



Memorandum

23 April 2024

To	Marc Messina		
Copy to	Will Grossett, U.S. EPA, Brendan Mullen, Dave Favero, RACER		
From	John-Eric Pardys/kf	Tel	+1 519 340 4316
Subject	Wetland Information	Project no.	11208041-MEM-9

On behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust, GHD has prepared this wetland information package to summarize available information in the area of the wetlands located on RACER's Saginaw Nodular Industrial Land (Site), located in Saginaw, Michigan. This information was prepared in response to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) comments on the proximity of elevated levels of pH and ammonia near wetlands identified on RACER's property provided during a conference call on March 13, 2024 related to the groundwater/surface water interface (GSI) pathway.

1. 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 1.1 presents the approximate location of the Site (RACER property)

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 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 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 1.2. This memorandum focuses IU-G, which is where the majority of the wetlands are located.

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, which included elevated ammonia and pH readings and from 2011 RACER continued to perform the EI monitoring for the Site until it was terminated, in coordination with U.S. EPA, following the 2020 annual EI monitoring event.

As a requirement of the UAO, GMC submitted an RFI Report to U.S. EPA on March 9, 2007 for the Larger Facility.

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 Order, RACER submitted a Supplemental RFI Report 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 RFI Report was submitted in 2007. The Supplemental RFI also addressed U.S. EPA comments received on the 2007 RFI Report which related to the RACER Site.

In order to identify areas of concern, analytical results collected during the RFI were screened against Michigan Part 201 cleanup criteria. In 2018 GHD completed a Site-wide soil evaluation which was submitted to U.S. EPA on April 20, 2018, and a groundwater evaluation which was submitted to U.S. EPA on October 15, 2018. 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 201 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 IU-G is presented in Table 1.1. Following the soil re-screening activity, EGLE criteria were updated on 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. 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 1.1.

Table 1.1 Summary of Investigative Units

Investigative Unit:	IU-G
IU Description	<ul style="list-style-type: none"> – Former Nodular Iron Plant Area – Located at the southwest property boundary – Northern portion of IU-G sold prior to the GMC bankruptcy
Potential Sources	Various
RFI/IM Activities Performed	<ul style="list-style-type: none"> – 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
Laboratory Analysis Performed	Metals, VOCs, SVOCs, Total PCBs, General Chemistry
Soil/Sediment Constituent of Concern	– Arsenic, manganese, PCBs,
Groundwater Constituents of Concern	– Ammonia, pH

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 [CMP]"). The Draft CMP was submitted to U.S. EPA on April 1, 2013. A revised Draft CMP was submitted on June 11, 2021 at U.S. EPA's request to incorporate additional activities that have been conducted since the initial draft submission and to update the proposed corrective measures, as necessary.

1.1 Surface Water - Wetland Area

IU-G was formerly the location of the Nodular Iron Plant, but in 1999, 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 July 2015, a wetland survey of the area completed by Niswander Environmental, 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 1.3. 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. There is no direct outlet for the wetlands. The Niswander wetland delineation report is included as Attachment 1.

1.2 Geology

There are four general types of subsurface geologic materials identified during the RFI at the Larger Facility: fill, fluvial and marsh deposits, glaciolacustrine sediments, and subglacial sand/bedrock. Monitoring well and boring logs for locations near the wetland area are included in Attachment 2.

1.2.1 Fill

Historical aerial photographs and topographic maps indicate that much of the surface of the Larger 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. Fill is approximately 5 to 15 feet thick throughout most of the Larger Facility.

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.

1.2.2 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.

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.

1.2.3 Glaciolacustrine Sediments

Glaciolacustrine sediments that were deposited in this lake environment were encountered at the Larger Facility during the RFI. The glaciolacustrine sediments encountered at the Larger Facility consist primarily of grey to brown clay and sandy clay. In the upper part of this unit, the clay is typically firm and damp. In many areas of the Larger 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.

1.2.4 Subglacial Deposits

The glaciolacustrine sediments are underlain in most areas of the Larger 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 Larger Facility, the subglacial

sediments consist primarily of poorly graded sand and silty sand. These sediments are grey and commonly contain gravel. 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.

Bedrock was encountered at five of the RFI drilling locations 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.

1.3 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. Figure 1.4 presents groundwater contours for the upper water bearing zone which is directed to the Saginaw River adjacent to the Site. Groundwater in the deeper sand/bedrock aquifer likely discharges to Saginaw Bay or Lake Huron.

The wetlands are intermittently inundated with water. Deeper sections may have one or more feet of water during wet seasons but are all usually without standing water during late summer or dry periods. There are monitoring wells adjacent to the wetland areas which are screened at various depths ranging from approximately 3 to 16 ft below ground surface, with one well screened from approximately 48 to 53 ft below ground surface. Monitoring well and boring logs for locations near the wetland area are included in Attachment 2.

The saturated thickness of the upper water bearing zone in the vicinity of the wetland was estimated by comparing the top of native clay elevation contours depicted in Figure 3.5 of Attachment 3, which generally defines the bottom of upper water bearing zone, to the groundwater elevation contours presented in Figure 1.4. When measured parallel to groundwater flow direction, the top of clay elevation ranges from approximately 576 feet above mean sea level (ft AMSL) (in the northwest corner, closest to the Saginaw River) to approximately 562 ft AMSL (at the southeast side of IU-G, furthest from the Saginaw River). Groundwater elevation contours (on Figure 1.4) measured from the same points range from approximately 585.5 ft AMSL (northwest corner) to approximately 588 (southeast side), and the resulting saturated thickness of the overburden ranges from approximately 9.5 ft (in the northwest corner) to approximately 26 ft (southeast side) of IU-G. For small portions of IU-G the saturated thickness of the overburden is as thin as approximately 3 ft (in the southwest corner of IU-G).

Therefore, since groundwater flow direction is towards the Saginaw River (i.e., away from the wetland(s)) and previous observations have identified that the existing wetlands are prone to seasonal drying out, the perched surface water from the wetland area(s) are acting as a 'losing' surface water body.

2. Summary of RFI Activities (since 2012)

2.1 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.

In 2019, a streamlined ERA was completed on the emergent/scrubland wetland formed in IU-G which was documented in a memorandum to U.S. EPA (Attachment 4). 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, which are prone to drying out in late summer and dry periods, may be filled during redevelopment of the Site. Therefore, the streamlined ERA concluded that no further evaluation of ecological risks is warranted.

Note, the 2019 screening assessment did not include ammonia and pH in the evaluation of ecological risks because pH was not assayed. Ammonia was assayed and presented in the data summary. However, it was not screened for ecological risks because that analysis focused on more usual toxic chemicals. Review of the data shows that ammonia was only incidentally detected at low concentrations. Ammonia was detected once out of nine samples at a concentration of 0.7 mg/kg with detection limits averaging about 2.4 mg/kg. By comparison, soil, which should have less ammonia due to being more oxygenated than sediments, is reported to typically have 1 to 5 mg/kg¹.

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. Approximately 93 tons of shallow PCB-impacted soil in the wetlands in IU-G was removed and disposed of off-Site in September 2020.

2.2 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 U.S. EPA 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 IU-G - Former Nodular Iron Plant, which was demolished in 1999, and a small portion of IU-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 discontinue groundwater monitoring. U.S. EPA responded via email on January 12, 2021 with no comments, therefore the groundwater monitoring program was discontinued.

Ammonia

As part of the EI groundwater monitoring program that began in 2004 and was terminated with U.S. EPA approval in 2020, first GMC and then RACER continued to monitor ammonia concentrations in groundwater. Initially, groundwater samples were analyzed and reported for total ammonia. However, on April 6, 2015, GHD (formerly CRA) submitted a draft memorandum that discussed ammonia in groundwater at the Site for U.S. EPA's review and it was subsequently forwarded to MDEQ (EGLE's predecessor) for review on April 8,

¹ ATSDR. 2004. Toxicological profile for ammonia. <https://www.atsdr.cdc.gov/toxprofiles/tp126.pdf>

2015. This memorandum incorporated the evaluation of the toxic fraction of ammonia (unionized ammonia) and concluded that no further activities to address ammonia above GSI criteria in monitoring wells next to the Saginaw River are necessary, but that continued monitoring would continue to be of value to ensure conditions remain as currently understood and characterized. From 2015 to 2020, the toxic fraction of total ammonia was calculated and both total and unionized ammonia were reported as part of the EI groundwater monitoring program.

The calculations for unionized ammonia involve averaging pH and temperature of groundwater from a given monitoring well and of surface water from the Saginaw River in order to calculate the unionized fraction. Table 2.1 presents the total ammonia data, pH, and temperature from the most recent EI sampling event in October 2020 for the three GSI compliance monitoring wells (MW-04257, MW-04051, MW-03945). Temperature and pH readings were measured in the Saginaw River the day samples were collected. Concentrations of unionized ammonia in the three GSI monitoring wells are below the chronic and the acute criteria.

Figure 1.4 presents the results for total and unionized ammonia and pH since 2011 for the GSI compliance monitoring locations, monitoring locations near the apparent source area, and monitoring wells between the source and the river. The results in the three GSI compliance monitoring wells along the Saginaw River have been consistently below the chronic and the acute criteria. The results in the monitoring well (MW-04835) located in within the wetland are below the chronic and the acute criteria.

2.3 Mixing Zone Determination

A mixing zone determination (MZDR) was made to the Michigan Department of Environmental Quality (MDEQ) in 2009 by GMC (Attachment 3) to address venting of groundwater with elevated ammonia and pH outside the acceptable range from the larger GMC SMCO Facility to the Saginaw River. The portion of the MZDR associated with the Site is referred to as the Ammonia Part 2 venting area. Based upon relative flows and pH conditions, the MZDR did not propose any "recommendations.... to be necessary to protect against acute or chronic un-ionized ammonia toxicity" (i.e., the Ammonia Part 2 plume did not pose "a reasonable potential to discharge chemicals to cause or contribute to water quality standards (WQS) being exceeded.", unlike the findings for the Ammonia Part 1 plume for which a mixing-zone based value was identified). Attachment 5 presents a copy of MDEQ's 2009 determination. In its 2009 determination, MDEQ states that, beyond the mixing-zone values identified for the Ammonia Part 1 plume (not Site related and non-RACER):

"No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges." (MDEQ, December 11, 2009)

On behalf of RACER Trust, GHD prepared a re-evaluation of the Mixing Zone Determination Request (MZDR) for the Site in a memorandum dated May 18, 2022 (Attachment 6) in response to the recommendations made by the EGLE Materials Management Division (MMD) Remediation Advisory Team meeting with the U.S. EPA on January 26, 2022.

In response to the May 18, 2022 request for a Mixing Zone Determination for venting groundwater to the Saginaw River from the Site, EGLE's MMD and Water Resources Division (WRD) identified the acceptable concentration limits of pH and total ammonia for discharge to the Saginaw River in their letter to the U.S. EPA dated October 26, 2022 (Attachment 7). The following limits were identified:

pH:	6.5 S.U. to 9.0. S.U.
Ammonia (total):	79 mg/L

In their October 26, 2022 letter, EGLE identified that RACER should continue to implement a mixing zone compliance monitoring program in order to demonstrate compliance with the mixing zone-based groundwater/surface water interface (GSI) criteria

RACER has conducted two rounds of sampling to demonstrate compliance with the mixing zone based groundwater/surface water GSI criteria. Figure 2.1 presents the sample results for pH and ammonia from 2011 to the present. There were no exceedances of the total ammonia criteria in any locations since 2011.

pH readings ranging from 9.69 to 12.0 S.U. were detected outside the acceptable range of 6.5 S.U. to 9.0 S.U. in four interior monitoring wells (MW-04438R, MW-05036R, MW-05038, and MW-8R) that are near the existing wetlands, however, all GSI compliance points downstream towards the Saginaw River are within the acceptable pH range.

3. Applicable Regulations

The wetlands described above are potentially subject to state and federal regulations/jurisdictions, namely:

- Code of Federal Regulations - Title 33, Chapter 26, subchapter 4, Section 1344 (i.e. Section 404 of the Clean Water Act) (Section 404),

Section 404 regulates the discharge of dredged or fill material into Waters of the United States, including wetlands. The conforming rule, "Revised Definition of 'Waters of the United States'" rule, became effective on September 8, 2023, as published in the federal register². The amended rule states that only wetlands and permanent bodies of water with a "continuous surface connection" to "traditional interstate navigable waters" are covered by Section 404. Due to ongoing litigation, the rule is not operative in all states and for certain parties. Several states and agencies are interpreting the definition under the pre-2015 regulatory regime, however the amended rule is currently being utilized in Michigan as of September 9, 2023³.

Pending a jurisdictional determination, it cannot be stated definitively that the wetlands described in the section above would be classified as 'Waters of the United States', however, based on the definition above it is not believed that any of the five wetlands would fit this definition since there is no continuous surface connection (i.e., hydrologically isolated) to any interstate navigable water, and therefore the wetlands would not be subject to Section 404.

- Michigan Legislature - Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA451 of 1994 (Part 303)

Part 303 regulates certain activities in regulated wetlands including the depositing of fill material into a wetland, dredging or removal of soil from a wetland, the construction, operation, or maintenance of any use or development in a wetland, or the drainage of surface water from a wetland. Part 303 defines wetland as the following:

(n) "Wetland" means a land or water feature, commonly referred to as a bog, swamp, or marsh, inundated or saturated by water at a frequency and duration sufficient to support, and that under normal circumstances does support, hydric soils and a predominance of wetland vegetation or aquatic life. A land or water feature is not a wetland unless it meets any of the following:

(i) Is a water of the United States as that term is used in section 502(7) of the federal water pollution control act, 33 USC 1362.

² US EPA. 2023. "About Waters of the United States". October 10, 2023. <https://www.epa.gov/wotus/about-waters-united-states>

³ US EPA. 2023. "Definition of 'Waters of the United States': Rule Status and Litigation Update. September 8, 2023. <https://www.epa.gov/wotus/definition-waters-united-states-rule-status-and-litigation-update>

(ii) Is contiguous to the Great Lakes, Lake St. Clair, an inland lake or pond, or a stream. As used in this

subparagraph, "pond" does not include a farm or stock pond constructed consistent with the exemption under section 30305(2)(g).

(iii) Is more than 5 acres in size.

(iv) Has the documented presence of an endangered or threatened species under part 365 or the endangered species act of 1973, Public Law 93-205.

(v) Is a rare and imperiled wetland.

Based on the definition above, only wetland B (~7.23 acres) may classify as being regulated under Part 303 since it is the only wetland greater than 5 acres in size, and none of the other criteria are expected to be met for any of the other wetland areas. As stated previously, a jurisdictional determination is required to definitively determine whether or not a wetland is regulated.

- Michigan Legislature – Part 31, Water Resources Protection (Floodplain Regulatory Authority), of the Natural Resources and Environmental Protection Act, 1994 PA451 of 1994 (Part 31)

Wetlands that are not regulated by Part 303 are considered 'surface waters of the state' by Part 31 (Floodplain Regulatory Authority) and are subject to groundwater-surface water interface (GSI) compliance statutory provisions. 'Surface waters of the state' include both regulated and unregulated wetlands.

4. Conclusions/Recommendations

Based on a preliminary evaluation, it is believed that the wetlands on-Site (both regulated or unregulated) are considered 'surface waters of the state' and are therefore subject to Part 31 (Floodplain Regulatory Authority) and corresponding groundwater-surface water interface (GSI) compliance statutory provisions.

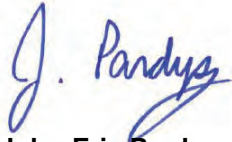
Per EGLE guidance "Groundwater-Surface Water Interface Pathway Compliance Options, April 2018" (Attachment 8), the GSI pathway is relevant when a remedial investigation or application of best professional judgment leads to the conclusion that a hazardous substance in groundwater can be reasonably expected to vent to surface waters of the state in concentrations that exceed the generic GSI criteria currently or in the future. Groundwater flow direction is towards the Saginaw River (i.e., away from the wetland(s)) and perched surface water from the wetland area(s) appear to act as a 'losing' surface water body which also supports that contaminated groundwater would not vent into the wetland area(s). In addition, prior evaluations have found that the existing wetlands are unnatural, small, isolated, prone to seasonal drying out, and of moderate to low habitat value. Based on this, existing data suggests that the pathway for venting groundwater is not relevant and further evaluation is not necessary.

Enclosures:

Figure 1.1	Site Location
Figure 1.2	Former Larger Facility Investigative Unit Boundaries
Figure 1.3	Approximate Extents of Wetlands
Figure 1.4	Summary of Calculated Unionized Ammonia Results (2011-2020)
Figure 2.1	2023 Mixing Zone Compliance Monitoring Results
Table 1.1	Summary of Investigative Units
Table 2.1	Groundwater Ammonia FAV Compliance Worksheet

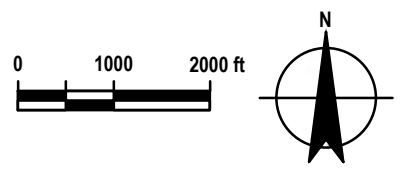
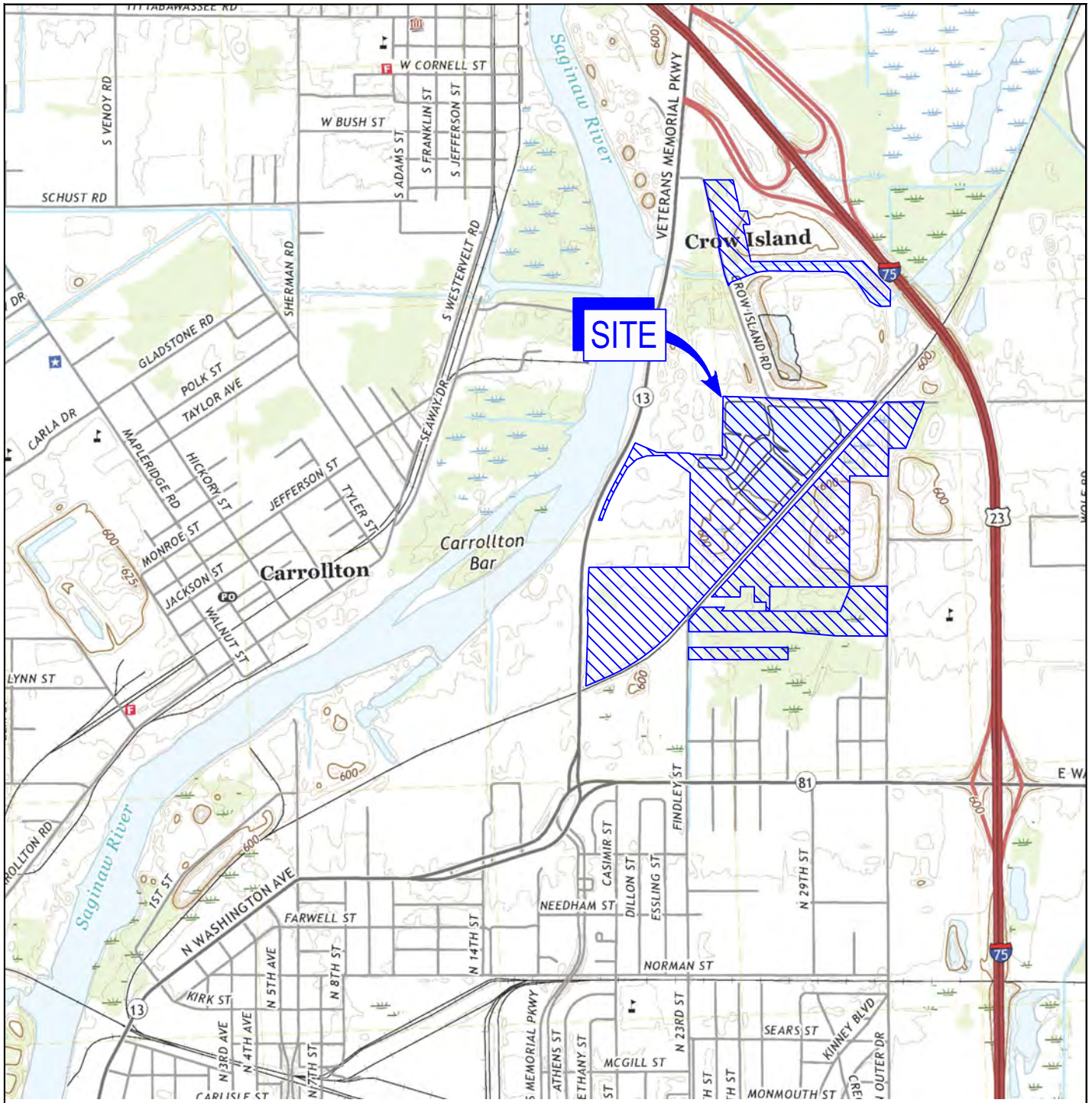
- Attachment 1 Niswander Wetland Delineation Report
- Attachment 2 Monitoring Well and Boring Logs
- Attachment 3 2009 Mixing Zone Determination Request
- Attachment 4 Ecological Screening Assessment
- Attachment 5 MDEQ's 2009 Determination of Mixing Zone Request
- Attachment 6 Mixing Zone – Re-evaluation
- Attachment 7 Implementation of a Mixing Zone Reauthorization Request
- Attachment 8 Groundwater-Surface Water Interface Pathway Compliance Options

Regards



John-Eric Pardys
Engineering Leader

Figures

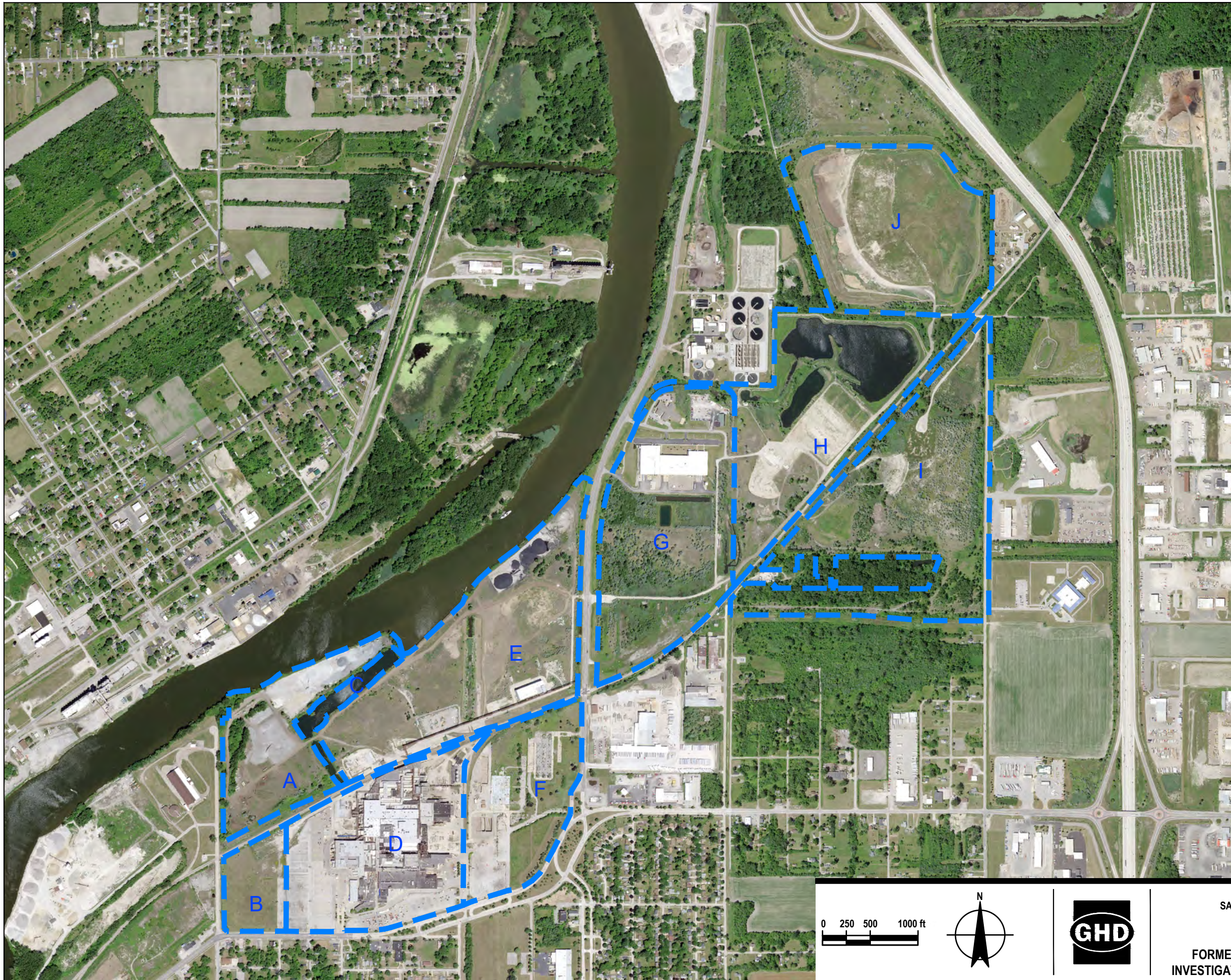


RACER TRUST
SAGINAW, MICHIGAN

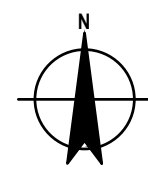
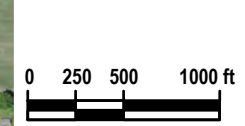
Project No. 11208041
Date March 2023

SITE LOCATION

FIGURE 1.1



LEGEND
 A — INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

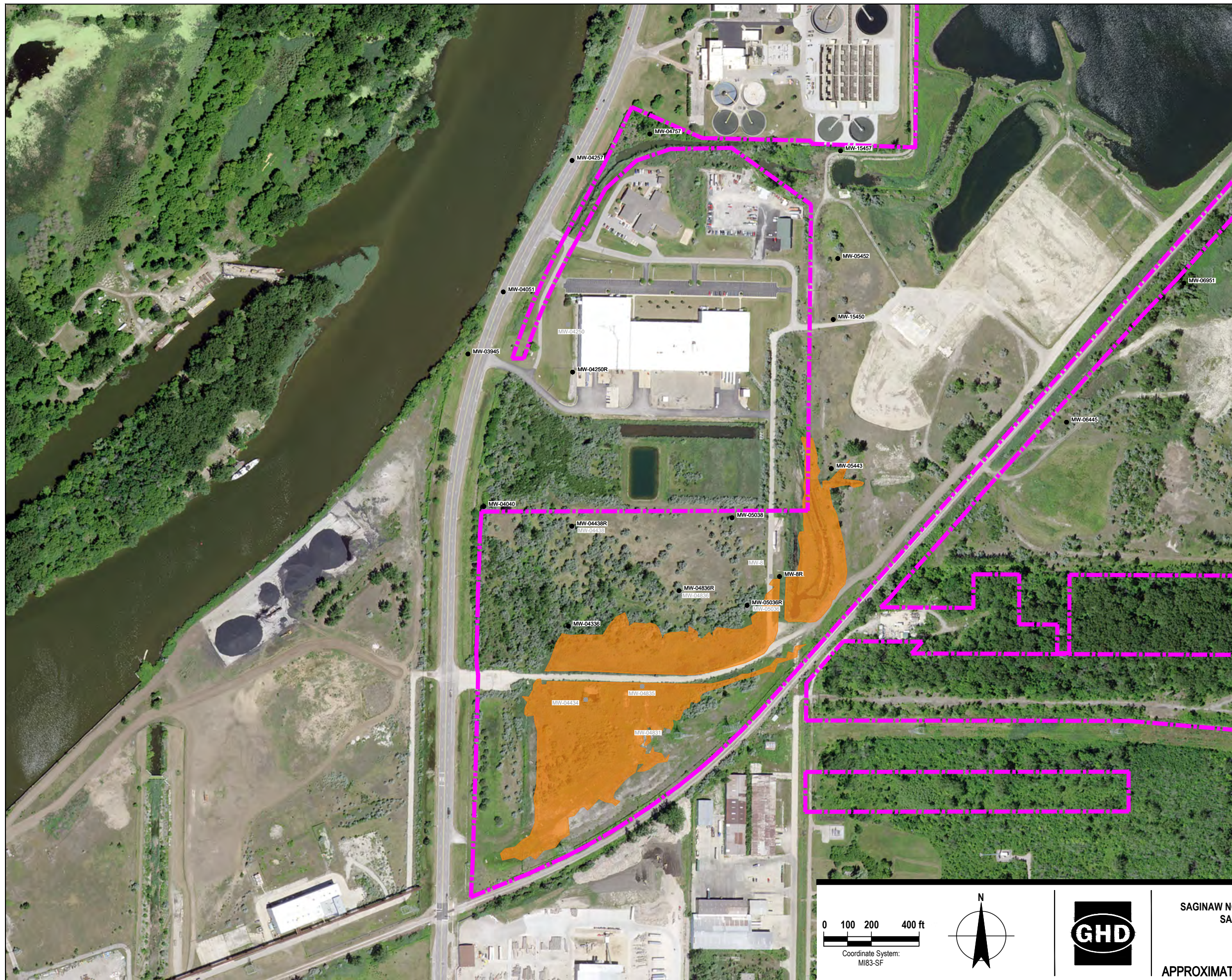


RACER TRUST
 SAGINAW, MICHIGAN





Project No. 11208041
 Date June 2021

**FORMER LARGER FACILITY
 INVESTIGATIVE UNIT BOUNDARIES**

FIGURE 1.2

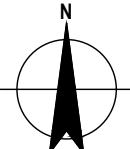


LEGEND

-  APPROXIMATE LIMITS OF RACER PROPERTY AND LAND SUBJECT TO THE REQUIREMENTS OF RCRA CORRECTIVE ACTION
-  REGULATED WETLAND (PER WETLAND DELINEATION COMPLETED BY NISWANDER ENVIRONMENTAL (JULY 22, 2015))
-  MW-06445 ● MONITORING WELL LOCATION
-  MW-8 ■ ABANDONED MONITORING WELL LOCATION

0 100 200 400 ft

Coordinate System:
MI83-SF

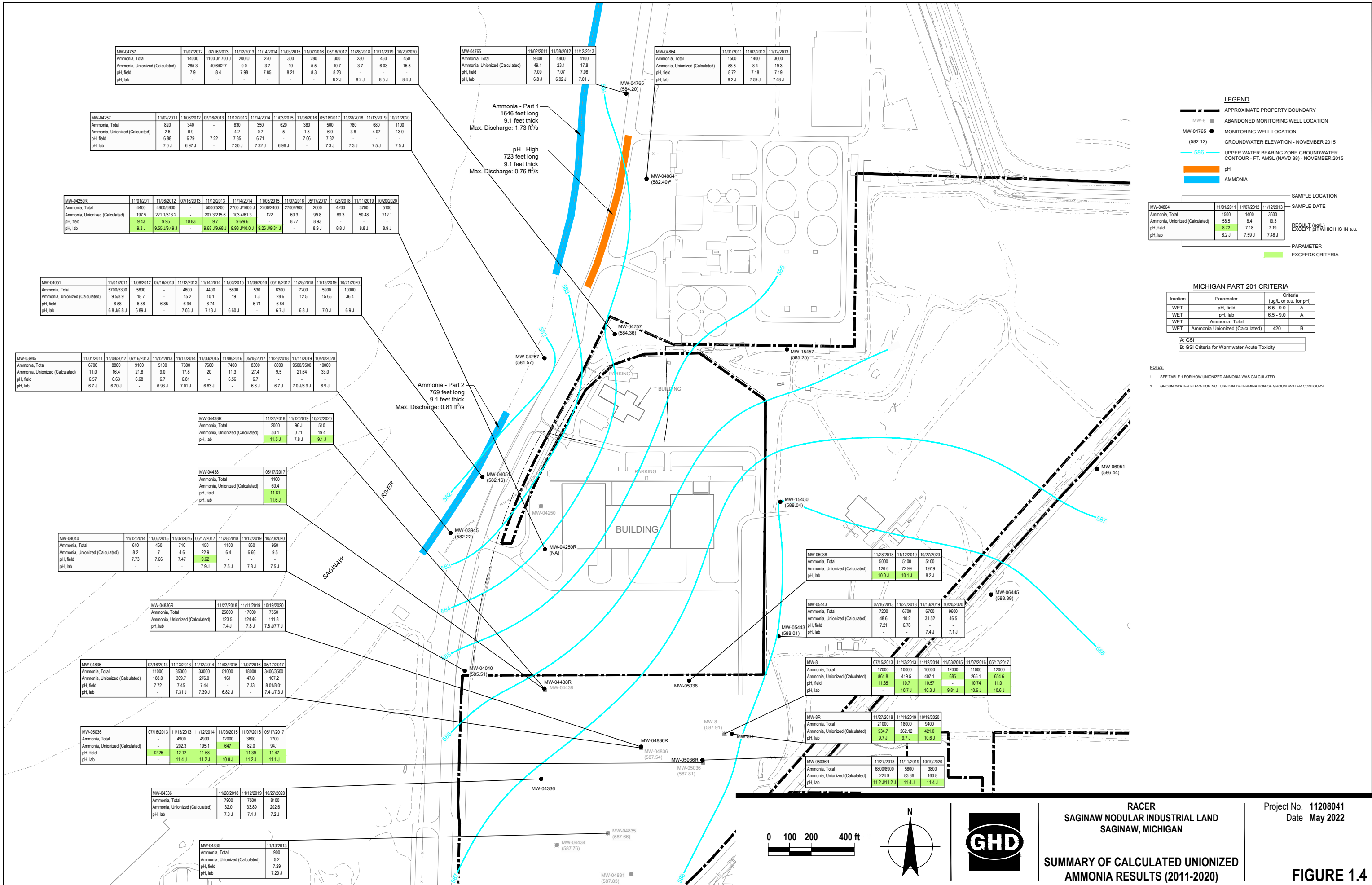


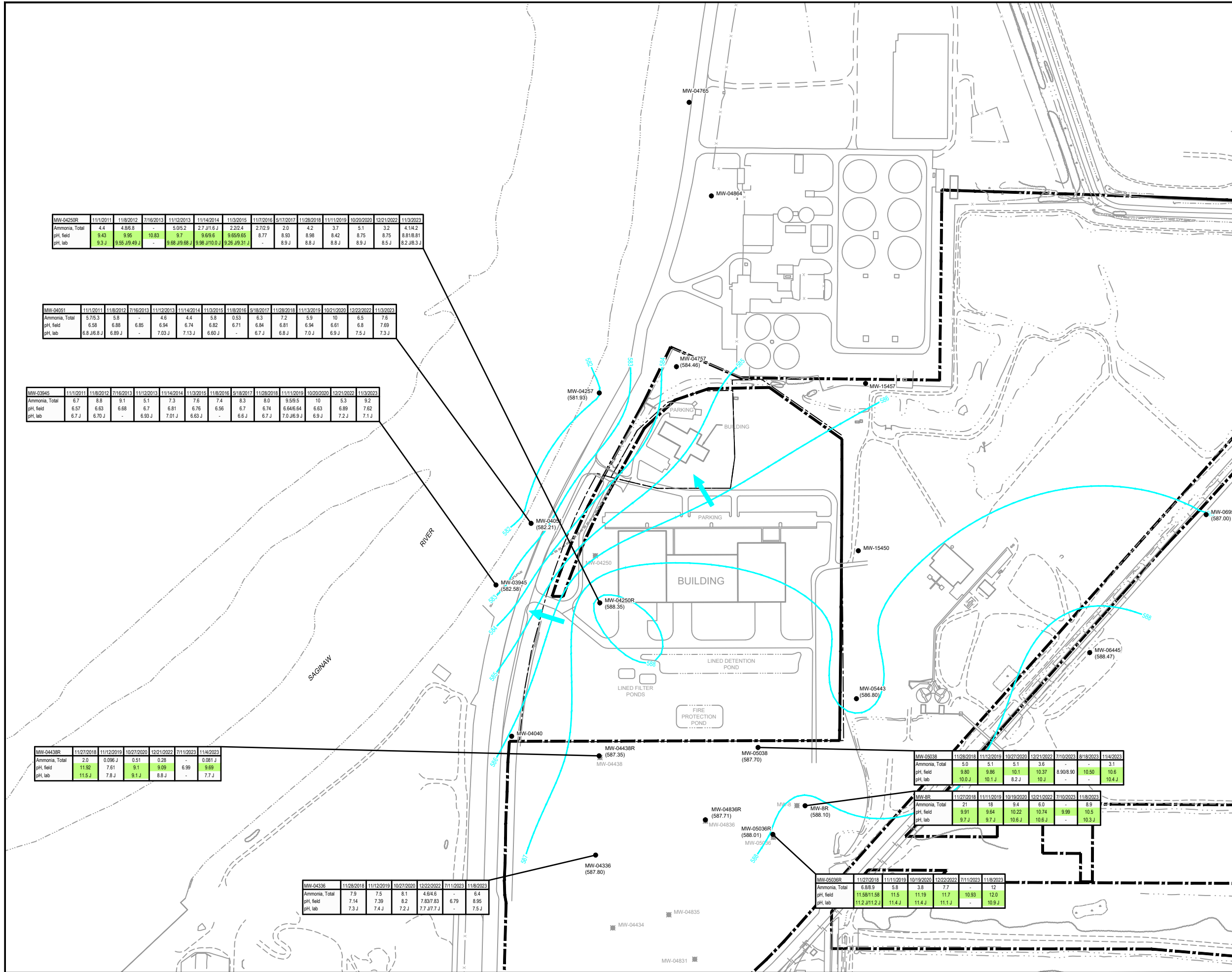

RACER
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN

APPROXIMATE EXTENT OF WETLANDS

Project No. 11208041
Date March 2024

FIGURE 1.3





MW-04250R	11/1/2011	11/8/2012	7/19/2013	11/12/2013	11/14/2014	11/3/2015	11/7/2016	5/17/2017	11/28/2018	11/11/2019	10/20/2020	12/21/2022	11/3/2023
Ammonia, Total	4.4	4.85.8	-	5.05.2	2.7 J/1.6 J	2.22.4	2.72.9	2.0	4.2	3.7	5.1	3.2	4.14.2
pH, field	9.43	9.95	10.83	9.7	9.69.6	9.65/9.65	8.77	8.93	8.98	8.42	8.75	8.75	8.81/8.81
pH, lab	9.3 J	9.55 J/9.49 J	-	9.68 J/9.68 J	9.98 J/10.0 J	9.26 J/9.31 J	-	8.9 J	8.8 J	8.8 J	8.9 J	8.5 J	8.2 J/8.3 J

MW-0451	11/1/2011	11/8/2012	7/19/2013	11/12/2013	11/14/2014	11/3/2015	11/8/2016	5/18/2017	11/28/2018	11/13/2019	10/20/2020	12/22/2022	11/3/2023
Ammonia, Total	5.75.3	5.8	-	4.6	4.4	5.8	0.53	6.3	7.2	5.9	10	6.5	7.6
pH, field	6.58	6.88	6.85	6.94	6.74	6.82	6.71	6.84	6.81	6.94	6.61	6.8	7.69
pH, lab	6.6 J/6.6 J	6.89 J	-	7.03 J	7.13 J	6.60 J	-	6.7 J	6.8 J	7.0 J	6.9 J	7.5 J	7.3 J

MW-03945	11/1/2011	11/8/2012	7/19/2013	11/12/2013	11/14/2014	11/3/2015	11/8/2016	5/18/2017	11/28/2018	11/11/2019	10/20/2020	12/21/2022	11/3/2023
Ammonia, Total	6.7	8.8	9.1	5.1	7.3	7.6	7.4	8.3	8.0	9.59.5	10	5.3	9.2
pH, field	6.57	6.63	6.68	6.7	6.81	6.76	6.56	6.7	6.74	6.64/6.64	6.63	6.89	7.62
pH, lab	6.7 J	6.70 J	-	6.93 J	7.01 J	6.63 J	-	6.6 J	6.7 J	7.0 J/6.9 J	6.9 J	7.2 J	7.1 J

