0.00043	0.1
Biochemical Oxygen Demand (BOD)	STL00311	W	Annual	SM 5210B	2	2	-
Boron	7440-42-8	W	Annual	EPA 200.7	0.1	0.036	5
Cadmium	7440-43-9	W	Annual	EPA 200.8	0.0005	0.00015	0.25
Calcium	7440-70-2	W	Annual	EPA 200.7	0.5	0.025	500
Chloroform	67-66-3	W	Annual	EPA 624	0.001	0.0005	1
Chromium, total	7440-47-3	W	Quarterly	EPA 200.8	0.005	0.0016	*See below 2*
Copper	7440-50-8	W	Annual	EPA 200.8	0.005	0.0017	1
Cyanide, total	57-12-5	W	Quarterly	EPA 335.4	0.1	0.025	3
Ethylbenzene	100-41-4	W	Annual	EPA 624	0.001	0.00033	0.1
Iron	7439-89-6	W	Annual	EPA 200.8	0.1	0.025	50
Lead	7439-92-1	W	Quarterly	EPA 200.8	0.0025	0.00098	0.8
Manganese	7439-96-5	W	Annual	EPA 200.8	0.005	0.0018	5
Mercury	7439-97-6	W	Quarterly	EPA 245.1	0.0002	0.00008	0.005
Methylene Chloride	75-09-2	W	Annual	EPA 624	0.005	0.0025	1
Naphthalene	91-20-3	W	Annual	EPA 625	0.01	0.0007	1
Nickel	7440-02-0	W	Annual	EPA 200.8	0.005	0.0019	2.3
Oil & Grease	STL00181	W	Annual	EPA 1664A	5.00	1.40	50
Pentachlorophenol	87-86-5	W	Annual	EPA 625	0.05	0.0018	-
2,4,6-Trichlorophenol	95-95-4	W	Annual	EPA 625	0.01	0.01	-
2,4,5-Trichlorophenol	88-06-2	W	Annual	EPA 625	0.01	0.00082	-
Phenols	STL00166	W	Quarterly	EPA 420.1	0.05	0.025	5
Silver	7440-22-4	W	Annual	EPA 200.8	0.001	0.0001	0.2
Toluene	108-88-3	W	Annual	EPA 624	0.001	0.00048	0.1
Total Suspended Solids	STL00161	W	Annual	SM 2540D	2.50	2.5	-
1,1,1 - Trichloroethane	71-55-6	W	Annual	EPA 624	0.001	0.00037	1
Xylene	1330-20-7	W	Annual	EPA 624	0.002	0.00057	0.1
Zinc	7440-66-6	W	Annual	EPA 200.8	0.02	0.0096	1.5

Notes:
- = No standard value
CAS = Chemical Abstracts Service
DQO = data quality objective
lb/day = pounds per day
MDL = method detection limit
mg/L = milligrams per liter
MRL = minimum reporting limit
POTW = publicly owned treatment works
W = water
1 = POTW Effluent Limitations are instantaneous maximums, except for mercury.
2 = Discharge for total chromium is 3.1 lb/day and will be based on the average of chromium sampling data and the quarterly average flow.
3 = The POTW Effluent Limitation for mercury is calculated as a quarterly average.

Table 3
Laboratory Method Summary - Groundwater and Surface Water Monitoring
Former Ciba-Geigy Facility, Glens Falls, NY

