Glenn Springs Holdings, Inc.
A subsidiary of Occidental Petroleum

Joe Branch
Project Manager
Direct Dial (231) 670-6809

7601 Old Channel Trail
Montague, MI 49437
Fax (231) 894-4033

August 2, 2024

Reference No. 11225008

Mr. Benjamin J. McPherson
RCRA Project Manager
New York State Department of Environmental Conservation (NYSDEC)
700 Delaware Avenue
Buffalo, NY 14209

Re: Final Remedial System Optimization Report
Occidental Chemical Corporation, Buffalo Avenue Plant
NY Permit Number 9-2911-00112/00167-0

In accordance with Schedule 1 of Module 1, Section D, Item 5 of the Buffalo Avenue Plant's Resource Conservation and Recovery Act (RCRA)/Part 373 Permit effective September 15, 2022, please find attached the "Final Remedial System Optimization Report". GSH has reviewed comments provided by NYSDEC via letter dated May 8, 2024 regarding the report entitled "Draft Remedial System Optimization Report". GSH's response to the comments are provided below. GSH has incorporated NYSDEC's May 8, 2024 comments on the "Draft Remedial System Optimization Report" into this "Final Remedial System Optimization Report".

Comment 1

Section 2.1, Off-Site Areas: it should be stated in this section that the off-site overburden groundwater is also subject to monitored natural attenuation in certain areas of the site.

Response

Please see revised Section 2.1.

Comment 2

Section 2.3.1.2.1 and 2.3.1.2.2, Sewer and Outfall Flow Volume: the volume of water that is discharged to the Niagara Falls Water Board and through the SPDES Outfalls is not typically included in corrective action reports. It is requested that future plans regarding improvements/changes to these systems include past flow data. Of particular interest is how the flow may have changed since the shutdown of chemical production operations at the site.

Response

Where available, GSH will provide flow data in future plans regarding system improvements.

Comment 3

Table 3.2, Recommendation EF2: it is requested that the interstage carbon data be provided to NYSDEC in any future assessments relating to this recommendation.

Response

Concur. GSH will provide interstage data to NYSDEC when this evaluation is completed.

Comment 4

Table 3.2, Recommendation EF3: in addition to redirecting rainwater out of the APL containment dike, consideration should be given to possible beneficial uses of already collected rainwater (e.g. to backwash sand filters).

Response

Table 3.2 has been revised to add this consideration.

Comment 5

Table 3.2, Recommendation PI4: NYSDEC is especially interested in the further evaluation of this recommendation. The Flow Zone 1 system remains one of NYSDEC's concerns and improvements to the Flow zone 1 system that reduce operational downtime may help to address these concerns.

Response

GSH will continue to evaluate the Flow Zone 1 system and areas for improvement. GSH will continue to keep NYSDEC informed of the outcome of the evaluation. As indicated in emails between GHD and NYSDEC dated June 18, June 25, and July 12, 2024, additional groundwater sampling was performed to assist in evaluating conditions in Flow Zone 1.

Comment 6

Table 3.2, Rating Description: a description of the rating "ABD" is missing from the rating notes and should be added to the table.

Response

See revised Table 3.2. "ABD" means "Already Being Done".

Comment 7

Figure 1.2, Flow Diagram: it is requested that the vapor and aqueous phase flowlines be shown as different symbols and/or with different colors on this figure. Clarification is also requested regarding the flow path from the carbon bed effluent to the scrubber.

Response

See revised Figure 1.2. Aqueous phase flowlines are now colored blue. The flow path from the carbon bed effluent to the scrubber does not exist and has been removed.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Should you have any questions on the above, please do not hesitate to contact Joseph Branch at 231-670-6809 or email at joseph_branch@oxy.com or Tim Bathory at 716-278-7679 or email at timothy_bathory@oxy.com.

Very truly yours,

Joseph Branch
Project Manager
Glenn Springs Holdings, Inc.

DQ/dq/24/11225008

Encl.

cc: A. Caprio, NYSDEC
L. Winterberger, NYSDEC
D. Evans, NYSDEC
A. Everett, USEPA
T. Bathory, GSH
D. Quigley, GHD
J. Pentilchuk, GHD

Final Remedial System Optimization Report

Occidental Chemical Corporation
Buffalo Avenue Plant
Niagara Falls, New York

Glenn Springs Holdings, Inc.

August 02, 2024

→ The Power of Commitment

Table of Contents

Figure index

Table index

Attachments

Attachment A OMP Figure 1.2 Third Quarter 2023 Quarterly Progress Report, Table 1 and Table 2

1. Introduction

A Corrective Action Program (CAP) has been implemented at Occidental Chemical Corporation's (OxyChem's) Buffalo Avenue Plant (Plant or Site) pursuant to the Plant's Resource Conservation and Recovery Act (RCRA)/Part 373 Permit (NY Permit Number 9-2911-00112/00167-0). Glenn Springs Holdings, Inc. (GSH), an affiliate of OxyChem, is responsible for this remediation project, including the implementation of the CAP.

The RCRA/Part 373 Permit was renewed in 2022. GSH has prepared this Final Remediation System Optimization (RSO) Report in accordance with Schedule 1 of Module 1, Section D, Item 5 of the RCRA/Part 373 Permit effective September 15, 2022. As stated under the referenced Item 5, Footnote 1, RSO is a “multi-tiered approach to improving efficiency, effectiveness, and net environmental benefit of a remedy, reducing costs, and achieving site closure”. The objective of the RSO is to improve operational efficiency to reduce costs, improve the sustainability of the remedy, hasten remediation, and reduce long-term operation and maintenance (O&M) costs. The purpose of this Final RSO Report is to document how GSH completed a RSO audit, evaluated options for improvement, and developed recommendations to improve system performance and facilitate progress toward remedy completion.

1.1 Scope of Work

As stated in Schedule 1 of Module 1, Section D, Item 5, Footnote 1 of the RCRA/Part 373 Permit:

> *“Remedial Site Optimization (RSO) is the multi-tiered approach to improving efficiency, effectiveness, and net environmental benefit of a remedy, reducing costs, and achieving site closure. This is achieved by focusing on the site strategy, process optimization and supply management. An RSO report provides a critique of a site’s conceptual model, gives a summary of past performance, documents current cleanup practices, summarizes progress made towards the site cleanup goals, and provides recommendations for improvement if needed. The RSO is not a periodic review report (PRR). The RSO is conducted in addition to the PRR. The RSO differs from a periodic review in that periodic review focuses on confirming the protectiveness of the remedy while RSO focuses on optimization of the remedy.*
>
> *The underlying concept for the RSO process is to identify and implement ongoing improvement. The RSO process evaluates the remedial situation, reports on it as it is, and provides recommendations for improvement.*
>
> *An RSO is an engineering audit of the performance of a site with an active remedy. A complete RSO cycle consists of performing the RSO audit, implementing the RSO's suggestions, and operating the remedy under the RSO changes for a period of time. The cycle is repeated through the life of the actively performing remedy.*
>
> *Objectives of the RSO include improving operational efficiency to reduce costs, improve the sustainability of the remedy, hasten remediation and reduce long-term O&M costs.*
>
> *The typical scope for an RSO may include research, evaluation, and recommendation.”*

As the RCRA/Part 373 Permit states, RSO is not the same as a periodic review. However, GSH has a robust site evaluation program that evaluates opportunities for system optimization, remedy optimization, and cost savings on an annual basis. GSH completed the RSO audit as a separate project, but GSH does focus on program optimization on a routine basis as part of regular operations and management of the Site.

A RSO Work Plan (Work Plan) was submitted to the New York Department of Environmental Conservation (NYSDEC) pursuant to the RCRA/Part 373 Permit on June 12, 2023. NYSDEC approved the Work Plan via letter dated October 12, 2023. The scope of the RSO audit as identified in the Work Plan included research and document review to identify opportunities for optimization. This included:

1. Corrective Measures Review
2. Review of Performance Data

3. Compliance Review
4. Review of Operations and Associated Records
5. Environmental Footprint Review
6. Best Management Practices and Automation Review
7. Safety Review

GSH then evaluated this information gathered during the research and document review step, and summarized it into findings and observations in the Draft RSO Report. GSH submitted the Draft RSO Report to NYSDEC on December 15, 2023. NYSDEC provided comments to GSH on the Draft RSO Report on May 8, 2024 and requested a response by June 24, 2024. NYSDEC later confirmed via an email dated June 7, 2024 that the due date of for the Final RSO Report in accordance with the Part 373 Permit was August 6, 2024. GSH has incorporated NYSDEC's May 8, 2024 comments into this Final RSO Report.

1.2 Report Overview

This Report is organized as follows:

– Section 2 presents Site background and a description of the remedial action, remedial goals, and program
– Section 3 presents findings and observations from the RSO audit
– Section 4 presents recommendations from the RSO audit, and
– Section 5 presents the schedule for next steps

2. Site Background and Remedial Action Description

2.1 Site Location, History, and Existing Remedy

The Site is located at 4700 Buffalo Avenue in Niagara Falls, New York. Chemical manufacturing has occurred at the Site since the early 1900s. The Plant ceased manufacturing in August 2021. Chlorine, caustic soda (sodium hydroxide), hydrogen, bleach and hydrochloric acid were the primary chemical products manufactured at the Plant. A wide range of chlorinated organic compounds were manufactured beginning in the 1920s, with production of these compounds peaking in the 1940s to 1970s. These include, but are not limited to, chlorobenzenes, chlorobenzotrifluorides, chloroethenes, chlorotoluenes, hexachlorobutadiene, hexachlorocyclopentadiene, and 2,4,5-trichlorophenol. Dioxin, mercury, and elemental phosphorus contamination related to the former manufacturing processes are also present at the Site.

