Corrective Measures Proposal

RCRA Corrective Action

Revitalizing Auto Communities Environmental Response Trust

11 June 2021

Draft for Review

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1. Introduction

This revised Resource Conservation and Recovery Act (RCRA) Corrective Measures Proposal (CMP) has been prepared in accordance with Paragraph 19 and 20 of the Administrative Order on Consent (RCRA 05 2011 0023) (AOC) between the United States Environmental Protection Agency (U.S. EPA) and the Revitalizing Auto Communities Environmental Response Trust (RACER) for the Saginaw Nodular Industrial Land (Site) located in Saginaw, Michigan (Figure 1.1). The AOC was executed by RACER and the U.S. EPA on September 29, 2011. The property subject to RCRA Corrective Action requirements and covered in this CMP are illustrated in Figure 1.2.

The purpose of the CMP is to propose final Corrective Measures necessary to protect human health and the environment from all current and future unacceptable risks due to releases of hazardous waste or hazardous constituents at or from the Site. This CMP describes all the Corrective Measures implemented at the Site since the effective date of the AOC. In addition, a description of all final Corrective Measures proposed and an evaluation of these measures relative to the nine criteria outlined in the U.S. EPA document entitled “RCRA Corrective Action Plan” (U.S. EPA, 1994), plus three additional criteria (community/state acceptance, and sustainability) are presented. Cost estimates for the proposed final Corrective Measures are included as part of this report. The CMP also includes an implementation schedule for the proposed final Corrective Measures. This CMP references information that can be found in the Supplemental RCRA Facility Investigation (RFI) (CRA, 2012) and in other documents submitted to U.S. EPA during the RCRA Corrective Action process between 1995 and 2021, as referenced herein and listed in Section 9.

The remainder of this CMP is organized into the following sections:

– Section 2: Site Background; describes the physical characteristics of the Site and summarizes the RFI
– Section 3: Summary of RFI Activities (Pre-2012); presents and describes RFI activities competed prior to the April 2013 Draft CMP (CRA, 2013B).
– Section 4: Summary of RFI Activities (Since 2012); presents and describes RFI activities competed following the April 2013 Draft CMP.
– Section 5: Interim Measures – Summary of Interim Measures completed on-Site.
– Section 6: Evaluation of Corrective Measures Alternatives; presents a description of the evaluation criteria and a summary of the evaluation of the proposed final corrective measures
– Section 7: Proposed Final Corrective Measures; presents and describes the proposed final corrective measures
– Section 8: Costs and Schedule; presents the proposed costs and schedule for implementation of this CMP
– Section 9: Supporting Documents/References; list documents used in preparation of this CMP

2. Site Background

The Site was part of a larger facility, formerly owned by General Motors Corporation (GMC), called the General Motors Powertrain Saginaw Metal Casting Operations (SMCO or Larger Facility); located in Saginaw, Michigan.

On June 1, 2009, GMC filed for Chapter 11 protection under U.S. Bankruptcy Code. On July 10, 2009 GMC was renamed Motors Liquidation Company (MLC). On the same day portions of the operating assets of MLC were sold to a newly formed company - "General Motors Company". General Motors Company changed its name to General Motors LLC (GM LLC) on October 16, 2009. Assets not sold to GM LLC remained the property of MLC, in its capacity as debtor in possession in the bankruptcy case. On March 31, 2011 the environmental remediation of this Site was transferred from MLC to RACER. Ownership of the properties was transferred to RACER Properties LLC, a wholly owned entity of RACER. Figure 1.2 presents the approximate location of the Site (RACER property), which is the focus of this Report.

The U.S. EPA Site ID Number for the RACER Site is MID 041 793 340. The U.S. EPA Site ID Number for the GM LLC property is MIK 277 668 315.

In May 1995, the Larger Facility was placed under a RCRA Section 3008(h) Unilateral Administrative Order (UAO) which required GMC to complete specific requirements in order to evaluate environmental impacts at the Larger Facility. These requirements included the completion of a: Description of Current Conditions report (DOCC), Interim Measures (IM) work plan and report, RFI work plan and report, and Corrective Measures Study (CMS) work plan and report.

In August 1995, GMC submitted a DOCC report (EMCON, 1995) to the U.S. EPA detailing the Larger Facility, work previously completed at the Larger Facility, and historical releases of hazardous constituents. In response to comments received from the U.S. EPA, an Addendum to the DOCC (EMCON, 1997) was submitted in October 1997.

In order to help with the evaluation, the Larger Facility was divided into ten Investigative Units (IUs); based on historical use of the property by GMC. The Larger Facility IU boundaries are presented on Figure 2.1. To simplify the remedial evaluation of the property, that nomenclature has been retained in this Report. Each IU may contain several Areas of Interest (AOIs). The report will discuss three IUs (IU-G, IU-H, and portion of IU-I) associated with the Site (RACER property) on which historical operations were performed. An additional three undeveloped portions of the Larger Facility were also transferred to RACER Trust, as presented in Figure 2.1: a parcel south and west of the former City of Saginaw Landfill (also known as the Crow Island Landfill) and herein referred to as the Crow Island Parcel including the area along the Gage Drain north of IU-J, the area at the corner of Hach Road and the end of Outer Drive, and the rectangular area south of IU-I. These areas were reviewed as part of the Site Inspection conducted by U.S. EPA on April 4, 2019, with a follow-up inspection of inaccessible areas conducted by GHD on April 11, 2019. No evidence of historical GMC operations was identified in these areas and as such no further action was recommended (GHD, 2019E). A summary of the RACER IUs investigated is presented in Table 2.1. The remaining IUs are managed separately and are the obligation of the current landowner/operator of those IUs, GM LLC.

Prior to bankruptcy, GMC completed Interim Measures for PCB impacted areas and three phases of Site investigation in accordance with Work Plans submitted and approved by U.S. EPA. Furthermore, GMC completed RCRA Corrective Action (CA) Environmental Indicator (EI) determinations for CA 725 and CA 750, as interim steps in the evaluation process. GMC commenced EI groundwater monitoring activities in 2004 and following the bankruptcy in 2010 RACER continued to perform the EI monitoring for the RACER Site until it was terminated, in coordination with U.S. EPA, following the 2020 annual EI monitoring event as discussed in Section 4.3.2.

As a requirement of the UAO, GMC submitted an RFI Report to U.S. EPA on March 9, 2007 (Phase 1C RFI Report; CRA, 2007) for the Larger Facility.

In order to identify areas of concern, analytical results collected during the RFI were screened against Michigan Part 201 cleanup criteria. In 2018 Site-wide soil (GHD, 2018C) and groundwater (GHD, 2018A) analytical results were re-screened against Michigan Department of Environment, Great Lakes and Energy (EGLE) Cleanup Criteria Requirements for Response Activity dated December 30, 2013 (formerly the Part 210 Generic Cleanup Criteria and Screening levels, which were the adopted criteria at that time). A summary of the constituents of concern (COCs), from the Site-wide re-screening completed in 2018 for each IU is presented in Table 2.1. Following the soil re-screening activity, EGLE criteria were updated (June 25, 2018). The 2018 updates pertain to the soil groundwater/surface water interface (GSI) protection criteria which, due to extensive groundwater monitoring results and on-going down gradient monitoring, do not warrant a further soil rescreen. Additional details regarding the identification of COCs and the GSI pathway on-Site is provided in Section 4. Since the use of groundwater as a drinking water source will be restricted at the Site, exceedances of drinking water criteria are not presented in Table 2.1.

Table 2.1 Summary of Investigative Units

Investigative Unit:	IU-G	IU-H	IU-I
IU Description	– Former Nodular Iron Plant Area – Located at the southwest property boundary – Northern portion of IU-G sold prior to the GMC bankruptcy	– Former WWTP and Lagoons – Located in the center of the property – Contains the north ditch, former primary, and secondary settling ponds	– Former classified sands staging area – Located at the southeast end of the property
Potential Sources	Various	Foundry sand removal from water recycling operations	Contaminated foundry sands
RFI/IM Activities Performed	– EI groundwater monitoring performed at 7 wells between IU-G and the Saginaw River – Delineation of PCB-impacted soil; PCB-impacted soil removal in wetland area	– Secondary pond water and sediment characterization and evaluation; PCB-impacted sediment removal – Primary basin stabilization	– Classified sands pile removed as part of primary basin stabilization
Laboratory Analysis Performed	Metals, VOCs, SVOCs, Total PCBs, General Chemistry	Metals, VOCs, SVOCs, Total PCBs, General Chemistry	Metals, VOCs, SVOCs, Total PCBs, General Chemistry
Soil/Sediment Constituent of Concern	– arsenic, manganese, PCBs,	– zinc, manganese, and PCBs	– formaldehyde, manganese
Groundwater Constituents of Concern	– ammonia, pH	– none	– none

On September 30, 2011 RACER entered into a new RCRA Section 3008(h) Performance based Administrative Order on Consent, RCRA 05 2011 0023 (Order), which solely covers the RACER Site.

As part of the requirements of the AOC, RACER submitted a Supplemental RFI Report (CRA, 2012) to U.S. EPA on September 28, 2012. The Supplemental RFI presented additional data associated with the RACER Site which had been obtained since the Phase 1C RFI Report was submitted in 2007. The Supplemental RFI also addressed comments received on the Phase 1C RFI Report which related to the RACER Site.

As part of the requirements of the Order, RACER is required to propose final corrective measures necessary to protect human health and the environment from all current and future unacceptable risks due to releases of hazardous waste or hazardous constituents at or from the Site (the "Final Corrective Measures Proposal"). The Draft CMP was submitted to U.S. EPA on April 1, 2013 (CRA, 2013B).

The Draft CMP has been used as the basis for this revised CMP report and is being updated at the request of U.S. EPA to incorporate additional activities that have been conducted since the initial draft submission and to update the proposed corrective measures, as necessary.

2.1 Site Location

The Site is primarily located in Buena Vista Township, and partially within the City of Saginaw, Michigan as presented on Figure 1.1. Prior to the GMC bankruptcy, the Larger Facility encompassed approximately 700 acres. Following the bankruptcy, approximately 315 acres as presented on Figure 1.2 were transferred to RACER. The Site now encompasses a portion of the Former Nodular Iron Plant Area (IU-G), the Former Waste Water Treatment System and Stormwater Ditch (IU-H), a portion of the Classified Sands Staging Area (portion of IU-I), Crow Island Parcel including the area along the Gage Drain north of IU-J, the area at the corner of Hach Road and the end of Outer Drive, and the rectangular area south of IU-I. The property subject to RCRA Corrective Action requirements and covered in the CMP are the parcels illustrated in Figure 1.2.

Areas surrounding the Site consist of commercial and light to heavy industrial use properties with an agricultural area to the east. The majority of the Site is covered by soil with grass/weeds and open water; however, at the location of the Former Nodular Iron plant and Former Waste Water Treatment Plant (WWTP), small portions of the concrete slabs are still present.

2.2 Climate

Refer to Section 3.1.2 of the Phase 1C RFI Report (CRA, 2007) for details on the Site climate; the associated excerpt from this Report is included in Appendix A.

No significant changes to the Site climate have occurred since the completion of the Phase 1C RFI Report.

2.3 Surface water

There are four man made surface water features within the boundaries of the Site. From north to south, these include: the Secondary Settling Pond, the North Ditch (formerly referred to as the Stormwater Discharge Ditch), Lagoon 5 (Water Reservoir), and the Wetland Area in IU-G. The Secondary Settling Pond, Lagoon 5, and the North Ditch are all formerly part of the former wastewater treatment system. The former wastewater treatment system also included four former Primary Settling Basins that were filled in 2012 in accordance with a U.S. EPA approved Work Plan as discussed in Section 5.1. The Wetland Area is an emergent wetland that has formed following the cessation of the dewatering performed at the Site.

The surface water features including the Secondary Settling Pond, Lagoon 5, the former Primary Settling Basins, and the North Ditch were characterized as part of the RFI using a boat and depth meter. Additional characterization of these water features has been conducted since the submission of the draft CMP. The resulting information was used to develop bottom profiles of the features to better characterize the potential habitat quality afforded by these features and to complete ecological screening assessments.

2.3.1 Gage Drain

Gage Drain is a Saginaw County flood control channel located between the Crow Island Parcel and the north end of IU-J, as presented on Figure 1.2. Gage Drain originates upstream of the RACER property at the Crow Island State Game Refuge, which is located immediately to the north of Interstate 75. Flow from Crow Island travels west beneath Interstate 75 and continues in a westerly direction toward the Saginaw River.

Flow from the Gage Drain to the Saginaw River can be substantial; however, the flow primarily reflects overflow from the Crow Island State Game Refuge (Exponent, 2007).

Two stormwater drainage ditches flow into the Gage Drain. The first, the Koehler Drain, is located south of Interstate 75 along the eastern boundary of the Site running the length of Outer Drive and immediately west of the Buena Vista publicly owned treatment works (POTW), as presented on Figure 1.2.