Analyte	Groundwater Quality Standard GA standard[1] (µg/L)	Surface Water Quality Standard[1] Class A, B, C (µg/L)	Method Number	Media	Anticipated Reporting Limit (µg/L)	Sample Container Type	Container Volume (each in mL)*	No. Containers per sample	Preservation	Holding Time
Geochemistry Parameters										
Total Dissolved Solids	not screened	not screened	SM2540C	Water	10,000	Plastic	500	1	Cool, < 6 deg. C.	7 days
Hardness	not screened	not screened	SM2340C	Water	2,000	Plastic	250	1	HNO3 to pH<2	6 Months
Dissolved Metals										
Chromium	50	calculated*	SW846 6020A	Water	1.5	Plastic	250	1	Filtration + HNO_3 to pH<2	6 Months
Vanadium	n/a	190 A(A) 14 A(C)			2					
Hexavalent Chromium	50	16 A(A) 11 A(C)	EPA 218.6	Water	0.3	Plastic	125	1	Filtration + NH4OH/(NH4)2SO4	28 days
Cyanide										
Total Cyanide	200	9000 H(FC)	SW846 9012B	Water	10	Plastic	250	1	NaOH to pH>12, Cool, < 6 deg. C.	14 Days
Volatile Organic Compounds										
Dichlorobenzenes (1,2-; 1,3-; and 1,4-)**	3	5	SW846 8260C	Water	1	Glass VOA	40	3	HCl to pH<2, Cool, < 6 deg. C.	14 Days
Free Available Cyanide										
Free Cyanide	n/a	5.2 A(C) 22 A(A)	OIA-1677	Water	2	Glass VOA	40	1	lead-acetate strip test for sulfide 40 mL VOA with NaOH or if sulfide detected 40 mL VOA no preservative	14 Days or 24 hrs

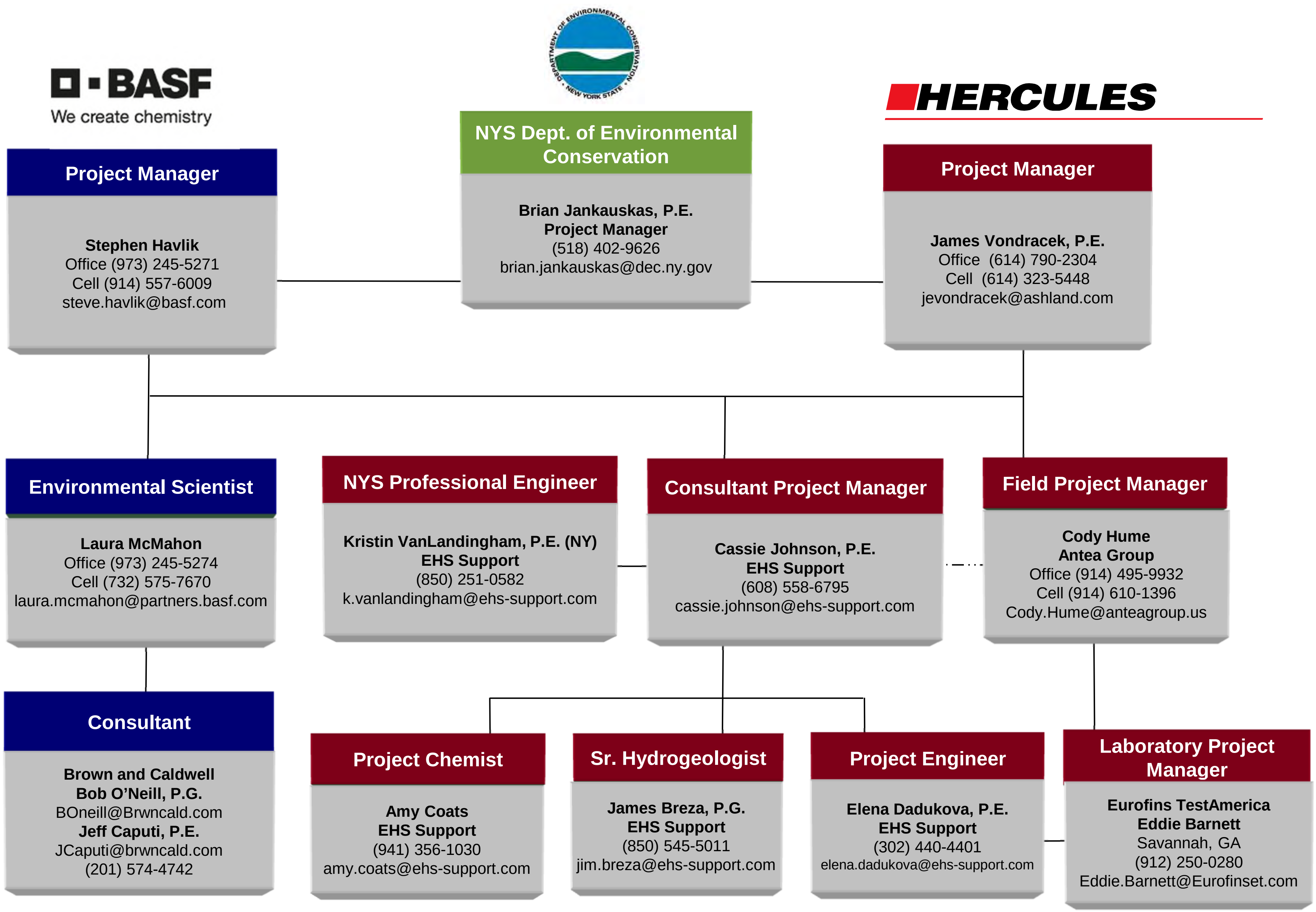
Notes:
* = indicates A(A) and A(C) values are calculated based on hardness
** = GA standard for dichlorobenzenes (DCB) applies individually to isomers (1,2-DCB; 1,3-DCB; and 1,4-DCB). Surface water A(C) value applies to the sum of the isomers.
µg/L = micrograms per liter
A(C) = protective of fish propagation 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)
DCB method will allow reporting to less than 3 µg/L with applicable qualification
deg C = degrees Celsius
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
HCl = hydrochloric acid
HNO3 = nitric acid
mL = milliliters
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.
NaOH = sodium hydroxide
NH4OH = ammonium hydroxide
(NH4)2SO4 = ammonium sulfate
NYCCR = New York Codes, Rules and Regulations
NYS = New York State
TOGS = Technical and Operational Guidance Series
VOA = volatile organic analysis
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).