The final RCRA Facility Investigation (RFI) was completed in February 1995. The RCRA/Part 373 Permit stated that the CAP for the Plant would be implemented in four separate phases as Interim Corrective Measures (ICMs) addressing the following:

– Bedrock groundwater flow regime
– Overburden groundwater flow regime
– Overburden soils
– Off-Site areas

The ICMs implemented for each of the four phases, as presented in the document entitled "Final Corrective Measures Study", dated November 1998 (Final CMS), were as follows:

Bedrock Groundwater

– Extraction wells along the downgradient west and northwest Plant property boundaries in the D-, C-, and B-Zones

– On-Site groundwater treatment system
– Hydraulic monitoring program to monitor the effectiveness of the hydraulic containment system
– Chemical monitoring program to verify long-term changes
– Non-aqueous phase liquid (NAPL) collection from on-Site bedrock wells
– Collection of NAPL

Overburden Groundwater

– Flow Zone 1 – Stages 1, 3, and 4 groundwater collection systems and on-Site treatment system
– Flow Zone 3 – Energy Boulevard Drain Tile System (EBDTS)
– Hydraulic monitoring program to monitor the effectiveness of the hydraulic containment systems
– Chemical monitoring program to verify long term changes
– Collection of groundwater via sanitary sewers and treatment at the Niagara Falls Water Board (NFWB) Wastewater Treatment Plant (WWTP)
– Monitoring groundwater infiltration into the outfall sewers as required by State Pollution Discharge Elimination System (SPDES) Permit (and reduction where necessary)

Overburden Soil

– Maintenance of overburden groundwater ICM components
– Deed restrictions
– Institutional controls
– Maintenance of Plant perimeter fence
– Perimeter overburden NAPL monitoring
– NAPL recovery (when sufficient quantity is encountered) and treatment of recovered NAPL
– Maintenance of capped dioxin and elemental phosphorus areas and surface drainage control
– Maintenance of capped and existing hard surfaced areas

Off-Site Areas

– Collection of off-Site groundwater via the existing bedrock groundwater extraction system which will continue to draw chemicals back toward the Plant and prevent further off-Site chemical migration.
– Collection of off-Site groundwater via the Falls Street Tunnel (FST) which collected D-Zone groundwater until April 30, 2012. All dry weather flow in the FST up until closure was treated by the NFWB WWTP.
– Monitored natural attenuation. Monitoring of off-Site bedrock groundwater quality is performed as part of the on-Site bedrock groundwater corrective measures. Off-site overburden groundwater is also subject to monitored natural attenuation in some areas of the Site.

A long-term performance monitoring program has been implemented to ensure that the Corrective Measures continue to achieve remedial goals. The long-term monitoring requirements include the following:

Bedrock Systems

– Bedrock groundwater hydraulic monitoring
– Bedrock groundwater chemical monitoring
– Bedrock groundwater treatment system effluent monitoring
– Bedrock NAPL monitoring and collection

Overburden Systems

– Overburden groundwater hydraulic monitoring
– Overburden groundwater chemical monitoring
– Overburden groundwater treatment system effluent monitoring

– Sanitary and outfall sewer effluent monitoring
– Overburden NAPL monitoring and collection
– Overburden soil cover material monitoring

A detailed description of all the Corrective Measures implemented at the Plant is presented in the Final CMS. An overview of the implemented Corrective Measures that require performance monitoring is presented in the following sections.

2.2 Bedrock Corrective Measures

A summary of the bedrock remedial program is presented in the following sections. The components of the bedrock remedial system are shown on Figure 2.1.

2.2.1 Bedrock Groundwater

The remedial system that was selected for the bedrock groundwater flow regime involved hydraulic containment, treatment, and monitoring of the chemical plume in the bedrock groundwater beneath the Plant. The remedial system commenced operation in April 1996 and consisted of the following components:

– A groundwater extraction system of 19 extraction wells capable of creating a hydraulic barrier in the D-, C-, and B-Zones of the bedrock along the northwestern and western Plant property boundaries
– An on-Site groundwater treatment system composed of an air stripper, thermal oxidation unit, and carbon vessels designed to treat 1,200 gallons per minute (gpm) located in the F-Area of the Plant (F-Area treatment system)
– A hydraulic monitoring program to monitor the effectiveness of the hydraulic containment system
– A chemical monitoring program to verify long term changes

As a result of evaluations performed by GSH, only 13 extraction wells are currently operational. C-Zone extraction wells BEW701C, BEW702C, and BEW703C were shut down on May 22, 2007 with NYSDEC approval and D-Zone extraction wells BEW701D, BEW702D, and BEW703D were shut down on October 9, 2008 with NYSDEC approval. Pumping from these extraction wells is no longer required to achieve hydraulic containment in the D- and C-Zones.

The bedrock groundwater remedial system components collect and treat bedrock groundwater from each of the three zones within the bedrock along the north and west (downgradient) boundaries of the Plant except the east portion of the north Plant boundary (east of OW408). Concentrations of Site-related chemicals in the bedrock groundwater in the eastern downgradient area are low and have been decreasing over time and consequently, a remedial system was not required in this area. The upper zone of the bedrock (D-Zone) is located from 0 to 45 ft below the top of rock (BTOR). The middle zone (C-Zone) is located from 55 to 85 ft BTOR. The lower zone (B-Zone) is located from 85 to 150 ft BTOR.

2.2.2 Bedrock NAPL

During investigations conducted as part of the RFI, some bedrock wells were observed to contain collectable quantities of NAPL. To address the NAPL presence in the bedrock, an ICM was implemented in 1992. The ICM consisted of the following components:

– NAPL collection from on-Site bedrock wells where substantial quantities of NAPL could be recovered
– Treatment of collected NAPL
– Monitoring all A-zone wells for NAPL presence and any B-Zone wells where NAPL is found in the corresponding A-well

There are currently only fourteen bedrock wells that exhibit collectable quantities of NAPL: OW402A, OW413A, OW417A, OW401B, OW229, OW243, OW618, OW619, OW620, OW621, OW634, OW638, OW635, and OW643. Extracted NAPL is treated off Site at an approved facility.

2.3 Overburden Corrective Measures

A summary of the overburden remedial program is presented in the following sections. The components of the overburden remedial system are shown on Figure 2.2.

2.3.1 Overburden Groundwater

Corrective measures for overburden groundwater were implemented in the following areas:

Perimeter Areas	Flow Zone 1 Flow Zone 3 Abandoned Outfall 005
Interior Areas	Sanitary Sewer System Outfall Sewer System

The ICMs implemented for each of these areas are described below.

2.3.1.1 Perimeter Areas

The remedial concept for the identified perimeter areas of the Plant was to establish hydraulic containment along the Plant boundary to restrict off-Site chemical migration via overburden groundwater flow in Flow Zone 1 and Flow Zone 3. The two flow zones were addressed as described below.

2.3.1.1.1 Flow Zone 1

The corrective measures for Flow Zone 1 were designed to intercept over 98 percent of the off-Site chemical loading leaving the Plant via the overburden groundwater flow regime. The remedial system for Flow Zone 1 was implemented in four stages. The final stage was completed in the fall of 1998. The Flow Zone 1 remedial system consists of the following components:

- A 1,500-foot-long groundwater collector that extends from MHA to MHF along the south boundary of the Plant and consists of the abandoned Outfall 002 and a new 6-inch diameter collection pipe installed immediately on top of Outfall 002
- A 740-foot-long groundwater collector installed along the southwest corner of the Plant that extends from CMH2 to MHA and drains to two wet wells (WW1 and WW2)
- A forcemain to connect WW1 and WW2 to BEW700B such that the groundwater is treated at the existing F-Area carbon treatment system
- An in-line carbon dioxide pH adjustment system at WW1, WW2, MHB, and MHC
- A hydraulic monitoring program to monitor the effectiveness of the hydraulic containment system
- A chemical monitoring program to verify long term changes

On December 11, 2008, a forcemain was completed to connect the Flow Zone 1 collection system (WW1 and WW2) to the F-Area treatment system via bedrock extraction well BEW700B. As of that date, all Flow Zone 1 remedial groundwater is treated by the F-Area treatment system.

2.3.1.1.2 Flow Zone 3

In 1979, a stormwater collection system was installed beneath Energy Boulevard as part of road and access improvements. The Energy Boulevard storm sewer system discharges to an off-Site section of Outfall 004 immediately north of the northern Plant boundary at 47th Street. Historic SPDES sampling showed elevated organic chemical presence in this storm system as a result of groundwater infiltration. The EBDTS was installed in 1980 parallel to and at an elevation below the invert of the storm sewer system to prevent infiltration of overburden groundwater and NAPL into the sewer. The location of the EBDTS is shown on Figure 2.2.