The second drainage ditch (a former section of the Diechmann Drain prior to 1968) is located immediately west of the abandoned Crow Island Roadbed as presented on Figure 1.2. The only apparent sources for water in the ditch are local surface flow and backflow from the Gage Drain. However, an emergency overflow pipe and valve system were installed from the Secondary Pond to this drainage ditch in March 2012 (Outfall 21) and a National Pollutant Discharge Elimination System (NPDES) permit (MI0059042) was obtained on August 24, 2012. A second overflow pipe (Outfall 24) for the Secondary Pond was added to the NPDES permit on July 1, 2018. Following the completion of additional ecological assessments, implementation of a U.S. EPA IM work plan for PCB-Impacted Sediment Removal (Section 5.2), and the quality of water in the Secondary Pond, the NPDES Permit MI0059042 was terminated with EGLE's approval, effective April 23, 2020 (EGLE, 2020).

Gage Drain is located far north of former Facility operations, and downstream of the former controlled discharges from the Secondary Pond. There are no known or suspected releases from the former Facility to the drain and following completion of the IM for the Secondary Pond, no future release of contamination is anticipated.

Sediment and surface water samples were collected from the drain in 1998 and did not show any indication of elevated concentrations of Site related chemical constituents. Therefore, there is no potential for exposure at the Gage Drain. As a result, the Phase 1C RFI Report identified that no further action was required at the Gage Drain (CRA, 2007).

2.3.2 Secondary Settling Pond and Lagoon 5

The Secondary Settling Pond (Secondary Pond) located in IU-H is the largest water body at the Site at approximately 22.3 acres, as presented on Figure 1.2. The Secondary Pond is north of and immediately adjacent to the former Primary Settling Basins and Lagoon 5. The Secondary Pond was in operation from 1977 to 2010 as part of the of the GMC Facility's wastewater treatment system; it received overflow water from the former Primary Settling Basins. There is no reverse pathway for flow from the Secondary Pond into either the former Primary Settling Basins or Lagoon 5. Effluent from the Secondary Pond was previously discharged via the North Ditch through a permitted outfall to the Saginaw River. The discharge from the Secondary Pond to the North Ditch was severed when the loop was closed in 1988. A pump station was installed in the Secondary Pond prior to the former discharge to the North Ditch. The pump station pumped water from the Secondary Pond through a pipe to the Inlet Reservoir north of the SMCO Plant (now GM LLC property). The connection from the Secondary Pond to the North Ditch and the outfall from the North Ditch to the Saginaw River have been plugged.

Lagoon 5 encompasses approximately 3.5 acres and is located northeast of the WWTP in IU-H, as presented on Figure 1.2. The impoundment serves as a stormwater collection basin. There are no connections for water transfer between Lagoon 5 and the Secondary Pond except for an overflow pipe from Lagoon 5 to the Secondary Pond. The overflow is equipped with a butterfly valve; however, the valve is left open to allow for uncontrolled overflow of accumulated stormwater, as needed.

Since cessation of WWTP operation in 2010 and sumps that dewatered portions of the Site were turned off in 2012, the Secondary Pond and Lagoon 5 have only received stormwater runoff from its catchment area. In the event of high-water conditions, overflow from the Secondary Pond occurs to the former Diechmann Drain on route to the Saginaw River, via the Gage Drain, through former NPDES permitted outfalls Outfall 21 and Outfall 24 (as further detailed in Section 2.3.1).

Additional characterization of the Secondary Pond and Lagoon 5 water and sediments was completed in 2011, 2016, 2017, and 2018 with ecological evaluations completed in 2017 and 2018. The additional characterization activities and ecological evaluations are further discussed in Section 4.1.1.

2.3.3 North Ditch

The North Ditch is located in IU-H southwest of the City of Saginaw POTW, as presented on Figure 1.2

Before construction of the recycle water system (circa 1988), Saginaw River water was used as process water in a single pass open loop, and the North Ditch connected the Secondary Pond with the Saginaw River. When the closed loop process water system was put into place the outlet from the Secondary Pond was replaced with a pump station discharging water to the Inlet Reservoir north of the SMCO plant. In addition, the outlet from the North Ditch to the Saginaw River was permanently closed. In 2004, the integrity of the closed outlet was found to be compromised. The former discharge pipes were located, filled with flowable fill and clay was placed over the ends of the pipes at the termination in the North Ditch. Currently, the North Ditch only receives stormwater runoff from its catchment area which includes adjacent properties not owned by RACER; however, with the outlet sealed, water accumulates. The North Ditch encompasses less than one acre of open water.

There is no outlet for the North Ditch area, however, should water levels rise sufficiently there is a stormwater catch basin located to the south of the North Ditch next to the Supplier Park/Halfway house driveway into which water from

the North Ditch area overflows. Stormwater that enters the catch basin discharges to the Saginaw River. This catch basin was identified as Outfall 22 under former NPDES permit MI0059042.

Additional characterization of North Ditch water and sediments was completed in July 2013 and December 2019 with ecological evaluations completed in 2019 and 2020. The additional characterization activities and ecological evaluations are further discussed in Section 4.1.2.

2.3.4 Wetland Area

IU-G was formerly the location of the Nodular Iron Plant, but in the early 2000s, the plant was demolished. A remaining sump that dewatered the area was turned off in 2012 and as a result surface water drainage has tended to collect in this low-lying area and in nearby low-lying areas at the southern end of IU-G. Since 2012 ponded water has produced hydric soils and promoted dominance by wetland vegetation. In 2015, a wetland survey of the area, as required by EGLE to support a proposed development, determined that several small, isolated wetlands had formed. The wetland survey delineated five isolated wetlands with areas of 0.23, 0.84, 1.08, 3.93, and 7.23 acres for a total of approximately 13.31 acres of wetland, as presented in Figure 2.3. These wetlands are isolated from each other due to access roads and driveways, which apparently preclude hydrologic connections among them. The wetlands may contain a foot or more of water during wetter seasons but tend to dry up completely during dry seasons.

Additional delineation of elevated PCB and manganese impacts were completed in March and April of 2015 with an ecological evaluation of recently formed wetlands in the area completed in January 2019. The additional delineation activities and ecological evaluations are further discussed in Section 4.1.3.

2.4 Geology

Refer to Section 3.2 of the Phase 1C RFI Report (CRA, 2007) which provides details on the regional and Site geology; the associated excerpt from this Report is included in Appendix A

2.5 Hydrogeology

Groundwater underlying the Site is present in an upper water bearing zone and in a deeper sand unit and bedrock aquifer. The upper water bearing zone was encountered in the fill and upper fluvial sand materials and appears to be perched on an approximately 60 foot thick clay layer, which separates this water bearing zone from the sand/bedrock aquifer. In addition, this upper water bearing zone does not exist in all areas of the Site. Perched shallow groundwater is expected to discharge to the Saginaw River adjacent to the Site. Groundwater in the deeper sand/bedrock aquifer likely discharges to Saginaw Bay or Lake Huron.

Refer to Section 3.3 of the Phase 1C RFI Report (CRA, 2007) which provides details on the regional and Site hydrogeology; the associated excerpt from this Report is included in Appendix A.

2.6 Water Supply and Groundwater Use

Since 1948, drinking water for Saginaw (which also supplies water to Buena Vista) has been obtained from Lake Huron. Potable water is distributed by the City of Saginaw. An updated well survey was completed by accessing the EGLE website on May 6, 2021 (EGLE, 2021). Twelve wells (10 active, 1 inactive, and 1 unknown), all of which are constructed with a casing to the bedrock unit, were identified within 1 mile of the Site as presented in a letter to U.S. EPA (GHD, 2021B). In addition, consistent with its mission per the terms of the GMC bankruptcy Settlement Agreement, in 2013 RACER proactively recorded a Declaration of Restrictive Covenant (DRC) for the majority of the Site that restricts groundwater use

2.6.1 Lower Unit

The bedrock (lower) unit has not been used historically and is not currently being used as a water supply at the Site. As described above, EGLE well records indicate that up to twelve wells completed into the lower unit are located within 1 mile of the Site, although, these wells do not appear to be directly downgradient of the Site. However, State regulations do not preclude the potential for future potable use of groundwater from the lower unit at or downgradient of the Site, with the following constraints:

– Wells must be cased to a depth of at least 25 feet below ground surface
– Wells must be located outside areas subject to flooding

2.6.2 Upper Water-Bearing Zone

In contrast to the lower unit, the shallow groundwater in the upper water bearing zone in the vicinity of the Site is not currently used and is not reasonably anticipated to be used in the future as a water supply. Use of groundwater from this zone to support current and reasonably anticipated industrial/commercial on-Site land use is highly unlikely. In particular, this water bearing zone is discontinuous across the Facility, is relatively shallow, and has a limited saturated thickness, except near the Saginaw River, which is in the floodplain of the river and thereby wells are prohibited by State regulations. Also, a well installed into this zone would likely not be able to satisfy the casing depth specified in the State well construction regulations. Further, its limited extent and saturated thickness makes this zone unlikely to be capable of supplying a sufficient quantity of water to serve as a reliable industrial/commercial water supply. Therefore, future development of the upper water bearing zone at the Site as a water supply is not reasonably expected. In addition, because the upper water bearing zone is hydraulically isolated from the lower unit by a regional clay layer and an upward hydraulic gradient (CRA, 2012) exists across this clay layer, this upper zone is not anticipated to provide a pathway to the lower aquifer.

2.7 Current and Future Land Use

The Site is located in an area of the City of Saginaw and Buena Vista Township that has been and currently is developed largely for industrial and commercial use. Master plans adopted by Saginaw (Spicer Goup, 2011) and Buena Vista (BVCT, 2017) were developed to serve as guides for long range, future land use planning. The City of Saginaw 2021 zoning map show the Site as M-3 (heavy industrial). Buena Vista Chartered Township existing land use, June 2, 2017, shows the Site as Industrial.

For the Site and surrounding area, land use plans identify continued existing industries and businesses while expanding commercial/industrial development to promote the growth of new business. The surrounding area is designated as a mixture of industrial and light industrial land to the east and west of the Site, in addition to residential and recreational land south of the Facility. Furthermore, Buena Vista's strategy for the M-81 and M-46 interchanges with I-75 is to strengthen their role as the premier industrial employment area for Saginaw, Bay City, and Midland (Cities). The goal of enhancing industrial/commercial growth in the area containing the Site is consistent with the Cities strategy to promote economic development and redevelopment in areas that are already heavily developed for industrial and commercial use. The strategy may include industrial redevelopment of existing commercial strips to service existing businesses and industries in an area.

Residential land use plans encourage redevelopment and infill construction in existing residential areas and interspersed vacant land, rather than creating new residential developments. Based on these land use plans, the potential for new residential development at or in the immediate vicinity of the Facility is considered to be unlikely. In addition, consistent with its mission per the terms of the GMC bankruptcy Settlement Agreement, in 2013 RACER proactively recorded a DRC for the majority of the Site that restricts future use of the Site to nonresidential use.

3. Summary of RFI Activities (Pre-2012)

The Phase 1C RFI Report submitted to the U.S. EPA in March 2007 covered the entire Facility (i.e., prior to the July 10, 2009 property split). A Supplemental RFI was submitted in September 2012 which summarized the findings of the Phase 1C RFI Report as they relate to the RACER Site, provided additional information collected since the submittal of the Phase 1C RFI Report, and responded to comments received from the U.S. EPA on the Phase 1C RFI Report which were applicable to the RACER Site. The Phase 1C RFI Report and Supplemental RFI summarize all of the analytical results for samples collected between 1998 and 2012 under multiple phases of work.

As part of the Phase 1C RFI, quantitative risk assessments were completed [Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA)] for the Larger Facility under all current and reasonably expected future land uses. The risk assessments were completed using all the data collected during the Phase 1C RFI. Based on the results of the HHRA and the ERA, it was concluded that the contamination characterized during the Phase 1C RFI did not pose an unacceptable risk to human health and the environment based on current and reasonably expected future land use with the exception of a potential for unacceptable non-cancer hazards to a hypothetical on-Site construction worker from exposures to elevated ammonia and pH levels in shallow groundwater in IU-G and to off-Site construction workers if off Site migration of overburden groundwater from IU-G, exhibiting high pH levels, were to occur. With construction activities covered by the Facility's Health and Safety Policy for on Facility excavations, no further remedial actions were warranted for the Site. The additional data collected since the Phase 1C submittal was consistent with the data evaluated in the Phase 1C RFI Report. The Phase 1C RFI Report recommended that a long-term groundwater monitoring program be developed to ensure that conditions remain stable. The Phase 1C RFI Report also recommended that institutional controls be evaluated for areas with elevated risk estimates associated with potential exposure of future receptors at the Site. In addition, the Phase 1C RFI Report identified that the Health and Safety Policies, which were in place at the time of the submittal of the report to protect construction workers from significant exposures, must be updated to reflect the findings of the Phase 1C RFI Report and maintained to protect future on Site construction workers.