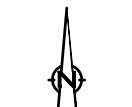
MW-04438R	11/27/2018	11/12/2019	10/27/2020	12/21/2022	7/11/2023	11/4/2023
Ammonia, Total	2.0	0.096 J	0.51	0.28	-	0.081 J
pH, field	11.92	7.61	9.1	9.09	6.99	9.69
pH, lab	11.5 J	7.8 J	9.1 J	8.8 J	-	7.7 J

MW-04336	11/28/2018	11/12/2019	10/27/2020	12/22/2022	7/11/2023	11/8/2023
Ammonia, Total	7.9	7.5	8.1	4.84.6	-	6.4
pH, field	7.14	7.39	8.2	7.63/7.83	6.79	8.95
pH, lab	7.3 J	7.4 J	7.2 J	7.7 J/7.7 J	-	7.5 J

MW-05038	11/28/2018	11/12/2019	10/27/2020	12/21/2022	7/10/2023	8/18/2023	11/4/2023
Ammonia, Total	5.0	5.1	5.1	3.6	-	-	3.1
pH, field	9.80	9.86	10.1	10.37	8.90/8.90	10.50	10.6
pH, lab	10.0 J	10.1 J	8.2 J	10 J	-	-	10.4 J

MW-8R	11/27/2018	11/12/2019	10/19/2020	12/21/2022	7/10/2023	11/8/2023
Ammonia, Total	21	18	9.4	6.0	-	8.9
pH, field	9.91	9.64	10.22	10.74	9.99	10.5
pH, lab	9.7 J	9.7 J	10.6 J	10.6 J	-	10.3 J

MW-05036R	11/27/2018	11/12/2019	10/19/2020	12/22/2022	7/11/2023	11/8/2023
Ammonia, Total	6.8/8.9	5.8	3.8	7.7	-	12
pH, field	11.58/11.58	11.5	11.19	11.7	10.93	12.0
pH, lab	11.2 J/11.2 J	11.4 J	11.4 J	11.1 J	-	10.9 J



- LEGEND**
- APPROXIMATE PROPERTY BOUNDARY
 - MW-8 ABANDONED MONITORING WELL LOCATION
 - MW-04765 MONITORING WELL LOCATION
 - (582.12) GROUNDWATER ELEVATION - NOVEMBER 2023
 - 586 UPPER WATER BEARING ZONE GROUNDWATER CONTOUR - FT. AMSL (NAVD 88) - NOVEMBER 2023

MW-04438R	11/27/2018	11/12/2019
Ammonia	2000	96 J
pH	11.5 J	7.8

SAMPLE LOCATION
 --- SAMPLE DATE
 --- RESULT (mg/L) EXCEPT pH WHICH IS IN S.U.
 --- PARAMETER
 --- EXCEEDS CRITERIA

CRITERIA

Parameter	Criteria
pH	6.5 S.U. TO 9.0 S.U.
Ammonia	79 mg/L

SCALE VERIFICATION
 THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

RACER
SAGINAW NODULAR INDUSTRIAL LAND
 SAGINAW, MICHIGAN
 2023 MIXING ZONE COMPLIANCE
 MONITORING RESULTS



Source Reference:

Project Manager:	Reviewed By:	Date:
M.T.	J.P.	January 2024
Scale:	Project No.:	Report No.:
1" = 200'	11208041	LTR-Messina001
		Drawing No.:
		figure 2.1

Tables

Table 2.1

**Groundwater Ammonia FAV Compliance Worksheet
GSI Compliance Sampling Event of October 2020
RACER Nodular Industrial Land
Saginaw, Michigan**

GSI Compliance Point Number (Well ID)	Measured Total NH3 (µg/L)	Groundwater Temperature (°C)	Groundwater pH	Saginaw River Temperature (°C)⁴	Saginaw River pH⁴	Average Temperature (°C)¹	Average pH²	% Unionized NH₃³	Calculated Unionized NH3 (µg/L)
MW-04257	1100	16.90	7.50	10.3	8.03	13.60	7.69	1.18%	13.0
MW-04051	10000	17.10	6.90	10.3	8.03	13.70	7.17	0.36%	36.4
MW-03945	10000	14.50	6.90	10.3	8.03	12.40	7.17	0.33%	33.0
Other Wells									
MW-04250R	5100	15.20	8.90	10.3	8.03	12.75	8.28	4.16%	212.1
MW-04757	450	16.10	8.40	10.3	8.03	13.20	8.18	3.45%	15.5
MW-04836R ⁽⁵⁾	7550	12.10	7.75	10.3	8.03	11.20	7.87	1.48%	111.8
MW-04040	950	12.60	7.50	10.3	8.03	11.45	7.69	1.00%	9.5
MW-8R	9400	14.00	10.60	10.3	8.03	12.15	8.33	4.48%	421.0
MW-05036R	3800	12.40	11.40	10.3	8.03	11.35	8.33	4.23%	160.8
MW-04438R	510	11.58	9.10	10.3	8.03	10.94	8.30	3.80%	19.4
MW-05038	5100	10.29	10.10	10.3	8.03	10.30	8.33	3.88%	197.9
MW-04336	8100	11.69	8.20	10.3	8.03	11.00	8.11	2.50%	202.6
MW-05443	9600	13.60	7.10	10.3	8.03	11.95	7.35	0.48%	46.5

Notes:

1. Temperature is the average of the groundwater temperature and the Saginaw River temperature
2. pH value for average of groundwater and Saginaw River H⁺ concentrations
3. Ammonia toxicity equations taken from Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997
4. The Saginaw River temperature and pH were measured on October 21, 2020
5. Measured Total NH3 and pH are an average of the parent sample and the duplicate

Boxed Value indicates exceedance of FAV criterion of 420 µg/L

Attachments

Attachment 1

Niswander Wetland Delineation Report



NISWANDER
ENVIRONMENTAL

Finding solutions in a complex world

9436 Maltby Road
Brighton, MI 48116
810.225.0539 office
810.225.0653 fax
www.niswander-env.com

July 22, 2015

Mr. Patrick Schaffer
Menard, Inc. – Properties Division
5101 Menard Drive
Eau Claire, WI 54703

Subject: *Wetland Delineation*
38.86-Acre Racer Trust Property
Buena Vista Township, Saginaw County, MI
NE 1424

Dear Mr. Schaffer:

Niswander Environmental was contracted in July 2015 to complete a wetland delineation on 38.86-acre property (Property) located at 2100 Veterans Memorial Parkway in Section 8 of Buena Vista Township, Saginaw County, Michigan (T12N, R5E). The Property is a former industrial complex that was decommissioned and demolished over 10 years ago. Currently, this disturbed site is a vacant brownfield that is dominated by wetland, old field, meadow, and/or young successional forested habitat. Russian olive and cottonwood dominate much of the land, particularly in the north. The central portions of the site are primarily scrub-shrub wetland. Areas in the south consist of open meadow and old field. Please refer to Photos 1 and 2 in the attached Photographic Log for a representation of the upland portions of the Property.

Niswander Environmental assessed the Property for existing wetlands, watercourses, and floodplains, and delineated the wetland features. During the on-site investigation, **Niswander Environmental identified five (5) wetlands within the Property (Figure 1 – Wetland Location Map)**. The following is a report detailing the results of Niswander Environmental's investigation.

SUPPORTING DOCUMENTATION

Wetlands and Watercourses

Prior to the site investigation, Niswander Environmental completed a thorough review of available State and County GIS data, online resources, wetland maps, historic aerial photos, topographic maps, soil maps, and other materials. Infrared and color aerial photographs (Michigan Geospatial Digital Library – MiGDL, 1998, 2005, and 2012) and 2014 color aerial photographs (GoogleEarth) were obtained and evaluated for any remarkable features. A review of National Wetland Inventory (NWI), Michigan Department of Environmental Quality (MDEQ) Final Wetland Inventory Map, and Saginaw County GIS data was conducted to determine the likely presence, location, size and type of wetlands that may be located on the Property. The United States Fish and Wildlife Service (USFWS) produce the NWI data

through aerial photograph interpretation. The MDEQ Final Wetland Inventory Map was created from the NWI, USDA Soils Map, and Land Cover, as mapped by the Michigan Resource Inventory System (MIRIS).

Review of the available wetland maps, including the NWI and MDEQ Final Wetland Inventory Map for Saginaw County, did not identify wetlands or hydric soil on the Property, likely because this Property contained an industrial facility until recently. These maps, however, may not always accurately show the extent or existence of wetland systems in a specific area or correctly identify the wetlands present since they were primarily generated through aerial interpretation. Wetland inventory maps are utilized for preliminary analysis only. Field investigations are always necessary to determine the actual existence and type of wetlands in a given area.

METHODS

Wetlands and Watercourses

Potential wetland areas within the Property were evaluated in the field using the procedures outlined in the US Army Corps of Engineers *1987 Wetland Delineation Manual* (“87 Manual”), and the Northeast/NorthCentral Supplement to the “87 Manual” as required by the State of Michigan, Department of Environmental Quality, under Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, PA451 of 1994, as amended (NREPA). According to these procedures, wetlands are identified by the presence of hydric soils, signs of hydrology indicators, and dominant hydrophytic vegetation.

Hydric soil indicators were assessed in the field through soil pits that were dug in and around potential wetland areas. A soil is considered hydric if it meets requirements as stated in the Natural Resources Conservation Service *Field Indicators of Hydric Soils in the United States* (Version 7.0, 2010), which specifies parameters such as soil matrix color, amount and contrast of redox concentrations or depletions, and depth and thickness for a specific soil type such as loamy, clayey, or sandy soils. Soils were not reviewed in areas with standing or flowing water since these areas are assumed to be hydric.

Signs of hydrology within potential wetland areas were also investigated. Standing water or saturated soils, water marks on trees, drift lines, sediment deposits, and water-stained leaves (among others) are considered primary indicators of hydrology, while secondary signs include drainage patterns, moss trim lines, crayfish burrows, and surface soil cracks. Either one primary or two secondary indicators are necessary in determining the presence of wetland hydrology.

Dominant vegetation for wetland areas are typically determined by estimating the most common species of tree, shrub, and forb layers. The top dominants are visually estimated for each layer or strata, and the indicator status of each dominant species is then determined. An indicator status of obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU) and/or upland (UPL) is typically assigned to each plant species on the U.S. Army Corps of Engineers *National Wetland Plant List* (<http://rsgisias.crrel.usace.army.mil/NWPL/>). An area has hydrophytic (wetland) vegetation when, under normal circumstances, more than 50 percent of the composition of the dominant species from all strata are OBL, FACW, and/or FAC species. An area has non-hydrophytic vegetation when 50 percent or more of the composition of the dominant species from all strata are FACU and/or UPL species. Areas

that meet the three criteria of hydric soils, wetland hydrology, and hydrophytic vegetation are considered wetlands. The perimeter of a wetland is typically determined by locating areas where one of these three criteria is no longer present (*i.e.*, where wetland vegetation transitions to upland vegetation or where signs of hydrology are no longer apparent, etc.).

The wetland boundary was flagged and GPS'd in the field, and then digitized into a GIS database (Figure 1 – Wetland Location Map). The actual wetland boundary should be surveyed and incorporated into any development plans to determine the exact size, shape, and location of the wetland.

Under NREPA, wetlands are regulated if they are greater than 5 acres in size or if they are connected to or within 500 feet of an inland lake, pond, river, drain, or stream (*i.e.*, watercourse). A pond is defined in Part 303 Administrative Rules (R 281.921) as a natural or artificial pond that has permanent open water with a surface area that is more than 1 acre, but less than 5 acres. Other watercourses are regulated by the State under Part 301 (Inland Lakes and Streams) if they exhibit defined banks, a bed, and visible evidence of a continued flow or continued occurrence of water. An inland lake or stream does not include the Great Lakes, Lake St. Clair, or a lake or pond that has a surface area of less than 5 acres. It should be noted that the MDEQ has the final authority on the regulatory status of wetlands and watercourses in the State of Michigan.

FINDINGS

On July 15 and 16, 2015 Niswander Environmental conducted a wetland delineation on the Property using the *87 Manual*. Five wetlands (Wetland A - E) were identified and flagged on the Property. The limits of the wetland were flagged in the field with pink flagging labeled A1 – A80, B1 – B145, C1 – C24, D1 – D14, and E1 – E 65. The wetland delineation, once surveyed by a registered surveyor, will provide the exact shape, size, and location of the on-site wetland.

WETLANDS A, B, AND D

Wetlands A, B, and D are similar in terms of habitat type, vegetative composition, soil structure, and hydrologic indicators. They are separated from each other through access roads and driveways, and there does not appear to be a hydrologic connection (Figure 1). Each of these wetlands are classified as emergent/scrub-shrub wetlands, meaning there are portions that are dominated by woody shrubs and small trees, but there are also openings comprised primarily of herbaceous plants. Despite their diversity, these wetlands are considered to be of moderate to moderately low quality because of recent disturbance (*i.e.*, the wetlands have developed since the demolition of the pre-existing buildings and infrastructure on the site) and contain an abundance of invasive vegetation such as Phragmites (*Phragmites australis*), red top (*Agrostis gigantea*), narrow-leaved cattail (*Typha angustifolia*), and purple loosestrife (*Lythrum salicaria*). Other common-to-abundant plants within Wetlands A, B, and D include path rush (*Juncus tenuis*), Torrey's rush (*Juncus torreyi*), sandbar willow (*Salix exigua*), cottonwood (*Populus deltoides*), slender fragrant goldenrod (*Euthamia graminifolia*), and sedge (*Carex* spp.). Wetland A contains a disturbed meadow area in the southern portion of the Property, where wildflowers such as vervain (*Verbena hastata*), late goldenrod (*Solidago gigantea*), swamp milkweed (*Asclepias incarnata*), and swamp aster (*Symphotrichum puniceum*) along with a variety of sedges and rushes. Please refer to Photos 3 – 7 in the attached Photographic Log.



Hydrologic indicators present at the time of inspection include standing water, saturated soils, aquatic fauna, algal mats, and a positive FAC-Neutral test. Soils within each wetland proved to be similar, consisting of a sandy mucky mineral that is hydric. The upland/wetland interface was determined through topographical differences and the presence/absence of upland species such as common buckthorn (*Rhamnus cathartica*), Virginia creeper (*Parthenocissus quinquefolia*), Russian olive (*Elaeagnus angustifolia*), thistle (*Cirsium arvense*), tall goldenrod (*Solidago altissima*), Queen Anne's lace (*Daucus carota*), spotted knapweed (*Centaurea stoebe*) and various upland grasses. Upland areas generally contained a few wetland species intermixed with an abundance of upland plants, and also lacked primary indicators of hydrology. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetlands A, B, and D.

Wetland B is likely regulated by the MDEQ due to the fact that it is greater than five acres in size. Wetlands A and D are likely not regulated since they are smaller than five acres and are hydrologically isolated.

WETLAND C

Wetland C is a small, depressional wetland located within a disturbed field along Veterans Memorial Parkway (Figure 1). This emergent wetland is dominated by scouring rush (*Equisetum hymale*), meadow sedge (*Carex granularis*), and taper-tip rush (*Juncus articulatis*). Other species present within this wetland include fowl bluegrass (*Poa palustris*), Torrey's rush, spikerush (*Eleocharis obtusa*), and swamp milkweed (Photo 8; Photographic Log).

Although the interior of the wetland contained standing water, a majority of the wetland was only saturated at the time of inspection. Hydric soils were confirmed when a mucky sand was revealed. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetland C.

Wetland C is likely not regulated by the MDEQ since it is less than five acres in size and is not hydrologically connected to a regulating body of water.

WETLAND D

Wetland E is a small (~1 ac) wetland located in the northwest portion of the Property, beginning just north of the access drive (Figure 1). Like the other on-site wetlands, this wetland is disturbed but is becoming more naturalized as the years pass. Most of the wetland is classified as scrub-shrub due to the abundance of sapling cottonwood, but other portions are more open and resemble a meadow (Photos 9 and 10; Photographic Log). While no single species truly dominates, the most abundant plants within this wetland include cottonwood, sandbar willow, purple loosestrife, scouring rush, vervain, late goldenrod, slender-fragrant goldenrod, and riverbank grape (*Vitis riparia*).

Wetland E contained a few pockets of standing water, but in general was saturated at or just below the surface. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetland E.

Wetland E is likely not regulated by the MDEQ since it is less than five acres in size and is hydrologically isolated.

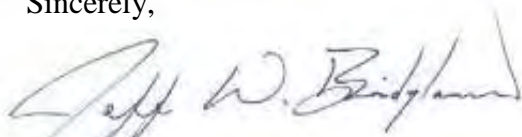
CONCLUSIONS

Niswander Environmental identified five wetlands (Wetlands A, B, C, D, and E) on the Property. The approximate size and shape of the wetland is represented in Figure 1 (Wetland Location Map). A survey of the wetland delineation should be conducted to accurately determine the wetland boundaries and any potential impacts resulting from future work within this area.

It is Niswander Environmental's professional opinion that Wetland B is regulated by the MDEQ due to the fact that it is greater than 5 acres in size. The remaining four wetlands are less than 5 acres in size, and are hydrologically isolated. However, since the MDEQ has the final regulatory authority, we recommend that a Pre-Application Meeting with the MDEQ be held prior to moving forward with any potential development. A MDEQ Part 303 Permit will be necessary if impacts to regulated wetland are proposed.

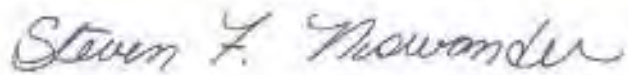
We look forward to working with you to make this project a success. If you have any questions or require additional information please call us at your convenience.

Sincerely,



Jeff W. Bridgland
Ecologist

Professional Wetland Scientist #1810



Steven F. Niswander
Principal

Professional Wetland Scientist #1276

Attachments: Figure 1 – Wetland Location Map
Photographic Log
Wetland Determination Data Forms



Photographic Log



Photo 1

The Racer Trust property is a 38.86-acre site that was a former industrial facility that was demolished roughly 10-15 years ago and left fallow.



Photo 2

This disturbed property is dominated by pioneer species such as cottonwood, willow, and Russian olive.

Photographic Log

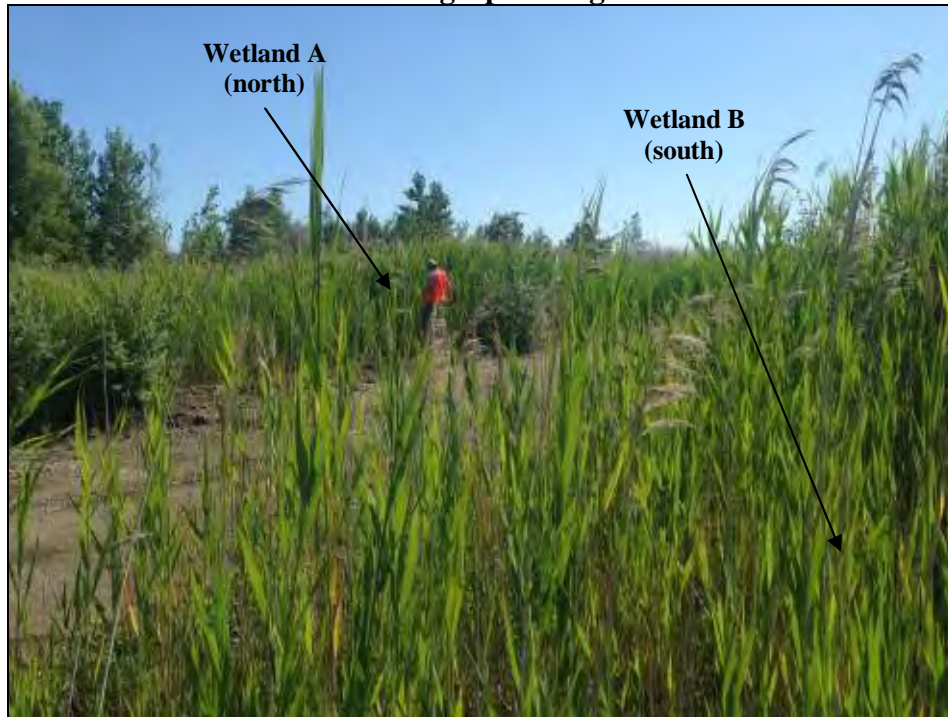


Photo 3

An access driveway splits Wetlands A and B, but there does not appear to be a hydrologic connection between the two. Along the road, these wetlands contain an abundance of invasive Phragmites.



Photo 4

Wetland A, located on the north side of the access drive, is dominated by Phragmites (although other species are present throughout).

Photographic Log



Photo 5

View facing south showing Wetland B, a large (~7⁺ acre) scrub-shrub wetland. This wetland is likely regulated by the MDEQ.



Photo 6

The southern portion of Wetland B is comprised primarily of meadow species as opposed to woody species that dominate further north.



Photographic Log



Photo 7

Wetland D, located in the northeast portion of the property, is primarily an emergent wetland dominated by Phragmites, cattail, sedge, and rush.



Photo 8

Wetland C is a small, isolated emergent wetland located along Veterans Memorial Highway.



Photographic Log



Photo 9

View facing north showing the scrub-shrub portion of Wetland E. This wetland contains both meadow and scrub-shrub characteristics, and is very diverse.



Photo 10

Pockets of open meadow are common throughout Wetland E. These areas contain an abundance of sedges, rushes and wildflowers such as vervain, goldenrod, milkweed, and aster.

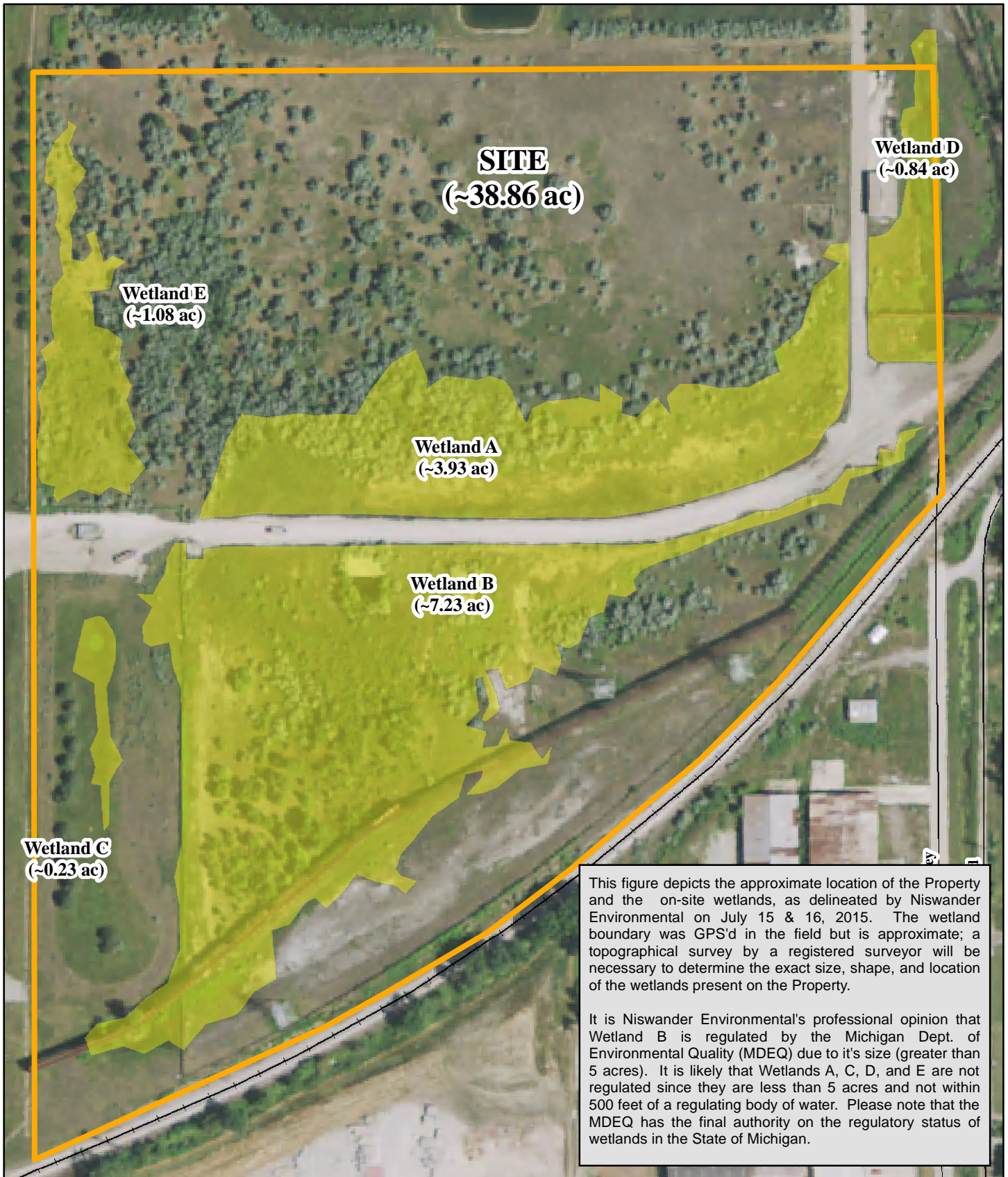


Figure 1. Wetland Location Map

NE 1424 Racer Trust Industrial Park

Client: Menard, Inc.

38.86-Acre Property at 2100 Veterans Memorial Parkway
Section 8 of Buena VistaTwp., Saginaw Co., MI (T12N, R5E)

Delineation Date: July 15 & 16, 2015

Map Created: July 16, 2015

Feet 0 100 200 400



	NISWANDER ENVIRONMENTAL	9436 Maltby Road, Brighton, MI 48116
		810.225.0539 office 810.225.0653 fax

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/15/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: A, B, D
 Investigator(s): J. Bridgland, T. Smith - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) Wetland Data Form for Wetlands A, B, and D. Each of these three wetlands exhibit similar habitat types, vegetative composition, soils, and hydrology. Separated by an access driveway, but no apparent hydrologic connection (no culverts observed). Highly disturbed - former industrial facility that was demolished roughly 10-15 years ago, capped with soil, and left to naturally vegetate. Wetland A = ~3.93 acres (80 flags); Wetland B = ~7.23ac (145 flags); Wetland C = ~ 0.23 ac (24 flags); Wetland D = ~0.84 ac (14 flags); Wetland E = ~ 1.08 ac (65 flags). Wetland B is likely regulated due to size. It is Niswander Environmental's professional opinion that Wetlands A, C, D, and E are hydrologically isolated and smaller than five acres in size and therefore are likely not regulated by the MDEQ.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) _____ Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) _____ Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
--	---

Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>3</u> Water Table Present? Yes <u>X</u> No _____ Depth (inches): <u>10</u> Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Wetlands A, B, and D exhibited standing water throughout much of the wetland at the time of the inspection. Much of the remainder of each wetland was saturated at the surface.

VEGETATION – Use scientific names of plants.

Sampling Point: A, B, D

<u>Tree Stratum</u> (Plot size: <u> 30 ft. </u>)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u> Eastern Cottonwood </u>	<u> 10 </u>	<u> Yes </u>	<u> FAC </u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 6 </u> (A) Total Number of Dominant Species Across All Strata: <u> 8 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 75.0% </u> (A/B)																
2. <u> Russian-Olive </u>	<u> 10 </u>	<u> Yes </u>	<u> FACU </u>																	
3. <u> Black Willow </u>	<u> 2 </u>	<u> No </u>	<u> OBL </u>																	
4. <u> </u>																				
5. <u> </u>																				
6. <u> </u>																				
7. <u> </u>																				
	<u> 22 </u> =Total Cover																			
<u>Sapling/Shrub Stratum</u> (Plot size: <u> 15 ft. </u>)				Prevalence Index worksheet: <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:50%;">Total % Cover of:</th> <th style="width:50%;">Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species <u> 117 </u></td> <td>x 1 = <u> 117 </u></td> </tr> <tr> <td>FACW species <u> 175 </u></td> <td>x 2 = <u> 350 </u></td> </tr> <tr> <td>FAC species <u> 45 </u></td> <td>x 3 = <u> 135 </u></td> </tr> <tr> <td>FACU species <u> 10 </u></td> <td>x 4 = <u> 40 </u></td> </tr> <tr> <td>UPL species <u> 0 </u></td> <td>x 5 = <u> 0 </u></td> </tr> <tr> <td>Column Totals: <u> 347 </u> (A)</td> <td><u> 642 </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u> 1.85 </u></td> </tr> </tbody> </table>	Total % Cover of:	Multiply by:	OBL species <u> 117 </u>	x 1 = <u> 117 </u>	FACW species <u> 175 </u>	x 2 = <u> 350 </u>	FAC species <u> 45 </u>	x 3 = <u> 135 </u>	FACU species <u> 10 </u>	x 4 = <u> 40 </u>	UPL species <u> 0 </u>	x 5 = <u> 0 </u>	Column Totals: <u> 347 </u> (A)	<u> 642 </u> (B)	Prevalence Index = B/A = <u> 1.85 </u>	
Total % Cover of:	Multiply by:																			
OBL species <u> 117 </u>	x 1 = <u> 117 </u>																			
FACW species <u> 175 </u>	x 2 = <u> 350 </u>																			
FAC species <u> 45 </u>	x 3 = <u> 135 </u>																			
FACU species <u> 10 </u>	x 4 = <u> 40 </u>																			
UPL species <u> 0 </u>	x 5 = <u> 0 </u>																			
Column Totals: <u> 347 </u> (A)	<u> 642 </u> (B)																			
Prevalence Index = B/A = <u> 1.85 </u>																				
1. <u> Sandbar Willow </u>	<u> 65 </u>	<u> Yes </u>																		
2. <u> Silky Dogwood </u>	<u> 10 </u>	<u> No </u>																		
3. <u> European Buckthorn </u>	<u> 10 </u>	<u> No </u>																		
4. <u> Russian-Olive </u>	<u> 10 </u>	<u> No </u>																		
5. <u> </u>																				
6. <u> </u>																				
7. <u> </u>																				
	<u> 95 </u> =Total Cover																			
<u>Herb Stratum</u> (Plot size: <u> 5 ft. </u>)				Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
1. <u> Common Reed </u>	<u> 80 </u>	<u> Yes </u>	<u> FACW </u>																	
2. <u> Purple Loosestrife </u>	<u> 50 </u>	<u> Yes </u>	<u> OBL </u>																	
3. <u> Narrow-Leaf Cat-Tail </u>	<u> 40 </u>	<u> Yes </u>	<u> OBL </u>																	
4. <u> Torrey's Rush </u>	<u> 40 </u>	<u> Yes </u>	<u> FACW </u>																	
5. <u> Late Goldenrod </u>	<u> 25 </u>	<u> No </u>	<u> FACW </u>																	
6. <u> Juncus tenuis </u>	<u> 25 </u>	<u> No </u>	<u> FAC </u>																	
7. <u> Agrostis gigantea </u>	<u> 20 </u>	<u> No </u>	<u> FACW </u>																	
8. <u> Common Fox Sedge </u>	<u> 10 </u>	<u> No </u>	<u> OBL </u>																	
9. <u> Flat-Top Goldentop </u>	<u> 10 </u>	<u> No </u>	<u> FACW </u>																	
10. <u> Swamp Milkweed </u>	<u> 5 </u>	<u> No </u>	<u> OBL </u>																	
11. <u> water plantain </u>	<u> 5 </u>	<u> No </u>	<u> OBL </u>																	
12. <u> Bebb's Sedge </u>	<u> 5 </u>	<u> No </u>	<u> OBL </u>																	
	<u> 315 </u> =Total Cover																			
<u>Woody Vine Stratum</u> (Plot size: <u> 15 ft. </u>)				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.																
1. <u> Vitis riparia </u>	<u> 10 </u>	<u> Yes </u>	<u> FAC </u>																	
2. <u> </u>																				
3. <u> </u>																				
4. <u> </u>																				
	<u> 10 </u> =Total Cover																			

Remarks: (Include photo numbers here or on a separate sheet.)
 Other species present include vervain, swamp aster, chairmakers rush, soft rush, green bulrush, joe-pye weed, boneset, taper-tip rush, and Indian hemp. Northern portions of Wetland A dominated 99% by Phragmites. Southern portions of Wetland B contain disturbed meadow. Upland/Wetland interface determined by presence of upland species such as spotted knapweed, russian olive, tall goldenrod, Virginia creeper, orchard grass, Queen Anne's lace, and/or thistle.

SOIL

Sampling Point A, B, D

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-8	10YR 2/1	95	7.5YR 3/4	5	C	M	Mucky Sand	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils³:	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR R, MLRA 149B)	<input type="checkbox"/> 2 cm Muck (A10) (LRR K, L, MLRA 149B)	<input type="checkbox"/> Coast Prairie Redox (A16) (LRR K, L, R)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR R, MLRA 149B)	<input type="checkbox"/> 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR K, L)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> High Chroma Sands (S11) (LRR K, L)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR K, L)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR K, L, R)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1) (LRR K, L)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 149B)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Depleted Dark Surface (F7)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)	<input type="checkbox"/> Marl (F10) (LRR K, L)	<input type="checkbox"/> Very Shallow Dark Surface (F22)
<input checked="" type="checkbox"/> Sandy Mucky Mineral (S1)			<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)			
<input checked="" type="checkbox"/> Sandy Redox (S5)			
<input type="checkbox"/> Stripped Matrix (S6)			
<input type="checkbox"/> Dark Surface (S7)			

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: _____ Depth (inches): _____	

Remarks:
 This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/15/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: C
 Investigator(s): J. Bridgland, T. Smith - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) Small, depressional PEM located within overgrown grassy field. Roughly 0.23 acres (24 flags). Likely not regulated due to lack of size and hydrologically isolated.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) _____ Water-Stained Leaves (B9) _____ High Water Table (A2) _____ Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) _____ Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
--	---

Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>1</u> Water Table Present? Yes _____ No _____ Depth (inches): _____ Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
---	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Interior portions of Wetland C contained standing water, but a majority of the wetland was saturated at the surface at the time of inspection

SOIL

Sampling Point **C**

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-12	10YR 2/1	95	7.5YR 3/4	5	C	M	Mucky Sand	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils³:	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR R, MLRA 149B)	<input type="checkbox"/> 2 cm Muck (A10) (LRR K, L, MLRA 149B)	<input type="checkbox"/> Coast Prairie Redox (A16) (LRR K, L, R)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR R, MLRA 149B)	<input type="checkbox"/> 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR K, L)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> High Chroma Sands (S11) (LRR K, L)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR K, L)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR K, L, R)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1) (LRR K, L)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 149B)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Depleted Dark Surface (F7)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)	<input type="checkbox"/> Marl (F10) (LRR K, L)	<input type="checkbox"/> Very Shallow Dark Surface (F22)
<input checked="" type="checkbox"/> Sandy Mucky Mineral (S1)			<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)			
<input checked="" type="checkbox"/> Sandy Redox (S5)			
<input type="checkbox"/> Stripped Matrix (S6)			
<input type="checkbox"/> Dark Surface (S7)			

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):		Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: _____	Depth (inches): _____	

Remarks:
 This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/16/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: E
 Investigator(s): J. Bridgland - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) PSS wetland with open meadow portions; diverse; hummocky, portions marginally wetland (mesic); Approximately 1.08 ac (65 flags). Likely not regulated due to size and lack of hydrologic connectivity.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> _____ Surface Water (A1) _____ Water-Stained Leaves (B9) <u>X</u> High Water Table (A2) <u>X</u> Aquatic Fauna (B13) <u>X</u> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) _____ Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) _____ Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <u>X</u> FAC-Neutral Test (D5)
--	--

Field Observations: Surface Water Present? Yes _____ No _____ Depth (inches): _____ Water Table Present? Yes <u>X</u> No _____ Depth (inches): <u>10</u> Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>4</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Very few pockets of standing water; portions saturated at surface, but mostly below the surface (@ roughly 4")

VEGETATION – Use scientific names of plants.

Sampling Point: E

<u>Tree Stratum</u> (Plot size: <u> 30 ft. </u>)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u>Populus deltoides</u>	<u> 30 </u>	Yes	FAC	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 9 </u> (A) Total Number of Dominant Species Across All Strata: <u> 9 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 100.0% </u> (A/B) Prevalence Index worksheet: <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align:center;">Total % Cover of:</td> <td style="width:50%; text-align:center;">Multiply by:</td> </tr> <tr> <td>OBL species <u> 55 </u></td> <td>x 1 = <u> 55 </u></td> </tr> <tr> <td>FACW species <u> 140 </u></td> <td>x 2 = <u> 280 </u></td> </tr> <tr> <td>FAC species <u> 135 </u></td> <td>x 3 = <u> 405 </u></td> </tr> <tr> <td>FACU species <u> 10 </u></td> <td>x 4 = <u> 40 </u></td> </tr> <tr> <td>UPL species <u> 0 </u></td> <td>x 5 = <u> 0 </u></td> </tr> <tr> <td>Column Totals: <u> 340 </u></td> <td>(A) <u> 780 </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u> 2.29 </u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u> 55 </u>	x 1 = <u> 55 </u>	FACW species <u> 140 </u>	x 2 = <u> 280 </u>	FAC species <u> 135 </u>	x 3 = <u> 405 </u>	FACU species <u> 10 </u>	x 4 = <u> 40 </u>	UPL species <u> 0 </u>	x 5 = <u> 0 </u>	Column Totals: <u> 340 </u>	(A) <u> 780 </u> (B)	Prevalence Index = B/A = <u> 2.29 </u>	
Total % Cover of:	Multiply by:																			
OBL species <u> 55 </u>	x 1 = <u> 55 </u>																			
FACW species <u> 140 </u>	x 2 = <u> 280 </u>																			
FAC species <u> 135 </u>	x 3 = <u> 405 </u>																			
FACU species <u> 10 </u>	x 4 = <u> 40 </u>																			
UPL species <u> 0 </u>	x 5 = <u> 0 </u>																			
Column Totals: <u> 340 </u>	(A) <u> 780 </u> (B)																			
Prevalence Index = B/A = <u> 2.29 </u>																				
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
5. _____	_____	_____	_____																	
6. _____	_____	_____	_____																	
7. _____	_____	_____	_____																	
	<u> 30 </u> =Total Cover																			
<u>Sapling/Shrub Stratum</u> (Plot size: <u> 15 ft. </u>)																				
1. <u>Populus deltoides</u>	<u> 50 </u>	Yes	FAC	Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
2. <u>Salix interior</u>	<u> 20 </u>	Yes	FACW																	
3. <u>Russian olive</u>	<u> 10 </u>	No	FACU																	
4. <u>Cornus amomum</u>	<u> 5 </u>	No	FACW																	
5. _____	_____	_____	_____																	
6. _____	_____	_____	_____																	
7. _____	_____	_____	_____																	
	<u> 85 </u> =Total Cover																			
<u>Herb Stratum</u> (Plot size: <u> 5 ft. </u>)																				
1. <u>Lythrum salicaria</u>	<u> 35 </u>	Yes	OBL	Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height. Hydrophytic Vegetation Present? Yes <u> X </u> No <u> </u>																
2. <u>Equisetum hyemale</u>	<u> 25 </u>	Yes	FAC																	
3. <u>Verbena hastata</u>	<u> 25 </u>	Yes	FACW																	
4. <u>Solidago gigantea</u>	<u> 20 </u>	Yes	FACW																	
5. <u>Euthamia graminifolia</u>	<u> 20 </u>	Yes	FACW																	
6. <u>Agrostis gigantea</u>	<u> 15 </u>	No	FACW																	
7. <u>Carex vulpinoidea</u>	<u> 15 </u>	No	OBL																	
8. <u>Apocynum cannabinum</u>	<u> 15 </u>	No	FACW																	
9. <u>Juncus torreyi</u>	<u> 10 </u>	No	FACW																	
10. <u>Phragmites australis</u>	<u> 10 </u>	No	FACW																	
11. <u>Juncus tenuis</u>	<u> 10 </u>	No	FAC																	
12. <u>Juncus articulatus</u>	<u> 5 </u>	No	OBL																	
	<u> 205 </u> =Total Cover																			
<u>Woody Vine Stratum</u> (Plot size: <u> 15 ft. </u>)																				
1. <u>Vitis riparia</u>	<u> 20 </u>	Yes	FAC																	
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
	<u> 20 </u> =Total Cover																			

Remarks: (Include photo numbers here or on a separate sheet.)
 Wetland E is dominated by cottonwood, sandbar willow, purple loosestrife, and grapevine. Abundant and common species include vervain, late goldenrod, scouring rush, slender-fragrant goldenrod, fox sedge, red top, and Indian hemp. Upland/Wetland interface marked by presence of Virginia creeper, russian olive, tall goldenrod, thistle, and poison ivy.