The EBDTS intercepts off-Site chemical loading from Flow Zone 3 identified during the RFI and consists of the following components:

– Approximately 500 ft of perforated collection tile
– A first-stage wet well where NAPL is collected and removed
– A second-stage wet well where groundwater is collected and removed
– An overhead forcemain that discharges groundwater to the Iroquois Street sanitary sewer
– A hydraulic monitoring program to monitor the effectiveness of the hydraulic containment system
– A chemical monitoring program to verify long-term changes

Although not part of the CAP, OxyChem voluntarily implemented upgrades in 2003 to the EBDTS that include the following:

– Installation of a forcemain that connects WWB of the EBDTS to extraction well BEW706C such that collected groundwater is treated at the F-Area treatment system instead of being discharged to the sanitary sewer
– Abandonment of a 360-foot section of sanitary sewer in the northern D-Area parallel to the north Plant boundary, and conversion of the abandoned sewer to a groundwater collection system that discharges to WWB of the EBDTS

The upgrades to the EBDTS are monitored and reported in accordance with the permitted overburden groundwater collection systems. The upgraded system commenced operation in the first quarter of 2004. The location of the abandoned D-Area sanitary sewer is shown on Figure 2.2.

2.3.1.1.3 Abandoned Outfall 005

Although not part of the CAP, OxyChem has voluntarily implemented an additional groundwater collection system. On November 29, 2002, the abandoned section of Outfall 005 in the F-Area of the Plant was tied into the F-Area groundwater treatment system via a pumping/forcemain system from MH159L. This system collects groundwater that infiltrates into the 925-foot-long section of abandoned gravity sewer. Full-scale pumping from MH159L commenced on December 21, 2002. This system is monitored and reported in accordance with the permitted overburden groundwater collection systems. The location of the Abandoned Outfall 005 system is shown on Figure 2.2.

2.3.1.2 Interior Areas

2.3.1.2.1 Groundwater Infiltration to Sanitary Sewer System

Historic sewer installations at the Plant did not use watertight construction materials and methods. Consequently, groundwater infiltration into the sanitary sewer system occurred. Throughout the late 1970s and to the present, OxyChem has been upgrading the sewers to improve the quality of the water leaving the Plant.

OxyChem is not planning further corrective measures on the sanitary sewer system at the Plant at present. Discharge to the sanitary sewer system is regulated under permit with the Niagara Falls Water Board (NFWB) (Significant Industrial User Wastewater Discharge Permit No. 22). The sanitary sewers currently operate within the discharge limit established by the NFWB permit (and the WWTP SPDES Permit). These systems provide an essential component of groundwater collection within the Plant area and at the Plant boundary. As conditions currently exist, the overburden flow, which discharges to the sanitary sewer, is treated prior to discharge to the Niagara River.

2.3.1.2.2 Groundwater Infiltration to Outfall Sewer System

OxyChem has conducted various investigations and made numerous modifications to the outfall sewer network beneath the Plant to significantly reduce chemical loadings to the Niagara River. Modifications have included abandoning sewer sections in demolished areas of the Plant, replacing sewers with watertight piping, lining existing sewer pipes, repairing and purging manholes, and cleaning of sewers.

Outfall sewer modifications have reduced the total loading of chlorinated compounds and benzene and toluene to the outfall sewers from approximately 119 pounds per day in 1984 to 8 pounds per day in 1990 for the sum of the Outfalls.

With the elimination of Outfall 001 in July 2006, the current load to the outfall sewers is less than 0.1 pounds per day based on SPDES Permit monitoring data.

Each of the Outfalls operates under permit with the State (SPDES Permit No. NY0003336) and the flow is regularly monitored to verify that the off-Site flow meets the discharge criteria as specified in each respective permit. The off-Site flow through the Outfalls consistently meets the discharge criteria established, but additional corrective measures will be implemented, if required, to continue to meet the discharge criteria.

2.3.1.2.3 Overburden NAPL

An ongoing NAPL collection program has been implemented at the Plant. NAPL is currently monitored, and collected if necessary, from the Outfall 003 NAPL Collection Trench; the EBDTS; monitoring wells OW306, OW313, OW317, OW320, OW358, OW523, OW537, OW562, OW563, OW572, TW-7, and OW577; three abandoned sewer manholes; and two NAPL collection sumps in the V-Area. The locations of these collection points are presented on Figure 2.2. Well OW354, MH773, and the N-Area north and south NAPL sumps were removed from the NAPL collection program in 2013 with approval from NYSDEC. MH773 and the N-Area sumps were abandoned in 2013 with approval from NYSDEC.

Mobile NAPL that is detected during future construction activities will be extracted using either extraction wells or an extraction trench. The most suitable extraction method will be chosen depending on local conditions such as underground utility congestion, soil porosity, and quantity of mobile NAPL available for extraction. Extracted NAPL will be treated off Site at an approved facility. NAPL encountered in sewers during future maintenance or construction activities will be extracted and treated.

2.3.1.2.4 Overburden Soil

To address chemical presence in overburden soils, ICMs were implemented to address surficial exposure to NAPL, dioxin, elemental phosphorus, and mercury, and to address the subsurface presence of mercury in the vicinity of the former Mercury Cell Area (former Building U-75).

The ICM to address surface exposure involved capping specific areas of the Plant. The areas capped and type of cover materials used is summarized below.

Area	Chemical Group	Cap Material
C/D-Area	NAPL and dioxin	Asphalt, gravel
F-Area	NAPL and dioxin	Asphalt, gravel
T-Area	NAPL	Asphalt
U-Area	NAPL dioxin mercury	Asphalt, gravel Asphalt Asphalt
N-Area	NAPL	Asphalt, gravel, soil/grass
X-Area	dioxin	Soil/grass
V-Area	elemental phosphorus	Asphalt

It should be noted that both the U-Area and N-Area also have concrete cover materials resulting from demolition of buildings (concrete building slabs were left in place). Demolition debris (crushed concrete and bricks) was also placed in these areas as a result of building demolition.

The ICM for the Mercury Cell Area involved the recovery of more than 33 tons of mercury from the soils/foundation beneath Building U-75. Remaining trace amounts of mercury are contained within a sheet pile wall keyed into the native till confining unit that encircled all of Building U-75.

2.4 Cleanup Goals and Site Closure Criteria

The Remedial Goals for the Site as stated in Schedule 1 of Module 1, Exhibit B of the RCRA/Part 373 Permit are as follows:

- *Restrict off-site migration of hazardous waste constituents in the bedrock groundwater*
- *Restrict off-site migration of hazardous waste constituents in the overburden groundwater*
- *Restrict discharge of hazardous waste constituents to the outfalls*
- *Restrict unacceptable (as determined by the Department and the Niagara Falls Water Board) discharge of hazardous waste constituents to the sanitary sewers*
- *Restrict migration of hazardous waste constituents from the overburden to bedrock*
- *Minimize human contact with hazardous waste constituents in on-site soils*
- *Minimize need for future/ongoing remediation and operation and maintenance activities by implementing solutions or technologies that will be reliable and effective over the long term*
- *Maintain compatibility with remedial efforts for specific areas of the Facility (e.g., S-Area (#932019A) and any off-site remediation) and with Facility operations*
- *Reduce the concentration of hazardous waste constituents in soil and groundwater at the Facility over time to acceptable State and Federal levels consistent with the use of the property and adjacent property, and*
- *Protect Niagara Falls Water Board drinking water supply system components at the Facility from releases of hazardous waste constituents.*

The definition of "restrict", as used in the above goals, is to eliminate off-site discharge or migration of hazardous waste constituents that pose a potential threat to human health or the environment to the maximum extent possible or technically feasible. These goals will be achieved through implementation of the corrective measures specified herein. Given the magnitude of contamination present at the Facility, the Department has determined that cleanup of the soils and groundwater beneath the facility to pre-industrial use conditions is not feasible at this time. Therefore, the primary objective of the corrective measures is to utilize containment technologies to achieve the remedial goals. Because cleanup of the Facility will not be feasible for the foreseeable future and because containment of the hazardous waste constituents is necessary for protection of human health and the environment, the Permittee is herein required to provide financial assurance that will ensure that the specified remedial systems are operated and maintained in perpetuity.

The RSO audit is aimed at system optimization rather than accelerating closure since the NYSDEC has concluded that the ICMs will operate in perpetuity.

2.5 System Goals and Objectives

The Remedial Goals are summarized in Section 2.4, above. As stated in the RCRA/Part 373 Permit, the corrective measures on Site operate on a continuous basis to achieve the Remedial Goals identified in Section 2.4, including hydraulic containment.

The F-Area treatment system flow schematic from the Operational Procedures Manual, F-Area Groundwater Remediation System (GHD, December 2016) (OMP) is presented in Attachment A on Figure 1.2. Although the treatment system design flow rate was 1,200 gpm, the actual average rate of groundwater extraction that the system operates at and that achieves hydraulic containment is closer to 500 gpm. The operational average target flow rate for the bedrock groundwater extraction system is 460 gpm, but the actual average flow rate (including downtime) was 383 gpm (over 201 million gallons of water treated in 2022). The actual average flow rate of the overburden groundwater extraction system was 41.2 gpm for Flow Zone 1 and 14.1 gpm for Flow Zone 3 and other areas. GSH provides groundwater elevations in its quarterly reports and evaluates hydraulic containment quarterly and annually.