The HHRA evaluation in the Phase 1C RFI Report assumed no current or future uses of groundwater would occur at the Site. In addition, the HHRA assumed future industrial uses (non-residential) of the Site consistent with the zoning. These assumptions are supported by the proposed implementation of institutional controls. The alternatives evaluated for addressing contaminated groundwater are designed to meet the corrective measures objective of demonstrating no migration of groundwater at concentrations above the drinking water levels to potential groundwater users.

The Supplemental RFI concluded that based on review of the Phase 1C RFI Report, comments received from the U.S. EPA, and additional information and data collected since submittal of the Phase 1C RFI Report:

– The exposed human population at the Site has not changed; with the exception of a reduced frequency and number of on Site workers
– No additional constituents of concern have been identified at the Site
– Current health and safety practices on-Site prevent the exposure of a construction worker to ammonia and pH in groundwater; furthermore, land use restrictions placed on the property will prevent the future exposure scenarios
– The potential exposures to routine workers, maintenance workers, trespassers, and off-Site residents are not significant
– Risk of adverse ecological effects is low to negligible from exposure to Site related constituents

4. Summary of RFI Activities (since 2012)

Since the submission of the Supplemental RFI, additional characterization activities and evaluations have been performed on-Site in consultation with U.S. EPA. The following sections summarize the evaluations and their conclusions.

4.1 Surface Water and Sediment

4.1.1 Secondary Pond and Lagoon 5

Initially, RFI sediment and surface water sampling was conducted in the Secondary Pond and Lagoon 5 in 1998 and 2005. As part of the Phase 1C RFI Report (CRA, 2007) an ERA and HHRA were completed of the Secondary Pond and Lagoon 5. Because the Secondary Pond and Lagoon 5 were then process-related settling ponds, the HHRA and ERA assumed that the ponds were not habitat for fish or macroinvertebrates. Consequently, the RFI's HHRA and ERA did not consider risks to humans, fish-eating wildlife, or in-pond biota. However, because larval aquatic insects were found in the pond's sediments, the ERA did consider potential risks to aerial insectivores that consume adult aquatic insects emerging from the pond. The ERA reported no unacceptable risks to aerial insectivores feeding on insects emerging from the pond (Exponent, 2007). The ERA concluded that, "Risk of adverse ecological effects is low to negligible from exposure to Facility-related constituents."

With operation of the WWTP ceasing in 2010, these surface water features are reverting back to a more natural condition. In June 2011 additional characterization of the Secondary Pond (sediment and water) was completed for the purpose of obtaining an NPDES permit for the discharge of water, and if necessary, to evaluate remedial alternatives to address any issues identified. In March 2016, additional investigation of the secondary pond sediments and water was completed to support RCRA Corrective Action and evaluation for suitability for potential establishment of mitigation wetlands. In May 2016, a more detailed investigation of the secondary pond sediments was completed as a follow-up to the March 2016 sampling. In August 2016 and September 2017 additional delineation of PCB impacts in sediment was completed to define the limits of elevated PCBs in sediments.

In 2017, a streamlined ERA was completed for the Secondary Pond and Lagoon 5, which was documented in a memorandum to U.S. EPA (GHD, 2017), that considered potential end-uses for the Secondary Pond and Lagoon 5. The streamlined ERA was completed under the assumption that PCB hot spots would be removed through the implementation of an IM work plan (completed IM activities are presented in Section 5.2).

Based on the ecological screening results for sediment and surface water in Lagoon 5, the streamlined ERA identified that concentrations of constituents in water and sediments of Lagoon 5 were not likely to cause toxicity to surface water biota, benthos living in the sediments, or to semi-aquatic predators consuming either fish or aerial insects emerging from Lagoon 5. The Lagoon 5 bottom was also determined to be non-toxic to aquatic plants. The streamlined ERA, therefore, concluded that there appears to be little risk if Lagoon 5 is maintained as open water habitat.

For the Secondary Pond (excluding Lagoon 5), concentrations of all detected chemicals were too low to cause toxic effects on water column biota. Concentrations of bioaccumulative chemicals in sediments were previously found to be too low to cause potential risks to semi-aquatic predators consuming emerging insects (Exponent, 2007). A simple food-chain analysis presented in the memorandum demonstrates that PCB concentration in sediments, after the completion of IM activities, would be only about 1/5$_{th}$ those that could cause PCB concentrations in forage fish sufficient to cause toxicity to most sensitive fish-eating wildlife.

In contrast, more than half the pond bottom had Carbon Normalized Excess Simultaneously Extracted Metals (CNE-SEM) values that were either potentially toxic or likely to be toxic and that without further analyses (e.g., pore water sampling), unacceptable risks to the Pond's benthos could not be dismissed with available information. Similarly, the concentrations of some metals were well above conservative screening values for phytotoxicity in soils. Thus, the

potential for phytotoxic effects on submerged and emergent aquatic plants could not be dismissed with available information.

U.S. EPA provided comments on the streamlined ERA on October 18, 2017. On December 4, 2017, RACER, GHD, U.S. EPA, and Booz Allen Hamilton (U.S. EPA contractor) participated in a conference call to discuss the comments. Following the call, GHD prepared and submitted a response to U.S. EPA comments on January 29, 2018 and also prepared and submitted a sediment pore water sampling Work Plan to address U.S. EPA's comments related to risk to benthic invertebrates (GHD, 2018B). The Work Plan was approved by U.S. EPA on March 2, 2018 and sampling was conducted on April 17, 2018.

The results were presented to U.S. EPA on May 11, 2018 and a memorandum summarizing the results was submitted on June 3, 2018. U.S. EPA provided comments on the pore water sample results on June 13, 2018 and responses to comments were provided to U.S. EPA on July 3, 2018. U.S. EPA provided email approval on September 17, 2018 to proceed with removal of PCBs >50 part per million (ppm) in Secondary Pond sediments and following the removal, to allow the Secondary Ponds to naturalize, and to implement appropriate institutional controls to prevent hydrologic connection between the pond and adjacent surface water.

The IM for the Secondary Pond was implemented in 2019 and is further discussed in Section 5.2.

4.1.2 North Ditch

Initially, RFI sediment and surface water sampling was conducted in the North Ditch in 1998 and 2005. As part of the Phase 1C RFI Report (CRA, 2007), an ERA and HHRA were completed for the North Ditch. Because the North Ditch was an artificial water body and, at the time of the ERA, was part of the plant's storm water system, the ERA did not consider risks to the fish and sediment macrobenthos in the North Ditch. Instead, the ERA considered only risk to semi-aquatic birds and mammals consuming fish and macroinvertebrates from the North Ditch. Based on this limited risk analysis, the ERA concluded that chemicals in ditch water and sediments did not pose ecological risks, via bioaccumulation pathways, to semi-aquatic predators of aquatic life living in the North Ditch.

Additional characterization of the North Ditch surface water and sediments was completed in July 2013 to assist in assessing stormwater improvement alternatives.

Consistent with the approach for the evaluation of Secondary Pond and Lagoon 5, a streamlined ERA was completed for the North Ditch in 2019 which was documented in a memorandum to U.S. EPA (GHD, 2019B).

Based on the ecological screening results for sediment and surface water in the North Ditch, the streamlined ERA identified that concentrations of constituents in water and sediments of the North Ditch were not likely to cause toxicity to surface water biota or benthos living in the sediments. No chemicals exceeded ecological screening values (ESVs) in North Ditch surface water. Metals, especially manganese and zinc, were elevated above ESVs in sediments, but more refined analyses suggested that these chemicals were not likely problematic. PCB concentrations in sediments were also elevated, but ecological risks were neutralized, in part, by the assumption of high concentrations of organic carbon (consistent with the Secondary Pond). Thus, PCBs were not likely to cause toxicity to benthic invertebrates. Overall, the assessment concluded that no further activity was required in the North Ditch, beyond some additional sampling to confirm concentrations of total organic carbon, which was documented in a Work Plan to complete Additional North Ditch Sediment Sampling (GHD, 2019C).

Sampling was completed on December 10, 2019, which confirmed the presence of total organic carbon. An updated streamlined ERA was submitted to the U.S. EPA (GHD, 2020A) which confirmed the previous conclusion that no further action is recommended for the North Ditch. The U.S. EPA approved the conclusions of the Streamline ERA by email on February 27, 2020.

4.1.3 Wetland Area

Characterization of soils across IU-G was completed between 1998 and 2003; prior to the formation of the emergent wetlands. As a result of elevated PCB and manganese detections in previous soil characterization activities, additional delineation of PCB and manganese impacts were completed in March and April of 2015. The purpose of the additional

investigation of PCBs in soil was to assist in developing and evaluating TSCA compliant remediation alternatives, including defining the limits of a possible PCB notice and restriction area.

The previous exceedance of Particulate Inhalation Criteria for manganese could not be replicated and as such no further action was recommended for this area. PCB impacts in soil were delineated to 1 ppm PCBs horizontally and vertically. The results were presented in a memorandum to U.S. EPA on May 8, 2015 (CRA, 2015).

In 2018, a streamlined ERA was completed on the emergent/scrubland wetland formed in IU-G which was documented in a memorandum to U.S. EPA (GHD, 2019A). The streamlined ERA considered three receptors: aquatic invertebrates including benthos, wetland plants, and predators of aquatic invertebrates. The latter were represented by bats and swallows, aerial insectivores that feed on adult stages of aquatic insects.

Based on the ecological screening results for soil in the wetland area, the streamlined ERA identified that significant ecological risks are unlikely to occur in the newly formed wetlands. These wetlands are unnatural, small, isolated, and of moderate to low habitat value. Moreover, over the long-term, the wetlands may be filled during redevelopment of the Site. Therefore, the streamlined ERA concluded that no further evaluation of ecological risks is warranted.

However, due to the potential for small ecological risks associated with PCBs in shallow soil, U.S. EPA requested that shallow soil be removed and disposed of off-Site. Shallow PCB-impacted soil in the wetlands in IUG was removed and disposed of off-Site in September 2020 and is further discussed in Section 5.3.

4.2 Soil

4.2.1 Soil Evaluation (April 20, 2018)

In 2018, an evaluation of soil sample results at the Site was conducted to identify any potential concerns when comparing the Site historical soil data to more recent non-residential screening criteria (EGLE Part 201 Cleanup Criteria Requirements for Response Activity dated December 30, 2013, and DRAFT 2017 Part 201 Generic Cleanup Criteria and Screening Levels). Soil investigations conducted since the Supplemental RFI (July 2013, March and April 2015) were included in the evaluation.

The soil evaluation concluded that, based on the comparison completed, no further action was recommended for the Site with respect to soil beyond recording a DRC. U.S. EPA responded with comments dated August 31, 2018 which were responded to in a letter dated November 26, 2018 (GHD, 2018D). RACER agreed to complete some limited additional soil delineation sampling in IU-G at SB-05542, as well as, MW-05443, which is scheduled to be completed in 2021.

4.2.2 IU-I Slag Area Sampling

At the request of U.S. EPA, a Site inspection of IU-I south was completed on April 11, 2019. The parcel was found to be heavily vegetated. Two areas with visible surficial slag were also identified totaling approximately 0.5 acres. To evaluate the potential impacts due to the presence of the slag, a work plan was submitted to U.S. EPA to complete soil sampling of the area, which was approved by U.S. EPA on October 18, 2019. Sampling was completed on December 11, 2019.

The results of the slag area sampling were summarized in a letter to U.S. EPA dated March 10, 2020 (GHD, 2020D). The results identified that there are no Site-related concentrations in soil that represent a potential for significant exposure to on- or off-site receptors and no further action was recommended of the area. U.S. EPA responded to the letter on March 12, 2020, via email, with no comments.

4.3 Groundwater

4.3.1 Groundwater Evaluation (October 15, 2018)

An evaluation of groundwater sample results collected from the start of the RFI (November 1998) to 2018 (GHD, 2018A) at the Site was completed to identify any potential concerns when comparing the Site historical groundwater data to more recent screening criteria (EGLE Cleanup Criteria Requirements for Response Activity dated December 30, 2013 and DRAFT 2017 Part 201 Generic Cleanup Criteria and Screening Levels), than was used to screen the data in the September 28, 2012 Supplemental RFI Report. Groundwater investigations conducted since the Supplemental RFI (2013 to 2018 EI Results) were included in the evaluation.

The groundwater evaluation concluded that various metals may be present in groundwater near the downgradient property boundaries at concentrations above the residential drinking water criteria and have the potential to migrate off-Site. In addition, elevated pH is present across the Site and ammonia was found above residential volatilization to indoor air screening levels at the downgradient property boundary. As a result, the following activities were recommended:

IU-G - Former Nodular Iron Plant (a portion of)

– Sample MW-04040 and analyze the sample for iron and vanadium
– Continued monitoring of pH as part of the groundwater monitoring program

IU-H - Wastewater Treatment System and Stormwater Discharge Ditch

– Sample MW-15457 and analyze the sample for antimony and cobalt
– Sample MW-05443 and analyze the sample for iron and ammonia
– Sample MW-17661 and analyze the sample for cobalt, nickel, and vanadium

IU-I - Classified Sand Staging Area

– Sample MW-07959 and analyze the sample for cobalt, cyanide, pentachlorophenol, and pH

The additional sampling was completed during the November 2018 EI sampling event, in accordance with the recommendations in the Groundwater Evaluation Memorandum dated October 15, 2018. The results were summarized in a memorandum dated March 13, 2019 (GHD, 2019D). Iron and nickel were detected above Residential Drinking Water criterion and total cyanide was detected above GSI criterion. The groundwater evaluation concluded that, based on the comparison completed, no further action was recommended for the Site with respect to groundwater beyond recording a DRC.