Attachment 2

Monitoring Well and Boring Logs



Boring/Well No.: MW-04040

Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 588.83'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/17/98 - 09/17/98	Total Depth: 16.00'
Depth to First Encountered Groundwater: 6.20'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.5' to: 6.07'	Remarks: Top of Casing Elevation: 591.32'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 6.07' to: 10.68'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
0		800045	9		Foundry Sand (SP), black (2.5Y 2/0), dry		0.5 ppm		
5		800046	24		<ul style="list-style-type: none"> 4': Very dark brown (7.5YR 2.5/3), banded black/reddish brown (5YR 4/4) 6.5': Black (2.5Y 2/0), wet 		1.5 ppm		
10			6		<ul style="list-style-type: none"> Clay (CL), brown (7.5YR 4/3) Foundry Sand (SP), black, wet 		1 ppm		
15		800047	1		<ul style="list-style-type: none"> Silty Clay (CL), dark grey (7.5YR 4/1), moist 13.6': Clay (CL), grey (7.5YR 5/1), roots present, soft, very moist 		1 ppm		
16					<ul style="list-style-type: none"> END OF BORING @ 16' TARGET DEPTH REACHED SHALLOW WELL INSTALLED 		1 ppm		



Boring/Well No.: MW-04250

Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 585.12'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/15/98 - 09/15/98	Total Depth: 14.00'
Depth to First Encountered Groundwater: 9.80'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.5' to: 5.37'	Remarks: Top of Casing Elevation: 587.57'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 5.37' to: 9.96'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
0		B00021	15		Sand (SP), olive brown (2.5Y 4/4) to black (2.5Y 2/0), moist (from early morning rain), interbedded foundry sand and native sand		1 ppm		
3.4			34		B00022: Duplicate sample				
3					⊙ 3': Light olive brown (2.5Y 5/6)		1 ppm		
5		B00023	52		⊙ 4.8-4.9': Coarse gravel layer		2 ppm		
2.5			25		⊙ 4.9': Gravelly Sand (SP), very coarse, very dark greyish brown (2.5Y 3/2), probably foundry sand/slag				
3.1			31		Interbedded Sand and Silty Sand (SP/SM), light olive brown (2.5Y 5/6) and (black 2.5Y 2/0), wet		2 ppm		
10			4		Foundry Sand (SP), black (2.5Y 2/0), moist		1 ppm		
0		B00024	0		Silty Clay (CL), black (2.5Y 2/0), moist		1 ppm		
11.5					⊙ 11.5': Clay (CL), grey (2.5Y 6/0), moist		1 ppm		
14					• END OF BORING ⊙ 14' • TARGET DEPTH REACHED • SHALLOW WELL INSTALLED				



Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 589.26'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/10/98 - 09/10/98	Total Depth: 28.00'
Depth to First Encountered Groundwater: 7.50'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.1' to: 6.24'	Remarks: Top of Casing Elevation: 591.36'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 6.24' to: 15.98'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
29		B00002	29		Interbedded Foundry Sand, Silty Sand and Clayey Silt (SP/SM/ML) ⊙ 0': Foundry Sand (SP), black (7.5YR 2/0), some fines, fine to medium sand, medium dense, dry		2 ppm		
23			23		⊙ 2': Silty Sand (SM), grey (10YR 5/1), some fines, fine to medium sand, medium dense, dry		1 ppm		
6			6		⊙ 3.5': Sand (SP), black (7.5YR 2/0), dry ⊙ 4': Grey (10YR 5/1), dry		1 ppm		
5					⊙ 5': Clayey Silt (ML), black (7.5YR 2/0), damp, soft		1 ppm		
		B00003	3		⊙ 6': Sand (SP), black (7.5YR 2/0), moist ⊙ 6.5': Clayey Silt (ML), dark grey (10YR 4/1), soft, moist ⊙ 7': Foundry Sand (SP), black (7.5YR 2/0), soft ⊙ 7.5': Sand (SP), pale brown (10YR 6/3), soft, wet ⊙ 8': Fine to medium sand		1 ppm		
10			2				1 ppm		
			0		⊙ 10': Foundry Sand (SP), black (7.5YR 2/0), some fines, very soft, wet ⊙ 11': Sand (SP), brown (10YR 6/3), wet ⊙ 11.5': Clayey Silt (ML), grey (10YR 6/1), wet, roots present ⊙ 12': Foundry Sand (SP), black (7.5YR 2/0), piece of brick in sample, very soft		1 ppm		
			0				1 ppm		
15			2				1 ppm		
			3		⊙ 14.7': Clayey Silt (ML), grey (10YR 6/1), wet, very soft, roots present ⊙ 16': Foundry Sand (SP), black (7.5YR 2/0), moist, some fines ⊙ 16.8-17.3': Clay (CL), dark grey (10YR 4/1) Sandy Silt (ML), grey (10YR 6/1), organic material and sea shells present, moist		1 ppm		
			3		⊙ 18.5': Grey (10YR 6/1), wet, sea shells ⊙ 19': Clayey Silt (ML), dark reddish brown (5YR 3/2), wet		1 ppm		



Boring/Well No.: MW-14831

Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 588.85'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/10/98 - 10/01/98	Total Depth: 38.05'
Depth to First Encountered Groundwater: 7.50'	Borehole Diameter: 8.00in
Well Casing: type: PVC and SS dia: 2.00in fm: -2.5' to: 33.27'	Remarks: Well was installed using stainless steel screen and polyvinyl chloride riser.
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 33.27' to: 37.99'	
Top of Casing Elevation: 591.31'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
5					0-28'--See log of boring MW-04831 for detailed soil descriptions Interbedded Foundry Sand, Silty Sand and Clayey Silt (SP/SM/ML)				
10									
15									
					Sandy Silt (ML)				



Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 588.85'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/10/98 - 10/01/98	Total Depth: 38.05'
Depth to First Encountered Groundwater: 7.50'	Borehole Diameter: 8.00in
Well Casing: type: PVC and SS dia: 2.00in fm: -2.5' to: 33.27'	Remarks: Well was installed using stainless steel screen and polyvinyl chloride riser.
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 33.27' to: 37.99'	Top of Casing Elevation: 591.31'

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
					Clayey Silt (ML)				
					Sand (SP)				
					Clay (CL)				
			9		● 28': Grey (10YR 5/1), stiff, gravel present, moist		1 ppm		
30			10				1 ppm		
			3		● 33': Very soft to firm, damp		1 ppm		
			0		● 34'5": Very soft, wet		1 ppm		
35		B00019-T	NA		B00019-T: Shelby tube sample				
					<ul style="list-style-type: none"> • END OF BORING ● 38' • TARGET DEPTH REACHED • INTERMEDIATE WELL INSTALLED 				



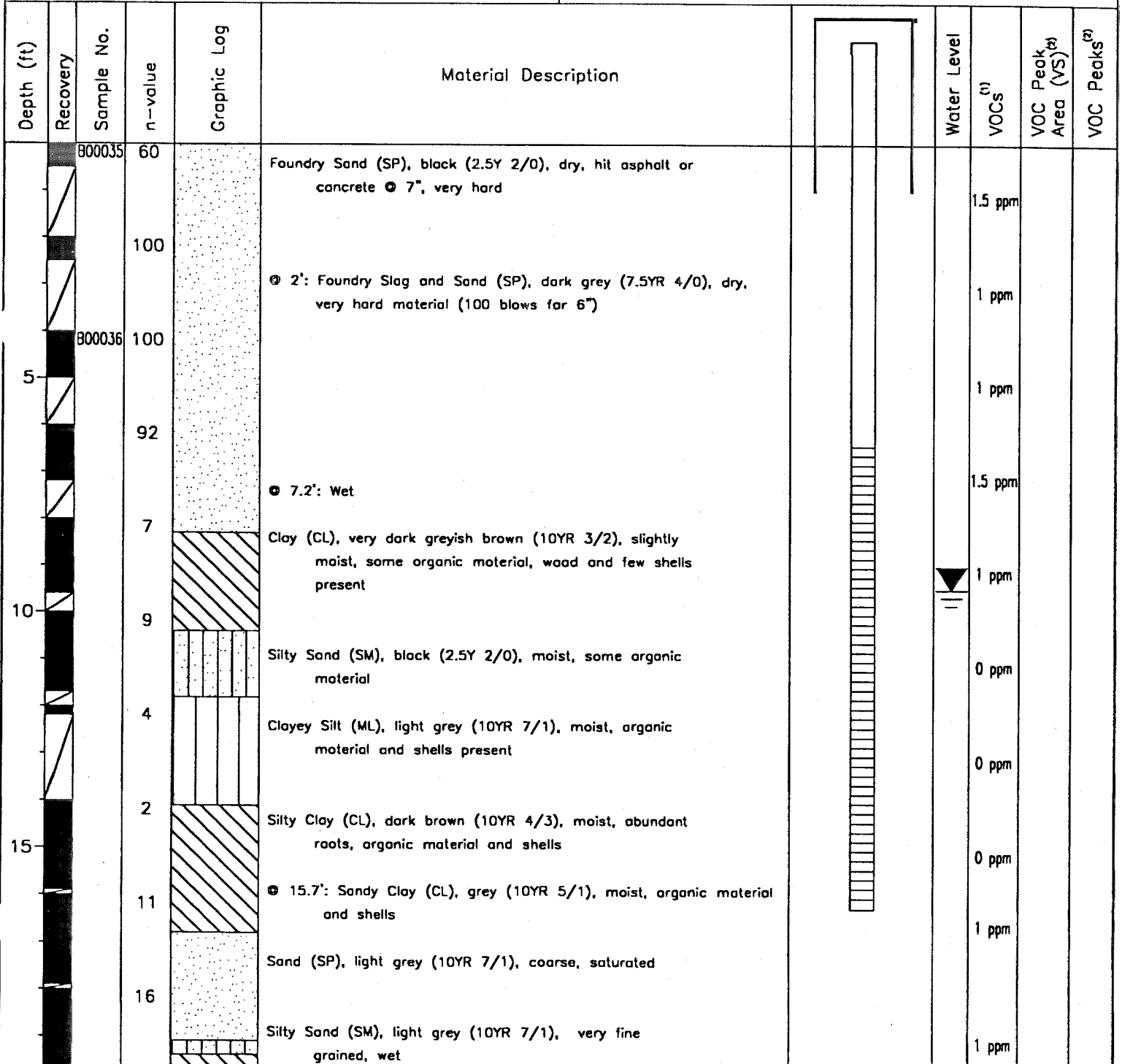
Boring/Well No.: MW-05036

Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 589.55'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: CET	Easting:
Logged By: SMC	Northing:
Drilled By: CET	Drilling Method: Hollow Stem Auger
Date(s): 10/30/98 - 10/30/98	Total Depth: 32.00'
Depth to First Encountered Groundwater: 7.10'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.4' to: 5.94'	Remarks: Top of Casing Elevation: 591.95'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 5.94' to: 15.68'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
10		B00148	10	[Stippled pattern]	Foundry Sand (SP), black (2.5Y 2/0), medium dense, moist ● 7.1': Wet				
16			16	[Stippled pattern]			1.5 ppm		
16		B00149	16	[Stippled pattern]			2.8 ppm		
5			9	[Stippled pattern]			2 ppm		
6			6	[Stippled pattern]			1 ppm		
10			3	[Stippled pattern]					
22			22	[Stippled pattern]					
33			33	[Stippled pattern]					
37			37	[Stippled pattern]					
3			3	[Vertical lines pattern]		Silty Sand (SM), dark grey (7.5YR 4/1), loose, wet		0 ppm	



Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 590.72'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/16/98 - 09/16/98	Total Depth: 22.00'
Depth to First Encountered Groundwater: 9.50'	Borehole Diameter: 8.00in
Well Casing: type: SS dio: 2.00in fm: -2.2' to: 6.44'	Remarks: Top of Casing Elevation: 592.92'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 6.44' to: 16.23'	





Project Name: Phase 1A Investigation Project Number: 84068-063.009	Location: Saginaw Metal Casting Operations-Saginaw, MI Ground Elevation: 588.88'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: CET	Easting:
Logged By: SMC	Northing:
Drilled By: CET	Drilling Method: Hollow Stem Auger
Date(s): 09/21/98 - 09/21/98	Total Depth: 10.00'
Depth to First Encountered Groundwater: 4.50'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.2' to: 3.71'	Remarks: Top of Casing Elevation: 591.11'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 3.71' to: 8.50'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
0		800064	5		Foundry Sand (SP), black (2.5Y 2/0), very loose, dry		1 ppm		
1.8					• 1.8-2': Native Sand (SP) layer, loose, slightly moist				
2					• 2': Foundry Sand (SP), black, medium dense, moist		3 ppm		
5		800065	2		Clay (CL), dark grey (7.5YR 4/1), very soft, moist		3 ppm		
5.5					• 5.5': Organic material present		2 ppm		
8		800066	5		• 8': Mottled strong brown (7.5YR 5/6) and grey (7.5YR 5/1), soft to firm, moist		3 ppm		
10					• END OF BORING • 10' • TARGET DEPTH REACHED • SHALLOW WELL INSTALLED				



Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations--Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 594.73'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 09/30/98 - 09/30/98	Total Depth: 54.00'
Depth to First Encountered Groundwater: 48.80'	Borehole Diameter: 8.00in
Well Casing: type: PVC and SS dia: 2.00in fm: -2.5' to: 48.10'	Remarks: Well was installed using stainless steel screen and polyvinyl chloride riser.
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 48.10' to: 52.70'	
Top of Casing Elevation: 597.18'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description	Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
0-18'		B00015-T	20		0-18'--See log of boring MW-05450 for detailed soil descriptions Silty Sand (SM) B00015-T: Brass tube sample				
5					Sand (SP)				
10					Clay (CL)				
15		B00016-T	NA		B00016-T: Shelby tube sample				
15			15		● 18': Greyish brown (10YR 5/2), stiff to very stiff, moist				



Boring/Well No.: MW-15457

Project Name: Phase 1A Investigation	Location: Saginaw Metal Casting Operations-Saginaw, MI
Project Number: 84068-063.009	Ground Elevation: 589.72'
Client: General Motors Corporation	Datum: NAVD '88
Contractor: EFD	Easting:
Logged By: SMC	Northing:
Drilled By: EFD	Drilling Method: Hollow Stem Auger
Date(s): 10/14/98 - 10/14/98	Total Depth: 18.00'
Depth to First Encountered Groundwater: 7.50'	Borehole Diameter: 8.00in
Well Casing: type: SS dia: 2.00in fm: -2.5' to: 5.09'	Remarks: Top of Casing Elevation: 592.18'
Screens: type: Slotted size: 0.010in dia: 2.00in fm: 5.09' to: 9.68'	

Depth (ft)	Recovery	Sample No.	n-value	Graphic Log	Material Description		Water Level	VOCs ⁽¹⁾	VOC Peak Area (VS) ⁽²⁾	VOC Peaks ⁽²⁾
0-16'					<p>--See log of boring MW-05457 for detailed soil descriptions</p> <p>Foundry Sand (SP)</p> <p>B00027T: Brass tube sample</p>					
4		B00027-T								
5										
					Clay (CL)					
10										
15			NA		<p>• 14': Attempted to collect Shelby tube sample; no recovery</p>					
18					<p>• 16': Brown, stiff, moist</p> <p>• END OF BORING • 18'</p> <p>• TARGET DEPTH REACHED</p> <p>• SHALLOW WELL INSTALLED</p>					

STRATIGRAPHY LOG (OVERBIDDEN)

PAGE 1 OF 1

PROJECT NAME Weldular
 PROJECT NUMBER _____
 CLIENT _____
 LOCATION _____

DREILING CONTRACTOR _____
 DRILLER _____
 SURFACE ELEVATION _____
 WEATHER (A.M.) _____
 (P.M.) _____

HOLE DESIGNATION MW-8R
 DATE/TIME STARTED _____
 DATE/TIME COMPLETED 10/23/18
 DRILLING METHOD _____
 CRA SUPERVISOR _____

SAMPLE DESCRIPTION

SAMPLE DETAILS

DEPTH IN FT./m BGS	STRATIGRAPHIC INTERVALS	ORDER OF DESCRIPTORS: SOIL TYPE SYMBOL(S) - PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT)	SAMPLING METHOD	SAMPLING DEPTH	PENETRATION RECORD SPLIT SPON BLOWS (RECORD 1-ALUBS & RECOVERIES)					SAMPLING INTERVAL	P/F/D (ppm)	CHEMICAL ANALYSIS	GRAIN SIZE	
					6"	6"	6"	6"	N					R
0	0	SP - sand / fine to med grain / poorly sorted / coarse pebbles (fill)												
6	7	wet seam												
7	9 1/2	no debris, only sand fill												
9 1/2	10	sand + gravel seam, grey, wet												
10	13	mix of SP-sand + SM-silty sand, moist to wet, black/grey												
13	15	ML - silty sand, shells + organic matter, wet, grey, soft												

DEPTH OF BOREHOLE CAVING _____
 WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____
 DEPTH OF FIRST GROUNDWATER ENCOUNTER _____
 TOSOL THICKNESS _____
 COMPLETION DETAILS: _____
 NOTE: FOR EACH SPLIT-SPON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.
 NOTES: 4 refusals at old MW location - moved approx. 20' east



STRATIGRAPHY LOG (VERBODEN)

PROJECT NAME Nodular
 PROJECT NUMBER _____
 CLIENT _____
 LOCATION _____

DRIILING CONTRACTOR _____
 DRILLER _____
 SURFACE ELEVATION _____
 WEATHER (A.M.) _____
 (P.M.) _____

HOLE DESIGNATION MW05038
 DATE/TIME STARTED _____
 DATE/TIME COMPLETED 10/24/18
 DRILLING METHOD _____
 CRA SUPERVISOR _____

SAMPLE DESCRIPTION

SAMPLE DETAILS

DEPTH IN FT./M	STRATIGRAPHIC INTERVALS	ORDER OF DESCRIPTORS: PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SOIL TYPE SYMBOL(S), RELATIVE DENSITY/CONSISTENCY, SECONDARY COMPONENTS, GRADATION/STRUCTURE, COLOUR, GRAIN SIZE/PLASTICITY, SUPPLEMENTARY DESCRIPTORS	MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS	NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL. (INDICATE IF MOISTURE WAS ADDED OR NOT)	SAMPLING METHOD	PENETRATION						SAMPLING METHOD	P / I F I D (ppm)	CHEMICAL ANALYSIS	GRAIN SIZE	
						6"	6"	6"	6"	N	R					
0	11/2	SP-sand, black, dry, concrete pieces														
11/2	3	SP-sand, tan, dry, (fill)														
3		SP-sand black, moist, med grain, trace concrete pieces (fill)														
11/2	13	wet														
13	14	Sim-silt, sand, black, fine moist to wet														
14	18	M-L sandy silt, grey, wet to moist, fine														
18	20	CL - sandy clay, med to med grey, sandy														

DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____
 WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____ AFTER _____ HOURS _____
 COMPLETION DETAILS: _____
 NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.

NOTES AND COMMENTS



Attachment 3

2009 Mixing Zone Determination Request

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Eric Alexander
Surface Water Quality Assessment Section
Water Bureau

FROM: Liane J. Shekter-Smith, P.E., Assistant Division Chief
Waste and Hazardous Materials Division

DATE: **October 1, 2009**

SUBJECT: **General Motors, SMCO**
Mixing Zone Determination Request, **Saginaw Bay** District

General Information

We are requesting a mixing zone determination for the above referenced facility, located in the **SW** 1/4 of the **SE** 1/4 of **Section 07**, **SE** 1/4 of the **SE** 1/4 of **Section 07**, **SW** 1/4 of the **SW** 1/4 of **Section 07**, **NW** 1/4 of the **NW** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NW** 1/4 of the **NW** 1/4 of **Section 17**, **T12N**, **R 5E** in **Saginaw County**.

WHMD or U.S. Environmental Protection Agency Contact Person: **Ron Stone** Phone #: **517-373-7141**

District Supervisor/Unit Chief: **Virginia Himich**

Phone #: **517-373-7974** FAX #: **517-373-4797**

Priority: (to be filled out by the Assistant Division Chief)

four week response eight week response

Facility Information

1. Please advise of the name of the receiving water body and the location of the venting groundwater contaminant plume; the map is attached. Please indicate if the discharge is to a public recreational area, a Great Lake, an inland lake or a wetland.

Saginaw River

- a. This is a new, increased, or existing discharge. If new or increased discharge, see Attachment 3.

- b. This is a discharge to a Great Lake, Inland Lake or wetland, not applicable.
- c. Is human body contact expected in the receiving water? yes no

2. General information regarding the origin of the pollutants. This includes the location, nature, and chemical characteristics of the source of the groundwater contamination plume(s):

Saginaw Metal Casting Operations (SMCO) Facility or the former Nodular Iron Foundry. Ammonia and pH have been reported above GSI criteria in groundwater samples from monitoring wells located next to the Saginaw River.

Technical Information

3. The name; Chemical Abstract Service (CAS) Number; worst case maximum concentration of contaminants reaching, or predicted to reach; the GSI. Generally, the highest concentration of the contaminant found in the groundwater would be appropriate to represent the worst case maximum. If source contaminants have not yet reached the groundwater but are expected to do so, source concentrations should be identified and noted as such.

Chemical or General Chemistry Parameter	CAS #	Worst Case Maximum GSI Discharge Concentration	Average Surface Water Conc. Upstream (if available)
pH	NA	5.39 (low)	NA
pH	NA	10.89 (high)	
Ammonia	7664-41-7	9.45 mg/L	NA

4. The maximum discharge rate of the venting groundwater contaminant plume in cubic feet per second. The maximum discharge rate must be recorded in the Request Form to ensure protection from acute effects to aquatic life. More than just the rate should be included here; all calculations need to be shown.

Please see Table 1 for a breakdown of the discharge rate calculations of the venting groundwater plume. Figures 1 and 2 attached show the approximate reaches of

groundwater venting for ammonia and pH, including their longitudinal distances as well as approximate saturated zone thicknesses.

The hydraulic conductivity of the fill material and the hydraulic gradient used in these calculations was 2.2×10^{-1} cm/s (0.0072 ft/s) and 0.016 (ft/ft) respectively and the hydraulic gradient represents the gradient directly adjacent to the Saginaw River (CRA, 2007).

Based on the calculations shown in Table 1, the maximum discharge rate for ammonia is calculated to be 2.53 ft³/s. For high pH the maximum discharge rate is 0.76 ft³/s and for low pH the maximum discharge rate is 2.05 ft³/s.

5. The location of other contaminant plumes entering the receiving surface water body, their constituents and concentrations, if available:

Attachments

cc:

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Equation Used:

Darcy's Law: $Q = KiA$

Where: Q = discharge [ft³/s]
 K = hydraulic conductivity [ft/second]
 i = hydraulic gradient [ft/ft]
 A = cross sectional area of saturated fill [ft²]

Darcy's Law Parameters:

1.) Hydraulic Gradient, i

- a) Calculated i at river location (close to MW-03746, using Figure 3.7)
 change in total head: 585 feet - 581 feet = 4 feet
 length over this head interval: (0.8 cm x (500'/1.3 cm)) = 307.7 feet
 $i = (4' / 307.7') = 0.013$

- b) Calculated i immediately adjacent to Saginaw River = 0.016

Source:

CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

The hydraulic gradient used for calculations was 0.016, as it is a more conservative estimate.

2.) Hydraulic Conductivity, K

- a) Calculated K in the fill material = 2.2×10^{-1} cm/s = 0.0072 ft/s

Source:

CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

3.) Height (average) of saturated fill material (used in cross sectional area calculation)

- a) Based on elevation values taken from Figures 3.5 and 3.7

Figure 3.7: <u>Water Level (feet)</u>	Figure 3.5: <u>Top of Native Clay (feet)</u>	<u>Thickness of Saturated Layer (feet)</u>
584	578	6
581	572	9
582.45	565.46	16.99
580.54	571.94	8.6
585	580	5
Average Thickness:		9.1

** Please note that this value of 9.1 feet is used for all calculations except for pH-low. The closest saturated thickness data for this area yields 16.9 feet, so a thickness of 17 feet was used as average in that case.

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Parameter:

Ammonia

Part 1 - See Figure 2

Length of discharge zone: (10.7 cm x (200 ft/1.3 cm)) = 1646 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Max. Discharge Rate, Q = 1646 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 1.73 ft³/s

Part 2 - See Figure 2

Length of discharge zone: (5.0 cm x (200 ft/1.3 cm)) = 769 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Max. Discharge Rate, Q = 769 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 0.81 ft³/s

Total Max. Discharge Rate: 2.53 ft³/s

pH - High

See Figure 2

Length of discharge zone: (4.7 cm x (200 ft/1.3 cm)) = 723 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Total Max. Discharge Rate, Q = 723 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 0.76 ft³/s

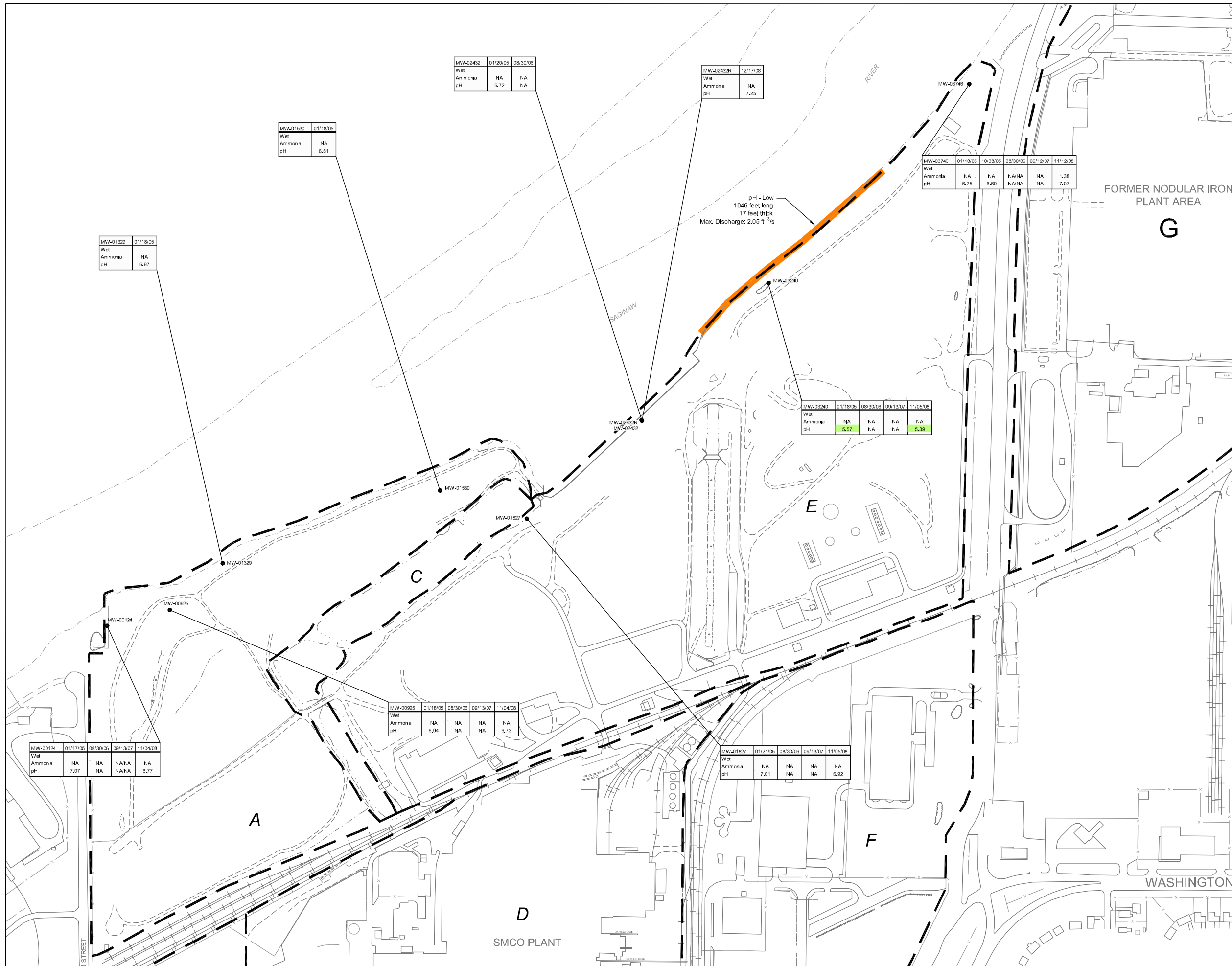
pH - Low

See Figure 1

Length of discharge zone: (6.8 cm x (200 ft/1.3 cm)) = 1046 ft
 Average thickness of zone: 17 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

**Note average thickness of zone in this location is 17 ft, not 9.1 ft

Total Max. Discharge Rate, Q = 1046 ft x 17 ft x 0.0072 ft/s x 0.016 = 2.05 ft³/s



LEGEND

- A --- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- MW-04785 ● INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- Orange bar pH

		SAMPLE LOCATION			
		01/18/05	08/30/06	09/13/07	11/05/08
		SAMPLE DATE			
		NA	NA	NA	NA
		RESULT (mg/L) EXCEPT pH WHICH IS uL			
		5.57	NA	NA	5.39
		PARAMETER			
		EXCEEDS CRITERIA			
		NA NOT ANALYZED			

Chemical Name	GS1 Criteria	Criteria unit
Wet	2.12	mg/L
Ammonia	6.5 • 8.0	uL

NOTE:

1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHROMIUM) FOR UNIONIZED AMMONIA IS 89 uL. FOR WARM WATER SURFACE WATER (SEE FOOTNOTE 02 OF THE PART 201 CLEANUP CRITERIA PART 213 RELEASED SCREENING LEVELS REGULATORY MEMORANDUM NO. 1, DATED DECEMBER 16, 2004), THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 429 uL. (PROVIDED TO CRA BY MDEQ ON MARCH 2, 2007 REGARDING A NEARBY FACILITY).

BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1982-2009) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONITORING PERIOD ARE 12.3 DEGREES CELSIUS AND 8.1 UNITS, RESPECTIVELY (USGS GAUGE 04151006 SOURCE: HTTP://WWW.WATERDATA.USGS.GOV/WWW/). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREES CELSIUS, APPROXIMATELY 23 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RELATIVE TO A TOTAL AMMONIA GENERIC GSI CRITERION (CHROMIUM) OF 2,120 uL (89 uL / 0.042).

THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREES CELSIUS, APPROXIMATELY 23 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 238 uL (8,455 uL X 0.028) FOR THE NOVEMBER 2008 EVENT.

2. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHROMIUM VALUE CALCULATION FOR TRIVALENT CHROMIUM, AS SPECIFIED IN THE MDEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM WAS SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

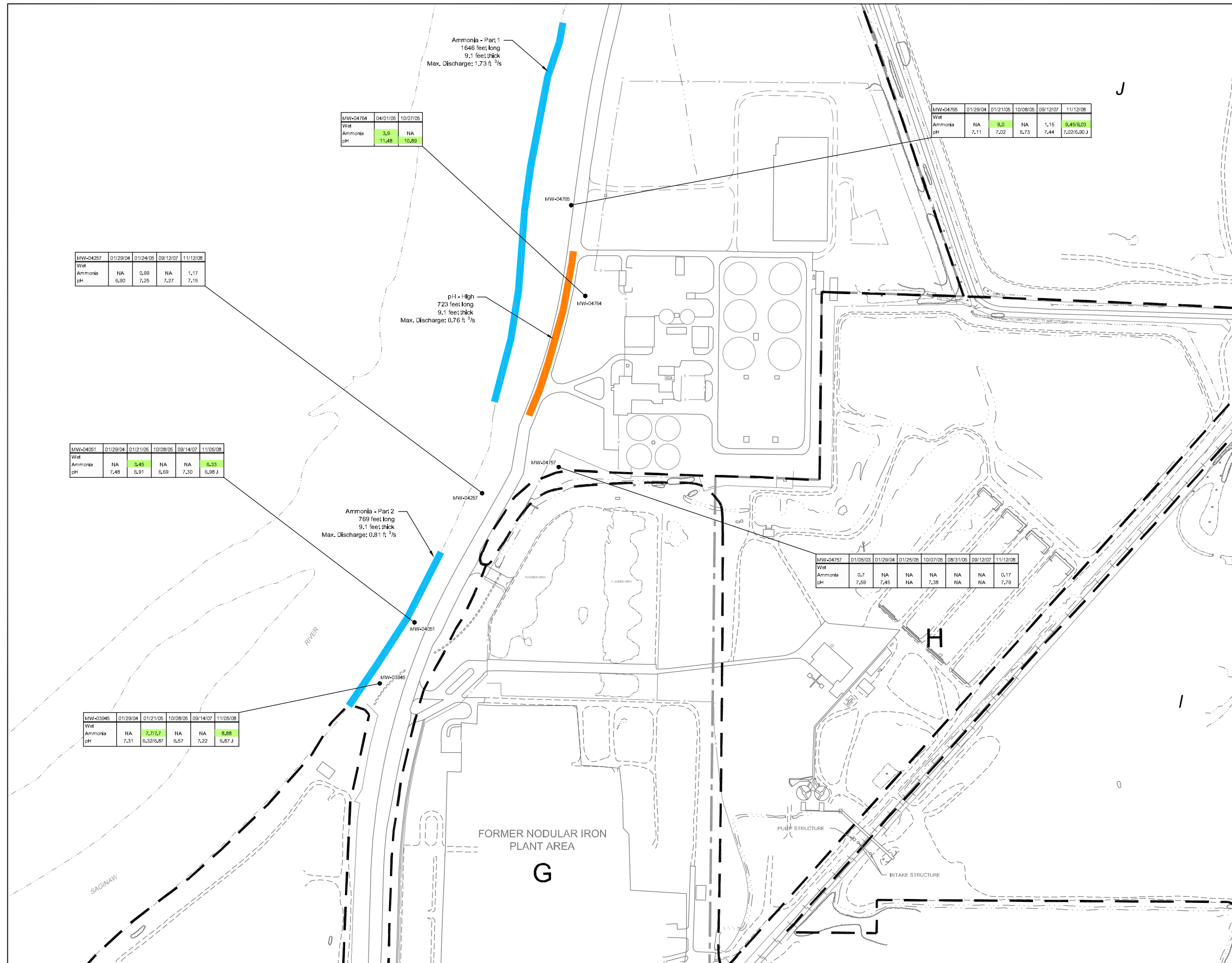
GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS
SAGINAW, MICHIGAN
SUMMARY OF GSI LOCATIONS WEST OF VETERANS
MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY
2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:
M.T.	I.R.	OCTOBER 2009
Scale:	Project N°:	Report N°:
1"=200'	17075-12	MEMO023
		Drawing N°:
		figure 1

17075-12(MEMO023)GH-WA004 OCT 09/2009



LEGEND

- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- MW-04755 • INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- Orange line pH
- Blue line AMMONIA

SAMPLE LOCATION

MW-04754	04/01/05	10/07/05
Wet		
Ammonia	3.9	NA
pH	11.48	10.89

EXCEEDS CRITERIA (Green)
NA NOT ANALYZED

Chemical Name	GSI Criteria	Criteria Unit
Wet		
Ammonia	2.12	mg/L
pH	6.5 - 8.0	unit

NOTE:
1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHRONIC) FOR UNIONIZED AMMONIA IS 59 µg/L FOR WARM WATER SURFACE WATER. SEE FOOTNOTE C OF THE PART 201 CLEANUP CRITERIA PART 213 RISK-BASED SCREENING LEVELS RFD OPERATIONAL, MEMORANDUM DATED DECEMBER 18, 2004. THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 420 µg/L PROVIDED TO EPA BY MODEL ON MARCH 2, 2007 REGARDING A NEARBY FACILITY.
BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1981-2002) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONTHS (SEPTEMBER) ARE 12.3 DEGREES CELSIUS AND 8.0 UNITS, RESPECTIVELY (USGS GAUGE 04157000 SOURCE: HTTP://WWW.WATERDATA.USGS.GOV/MWBSON). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREES CELSIUS, APPROXIMATELY 2.3 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RESULTING IN A TOTAL AMMONIA GENERIC GSI CRITERION (CHRONIC) OF 2.12 µg/L (89 µg/L (6.025)).
THEREFORE, FOR A PH OF 9 AND A TEMPERATURE OF 12.3 DEGREES CELSIUS, APPROXIMATELY 2.3 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 238 µg/L (9.459 µg/L X 25) FOR THE NOVEMBER 2030 EVENT.

2. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHRONIC VALUE CALCULATION FOR TRIVALENT CHROMIUM AS SPECIFIED IN THE ADEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM IS STILL SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

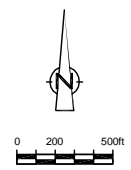
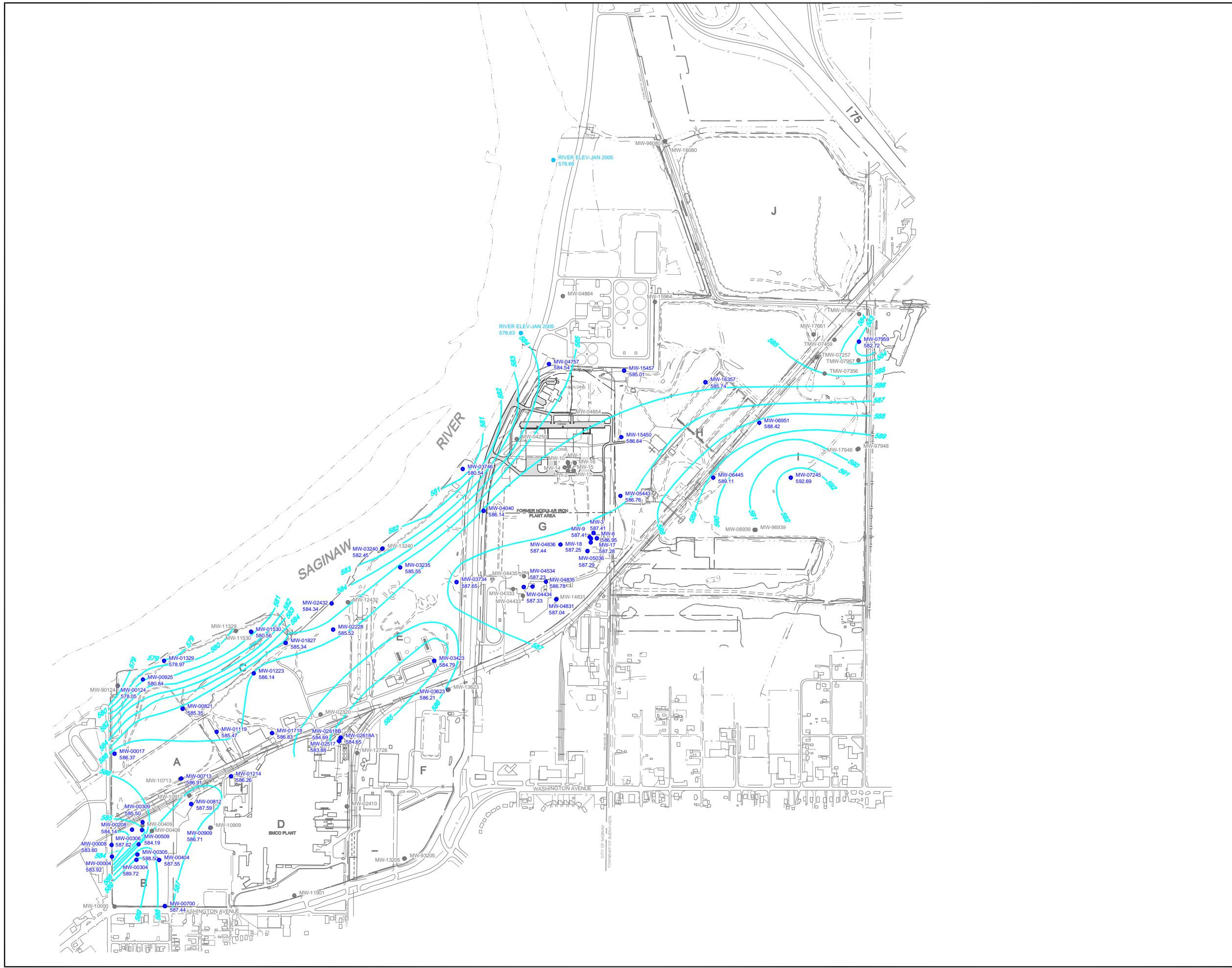
GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS
SAGINAW, MICHIGAN
SUMMARY OF GSI LOCATIONS EAST OF VETERANS
MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY
2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:
M.T.	I.R.	OCTOBER 2009
Scale:	Project N°:	Report N°:
1"=200'	17075-12	MEMO023
		Drawing N°:
		figure 2

17075-12(MEMO023)GH-WA005 OCT 09/2009



- LEGEND**
- 500' GROUNDWATER ELEVATION FT. AMSL (NAVD 88)
 - MW-07245 (592.68) EXISTING MONITORING WELL WITH GROUNDWATER ELEVATION (JANUARY 2005)
 - MW-17661 EXISTING MONITORING WELL

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



**GENERAL MOTORS CORPORATION
SAGINAW METAL CASTING OPERATIONS**

SAGINAW, MICHIGAN

**UPPER WATER BEARING ZONE
GROUNDWATER CONTOUR MAP**



Source Reference:

Project Manager: I.R.	Reviewed By: M.T.	Date: FEBRUARY 2007
Scale: 1" = 500'	Project No: 17075-16	Report No: 027
		Drawing No: figure 3.7

Attachment 4

Ecological Screening Assessment



Memorandum

January 4, 2019

To: Zack Sasnow *Daniel W Smith* Ref. No.: 058502

From: Daniel Smith/kf/34

CC: Dave Favero, Michael Tomka,
John-Eric Pardys

Subject: Ecological Screening Assessment for Isolated Wetlands Recently Formed in IU G

1. Introduction

This memorandum presents a streamlined ecological risk assessment (ERA) for several small isolated wetlands that have recently formed at the southern end of Investigation Unit G (IU G) at RACER's Saginaw Nodular Industrial Land (Site) in Saginaw, Michigan. These wetlands developed in the last 6 years, in the footprint of the former Nodular Iron Plant and just south of that footprint (Figure 1). The wetlands appear to have been inadvertently produced by altered drainage and subsequent ponding of perched water that has occurred due to demolition of the Nodular Iron Plant in the early 2000s (including shutting down of dewatering associated with the former Plant) and shutting off sumps that previously pumped water from these general areas to the Secondary Pond in 2012.

As with the recent ecological risk analysis for the Secondary Pond (GHD 2017), this document does not follow the standard United States Environmental Protection (USEPA) ERA process (e.g., USEPA 1997). The intent of this analysis is different from a typical ERA. A typical ERA deals with a natural ecosystem (e.g., an aquatic area, wetland, or terrestrial habitat) that has been contaminated by chemicals. For this typical situation, the goal of an ERA and subsequent remediation is to return an area to its original ecosystem with acceptable risks from historical chemical contaminants. However, the newly formed wetlands are neither natural ecosystems nor are they very good wetland habitats (see discussion below). In addition, RACER's goal is for the area to be redeveloped. In this case, the newly formed wetlands will be filled and or altered. In fact, the wetlands were discovered as part of a potential sale and redevelopment of the area that was ultimately not completed. Thus, the goal of this streamlined ERA is not a return to a natural state but prevention of significant toxic effects until the Site is redeveloped.

The following figures, tables, and attachments were prepared in support of this ecological screening assessment for isolated wetland recently formed in IU G:

Figure 1 – Investigative Unit G – South Wetland Evaluation Biological Zone Samples (0-2 feet [ft])

Figure 2 – Investigative Unit G – South Wetland Evaluation PCB Concentrations - Biological Zone (0-2 ft)



Table 1 – Screening of Risk to Aquatic Invertebrates

Table 2 – Screening of Risk to Wetland Plants

Table 3 – Exposure to Insectivores

Table 4 – Exposure Concentrations

Table 5 – Summary of Food Chain Model for Tree Swallow

Table 6 – Summary of Food Chain Model for Brown Bat

Attachment A – Wetland Description

1.1 Background

IU G was formerly the location of the Nodular Iron Plant, but in the early 2000s, the plant was demolished. As part of the General Motors Corporation (GMC) bankruptcy, a portion of IU G (southern half), as presented in Figure 1, became the responsibility of RACER. RACER's portion of IU G is approximately 1,300 ft by 1,800 ft, for a total area of approximately 54 acres. Following the demolition of the former Nodular Iron Plant, the remaining concrete floor slab was covered with clean fill (foundry sand) and revegetated (Exponent 2007). Exponent (2007) completed an ERA for the entire Nodular Site, including this portion of IU G. As described therein, in 2007, the vegetation in IU G was in the early stages of old field succession. In the original ERA, the biological habitat of IU G was considered too poor to warrant consideration (Exponent 2007). At that time, the very southern edge of IU G, just south of the Nodular Plant footprint, contained a "a small, isolated, low-lying area that was periodically wet and supported some wetland vegetation (e.g., cattails, *Typha angustifolia*)" (Exponent 2007). However, the ERA stated that this low-lying area was nonetheless poor terrestrial habitat that did not support aquatic habitat. Thus, this area was not considered in the Exponent ERA.

Since the completion of the ERA in 2007, sumps that dewatered the area were 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. With the collection of water in the low lying areas, the haul road, which provides access for GM to their landfill to the north, was built-up. Over the last decade or so, this ponded water has produced hydric soils and promoted dominance by wetland vegetation. In 2015, a wetland survey of the area, as required by MDEQ to support a proposed development, determined that several small isolated wetlands had formed (Niswander 2015, Attachment A). 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. 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.

According to the wetland scientists (Niswander 2015), the newly formed wetlands are considered to be of "moderate to moderately low quality because of recent disturbance (i.e. the wetlands have developed since the demolition of the pre-existing buildings and infrastructure on the Site) and contain an abundance of invasive vegetation such as Phragmites (*Phragmites australis*), red top



(*Agrostis gigantea*), narrow-leaved cattail (*T. angustifolia*), and purple loosestrife (*Lythrum salicaria*).”

The wetlands are described in greater detail in Attachment A.

As noted above, the 2007 ERA did not consider potential ecological risks in this area because highly disturbed, abandoned industrial uplands have minimal ecological value. However, wetlands, even mediocre and low quality wetlands, are typically accorded more public protection than uplands. Consequently, now that some of IU G has transitioned to wetlands, it appears necessary that potential ecological risks should be considered in these newly formed wetlands.

The following is a streamlined ERA of these newly formed wetland areas. As with the analysis of the secondary ponds, this analysis takes a streamlined approach that does not include the very conservative preliminary steps in the ERA process. The wetlands are not natural and have a low ecological value because they are small and isolated from surface waters. In addition, RACER’s goal is for this land to be redeveloped, in which case the wetlands will be filled and/or drained. Thus, the intent of the following analysis is to determine whether acute ecological impacts, if any, are likely.

2. Investigation Summary

2.1 RCRA Facility Investigation

The RFI was conducted by GMC in several phases between 1998 and 2007 in accordance with a June 2, 1995 unilateral order from EPA. The purpose of the RFI was to (i) define the nature and extent of contamination that may be impacting human health and the environment; (ii) focus investigation activities such that the subsequent phases becoming increasingly specific and data quality is sufficient to support the RFI baseline risk assessments; and (iii) collect data sufficient to support Corrective Measures Study. The results of the investigations were submitted to EPA in the Phase 1C RFI in March 2007 and included a human health risk assessment (HHRA) and an ERA (CRA, 2007). Following the bankruptcy, a supplemental RFI report (CRA, 2012) was submitted, which focused on the IUs which were owned by RACER Properties and included sampling results and findings associated with work on-Site since the submittal of the Phase 1C RFI. In addition, the supplemental RFI report included revisions and/or supplements to address EPA comments received in 2007 and 2008 after submittal of the 2007 Phase 1C Report, as appropriate for the Site.

2.2 2015 Additional RFI Investigation

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 purpose of the additional investigation of manganese in soil was to confirm the presence of manganese above MDEQ Part 201 Particulate Inhalation Criteria, and if confirmed, define an area that will require a cover to protect against particulate inhalation exposures and a deed restriction.

The previous exceedance of MDEQ Part 201 Particulate Inhalation Criteria could not be corroborated by additional sampling. All soil samples collected and submitted for analysis of manganese had concentrations



below MDEQ Part 201 Particulate Inhalation Criteria. Therefore, no further action related to manganese was recommended for this area, with the exception of proposed overall Site deed restrictions. The overall Site deed restrictions include restricting future use to non-residential purposes, prohibiting the use of groundwater for potable purpose, properly managing contaminated soil, and properly managing potential vapor intrusion.

PCB concentrations in soil have been delineated to 1 milligrams per kilogram (mg/kg) vertically and horizontally. With the extent of PCBs above 1 mg/kg defined, options for closure include placing a deed restriction, placing a cover, or excavate and disposal of PCB impacted soil above 1 mg/kg.

3. Ecological Evaluation of Recently Formed Wetlands

The wetlands are intermittently inundated. Deeper sections may have one or more feet of water during wet seasons, but all are usually without standing water during late summer and droughts. The lack of permanent standing water precludes establishment of fish fauna and of longer-lived aquatic invertebrates. Thus, the primary ecological receptors in these wetlands are wetland plants, shorter-lived aquatic invertebrates, and predators that consume these invertebrate fauna. Exposure media are, therefore, chemicals in soil/sediments and in the aquatic biological tissue for bioaccumulating substances. Assessment endpoints for the ecological evaluation are wetland plants and benthic aquatic organisms, facing direct exposure to chemicals in soils/sediments. The evaluation also considers potential risks to populations of vertebrate predators of the aquatic invertebrates, exposed to chemicals via bioaccumulation pathways. Risks to these ecological receptors via these exposure media will be considered in the ecological evaluation below.

There are also other exposure media and less exposed receptors that will also be tacitly considered. Thus, chemicals desorb and solubilize from the soils/sediments into overlying surface water and then pose direct exposure to aquatic invertebrates living in the water column (e.g., mosquito larvae) or attached to plants (e.g., beetle and dragonfly larvae). However, exposures of water column species to chemicals desorbed from underlying soils/sediments to surface water are typically considerably lower than chemical exposures to benthic invertebrates, living in or on those contaminated soils/sediments. There may also be amphibians breeding in the wetlands. Again, however, amphibians are water column biota, and their exposures to chemicals in soils/sediments are also assumed to be less than those for aquatic benthos. Similarly, herbivorous wildlife may also be exposed to chemicals bioaccumulated by wetland plants. However, the plant bioaccumulation pathway is generally much less efficient than the bioaccumulation pathway from chemicals in soil/sediments to soil/sediment invertebrates. Thus, risks to herbivorous wildlife feeding on wetland plants are assumed to be less than those for predators of benthic invertebrates.

Previous soil sampling of IU G included surface soil samples, usually 0 to 2 feet below ground surface (ft bgs), as well as deeper samples that went 10 or more feet below ground surface. Because exposures to ecological receptors are limited to surface strata of soils/sediments, only data from the very surficial samples are considered.

3.1 Risks to Aquatic Benthos

To screen for risks to aquatic benthos, the surface soil/sediment data were screened against the following ecological screening values (ESVs) that are typically used to assess direct toxicity to benthos. These were



the same ESVs used in the recent screening of potential risks in the Secondary Ponds. Non-polar organics were screened against Final Chronic Values (FCVs) produced in USEPA (2003 and 2008). Because several non-polar organics were detected and these pose additive toxicity, the FCVs for individual chemicals were conservatively divided by 10 to produce ESVs that account for potential additive toxicity. When converted to bulk soil/sediments concentrations with equilibrium partitioning, FCVs require knowledge of the organic carbon (OC) concentrations. OC was not assayed in wetland soils/sediments. However, a reasonable value of 2 percent was assumed because wetland soils/sediments tend to have high levels of OC.

Metals, polychlorinated biphenyls (PCBs), and Total polycyclic aromatic hydrocarbons (PAHs) were screened against Probable Effects Concentrations (PEC), which are recommended by the Michigan as indicators of potential toxicity to aquatic benthos¹. As a third choice of sediment ESVs, Region 4 ESVs were used. Because the intent of this screening is to assess real potential for toxicity, Region 4's less conservative refinement values were used if they were available. If none of these sources had an ESV, then Dutch Maximum Permissible Concentrations (MPC) for sediments were used (Crommentuijn et al. 1997)².

Screening of risks was based on the widely used quotient method, in which an ecological screening quotient (SQ) for each chemical is estimated as:

$$SQ = \frac{EEC}{ESV}$$

where EEC is the estimated exposure concentration and ESV is the ecological screening value, which is also a concentration. In the following analyses, the EEC and SQ values are based on both the maximum and mean concentrations of each chemical. In addition to SQ values, screening tables also provide the frequency of exceedance (FOE), the proportion of samples that exceeded the ESVs. Assuming that samples are reasonably dispersed in space, the FOE is an index of the percent of area that could be potentially problematic. For sedentary and non-motile biota, such as plants and benthic invertebrates, the FOE may be a useful indicator of potential risks to the populations. Screening tables also provide summary information about samples, such as number of samples, frequency of detection, maximum and mean concentrations.

The screening results of wetland soils/sediments are presented in Table 1. As shown, there are occasional exceedance of ESVs for a few metals (chromium and manganese), individual PAH compounds, PCBs, and phenol. However, none of these exceedances are considered ecologically significant for several reasons. First, the exceedances are generally limited to a small number and percentage of samples representing a relatively small proportion of the wetland area. Second, the exceedances are generally attributable to the conservativeness of the ESVs rather than actual potential for harm. Thus, chromium III is typically very

¹ For assessing risks additive risks from all PAHs, the PEC for total PAH was used. For this screening, total PAHs concentrations were estimated as the sum of anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene. These are the PAH compounds that have single PAHs PECs in the source document for PECs.

² The MPCs are estimated as the maximum amount of a metal that could be added to background concentrations without causing toxicity to most species. The derivation of the Netherlands MPCs is transparent, and it is well described in the source document (Crommentuijn et al., 1997). The Netherlands values also specifically incorporate background concentrations. These values are primarily based on direct toxicity, although potential toxicity via bioaccumulation pathways is a minor part of the derivation.



insoluble and not toxic in sediments below about 1000 mg/kg (Berry et al. 2004), far above the PEC value of 110 mg/kg. Similarly, the manganese ESV is a problematic co-occurrence sediment quality benchmark, rather than one based on bioassays. Still the manganese concentrations marginally exceed this conservative value, and manganese was above its ESV in only 22 percent of samples. This frequency of exceedance (FOE) was not considered meaningful because it is only slightly above a widely used threshold, 20 percent, for *de minimis* ecological effects (Suter et al. 1995, 2000; Henning and Shear 1998). In addition, for those samples that exceed the ESV, the negligible magnitude of exceedance of this conservative ESV suggests that risks from manganese can also be dismissed.

PCB concentrations also exceeded the PEC. However, it is well known that PCBs are not very toxic to benthic invertebrates because they lack the Ah receptor, which mediates the extreme toxicity of PCBs. Thus, risks of PCBs to invertebrates are dismissed as unlikely. On the other hand, as is also well known, PCBs are very toxic to vertebrates, which have Ah receptors. Hence, risks to vertebrates from PCBs are addressed below in Section 3.3.

Some individual PAHs exceeded their PAH ESV. However, the ESVs were set equal to the 1/10th the FCV to account for additive effects of other PAHs. Total PAH concentrations did not exceed the PEC for total PAHs, which does account for additive effects of all PAHs. Thus, risks of PAHs to benthic invertebrates can be dismissed with available information.

3.2 Risks to Wetland Plants

Potential toxicity to wetland plants was screened using the plant-specific screening values found in USEPA's EcoSSLs. If no EcoSSL value for phytotoxicity is available, the Dutch MPC was used to screen for phytotoxicity to wetland plants. Potential risk from organic chemicals were not considered in this screening because detected organics are not likely to persist (volatile organic carbons (VOCs), phenol, lighter PAHs) in the root zones of plants, are minimally toxic to plants, such as PCBs and PAHs, or both.

As shown in Table 2, a few metals exceeded ESVs for protection of plants -- chromium, nickel, selenium, manganese, and zinc. Some of these exceedances are due to the conservatism of the benchmarks. The selenium and manganese ESVs are both about half of naturally occurring background concentrations for Michigan. Chromium is generally so sparingly soluble in soils, that it can only be rarely toxic to plants. In addition to the conservativeness of the ESVs, exceedances of most metals are infrequent and the degree of exceedance for these metals is generally only moderate. The plant community in the wetlands is also dense, demonstrating that phytotoxicity is not acute.

In summary, maximum soil/sediment concentrations of some metals are moderately above screening levels for phytotoxic effects. However, the ESVs are very conservative, exceedances are generally limited in magnitude and areal extent, and the area is well vegetated. Thus, current information is sufficient to reasonably dismiss the potential for phytotoxic effects on wetland vegetation.

3.3 Risks to Aerial Insectivores from Chemicals Bioaccumulated by Aquatic Insects

The ESVs used above consider potential risks via direct toxicity to benthos and plants, but not via food chain/bioaccumulation pathways. Thus, it is necessary to consider risks to predators of aquatic invertebrates,



which may have bioaccumulated chemicals found in wetland soils/sediments. Potential predators of benthos include birds, such as ducks, and raccoons that feed on the aquatic benthos in the water column and sediments. After emergence, adults of the benthic insects present a complete exposure pathway from chemicals in sediments to bats and swallows and other insectivorous birds such as redwing blackbirds. If a chemical bioaccumulates readily in food chains, as with PCBs, these chemicals may be passed up from the sediments through the benthos and then to aerial insectivores feeding on adult aquatic insects after emergence. Although many chemicals were found at elevated concentrations in surface soils/sediments, only PCBs readily bioaccumulate in food chains. However, risk assessment guidance from EPA Region 4 (EPA Region 4 2015) suggests that high molecular weight PAHs also bioaccumulate readily in aquatic food chains. Therefore, to be conservative, high molecular weight PAHs are also considered in the food chain analyses.

3.3.1 Estimating Exposure to Aerial Insectivores

In this ecological evaluation, bats and swallows, which may feed on aquatic insects emerging from on-Site sediments, represent consumers of aquatic invertebrates. These receptors are smaller than other potential predators (e.g., ducks and raccoons), so they have higher consumption rates and more exposure to bioaccumulated chemicals. To be conservative, the potential food chain exposure to chemicals was initially modeled using worst-case assumptions. That is, these receptors were assumed to eat only contaminated food from the Site for their entire lives. Thus, bats and swallows were assumed to eat only aquatic insects emerging from the newly formed wetlands, not from extensive terrestrial and aquatic areas surrounding the wetlands. Seasonal migrations and very dry periods, when the wetlands are dry, were also not considered. The total exposure for each species was modeled as:

$$\text{Total Dose} = [\text{food}] * \text{consumption rate} * \text{absorption efficiency} + [\text{soil}] * \text{incidental soil/sediment consumption rate} * \text{absorption efficiency} + [\text{water}] * \text{drinking rate} * \text{absorption efficiency}$$

All bracketed terms (e.g., [water]) refer to the concentration of the chemical in that medium; other values are self-explanatory. Based on the conservative methodology recommended by the USEPA (1997), relative absorption efficiency³ was assumed to be 100 percent for all pathways. On the other hand, exposure via water ingestion can be assumed to be insignificant. Although concentrations of chemicals in wetland surface water were not measured, concentrations of the very hydrophobic PAHs and PCBs can be assumed to be at very low levels. Therefore, exposure via drinking water is assumed to be negligible.

Consequently, the equation collapses to:

$$\text{Total Dose} = [\text{food}] * \text{consumption rate} + [\text{soil}] * \text{incidental soil consumption rate}$$

Species-specific ingestion rates were taken from data supplied in USEPA (1993a) or other sources (e.g., Baron et al., 1999), when available. Body weights and ingestion rates used for the ERA's measurement receptors were based on the adult breeding female and are as presented in Table 3.

³ Relative absorption efficiency refers to the absorption efficiency of a compound in a medium, for example soil, compared to that in the original toxicological studies. In general, this refers to the relative absorption of a compound in soil compared to that in food.



The initial, more conservative analyses assume that the bats and swallows only eat insects emerging from the approximately 13.31 acres of newly formed marsh. However, both species have much larger home ranges (Table 3). Consequently, Area Use Factors (AUF) were estimated as 13.31 acres divided by each species home range to estimate the percent of total exposure likely due to the newly formed wetlands. This is still a conservative adjustment because it does not account for seasonal migration for the swallows or those drying periods when the wetlands are dry and not producing adult aquatic insects.

3.3.2 Estimation of COPEC Concentrations in Aquatic Invertebrate Prey

PCB concentrations in aquatic invertebrates were predicted from empirical results of Tracey and Hansen (1995). Tracey and Hansen present empirical biota-to-sediment accumulation factors (BSAF) values normalized to OC in the sediments and lipid in the benthos. Median BSAFs for PCBs were 1.1 on a gram lipid per gram OC basis. OC was not measured in the wetland soils/sediments. However, a relatively low value of 2 percent OC is a reasonable assumption for wetland soils/sediments. Aquatic invertebrates have lipid levels of about 2.0 percent (Oliver and Niimi, 1988). In this case, the lipid and OC concentrations cancel each other, and the final BSAFs for PCBs would be 1.1.

Estimating bioaccumulation of PAHs by aquatic invertebrates is complicated because PAHs are readily metabolized by a variety of taxa (Broman et al. 1990; Thomann and Komlos 1999). In addition, some of the higher molecular weight PAHs are poorly assimilated across the respiratory organs/gills and guts of biota such that total bioaccumulation of the most hydrophobic PAHs is further reduced. Thus, bioaccumulation of PAHs by benthic organisms can be 2 to 3 orders of magnitude less than bioaccumulation of similarly hydrophobic, but hard-to-metabolize chemicals like PCBs and chlorinated pesticides. PAH body burdens of benthic invertebrate were estimated with the BSAF model of Thomann and Komlos (1999). This model successfully predicts empirical data for bioaccumulation of PAHs by crayfish in a small stream (Burkhard and Sheedy 1995), with ongoing inputs of PAHs to both water and sediments. The Thomann/Komlos model predicts BSAFs for PAHs as function of the Kow of the PAH, the lipid concentrations in crayfish, and the OC in sediments. As above, both OC in sediments and lipid levels in benthic invertebrates were assumed to be 2 percent. Using the model's best fit (Figure 10 of that reference), concentrations of PAH were predicted in crayfish based on Log Kow supplied by EPA (2003).

These chemical-specific BSAF values were then applied to maximum and average sediment concentrations to estimate maximum and mean concentrations of PCBs and PAHs in aquatic insects (Table 4). Coupled with the food chain exposure information provided in Table 3, these estimated insect concentrations yielded exposure estimates for each chemical to the swallows and bats (Tables 5 and 6).

3.3.3 Estimation of COPEC Concentrations in Aquatic Invertebrate Prey

After dietary exposures of bioaccumulating chemicals are estimated, these exposures are compared to a toxicity reference value (TRV). As recommended by USEPA (1997), TRVs used in the SLERA are NOAELs (no observed adverse effects levels). These are doses of a chemical shown to have no ecological effects on an organism. When the estimated exposure is divided by the TRV, it produces an SQ. As before, SQs below 1.0 indicate that that chemical is unlikely to cause impacts. SQ values above 1.0 indicate that the potential for risk cannot be dismissed with the current analysis and data.



Estimated exposures are also compared to LOAELs (lowest observed adverse effects levels). LOAELs are the lowest doses that have been shown to cause ecologically significant toxicity. Exceedance of a LOAELs provides perspective on potential impacts.

TRVs for PCBs for mammals and birds were taken from Region V summary document (Chapman 2003). For PAHs, the NOAEL value (0.61 mg/kg-day) used in deriving the EcoSSLs for PAHs was used for mammals (USEPA 2007). For a number of reasons (see Smith and Pawlisz 2013), this NOAEL is a very conservative value that may not be valid. Smith and Pawlisz (2013) generated an alternative NOAEL of 22.2 mg/kg-day. This value was used as a LOAEL. For birds, a NOAEL of 2 mg/kg-day, from Trust et al. 1994, was used. That same study provided a LOAEL of 20 mg/kg⁴-day.

3.3.4 Results of Food Chain Analyses

The results of the food chain analyses are presented in Tables 5 and 6. No matter the scenario, exposures to PAHs are far below even very conservative TRVs for both swallows and bat. This is not surprising because PAH concentrations were not high and because PAHs do not readily bioaccumulate. On the other hand, estimated PCB exposures were above TRVs under more conservative scenarios: use of maximum concentrations and assumption that the predator only eats insects from the wetlands. Risks fall to nominal levels with more realistic assumptions: use of average concentrations and assumption that these insectivores forage on insects from other sources. Thus, risks to aerial insectivores can be dismissed with available information.

This conclusion is bolstered by a fine-grained view of PCB concentrations (Figure 2). Most, approximately 90 percent, of the PCB samples are centered around a PCB hot spot. These highly localized samples were taken in order to delineate that hot spot. Thus, the average of all PCB samples is dominated by the delineation samples, which are representative of an area about 150 ft in diameter. This <0.5 acre area makes up less than 1/20th of the total wetland acreage. In contrast, the remainder of the samples, which are distributed across the remaining 95 percent of the wetland area, have a total PCB concentration of about 0.1 mg/kg. This latter average is closer to the actual areal average concentration than the average of all samples, 0.58 mg/kg, used in Tables 4, 5 and 6.

4. Summary and Conclusions

IU G is an area of the former Nodular Iron Plant. The plant was demolished in the early 2000s, and a layer of clean fill was reportedly placed over the footprint and surrounding area (Exponent 2007). Potential ecological risks of IU G were not considered in the 2007 ERA (Exponent 2007) because the area was poor, highly

⁴ For one, the TRV is based on a lifetime cancer bioassay with a strain of mice that is so unusually sensitive to cancer that the results may not be applicable to normal animals. Second, the NOAEL is bounded by LOAEL impacts, which are slight reductions in late life survival. However, slight reductions in late life survival for iteroparous species has no significant ecological effect. Thus, the actual ecological NOAELs for this experiment are doses 5 and 20 times higher than the NOAEL identified by EPA. Third, the causal mechanism for this additional late life mortality was cancer caused by the potent carcinogen, benzo(a)pyrene. Application of these toxicity data to other PAHs must, therefore, consider the relatively much weaker carcinogenic potencies of these other PAH's. Lastly, the NOAEL for this study was a clear outlier, almost 30 times lower than the geomean of other NOAELs for high molecular weight PAHs in other experiments.



disturbed upland habitat. However, over the last decade or so, five small wetlands have developed in the southern edge of IU G as a result of discontinuing dewatering associated with the former Plant in the early 2000s and shutting down sumps that previously helped to dewater the areas in 2012. The newly formed wetlands total an area of about 13.31 acres. Since greater protection is typically accorded to wetland habitats, the potential ecological risks in the wetland areas were considered in an abbreviated risk analysis. The risk assessment used results from previous sampling of the soils of IU G. Only samples from the top 2 ft were considered, as that stratum best represents the biologically active zone of wetlands ecosystems.

The screening considered three receptors: aquatic invertebrates including benthos, wetland plants, and predators of aquatic invertebrates. The latter were represented by bats and swallows, aerial insectivores than feed on adult stages of aquatic insects.

Risks to aquatic invertebrates were screened by comparing chemical concentrations in wetland soils/sediments to ESVs protective of aquatic benthos. Although a few chemicals exceeded these ESVs, the exceedances were generally limited in areal extent and magnitude of exceedance. Thus, risks to benthos were dismissed as unlikely.

Risks to wetland plants were also considered by screening concentrations of metals against very conservative ESVs, mostly derived from EcoSSLs. (Non-metals were not screened because they were found at low concentrations, are not expected to persist in root zones, are not very toxic to plants, or combinations of the previous factors). A few metals exceeded phytotoxic ESVs, however, these exceedances were mostly attributable to the conservativeness of the ESVs rather than real potential for plant toxicity. Supporting this conclusion, the area is well vegetated, demonstrating the lack of acute phytotoxicity.

Lastly, risks to predators of invertebrates from the wetlands were considered for bioaccumulative chemicals (PCBs and high molecular weight PAHs) found at elevated concentrations in wetland soils/sediments. Aerial insectivores, bats and swallows, were chosen as sentinel species for predators of aquatic invertebrates. Concentrations of PCBs and PAHs in aquatic insects were estimated with soil/sediment concentrations and chemical-specific BSAF values. Exposures were first estimated based on the assumption that bats and swallows only forage on aquatic insects emerging from the marsh. These estimated exposures were compared to NOAEL and LOAEL values. PAH exposures were far below levels that could pose toxicity. PCBs were potentially problematic under most conservative assumptions, but these risks could be dismissed for more realistic exposure scenarios – average PCB concentration and realistic area-use factors. In addition, most PCB samples were clustered around a PCB hot-spot; likely areal average concentrations were considerably lower than those used in the exposure assessment, which was based on the average of the highly biased sample set.

In short, the available data indicate 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. Further evaluation of ecological risks is not warranted.

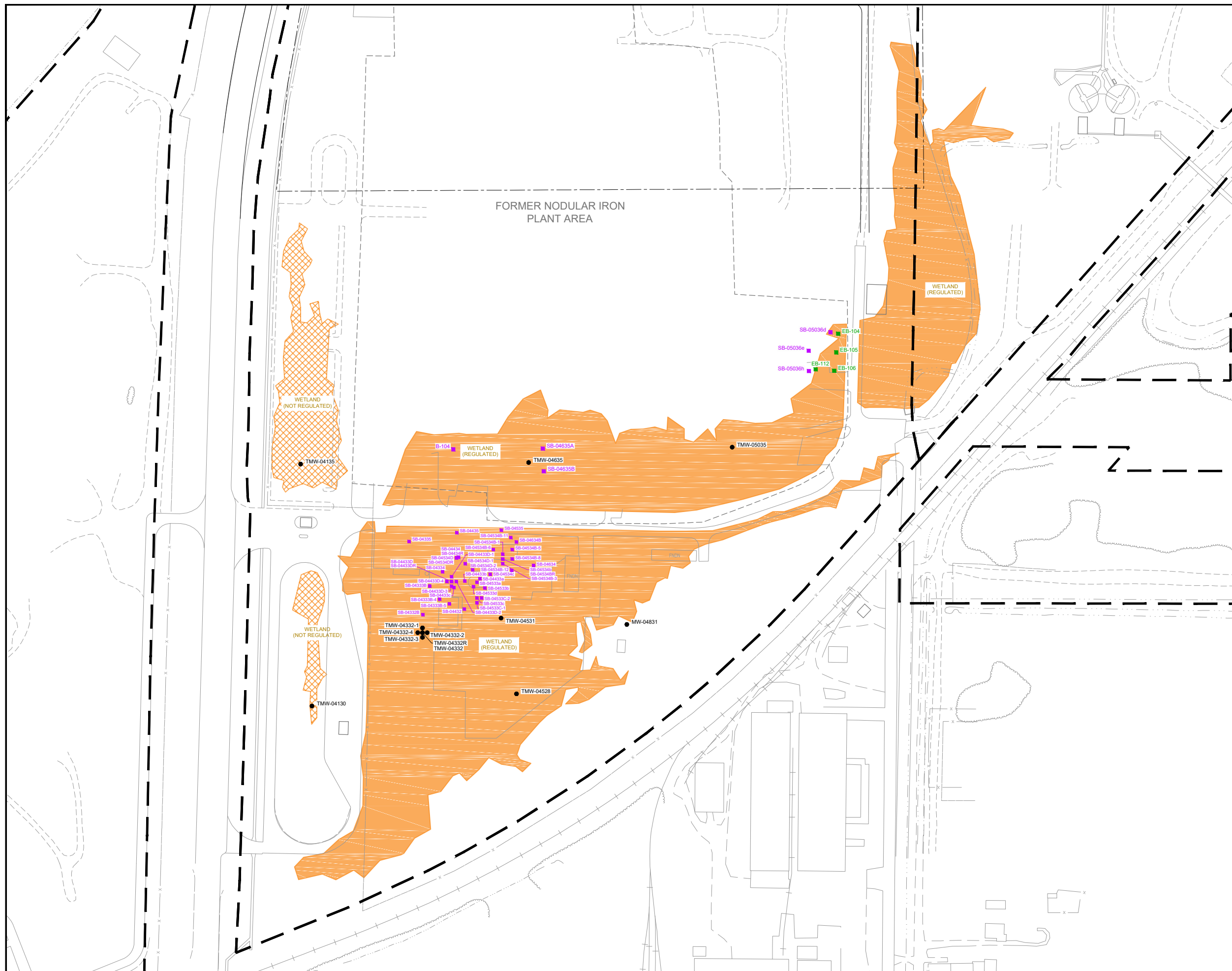


5. References

- Baron, L. A., B. E. Sample, and G. W. Suter II, 1999. Ecological risk assessment in a large river-reservoir: 5. Aerial insectivorous wildlife. *Environmental Toxicology and Chemistry* (18): 621-627.
- Burkhard, L.P. and B. R. Sheedy. 1995. Evaluation of screening procedures for bioconcentratable organic chemicals in effluents and sediments. *Environmental Toxicology and Chemistry* 14:697-711.
- Berry, W.J., W.S. Boothman, J.R. Serbst, and P.A. Edwards. 2004. Predicting the toxicity of chromium in sediments. *Environ Toxicol Chem* 23(12):2981–2992.
- Chapman, J. 2003. Memo from James Chapman, EPA Region 5, to Shari Kolak, on-line at www.michigan.gov/documents/deq/deq-rrd-KzooRiv-BERA-102003zAppendixD_312426_7.pdf.
- Crommentuijn, T., M.D. Polder, and E.J. van de Plassche, 1997. Maximum permissible concentrations and negligible concentrations for metals, taking into account background. Report #601501.001, National Institute of Public Health and the Environment, Bilthoven, The Netherlands.
- CRA. 2007. Phase 1C RFI Report. March, 2007.
- CRA. 2012. Supplemental RCRA Facility Investigation (RFI) Report. September 2012.
- Exponent. 2007. Ecological Risk Assessment. Appendix B of the RFI.
- GHD. 2017. Ecological Screening Assessment for Secondary Pond under Future Use Scenarios. Memo from Daniel Smith of GHD to Nate Nemani of EPA. August 15, 2017.
- Henning, M. and N. Shear. 1998. Regulatory perspectives on the significance of ecological changes as reported in ecological risk assessments. *Human and ecological risk assessment*, 4: 807-814.
- Michigan DEQ. 2013. Cleanup Criteria Requirements for Response Activity (Formerly the Part 201 Generic Cleanup Criteria and Screening Levels). http://www.michigan.gov/deq/0,4561,7-135-3311_4109-251790--,00.html.
- Niswander 2015. Joint Permit Application: Menard, Inc. – Applicant. Wetland survey conducted by Niswander Environmental, January 4, 2015.
- Smith, D.W. and A. Pawlisz. 2013. Fixing the ECO-SSLs one step at a time: high molecular weight (HMW) PAHs. SETAC North America Annual Meeting. Nashville, TN.
- Suter, G. W., B. W. Cornaby, C. T. Hadden, R. N. Hull, M. Stack, and F. A. Zafran, 1995. An approach for balancing health and ecological risks at hazardous waste sites. *Risk Analysis* 15: 221-231.
- Suter, G.W., R.A. Efrogmson, B.E. Sample, and D.S. Jones. 2000. *Ecological Risk Assessment for Contaminated Sites*. CRC press, 460 pp.
- Thomann, R. V. and J. Komlos. 1999. Model of biota-sediment accumulation factor for polycyclic aromatic hydrocarbons. *Environmental Toxicology and Chemistry*: Vol. 18, No. 5, pp. 1060-10.



- Tracey, G.A. and D.J. Hansen. 1996. Use of biota-sediment accumulation factors to assess similarity of nonionic organic chemical exposure to benthically coupled organisms of differing trophic mode. *Arch Environ Contam Toxicol* 30:467-475.
- Trust, K. A., A. Fairbrother, and M.J. Hooper, 1994. Effects of 7,12-dimethylbenz(a)anthracene on immune function and mixed-function oxygenase activity in the European starling. *Environmental Toxicology and Chemistry*. 13: 821-830.
- USEPA. 1993. *Wildlife Exposure Factors Handbook*, volumes I and II, U. S. Environmental Protection Agency, USEPA/600/R-93/187a and 187b, December 1993.
- USEPA. 1997. *Ecological risk assessment guidance for Superfund: process for designing and conducting ecological risk assessments*. Interim final. USEPA 540/R/97 OCS. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Edison, NJ.
- USEPA. 1998. *Proposed Guidelines for Ecological Risk Assessment*, USEPA Risk Assessment Forum, Washington D.C. USEPA/630/R 95/002B, August 1998.
- USEPA. 2003. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures*. EPA 600 R 02 013. Office of Research and Development, Washington, DC 20460.
- USEPA. 2005. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc)*. EPA/600/R-02/011.
- USEPA. 2007. *EcoSSL for PAHs*. http://rais.ornl.gov/documents/eco-ssl_pah.pdf.
- USEPA. 2008. *Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics*. EPA-600-R-02-016. Office of Research and Development. Washington, DC 20460.
- USEPA. 2012. *Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Procedures for the Determination of the Freely Dissolved Interstitial Water Concentrations of Nonionic Organics*. EPA 600/R-02/012. Technical Report, Washington, DC.
- USEPA Region 4. 2015. *Region 4 Ecological Risk Assessment Supplemental Guidance Interim Draft* https://www.epa.gov/Sites/production/files/2015-09/documents/r4_era_guidance_document_draft_final_8-25-2015.pdf.