The F-Area treatment system operates seven days a week on a continuous basis to treat extracted groundwater to meet the SPDES Permit limits. Compliance does not require GSH to maintain operations all times, but GSH is

required to report down time under specified circumstances. If any part of the system which affects the ability of the corrective measures to achieve the remedial intent is inoperable ("down") for a period of more than three days consecutively or five days in a calendar month, GSH must notify NYSDEC.

GSH prepares quarterly data reports in accordance with Module II of the RCRA/Part 373 Permit. These reports summarize:

– Treatment system operational time and down time
– Downtime for extraction and wet wells
– Performance monitoring data, including hydraulic monitoring, chemical monitoring, recovery volumes, flow rates, groundwater elevations, and groundwater contours
– Analytical data

Attachment A, Table 1 presents the summary of monitoring tasks submitted with the third quarter 2023 report, which is typical of quarterly monitoring.

2.6 Operation and Maintenance Program

The F-Area treatment system is operated in accordance with the OMP and best management practices. Attachment A, Figure 1.2 presents the treatment system process schematic from the OMP. As requested by NYSDEC, GSH has updated Figure 1.2 to clarify air/vapor and water/aqueous phase flows, and clarified that there is no flow path from the carbon bed effluent to the scrubber. Attachment A, Table 2 presents a summary of maintenance activities from the third quarter 2023 report, as an example of maintenance reported to NYSDEC each quarter.

3. Findings and Observations

3.1 Research and Document Review

As the first step in the RSO audit, GSH completed research and document review activities as summarized in Section 1.1, with the intent of identifying opportunities for optimization. GSH then completed an on-Site RSO audit and two idea generation workshops with individuals associated with operation, maintenance, monitoring, and management of the CAP to further develop ideas for optimization and identify those ideas that would be carried forward.

The outcome of the research and document review is summarized in the following subsections. Ideas for optimization are discussed in Section 4 of this Report.

3.1.1 Conceptual Site Model Review

As part of the RSO audit, GSH completed a review of the implemented corrective measures and conceptual site model (CSM), the original remedial goals of the ICMs (incorporated into the Final Corrective Measures), and the current strategy for remediation. As a critical aspect to the lifecycle of the environmental remediation system, the corrective measures were evaluated to confirm core components (assumptions, design criteria, remedies, pathway receptors, etc.) were included and maintained to substantiate its validity. The remediation strategy was evaluated to determine the efficacy of the remedy and consider possible alternative mechanisms and/or technologies.

The CSM is presented in the RCRA Facility Investigation Report, dated January 1995. The geology for the Site included the following stratigraphic units:

– Overburden:
    - Fill materials consisting of gravel, sand, silt, clay, demolition debris, flyash, and cinders, 0 to 15 ft thick, averaging 5.5 ft thick

- Alluvial River Deposits consisting of native light brown silt to silty sand, 0 to 14.9 ft thick, averaging 6.4 ft thick
- Glaciolacustrine Clay consisting of silty clay to sandy to clayey silt, acting as an aquitard, 0 to 14.7 ft thick, averaging 8.4 ft thick
- Glacial Till consisting of sandy silt with trace to some clay and gravel, acting as an aquitard, 0 to 14.8 ft thick, averaging 6.8 ft thick

– Bedrock (Lockport Dolomite):
  - Oak Orchard Formation divided into upper D-Zone and lower C-Zone flow zones, averaging 88 ft thick
  - Eramosa Formation comprising the B-Zone, averaging 20 ft thick
  - Goat Island Formation, without significant flow zones, averaging 16 ft thick
  - Gasport Formation, without significant flow zones, averaging 30 ft thick
  - Decew Formation comprising the A-Zone, averaging 8 ft thick
  - Rochester Formation shale aquitard

The fill and river alluvial deposits form the upper overburden water-bearing unit. The glaciolacustrine clay and glacial till unit acts as an aquitard restricting any downward movement of groundwater or NAPL. Groundwater elevations prior to implementation of corrective measures showed that groundwater in the overburden flowed in a general southerly direction from the Site toward the Niagara River. The implementation of overburden corrective measures commencing in fall of 1998 has restricted further migration of overburden groundwater from the Site to the Niagara River along the south and southwest boundary of the Site (Flow Zone 1). Groundwater immediately north and south of the Flow Zone 1 remedial system is captured and conveyed to F-Area for treatment. Within the Site area, groundwater flow is influenced by man-made sewers and sewer bedding. These have been addressed with Site interior collection systems and sewer retrofits, as discussed in Section 2.3 of this Report.

Groundwater flow in the bedrock occurs primarily within bedding-plane fractures interconnected with sub-vertical fractures. Many of these bedding-plane fractures have been shown to be related to specific zones within the Lockport Dolomite, forming stratigraphically related flow zones. The upper D-Zone underlying C-Zone, both within the Oak Orchard Formation comprise the bulk of the groundwater flow in the bedrock. Bedrock groundwater flow is controlled by the bedrock corrective measures installed for that purpose, as summarized in Section 2.2 of this Report.

The description of and the operation of these corrective measures and their associated effectiveness is monitored and reported in Annual Performance Evaluation Reports, the most recent of which did not recommend any changes to the ICMs other than those specific to Flow Zone 1 (Corrective Measures Implementation Annual Performance Evaluation January through December 2022 [GHD, April 2023]).

In response to comments from the NYSDEC, subsequent discussions, and as required by the Site's RCRA/Part 373 Permit, additional assessment was conducted regarding operation of the Flow Zone 1 remedial system to evaluate the system's effectiveness. The results of the assessment were presented in the report Flow Zone 1 Remedial System Assessment – Rev 1 (GHD, May 2023), which recommended routine cleaning of collection pipes to address carbonate precipitation and improve hydraulic containment and consideration of potential additional improvements as part of this RSO. An additional evaluation in the area where the Flow Zone 1 remedial system collection pipe is significantly above the confining layer will be conducted in the future, and the scope of which will be submitted to NYSDEC in a Work Plan as discussed during call on August 2, 2023.

Based on the above, GSH did not identify any discrepancies or data gaps that preclude our understanding of hydraulic containment at the Site, although additional evaluation of the Flow Zone 1 remedial system will be conducted as indicated above. GSH will continue to evaluate the corrective measures performance annually, but at this time there is no need to reevaluate the remedial strategy for the Site or evaluate alternative mechanisms and/or technologies to achieve hydraulic containment and meet the goals of the corrective measures.

3.2 Subsurface Performance

GSH monitors extracted groundwater flow continuously and completes hydraulic monitoring quarterly. GSH submits a Corrective Measures Implementation Annual Performance Evaluation to NYSDEC each spring. The report covering January to December 2023 will be submitted in spring 2024. GSH also submits a quarterly progress report that summarizes quarterly data, monitoring tasks, and maintenance activities.

The intent of this RSO is not to repeat the performance review completed annually, but instead to focus on areas for improvement and optimization. As part of this RSO, GSH completed a comparative analysis of the design groundwater containment against actual containment and provided conclusions regarding system performance. This review indicated the following:

Bedrock

- The average extraction system operational efficiency (up time) was 89.5 percent in 2022, and operated at similar levels in 2023. Downtime of bedrock extraction wells was typically due to electrical issues, pump motor issues, or treatment system downtime due to air compressor issues, pH issues, and leak detection issues. These issues are part of the focus of this RSO.
- Hydraulic containment is generally achieved when the system was operating, as indicated by potentiometric surface contour maps presented in the quarterly and annual reports.

Overburden

- As summarized in the Flow Zone 1 Assessment Report (GHD, May 2023), the corrective measures for Flow Zone 1 were designed to intercept approximately 98 percent of the off-Site chemical loading leaving the Plant via the overburden groundwater flow regime. A groundwater elevation of approximately 561 ft AMSL is adequate to create hydraulic containment by the Flow Zone 1 remedial system. Water levels in MHA through MHF below 561 ft AMSL have often been achieved. This results in gradients toward the Flow Zone 1 remedial system from monitoring wells to the north and south, and indicates that the Flow Zone 1 remedial system can achieve containment. In 2023, groundwater elevations were less than 561 ft AMSL during the monitoring event completed in September.
- As summarized in the Flow Zone 1 Assessment Report (GHD, May 2023), routine cleaning of the Flow Zone 1 system is required to address restrictions caused by carbonate precipitation. Prevention of precipitation (currently addressed by pH adjustment) is identified as an area for potential improvement, as summarized in Table 3.1 and Table 3.2.
- The average overburden groundwater extraction system operational efficiency (up time) for was 87 percent in 2022 and operated at similar levels in 2023 with some fluctuations due to maintenance issues. These issues are part of the focus of this RSO.