4.3.2 Environmental Indicators

Annual CA 750 EI groundwater sampling events have been conducted since 2004 until 2020 in accordance with the RCRA CA725 & CA750 EI Supporting Documentation dated September 17, 2003. The results from the annual EI monitoring continue to be consistent, or lower than, the data evaluated in the EI Supporting Documentation; therefore, the EIs continue to be satisfied. In the 2019 CA 750 EI Annual Monitoring Results letter dated January 17, 2020, RACER requested to terminate groundwater monitoring if 2020 monitoring data was consistent with previous data or when USEPA completes its formal RCRA Corrective Action decision, whichever came first. The monitoring wells included in the EI groundwater monitoring program are located within or downgradient of Investigative Unit G - Former Nodular Iron Plant, which was demolished in 1999, and a small portion of Investigative Unit H – Wastewater Treatment System and Stormwater Discharge Ditch, specifically the North Ditch, which stopped receiving water from the Former Nodular Iron Plant when it was demolished in 1999. There have been no activities in these areas since the Former Nodular Iron Plant was demolished in 1999 beyond investigation and remedial actions. The 2020 results were generally consistent with previous data and groundwater/surface water interface compliance continues to be below the applicable criteria and levels are stable. On January 8, 2021, RACER requested to terminate groundwater monitoring. U.S. EPA responded on January 12, 2021 with no comments.

4.3.3 Site-wide PFAS and 1,4-dioxane Assessment

Per- and Polyfluoroalkyl Substances (PFAS) has been termed an emerging contaminant because it presents unique issues associated with its distribution in the environment and the potential for adverse effects on ecological and human health. Because it is not a “hazardous constituent” for regulatory purposes according to U.S. EPA, it was not previously assessed on-Site for the potential for a significant release from current or historical operations. An evaluation of the potential for release of PFAS was submitted to the U.S. EPA on April 28, 2021 (GHD, 2021A). The assessment determined that there is no known or suspected release of PFAS containing material to the environment that warrants investigation as part of RCRA Corrective Action.

A similar assessment for 1,4-dioxane was provided to U.S. EPA in a letter dated March 18, 2021. The assessment determined that evaluation and investigation of 1,4-dioxane was unnecessary (GHD, 2021B).

4.4 U.S. EPA Site Visit – April 4, 2019

On April 4, 2019, a Site visit was conducted with U.S. EPA to familiarize the new U.S. EPA project manager with the Site and to provide a brief history. GHD conducted a follow-up Site inspection on April 11, 2019 of areas not accessible on April 4, 2019 including: the Crow Island Parcel including the area along the Gage Drain north of IU-J, the area at the corner of Hach Road and the end of Outer Drive, and the rectangular area south of IU-I. A memorandum was submitted on May 29, 2019 responding to U.S. EPA comments during the Site inspection, as well as, providing details on the follow-up inspection.

The follow-up Site inspection identified that the Crow Island Landfill, the area at the corner of Hach Road and the end of Outer Drive, and the rectangular parcel south of IU I had no evidence of historical GMC operations and as such no further action was recommended.

In addition, the follow-up Site inspection identified the presence of slag in two areas south of clay pile in IU I. A work plan to conduct additional characterization was prepared and implemented as further discussed in Section 4.2.2.

4.5 U.S. EPA Overall Site Review of Available Data

On February 4, 2021, U.S. EPA submitted comments following their review of the existing information for the Site. A letter was submitted on March 18, 2021 to U.S. EPA (GHD, 2021B) which included responses to specific comments on the human health risk assessments, submittal of a work plan to complete additional delineation sampling recommended in the April 20, 2018 Soil Evaluation, response to the request to conduct additional groundwater sampling for PFAS and 1,4-dioxane, and submittal of an updated well inventory.

In response to the request PFAS sampling, a follow-up memorandum was provided to U.S. EPA on April 28, 2021 (GHD, 2021A) documenting potential uses/sources of PFAS at the Site and the conclusion that there are no known or suspected releases of PFAS containing material to the environment that warrants investigation as part of RCRA Corrective Action.

5. Interim Measures

The conclusions of both the Phase 1C RFI Report, Supplemental RFI, and subsequent soil evaluations, groundwater evaluations, and ecological assessments found that there was no unacceptable risk to human health or the environment associated with the RACER Site based on current and reasonable anticipated future land use, with the exception of a potential for unacceptable non-cancer hazards to a hypothetical on-Site construction worker from exposures to elevated ammonia and pH levels in shallow groundwater in IU-G and to off-Site construction workers if off-Site migration of overburden groundwater from IU-G, exhibiting high pH levels, were to occur.

To further reduce the potential for future unacceptable risk on Site, the following IM activities were conducted.

5.1 Stabilization of Former Primary Basins

The four former Primary Basins located in IU-H are presented on Figure 2.3. The former Primary Basins were not identified as a source of unacceptable risk; however, following cessation of operation at the WWTP in 2010, the former Primary Basins began collecting stormwater and could not be operated in an appropriate manner to safely discharge the water. In July 2012, a "Site Stabilization Work Plan for Closure of Four Primary Settling Basins" was prepared and submitted to U.S. EPA that detailed the proposed activities for the Primary Basins. The work plan included the infill of the Primary Basins and re-grading to promote stormwater flow away from the Primary Basins. The work plan was approved by U.S. EPA on September 18, 2012 and implemented in December 2012. Final restoration was completed in June 2013 with a construction completion report submitted to U.S. EPA on September 4, 2013 (CRA, 2013A).

5.2 Secondary Pond

As contemplated in the ecological screening assessment for the Secondary Pond, a draft IM work plan for PCB-Impacted Sediment Removal was prepared in accordance with Title 40 of the Code of Federal Regulations, Part 761 (40 CFR 761) as a notification to the U.S. EPA of RACER's intent to implement a cleanup of the Site related PCB contamination under the risk based option set forth under 40 CFR §761.61(c) and included applicable aspects of the self-implementation alternative described in 40 CFR §761.61(a). The Draft Work Plan was submitted to U.S. EPA on December 19, 2018 in accordance with the procedures set forth in 40 CFR §761.61 of TSCA. The purpose of the Draft Work Plan was to reduce risk to aquatic benthos by removing sediments impacted with >50 ppm PCBs. U.S. EPA conditionally approved the Draft Work Plan via email on February 14, 2019. In consultation with U.S. EPA, the work plan was approved by U.S. EPA on August 20, 2019. The work plan was implemented between August and November 2019.

During implementation of the work plan, the clay depths were found to be deeper than previously identified. In an email dated October 2, 2019, GHD requested to modify the approved work plan to excavate sediment to a maximum depth of 6 feet or to the clay bottom, whichever was shallower. Additionally, based on difficulties in completing verification sampling of wet sediments, GHD proposed replacing the requirement to complete verification sampling with the installation of a 1-ft clean material cover (including a demarcation layer between the cover and underlying sediments). U.S. EPA approved the request on October 2, 2019 with the condition that a carbon amendment be added to the cover material to prevent back-diffusion of PCBs.

Approximately 2,547 tons of PCB-impacted sediment (> 50 ppm PCBs) were removed from the Secondary Pond. Sediments were excavated under dewatered conditions. Following excavation, a 1-ft topsoil cover, amended with black carbon, was placed over the excavation areas along with a demarcation layer. A PCB cleanup summary report was submitted on February 11, 2020 (GHD, 2020B), and approved by U.S. EPA on April 19, 2021, by email.

5.3 Wetland Area

At U.S. EPA's request, an IM work plan for PCB-Impacted Soil Removal in IU-G Wetland Area was prepared in accordance with Title 40 of the Code of Federal Regulations, Part 761 (40 CFR 761) as a notification to the U.S. EPA of RACER's intent to implement a cleanup at the site of PCB contamination under the risk based option set forth under 40 CFR §761.61(c). The work plan was submitted to U.S. EPA on July 10th, 2020 in accordance with the procedures set forth in 40 CFR §761.61 of TSCA. The purpose of the work plan was to remove soil within the top 12 inches with <50 ppm PCBs to reduce risk to benthic invertebrates. U.S. EPA approved the Work Plan in a letter dated September 2, 2020.

The work plan was implemented between September 15 and 17, 2020. Approximately 93 tons of PCB-impacted sediment (< 50 ppm PCBs) were removed from the Wetland Area. Soil was excavated under naturally dry conditions. Following excavation, the area was backfilled with clean material from an on-Site source. A straw mat was placed over the area to aid re-establishment of wetland vegetation. Wetland seed was broadcast over the disturbed area including

the surrounding area. A PCB cleanup summary report was submitted on October 16, 2020 (GHD, 2020C), and approved by U.S. EPA on October 20, 2020, by email.

6. Evaluation of Corrective Measures Alternatives

With the completion of extensive sampling under the RFI, as well as Human Health and Ecological risk assessment evaluations, comparison to EGLE Part 201 generic cleanup criteria, combined with implemented interim measures, minimal unacceptable exposures are present under current and expected future land uses. Potential Human Health risks included:

– Unacceptable non-cancer hazards to a hypothetical on-Site construction worker from exposures to elevated ammonia and pH levels in shallow groundwater in IU-G
– Off-Site construction workers if off-Site migration of overburden groundwater from IU-G, exhibiting high pH levels, were to occur.
– Groundwater use as a potable source
– Residential land use.

There were no unacceptable exposures identified in the ecological screening assessments with the possible exception of limited zinc toxicity to aquatic biota in the Secondary Pond sediments however, if toxicity is present, it will diminish over the long-term as the pond naturalizes.

Corrective actions, other than the presumptive institutional controls (i.e., non-residential land use and groundwater use restriction), other deed restrictions (see Section 7) and groundwater monitoring, to eliminate potential risk or exposure pathways becoming complete are extremely costly (i.e., pump and treat until standards met) and would require the presumptive institutional controls, other deed restrictions, and monitoring until acceptable levels would be achieved. Therefore, no alternatives have been evaluated other than the proposed final corrective measures. See Section 7 for a description of the proposed final corrective measures.

The proposed final corrective measures were evaluated using the nine criteria outlined in the U.S. EPA document entitled "RCRA Corrective Action Plan" (U.S. EPA, 1994). Three additional criteria have been added to evaluate the corrective measures alternatives (community/state acceptance, and sustainability). The following section presents a brief description of each of the twelve criteria.

6.1 Criteria for Evaluation of Corrective Measures Alternatives

The RCRA Corrective Action evaluation criteria are summarized below:

1) Protect Human Health and the Environment

This criterion considers the ability of the remedial alternative to protect both human health and the environment.

2) Attain Media Cleanup Standards Set by the Implementing Agency

This criterion considers the ability of the remedial alternatives to attain the cleanup standards for that specific media.

3) Controlling the Sources of Releases

To the extent practicable, the remedial alternative must control the source of the release. This criterion considers the ability of the remedial alternative to reduce or eliminate any further releases of hazardous substances that would pose a risk to human health or the environment.

4) Comply with any Applicable Standards for Management of Wastes

This criterion considers the ability of the remedial alternative to comply with applicable standards for waste management (i.e., hazardous waste storage and transportation regulations, emissions limitations, etc.).

5) Long Term Reliability and Effectiveness

This criterion considers both the level of threat posed by hazardous constituents remaining in place and the adequacy of the remedial alternative and the risk associated with any treatment residuals compared to untreated waste.

6) Reduction in the Toxicity, Mobility or Volumes of Wastes

This criterion considers the ability of the remedial alternatives to reduce the toxicity, mobility, or volume of waste significantly and permanently.

7) Short term Effectiveness

This criterion evaluates the effects of the remedial alternatives on human health and the environment during their implementation period. It considers factors such as impacts from remedy construction, transportation, and air quality.

8) Implementability

This criterion considers the technical and administrative feasibility of implementing the selected remedial alternative.

9) Cost

This criterion considers the cost effectiveness of each alternative. Cost effectiveness is evaluated by comparing the costs proportional to the effectiveness achieved by the remedial alternative.

10) Community Acceptance

This criterion evaluates the issues and concerns the local community may have regarding the alternatives. U.S. EPA encourages community involvement in remedial alternatives and community acceptance will be considered in the remedial alternative selection.

11) State Acceptance

This criterion evaluates the technical and administrative issues and concerns the state environmental agency may have regarding the alternatives. U.S. EPA encourages coordination with state agencies and state acceptance will be considered in the remedial alternative selection.

12) Sustainability

This criterion considers the sustainability of each alternative with regard to energy requirements; air emissions; water requirements including impacts on water resources; land and ecosystem impacts; and material consumption and waste generation as part of the evaluation of remedial alternatives. The sustainability evaluation was used in conjunction with the core elements of RCRA corrective action alternatives evaluation to identify corrective measures alternatives that would balance effectiveness and sustainability.