Table 4
DQOs for Groundwater and Surface Water Sampling
Former Ciba-Geigy Facility, Glens Falls, New York

Parameter	CAS Number	Laboratory Method	Media	MRLs (µg/L)	MDLs (µg/L)	Groundwater Quality Standard GA standard[1] (µg/L)	Surface Water Quality Standard[1] Class A, B, C (µg/L)
Chromium	7440-47-3	SW846 6020A	W	1.5	0.36	50	calculated[2]
Vanadium	7440-62-2		W	2	1.2	n/a	190 A(A) 14 A(C)
Hexavalent Chromium	18540-29-9	EPA 218.6	W	0.3	0.23	50	16 A(A) 11 A(C)
Total Cyanide	57-12-5	SW846 9012B	W	10	5	200	9000 H(FC)
1,2-Dichlorobenzene[3]	95-50-1	SW846 8260C	W	1	0.79	3	5 A(C)
1,3-Dichlorobenzene[3]	541-73-1	SW846 8260C	W	1	0.78	3	5 A(C)
1,4-Dichlorobenzene[3]	106-46-7	SW846 8260C	W	1	0.84	3	5 A(C)
Total Dissolved Solids	n/a	SM2540C	W	10000	4000	not screened	not screened
Hardness	n/a	SM2340C	W	2000	525	not screened	not screened
Free Cyanide	57-12-5F	OIA-1677	W	2	1.69	n/a	5.2 A(C) 22 A(A)

Notes:
µg/L = micrograms per liter
A(C) = protective of fish propagation in fresh waters
A(A) = protective of fish survival in fresh waters
CAS = Chemical Abstracts Service
DCB = dichlorobenzenes
DQO = data quality objective
GA = protective of fresh groundwaters for drinking water source
H(FC) = protective of human health for fish consumption
MRL = minimum reporting limit
MDL = method detection limit
n/a = not applicable
not screened = indicates not a site-related constituent; data used for geochemical assessment/developing surface water criteria only
W = water
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).
2 = A(A) and A(C) values are calculated based on hardness.
3 = GA standard for 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 µg/L with applicable qualification.

Figures



EHS Support

Figure 1. Project Organization Chart
Former Ciba-Geigy Facility, Glens Falls, New York

03/01/2021