GSH reviewed pumping rates versus containment and system runtime to identify areas for optimization and areas of risk. Areas for optimization and risk include:

- Increased preventative maintenance of aging equipment and cleaning of precipitation in collection systems will increase runtime. This should be balanced with the understanding that due to the gradient on Site and groundwater velocity, the groundwater remedial systems can be down for an extended period of time (weeks) without risk of irreversible loss of hydraulic containment. Groundwater will take several weeks to migrate away from the containment system, and flow direction can be reversed once the system is restarted.
- See Table 3.1 and Table 3.2 for other recommendations related to increasing system performance and runtime.
- Quarterly hydraulic monitoring is completed to evaluate containment. One opportunity for cost reduction may be to reduce hydraulic monitoring to semi-annual monitoring. This would have minimal risk other than perception of the need for a higher frequency of monitoring.

GSH completes annual groundwater sampling. GSH reviewed analytical data for pumped groundwater and monitoring wells with the intent of optimizing this monitoring program and identifying potential areas for improvement either in monitoring or in groundwater extraction. The data review concluded the following:

– Annual groundwater monitoring data have indicated that the groundwater extraction system is effective in removing chemicals present in groundwater, and concentrations of chemicals in off-Site bedrock groundwater monitoring wells have decreased over time.
– Concentrations of chemicals in overburden groundwater have fluctuated in recent monitoring events as compared to historic monitoring events; however, annual monitoring is sufficient to evaluate these trends.
– Total organic site-specific indicator concentrations are used to demonstrate remedial progress, so there is limited benefit to reducing the monitoring parameters.

As discussed with NYSDEC, the SPDES permit will require modification should GSH proceed with a project to divert groundwater from the S-Area Landfill Site to the F-Area treatment system for treatment. GSH is considering implementing this project in 2025 (tentative timing). As part of this project, GSH will review the modified SPDES permit to evaluate any impact with respect to the F-Area treatment system's operational effectiveness and proceed accordingly to ensure discharge limits continue to be met.

GSH reviewed the status of the groundwater infiltration approaches (to sanitary sewer) to identify opportunities for optimization. No opportunities were identified at present; however, GSH will evaluate the potential to convert additional sewers to groundwater collection systems in the future once plans for the decommissioned facility are known.

3.3 Treatment System Performance

GSH completed a Site inspection and three workshops to evaluate treatment system performance and opportunities for improvement based on:

– Runtime, maintenance requirements, best management practices, and environmental footprint.
– Chemical loading to the system (based on analytical data for system influent) and removal efficiency.

During the workshops, GSH assessed the existing treatment system in the context of the efficacy of the overall remediation strategy. Table 3.1 summarizes the main project-specific considerations that were identified as part of the remedy review, and which contributed to the development of ideas for optimization and identification of risk. Table 3.2 summarizes ideas for improvement generated during the workshops, and indicates which of these ideas are recommended for further evaluation ("carried forward") to optimize system operation and reduce risk.

3.4 Regulatory Compliance

GSH summarizes the frequency and schedule of monitoring, run time, and soil management in quarterly reports to NYSDEC. GSH also completes an annual report that summarizes hydraulic containment and monitoring data.

GSH completed a compliance review to confirm ongoing compliance with the RCRA/Part 373 Permit requirements as well as the following state and local permits and registrations are applicable to the facility:

– State Pollutant Discharge Elimination System (SPDES) Permit No. NY0003336
– Air Title V Facility Permit: No. 9-2911-00112/00234 [Remedial Treatment System/Dechlorane Plus]
– Niagara Falls Water Board, Significant Industrial User Discharge Permit No. 22

GSH did not find any compliance issues during the RSO audit. Shutdown periods were reported to NYSDEC as required in each quarterly report.

3.5 Major Cost Components or Processes

The largest cost areas of the CAP are as follows:

– Operations

– Monitoring
– Maintenance, including equipment replacement at the F-Area treatment plant
– Utilities (electricity, gas, and city water)
– Waste disposal
– Financial assurance

3.5.1 Environmental Footprint

GSH reviewed energy consumption, water use, and waste generation to identify potential areas for improvement as part of this RSO audit.

Based on instantaneous readings at the Site in 2022 and 2023, the estimated electricity usage at the F-Area treatment system is 155 to 175 kilovolt amps (kVA). This will be used as a benchmark for measuring reductions in electricity usage at the treatment system.

GSH estimates that approximately 3,000,000 gallons of fresh (municipal) water is used at the F-Area treatment system each year. GSH believes that this is an area for potential improvement that will not only save money but will reduce the environmental footprint of the Site.

Waste generated at the Site includes NAPL collected for disposal off Site, used carbon shipped off Site for regeneration, and a minor amount of solid waste (refuse) generated by remedial activities. The volume of NAPL removed depends upon the year but has decreased significantly over the past twenty years. Bedrock NAPL recovery (and off-Site disposal) has decreased from over 6,400 gallons in 2003 to 14.4 gallons in 2022. Overburden NAPL recovery (and off-Site disposal) was 1.85 gallons in 2022, but over 7,000 gallons have been collected and disposed of as of 2023. GSH is motivated to recover and dispose of as much NAPL as practicable through the existing collection program.

The volume of carbon disposed of off-Site has varied depending on the frequency of carbon changeout, which is tied to flow rate and influent chemistry. GSH disposed of 164,550 lbs of carbon in 2021, 0 lbs of carbon in 2022, and 74,660 lbs of carbon in 2023, which based on long-term trends, is equivalent of changing out the two lead carbon beds (20,000 lbs fresh carbon each) per year.

4. Recommendations

4.1 Recommendations to Achieve or Accelerate Site Closure

The corrective measures are intended to operate in perpetuity, with the goal of achieving hydraulic containment of impacted groundwater on Site. Given the goals of the ICMs, Site closure was not evaluated as part of this RSO.

GSH did not identify any significant recommendations to improve the sampling program as a result of this RSO. This is due to the fact that GSH focuses on program optimization on a routine basis as part of the annual reporting for the Site.

As summarized in Section 3.1.1, the fundamental assumptions regarding the CSM remain accurate and add value by assisting the understanding of how to achieve hydraulic containment on Site. GSH did not identify any discrepancies or data gaps that preclude our understanding of hydraulic containment at the Site. GSH will continue to evaluate the corrective measures performance annually, but at this time there is no need to reevaluate the remedial strategy for the Site. The remedy remains adequate to protect human health and the environment.

4.2 Recommendations to Improve Performance if Practicable

Table 3.1 summarizes the basic considerations, issues, and opportunities for improvement that were identified during the RSO audit and associated workshops, and were used to focus on the generation of ideas that could add value and improve performance.

Table 3.2 summarizes the options that GSH believes have the most merit, and recommends carrying forward (marked CF) for further evaluation to improve system performance. Not all of the ideas in Table 3.2 will be implemented, as each required further detailed evaluation.

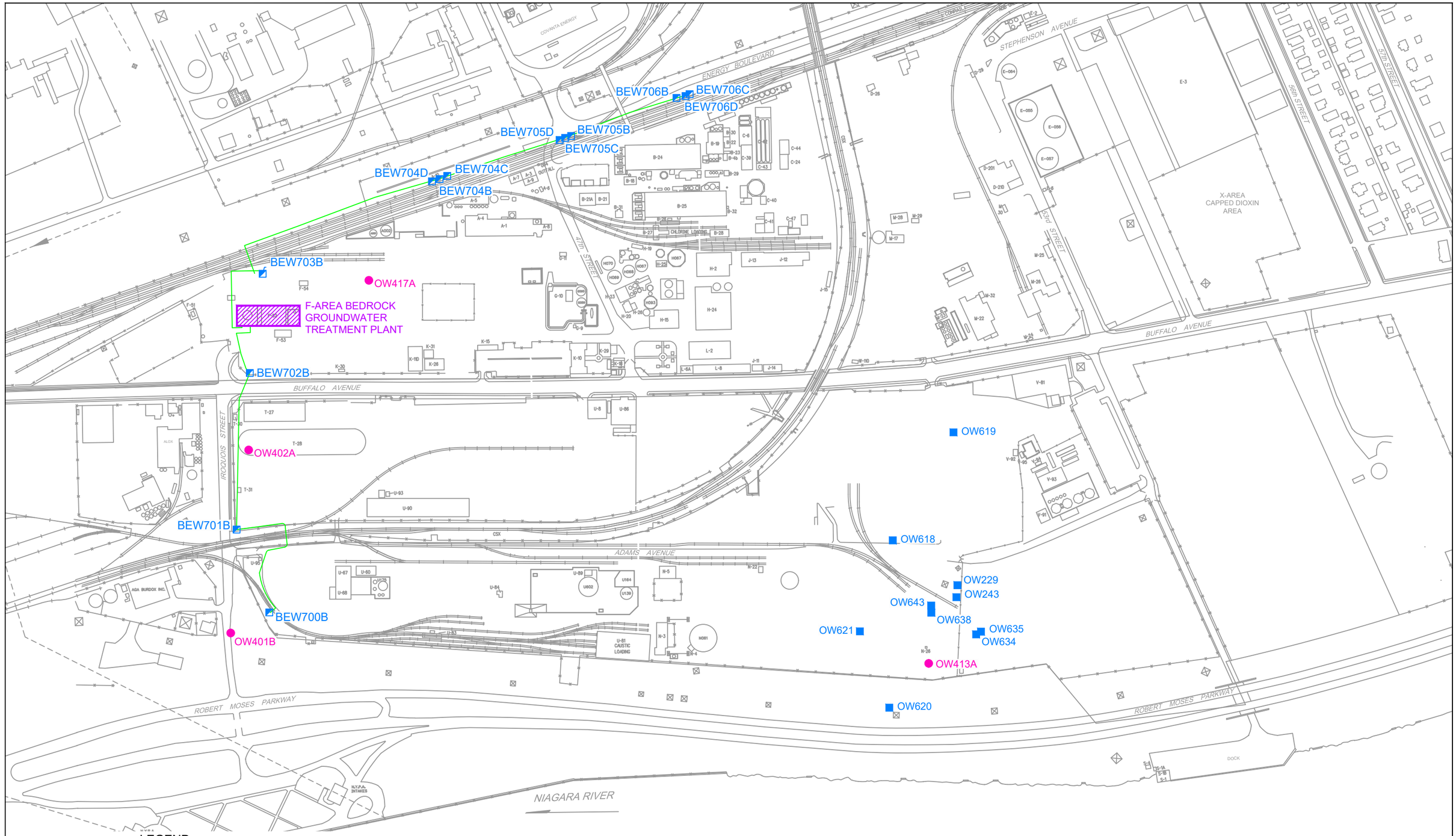
Safety is a significant part of GSH culture. Table 3.2 includes some minor suggestions regarding safety, but safety is reviewed on a daily basis during Site activities.