6.2 Summary of Corrective Measures Alternatives Evaluation

An overview of the proposed corrective measures alternatives is presented in Table 6.1. The evaluation of the corrective measures alternatives as compared to the criteria is presented in Section 6.1 is presented in Table 6.2. Corrective measures evaluated include on-Site land and on/off-Site potable groundwater use restrictions and on-Site and limited off-Site groundwater monitoring.

Table 6.1 Overview of Corrective Measures Alternatives

Remedial Strategy:	Institutional Controls / Deed Restrictions	Groundwater Monitoring
Description of Remedial Strategy	This option would restrict land use to industrial/commercial use, which is consistent with zoning and the current use of the property. Deed restrictions would also restrict the potable use of groundwater on/off-Site. A notification on the deed would also address potential groundwater contact exposures.	This option would allow for monitoring of Site constituents to track trends and distribution
Advantages of the Remedial Strategy	– Effective mechanism to restrict land use – Effective mechanism to inform future owners of Site conditions and restrictions	– Effective mechanism to monitor groundwater migration and concentration trends
Limitations of the Remedial Strategy	– Does not treat impacts	– Potentially longer timeframe than treatment – No active source mitigation
Timeframe	Foreseeable future	Dependent on natural attenuation/trends
Health and Safety Considerations	– Applicable activities would require proper health and safety precautions per OSHA	– Minimal health and safety concerns during monitoring
Feasible Technology for this Project?	Feasible	Feasible

Table 6.2 Evaluation of Corrective Measures Alternatives

Criteria	Institutional Controls / Deed Restrictions	Groundwater Monitoring
Protect Human Health and the Environment	By implementing the restrictions potential pathways by which humans and the environment would potentially become exposed to hazardous constituents on-Site can be kept incomplete.	Provides a means to track concentrations in groundwater and allows for consideration of additional measures in the event that the level of risk increases.
Attain Media Cleanup Standards	This corrective measure allows for the natural attenuation of Site related constituents.	This corrective measure allows for the natural attenuation of Site related constituents.
Controlling the Source of Release	Sources no longer exist on-Site.	This option provides a means of monitoring the Site to determine if migration of hazardous constituents is occurring and to what extent.
Comply with Applicable Waste Management Standards	No waste management is required by this corrective measure.	Minimal waste management is required for sampling waste.
Long-term Reliability and Effectiveness	This is a reliable and effective mechanism to prevent potential exposure pathways from becoming complete while allowing for the natural attenuation of Site related constituents.	This is a reliable and effective mechanism to monitor concentration trends of Site related constituents.
Reduction in the toxicity, Mobility, and Volume of Waste	This option does not reduce the toxicity, mobility, or volume of waste.	This option does not reduce toxicity, mobility, or volume of waste.
Short-term Effectiveness	This is a reliable mechanism which can be implemented in a relatively short period of time to mitigate potentially complete exposure pathways.	This method is effective in the short-term to identify any groundwater concentration changes that need further evaluation.

Criteria	Institutional Controls / Deed Restrictions	Groundwater Monitoring
Implementability	This option can be easily implemented.	Groundwater monitoring has been on-going from 2004 to 2020 and can be easily implemented. The availability of monitoring location on the property allows for flexibility in the event that trends are observed.
Community Acceptance	Deed restrictions are expected to be acceptable to the community.	Groundwater monitoring is expected to be acceptable to the community.
State Acceptance (EGLE)	Deed restrictions are commonly accepted by EGLE.	EGLE commonly excepts groundwater monitoring.
Sustainability	This option does not generate waste or require energy.	This option produces minimal waste and has minimal energy requirements
Cost	Costs include supporting preparation of a deed restriction and if necessary, performing a legal survey of the property and are estimated at $33,500.	Costs include performing annual groundwater monitoring and reporting (estimated at $34,000 biennially); assuming that monitoring is completed for 10 years at and inflation rate of 2% the total ten-year cost would be $184,000. Costs also include well abandonment (estimated at $46,000).

7. Proposed Final Corrective Measures

The proposed final corrective measures to manage potential unacceptable risks and to prevent potential exposure pathways from becoming complete, are presented in Table 6.2 and in the following subsection.

7.1 Institutional Controls / Deed Restrictions

The following institutional controls/deed restrictions are proposed final corrective measures and will serve as Site-wide management controls for the entirety of the RACER property presented in Figure 1.2. The below restrictions will replace the current DRC.

1. Prohibit all uses of the Property that are not compatible with or are inconsistent with the exposure assumptions for the nonresidential cleanup criteria established pursuant to MCL 324.20120a(1)(b) of NREPA.
2. Prohibit installation or use of drinking water wells on the Property.
3. Prohibit installation or use of groundwater extraction wells or other devices on the Property, except for wells and devices that are part of a USEPA or EGLE approved response activity, and for short-term dewatering for construction purposes, provided the dewatering, including management and disposal of the groundwater, is conducted in accordance with all applicable environmental laws and does not cause or result in a new release, exacerbation of any pre-existing environmental condition, or any other violation of environmental laws.
4. Prohibit removal, disturbance or damage to any monitoring wells on the Property without U.S. EPA and RACER Trust approval.
5. Prohibit the “treatment”, “storage”, “disposal”, or release any Hazardous Substances, on, at, or below the Property and prohibit the “treatment”, “storage”, “disposal”, or release any Hazardous Substances, on, at, or below the Property in a manner that would require a permit under RCRA, 42 U.S.C. §§ 6901 et seq. or Part 111 of NREPA, except pursuant to a plan, permit, or license approved in writing by U.S. EPA or EGLE, pursuant to those statutory authorities.

6. Require contaminated soils (if present), media and/or debris (if present) and all other soils located on the Property be properly managed whether encountered on the surface or during below grade work in accordance with the requirements of Part 111 and RCRA Subtitle C, the administrative rules or regulations promulgated pursuant to Part 111 and RCRA, and all other relevant state and federal laws, including but not limited to MCL 324.20120c and 40 CFR Part 761.
7. Prohibit construction, installation or maintenance of subsurface utilities, structures or other features (collectively, Subsurface Features), at the Property, unless: 1) the construction is approved in writing in advance by U.S. EPA or EGLE as applicable, and RACER Trust; 2) any conditions or requirements of such approval are complied with; and 3) such construction incorporates engineering controls designed, as necessary and applicable: a) to provide adequate protection for construction or maintenance workers; b) to eliminate the potential for the Subsurface Features and/or the Subsurface Features corridor to be a preferential contaminant migration pathway for impacted subsurface water or vapor; or c) to eliminate the potential for the Subsurface Features to release fluids that could infiltrate through the subsurface and exacerbate impacts to groundwater.
8. Prohibit the removal any slabs, pavement, or other impervious surface (collectively, Impervious Surface) on the Property without U.S. EPA and RACER Trust approval.
9. Prohibit construction and/or occupancy of any new structure, including buildings, basements, and/or additions to existing structures at the Property, unless such construction and/or occupancy incorporates engineering controls designed to eliminate the potential for subsurface vapor phase contaminants or hazardous substances to migrate into the new structure at concentrations greater than the appropriate concentrations protective of public health; or unless prior to construction and/or occupancy of any structure, an evaluation of the potential for any contaminants or hazardous substances to volatilize into indoor air assures the protection of persons who may be present in the buildings. Prior to conducting any activity that may increase the potential for any human exposures, Owner must submit to U.S. EPA and EGLE for approval documentation of compliance with the above requirements and submit to RACER Trust with a copy to U.S. EPA or EGLE as appropriate this documentation of compliance and evidence of either U.S. EPA's or EGLE's written approval of such compliance.
10. Prohibit excavation or performance of any other intrusive activities at the Property, including but not limited to removal, disturbing, damaging, interfering or otherwise negatively affecting the integrity, effectiveness and operation of the ground surface covers (concrete, soil or vegetative cover), or monitoring wells, except: such activities are temporary (less than sixty (60) days in duration); are part of a U.S. EPA- or EGLE-approved response activity; are conducted in accordance with all applicable environmental laws; do not cause or result in a new release, exacerbation of any pre-existing environmental condition or any other violation of environmental laws; are approved by U.S. EPA or EGLE as applicable, and RACER Trust in writing in advance; and repaired to at least the pre-disturbance condition within fourteen (14) days of work completion. Owner shall comply with any conditions or requirements of any approval issued pursuant to this Subsection. Owner will provide to U.S. EPA, EGLE and RACER Trust documentation confirming the proper and complete implementation of any activity covered by this Subsection.
11. Prohibit the owner to allow, cause, or create an uncontrolled above ground connection that allows for a back and forth flow of water between the Secondary Pond and the adjacent drainage ditches unless such a connection is first approved in writing by U.S. EPA and RACER Trust.
12. Require compliance with Due Care requirements.
13. Providing notification of the presence of PCB remediation waste and prohibiting uses in that area that are not in accordance with requirements for Low Occupancy as defined in 40 CFR 761.3.
14. Providing notification of arsenic impacted soil remaining on-Site.

7.2 Groundwater Monitoring Program

A groundwater monitoring program is also proposed that will consist of the following components:

– Annual groundwater level monitoring at MW-03945, MW-04051, MW-04250R, MW-04257, MW-04336, MW-04438R, MW,04757, MW-04836R, MW-05036R, MW-05038, MW-05443, MW-06951, MW-06445 and MW-8R.
– Biennial (every two years) groundwater sampling for pH and Ammonia at: MW-03945 and MW-04051 (former EI compliance Points); MW-05036R, MW-8R (Source Area); and MW-04250R, MW-04336, MW-04438R, and MW-05038 (Intermediate Points)
– Annual summary report preparation and submittal
– Anticipated duration of the program is 10 years but may be terminated earlier if groundwater quality remains stable or decreasing.

In addition to the groundwater monitoring program all remaining monitoring wells should be abandoned; excluding those used for on-going monitoring.

8. Costs and Schedule

The cost required to prepare a DRC for the Site include supporting preparation of a DRC and performing a legal survey of the property (if necessary), for a total cost of approximately $33,500. A draft DRC will be prepared and submitted to U.S. EPA within three months of U.S. EPA issuing a Final Decision. A detailed cost breakdown is provided in Table 8.1.

On-Site and limited off-Site groundwater monitoring costs include performing annual groundwater monitoring as described in Section 7.1 (#0) and reporting for an estimated cost of $34,000 biennially. The groundwater monitoring program will be reviewed biennially, and revisions will be proposed to U.S. EPA, as appropriate. The monitoring will be terminated following U.S. EPA approval. Assuming that monitoring will terminate after 10 years and an inflation rate of 2 percent, the total ten-year monitoring cost is approximately $184,000. All monitoring wells will be properly abandoned following U.S. EPA approval of terminating monitoring for an estimated cost of $77,000.00. A detailed cost breakdown is provided in Table 8.1.

Table 8.1 Detailed Cost Breakdowns

Declaration of Restrictive Covenant					
		Unit	**Rate**	**Quantity**	**Total Cost**
Project Manager		hour	$159.67	10	$1,596.70
Project Engineer		hour	$124.44	40	$4,977.60
Drafting and Design		hour	$94.24	30	$2,827.20
Administrative Support		hour	$59.01	10	$590.10
Disbursements/IT		lump sum	$500.00	1	$500.00
Legal Survey		lump sum	$23,000.00	1	$23,000.00
					DRC Total: $33,500.00
Well Abandonment					
		Unit	**Rate**	**Quantity**	**Total Cost**
Project Engineer		hour	$124.44	20	$2,489.00

Declaration of Restrictive Covenant					
Technician (1 staff)		Hour	$114.37	100	$11,437.00
Well Abandonment		LS (per well)	$600	53	$31,800.00
					Abandonment Total: $46,000.00
Two-year On-Site and Limited Off-Site Groundwater Monitoring (This option would allow for monitoring and reporting of Site constituents to track trends and distribution)					
		Unit	**Rate**	**Quantity**	**Total Cost**
Project Manager		hour	$159.67	10	$1,596.70
Project Engineer		hour	$124.44	20	$2,488.80
Technician (1 staff)		hour	$228.74	70	$16,011.80
Drafting and Design		hour	$94.24	8	$753.92
Administrative Support		hour	$59.01	8	$472.08
Data Management/Validation		lump sum	$5,000.00	1	$5,000.00
Disbursements/IT		lump sum	$4,000.00	1	$4,000.00
Analytical		lump sum	$4,000.00	1	$4,000.00
					Monitoring Two-year Total: $34,000.00
					Monitoring Ten-Year Cost Estimate[1]: $184,000.00

[1] Ten-year costs estimate assumes the two-year monitoring program is completed for the next 10 years at an annual inflation rate of 2%.