N

0 50 100 ft

LEGEND

A--- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

● MONITORING WELL LOCATION

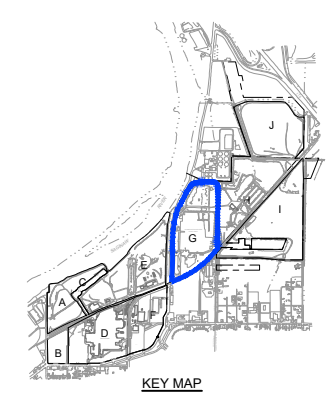
■ SOIL BORING LOCATION

■ SOIL BORING LOCATION - HISTORICAL

NOTES:

1) THIS FIGURE HIGHLIGHTS THE EXCEEDANCES OF ALL SOIL DATA SCREENED AGAINST THE 2013 MDEQ NON-RESIDENTIAL PART 201 GENERIC CLEANUP CRITERIA AND SCREENING LEVELS, WITH THE FOLLOWING EXCEPTIONS:

- EXCEEDANCES OF NON-RESIDENTIAL DRINKING WATER PROTECTION CRITERIA ARE NOT HIGHLIGHTED ON THIS FIGURE, AS DRINKING WATER AT THE SITE WILL BE RESTRICTED.
- SOIL DATA WERE NOT SCREENED AGAINST THE GROUNDWATER SURFACE WATER INTERFACE PROTECTION CRITERIA, AS THERE IS GROUNDWATER DATA AVAILABLE FOR THE SITE.



SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

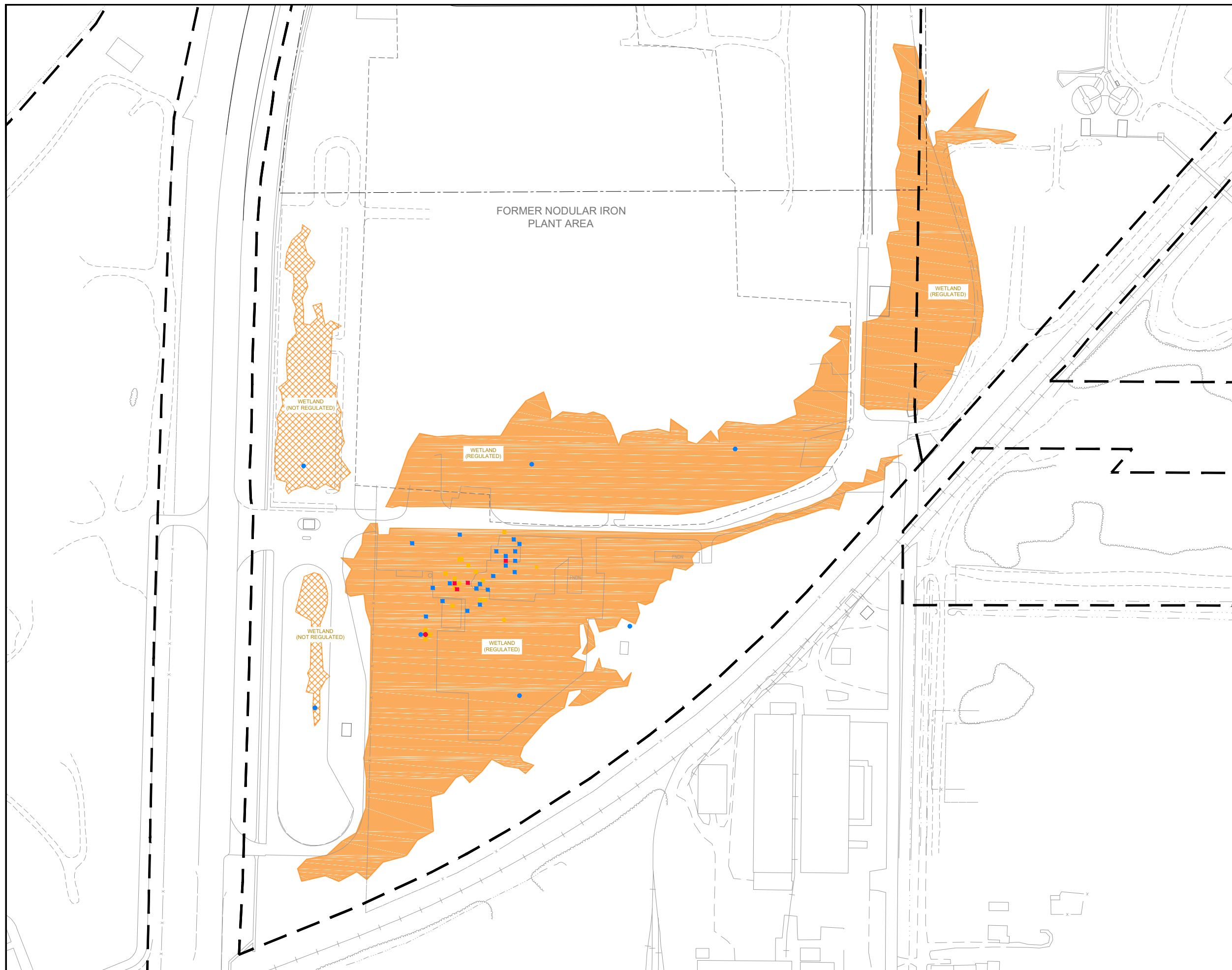
**RACER
NODULAR IRON INDUSTRIAL LAND**

SAGINAW, MICHIGAN

INVESTIGATIVE UNIT G - SOUTH
WETLAND EVALUATION
BIOLOGICAL ZONE SAMPLES (0-2 FEET)

Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88

Project Manager: MT	Reviewed By: JEP	Date: AUGUST 2018
Scale: 1" = 100'	Project NR: 58502-T01	Report NR: MEMO034
		Drawing NR: figure 1



LEGEND

A --- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

● MONITORING WELL LOCATION

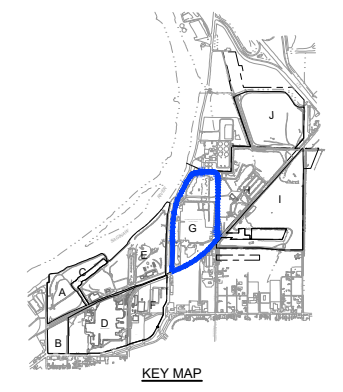
■ SOIL BORING LOCATION

PCB CONCENTRATIONS

■ < 0.2 mg/kg

■ 0.2 - 1.0 mg/kg

■ > 1.0 mg/kg



SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

**RACER
NODULAR IRON INDUSTRIAL LAND**

SAGINAW, MICHIGAN

INVESTIGATIVE UNIT G - SOUTH
WETLAND EVALUATION
PCB CONCENTRATIONS - BIOLOGICAL ZONE (0-2 FEET)



Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88

Project Manager: MT	Reviewed By: JEP	Date: AUGUST 2018
Scale: 1" = 100'	Project N°: 58502-T01	Report N°: MEMO034 Drawing N°: figure 2

Table 1
Screening of Risk to Aquatic Invertebrates
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan

Parameters	Units	ESV	Source	# Samples	Frequency of	Mean	Max SQ	Mean SQ (ND=1/2 DL)	Mean SQ (ND = 0)	Frequency of Exceedance		
					Detection	Detection						
Metals												
Aluminum	mg/kg	Not Toxic	-	9	100%	12600.00	4728.89	4728.89	NA	NA	NA	NA
Antimony	mg/kg	25.00	Region 4	9	22%	12.00	2.13	1.37	0.48	0.09	0.05	0%
Arsenic	mg/kg	33.00	PEC	16	100%	11.00	3.00	3.00	0.33	0.09	0.09	0%
Barium	mg/kg	60.00	Region 4	9	100%	80.30	38.63	38.63	1.34	0.64	0.64	11%
Beryllium	mg/kg	1.20	Dutch	9	67%	0.75	0.30	0.18	0.63	0.25	0.15	0%
Cadmium	mg/kg	4.98	PEC	13	54%	0.40	0.23	0.05	0.08	0.05	0.01	0%
Calcium	mg/kg	Nutrient	-	9	100%	92700.00	23133.33	23133.33	NA	NA	NA	NA
Chromium	mg/kg	110.00	PEC	15	100%	309.00	55.67	55.67	2.81	0.51	0.51	13%
Cobalt	mg/kg	50.00	Region 4	9	89%	6.10	2.50	2.39	0.12	0.05	0.05	0%
Copper	mg/kg	149.00	PEC	9	100%	98.00	22.71	22.71	0.66	0.15	0.15	0%
Iron	mg/kg	Not Toxic	-	9	100%	98000.00	21401.11	21401.11	NA	NA	NA	NA
Lead	mg/kg	128.00	PEC	13	85%	24.00	9.58	8.69	0.19	0.07	0.07	0%
Magnesium	mg/kg	Nutrient	-	7	100%	37200.00	7011.86	7011.86	NA	NA	NA	NA
Manganese	mg/kg	1100.00	Region 4	9	100%	1230.00	622.22	622.22	1.12	0.57	0.57	22%
Mercury	mg/kg	1.10	PEC	9	11%	0.10	0.05	0.01	0.09	0.05	0.01	0%
Nickel	mg/kg	48.30	PEC	9	89%	71.00	20.26	19.70	1.47	0.42	0.41	11%
Potassium	mg/kg	Nutrient	-	7	86%	1610.00	467.79	467.43	NA	NA	NA	NA
Selenium	mg/kg	20.00	Region 4	13	46%	0.79	0.33	0.14	0.04	0.02	0.01	0%
Sodium	mg/kg	Nutrient	-	7	100%	263.00	146.13	146.13	NA	NA	NA	NA
Thallium	mg/kg	2.60	Dutch	9	67%	0.10	0.16	0.02	0.04	0.06	0.01	0%
Vanadium	mg/kg	56.00	Dutch	9	100%	29.00	8.51	8.51	0.52	0.15	0.15	0%
Zinc	mg/kg	459.00	PEC	13	100%	380.00	113.08	113.08	0.83	0.25	0.25	0%
PCBs												
Aroclor-1242 (PCB-1242)	mg/kg	0.67	PEC	62	10%	0.11	0.17	0.01	0.16	0.25	0.01	0%
Aroclor-1248 (PCB-1248)	mg/kg	0.67	PEC	62	2%	0.05	0.16	0.00	0.07	0.24	0.00	0%
Aroclor-1254 (PCB-1254)	mg/kg	0.67	PEC	62	0%	0.00	0.17	0.00	0.00	0.25	0.00	0%
Aroclor-1260 (PCB-1260)	mg/kg	0.67	PEC	62	79%	8.80	0.58	0.56	13.13	0.86	0.83	16%
Total PCBs from Aroclors	mg/kg	0.67	PEC	62	79%	8.80	0.56	0.56	13.13	0.84	0.84	16%
SVOAs												
1,2,4-Trichlorobenzene	mg/kg	2.20	EPA 2008/10	23	13%	1.90	0.33	0.16	0.86	0.15	0.07	0%
1,2-Dichlorobenzene	mg/kg	1.56	EPA 2008/10	20	10%	0.69	0.22	0.04	0.44	0.14	0.02	0%
1,3-Dichlorobenzene	mg/kg	1.56	EPA 2008/10	20	10%	0.17	0.20	0.02	0.11	0.13	0.01	0%
1,4-Dichlorobenzene	mg/kg	1.56	EPA 2008/10	20	5%	0.05	0.20	0.00	0.03	0.13	0.00	0%
2,4-Dimethylphenol	mg/kg	0.07	Region 4	23	4%	0.03	0.19	0.00	0.37	2.53	0.02	0%
2-Methylnaphthalene	mg/kg	0.89	EPA 2003 / 10	23	70%	26.00	2.35	2.29	29.15	2.64	2.57	9%
2-Methylphenol	mg/kg	0.21	Region 4	23	4%	0.04	0.19	0.00	0.17	0.89	0.01	0%
Acenaphthene	mg/kg	0.98	EPA 2003 / 10	23	9%	1.30	0.28	0.10	1.32	0.29	0.11	9%
Anthracene	mg/kg	1.19	EPA 2003 / 10	23	39%	0.15	0.14	0.02	0.13	0.11	0.02	0%
Benzo(a)anthracene	mg/kg	1.68	EPA 2003 / 10	23	43%	0.27	0.15	0.04	0.16	0.09	0.02	0%
Benzo(a)pyrene	mg/kg	1.93	EPA 2003 / 10	23	39%	0.23	0.15	0.03	0.12	0.08	0.02	0%
Benzo(b)fluoranthene	mg/kg	1.96	EPA 2003 / 10	23	39%	0.23	0.15	0.04	0.12	0.08	0.02	0%
Benzo(g,h,i)perylene	mg/kg	2.19	EPA 2003 / 10	23	39%	0.18	0.15	0.03	0.08	0.07	0.01	0%
Benzo(k)fluoranthene	mg/kg	1.96	EPA 2003 / 10	23	30%	0.20	0.16	0.03	0.10	0.08	0.01	0%
bis(2-Chloroethyl)ether	mg/kg	4761.00	Region 4	23	4%	0.03	0.19	0.00	0.00	0.00	0.00	0%
bis(2-Ethylhexyl)phthalate (DEHP)	mg/kg	5.29	Region 4	23	26%	0.10	0.16	0.02	0.02	0.03	0.00	0%
Butyl benzylphthalate (BBP)	mg/kg	0.59	Region 4	23	4%	0.07	0.19	0.00	0.13	0.32	0.01	0%
Carbazole	mg/kg	2.20	Region 4	21	10%	0.07	0.19	0.01	0.03	0.09	0.00	0%
Chrysene	mg/kg	1.69	EPA 2008 / 10	23	43%	0.29	0.15	0.04	0.17	0.09	0.02	0%

Table 1
Screening of Risk to Aquatic Invertebrates
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan

Parameters	Units	ESV	Source	# Samples	Frequency of		Mean	Mean Detection	Max SQ	Mean SQ	Mean SQ	Frequency of Exceedance
					Detection	Max Detection	Detection (ND = 1/2 DL)	(ND = 0)		(ND=1/2 DL)	(ND = 0)	
Dibenzofuran	mg/kg	3.40	EPA 2008 / 10	23	57%	0.66	0.15	0.07	0.19	0.05	0.02	0%
Di-n-butylphthalate (DBP)	mg/kg	2000.00	Region 4	23	4%	0.05	0.19	0.00	0.00	0.00	0.00	0%
Fluoranthene	mg/kg	1.41	EPA 2003 / 10	23	61%	0.67	0.16	0.09	0.47	0.11	0.06	0%
Fluorene	mg/kg	1.08	EPA 2003 / 10	23	13%	2.10	0.35	0.18	1.95	0.33	0.17	9%
Indeno(1,2,3-cd)pyrene	mg/kg	2.23	EPA 2003 / 10	23	26%	0.16	0.17	0.02	0.07	0.07	0.01	0%
Naphthalene	mg/kg	0.77	EPA 2003 / 10	23	70%	2.40	0.31	0.26	3.12	0.41	0.33	9%
Phenanthrene	mg/kg	1.20	EPA 2003 / 10	23	65%	1.80	0.30	0.23	1.50	0.25	0.19	9%
Phenol	mg/kg	0.24	Region 4	23	57%	5.10	0.35	0.26	21.25	1.45	1.10	4%
Pyrene	mg/kg	1.39	EPA 2003 / 10	23	39%	0.47	0.18	0.07	0.34	0.13	0.05	0%
Total PAH1	mg/kg	22.80	PEC	23	70%	8.08	0.95	0.95	0.35	0.04	0.04	0%
VOAs												
1,1-Dichloroethane	mg/kg	0.92	EPA 2008 / 10	19	5%	0.02	0.03	0.00	0.02	0.03	0.00	0%
1,2,4-Trimethylbenzene	mg/kg	2.25	EPA 2008 / 10	7	43%	0.08	0.11	0.02	0.03	0.05	0.01	0%
1,2-Dichlorobenzene	mg/kg	1.56	EPA 2008 / 10	3	33%	0.07	0.05	0.02	0.04	0.03	0.01	0%
1,3,5-Trimethylbenzene	mg/kg	2.25	EPA 2008 / 10	7	43%	0.03	0.10	0.01	0.01	0.04	0.00	0%
Benzene	mg/kg	1.32	EPA 2008 / 10	26	8%	0.10	0.04	0.01	0.08	0.03	0.01	0%
cis-1,2-Dichloroethene	mg/kg	0.92	EPA 2008 / 10	19	5%	0.03	0.03	0.00	0.03	0.03	0.00	0%
Ethylbenzene	mg/kg	1.94	EPA 2008 / 10	26	12%	0.06	0.03	0.01	0.03	0.02	0.00	0%
Isopropyl benzene	mg/kg	2.31	EPA 2008 / 10	7	14%	0.02	0.15	0.00	0.01	0.06	0.00	0%
m&p-Xylenes	mg/kg	1.96	EPA 2008 / 10	25	16%	0.27	0.07	0.02	0.14	0.04	0.01	0%
Methylene chloride	mg/kg	0.75	EPA 2008 / 10	19	11%	0.23	0.14	0.01	0.31	0.19	0.02	0%
Naphthalene	mg/kg	0.77	EPA 2003 / 10	2	0%	0.00	0.05	0.00	0.00	0.06	0.00	0%
N-Butylbenzene	mg/kg	2.73	EPA 2008 / 10	7	29%	0.02	0.11	0.00	0.01	0.04	0.00	0%
o-Xylene	mg/kg	0.92	EPA 2008 / 10	25	12%	0.15	0.05	0.01	0.16	0.05	0.01	0%
Toluene	mg/kg	1.14	EPA 2008 / 10	19	26%	0.17	0.05	0.02	0.15	0.04	0.02	0%
Trichloroethene	mg/kg	1.30	EPA 2008 / 10	19	5%	0.05	0.03	0.00	0.04	0.02	0.00	0%
Wet Chemistry												
Ammonia	mg/kg	NA	-	9	11%	0.70	0.94	0.08				
Cyanide (total)	mg/kg	NA	-	2	50%	3.70	2.10	1.85				
Sulfide	mg/kg	NA	-	2	100%	55.40	36.50	36.50				

Notes:

Total PAHs were estimated as the sum of anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene.

Table 2

Screening of Risk to Wetland Plants
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan

Parameters	Units	ESV	Source	# Samples	Frequency of Detection	Max Detection	Mean Detection (ND = 1/2 DL)	Mean Detection (ND = 0)	Max SQ	Mean SQ (ND=1/2 DL)	Mean SQ (ND = 0)	Frequency of Exceedance
Metals												
Antimony	mg/kg	11.00	EcoSSL Plant	9	0.22	12.00	2.13	1.37	1.09	0.19	0.12	0.11
Cadmium	mg/kg	32.00	EcoSSL Plant	13	0.54	0.40	0.23	0.05	0.01	0.01	0.00	0.00
Chromium	mg/kg	100.00	Dutch MPC	15	1.00	309.00	55.67	55.67	3.09	0.56	0.56	0.13
Chromium VI	mg/kg	0.35	EcoSSL Plant	3	0.00	0.00	0.32	0.00	0.00	0.90	0.00	0.00
Copper	mg/kg	70.00	EcoSSL Plant	9	1.00	98.00	22.71	22.71	1.40	0.32	0.32	0.11
Lead	mg/kg	120.00	EcoSSL Plant	13	0.85	24.00	9.58	8.69	0.20	0.08	0.07	0.00
Manganese	mg/kg	220.00	EcoSSL Plant	9	1.00	1230.00	622.22	622.22	5.59	2.83	2.83	0.67
Mercury	mg/kg	2.20	Dutch MPC	9	0.11	0.10	0.05	0.01	0.04	0.02	0.00	0.00
Nickel	mg/kg	38.00	EcoSSL Plant	9	0.89	71.00	20.26	19.70	1.87	0.53	0.52	0.22
Potassium	mg/kg	Nutrient	-	7	0.86	1610.00	467.79	467.43	-	-	-	-
Selenium	mg/kg	0.52	EcoSSL Plant	13	0.46	0.79	0.33	0.14	1.52	0.63	0.26	0.08
Sodium	mg/kg	Nutrient	-	7	1.00	263.00	146.13	146.13	-	-	-	-
Thallium	mg/kg	1.00	EcoSSL Plant	9	0.67	0.10	0.16	0.02	0.10	0.16	0.02	0.00
Vanadium	mg/kg	60.00	EcoSSL Plant	9	1.00	29.00	8.51	8.51	0.48	0.14	0.14	0.00
Zinc	mg/kg	160.00	EcoSSL Plant	13	1.00	380.00	113.08	113.08	2.38	0.71	0.71	0.23

**Exposure to Insectivores
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan**

Species	Body Weight (kg)	Ecological Guild	Contaminated Prey	Feeding Rate (kg WW / kg BW-day)	Soil Ingestion Rate (kg DW / kg BW-day)	Home Range (acres)
Brown Bat	0.007	Insectivore	Aquatic Insects	0.333	0.000	75
Tree Swallow	0.02	Insectivore	Aquatic Insects	0.755	0.000	80

Notes:

BW refers to body weight

WW refers to wet weight

DW refers to dry weight

Parameters from EPA (1993a) except for bat, which were obtained from Baron et al. (1999).

**Exposure Concentrations
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan**

COPEC	BSAF	Maximum Concentrations		Average Concentrations	
		Sediment (mg/kg DW)	Aerial Invertebrates (mg/kg WW)	Sediment (mg/kg DW)	Aerial Invertebrates (mg/kg WW)
Total PCBs	1.1	8.80	9.68	0.58	0.64
Benzo(a)anthracene	0.03	0.29	0.01	0.04	0.001
Benzo(a)pyrene	0.03	0.47	0.01	0.07	0.002
Chrysene	0.03	0.23	0.01	0.04	0.001
Pyrene	0.05	0.18	0.01	0.03	0.001
Benzo(b)fluoranthene	0.02	0.20	0.005	0.03	0.001
Benzo(g,h,i)perylene	0.02	0.16	0.003	0.02	0.000
Benzo(k)fluoranthene	0.02	0.20	0.005	0.03	0.001
Indeno(1,2,3-cd)pyrene	0.02	0.16	0.003	0.02	0.000

Notes:

COPEC - Constituent of Potential Ecological Concern

DW - Dry Weight, WW - Wet Weight

BSAF Sources: PCBs from Tracey and Hansen (1995); PAHs from Thomann and Komlos (1999).

**Ssummary of Food Chain Model for Tree Swallow
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan**

COPEC	IR _{Total} (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	Unadjusted for Area Use		Adjusted for Area Use ¹	
				HQ _{NOAEL}	HQ _{LOAEL}	HQ _{NOAEL}	HQ _{LOAEL}
Mamimum Exposure Concentrations							
Total PCBs	7.31	0.6	1.2	12.2	6.1	2.0	1.0
Benzo(a)anthracene	0.01	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(a)pyrene	0.01	2.0	20.0	0.0	0.0	0.0	0.0
Chrysene	0.01	2.0	20.0	0.0	0.0	0.0	0.0
Pyrene	0.01	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(b)fluoranthene	0.004	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(g,h,i)perylene	0.002	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(k)fluoranthene	0.004	2.0	20.0	0.0	0.0	0.0	0.0
Indeno(1,2,3-cd)pyrene	0.002	2.0	20.0	0.0	0.0	0.0	0.0
Average Exposure Concentrations							
Total PCBs	0.49	0.6	1.2	0.8	0.4	0.1	0.1
Benzo(a)anthracene	0.001	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(a)pyrene	0.001	2.0	20.0	0.0	0.0	0.0	0.0
Chrysene	0.001	2.0	20.0	0.0	0.0	0.0	0.0
Pyrene	0.001	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(b)fluoranthene	0.0005	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(g,h,i)perylene	0.0003	2.0	20.0	0.0	0.0	0.0	0.0
Benzo(k)fluoranthene	0.0005	2.0	20.0	0.0	0.0	0.0	0.0
Indeno(1,2,3-cd)pyrene	0.0003	2.0	20.0	0.0	0.0	0.0	0.0

Notes:

Bold identifies a Hazard Quotient greater than unity (1.0)

HQ - Hazard Quotient

IR - Ingestion Rate

NOAEL - No Observed Adverse Effect Level

LOAEL - Lowest Observed Adverse Effect Level

¹ Area Use calculated as 13.3 acres divided by species specific home range.

**Summary of Food Chain Model for Brown Bat
Ecological Screening Assessment for Newly Formed Wetlands
Nodular Industrial Land
Saginaw, Michigan**

COPEC	IR _{Total} (mg/kg-day)	NOAEL (mg/kg-day)	LOAEL (mg/kg-day)	Unadjusted for Area Use		Adjusted for Area Use ¹	
				HQ _{NOAEL}	HQ _{LOAEL}	HQ _{NOAEL}	HQ _{LOAEL}
Maximum Exposure Concentrations							
Total PCBs	3.22	0.17	0.20	19.3	16.1	3.4	2.9
Benzo(a)anthracene	0.003	0.62	22.20	0.0	0.0	0.0	0.0
Benzo(a)pyrene	0.004	0.62	22.20	0.0	0.0	0.0	0.0
Chrysene	0.003	0.62	22.20	0.0	0.0	0.0	0.0
Pyrene	0.003	0.62	22.20	0.0	0.0	0.0	0.0
Benzo(b)fluoranthene	0.002	0.62	22.20	0.0	0.0	0.0	0.0
Benzo(g,h,i)perylene	0.001	0.62	22.20	0.0	0.0	0.0	0.0
Benzo(k)fluoranthene	0.002	0.62	22.20	0.0	0.0	0.0	0.0
Indeno(1,2,3-cd)pyrene	0.001	0.62	22.20	0.0	0.0	0.0	0.0
Average Exposure Concentrations							
Total PCBs	0.21	0.17	0.20	1.3	1.1	0.2	0.2
Benzo(a)anthracene	0.0005	0.62	22.2	0.0	0.0	0.0	0.0
Benzo(a)pyrene	0.001	0.62	22.2	0.0	0.0	0.0	0.0
Chrysene	0.0004	0.62	22.2	0.0	0.0	0.0	0.0
Pyrene	0.0005	0.62	22.2	0.0	0.0	0.0	0.0
Benzo(b)fluoranthene	0.0002	0.62	22.2	0.0	0.0	0.0	0.0
Benzo(g,h,i)perylene	0.0001	0.62	22.2	0.0	0.0	0.0	0.0
Benzo(k)fluoranthene	0.0002	0.62	22.2	0.0	0.0	0.0	0.0
Indeno(1,2,3-cd)pyrene	0.0001	0.62	22.2	0.0	0.0	0.0	0.0

Notes:

Bold identifies a Hazard Quotient greater than unity (1.0)

HQ - Hazard Quotient

IR - Ingestion Rate

LOAEL - Lowest Observed Adverse Effect Level

NOAEL - No Observed Adverse Effect Level

¹ Area Use calculated as 13.3 acres divided by species specific home range.

Attachment A Wetland Description



9436 Maltby Road
Brighton, MI 48116
810.225.0539 office
810.225.0653 fax
www.niswander-env.com

July 22, 2015

Mr. Patrick Schaffer
Menard, Inc. – Properties Division
5101 Menard Drive
Eau Claire, WI 54703

Subject: *Wetland Delineation*
38.86-Acre Racer Trust Property
Buena Vista Township, Saginaw County, MI
NE 1424

Dear Mr. Schaffer:

Niswander Environmental was contracted in July 2015 to complete a wetland delineation on 38.86-acre property (Property) located at 2100 Veterans Memorial Parkway in Section 8 of Buena Vista Township, Saginaw County, Michigan (T12N, R5E). The Property is a former industrial complex that was decommissioned and demolished over 10 years ago. Currently, this disturbed site is a vacant brownfield that is dominated by wetland, old field, meadow, and/or young successional forested habitat. Russian olive and cottonwood dominate much of the land, particularly in the north. The central portions of the site are primarily scrub-shrub wetland. Areas in the south consist of open meadow and old field. Please refer to Photos 1 and 2 in the attached Photographic Log for a representation of the upland portions of the Property.

Niswander Environmental assessed the Property for existing wetlands, watercourses, and floodplains, and delineated the wetland features. During the on-site investigation, **Niswander Environmental identified five (5) wetlands within the Property (Figure 1 – Wetland Location Map)**. The following is a report detailing the results of Niswander Environmental's investigation.

SUPPORTING DOCUMENTATION

Wetlands and Watercourses

Prior to the site investigation, Niswander Environmental completed a thorough review of available State and County GIS data, online resources, wetland maps, historic aerial photos, topographic maps, soil maps, and other materials. Infrared and color aerial photographs (Michigan Geospatial Digital Library – MiGDL, 1998, 2005, and 2012) and 2014 color aerial photographs (GoogleEarth) were obtained and evaluated for any remarkable features. A review of National Wetland Inventory (NWI), Michigan Department of Environmental Quality (MDEQ) Final Wetland Inventory Map, and Saginaw County GIS data was conducted to determine the likely presence, location, size and type of wetlands that may be located on the Property. The United States Fish and Wildlife Service (USFWS) produce the NWI data

through aerial photograph interpretation. The MDEQ Final Wetland Inventory Map was created from the NWI, USDA Soils Map, and Land Cover, as mapped by the Michigan Resource Inventory System (MIRIS).

Review of the available wetland maps, including the NWI and MDEQ Final Wetland Inventory Map for Saginaw County, did not identify wetlands or hydric soil on the Property, likely because this Property contained an industrial facility until recently. These maps, however, may not always accurately show the extent or existence of wetland systems in a specific area or correctly identify the wetlands present since they were primarily generated through aerial interpretation. Wetland inventory maps are utilized for preliminary analysis only. Field investigations are always necessary to determine the actual existence and type of wetlands in a given area.

METHODS

Wetlands and Watercourses

Potential wetland areas within the Property were evaluated in the field using the procedures outlined in the US Army Corps of Engineers *1987 Wetland Delineation Manual* (“87 Manual”), and the Northeast/NorthCentral Supplement to the “87 Manual” as required by the State of Michigan, Department of Environmental Quality, under Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, PA451 of 1994, as amended (NREPA). According to these procedures, wetlands are identified by the presence of hydric soils, signs of hydrology indicators, and dominant hydrophytic vegetation.

Hydric soil indicators were assessed in the field through soil pits that were dug in and around potential wetland areas. A soil is considered hydric if it meets requirements as stated in the Natural Resources Conservation Service *Field Indicators of Hydric Soils in the United States* (Version 7.0, 2010), which specifies parameters such as soil matrix color, amount and contrast of redox concentrations or depletions, and depth and thickness for a specific soil type such as loamy, clayey, or sandy soils. Soils were not reviewed in areas with standing or flowing water since these areas are assumed to be hydric.

Signs of hydrology within potential wetland areas were also investigated. Standing water or saturated soils, water marks on trees, drift lines, sediment deposits, and water-stained leaves (among others) are considered primary indicators of hydrology, while secondary signs include drainage patterns, moss trim lines, crayfish burrows, and surface soil cracks. Either one primary or two secondary indicators are necessary in determining the presence of wetland hydrology.

Dominant vegetation for wetland areas are typically determined by estimating the most common species of tree, shrub, and forb layers. The top dominants are visually estimated for each layer or strata, and the indicator status of each dominant species is then determined. An indicator status of obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU) and/or upland (UPL) is typically assigned to each plant species on the U.S. Army Corps of Engineers *National Wetland Plant List* (<http://rsgisias.crrel.usace.army.mil/NWPL/>). An area has hydrophytic (wetland) vegetation when, under normal circumstances, more than 50 percent of the composition of the dominant species from all strata are OBL, FACW, and/or FAC species. An area has non-hydrophytic vegetation when 50 percent or more of the composition of the dominant species from all strata are FACU and/or UPL species. Areas

that meet the three criteria of hydric soils, wetland hydrology, and hydrophytic vegetation are considered wetlands. The perimeter of a wetland is typically determined by locating areas where one of these three criteria is no longer present (*i.e.*, where wetland vegetation transitions to upland vegetation or where signs of hydrology are no longer apparent, etc.).

The wetland boundary was flagged and GPS'd in the field, and then digitized into a GIS database (Figure 1 – Wetland Location Map). The actual wetland boundary should be surveyed and incorporated into any development plans to determine the exact size, shape, and location of the wetland.

Under NREPA, wetlands are regulated if they are greater than 5 acres in size or if they are connected to or within 500 feet of an inland lake, pond, river, drain, or stream (*i.e.*, watercourse). A pond is defined in Part 303 Administrative Rules (R 281.921) as a natural or artificial pond that has permanent open water with a surface area that is more than 1 acre, but less than 5 acres. Other watercourses are regulated by the State under Part 301 (Inland Lakes and Streams) if they exhibit defined banks, a bed, and visible evidence of a continued flow or continued occurrence of water. An inland lake or stream does not include the Great Lakes, Lake St. Clair, or a lake or pond that has a surface area of less than 5 acres. It should be noted that the MDEQ has the final authority on the regulatory status of wetlands and watercourses in the State of Michigan.

FINDINGS

On July 15 and 16, 2015 Niswander Environmental conducted a wetland delineation on the Property using the *87 Manual*. Five wetlands (Wetland A - E) were identified and flagged on the Property. The limits of the wetland were flagged in the field with pink flagging labeled A1 – A80, B1 – B145, C1 – C24, D1 – D14, and E1 – E 65. The wetland delineation, once surveyed by a registered surveyor, will provide the exact shape, size, and location of the on-site wetland.

WETLANDS A, B, AND D

Wetlands A, B, and D are similar in terms of habitat type, vegetative composition, soil structure, and hydrologic indicators. They are separated from each other through access roads and driveways, and there does not appear to be a hydrologic connection (Figure 1). Each of these wetlands are classified as emergent/scrub-shrub wetlands, meaning there are portions that are dominated by woody shrubs and small trees, but there are also openings comprised primarily of herbaceous plants. Despite their diversity, these wetlands are considered to be of moderate to moderately low quality because of recent disturbance (*i.e.*, the wetlands have developed since the demolition of the pre-existing buildings and infrastructure on the site) and contain an abundance of invasive vegetation such as Phragmites (*Phragmites australis*), red top (*Agrostis gigantea*), narrow-leaved cattail (*Typha angustifolia*), and purple loosestrife (*Lythrum salicaria*). Other common-to-abundant plants within Wetlands A, B, and D include path rush (*Juncus tenuis*), Torrey's rush (*Juncus torreyi*), sandbar willow (*Salix exigua*), cottonwood (*Populus deltoides*), slender fragrant goldenrod (*Euthamia graminifolia*), and sedge (*Carex* spp.). Wetland A contains a disturbed meadow area in the southern portion of the Property, where wildflowers such as vervain (*Verbena hastata*), late goldenrod (*Solidago gigantea*), swamp milkweed (*Asclepias incarnata*), and swamp aster (*Symphotrichum puniceum*) along with a variety of sedges and rushes. Please refer to Photos 3 – 7 in the attached Photographic Log.



Hydrologic indicators present at the time of inspection include standing water, saturated soils, aquatic fauna, algal mats, and a positive FAC-Neutral test. Soils within each wetland proved to be similar, consisting of a sandy mucky mineral that is hydric. The upland/wetland interface was determined through topographical differences and the presence/absence of upland species such as common buckthorn (*Rhamnus cathartica*), Virginia creeper (*Parthenocissus quinquefolia*), Russian olive (*Elaeagnus angustifolia*), thistle (*Cirsium arvense*), tall goldenrod (*Solidago altissima*), Queen Anne's lace (*Daucus carota*), spotted knapweed (*Centaurea stoebe*) and various upland grasses. Upland areas generally contained a few wetland species intermixed with an abundance of upland plants, and also lacked primary indicators of hydrology. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetlands A, B, and D.

Wetland B is likely regulated by the MDEQ due to the fact that it is greater than five acres in size. Wetlands A and D are likely not regulated since they are smaller than five acres and are hydrologically isolated.

WETLAND C

Wetland C is a small, depressional wetland located within a disturbed field along Veterans Memorial Parkway (Figure 1). This emergent wetland is dominated by scouring rush (*Equisetum hymale*), meadow sedge (*Carex granularis*), and taper-tip rush (*Juncus articulatis*). Other species present within this wetland include fowl bluegrass (*Poa palustris*), Torrey's rush, spikerush (*Eleocharis obtusa*), and swamp milkweed (Photo 8; Photographic Log).

Although the interior of the wetland contained standing water, a majority of the wetland was only saturated at the time of inspection. Hydric soils were confirmed when a mucky sand was revealed. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetland C.

Wetland C is likely not regulated by the MDEQ since it is less than five acres in size and is not hydrologically connected to a regulating body of water.

WETLAND D

Wetland E is a small (~1 ac) wetland located in the northwest portion of the Property, beginning just north of the access drive (Figure 1). Like the other on-site wetlands, this wetland is disturbed but is becoming more naturalized as the years pass. Most of the wetland is classified as scrub-shrub due to the abundance of sapling cottonwood, but other portions are more open and resemble a meadow (Photos 9 and 10; Photographic Log). While no single species truly dominates, the most abundant plants within this wetland include cottonwood, sandbar willow, purple loosestrife, scouring rush, vervain, late goldenrod, slender-fragrant goldenrod, and riverbank grape (*Vitis riparia*).

Wetland E contained a few pockets of standing water, but in general was saturated at or just below the surface. Please refer to the attached Wetland Determination Data Form for more details pertaining to Wetland E.

Wetland E is likely not regulated by the MDEQ since it is less than five acres in size and is hydrologically isolated.

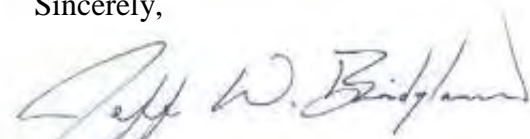
CONCLUSIONS

Niswander Environmental identified five wetlands (Wetlands A, B, C, D, and E) on the Property. The approximate size and shape of the wetland is represented in Figure 1 (Wetland Location Map). A survey of the wetland delineation should be conducted to accurately determine the wetland boundaries and any potential impacts resulting from future work within this area.

It is Niswander Environmental's professional opinion that Wetland B is regulated by the MDEQ due to the fact that it is greater than 5 acres in size. The remaining four wetlands are less than 5 acres in size, and are hydrologically isolated. However, since the MDEQ has the final regulatory authority, we recommend that a Pre-Application Meeting with the MDEQ be held prior to moving forward with any potential development. A MDEQ Part 303 Permit will be necessary if impacts to regulated wetland are proposed.

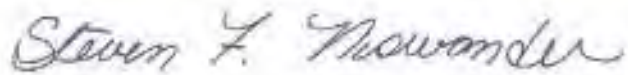
We look forward to working with you to make this project a success. If you have any questions or require additional information please call us at your convenience.

Sincerely,



Jeff W. Bridgland
Ecologist

Professional Wetland Scientist #1810



Steven F. Niswander
Principal

Professional Wetland Scientist #1276

Attachments: Figure 1 – Wetland Location Map
Photographic Log
Wetland Determination Data Forms



Photographic Log



Photo 1

The Racer Trust property is a 38.86-acre site that was a former industrial facility that was demolished roughly 10-15 years ago and left fallow.



Photo 2

This disturbed property is dominated by pioneer species such as cottonwood, willow, and Russian olive.