Following NYSDEC approval of the Final RSO Report, GSH will commence implementation of the RSO, which will include further detailed evaluation of the ideas identified as “CF” in Table 3.2. The timing of the evaluation is shown as short term, medium term, and long term, depending on the complexity of the suggestion, and if it will be most valuable to include the idea evaluation as part of the expected system improvements in 2025 (tentative) associated with the S-Area project. GSH anticipates that a number of the ideas will be incorporated into the design of the diversion of S-Area groundwater to be treated by the F-Area treatment system.

5. Schedule

In accordance with Schedule 1 of Module 1, Section D, Item 5 of the RCRA/Part 373 Permit, the next steps in the RSO schedule are as follows:

Description	Deliverable Date
Final RSO Report	Within 90 days of NYSDEC comments on the Draft RSO Report
RSO Implementation	Within 45 days of NYSDEC approval of the Final RSO Report



LEGEND

- BEW700B — BEDROCK GROUNDWATER FORCEMAIN
- BEW700B — BEDROCK EXTRACTION WELL
- OW401B — BEDROCK NAPL COLLECTION WELL
- OW229 — S-AREA NAPL COLLECTION WELL

0 150 300 ft

1" = 300 ft

N

GHD

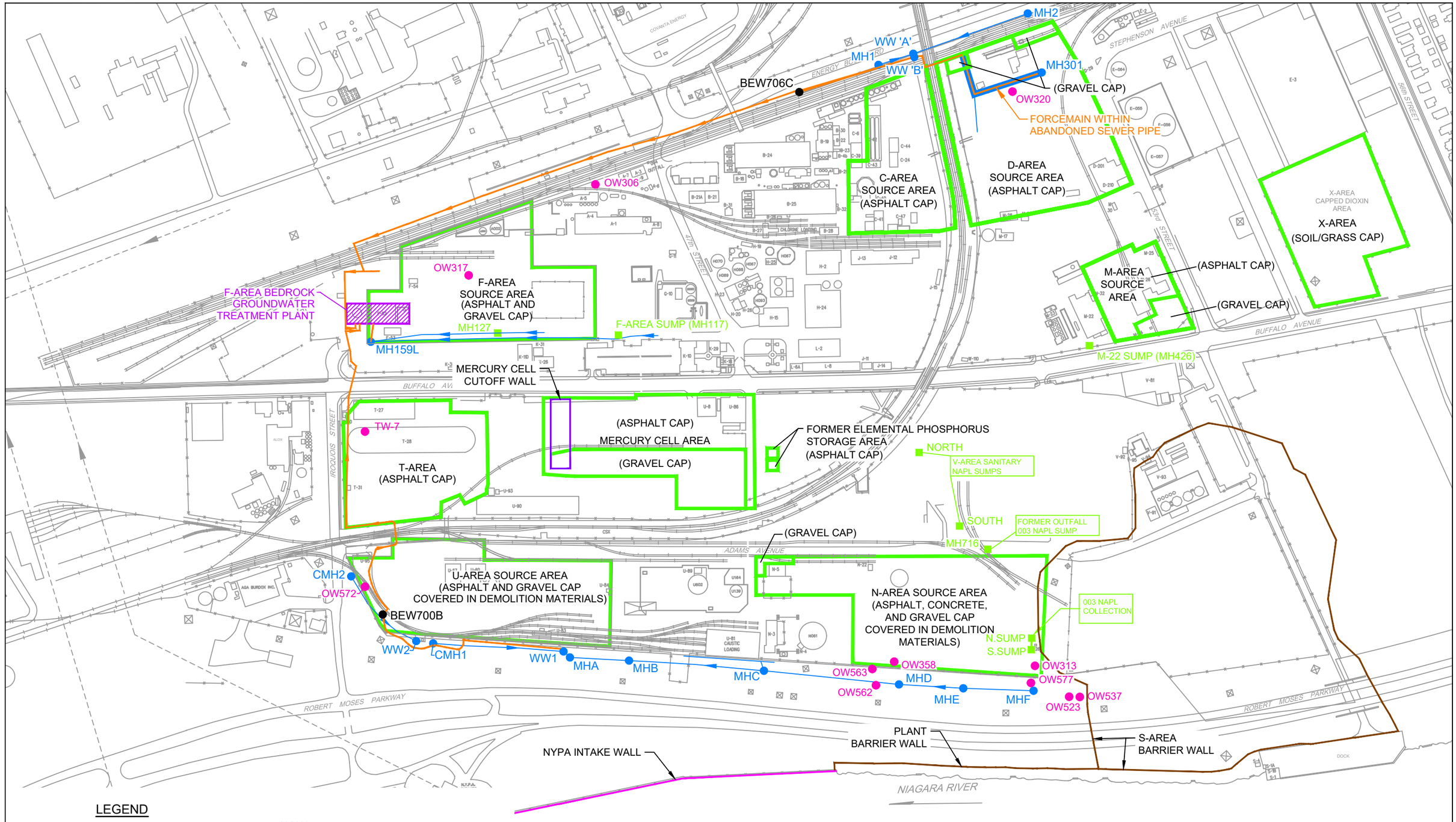
OCCIDENTAL CHEMICAL CORPORATION
GLENN SPRINGS HOLDINGS, INC.
BUFFALO AVENUE PLANT
NIAGARA FALLS, NEW YORK

BEDROCK REMEDIAL SYSTEMS

Project No. **11225008**
Date **June 2023**

FIGURE 2.1

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\11225008\Digital_Design\ACAD\Figures\RPT005\11225008-GHD-00-00-RPT-EN-D101_WA-005.dwg
Plot Date: 05 June 2023 8:15 AM



LEGEND

- OVERBURDEN GROUNDWATER COLLECTOR
- FORCEMAIN
- AREA TO BE INSPECTED UNDER PART 373 PERMIT
- MH1 — MANHOLE
- WW1 — WET WELL
- BEW706C — BEDROCK EXTRACTION WELL
- OW523 — NAPL COLLECTION WELL
- NORTH — NAPL COLLECTION/ MONITORING SUMP

0 150 300 ft

1" = 300 ft

GHD

OCCIDENTAL CHEMICAL CORPORATION
GLENN SPRINGS HOLDINGS, INC.
BUFFALO AVENUE PLANT
NIAGARA FALLS, NEW YORK

OVERBURDEN REMEDIAL SYSTEMS

Project No. **11225008**
Date **June 2023**

FIGURE 2.2

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\11225008\Digital_Design\ACAD\Figures\RPT005\11225008-GHD-00-00-RPT-EN-D102_WA-005.dwg
Plot Date: 05 June 2023 8:16 AM

Table 3.1

Project-Specific Considerations and Focus
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

1. Safety is a key component of culture at the Site and is reviewed on a daily basis, through the use of Health and Safety Plans and Job Safety Analysis. All people on Site have stop work authority.
2. The purpose of the groundwater extraction systems is to achieve hydraulic containment. By achieving hydraulic containment and also collecting non-aqueous phase liquid as needed, the extraction systems prevent contaminant migration, which prevents exposure to contaminants.
3. The purpose of the groundwater treatment system is to reduce concentrations to meet the SPDES permit limits at Outfall 007.
4. Age of equipment and difficulty acquiring spare parts is an issue but does not affect containment (shut down duration is short enough), so preventative maintenance has to be balanced with cost.
5. GSH plans to combine groundwater from the S-Area Landfill Site with Site groundwater for treatment at the F-Area treatment system via a project tentatively anticipated to be implemented in 2025, so areas of optimization that are not short term needs will be incorporated into that project. A number of the issues related to equipment operating at the lower end of its range will be addressed when the flow into the F-Area treatment system is increased.
6. There is an opportunity to decrease need for on call staff to go to site after hours to respond to alarms.
7. Rainwater accumulation in vaults routinely triggers high level alarm aimed at forcemain leakage detection, and requires pump out by a contractor.
8. Precipitate formation in the Flow Zone 1 remedial system is controlled by a carbon dioxide (CO_2) injection system but some formation does still occur over time, resulting in a maintenance issue.
9. Sustainability should be evaluated on an ongoing basis in terms of vendor selection and routine maintenance activities to the extent practicable.
10. The opportunities to reduce clean water usage and limit greenhouse gas generation are limited on Site and confined generally to the treatment system.