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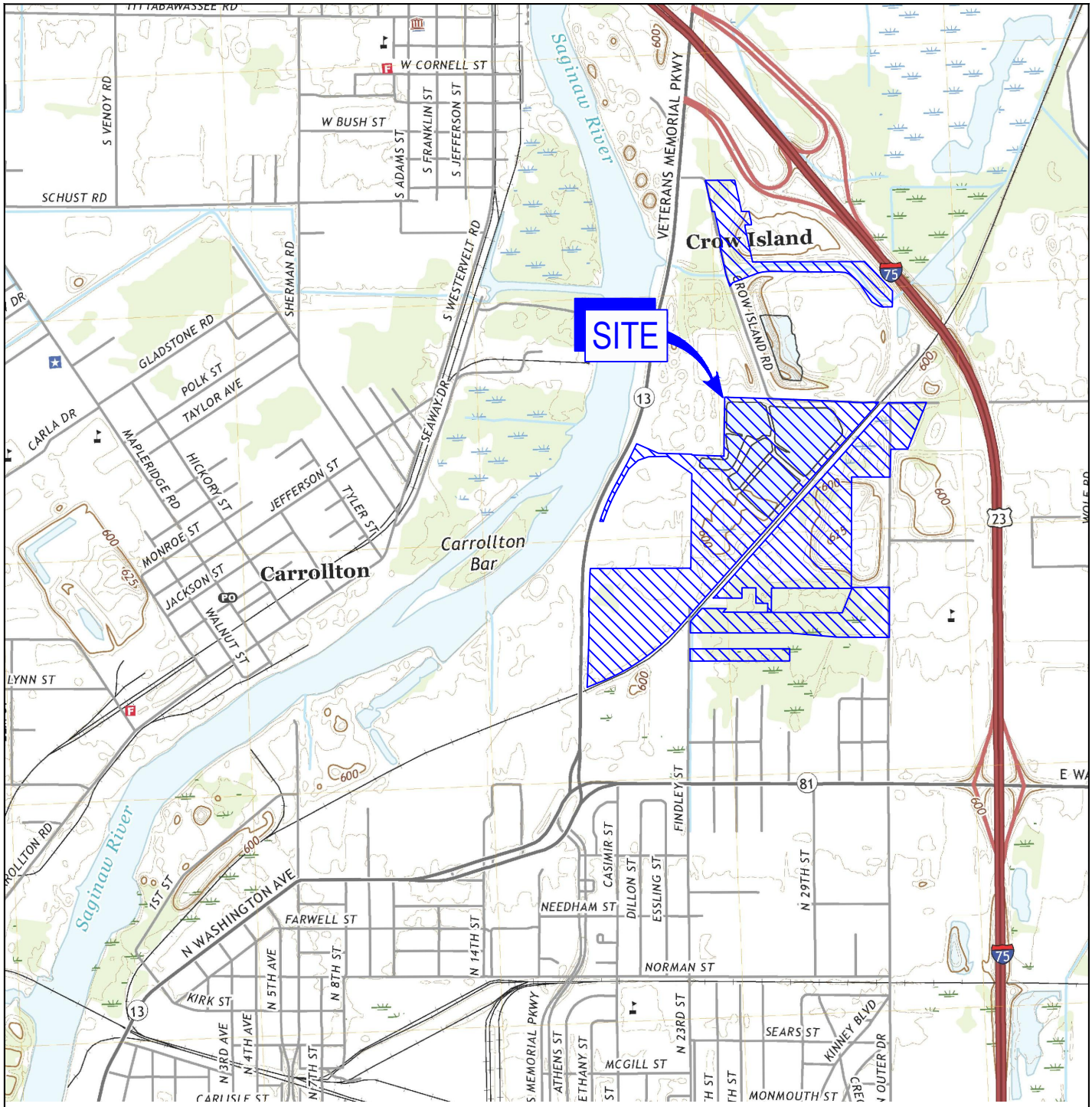


0 1000 2000 ft

N

GHD

RACER TRUST
SAGINAW, MICHIGAN

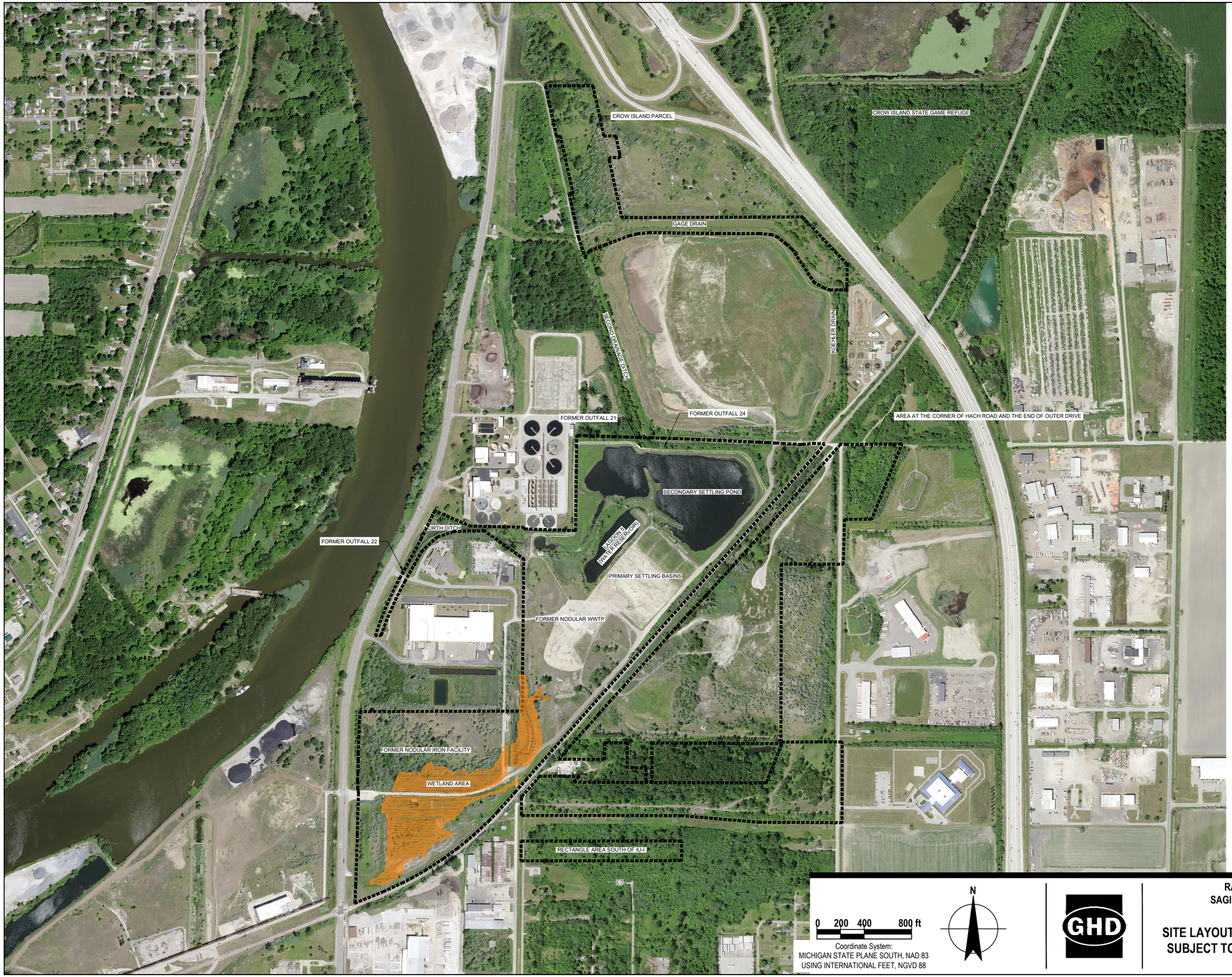
Project No. **11208041**
Date **May 2021**

SITE LOCATION

FIGURE 1.1

Filename: N:\CA\Waterloo\Projects\662\11208041\Digital_Design\ACAD 2020\Figures\RPT005\11208041-GHD-0000-RPT-EN-0101_WA-005.DWG
Plot Date: 31 May 2021 12:59 PM

Data Source: USGS QUADRANGLE MAP; SAGINAW, MI; 2019



LEGEND

APPROXIMATE LIMITS OF RACER PROPERTY AND LAND SUBJECT TO THE REQUIREMENTS OF RCRA CORRECTIVE ACTION AND ADDRESSED IN THIS CMP

REGULATED WETLAND (PER WETLAND DELINEATION COMPLETED BY NISWANDER ENVIRONMENTAL [JULY 22, 2015])

0 200 400 800 ft

Coordinate System:
MICHIGAN STATE PLANE SOUTH, NAD 83
USING INTERNATIONAL FEET, NGVD 88

N

GHD

RACER TRUST
SAGINAW, MICHIGAN

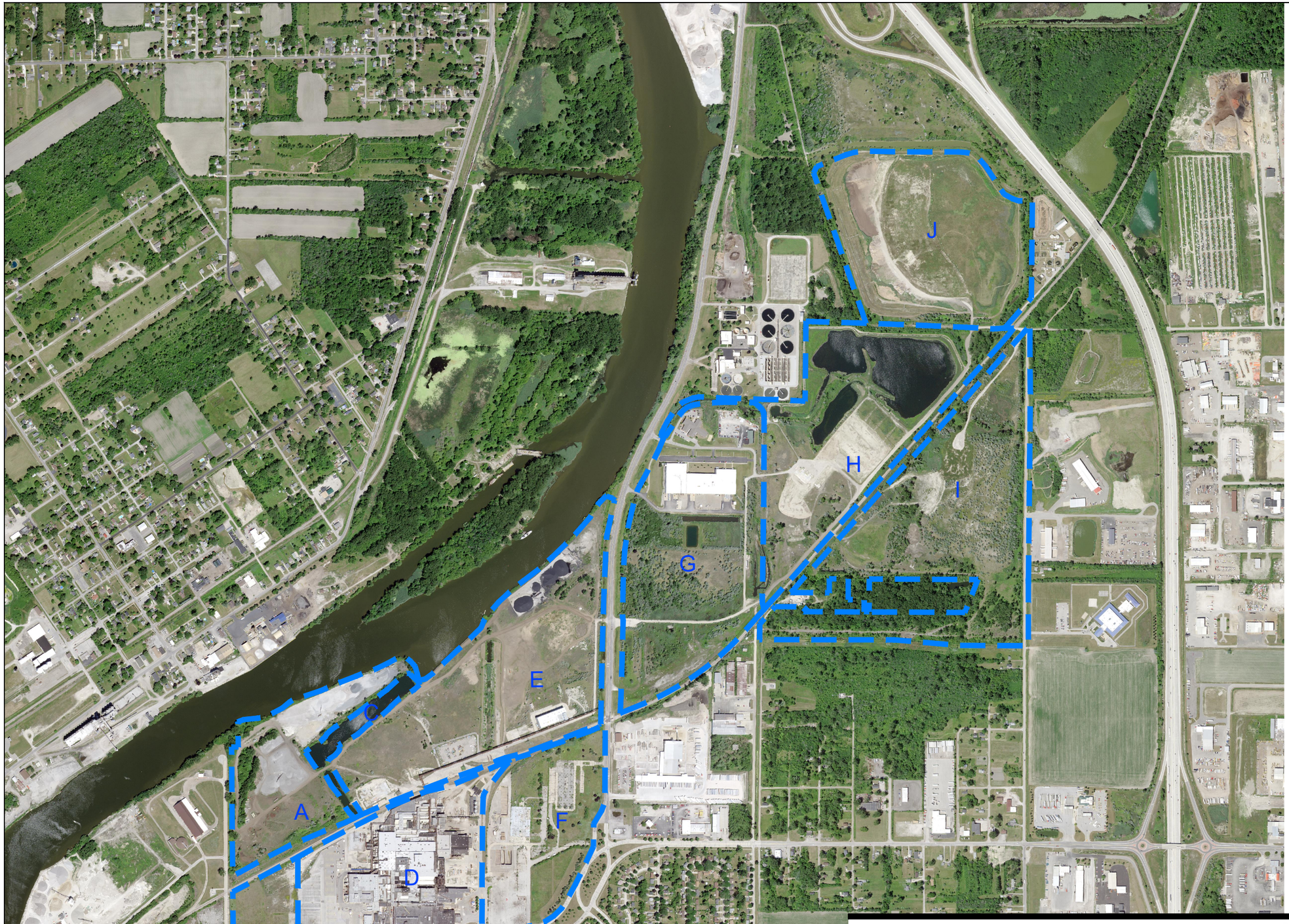
SITE LAYOUT AND THE PROPERTY SUBJECT TO RCRA CORRECTIVE ACTION

Project No. **11208041**
Date **May 2021**

FIGURE 1.2

Filename: N:\CA\Waterloo\Projects\662\11208041\Digital_Design\ACAD 2020\Figures\RPT005\11208041-GHD-0000-RPT-EN-0103_WA-005.DWG
Plot Date: 11 June 2021 2:46 PM

Data Source: Source: U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). Acquired 3-Jul-2018



LEGEND

A — INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

0 250 500 1000 ft

N

GHD

RACER TRUST
SAGINAW, MICHIGAN

Project No. **11208041**
Date **June 2021**

FIGURE 2.1

FORMER FACILITY INVESTIGATIVE UNIT BOUNDARIES

Filename: N:\CA\Waterloo\Projects\662\11208041\Digital_Design\ACAD 2020\Figures\RPT005\11208041-GHD-0000-RPT-EN-0102_WA-005.DWG
Plot Date: 11 June 2021 2:46 PM

Data Source: Source: U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). Acquired 3-Jul-2018

Appendices

Appendix A

RFI – Phase 1C Report Excerpts

3.0 ENVIRONMENTAL SETTING

Information gathered during the RFI regarding the Facility's physical setting, geologic and hydrogeologic conditions, and current and likely future land use and groundwater use is detailed in the Phase 1A, and Phase 1B RFI Reports and summarized below. The use of this information in developing the conceptual Facility model for the hydrogeologic setting and potential human exposures is also presented in this section.