Photographic Log

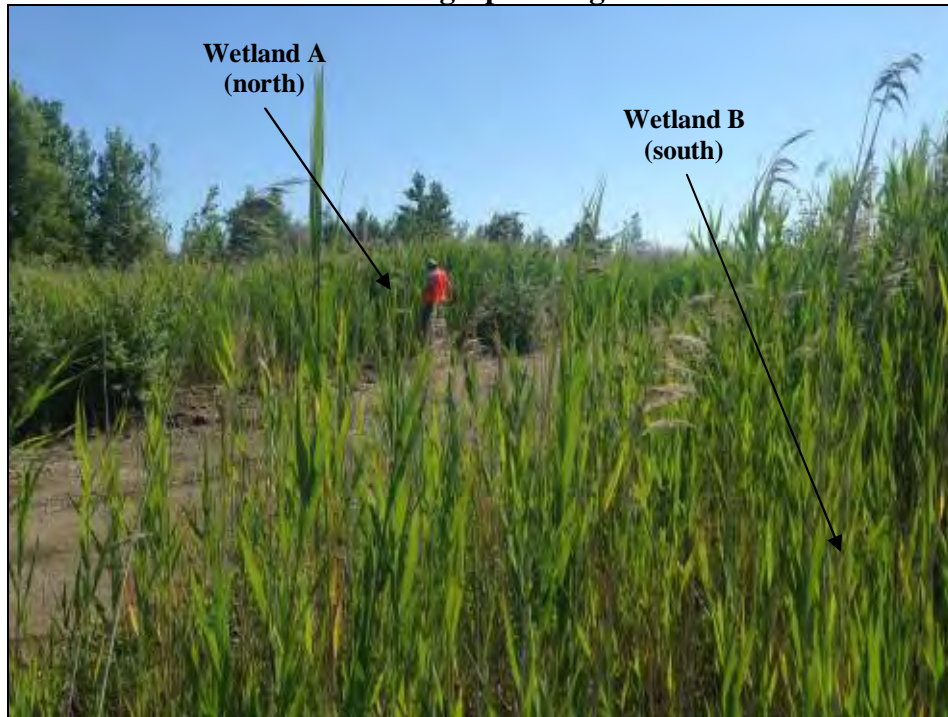


Photo 3

An access driveway splits Wetlands A and B, but there does not appear to be a hydrologic connection between the two. Along the road, these wetlands contain an abundance of invasive Phragmites.



Photo 4

Wetland A, located on the north side of the access drive, is dominated by Phragmites (although other species are present throughout).

Photographic Log



Photo 5

View facing south showing Wetland B, a large (~7⁺ acre) scrub-shrub wetland. This wetland is likely regulated by the MDEQ.



Photo 6

The southern portion of Wetland B is comprised primarily of meadow species as opposed to woody species that dominate further north.



Photographic Log



Photo 7

Wetland D, located in the northeast portion of the property, is primarily an emergent wetland dominated by Phragmites, cattail, sedge, and rush.



Photo 8

Wetland C is a small, isolated emergent wetland located along Veterans Memorial Highway.



Photographic Log



Photo 9

View facing north showing the scrub-shrub portion of Wetland E. This wetland contains both meadow and scrub-shrub characteristics, and is very diverse.



Photo 10

Pockets of open meadow are common throughout Wetland E. These areas contain an abundance of sedges, rushes and wildflowers such as vervain, goldenrod, milkweed, and aster.

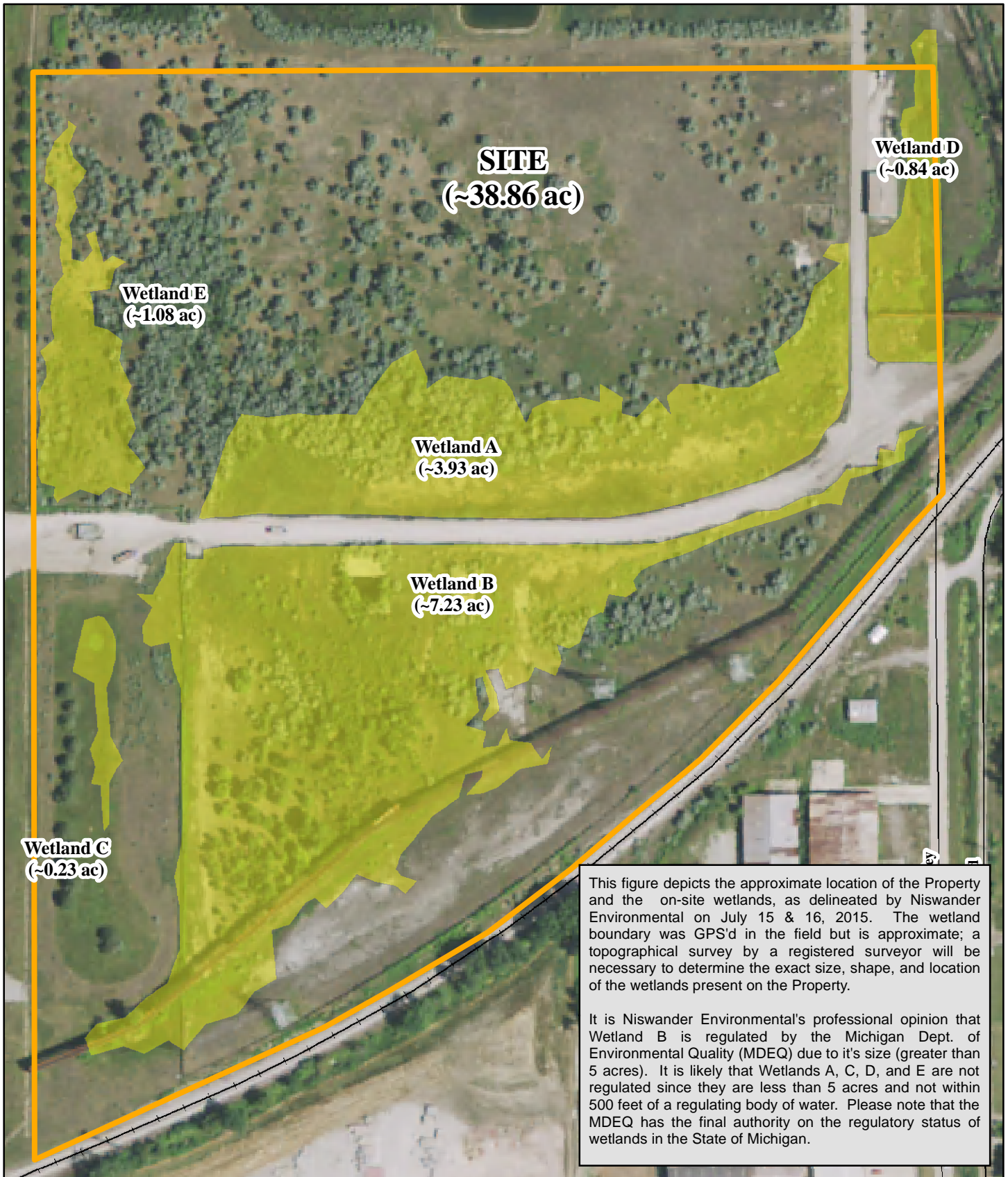


Figure 1. Wetland Location Map

NE 1424 Racer Trust Industrial Park

Client: Menard, Inc.

38.86-Acre Property at 2100 Veterans Memorial Parkway
Section 8 of Buena VistaTwp., Saginaw Co., MI (T12N, R5E)

Delineation Date: July 15 & 16, 2015

Map Created: July 16, 2015



	NISWANDER ENVIRONMENTAL	9436 Maltby Road, Brighton, MI 48116
		810.225.0539 office 810.225.0653 fax

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/15/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: A, B, D
 Investigator(s): J. Bridgland, T. Smith - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) Wetland Data Form for Wetlands A, B, and D. Each of these three wetlands exhibit similar habitat types, vegetative composition, soils, and hydrology. Separated by an access driveway, but no apparent hydrologic connection (no culverts observed). Highly disturbed - former industrial facility that was demolished roughly 10-15 years ago, capped with soil, and left to naturally vegetate. Wetland A = ~3.93 acres (80 flags); Wetland B = ~7.23ac (145 flags); Wetland C = ~ 0.23 ac (24 flags); Wetland D = ~0.84 ac (14 flags); Wetland E = ~ 1.08 ac (65 flags). Wetland B is likely regulated due to size. It is Niswander Environmental's professional opinion that Wetlands A, C, D, and E are hydrologically isolated and smaller than five acres in size and therefore are likely not regulated by the MDEQ.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) _____ Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) _____ Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
--	---

Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>3</u> Water Table Present? Yes <u>X</u> No _____ Depth (inches): <u>10</u> Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Wetlands A, B, and D exhibited standing water throughout much of the wetland at the time of the inspection. Much of the remainder of each wetland was saturated at the surface.

VEGETATION – Use scientific names of plants.

Sampling Point: A, B, D

<u>Tree Stratum</u> (Plot size: <u> 30 ft. </u>)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u>Eastern Cottonwood</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 6 </u> (A) Total Number of Dominant Species Across All Strata: <u> 8 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 75.0% </u> (A/B)																
2. <u>Russian-Olive</u>	<u>10</u>	<u>Yes</u>	<u>FACU</u>																	
3. <u>Black Willow</u>	<u>2</u>	<u>No</u>	<u>OBL</u>																	
4. _____																				
5. _____																				
6. _____																				
7. _____																				
	<u>22</u>	=Total Cover																		
<u>Sapling/Shrub Stratum</u> (Plot size: <u> 15 ft. </u>)				Prevalence Index worksheet: <table style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:50%;">Total % Cover of:</th> <th style="width:50%;">Multiply by:</th> </tr> </thead> <tbody> <tr> <td>OBL species <u> 117 </u></td> <td>x 1 = <u> 117 </u></td> </tr> <tr> <td>FACW species <u> 175 </u></td> <td>x 2 = <u> 350 </u></td> </tr> <tr> <td>FAC species <u> 45 </u></td> <td>x 3 = <u> 135 </u></td> </tr> <tr> <td>FACU species <u> 10 </u></td> <td>x 4 = <u> 40 </u></td> </tr> <tr> <td>UPL species <u> 0 </u></td> <td>x 5 = <u> 0 </u></td> </tr> <tr> <td>Column Totals: <u> 347 </u></td> <td>(A) <u> 642 </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u> 1.85 </u></td> </tr> </tbody> </table>	Total % Cover of:	Multiply by:	OBL species <u> 117 </u>	x 1 = <u> 117 </u>	FACW species <u> 175 </u>	x 2 = <u> 350 </u>	FAC species <u> 45 </u>	x 3 = <u> 135 </u>	FACU species <u> 10 </u>	x 4 = <u> 40 </u>	UPL species <u> 0 </u>	x 5 = <u> 0 </u>	Column Totals: <u> 347 </u>	(A) <u> 642 </u> (B)	Prevalence Index = B/A = <u> 1.85 </u>	
Total % Cover of:	Multiply by:																			
OBL species <u> 117 </u>	x 1 = <u> 117 </u>																			
FACW species <u> 175 </u>	x 2 = <u> 350 </u>																			
FAC species <u> 45 </u>	x 3 = <u> 135 </u>																			
FACU species <u> 10 </u>	x 4 = <u> 40 </u>																			
UPL species <u> 0 </u>	x 5 = <u> 0 </u>																			
Column Totals: <u> 347 </u>	(A) <u> 642 </u> (B)																			
Prevalence Index = B/A = <u> 1.85 </u>																				
1. <u>Sandbar Willow</u>	<u>65</u>	<u>Yes</u>																		
2. <u>Silky Dogwood</u>	<u>10</u>	<u>No</u>																		
3. <u>European Buckthorn</u>	<u>10</u>	<u>No</u>																		
4. <u>Russian-Olive</u>	<u>10</u>	<u>No</u>																		
5. _____																				
6. _____																				
7. _____																				
	<u>95</u>	=Total Cover																		
<u>Herb Stratum</u> (Plot size: <u> 5 ft. </u>)				Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
1. <u>Common Reed</u>	<u>80</u>	<u>Yes</u>	<u>FACW</u>																	
2. <u>Purple Loosestrife</u>	<u>50</u>	<u>Yes</u>	<u>OBL</u>																	
3. <u>Narrow-Leaf Cat-Tail</u>	<u>40</u>	<u>Yes</u>	<u>OBL</u>																	
4. <u>Torrey's Rush</u>	<u>40</u>	<u>Yes</u>	<u>FACW</u>																	
5. <u>Late Goldenrod</u>	<u>25</u>	<u>No</u>	<u>FACW</u>																	
6. <u>Juncus tenuis</u>	<u>25</u>	<u>No</u>	<u>FAC</u>																	
7. <u>Agrostis gigantea</u>	<u>20</u>	<u>No</u>	<u>FACW</u>																	
8. <u>Common Fox Sedge</u>	<u>10</u>	<u>No</u>	<u>OBL</u>																	
9. <u>Flat-Top Goldentop</u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
10. <u>Swamp Milkweed</u>	<u>5</u>	<u>No</u>	<u>OBL</u>																	
11. <u>water plantain</u>	<u>5</u>	<u>No</u>	<u>OBL</u>																	
12. <u>Bebb's Sedge</u>	<u>5</u>	<u>No</u>	<u>OBL</u>																	
	<u>315</u>	=Total Cover																		
<u>Woody Vine Stratum</u> (Plot size: <u> 15 ft. </u>)				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.																
1. <u>Vitis riparia</u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>																	
2. _____																				
3. _____																				
4. _____																				
	<u>10</u>	=Total Cover																		

Remarks: (Include photo numbers here or on a separate sheet.)
 Other species present include vervain, swamp aster, chairmakers rush, soft rush, green bulrush, joe-pye weed, boneset, taper-tip rush, and Indian hemp. Northern portions of Wetland A dominated 99% by Phragmites. Southern portions of Wetland B contain disturbed meadow. Upland/Wetland interface determined by presence of upland species such as spotted knapweed, russian olive, tall goldenrod, Virginia creeper, orchard grass, Queen Anne's lace, and/or thistle.

SOIL

Sampling Point A, B, D

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-8	10YR 2/1	95	7.5YR 3/4	5	C	M	Mucky Sand	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils³:	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR R, MLRA 149B)	<input type="checkbox"/> 2 cm Muck (A10) (LRR K, L, MLRA 149B)	<input type="checkbox"/> Coast Prairie Redox (A16) (LRR K, L, R)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR R, MLRA 149B)	<input type="checkbox"/> 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)	<input type="checkbox"/> Polyvalue Below Surface (S8) (LRR K, L)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> High Chroma Sands (S11) (LRR K, L)	<input type="checkbox"/> Thin Dark Surface (S9) (LRR K, L)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR K, L, R)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1) (LRR K, L)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 149B)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Red Parent Material (F21)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Depleted Dark Surface (F7)	<input type="checkbox"/> Very Shallow Dark Surface (F22)
<input checked="" type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Redox Depressions (F8)	<input type="checkbox"/> Marl (F10) (LRR K, L)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Sandy Gleyed Matrix (S4)			
<input checked="" type="checkbox"/> Sandy Redox (S5)			
<input type="checkbox"/> Stripped Matrix (S6)			
<input type="checkbox"/> Dark Surface (S7)			

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: _____ Depth (inches): _____	

Remarks:
 This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/15/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: C
 Investigator(s): J. Bridgland, T. Smith - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) Small, depressional PEM located within overgrown grassy field. Roughly 0.23 acres (24 flags). Likely not regulated due to lack of size and hydrologically isolated.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) _____ Water-Stained Leaves (B9) _____ High Water Table (A2) _____ Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) _____ Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
--	---

Field Observations: Surface Water Present? Yes <u>X</u> No _____ Depth (inches): <u>1</u> Water Table Present? Yes _____ No _____ Depth (inches): _____ Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>0</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
---	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Interior portions of Wetland C contained standing water, but a majority of the wetland was saturated at the surface at the time of inspection

VEGETATION – Use scientific names of plants.

Sampling Point: C

<u>Tree Stratum</u> (Plot size: <u> 30 ft. </u>)	Absolute % Cover	Dominant Species?	Indicator Status																									
1. _____	_____	_____	_____	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 3 </u> (A) Total Number of Dominant Species Across All Strata: <u> 3 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 100.0% </u> (A/B)																								
2. _____	_____	_____	_____																									
3. _____	_____	_____	_____																									
4. _____	_____	_____	_____																									
5. _____	_____	_____	_____																									
6. _____	_____	_____	_____																									
7. _____	_____	_____	_____																									
	_____	=Total Cover		Prevalence Index worksheet: <table style="width:100%; border:none;"> <tr> <td style="text-align:right">Total % Cover of:</td> <td style="text-align:right">Multiply by:</td> <td></td> </tr> <tr> <td>OBL species <u> 38 </u></td> <td>x 1 =</td> <td><u> 38 </u></td> </tr> <tr> <td>FACW species <u> 72 </u></td> <td>x 2 =</td> <td><u> 144 </u></td> </tr> <tr> <td>FAC species <u> 55 </u></td> <td>x 3 =</td> <td><u> 165 </u></td> </tr> <tr> <td>FACU species <u> 0 </u></td> <td>x 4 =</td> <td><u> 0 </u></td> </tr> <tr> <td>UPL species <u> 0 </u></td> <td>x 5 =</td> <td><u> 0 </u></td> </tr> <tr> <td>Column Totals: <u> 165 </u></td> <td>(A)</td> <td><u> 347 </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:right">Prevalence Index = B/A =</td> <td><u> 2.10 </u></td> </tr> </table>	Total % Cover of:	Multiply by:		OBL species <u> 38 </u>	x 1 =	<u> 38 </u>	FACW species <u> 72 </u>	x 2 =	<u> 144 </u>	FAC species <u> 55 </u>	x 3 =	<u> 165 </u>	FACU species <u> 0 </u>	x 4 =	<u> 0 </u>	UPL species <u> 0 </u>	x 5 =	<u> 0 </u>	Column Totals: <u> 165 </u>	(A)	<u> 347 </u> (B)	Prevalence Index = B/A =		<u> 2.10 </u>
Total % Cover of:	Multiply by:																											
OBL species <u> 38 </u>	x 1 =	<u> 38 </u>																										
FACW species <u> 72 </u>	x 2 =	<u> 144 </u>																										
FAC species <u> 55 </u>	x 3 =	<u> 165 </u>																										
FACU species <u> 0 </u>	x 4 =	<u> 0 </u>																										
UPL species <u> 0 </u>	x 5 =	<u> 0 </u>																										
Column Totals: <u> 165 </u>	(A)	<u> 347 </u> (B)																										
Prevalence Index = B/A =		<u> 2.10 </u>																										
<u>Sapling/Shrub Stratum</u> (Plot size: <u> 15 ft. </u>)																												
1. _____	_____	_____	_____																									
2. _____	_____	_____	_____																									
3. _____	_____	_____	_____																									
4. _____	_____	_____	_____																									
5. _____	_____	_____	_____																									
6. _____	_____	_____	_____																									
7. _____	_____	_____	_____																									
	_____	=Total Cover																										
<u>Herb Stratum</u> (Plot size: <u> 5 ft. </u>)				Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																								
1. <u>Equisetum hyemale</u>	50	Yes	FAC																									
2. <u>Carex granularis</u>	50	Yes	FACW																									
3. <u>Juncus articulatus</u>	30	No	OBL																									
4. <u>Poa palustris</u>	15	No	FACW																									
5. <u>Juncus torreyi</u>	5	No	FACW																									
6. <u>Eleocharis obtusa</u>	5	No	OBL																									
7. <u>Asclepias incarnata</u>	1	No	OBL																									
8. <u>Carex vulpinoidea</u>	1	No	OBL																									
9. <u>Scirpus cyperinus</u>	1	No	OBL																									
10. <u>Agrostis gigantea</u>	1	No	FACW																									
11. <u>Solidago gigantea</u>	1	No	FACW																									
12. _____	_____	_____	_____																									
	160	=Total Cover																										
<u>Woody Vine Stratum</u> (Plot size: <u> 15 ft. </u>)				Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height.																								
1. <u>Vitis riparia</u>	5	Yes	FAC																									
2. _____	_____	_____	_____																									
3. _____	_____	_____	_____																									
4. _____	_____	_____	_____																									
	5	=Total Cover																										

Remarks: (Include photo numbers here or on a separate sheet.)
 Dominated by scouring rush, C. granularis (or C. pellita), and taper-tip rush. Upland/Wetland interface determined by subtle slope, presence of upland grasses and thistle.

SOIL

Sampling Point **C**

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-12	10YR 2/1	95	7.5YR 3/4	5	C	M	Mucky Sand	Prominent redox concentrations

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- ? Dark Surface (S7)

- Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- Thin Dark Surface (S9) (LRR R, MLRA 149B)
- High Chroma Sands (S11) (LRR K, L)
- Loamy Mucky Mineral (F1) (LRR K, L)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Marl (F10) (LRR K, L)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- Coast Prairie Redox (A16) (LRR K, L, R)
- 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- Polyvalue Below Surface (S8) (LRR K, L)
- Thin Dark Surface (S9) (LRR K, L)
- Iron-Manganese Masses (F12) (LRR K, L, R)
- Piedmont Floodplain Soils (F19) (MLRA 149B)
- Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- Red Parent Material (F21)
- Very Shallow Dark Surface (F22)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Type: _____	
Depth (inches): _____	

Remarks:
 This data form is revised from Northcentral and Northeast Regional Supplement Version 2.0 to include the NRCS Field Indicators of Hydric Soils version 7.0 March 2013 Errata. (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051293.docx)

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: Menard's Saginaw City/County: Buena Vista Twp., Saginaw Co. Sampling Date: 7/16/2015
 Applicant/Owner: Racer Trust State: MI Sampling Point: E
 Investigator(s): J. Bridgland - Niswander Environmental Section, Township, Range: Sec. 8, T12N, R5E
 Landform (hillside, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope %: _____
 Subregion (LRR or MLRA): Lat: 43 27' 25.00"N Long: 83 54' 32.82"W Datum: GoogleEarth
 Soil Map Unit Name: Urban Land (74) NWI classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
 Are Vegetation _____, Soil X, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No x
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>X</u> No _____ Hydric Soil Present? Yes <u>X</u> No _____ Wetland Hydrology Present? Yes <u>X</u> No _____	Is the Sampled Area within a Wetland? Yes <u>X</u> No _____ If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.) PSS wetland with open meadow portions; diverse; hummocky, portions marginally wetland (mesic); Approximately 1.08 ac (65 flags). Likely not regulated due to size and lack of hydrologic connectivity.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> _____ Surface Water (A1) _____ Water-Stained Leaves (B9) <u>X</u> High Water Table (A2) <u>X</u> Aquatic Fauna (B13) <u>X</u> Saturation (A3) _____ Marl Deposits (B15) _____ Water Marks (B1) _____ Hydrogen Sulfide Odor (C1) _____ Sediment Deposits (B2) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Drift Deposits (B3) _____ Presence of Reduced Iron (C4) _____ Algal Mat or Crust (B4) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Iron Deposits (B5) _____ Thin Muck Surface (C7) _____ Inundation Visible on Aerial Imagery (B7) _____ Other (Explain in Remarks) _____ Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> _____ Surface Soil Cracks (B6) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) _____ Geomorphic Position (D2) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) <u>X</u> FAC-Neutral Test (D5)
--	--

Field Observations: Surface Water Present? Yes _____ No _____ Depth (inches): _____ Water Table Present? Yes <u>X</u> No _____ Depth (inches): <u>10</u> Saturation Present? Yes <u>X</u> No _____ Depth (inches): <u>4</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <u>X</u> No _____
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
 Very few pockets of standing water; portions saturated at surface, but mostly below the surface (@ roughly 4")

VEGETATION – Use scientific names of plants.

Sampling Point: E

<u>Tree Stratum</u> (Plot size: <u> 30 ft. </u>)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u>Populus deltoides</u>	<u> 30 </u>	Yes	FAC	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u> 9 </u> (A) Total Number of Dominant Species Across All Strata: <u> 9 </u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u> 100.0% </u> (A/B) Prevalence Index worksheet: <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align:center;">Total % Cover of:</td> <td style="width:50%; text-align:center;">Multiply by:</td> </tr> <tr> <td>OBL species <u> 55 </u></td> <td>x 1 = <u> 55 </u></td> </tr> <tr> <td>FACW species <u> 140 </u></td> <td>x 2 = <u> 280 </u></td> </tr> <tr> <td>FAC species <u> 135 </u></td> <td>x 3 = <u> 405 </u></td> </tr> <tr> <td>FACU species <u> 10 </u></td> <td>x 4 = <u> 40 </u></td> </tr> <tr> <td>UPL species <u> 0 </u></td> <td>x 5 = <u> 0 </u></td> </tr> <tr> <td>Column Totals: <u> 340 </u></td> <td>(A) <u> 780 </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u> 2.29 </u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u> 55 </u>	x 1 = <u> 55 </u>	FACW species <u> 140 </u>	x 2 = <u> 280 </u>	FAC species <u> 135 </u>	x 3 = <u> 405 </u>	FACU species <u> 10 </u>	x 4 = <u> 40 </u>	UPL species <u> 0 </u>	x 5 = <u> 0 </u>	Column Totals: <u> 340 </u>	(A) <u> 780 </u> (B)	Prevalence Index = B/A = <u> 2.29 </u>	
Total % Cover of:	Multiply by:																			
OBL species <u> 55 </u>	x 1 = <u> 55 </u>																			
FACW species <u> 140 </u>	x 2 = <u> 280 </u>																			
FAC species <u> 135 </u>	x 3 = <u> 405 </u>																			
FACU species <u> 10 </u>	x 4 = <u> 40 </u>																			
UPL species <u> 0 </u>	x 5 = <u> 0 </u>																			
Column Totals: <u> 340 </u>	(A) <u> 780 </u> (B)																			
Prevalence Index = B/A = <u> 2.29 </u>																				
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
5. _____	_____	_____	_____																	
6. _____	_____	_____	_____																	
7. _____	_____	_____	_____																	
	<u> 30 </u> =Total Cover																			
<u>Sapling/Shrub Stratum</u> (Plot size: <u> 15 ft. </u>)																				
1. <u>Populus deltoides</u>	<u> 50 </u>	Yes	FAC	Hydrophytic Vegetation Indicators: <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input checked="" type="checkbox"/> 3 - Prevalence Index is ≤3.0 ¹ <input type="checkbox"/> 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
2. <u>Salix interior</u>	<u> 20 </u>	Yes	FACW																	
3. <u>Russian olive</u>	<u> 10 </u>	No	FACU																	
4. <u>Cornus amomum</u>	<u> 5 </u>	No	FACW																	
5. _____	_____	_____	_____																	
6. _____	_____	_____	_____																	
7. _____	_____	_____	_____																	
	<u> 85 </u> =Total Cover																			
<u>Herb Stratum</u> (Plot size: <u> 5 ft. </u>)																				
1. <u>Lythrum salicaria</u>	<u> 35 </u>	Yes	OBL	Definitions of Vegetation Strata: Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/shrub – Woody plants less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vines – All woody vines greater than 3.28 ft in height. Hydrophytic Vegetation Present? Yes <u> X </u> No <u> </u>																
2. <u>Equisetum hyemale</u>	<u> 25 </u>	Yes	FAC																	
3. <u>Verbena hastata</u>	<u> 25 </u>	Yes	FACW																	
4. <u>Solidago gigantea</u>	<u> 20 </u>	Yes	FACW																	
5. <u>Euthamia graminifolia</u>	<u> 20 </u>	Yes	FACW																	
6. <u>Agrostis gigantea</u>	<u> 15 </u>	No	FACW																	
7. <u>Carex vulpinoidea</u>	<u> 15 </u>	No	OBL																	
8. <u>Apocynum cannabinum</u>	<u> 15 </u>	No	FACW																	
9. <u>Juncus torreyi</u>	<u> 10 </u>	No	FACW																	
10. <u>Phragmites australis</u>	<u> 10 </u>	No	FACW																	
11. <u>Juncus tenuis</u>	<u> 10 </u>	No	FAC																	
12. <u>Juncus articulatus</u>	<u> 5 </u>	No	OBL																	
	<u> 205 </u> =Total Cover																			
<u>Woody Vine Stratum</u> (Plot size: <u> 15 ft. </u>)																				
1. <u>Vitis riparia</u>	<u> 20 </u>	Yes	FAC																	
2. _____	_____	_____	_____																	
3. _____	_____	_____	_____																	
4. _____	_____	_____	_____																	
	<u> 20 </u> =Total Cover																			

Remarks: (Include photo numbers here or on a separate sheet.)
 Wetland E is dominated by cottonwood, sandbar willow, purple loosestrife, and grapevine. Abundant and common species include vervain, late goldenrod, scouring rush, slender-fragrant goldenrod, fox sedge, red top, and Indian hemp. Upland/Wetland interface marked by presence of Virginia creeper, russian olive, tall goldenrod, thistle, and poison ivy.

Attachment 5

**MDEQ's 2009 Determination of Mixing
Zone Request**

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division
FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau
DATE: December 11, 2009
SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

- Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

Table with 7 columns (JAN. to JUNE) and 2 rows (50%, 95%) for each month, showing exceedance flows in cfs.

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

Table with 7 columns (JAN. to JUNE) and 2 rows (50%, 95%) for each month, showing exceedance flows in cfs.

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

**Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater**

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity


Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Nate Nemani, Resource Conservation and Recovery Act of 1976 Corrective Action Project Manager, Land and Chemicals Division, Remediation and Reuse Branch, U.S. Environmental Protection Agency

FROM: Ronald Stone, Senior Geologist, Waste and Hazardous Materials Division, Michigan Department of Environmental Quality 

DATE: January 12, 2010

SUBJECT: Implementation of a Mixing Zone Request; General Motors - Saginaw Metal Castings Operation (GM-SMCO); MID 041 793 340

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from GM-SMCO in Saginaw County, Michigan and forwarded that request to the MDEQ, Water Bureau (WB). The attached response provided by the WB identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

Based on the information provided by the WB, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Saginaw River

Parameter	Final Acute Value	Final Chronic Value	Reported Worst Case Maximum Site Concentration
pH	6.5 - 9.0 S.U.		
Ammonia Nitrogen	3.1 mg/l		

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:
 - a. If any existing exceedances are upgradient of the compliance monitoring wells, GM-SMCO must demonstrate that data from all of the compliance monitoring wells in the Mixing Zone Compliance Monitoring Plan are, and will be, in compliance with acute

mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern. Acute mixing zoned-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.

- b. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.
2. It has been determined that any other parameter on the mixing zone request form, not given a recommended mixing zone-based GSI criteria in the table above (if any) or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in the mixing zone request, which was submitted to the WB by the WHMD.

In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, GM-SMCO will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that GM-SMCO proposes to sample to show compliance with the mixing zone-based GSI criteria (along the GSI at the GSI point of compliance) and any sentinel wells within the appropriate portions of the plume, and provide an explanation of the monitoring schedule and reporting process.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me via e-mail at stoner@michigan.gov or by telephone at 517-373-7141.

Attachment

cc/att: Ms. Cheryl Howe, WHMD
Ms. Rhonda Klann, Remediation and Redevelopment Division
Mr. David Slayton, WHMD
Corrective Action File

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

**Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater**

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

Attachment 6

Mixing Zone - Re-evaluation



Memorandum

18 May 2022

To	Zack Sasnow, U.S. EPA		
Copy to	Dave Favero, RACER		
From	John-Eric Pardys/kf	Tel	519-340-4316
Subject	Mixing Zone	Project no.	11208041-MEM-5

On behalf of Revitalizing Auto Communities Environmental Response (RACER) Trust, GHD has prepared this re-evaluation of the Mixing Zone Determination Request (MZDR) for the RACER Saginaw Nodular Industrial Land (Site), located in Saginaw, Michigan in response to the recommendations in the Michigan Department of environment, Great Lakes, and Energy (EGLE) Materials Management Division (MMD) Remediation Advisory Team meeting with the U. S. Environmental Protection Agency (U.S. EPA) on January 26, 2022.

Background

The Site was part of a larger facility, owned by the former General Motors Corporation (GMC), called the General Motors Powertrain Saginaw Metal Casting Operations (SMCO or 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 certain environmental obligations for this Site were transferred from MLC to the RACER Trust. Ownership of the Site was transferred to RACER Properties LLC, a wholly owned subsidiary of RACER Trust. Figure 1 presents the approximate location of the RACER Site.

A MZDR was made to the Michigan Department of Environmental Quality (MDEQ) in 2009 by GMC (Attachment 1) to address venting of groundwater with elevated ammonia and pH outside the acceptable range from the larger GMC SMCO Facility to the Saginaw River. The portion of the MZDR associated with the Site is referred to as the Ammonia Part 2 venting area. Based upon relative flows and pH conditions, the MZDR did not propose any "recommendations.... to be necessary to protect against acute or chronic un-ionized ammonia toxicity" (i.e., the Ammonia Part 2 plume did not pose "a reasonable potential to discharge chemicals to cause or contribute to water quality standards (WQS) being exceeded.", unlike the findings for the Ammonia Part 1 plume for which a mixing-zone based value was identified). Attachment 2 presents a copy of MDEQ's 2009 determination. In its 2009 determination, MDEQ states that, beyond the mixing-zone values identified for the Ammonia Part 1 plume (not Site related and non-RACER):

"No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges." (MDEQ, December 11, 2009)

GSI Criteria for Ammonia and Pathway Compliance Options per Section 20120e (and GSICO)

"Generic" GSI criteria for ammonia pursuant to NREPA (Part 201) are identified in Table 1 of administrative rules for the Michigan Department of Environment, Great Lakes, and Energy (EGLE) RRD "Cleanup Criteria Requirements for Response Activity" (specifically, Rule 44). The criterion identified for ammonia is stated as "CC" which is explained in the footnotes of the administrative rule to be dependent upon: a) whether the receiving water body is protected as a cold water or warm water resource, and b) the amount of ammonia which is present in the "unionized" form, which is dependent upon the temperature and pH of the receiving water.

The receiving waters (Saginaw River) are classified and protected as a warm water resource. Only a fraction of total ammonia (unionized ammonia) is considered toxic. Water quality standards which are the basis for GSI criteria are the "Rule 57" water quality values identified by EGLE for warm water resources as 53 micrograms per liter ($\mu\text{g/L}$) (for chronic exposures) and 420 $\mu\text{g/L}$ (for acute exposures) of unionized ammonia. The footnote explaining the Part 201 GSI criterion for ammonia provides a table for interpreting the percentage of total ammonia concentrations which are in the unionized form under various temperature and pH conditions. Similarly, U.S. EPA guidance entitled, "Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater 2013" (U.S. EPA, April 2013) provides two tables for acute and chronic total ammonia based on various pH and temperatures.

The previous 2009 MDEQ determination for this Site (and also for a similar condition downstream from the Site at the Middleground Landfill located at Bay City which is also on the Saginaw River) indicates EGLE finds "mixing" of venting groundwater to be such that "chronic" impacts are not likely, and that venting in excess of concentrations protective of acute impacts (420 $\mu\text{g/L}$ unionized ammonia) would be a condition requiring response activity to ensure adequate resource protection. However, as described above, the ammonia concentrations originating from the Site and venting (Ammonia Part 2 plume) was actually considered to be so limited as to not even pose a potential for exceeding either the acute or chronic water quality standards.

Ammonia Part 2 Results

As part of the Environmental Indicators (EI) groundwater monitoring program that began in 2004 and was terminated with U.S. EPA approval in 2020, first GMC and then RACER continued to monitor ammonia concentrations in groundwater. Initially, groundwater samples were analyzed and reported for total ammonia. However, on April 6, 2015, GHD (formerly CRA) submitted a memorandum that discussed ammonia in groundwater at the Site for U.S. EPA's review and it was subsequently forwarded to MDEQ for review on April 8, 2015. This memorandum incorporated the evaluation of the toxic fraction of ammonia (unionized ammonia) and concluded that no further activities to address ammonia above GSI criteria in monitoring wells next to the Saginaw River are necessary, but that continued monitoring would continue to be of value to ensure conditions remain as currently understood and characterized. From 2015 to 2020, the toxic fraction of total ammonia was calculated and both total and unionized ammonia were reported as part of the EI groundwater monitoring program.

The calculations for unionized ammonia involve averaging pH and temperature of groundwater from a given monitoring well and of surface water from the Saginaw River in order to calculate the unionized fraction. Table 1 presents the total ammonia data, pH, and temperature from the most recent EI sampling event in October 2020 for the three GSI compliance monitoring wells (MW-04257, MW-04051, MW-03945). Temperature and pH readings were measured in the Saginaw River the day samples were collected. Concentrations of unionized ammonia in the three GSI monitoring wells are below the chronic and the acute criteria.

Figure 2 presents the results for total and unionized ammonia and pH since 2011 for the GSI compliance monitoring locations, monitoring locations near the apparent source area, and monitoring wells between the source and the river. The results in the three GSI compliance monitoring wells have been consistently

below the chronic and the acute criteria, with exception of one sampling event (November 2014) in which the calculated unionized ammonia (61.1 µg/L) was above the chronic criteria (53 µg/L).

Ammonia Part 1 and High pH Results

As part of the original 2009 MZDR, elevated concentrations of ammonia were identified at MW-04764 and MW-04765 (Ammonia Part 1), as well as elevated pH readings at MW-04764 (high pH). These monitoring locations are located adjacent to the City of Saginaw Publicly Owned Treatment Works (POTW) and therefore likely influenced by the POTW. As a result, in October 23, 2013, Conestoga-Rovers & Associates (CRA) (now GHD) submitted a memorandum which discussed North Ditch Characterization and select Groundwater Monitoring (Attachment 3) and one of the recommendations was to discontinue monitoring at MW-04765 and MW-04864 (which is located immediately adjacent to MW-04764 and was selected to be monitored as part of the EI groundwater monitoring program) since results from these locations would be influenced by the POTW. A Site meeting was conducted on November 6, 2013 to review the area and on November 29, 2013, U.S. EPA approved (via email provided in Attachment 3) the recommendation to discontinue monitoring at MW-04765 and MW-04684.

Regardless, Figure 2 presents the results for total and unionized ammonia and pH from 2011 until 2013 when monitoring was discontinued for MW-04765 and MW-04864. The unionized ammonia results at MW-04765 and MW-04684 were consistently below the chronic and the acute criteria. The most recent results for pH in 2012 and 2013 were within the acceptable range for pH (6.5 to 8.5).


Conclusion

MDEQ's December 2009 MZDR did not have any recommendations to protect against acute or chronic un-ionized ammonia toxicity for the ammonia plume originating from the Site and venting to the Saginaw River (Ammonia Part 2 plume), and subsequent groundwater monitoring results have not shown any exceedances of the Part 201 Cleanup Criteria Requirements for Response Activity Groundwater Surface Water Interface (GSI) criteria for ammonia. Further evaluations/updates to the MZDR are not warranted for Ammonia Part 2 plume.