Table 3.2

Creative Idea Output and Recommendations
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

Category	No.	Idea Description	Improvement Area	Evaluation Rating	Timing
Preventative Maintenance	PM1	Precipitation in perforated pipe that runs from MHA to WW1 line causes plugging. Pump in WW1 has level control tied to elevation. Goal is to obtain water level of approx. 561 feet AMSL (or less). Investigate options to address this plugging to improve understanding of drawdown and allow system optimization. Also evaluate opportunity for new level measurement technology such as radar/ultrasonic.	Process improvement, maintenance improvement	CF	M
	PM2	Routine cleaning of Flow Zone 1 collection system to address precipitation (per Flow Zone 1 Assessment recommendations) has been implemented. Review to optimize.	Sustainability/resilience, maintenance improvement	CF, review to optimize	S
	PM3	Enhance preventative maintenance program to evaluate corrosion on a set frequency and a decision tree for maintenance, scraping/painting, and repair. Example - visible corrosion on aqueous phase liquid (APL) line	Sustainability/resilience, maintenance improvement	CF	S
	PM4	Address difficulty with operation of APL feed pumps and control valves upon startup, which must be adjusted manually to maintain optimal system levels until the system equilibrates. Valves to control system levels have automated pre-set levels. Short term solution: evaluate programming improvements to allow better control and reduced operator effort at current flow (500 gpm +/-) Longer term solution: Evaluate adding Variable frequency drives (VFD) to pump motor and controls modification to adjust the motor speed based on the flow rate set point (saves energy by avoiding the energy losses due to the control valve and results in better process control [less operator intervention] at lower flow rates). Also consider the Carbon Adsorber feed pumps for VFDs. Balance cost/benefit of VFD vs energy savings and sustainable solutions	Process improvement	CF, likely OS 2025 timeframe	S
	PM5	Evaluate frequency of air stripper maintenance and optimize air stripper packing ball changeout (done every 10 years +/-). Review removal efficiencies of the air stripper (at a consistent air and water flow rate) to identify if there is a deterioration in performance as an indication of the stripper performance.	Process improvement, maintenance improvement, cost reduction	CF	S

Table 3.2

Creative Idea Output and Recommendations
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

Category	No.	Idea Description	Improvement Area	Evaluation Rating	Timing
Environmental Footprint	EF1	Optimize use of city water. Currently being used for sand filter backwash, make-up water for scrubber, and some city water used for carbon washout. Evaluate option to use decanter water or treated water for backwash to minimize fresh city water use.	Sustainability, cost reduction	CF, DS	S, L
	EF2	Carbon changeout has historically been on a set freqency based on carbon age and breakthrough monitoring of the lead beds. Review interstage analytical data (already collected) to determine optimal timing for carbon changeout reducing frequency of changeout to extent to extent practicable). This may increase life of carbon by approximately 6+ months. Also review in context with S-Area groundwater for future treatment	Sustainability, maintenance improvement, cost reduction	CF	S
	EF3	Redirect roof water, which currently drains into APL storage dike, so that it drains to storm sewer or sheet flows away from building. As appropriate, evaluate potential beneficial reuse of rainwater.	Sustainability	CF	S
	EF4	Switch On/Off level controls over to VFDs to reduce energy usage. Consider this for pumps within the treatment system that typically operate continuously and have larger motors. Do not consider for pumps such as sump pumps that cycle occasionally.	Sustainability, cost reduction	CW PM4 and PM5	
	EF5	Evaluate compressed air usage vs cost of having a large air compressor running. Small rental unit may be appropriate. For normal operation, the 10 HP compressor is oversized but needed for high air demand activities such as carbon transfer. Cost savings also reflect ongoing maintenance of owned unit.	Sustainability, cost reduction	CF	S
	EF6	Oxidizer operates at 1650 degrees F, but permit allows 1550 degrees F. Review with manufacturer/vendor to determine if operating temperature based on current and future groundwater chemistry vs design chemistry. Review allowable set point cushion that will ensure that normal fluctuation in operating condition. Determine if temperature can be reduced to reduce fuel usage without permit violation.	Sustainability, cost reduction	CF, DS, CW EF7	S

Table 3.2

Creative Idea Output and Recommendations
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

Category	No.	Idea Description	Improvement Area	Evaluation Rating	Timing
	EF7	Evaluate current and expected influent chemistry to oxidizer to determine if manufacturer/vendor recommendation would recommend changes to air/gas mix to reduce fuel usage. Lower air flow rates should reduce the energy consumption or anyother potetnial otpimizations with little impact on performance and may improve overall performance due to longer residence times. Optimize treatment by air stripper, carbon treatment, and thermal oxidizer to achieve treatment for least cost.	Process improvement, sustainability, cost reduction	CF, DS, CW EF6	S
	EF8	Monitor annual ratio of natural gas to uptime and water usage to uptime to drive continuous improvement and reduce environmental footprint	Sustainability, cost reduction	CF	L
Performance Improvement	PI1	Evaluate existing instrumentation to determine if safe remote assessment of conditions and system restart can be improved. Potential use cameras in key locations (oxidizer, air stripper, vault, extraction wells, wet wells) so that an operator can quickly restart the system without visiting the site when the system shuts down at night or on a weekend due to rain accumulation in the vault.	Run time, safety, cost reduction	CF	M
	PI2	Improve programmable logic controller (PLC) display to show set points for each functional control - i.e., show the set points and what can be controlled manually vs what has to be changed by code. Complete an initial assessment of the control system. Determine if the existing hardware and SCADA system will continue to be used and if modifications completed in the short term could remain in use during and after the combining with S-Area.	Process improvement	CF	M
	PI3	Evaluate CO2 injection locations (to minimize precipitation accumulation). Preferentially sparge the higher pH locations at higher rates. For better efficiency consider controls (solenoids) that turn off the CO2 when there is no groundwater flow.	Run time, process improvement	CW PM1	

Table 3.2

Creative Idea Output and Recommendations
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

Category	No.	Idea Description	Improvement Area	Evaluation Rating	Timing
	PI4	Separate the Flow Zone 1 system into two groundwater collection systems before treatment, allowing improved and more efficient treatment. The system that runs between MHC and MHA is a different pH and source of precipitation than at WW1, so it could be separated. This would add considerable cost. Reevaluate when design of S-Area to F-Area system is being evaluated.	Process improvement	OS, reevaluate in 2025	L
	PI5	Evaluate optimizing bedrock groundwater extraction system so that the pumps run based on water level control (LIC), not set current. Pump optimization will be completed as part of S-Area to F-Area project.	Process improvement	OS - 2025 timeframe	
	PI6	Add flow meter for WW1 and feed to SCADA system to allow more efficient operation of extraction system	Process improvement	OS - 2025 timeframe	
	PI7	Determine if it will improve operations to backwash carbon filter into sludge tank instead of influent (decanter) tank, providing more opportunity for solids to settle outside of the influent tank.	Process improvement, maintenance improvement	CF	S
	PI8	Install new level controllers on knock out pot to improve performance over existing floats (which can freeze/get stuck)	Process improvement	CF	S
	PI9	Evaluate sewer system on Site and conversion of sewers (no longer needed due to plant closure) to groundwater collection system if practicable	Source reduction	CF	S
	PI10	Evaluate adding a rinse step to improve carbon changeout process and reduce the impact of post-carbon change high pH	Process improvement, maintenance improvement	CF	S
	PI11	Evaluate use of a multi-container truck to reduce the cost of carbon changeout waste disposal	Process improvement, maintenance improvement, cost reduction	CF	S
Safety	S1	Bedrock well vault entry (down to grate 4 feet down) requires climbing backwards down a ladder. Difficult to maintain 3 points of contact. Evaluate this during monthly safety meetings to identify opportunities to ensure safe work and eliminate hazard.	Safety improvement	ABD	

Table 3.2

Creative Idea Output and Recommendations
Remedial System Optimization Report
Occidental Chemical Corporation Buffalo Avenue Plant, Niagara Falls, New York