3.1 PHYSICAL SETTINGS

Characterization of the physical setting is presented below.

3.1.1 TOPOGRAPHY

The topography is generally flat to gently rolling, with small decreases in elevation to the northwest, towards the Saginaw River, with the exception of several material staging areas. The approximate elevation in the vicinity of the Facility is 590 feet above sea level (AMSL).

3.1.2 CLIMATE

The National Oceanic & Atmospheric Administration (NOAA) operates a weather monitoring station in Saginaw, Michigan, where temperature, precipitation, wind direction, and other climatic parameters are measured. Climatological data for the station in Saginaw has been summarized by NOAA.

Annual precipitation in the area averages 26.9 inches and is evenly distributed throughout three quarters of the year and relatively low during the winter months (December to March). Over the study period, May was typically the wettest, while January was typically the driest. The greatest monthly precipitation on record occurred in May 2004, with 8.1 inches, and March 2001 was the driest month with 0.5 inches.

The average annual temperature of the area is 47.2°F. July is typically the warmest month of the year, with an average temperature of 70.1°F; the coldest month is typically January, with an average temperature of 21.6°F. The average relative humidity is 73 percent to 83 percent.

Long-term winds records are based on the windrose from the Saginaw Airport. Based on the windrose, the prevailing wind is south-westerly, primarily between 3 and 13 miles per hour.

3.2 GEOLOGY

Information regarding regional geology was obtained from published literature. Facility-specific geology was characterized during the drilling activities that were performed as part of the RFI.

3.2.1 REGIONAL

The Facility lies within the Michigan Basin, a synclinal structure roughly circular in shape. Bedrock in Saginaw County reportedly dips north-northwest toward the deepest part of the basin, which generally underlies Gladwin County approximately 45 miles northwest of Saginaw County. The physiographic province of the project area is the Saginaw-Lake-Border Plain region. It is characterized as a minimal elevational land area with features such as beach ridges, inland dune fields, and sharply defined valleys.

The surficial glacial deposits in the Saginaw area are primarily the result of the Wisconsinan Stage of the Pleistocene Ice Age. As the Saginaw Lobe of the Laurentide Ice Sheet retreated from the Saginaw area, the material transported by the ice was deposited on the ground surface in a series of ridges called end moraines and as relatively flat surfaces called ground moraine or glacial till. During interglacial periods (i.e., warming conditions during the Wisconsin Glacial Stage), the lobes of the Ice Sheet retreated to the Michigan, Huron-Erie, and Saginaw Basins. Melt water from the glacier could not drain across the encircling moraine to the southwest, and so became ponded between the end moraines and the ice front. When the ice front subsequently re-advanced, it carried additional sediments that were deposited in the glaciolacustrine (lake bed) environment when melting occurred again.

Most of the surficial soils in the Saginaw area consist of glaciolacustrine clays, water-laid tills, and modern alluvium. There are some level areas of sand and common sand ridges that represent bars and beaches produced when post-glacial Lake Huron diminished in size by steps or stages. The glaciolacustrine clays are fine-grained by nature and have

low effective permeabilities. Water does not enter readily or move freely within these deposits.

The bedrock directly underlying the glacial deposits in Saginaw County is principally the Middle Carboniferous Saginaw Formation (deposited 290 to 315 million years ago). The Saginaw Formation, composed of sandstone, shale, and some coal, averages 380 feet in thickness.

3.2.2 FACILITY-SPECIFIC

There are four general types of subsurface geologic materials identified during the RFI at the Facility: fill, fluvial and marsh deposits, glaciolacustrine sediments, and subglacial sand/bedrock. Detailed descriptions of the materials encountered during the Phase 1C RFI are presented on the stratigraphic logs in Appendix C. Figure 3.1 presents the locations of the Facility geologic cross-sections, and Figures 3.2 and Figure 3.3 present detailed cross-sections A-A' and B-B', respectively, of the Facility geology.

Fill

Historical aerial photographs and topographic maps indicate that much of the surface of the Facility was once a marsh. The former marsh area is now overlain by fill in many locations. The fill generally consists primarily of foundry sand, a poorly graded sand and silty sand, with some localized clay zones (Figure 3.4).

Fill is approximately 5 to 15 feet thick throughout most of the Facility (Figure 3.4). However, near the Saginaw River, where significant filling has occurred and where historical former portions of the Saginaw River have been filled in, the fill extends to a depth of 18 feet bgs. The fill is also thick near the GM WWTP, and specifically the Primary lagoons (approximately 19 feet) where substantial fill was used to construct the lagoons.

Clay fill from the construction of the GM landfill was 46.5 feet thick in soil boring MW-07245, which is located in IU I.

Fluvial and Marsh Deposits

Underlying the fill material in some areas near the Saginaw River are unconsolidated sediments that appear to have been deposited in a stream environment (i.e., fluvial deposits or alluvium) or in an adjacent marsh (i.e., overbank or backswamp deposits). The fluvial deposits consist primarily of silty sand and poorly graded sand; traces of fine gravel are present locally, most likely deposited by the Saginaw River. These materials are typically loose, wet, and grey to brownish grey. Locally, shells, shell fragments, and wood debris are common. Three samples of this material were previously collected for physical testing. The samples were described as silty sand and poorly graded sand, and they contained 0 to 3.0 percent gravel.

The marsh deposits are primarily silt and clay with traces of sand. Peat up to 3 feet thick was also encountered immediately beneath the fill material in some soil borings. The marsh deposits are typically soft, wet, and grey to black. Locally, shells and organic material, including wood fragments, are common. Six samples of this material were previously collected for physical testing. Four of these samples were described as lean clay, and two were described as elastic silt with sand. The samples contained 0.8 to 18.1 percent sand, and only one of the six samples contained a trace of gravel (0.1 percent).

Glaciolacustrine Sediments

Glaciolacustrine sediments that were deposited in this lake environment were encountered at the Facility during the RFI.

The glaciolacustrine sediments encountered at the Facility consist primarily of grey to brown clay and sandy clay (Appendix C). In the upper part of this unit, the clay is typically firm and damp. In many areas of the Facility, the clay becomes softer with depth, and the moisture content increases notably. This moist to wet clay was considered by field personnel to be a "potentially water-bearing" unit, so "intermediate" (i.e., confining layer) wells were previously installed within this zone, where encountered.

Thirty-three soil samples of the glaciolacustrine sediments were previously collected for physical testing. All of the samples were described as clay (lean clay, sandy lean clay, lean clay with sand, or sandy silty clay). The samples contained 1.1 to 40.2 percent sand and up to 7.8 percent gravel. Most of the samples contained between 20 and 35 percent

sand. The permeability test results for these samples are discussed in Section 3.3. Figure 3.5 presents the top of native clay contours.

Subglacial Deposits

The glaciolacustrine sediments are underlain in most areas of the Facility by subglacial deposits. Subglacial deposits reformed or accumulated beneath glaciers in environments such as meltwater streams or were the erosional surface of the underlying sandstone bedrock. At the Facility, the subglacial sediments consist primarily of poorly graded sand and silty sand. These sediments are grey and commonly contain gravel (see stratigraphic logs in Appendix C). These saturated sediments are hard yet unconsolidated; during the RFI drilling activities, they frequently flowed up into the hollow stem of the augers. This indicates that this deeper water-bearing zone is under significant hydrostatic pressure, which likely results from the overlying low permeability glaciolacustrine clay acting as a confining layer. Details regarding the hydrogeologic conditions of this water-bearing zone are presented in Section 3.3.

Given the difficulty of drilling and sampling within the flowing sands that typify this unit, only one sample of the subglacial sediments was collected (in Phase 1A) for physical testing. The sample contained 41.6 percent fines (silt and clay), 53.8 percent sand, and 4.6 percent gravel. The grain size distribution indicates that it was a silty sand. This is consistent with the field description of the soil shown on the boring log (Appendix C).

Bedrock was encountered at five of the RFI drilling locations (MW-90124, MW-93205, MW-96080, MW-96939, and MW-97948) at depths ranging from 84 to 106 feet. The bedrock is a hard, fine-grained sandstone. It is primarily light tan to brown with some white and light grey areas. Much of the unit appears massive; however, laminations and cross-bedding were visible in some portions of the sandstone, as shown by grain size and color variations within the unit. Based on the increased hardness of the geologic materials encountered just above the competent bedrock at some of the boring locations, the sandstone seems to be weathered locally. Based on the borings, which encountered the weathered or competent bedrock, it appears that the bedrock surface generally slopes toward the south (Figure 3.6).

3.3 HYDROGEOLOGY

The following sections describe the regional and Facility-specific hydrogeologic conditions near the Facility.

3.3.1 REGIONAL HYDROGEOLOGY

Regionally, groundwater is transmitted in the coarser-grained glacial deposits (i.e., sands, silts) and in the bedrock where primary and/or secondary porosity provides a flowpath. According to the *Hydrogeologic Atlas of Michigan* (WMU, 1981), the first usable aquifer in the area is the fractured bedrock aquifer, which is isolated from surficial influences by an impervious confining layer. The "impervious" layer likely is comprised of finer-grained glaciolacustrine deposits, as described in Section 3.2.1, while the first usable aquifer is the upper weathered and fractured portion of the sandstone unit of the Saginaw Formation, including the subglacial sand deposits, where present (uppermost aquifer), which is encountered approximately 80 to 100 feet bgs).

Groundwater in the bedrock aquifer reportedly discharges to the Saginaw River and its tributaries (though not at this location), Saginaw Bay, and Lake Huron.

3.3.2 FACILITY-SPECIFIC HYDROGEOLOGIC CONDITIONS

3.3.2.1 HYDROSTRATIGRAPHIC UNITS

Facility-specific hydrogeologic conditions were evaluated based on the existing stratigraphic logs and on data from the monitoring wells installed during the RFI. All borings drilled during the investigation were terminated at depths no greater than the upper few feet of the Saginaw Formation Bedrock layer (see Section 3.2.1). Three hydrostratigraphic units were identified during the RFI: an upper water-bearing zone; a confining clay layer and; a lower subglacial sand/bedrock aquifer. All three hydrostratigraphic units, which consist of one or more geologic depositional units, were identified based on the occurrence of groundwater, the soil type, and on several depth-to-water measurements.

The materials comprising the upper water-bearing zone generally consist of three soil types: black, foundry sand fill; fluvially-deposited sand and gravel; and silt associated with a lower energy, marsh environment. Thin, discontinuous lenses of clay, sandy clay,

silty clay, and clayey sand are interbedded within all soil types comprising the upper water-bearing zone.

The upper water-bearing zone was encountered in most locations across the Facility. This upper water-bearing zone, where present, is found up to approximately 60 feet thick near the Saginaw River; thinning inland. Sixty-one groundwater monitoring wells were installed within the upper water-bearing zone as part of the RFI. The upper water-bearing zone was not encountered in the northern portion of IU H near the secondary settling pond, in IU J around the landfill, and within most of IU F.

The upper water-bearing zone is unconfined throughout most of the Facility. However, it is confined locally, particularly near the filled-in area at the primary lagoons (IU H). Except in parts of IU H and I, groundwater within the upper water-bearing zone is generally less than 15 feet below the ground surface. In parts of IU H and I, stockpiled clay material up to approximately 40 feet thick overlies the upper water-bearing zone.

Eighteen groundwater monitoring wells were initially installed within the confining layer in the Phase 1A. Groundwater within the confining layer occurs at various depths and does not appear to be present within a continuous, permeable unit. Rather, non-continuous zones of groundwater were found to occur within discontinuous sand and silt seams within the clay throughout the confining unit. The thickness of the confining layer ranges from approximately 15 to 80 feet. It is generally thicker inland and decreases in thickness toward the Saginaw River. Some laterally discontinuous sand lenses were identified during implementation of the RFI. The average horizontal hydraulic conductivity of these sand lenses is approximately 4.5×10^{-3} centimeter per second (cm/sec), based on the data for two monitoring wells. The average horizontal hydraulic conductivity of the clay material comprising the clay confining layer is approximately 4.5×10^{-4} cm/sec, based on the results of the individual slug tests. Twenty-seven clay samples and one silt sample were collected from the clay confining layer for vertical permeameter testing. The average vertical permeability from these tests is approximately 5.4×10^{-8} cm/sec.