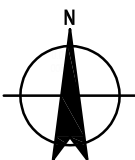
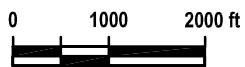
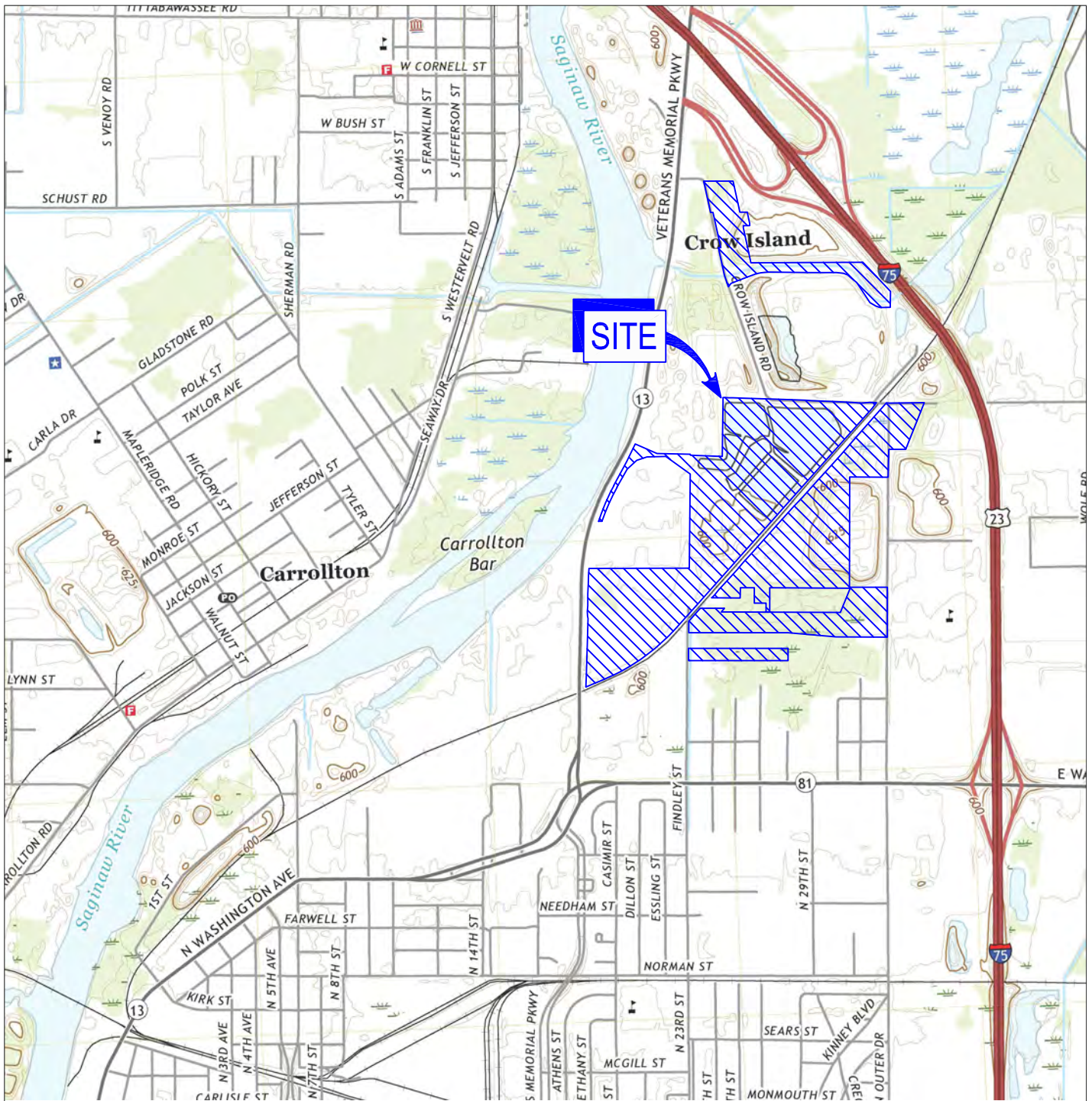
Ammonia Part 1 plume and high pH plume are located adjacent to and likely influenced by the POTW. The most recent readings from MW-04765 and MW-04864 have not shown exceedances of the Part 201 Cleanup Criteria Requirements for Response Activity Groundwater Surface Water Interface (GSI) criteria for ammonia or pH. Therefore, no further evaluations/updates to the MZDR by RACER are warranted.

Figure 1	Site Location
Figure 2	Summary of Ammonia and pH results
Table 1	Groundwater Ammonia Compliance Worksheet
Attachment 1	2009 Mixing Zone Determination Request
Attachment 2	2009 and 2010 Mixing Zone Determination and Implementation Responses
Attachment 3	Correspondence Related to Discontinuing Monitoring at MW-04765 and MW-04864

Regards


John-eric Pardys

Figures

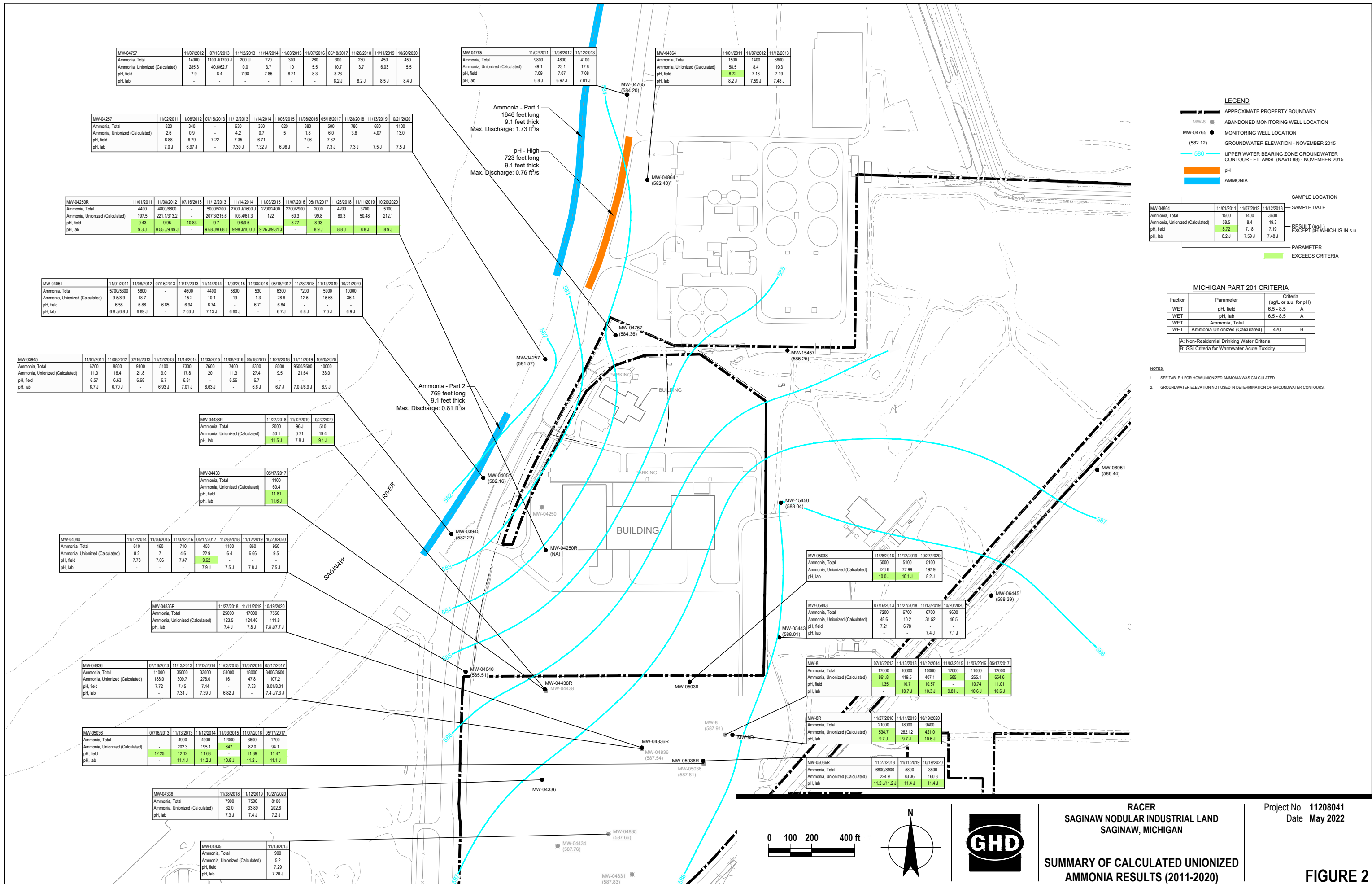


RACER TRUST
SAGINAW, MICHIGAN

Project No. 11208041
Date March 2022

SITE LOCATION

FIGURE 1



Tables

**Groundwater Ammonia FAV Compliance Worksheet
GSI Compliance Sampling Event of October 2020
RACER Nodular Industrial Land
Saginaw, Michigan**

GSI Compliance Point Number (Well ID)	Measured Total NH3 (µg/L)₄	Groundwater Temperature (°C)₄	Groundwater pH₄	Saginaw River Temperature (°C)⁴	Saginaw River pH⁴	Average Temperature (°C)¹	Average pH²	% Unionized NH₃³	Calculated Unionized NH3 (µg/L)
MW-04257	1100	16.90	7.50	10.3	8.03	13.60	7.69	1.18%	13.0
MW-04051	10000	17.10	6.90	10.3	8.03	13.70	7.17	0.36%	36.4
MW-03945	10000	14.50	6.90	10.3	8.03	12.40	7.17	0.33%	33.0

Notes:

1. Temperature is the average of the groundwater temperature and the Saginaw River temperature
2. pH value for average of groundwater and Saginaw River H⁺ concentrations
3. Ammonia toxicity equations taken from Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997
4. The NH3 and groundwater and Saginaw River temperature and pH were measured on October 21, 2020

 Boxed Value indicates exceedance of FAV criterion of 420 µg/L

Attachments

Attachment 1

2009 Mixing Zone Determination Request

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Eric Alexander
Surface Water Quality Assessment Section
Water Bureau

FROM: Liane J. Shekter-Smith, P.E., Assistant Division Chief
Waste and Hazardous Materials Division

DATE: **October 1, 2009**

SUBJECT: **General Motors, SMCO**
Mixing Zone Determination Request, **Saginaw Bay** District

General Information

We are requesting a mixing zone determination for the above referenced facility, located in the **SW** 1/4 of the **SE** 1/4 of **Section 07**, **SE** 1/4 of the **SE** 1/4 of **Section 07**, **SW** 1/4 of the **SW** 1/4 of **Section 07**, **NW** 1/4 of the **NW** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NE** 1/4 of the **NE** 1/4 of **Section 18**, **NW** 1/4 of the **NW** 1/4 of **Section 17**, **T12N**, **R 5E** in **Saginaw County**.

WHMD or U.S. Environmental Protection Agency Contact Person: **Ron Stone** Phone #: **517-373-7141**

District Supervisor/Unit Chief: **Virginia Himich**

Phone #: **517-373-7974** FAX #: **517-373-4797**

Priority: (to be filled out by the Assistant Division Chief)

four week response eight week response

Facility Information

1. Please advise of the name of the receiving water body and the location of the venting groundwater contaminant plume; the map is attached. Please indicate if the discharge is to a public recreational area, a Great Lake, an inland lake or a wetland.

Saginaw River

- a. This is a new, increased, or existing discharge. If new or increased discharge, see Attachment 3.

- b. This is a discharge to a Great Lake, Inland Lake or wetland, not applicable.
- c. Is human body contact expected in the receiving water? yes no

2. General information regarding the origin of the pollutants. This includes the location, nature, and chemical characteristics of the source of the groundwater contamination plume(s):

Saginaw Metal Casting Operations (SMCO) Facility or the former Nodular Iron Foundry. Ammonia and pH have been reported above GSI criteria in groundwater samples from monitoring wells located next to the Saginaw River.

Technical Information

3. The name; Chemical Abstract Service (CAS) Number; worst case maximum concentration of contaminants reaching, or predicted to reach; the GSI. Generally, the highest concentration of the contaminant found in the groundwater would be appropriate to represent the worst case maximum. If source contaminants have not yet reached the groundwater but are expected to do so, source concentrations should be identified and noted as such.

Chemical or General Chemistry Parameter	CAS #	Worst Case Maximum GSI Discharge Concentration	Average Surface Water Conc. Upstream (if available)
pH	NA	5.39 (low)	NA
pH	NA	10.89 (high)	
Ammonia	7664-41-7	9.45 mg/L	NA

4. The maximum discharge rate of the venting groundwater contaminant plume in cubic feet per second. The maximum discharge rate must be recorded in the Request Form to ensure protection from acute effects to aquatic life. More than just the rate should be included here; all calculations need to be shown.

Please see Table 1 for a breakdown of the discharge rate calculations of the venting groundwater plume. Figures 1 and 2 attached show the approximate reaches of

groundwater venting for ammonia and pH, including their longitudinal distances as well as approximate saturated zone thicknesses.

The hydraulic conductivity of the fill material and the hydraulic gradient used in these calculations was 2.2×10^{-1} cm/s (0.0072 ft/s) and 0.016 (ft/ft) respectively and the hydraulic gradient represents the gradient directly adjacent to the Saginaw River (CRA, 2007).

Based on the calculations shown in Table 1, the maximum discharge rate for ammonia is calculated to be 2.53 ft³/s. For high pH the maximum discharge rate is 0.76 ft³/s and for low pH the maximum discharge rate is 2.05 ft³/s.

5. The location of other contaminant plumes entering the receiving surface water body, their constituents and concentrations, if available:

Attachments

cc:

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Equation Used:

Darcy's Law: $Q = KiA$

Where: Q = discharge [ft³/s]
 K = hydraulic conductivity [ft/second]
 i = hydraulic gradient [ft/ft]
 A = cross sectional area of saturated fill [ft²]

Darcy's Law Parameters:

1.) Hydraulic Gradient, i

- a) Calculated i at river location (close to MW-03746, using Figure 3.7)
 change in total head: 585 feet - 581 feet = 4 feet
 length over this head interval: (0.8 cm x (500'/1.3 cm)) = 307.7 feet
 $i = (4'/307.7') = 0.013$

- b) Calculated i immediately adjacent to Saginaw River = 0.016

Source:

CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

The hydraulic gradient used for calculations was 0.016, as it is a more conservative estimate.

2.) Hydraulic Conductivity, K

- a) Calculated K in the fill material = 2.2×10^{-1} cm/s = 0.0072 ft/s

Source:

CRA. 2007. Resource Conservation and Recovery Act - Facility Investigation - Phase 1C Report - Revised. March. (page 30).

3.) Height (average) of saturated fill material (used in cross sectional area calculation)

- a) Based on elevation values taken from Figures 3.5 and 3.7

Figure 3.7: <u>Water Level (feet)</u>	Figure 3.5: <u>Top of Native Clay (feet)</u>	<u>Thickness of Saturated Layer (feet)</u>
584	578	6
581	572	9
582.45	565.46	16.99
580.54	571.94	8.6
585	580	5
Average Thickness:		9.1

** Please note that this value of 9.1 feet is used for all calculations except for pH-low. The closest saturated thickness data for this area yields 16.9 feet, so a thickness of 17 feet was used as average in that case.

TABLE 1
GM SMCO - RESPONSE TO ITEM NO. 4
CALCULATIONS
MAXIMUM DISCHARGE RATE OF VENTING CONTAMINANT PLUME

Parameter:

Ammonia

Part 1 - See Figure 2

Length of discharge zone: (10.7 cm x (200 ft/1.3 cm)) = 1646 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Max. Discharge Rate, Q = 1646 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 1.73 ft³/s

Part 2 - See Figure 2

Length of discharge zone: (5.0 cm x (200 ft/1.3 cm)) = 769 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Max. Discharge Rate, Q = 769 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 0.81 ft³/s

Total Max. Discharge Rate: 2.53 ft³/s

pH - High

See Figure 2

Length of discharge zone: (4.7 cm x (200 ft/1.3 cm)) = 723 ft
 Average thickness of zone: 9.1 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

Total Max. Discharge Rate, Q = 723 ft x 9.1 ft x 0.0072 ft/s x 0.016 = 0.76 ft³/s

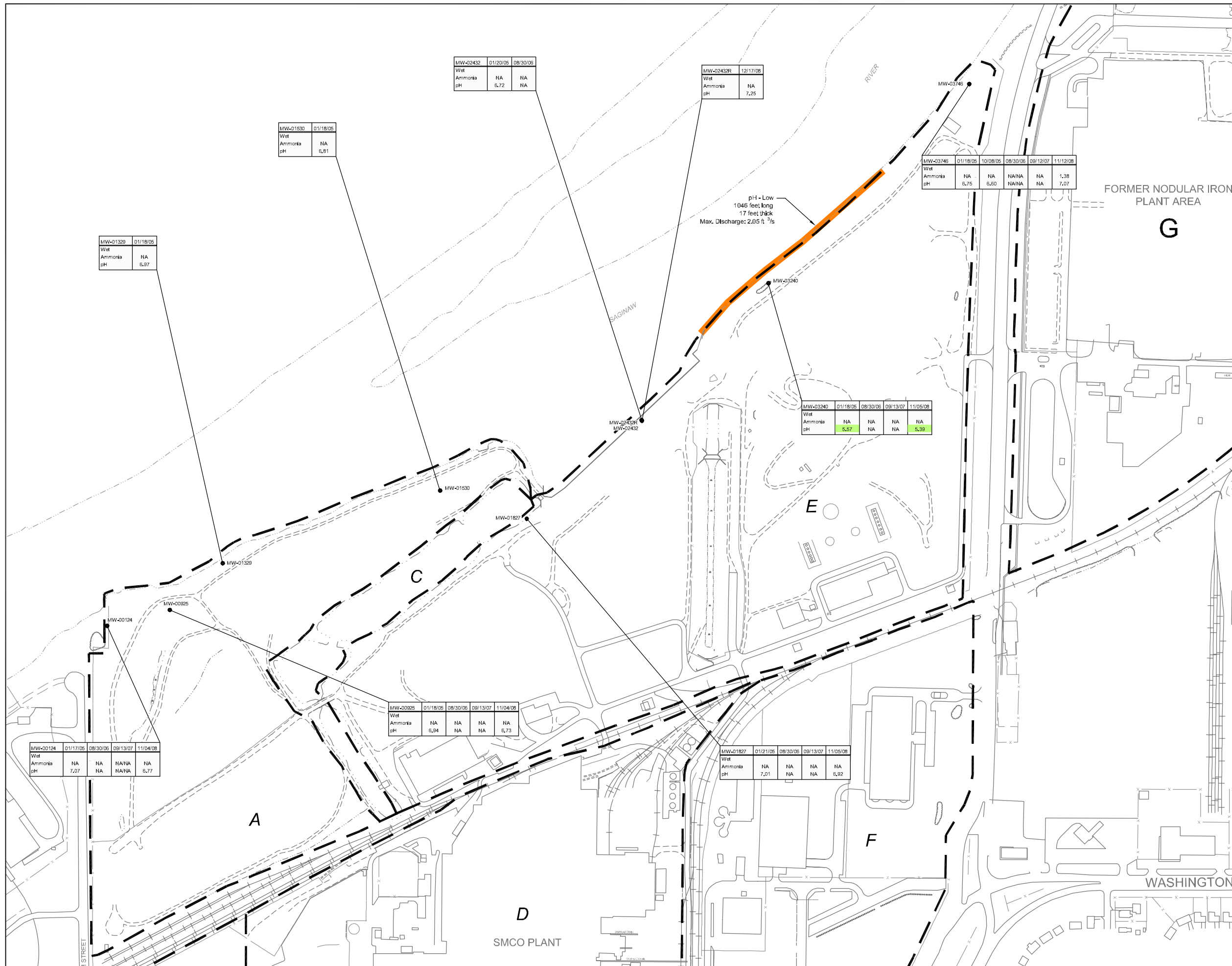
pH - Low

See Figure 1

Length of discharge zone: (6.8 cm x (200 ft/1.3 cm)) = 1046 ft
 Average thickness of zone: 17 ft
 Hydraulic conductivity, K: 0.0072 ft/s
 Hydraulic Gradient, *i*: 0.016

**Note average thickness of zone in this location is 17 ft, not 9.1 ft

Total Max. Discharge Rate, Q = 1046 ft x 17 ft x 0.0072 ft/s x 0.016 = 2.05 ft³/s



N

0 100 200

LEGEND

A --- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

MW-04785 ● INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER

PH

		SAMPLE LOCATION			
		01/18/05	08/30/06	09/13/07	11/05/08
		SAMPLE DATE			
		NA	NA	NA	NA
		RESULT (mg/L) EXCEPT pH WHICH IS μ L			
		5.57	NA	NA	5.39
		PARAMETER			
		EXCEEDS CRITERIA			
		NA NOT ANALYZED			

Chemical Name	GS1 Criteria	Criteria unit
Wet	2.12	mg/L
Ammonia	6.5 • 8.0	μ L
pH		

NOTE:

1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHROMIUM) FOR UNIONIZED AMMONIA IS 89 μ L FOR WARM WATER SURFACE WATER. (SEE FOOTNOTE 02 OF THE PART 201 CLEANUP CRITERIA PART 213 RELEASED SCREENING LEVELS REGULATORY MEMORANDUM NO. 1, DATED DECEMBER 15, 2004). THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 429 μ L (PROVIDED TO CRA BY MDEQ ON MARCH 2, 2007 REGARDING A NEARBY FACILITY).

BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1982-2009) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONITORING (SEPTEMBER AND 12.3 DEGREE CELSIUS AND 8.1 UNITS, RESPECTIVELY) (USGS GAUGE 04151006 SOURCE: HTTP://WWW.WATERDATA.USGS.GOV/WWW/SHOW). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREE CELSIUS, APPROXIMATELY 23 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RELATIVE TO A TOTAL AMMONIA GENERIC GSI CRITERION (CHROMIUM) OF 2,120 μ L (89 μ L / 0.0423).

THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREE CELSIUS, APPROXIMATELY 23 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 238 μ L (8,455 μ L X 0.028) FOR THE NOVEMBER 2008 EVENT.

2. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHROMIUM VALUE CALCULATION FOR TRIVALENT CHROMIUM, AS SPECIFIED IN THE MDEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM WAS SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION

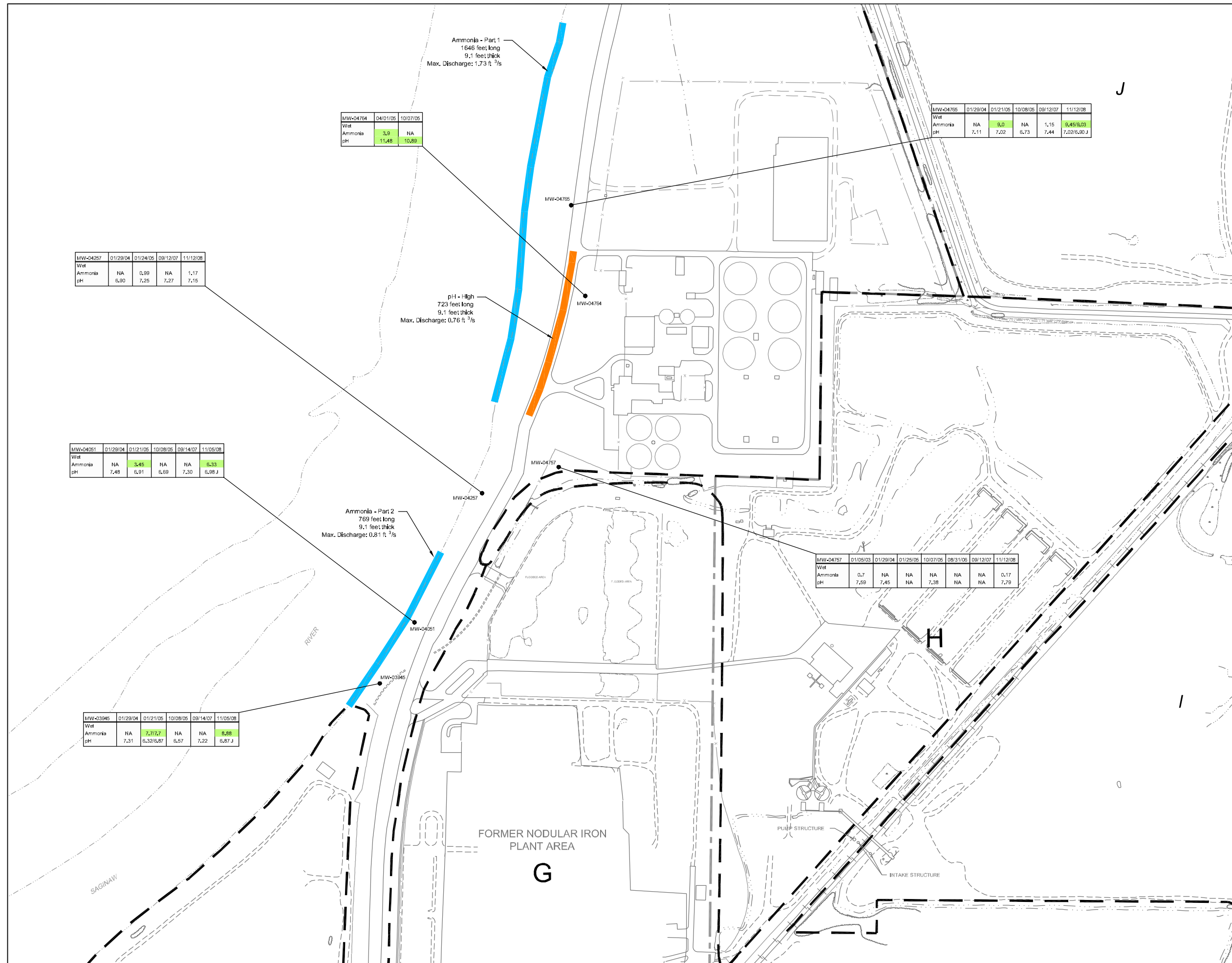
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS
SAGINAW, MICHIGAN
SUMMARY OF GSI LOCATIONS WEST OF VETERANS
MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY
2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:

Project Manager:	Reviewed By:	Date:
M.T.	I.R.	OCTOBER 2009
Scale:	Project N°:	Report N°:
1"=200'	17075-12	MEMO023
		Drawing N°:
		figure 1



0 100 200'

LEGEND

- INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- MW-04755 • INVESTIGATIVE UNIT BOUNDARY AND IDENTIFIER
- Orange line pH
- Blue line AMMONIA

SAMPLE LOCATION

MW-04754	04/01/05	10/07/05
Wet		
Ammonia	3.9	NA
pH	11.48	10.89

EXCEEDS CRITERIA
NA NOT ANALYZED

Chemical Name	GSI Criteria	Criteria Unit
Wet		
Ammonia	2.12	mg/L
pH	6.5 - 8.0	unit

NOTE:

1. NOTE THAT THE UNIONIZED FRACTION OF AMMONIA IS A FUNCTION OF THE WATER BODY CLASSIFICATION (WARM WATER OR COLD WATER), PH AND TEMPERATURE OF THE RECEIVING WATER AND IS ESTIMATED AS A PERCENT OF THE TOTAL AMMONIA. THE SAGINAW RIVER HAS BEEN CLASSIFIED AS WARM WATER. THE GENERIC GSI CRITERION (CHRONIC) FOR UNIONIZED AMMONIA IS 59 µg/L FOR WARM WATER SURFACE WATER. (SEE FOOTNOTE C OF THE PART 201 CLEANUP CRITERIA PART 213 RISK-BASED SCREENING LEVELS RFD OPERATIONAL, MEMORANDUM DATED DECEMBER 18, 2004). THE GENERIC ACUTE TOXICITY CRITERION FOR UNIONIZED AMMONIA IS 420 µg/L PROVIDED TO EPA BY MODEL ON MARCH 2, 2007 REGARDING A NEARBY FACILITY.

BASED ON DATA AVAILABLE FOR THE SAGINAW RIVER FROM USGS, THE AVERAGE (1981-2002) TEMPERATURE AND PH FOR THE SAGINAW RIVER DURING THE FALL MONTHS (SEPTEMBER) ARE 12.3 DEGREES CELSIUS AND 8.0 UNITS, RESPECTIVELY (USGS GAUGE 04157000 SOURCE: HTTP://WWW.WATERDATA.USGS.GOV/MWBSON). THEREFORE, FOR A PH OF 8 AND A TEMPERATURE OF 12.3 DEGREES CELSIUS, APPROXIMATELY 2.3 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM RESULTING IN A TOTAL AMMONIA GENERIC GSI CRITERION (CHRONIC) OF 2.120 µg/L (89 µg/L (6.025)).

2. THEREFORE, FOR A PH OF 9 AND A TEMPERATURE OF 12.5 DEGREES CELSIUS, APPROXIMATELY 2.5 PERCENT OF THE TOTAL AMMONIA WILL BE PRESENT IN THE UNIONIZED FORM OR A MAXIMUM OF 238 µg/L (9.439 µg/L X 25) FOR THE NOVEMBER 2003 EVENT.

3. NOTE THAT THE GSI CRITERIA DEVELOPED FOR TOTAL CHROMIUM WAS DEVELOPED FROM THE FINAL CHRONIC VALUE CALCULATION FOR TRIVALENT CHROMIUM AS SPECIFIED IN THE ADEQ GUIDANCE. TOTAL CHROMIUM RESULTS WERE COMPARED TO TRIVALENT CHROMIUM CRITERIA SINCE EXTENSIVE SITE DATA SUPPORTS THAT THE MAJORITY OF THE TOTAL CHROMIUM IS TRIVALENT CHROMIUM. HEXAVALENT CHROMIUM IS STILL SAMPLED AT NUMEROUS LOCATIONS AND IS COMPARED TO HEXAVALENT CHROMIUM CRITERIA.

DRAFT
PREPARED AT THE REQUEST OF COUNSEL

SCALE VERIFICATION
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

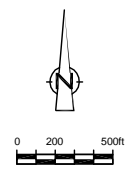
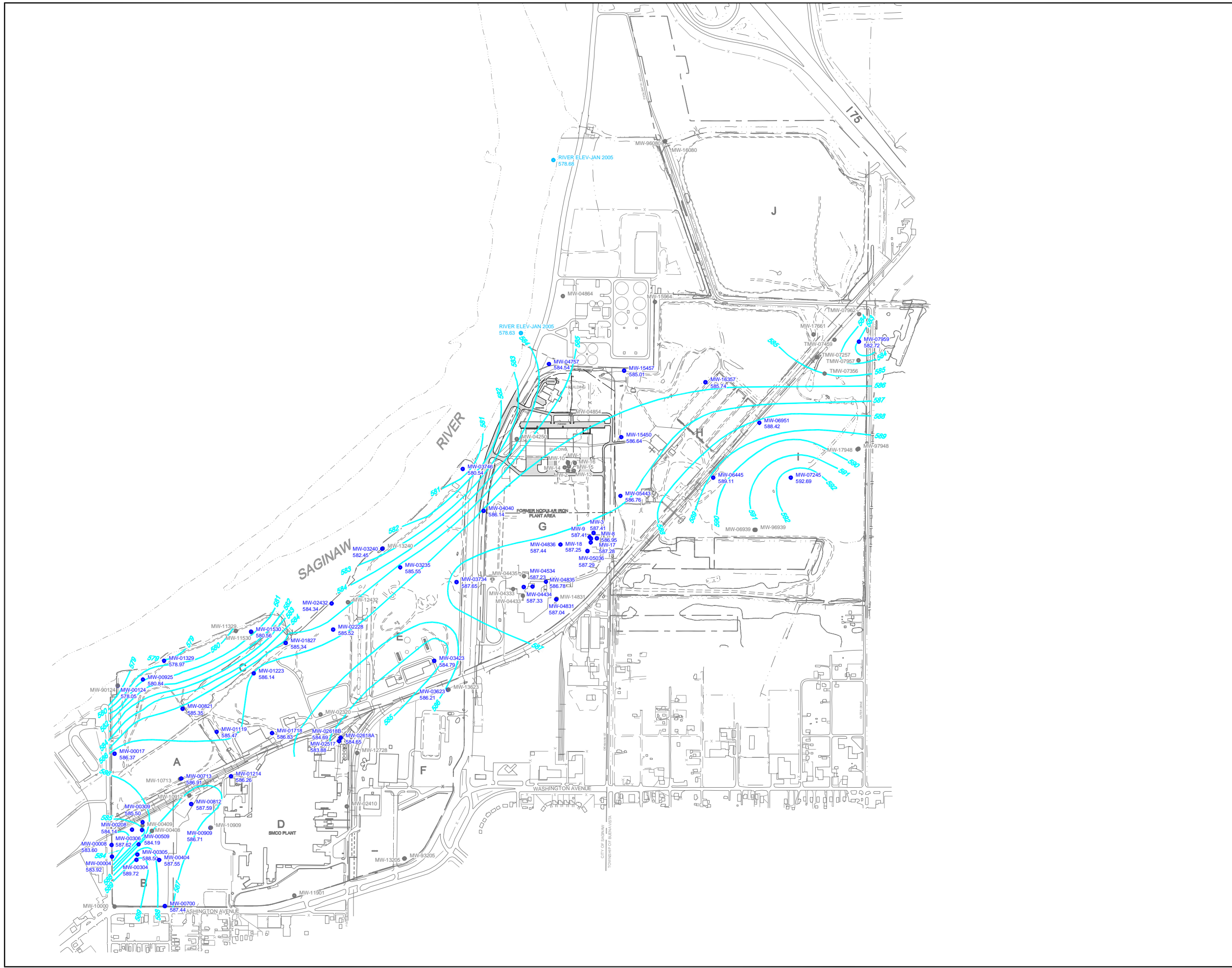
GENERAL MOTORS COMPANY
SAGINAW METAL CASTING OPERATIONS
SAGINAW, MICHIGAN
SUMMARY OF GSI LOCATIONS EAST OF VETERANS
MEMORIAL HIGHWAY AND EXCEEDANCE SUMMARY
2003 TO PRESENT

CONESTOGA-ROVERS & ASSOCIATES

Source References:

Project Manager:	Reviewed By:	Date:
M.T.	I.R.	OCTOBER 2009
Scale:	Project N°:	Report N°:
1"=200'	17075-12	MEMO023
		Drawing N°:
		figure 2

17075-12(MEMO023)GH-WA005 OCT 09/2009



- LEGEND**
- 586' — GROUNDWATER ELEVATION FT. AMSL (NAVD 88)
 - MW-07245 ● EXISTING MONITORING WELL WITH GROUNDWATER ELEVATION (JANUARY 2005)
 - MW-17661 ● EXISTING MONITORING WELL

SCALE VERIFICATION
THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

**GENERAL MOTORS CORPORATION
SAGINAW METAL CASTING OPERATIONS**
SAGINAW, MICHIGAN
**UPPER WATER BEARING ZONE
GROUNDWATER CONTOUR MAP**



Source Reference:

Project Manager: I.R.	Reviewed By: M.T.	Date: FEBRUARY 2007
Scale: 1" = 500'	Project No: 17075-16	Report No: 027
		Drawing No: figure 3.7

Attachment 2

2009 and 2010 Mixing Zone Determination and Implementation Responses

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

**Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater**

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity


Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Nate Nemani, Resource Conservation and Recovery Act of 1976 Corrective Action Project Manager, Land and Chemicals Division, Remediation and Reuse Branch, U.S. Environmental Protection Agency

FROM: Ronald Stone, Senior Geologist, Waste and Hazardous Materials Division, Michigan Department of Environmental Quality 

DATE: January 12, 2010

SUBJECT: Implementation of a Mixing Zone Request; General Motors - Saginaw Metal Castings Operation (GM-SMCO); MID 041 793 340

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from GM-SMCO in Saginaw County, Michigan and forwarded that request to the MDEQ, Water Bureau (WB). The attached response provided by the WB identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

Based on the information provided by the WB, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Saginaw River

Parameter	Final Acute Value	Final Chronic Value	Reported Worst Case Maximum Site Concentration
pH	6.5 - 9.0 S.U.		
Ammonia Nitrogen	3.1 mg/l		

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:
 - a. If any existing exceedances are upgradient of the compliance monitoring wells, GM-SMCO must demonstrate that data from all of the compliance monitoring wells in the Mixing Zone Compliance Monitoring Plan are, and will be, in compliance with acute

mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern. Acute mixing zoned-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.

- b. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.
2. It has been determined that any other parameter on the mixing zone request form, not given a recommended mixing zone-based GSI criteria in the table above (if any) or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in the mixing zone request, which was submitted to the WB by the WHMD.

In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, GM-SMCO will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that GM-SMCO proposes to sample to show compliance with the mixing zone-based GSI criteria (along the GSI at the GSI point of compliance) and any sentinel wells within the appropriate portions of the plume, and provide an explanation of the monitoring schedule and reporting process.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me via e-mail at stoner@michigan.gov or by telephone at 517-373-7141.

Attachment

cc/att: Ms. Cheryl Howe, WHMD
Ms. Rhonda Klann, Remediation and Redevelopment Division
Mr. David Slayton, WHMD
Corrective Action File

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
Ammonia Part 2 – 6.86
pH-High – 11.19
pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

**Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
Combined Ammonia Part 1 and pH-High groundwater venting
WQBELs assume a pH of 9.0 S.U. or less in venting groundwater**

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
Eric Alexander/Groundwater Venting File, SWAS, WB

Attachment 3

**Correspondence Related to Discontinuing
Monitoring at MW-04765 and MW-04864**

From: [Tomka, Mike](#)
To: "Nemani, Nate"
Cc: [Dave Favero \(dfavero@racertrust.org\)](mailto:dfavero@racertrust.org); [Hoevemeyer, Steven](#); [Pardys, John-Eric](#); [Project Email Filing](#)
Subject: RE: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~
Date: Friday, November 29, 2013 4:42:06 PM

Thank you Nate.
Mike

From: Nemani, Nate [mailto:nemani.nate@epa.gov]
Sent: Friday, November 29, 2013 4:37 PM
To: Tomka, Mike
Cc: Dave Favero (dfavero@racertrust.org); Hoevemeyer, Steven; Pardys, John-Eric; Project Email Filing
Subject: RE: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~

Just in case I did not respond, you may implement the recommendations for the North Ditch as detailed below.

NATE NEMANI, P.E.
RCRA CORRECTIVE ACTION PROJECT MANAGER
LAND AND CHEMICALS DIVISION
REMEDIATION AND REUSE BRANCH,
U. S.EPA, REGION 5 ,
77 W JACKSON Blvd, CHICAGO, ILLINOIS, 60604, Mail Code: LU-9J
(312) 886-3224 (PHONE)
(312) 692-2176 (FAX)
nemani.nate@epa.gov (e-mail address)

From: Tomka, Mike [mailto:mtomka@croworld.com]
Sent: Thursday, November 07, 2013 7:10 AM
To: Nemani, Nate
Cc: Dave Favero (dfavero@racertrust.org); Hoevemeyer, Steven; Pardys, John-Eric; Project Email Filing
Subject: Follow-up From Site Visit on 11/6/13, Nodular ~COR-058502~

Nate, thank you for your time yesterday. I think it was good for us all to visit the Nodular Site and see the areas we're working on.

Just to memorialize our discussion on the upcoming EI groundwater monitoring, the following presents a summary of our discussion:

- sampling will be conducted next week
- we'll proceed with the recommendations in the attached 3/11/13 EI submittal and the 10/23/13 North Ditch memo, with the exception that we will continue to monitor MW-04257 for ammonia, contrary to the 3/11/13 recommendation.

Take care.
Mike

Michael R. Tomka, P.Eng., P.E.
Conestoga-Rovers & Associates
Mailing Address: 651 Colby Drive, Waterloo, ON, Canada N2V 1C2


Office Address: 40 Bathurst Drive, Waterloo, ON
Voice: 519-884-0510 x3464 Fax: 519-725-1394
Mobile: 519-241-0007
mtomka@craworld.com www.craworld.com

This communication and any accompanying document(s) are confidential and are intended for the sole use of the addressee. If you are not the intended recipient, please notify me at the telephone number shown above or by return e-mail and delete this e-mail and any copies. You are advised that any disclosure, copying, distribution, or the taking of any action in reliance upon the communication without consent is strictly prohibited. Thank you.



DRAFT MEMORANDUM

TO: Nate Nemani **REF. NO.:** 058502



FROM: Michael Tomka/kf/8 **DATE:** October 23, 2013

CC: Dave Favero (RACER), Grant Trigger (RACER)

RE: **North Ditch Characterization and Select Groundwater Monitoring
Saginaw Nodular Industrial Land**

Introduction

The following memorandum summarizes the North Ditch characterization and select groundwater sampling completed at the RACER Trust Saginaw Nodular Industrial Land (Site) in Saginaw, Michigan. The work was completed in accordance with Conestoga-Rovers and Associates (CRA), Additional Investigation Sampling and Analysis Plan (SAP), dated April 2013 (Work Plan), which was approved via email by the United States Environment Protection Agency (U.S. EPA) on July 8, 2013 via email.