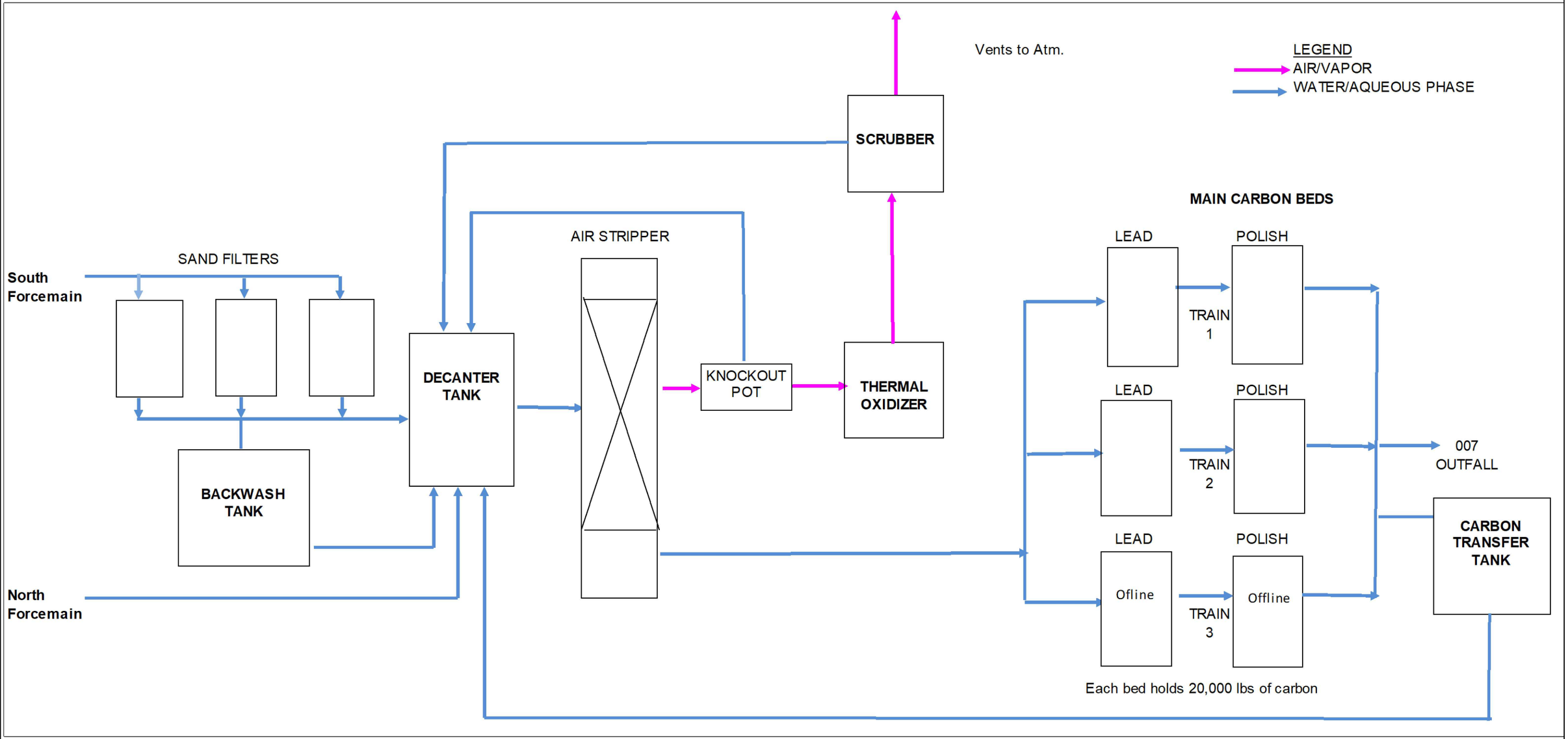
Category	No.	Idea Description	Improvement Area	Evaluation Rating	Timing

Rating:
ABD: Already Being Done
CF: Carried Forward
NCF: Not Carried Forward
CW: Combine With
OS: Outside Scope (beyond scope of optimization, but could be considered for future)
DS: Design Suggestion
S: short term (6-12 months)
M: medium term (1-2 years)
L: long term (1-4 years)

Attachments

Attachment A

OMP Figure 1.2
Third Quarter 2023 Quarterly Progress Report, Table 1 and Table 2



GHD

OCCIDENTAL CHEMICAL CORPORATION
GLENN SPRINGS HOLDINGS, INC.
NIAGARA PLANT
NIAGARA FALLS, NEW YORK

PROCESS SCHEMATIC F-AREA
GROUNDWATER REMEDIATION SYSTEM

Project No. **11225008**
Date **July 2024**

FIGURE 1.2

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\11225008\Digital_Design\ACAD\Figures\RPT006\11225008-GHD-00-00-RPT-EN-D101_WA-006.dwg
Plot Date: 31 July 2024 12:01 PM

Table 1

Summary of Monitoring Tasks and Associated Completion Dates
Third Quarter 2023
Buffalo Avenue Plant

Quarter	Program	Task	Date(s) Task was Completed (2023)
First	**Bedrock Groundwater**	Weekly Flow Measurements	1/2, 1/9, 1/16, 1/23, 1/30, 2/6, 2/13, 2/20, 2/27, 3/6, 3/13, 3/20
		Quarterly Hydraulic Monitoring	3/7
		Annual Chemical Monitoring	1/9 - 1/26
	Overburden Groundwater	Weekly Flow Measurements	1/2, 1/9, 1/16, 1/23, 1/30, 2/6, 2/13, 2/20, 2/27, 3/6, 3/13, 3/20
		Quarterly Hydraulic Monitoring - Flow Zones 1 and 3	3/8
	NAPL Monitoring	Quarterly NAPL Monitoring/Collection in 003 Collection Trench	1/20
		Quarterly NAPL Monitoring/Collection - N-Area Bedrock Wells	3/21
		Quarterly NAPL Monitoring/Collection of EBDTS	3/21
		Annual NAPL Monitoring/Collection of Overburden Monitoring Wells	3/21
Second	**Bedrock Groundwater**	Weekly Flow Measurements	4/3, 4/10, 4/17, 4/24, 5/1, 5/8, 5/15, 5/22, 5/29, 6/5, 6/12, 6/19, 6/26
		Quarterly Hydraulic Monitoring	6/6
	Overburden Groundwater	Weekly Flow Measurements	4/3, 4/10, 4/17, 4/24, 5/1, 5/8, 5/15, 5/22, 5/29, 6/5, 6/12, 6/19, 6/26
		Quarterly Hydraulic Monitoring - Flow Zones 1 and 3	6/7
		Annual Chemical Monitoring - Mercury Cell Area (OW304, OW305, OW306, and OW574)	(1)
		Annual Chemical Monitoring - Plant Wells	(1)
	NAPL Monitoring	Quarterly NAPL Monitoring/Collection in 003 Collection Trench	4/3
		Quarterly NAPL Monitoring/Collection - N-Area Bedrock Wells	6/20
		Quarterly NAPL Monitoring/Collection of EBDTS	6/15
Third	**Bedrock Groundwater**	Weekly Flow Measurements	7/3, 7/10, 7/17, 7/24, 7/31, 8/7, 8/14, 8/21, 8/28, 9/4, 9/11, 9/18, 9/25
		Quarterly Hydraulic Monitoring	9/12
	Overburden Groundwater	Weekly Flow Measurements	7/3, 7/10, 7/17, 7/24, 7/31, 8/7, 8/14, 8/21, 8/28, 9/4, 9/11, 9/18, 9/25
		Quarterly Hydraulic Monitoring - Flow Zones 1 and 3	9/28
		Annual Hydraulic Monitoring - Other Areas	9/28
	NAPL Monitoring	Quarterly NAPL Monitoring/Collection in 003 Collection Trench	7/19
		Quarterly NAPL Monitoring/Collection of EBDTS	9/11
		Quarterly NAPL Monitoring/Collection - N-Area Bedrock Wells	8/18
		Semiannual NAPL Monitoring/Collection of Overburden Monitoring Wells	9/19
		Annual NAPL Check - OW401B, OW402A, OW413A, and OW417A	8/9
		Annual Sump/Manhole NAPL Checks	9/27
Fourth	**Bedrock Groundwater**	Weekly Flow Measurements	
		Quarterly Hydraulic Monitoring	
		Annual Well Inspections	
	Overburden Groundwater	Weekly Flow Measurements	
		Quarterly Hydraulic Monitoring - Flow Zones 1 and 3	
		Semiannual Chemical Monitoring - Mercury Cell Area (OW574)	
		Annual Well Inspections	
	NAPL Monitoring	Quarterly NAPL Monitoring/Collection in 003 Collection Trench	
		Quarterly NAPL Monitoring/Collection of EBDTS	
		Quarterly NAPL Monitoring/Collection - N-Area Bedrock Wells	

Notes:
(1) - To be completed in the next quarter

Table 2

Summary of Maintenance Activities
Third Quarter 2023
Buffalo Avenue Plant

Date	Location	Maintenance Activity
8/4/2023	F-Area	Fixed leak on the air stripper tower
8/18/2023	F-Area	Performed troubleshooting on the main air compressor
8/21/2023	F-Area	Pulled BEW-706C and replace motor and wires
8/21/2023	F-Area	Pumped out chamber, BEW-701D and BEW-706D
8/22/2023	F-Area	Pulled BEW-706D. Pipe broke off below top flange.
8/22/2023	F-Area	Performed troubleshooting on both air compressors
8/25/2023	F-Area	Repaired main air compressor
8/25/2023	F-Area	Removed water from the oxidized process fan
8/31/2023	F-Area	Replaced parts on the older air compressor
9/5/2023	F-Area	Reset power to the bleach pump GFI socket
9/8/2023	F-Area	Pumped out chamber BEW-703D
9/14/2023	F-Area	Repaired leaks on the bleach addition pump
9/21/2023	F-Area	Replaced the unloader line on the main air compressor
9/21/2023	F-Area	Unplugged the floor drain the the scrubber room
9/25/2023	FZ-1	Cleaned out the chamber for WW-1
9/25/2023	FZ-1	Pulled and cleaned pump at WW-1