The lower aquifer consists of subglacial deposits (sands and silts), weathered bedrock (non-lithified sand), and competent bedrock (sandstone and conglomerate). Five groundwater monitoring wells were installed in the lower aquifer during the Phase 1A RFI. Groundwater in the lower aquifer is under confined conditions and is present throughout the Facility. The lower subglacial sand/bedrock aquifer is believed to be the uppermost aquifer encountered at the Facility.

3.3.2.2 GROUNDWATER FLOW

Horizontal groundwater flow within the upper water-bearing zone is generally to the north, west-northwest across the Facility toward the Saginaw River. The most recent complete round of water levels was measured prior to the Phase 1C investigations in January 2005. Figure 3.7 presents the upper water bearing zone groundwater contours. The northern portion of IU I is an exception to this flow pattern as shallow groundwater appears to be flowing towards the east in this area. It is believed that the apparent easterly flow in this area is an artifact of the geology because the shallow fill unit pinches out directly east of this location. The shallow water-bearing zone is not present in IU J and does not appear to be present in the northern portion of the secondary settling pond in IU H. In the northern portion of IU H and across IU J, the native clay-confining unit is present at the ground surface. This clay-confining unit is extensive and extends to the sandstone water-bearing unit, which is approximately 95 feet bgs in IU J. This clay-confining unit is also present underneath the entire Facility and serves as a confining unit to the first continuous aquifer.

Groundwater recharge to the upper water-bearing zone occurs in the unpaved areas of the Facility via the infiltration of precipitation. However, groundwater recharge from the surface is not expected to occur through the overlying clay materials that are present in portions of IU H and I, where locally confined conditions are encountered. A groundwater sink exists in the vicinity of the SMCO Plant, due to the basement dewatering activities. Historically, there was a second groundwater sink present at the Former Nodular Iron Plant due to former dewatering activities there. The groundwater sink caused by the Former Nodular Iron Plant is presented in historic groundwater contour figures in Appendix G. However, since the demolition of the building in 1999 and the cessation of pumping around the Nodular basement, the groundwater sink has dissipated. Groundwater within the upper water-bearing zone, where not affected by dewatering activities, is expected to discharge to the Saginaw River along the northwestern external border of the Facility. The average horizontal hydraulic gradient across the Facility is approximately 0.005 feet/foot. The horizontal hydraulic gradient steepens to approximately 0.016 feet/foot immediately adjacent to the Saginaw River. The average and the geometric mean for the horizontal hydraulic conductivity of the upper water-bearing zone is approximately 2.2×10^{-1} cm/sec and 5.5×10^{-2} cm/s, respectively, based on the results of the individual slug tests from monitoring wells

completed in the fill and native sands and those screened across laterally discontinuous lenses of silt and/or clay.

Beneath the confining layer across the Facility, groundwater occurs within the subglacial sands and silts and within the sandstone bedrock. Based on the static water elevations, it appears that there is a hydraulic connection and therefore, they are considered as one hydrostratigraphic unit. Horizontal groundwater flow through the lower aquifer is to the north-northeast at an approximate horizontal hydraulic gradient of 2.8×10^{-4} feet/foot. The most recent complete round of water levels was measured prior to the Phase 1C investigations in January 2005. Figure 3.8 presents the bedrock aquifer groundwater contours. Seven slug tests were completed from monitoring wells screened in the lower subglacial sand/bedrock aquifer. The average horizontal hydraulic conductivity results for wells completed in this lower aquifer is approximately 2.8×10^{-3} cm/sec. The average horizontal hydraulic conductivity for the four wells (MW-90124, MW-93205, MW-97948, and MW-96080) completed in the competent bedrock was approximately one order of magnitude lower than the three wells (MW-11901, MW-12432, and MW-13205) completed in the subglacial sand and weathered bedrock.

The vertical hydraulic gradient within the lower aquifer is upward at approximately 0.003 feet/foot. Based on the static water elevations measured within the monitoring wells installed in the lower aquifer, the direction of groundwater flow, and on information contained in literature, it appears groundwater discharge from the lower aquifer is likely to Saginaw Bay or Lake Huron. Vertical permeability tests were not completed for the lower aquifer.

3.3.2.2.1 WATER LEVEL STUDY

A water level study has been conducted throughout the duration of the RFI. The water level study involved recording groundwater levels for both the upper water-bearing zone and lower aquifer. Between August 1999 and 2000, monthly groundwater levels were monitored to identify seasonal changes in groundwater flow. The study also involved the collection of surface water levels at the inlet reservoir, settling basins, and the river. Two pumping tests in 1999 and 2000 were also conducted. The following section discusses the results of the water level study.

Based on the static water levels measured monthly for 1 year and then quarterly for 2 years from Facility monitoring wells, groundwater from the upper water-bearing zone generally flows to the northwest across the Facility towards the Saginaw River. The overall groundwater volumetric flow is low since the upper water-bearing zone is vertically bounded by the presence of the low permeability clay at shallow depths. Groundwater flow does not appear to be influenced by the Primary or Secondary Settling Pond system (i.e., contours do not deviate near the lagoon system). In addition, the water levels within the Primary Basin, Secondary Basin, and within monitoring well MW-16357 located north of the Primary Ponds were measured simultaneously in March 1999. The water level in the Secondary Basin was approximately 4.5 feet higher than the monitoring well screened in the upper, water-bearing zone immediately adjacent to the Primary/Secondary Basins. The water level within the Primary Basin was approximately 12 feet higher than the groundwater. This information suggests that the clay lined ponds have no direct hydraulic connection between the Primary Basins or Secondary Basin and the groundwater found in the upper water-bearing zone.

Geologic cross-sections prepared from data collected during the RFI, also support the statement that the Primary/Secondary Basins are underlain by clay and physically isolated from the upper water-bearing zone (Figure 3.3). Because of the lack of hydrogeologic connection and the preliminary analysis of the sludge data, further evaluation of the Primary /Secondary Basins was deemed unnecessary in the Phase 1B.

Groundwater contours and surface water elevations were also evaluated at the Inlet Reservoir. The elevations of the groundwater upgradient of the Inlet Reservoir are slightly higher than the Inlet Reservoir surface water, and the Inlet Reservoir surface water elevation is slightly higher than the groundwater elevations on the downgradient side (toward the Saginaw River). The surface water elevation within the Inlet Reservoir is approximately 4.5 feet higher than the elevation of the surface water at the Saginaw River. The water level in the Inlet Reservoir fluctuates based on the volume of water in the Water Recycle System (WRS). This information suggests that there may be some degree of hydraulic connection between the Inlet Reservoir and the adjacent groundwater in the upper water-bearing zone.

Two separate pumping tests have been completed in the vicinity of the WRS at the SMCO Plant. The first (a 72-hour pump test) was completed from March 24 to 27, 1999, and the second (a 4-hour pump test) was completed on October 26 and 27, 2000. Neither test revealed any hydraulic interconnectivity between the groundwater in the upper water-bearing zone, and surface water in the Inlet Reservoir and Primary/Secondary

Basins. Drawdown was observed in adjacent groundwater monitoring wells under pumping conditions; however, water levels measured with staff gauges in the Inlet Reservoir and Primary/Secondary Basins remained unchanged during the pumping tests.

Two anthropogenic effects on the shallow groundwater flow were observed prior to and during the water level study. The first was dewatering activities at the currently SMCO Plant, where the effects of dewatering are apparent in the static water elevations. The presence of the basement and the continual dewatering activities create a sink, or inward hydraulic gradient, for groundwater near the SMCO Plant. The dewatering activities in this area are not anticipated to change in the foreseeable future, so the groundwater flow patterns in the upper water-bearing zone are not expected to alter significantly from those observed during the RFI.

During the initial investigation Phase of the RFI, a second anthropogenic effect on the shallow groundwater flow pattern was observed at the Former Nodular Iron Plant. The pumping around the basement created a sink at this location. Since pumping ceased, the water table has rebounded, and the groundwater flow patterns currently reflects an overall flow to the northwest toward the Saginaw River

Groundwater discharge from the upper water-bearing zone appears to be to the Saginaw River. Minor groundwater fluctuations were identified in monitoring wells located adjacent to the River. These fluctuations were not observed away from the Saginaw River. A comparison of the fluctuations measured in the Saginaw River with those measured in the shallow monitoring wells adjacent to the River indicates that there is a connection between the shallow groundwater and the Saginaw River. The Facility monitoring wells adjacent to the river rapidly adjust to the River stage.

Flow patterns did not appreciably alter during the period of study and only minor water level fluctuations were observed. No groundwater flow reversals were observed during the water level study, which was conducted over twelve consecutive months. Typically, the month of May had the highest groundwater levels and February the lowest.

Minor fluctuations of the shallow groundwater were also observed in monitoring wells located near the currently operating metal casting plant. These fluctuations are likely the result of the cycling of the dewatering system at the plant. The shallow groundwater flow patterns did not appreciably alter during the observed groundwater elevation fluctuations.

3.4 HYDROGEOLOGIC CONCEPTUAL FACILITY MODEL

Based on the evaluation of regional and Facility-specific hydrogeologic conditions conducted during the RFI, a hydrogeologic conceptual Facility model (HCSM) was developed for the Facility. This HCSM provides an overview of the hydrogeologic conditions and is not intended to provide specific conditions at any given area of the Facility. The HCSM can be summarized as follows:

- Three hydrostratigraphic units were identified during the RFI: an upper water-bearing zone; a confining clay layer; and a lower subglacial sand/bedrock aquifer (lower aquifer). All three hydrostratigraphic units, which consist of one or more geologic depositional units, were identified based on the occurrence of groundwater, on the soil type, and on several depth-to-water measurements.
- The materials comprising the upper water-bearing zone generally consist of three soil types: black, sand fill; fluvially-deposited sand and gravel; and silt associated with a lower energy, marsh environment. Thin, discontinuous lenses of clay, sandy clay, silty clay, and clayey sand are interbedded within all soil types comprising the upper water-bearing zone. This unit appears to pinch out toward the eastern property boundary.
- A clay confining layer occurs at various depths beneath the upper water-bearing zone. The thickness of the confining layer ranges from approximately 15 to 80 feet. It is generally thicker inland and decreases in thickness toward the Saginaw River. Some laterally discontinuous sand lenses were identified within this zone during implementation of the RFI.
- The lower aquifer consists of subglacial deposits (sands and silts), weathered bedrock (non-lithified sand), and competent bedrock (sandstone and conglomerate).
- The upper water-bearing zone was encountered in most locations across the Facility. This upper water-bearing zone, where present, is found up to approximately 60 feet thick near the Saginaw River; thinning to zero feet thickness inland. The upper water-bearing zone is unconfined throughout most of the Facility. However, it is confined locally, particularly near the filled-in area at the primary lagoons (IU H). Except in parts of IU H and I, groundwater within the upper water-bearing zone is generally less than 15 feet below the ground surface. In parts of IUs H and I, stockpiled clay material up to approximately 40 feet thick overlies the upper water-bearing zone. The upper water-bearing zone was not encountered in the

northern portion of IU H near the secondary settling pond, in IU J around the landfill, or within most of IU F.

- Groundwater within the confining layer occurs at various depths and does not appear to be present within a continuous, permeable unit. Rather, groundwater was found to occur within discontinuous sand and silt seams within the clay of the confining unit. There is an upward gradient in the groundwater between the lower aquifer and upper water-bearing zone. This gradient is present because the lower aquifer is a confined aquifer and therefore, under pressure.
- Groundwater flow occurs predominantly horizontally through the upper water-bearing zone and through the lower bedrock aquifer.
- Shallow groundwater present within the upper water-bearing zone is generally present within 10 feet bgs throughout most of the Facility where fluvial sand and sand fill materials are present in sufficient thickness. Some portions of the Facility do not contain shallow groundwater; these areas are generally along the southeastern portion of the Facility in IUs D and F, in the northern portion of the Facility, the landfill in IU J, and in a small area at the southwest corner of the Facility in IU A. Shallow groundwater is located within the fill materials at the Facility and appears to be perched on a clay surface that may represent a former land surface prior to filling (i.e., marsh/wetland). Generally, the upper water-bearing zone is unconfined; it is only confined locally where overlain with clay stockpile material (IU H and I). Groundwater recharge to the upper water-bearing zone appears to be from atmospheric precipitation that infiltrates the surface in uncovered areas of the Facility. Shallow groundwater generally discharges to the Saginaw River along the western portion of the Facility.
- The upper water-bearing zone is separated vertically from the lower subglacial sand/bedrock aquifer by an average of approximately 60 feet of clay material that serves as a confining layer. The subglacial sand/bedrock aquifer is under confined conditions and flow appears to be north-northeast across the Facility. The discharge location for this aquifer is appears to be either Saginaw Bay or Lake Huron.
- Water is sometimes present in the confining layer within discontinuous sand, clayey sand, sandy-clay, and/or silt lenses. Based on the observed groundwater elevations, there does not appear to be any continuous unit within the confining layer to allow for groundwater flow.