Summary of Investigation

The following presents a brief summary of the results:

North Ditch Characterization

The following investigation of surface water, sediment, and soil on the bank was conducted to characterize impacts in the Former Stormwater Discharge Ditch (North Ditch) to assist in assessing alternatives to address the North Ditch.

Surface Water

- Six water samples were collected from three locations at two depths (surface and mid-depth) from the North Ditch.
- The samples were analyzed for: target analyte list (TAL) metals, polychlorinated biphenyls (PCBs), ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), cyanide (total and amenable), hardness, nitrate, oil and grease, pH, phenols, and total organic carbon (TOC).
- The results were screened against the Michigan Department of Environmental Quality (MDEQ) Groundwater Surface Water Interface (GSI) criteria and the DEQ Rule 57 Water Quality Values for surface water. All sample results were below criteria.

Figure 1 presents the surface water (SW) and mid-depth (MD) sample locations in the North Ditch and Figure 2 presents the depth of water and sediment at each sample location. Table 1 presents a summary of the surface water sample results.

Sediment/Native Material

- Seven sediment samples were collected from six locations in the North Ditch. In addition, five soil samples were collected from the native material (soil) underlying the sediment.
- The seven sediment and five soil samples were analyzed for: TAL metals, PCBs, ammonia, cyanide (total), nitrate, pH, sulfide, and TOC. The seven sediment samples were also analyzed for acid volatile sulfide/simultaneously extracted metals (AVS/SEM).
- The results were first screened against the Michigan Statewide Default Background Levels then compared to the MDEQ GSI protection criteria. All the soil and sediment sample results exceeded GSI protection criteria for at least one of four metals (arsenic, chromium, cobalt, and selenium) or total cyanide.

AVS/SEM analyses consider the bioavailability of divalent metals and potential toxicity to benthic invertebrates. For the AVS/SEM data, EPA guidance (EPA 2005¹) indicates that values of carbon normalized excess (CNE) - SEM less than 130 umol/gram organic carbon (OC) are not toxic to benthic invertebrates. Values above 130 umol/gram OC but below 3,000 umol/gram OC are potentially toxic to benthic invertebrates, and values above 3,000 umol/gram OC are more likely to be toxic than nontoxic. The CNE-SEM values for all seven samples were calculated. Five of the seven sediment samples had CNE-SEM concentrations less than 130 umol/gram OC, indicating no reasonable potential for toxicity. The remaining two samples were above 130 umol/gram OC at 296 and 248 umol/gram OC. These two sediment samples were well below 3,000 umol/gram OC, above which sediments are predominantly toxic. Based on information provided in EPA (2005), these two samples have a low probability, about 10 percent, of being toxic to benthic invertebrates from divalent metals.

Figure 1 presents the sediment (SD) and native material (SO) sample locations in the North Ditch and Figure 2 presents the depth of water and sediment at each sample location. Table 2 presents a summary of the sediment and native soil sample results.

Soil

- Eighteen soil samples were collected from nine locations at two depths (0-5 inches and 5-12 inches) on the banks of the North Ditch.
- The nine shallow samples were analyzed on a one week turn for: TAL metals, PCBs, ammonia, cyanide (total), Nitrate, pH and total organic carbon. The nine deeper samples were placed on hold pending the analysis of the shallow samples.
- The results of the shallow samples were first screened against the Michigan Statewide Default Background Levels then compared to the MDEQ GSI protection criteria and MDEQ Direct Contact Criteria. The sample results exceeded GSI protection criteria for three metals (arsenic, chromium, and selenium) as well as total cyanide but did not exceed Direct Contact criteria. The PCB results of the shallow samples were well below the TSCA high occupancy criteria of 1,000 micrograms per kilogram ($\mu\text{g}/\text{kg}$). The highest detection of PCBs in the bank soil was 0.35 $\mu\text{g}/\text{kg}$. Due to the low detected concentrations of PCBs as well as no North Ditch water sample results exceeding GSI criteria for those compounds that exceeded GSI protection criteria in soil, analysis of the deeper soil samples was not completed.

Figure 1 presents the bank soil (SO) sample locations in the North Ditch. Table 3 presents a summary of the bank soil sample results.

¹ USEPA. 2005. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver and Zinc). EPA/600/R-02/011.

Select Groundwater Investigation

The following investigation of groundwater was conducted to re-assess potential unacceptable risk to construction workers as identified in the Human Health Risk Assessment (CRA, March 2007) from exposures to shallow groundwater for elevated pH and ammonia. The data that formed the basis for the risk determination was collected between 2000 and 2005.

- Groundwater samples were collected from fourteen monitoring wells and analyzed for ammonia. pH was measured in samples from fifteen monitoring wells.
- Samples were either submitted to the laboratory (11 samples for ammonia) for analysis and/or field tested (six samples for ammonia and 15 samples for pH).
- The laboratory or field analyzed ammonia, along with the average pH of the groundwater and receiving water (Saginaw River) and the average temperature of the groundwater and receiving water (Saginaw River) were used to calculate the un-ionized ammonia concentration using the equations developed by Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997. The un-ionized ammonia was then screened against the warmwater un-ionized ammonia acute toxicity criterion (0.42 mg/L) consistent with the Mixing Zone Determination (MDEQ, January 12, 2010) provided in Attachment 1 as there are no established criteria for assessing direct contact exposures to ammonia. The Mixing Zone Determination was submitted on October 2, 2009 for ammonia and pH that were reported above GSI criteria in groundwater samples from monitoring wells located next to the Saginaw River.
- The pH results were screened against MDEQ GSI criteria as there are no established criteria for assessing direct contact exposures to pH, however, for pH the RCRA pH range for determining if a waste is characteristically hazardous due to corrosivity is; less than or equal to 2 s.u. or greater than or equal to 12.5 s.u.
- Ammonia did not exceed the warmwater un-ionized ammonia acute toxicity criterion at monitoring wells next to the Saginaw River.
- pH did not exceed MDEQ GSI criteria at monitoring wells next to the Saginaw River.

Figure 3 presents a summary of results of ammonia and pH in monitoring wells sampled as part of the SAP and sampled as part of the annual Environmental Indicator (EI) monitoring. Table 4 presents the analytical results summary of the monitoring wells sampled and analyzed for ammonia and pH as part of the SAP and compared to the warmwater un-ionized ammonia acute toxicity criterion and MDEQ GSI criterion, respectively.

Conclusions and Proposed Next Steps

The results of the North Ditch surface water investigation identified no exceedances of MDEQ GSI criteria or Rule 57 Water Quality Values. The results of the North Ditch soil and sediment investigation identified exceedances of MDEQ GSI protection criteria. The soil or sediment sample results exceeded GSI protection criteria for four metals (arsenic, chromium, cobalt, and selenium) as well as total cyanide. However, since the surface water sample results did not exceed GSI criteria for these constituents, this indicates that the parameters exceeding criteria did not leach significantly into the surface water. The soil and sediment have been in place for many years, therefore, we expect that leaching, if any, is in equilibrium. Therefore, soil and sediment exceedances of GSI protection criteria do not warrant further consideration with the exception of the potential for re-suspension of solids.

The results of the AVS/SEM analyses identified that five of the seven samples would not be toxic to benthic invertebrates from divalent metals, while the remaining two samples have a low potential of being toxic (EPA 2005). Hence, the sediments of the North Ditch, on overall average, have no significant toxicity to benthic invertebrates.

Notwithstanding the negligible potential toxicity to benthic invertebrates in the North Ditch, it is proposed that options to address the sediment be identified and evaluated.

The results of the groundwater monitoring sampling for ammonia indicate that the calculated un-ionized fraction of ammonia meets the warmwater un-ionized ammonia acute toxicity criterion at the river, however, there continues to be elevated un-ionized ammonia concentrations above criteria in the area where there has been historically high concentrations. The warmwater un-ionized ammonia acute toxicity criterion is intended to protect against significant exposures to aquatic life through contact with surface water. In addition, the site-specific Ecological Risk Assessment (CRA, March 2007) evaluated the migration of contaminants from groundwater to surface water. The evaluation concluded that groundwater discharging to surface water is not a significant exposure pathway for ecological receptors in the Saginaw River. Therefore, since the un-ionized ammonia results are below the warmwater un-ionized ammonia acute toxicity criterion next to the river and are consistent and/or decreasing when compared to historical results, groundwater discharge to surface water is not a significant exposure pathway.

Because potential unacceptable risk to construction workers from exposures to shallow groundwater impacted by ammonia was identified in the Human Health Risk Assessment (CRA, March 2007), groundwater samples were collected from select monitoring wells in order to provide current ammonia concentrations. The results were compared to the historical ammonia concentrations at MW-8 which were initially above the noncancer hazard quotient (HQ) of 1 at a concentration 55.7 mg/L and more recently were below the noncancer HQ of 1 at concentrations of 33 mg/L and 30.3 mg/L as described in the HHRA (CRA, March 2007). All concentrations of ammonia for this monitoring event were less than 30.3 mg/L, therefore, ammonia does not exceed the noncancer HQ of 1. In addition monitoring wells with historically high ammonia concentrations (MW-8, MW-17, and MW-18) have had a decrease in ammonia over time. Those monitoring wells down gradient of these wells report generally stable or lower concentrations of ammonia.

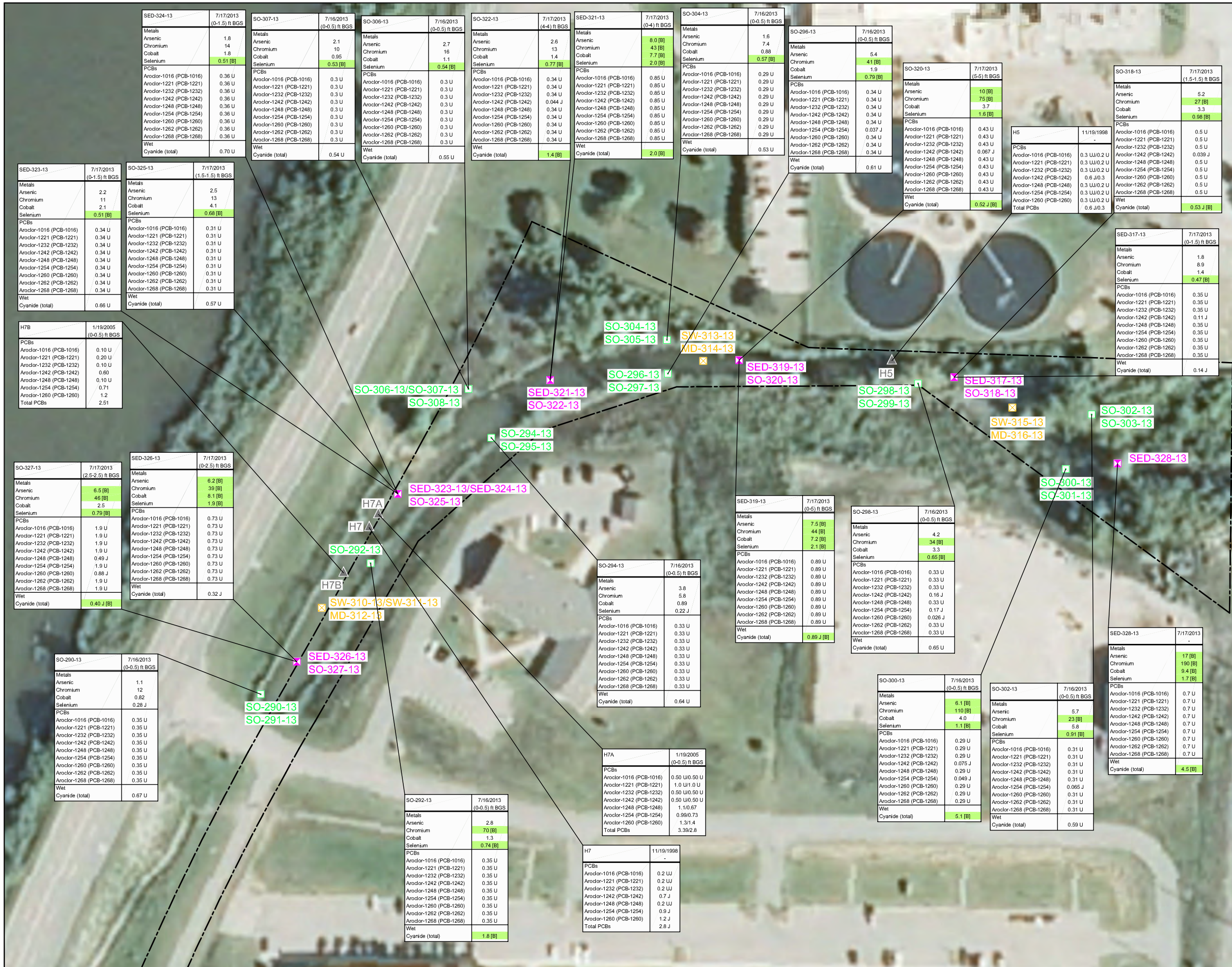
The pH results for this monitoring event indicate that there continues to be elevated pH when compared to the GSI criterion, however, results for monitoring wells next to the river meet the GSI criteria.

Since the shallow groundwater flow direction is generally towards the river, it is proposed that monitoring of the elevated ammonia and pH area and downgradient of this area be conducted to confirm stable conditions. Monitoring of ammonia and pH is currently conducted as part the annual EI monitoring event. The following adjustments to the EI program are recommended to confirm stable conditions of pH and ammonia:

- Add monitoring well locations MW-04836, MW-05036, and MW-8 in the area where there was historically high concentrations of pH and ammonia
- Add monitoring well location MW-04835 to provide delineation to the south
- Discontinue monitoring wells MW-04765 and MW-04864 since results from these locations would be influenced by the City of Saginaw Waste Water Treatment Plant

If acceptable to U.S. EPA, the above adjustments to the EI monitoring program will be included as part of the 2013 EI sampling event which is scheduled to be completed in November 2013. Further recommendations to revise the EI monitoring program maybe included with the submittal of 2013 EI results.

Should you have any questions, please do not hesitate to call.



LEGEND

- SURVEYED PROPERTY BOUNDARY
- ▲ HISTORICAL SEDIMENT SAMPLE LOCATION
- ✱ SEDIMENT SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- ⊗ SURFACE WATER SAMPLE LOCATION

NOTES:
 SO = SOIL
 SED = SEDIMENT
 SW = SURFACE WATER
 MD = DEPTH OF WATER COLUMN

--- SAMPLE LOCATION
 --- SAMPLE DATE
 --- SAMPLE DEPTH
 --- RESULT (mg/kg)
 --- PARAMETER
 --- EXCEEDS CRITERIA

Chemical Name	A	B	C	Unit
Arsenic	5.8	4.6	37	mg/kg
Chromium	16	3.3	9200	mg/kg
Cobalt	6.8	2	9000	mg/kg
Selenium	0.41	0.4	9600	mg/kg
Aroclor-1016 (PCB-1016)	-	-	16	mg/kg
Aroclor-1221 (PCB-1221)	-	-	16	mg/kg
Aroclor-1232 (PCB-1232)	-	-	16	mg/kg
Aroclor-1242 (PCB-1242)	-	-	16	mg/kg
Aroclor-1248 (PCB-1248)	-	-	16	mg/kg
Aroclor-1254 (PCB-1254)	-	-	16	mg/kg
Aroclor-1260 (PCB-1260)	-	-	16	mg/kg
Aroclor-1262 (PCB-1262)	-	-	16	mg/kg
Aroclor-1268 (PCB-1268)	-	-	16	mg/kg
Total PCBs	-	-	16	mg/kg
Cyanide (total)	0.39	0.1	250	mg/kg

A. statewide Default background levels
 B. GSI Criteria
 C. Non-RES/Direct Contact

SOURCE: 2009 NAIIP

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.

**RACER TRUST
 SAGINAW NODULAR INDUSTRIAL LAND
 SAGINAW, MICHIGAN**

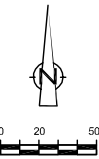
**NORTH DITCH SEDIMENT AND SOIL
 SUMMARY OF EXCEEDANCES**

CONESTOGA-ROVERS & ASSOCIATES

Source Reference:
 MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 86
 AERIAL: NAIP, 2009.

Project Manager:	M.T.	Reviewed By:	B.P.	Date:	OCTOBER 2013
Scale:	1" = 50'	Project No.:	58502-T02	Report No.:	MEMO008
				Drawing No.:	figure 1

58502-T02(MEMO008)GN-WA001 OCT 22/2013



LEGEND

- SURVEYED PROPERTY BOUNDARY
- ▲ HISTORICAL SEDIMENT SAMPLE LOCATION
- ✕ SEDIMENT SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- ⊗ SURFACE WATER SAMPLE LOCATION
- 4' WATER DEPTH
- 1.5' SEDIMENT THICKNESS

SOURCE: 2009 NAIP

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



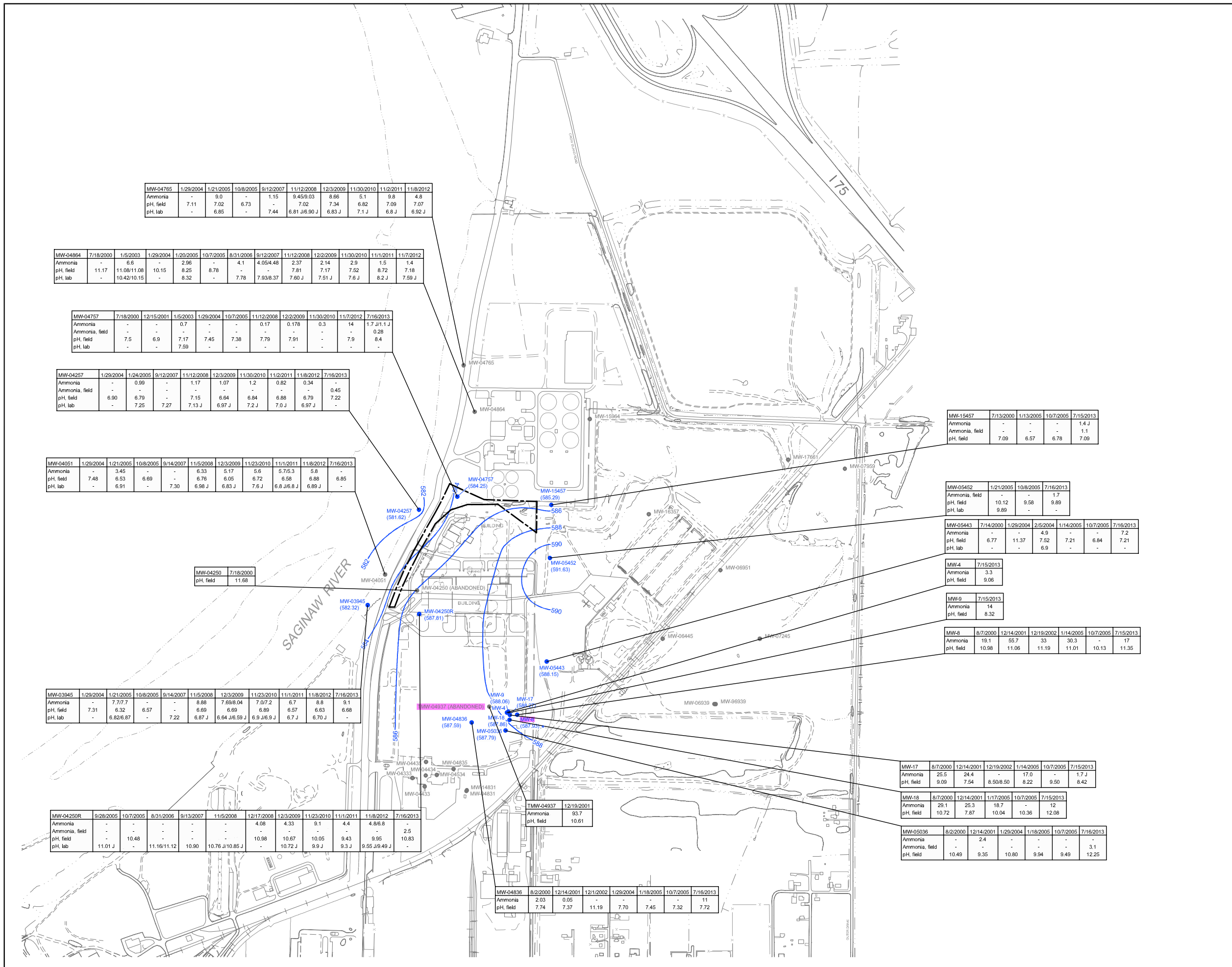
**RACER TRUST
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN**

**NORTH DITCH WATER DEPTH
AND SEDIMENT THICKNESS**



Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88
AERIAL: NAIP, 2009.

Project Manager: M.T.	Reviewed By: B.P.	Date: OCTOBER 2013
Scale: 1" = 50'	Project No: 58502-T02	Report No: MEMO008
		Drawing No: figure 2



MW-04755	1/29/2004	1/21/2005	10/8/2005	9/12/2007	11/12/2008	12/3/2009	11/30/2010	11/2/2011	11/8/2012
Ammonia	-	9.0	-	1.15	9.45/9.03	8.85	5.1	9.8	4.8
pH, field	7.11	7.02	6.73	-	7.02	7.34	6.82	7.00	7.07
pH, lab	-	6.85	-	7.44	6.81 J/6.90 J	6.83 J	7.1 J	6.8 J	6.92 J

MW-04864	7/18/2000	1/5/2003	1/29/2004	1/20/2005	10/7/2005	8/31/2006	9/12/2007	11/12/2008	12/2/2009	11/30/2010	11/1/2011	11/7/2012
Ammonia	-	6.6	-	2.95	-	4.1	4.05/4.48	2.37	2.14	2.9	1.5	1.4
pH, field	11.17	11.08/11.08	10.15	8.25	8.78	-	7.81	7.17	7.52	8.72	7.18	7.18
pH, lab	-	10.42/10.15	-	8.32	-	7.78	7.93/8.37	7.60 J	7.51 J	7.6 J	8.2 J	7.50 J

MW-04757	7/18/2000	12/15/2001	1/5/2003	1/29/2004	10/7/2005	11/12/2008	12/2/2009	11/30/2010	11/7/2012	7/16/2013
Ammonia	-	-	-	0.7	-	0.17	0.178	0.3	14	1.7 J/1.1 J
Ammonia, field	-	-	-	-	-	-	-	-	-	0.28
pH, field	7.5	6.9	7.17	7.45	7.38	7.79	7.91	-	7.9	8.4
pH, lab	-	-	7.59	-	-	-	-	-	-	-

MW-04257	1/29/2004	1/24/2005	9/12/2007	11/12/2008	12/3/2009	11/30/2010	11/2/2011	11/8/2012	7/16/2013
Ammonia	-	0.99	-	1.17	1.07	1.2	0.82	0.34	-
Ammonia, field	-	-	-	-	-	-	-	-	0.45
pH, field	6.90	6.79	-	7.15	6.64	6.84	6.88	6.79	7.22
pH, lab	-	7.25	7.27	7.13 J	6.97 J	7.2 J	7.0 J	6.97 J	-

MW-04051	1/29/2004	1/21/2005	10/8/2005	9/14/2007	11/5/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	3.45	-	-	6.33	5.17	5.6	5.7/5.3	5.8	-
pH, field	7.48	6.53	6.69	7.30	6.76	6.05	6.72	6.58	6.88	6.85
pH, lab	-	6.91	-	-	6.98 J	6.83 J	7.6 J	6.8 J/6.8 J	6.89 J	-

MW-04250	7/18/2000
pH, field	11.68

MW-15457	7/13/2000	1/13/2005	10/7/2005	7/15/2013
Ammonia	-	-	-	1.4 J
Ammonia, field	-	-	-	1.1
pH, field	7.09	6.57	6.78	7.09

MW-05452	1/21/2005	10/8/2005	7/16/2013
Ammonia, field	-	-	1.7
pH, field	10.12	9.58	9.89
pH, lab	-	-	-

MW-05443	7/14/2000	1/29/2004	2/5/2004	1/14/2005	10/7/2005	7/16/2013
Ammonia	-	-	4.9	-	-	7.2
pH, field	6.77	11.37	7.52	7.21	6.84	7.21
pH, lab	-	-	6.9	-	-	-

MW-4	7/15/2013
Ammonia	3.3
pH, field	9.06

MW-9	7/15/2013
Ammonia	14
pH, field	8.32

MW-8	8/7/2000	12/14/2001	12/19/2002	1/14/2005	10/7/2005	7/15/2013
Ammonia	19.1	55.7	33	30.3	-	17
pH, field	10.98	11.06	11.19	11.01	10.13	11.35

MW-03945	1/29/2004	1/21/2005	10/8/2005	9/14/2007	11/5/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	7.77.7	-	-	8.88	7.69/8.04	7.07.2	6.7	8.8	9.1
pH, field	7.31	6.32	6.57	7.22	6.69	6.69	6.89	6.57	6.63	6.68
pH, lab	-	6.82/6.87	-	-	6.87 J	6.64 J/6.59 J	6.9 J/6.9 J	6.7 J	6.70 J	-

MW-04250R	9/28/2005	10/7/2005	8/31/2006	9/13/2007	11/5/2008	12/17/2008	12/3/2009	11/23/2010	11/1/2011	11/8/2012	7/16/2013
Ammonia	-	-	-	-	-	4.08	4.33	9.1	4.4	4.8/6.8	2.5
Ammonia, field	-	-	-	-	-	-	-	10.67	10.05	9.43	9.65
pH, field	-	10.48	-	-	-	10.98	-	10.72 J	9.9 J	9.3 J	10.83
pH, lab	11.01 J	-	11.16/11.12	10.90	10.76 J/10.85 J	-	-	-	9.55 J/8.49 J	-	-

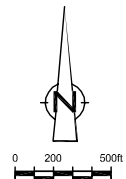
MW-04937	12/19/2001
Ammonia	83.7
pH, field	10.61

MW-17	8/7/2000	12/14/2001	12/19/2002	1/14/2005	10/7/2005	7/15/2013
Ammonia	25.5	24.4	-	17.0	-	1.7 J
pH, field	9.09	7.54	8.50/8.50	8.22	9.50	8.42

MW-18	8/7/2000	12/14/2001	1/17/2005	10/7/2005	7/15/2013
Ammonia	29.1	25.3	18.7	12	-
pH, field	10.72	7.87	10.04	10.36	12.08

MW-05036	8/2/2000	12/14/2001	1/29/2004	1/18/2005	10/7/2005	7/16/2013
Ammonia	-	2.4	-	-	-	3.1
Ammonia, field	-	-	-	-	-	-
pH, field	10.49	9.35	10.80	9.94	9.49	12.25

MW-04836	8/2/2000	12/14/2001	12/1/2002	1/29/2004	1/18/2005	10/7/2005	7/16/2013
Ammonia	2.03	0.05	-	-	-	-	11
pH, field	7.74	7.37	11.19	7.70	7.45	7.32	7.72



- LEGEND**
- SURVEYED PROPERTY BOUNDARY
 - MONITORING WELL LOCATION SAMPLED AND ANALYZED FOR AMMONIA
 - OTHER MONITORING WELL LOCATION
 - HISTORICAL LOCATION OF ELEVATED AMMONIA LEVELS (591.63)
 - GROUNDWATER ELEVATION
 - 590--- GROUNDWATER ELEVATION CONTOUR
 - WATER ELEVATION NOT USED IN GROUNDWATER CONTOURING

SAMPLE LOCATION

MW-15457	7/15/2013
Ammonia	1.4 J
Ammonia, field	1.1

PARAMETER

NOTE: TOPO - SANBORN, 1988

SCALE VERIFICATION

THIS BAR MEASURES 1" ON ORIGINAL. ADJUST SCALE ACCORDINGLY.



**RACER
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN
GROUNDWATER ANALYTICAL
RESULTS**



Source Reference:
MICHIGAN STATE PLANE SOUTH, NAD 83 USING INTERNATIONAL FEET, NGVD 88

Project Manager: I.R.	Reviewed By: M.T.	Date: OCTOBER 2013
Scale: 1" = 500'	Project No: 58502-T02	Report No: MEMO008
		Drawing No: figure 3

**ANALYTICAL RESULTS SUMMARY - SURFACE WATER DATA
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:
Sample ID:
Sample Date:
Sample Depth:
matrix_code

	MD-312-13	MD-314-13	MD-316-13	SW-310-13
	W-58502-071713-SSH-312	W-58502-071713-SSH-314	W-58502-071713-SSH-316	W-58502-071713-SSH-310
	7/17/2013	7/17/2013	7/17/2013	7/17/2013
	(2.5-2.5) ft BWS	(2.5-2.5) ft BWS	(2-2) ft BWS	(0-0) ft BWS
	WS	WS	WS	WS

Parameters: **Units** Res/Non_Res/GW SW Interface DEQ Rule 57 - Surface Water Quality Values

Metals

Antimony	mg/L	0.13	0.0017	0.00038 J	0.00045 J	0.00029 J	0.0005 J
Arsenic	mg/L	0.01	0.01	0.005 U	0.005 U	0.005 U	0.005 U
Barium	mg/L	-	1.9	0.036 J	0.033 J	0.033 J	0.037 J
Beryllium	mg/L	-	0.16	0.001 U	0.00013 J	0.000056 J	0.00025 J
Cadmium	mg/L	-	0.0025	0.00003 J	0.00012 J	0.001 U	0.00014 J
Chromium	mg/L	0.011	0.12	0.005 U	0.005 U	0.005 U	0.005 U
Cobalt	mg/L	0.1	0.1	0.00018 J	0.0002 J	0.000093 J	0.00029 J
Copper	mg/L	-	0.47	0.002 U	0.002 U	0.002 U	0.002 U
Lead	mg/L	-	0.014	0.0014 J	0.001 J	0.00053 J	0.002 J
Manganese	mg/L	-	1.3	0.16	0.14	0.14	0.17
Mercury	mg/L	0.000013	0.000013	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel	mg/L	-	2.6	0.02 U	0.02 U	0.02 U	0.02 U
Selenium	mg/L	0.005	0.005	0.00067 J	0.00056 J	0.00035 J	0.00083 J
Silver	mg/L	0.0002	0.00006	0.000019 J	0.000018 J	0.00001 J	0.000039 J
Thallium	mg/L	0.0037	0.0012	0.001 U	0.001 U	0.001 U	0.001 U
Vanadium	mg/L	0.012	0.027	0.004 U	0.004 U	0.004 U	0.004 U
Zinc	mg/L	-	3.3	0.02 U	0.02 U	0.02 U	0.02 U

Polychlorinated Biphenyls

Aroclor-1016 (PCB-1016)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1221 (PCB-1221)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1232 (PCB-1232)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1242 (PCB-1242)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1248 (PCB-1248)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1254 (PCB-1254)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1260 (PCB-1260)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1262 (PCB-1262)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U
Aroclor-1268 (PCB-1268)	mg/L	0.0002	0.00000026	0.000095 U	0.000095 U	0.000095 U	0.00011 U

General Chemistry

Ammonia	mg/L	-	-	1.4 J	2.0 U	2.0 U	2.0 U
Ammonia (unionized)	mg/L	0.053	0.053	0.01	-	-	-
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 U	2.0 U	2.0 U	2.0 U
Chemical oxygen demand (COD)	mg/L	-	-	20	20	22	22
Cyanide (amenable)	mg/L	-	-	0.010 U	0.010 U	0.010 U	0.010 U
Cyanide (total)	mg/L	0.0052	0.0052	0.010 U	0.010 U	0.010 U	0.010 U
Hardness, carbonate	mg/L	-	-	130	130	120	180
Hardness, magnesium	mg/L	-	-	44	45	46	45
Nitrate (as N)	mg/L	-	10	0.10 U	0.10 U	0.10 U	0.10 U
Oil and grease (HEM), polar	mg/L	-	-	4.7 U	4.8 UJ	4.8 U	4.9 U
pH, lab	s.u.	-	-	7.45 J	7.52 J	7.42 J	7.43 J
Phenolics (total)	mg/L	-	-	0.040 U	0.040 U	0.040 U	0.040 U
Total organic carbon (TOC)	mg/L	-	-	5.9	6.2	6.1	6.0

Notes:

- J - Estimated concentration.
- U - Not present at or above the associated value.
- UJ - Estimated reporting limit.
- BWS - Below Water surface
- ⁽¹⁾ The generic GSI criteria are based on the toxicity of unionized ammonia (NH3); the criteria is 53 µg/L warm water surface water
- ⁽²⁾ Temperature of the water was assumed to be approximately 65 degrees F at the criteria is 53 µg/L warm water surface water

TABLE 1

**ANALYTICAL RESULTS SUMMARY - SURFACE WATER DATA
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	SW-311-13	SW-313-13	SW-315-13
Sample ID:	W-58502-071713-SSH-311	W-58502-071713-SSH-313	W-58502-071713-SSH-315
Sample Date:	7/17/2013	7/17/2013	7/17/2013
Sample Depth:	(0-0) ft BWS	(0-0) ft BWS	(0-0) ft BWS
matrix_code	WS	WS	WS

Parameters:	Units	Res/Non_Res/GW SW Interface	DEQ Rule 57 - Surface Water Quality Values			
Metals						
Antimony	mg/L	0.13	0.0017	0.00036 J	0.00032 J	0.00036 J
Arsenic	mg/L	0.01	0.01	0.005 U	0.005 U	0.005 U
Barium	mg/L	-	1.9	0.036 J	0.033 J	0.033 J
Beryllium	mg/L	-	0.16	0.00015 J	0.00004 J	0.000096 J
Cadmium	mg/L	-	0.0025	0.000029 J	0.001 U	0.001 U
Chromium	mg/L	0.011	0.12	0.005 U	0.005 U	0.005 U
Cobalt	mg/L	0.1	0.1	0.00018 J	0.000083 J	0.00014 J
Copper	mg/L	-	0.47	0.002 U	0.002 U	0.002 U
Lead	mg/L	-	0.014	0.0015 J	0.00062 J	0.001 J
Manganese	mg/L	-	1.3	0.15	0.11	0.18
Mercury	mg/L	0.0000013	0.0000013	0.0002 U	0.0002 U	0.0002 U
Nickel	mg/L	-	2.6	0.02 U	0.02 U	0.02 U
Selenium	mg/L	0.005	0.005	0.00052 J	0.00055 J	0.00049 J
Silver	mg/L	0.0002	0.00006	0.000022 J	0.000017 J	0.000012 J
Thallium	mg/L	0.0037	0.0012	0.001 U	0.001 U	0.001 U
Vanadium	mg/L	0.012	0.027	0.004 U	0.004 U	0.004 U
Zinc	mg/L	-	3.3	0.02 U	0.02 U	0.02 U
Polychlorinated Biphenyls						
Aroclor-1016 (PCB-1016)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1221 (PCB-1221)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1232 (PCB-1232)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1242 (PCB-1242)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1248 (PCB-1248)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1254 (PCB-1254)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1260 (PCB-1260)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1262 (PCB-1262)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
Aroclor-1268 (PCB-1268)	mg/L	0.0002	0.000000026	0.0001 U	0.0001 U	0.000097 U
General Chemistry						
Ammonia	mg/L	-	-	1.1 J	1.1 J	2.0 U
Ammonia (unionized)	mg/L	0.053	0.053	0.01	0.01	-
Biochemical oxygen demand (BOD)	mg/L	-	-	2.0 U	2.0 U	2.0 U
Chemical oxygen demand (COD)	mg/L	-	-	25	17 J	30
Cyanide (amenable)	mg/L	-	-	0.010 U	0.010 U	0.010 U
Cyanide (total)	mg/L	0.0052	0.0052	0.010 U	0.010 U	0.010 U
Hardness, carbonate	mg/L	-	-	180	170	170
Hardness, magnesium	mg/L	-	-	44	45	44
Nitrate (as N)	mg/L	-	10	0.10 U	0.10 U	0.10 U
Oil and grease (HEM), polar	mg/L	-	-	4.9 U	4.8 U	4.9 U
pH, lab	s.u.	-	-	7.44 J	7.44 J	7.41 J
Phenolics (total)	mg/L	-	-	0.040 U	0.040 U	0.040 U
Total organic carbon (TOC)	mg/L	-	-	6.1	6.0	6.4

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

UJ - Estimated reporting limit.

BWS - Below Water surface

⁽¹⁾ The generic GSI criteria are based on the toxicity of unionized ammonia (NH₃); the criteria is 53 µg/L warm water surface water

⁽²⁾ Temperature of the water was assumed to be approximately 65 degrees F at the criteria is 53 µg/L warm water surface water

**ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	H5	H5	H7	H7A	H7A	H7B
Sample ID:	S00016	S00017	S00020	B-7-0531	B-7-0532Q	B-7-0530
Sample Date:	11/19/1998	11/19/1998	11/19/1998	1/19/2005	1/19/2005	1/19/2005
Sample Depth:		DUP		(0-0.5) ft BGS	DUP (0-0.5) ft BGS	(0-0.5) ft BGS
matrix_code	SE	SE	SE	SE	SE	SE

Parameters:	Units	Statewide Default Background Levels	Res/Non_Res/GW Prot_GW SW Interface Prot					
Metals								
Aluminum	mg/kg		-					
Antimony	mg/kg		94					
Arsenic	mg/kg	5.8	4.6					
Barium	mg/kg		-					
Beryllium	mg/kg		-					
Cadmium	mg/kg		-					
Calcium	mg/kg		-					
Chromium	mg/kg	18	3.3					
Cobalt	mg/kg	6.8	2					
Copper	mg/kg		-					
Iron	mg/kg		-					
Lead	mg/kg		-					
Magnesium	mg/kg		-					
Manganese	mg/kg		-					
Mercury	mg/kg	0.13	0.05					
Nickel	mg/kg		-					
Potassium	mg/kg		-					
Selenium	mg/kg	0.41	0.4					
Silver	mg/kg	1.0	0.1					
Sodium	mg/kg		-					
Thallium	mg/kg		4.2					
Vanadium	mg/kg		190					
Zinc	mg/kg		-					
Metals - SEM								
Cadmium	mg/kg		-					
Copper	mg/kg		-					
Lead	mg/kg		-					
Mercury	mg/kg		0.05					
Nickel	mg/kg		-					
Zinc	mg/kg		-					
SEM/AVS	none		-					
Polychlorinated Biphenyls								
Aroclor-1016 (PCB-1016)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	0.50 U	0.10 U
Aroclor-1221 (PCB-1221)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	1.0 U	0.20 U
Aroclor-1232 (PCB-1232)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	0.50 U	0.10 U
Aroclor-1242 (PCB-1242)	ug/kg		-	0.6 J	0.3	0.7 J	0.50 U	0.60
Aroclor-1248 (PCB-1248)	ug/kg		-	0.3 UJ	0.2 U	0.2 UJ	1.1	0.67
Aroclor-1254 (PCB-1254)	ug/kg		-	0.3 UJ	0.2 U	0.9 J	0.99	0.73
Aroclor-1260 (PCB-1260)	ug/kg		-	0.3 UJ	0.2 U	1.2 J	1.3	1.4
Aroclor-1262 (PCB-1262)	ug/kg		-					
Aroclor-1268 (PCB-1268)	ug/kg		-					
Total PCBs (ND = 0)	ug/kg		-					
Total PCBs At 1% OC	ug/kg		-	0.6 J	0.3	2.8 J	3.39	2.8
			-					2.51
General Chemistry								
Ammonia	mg/kg		-					
Cyanide (total)	mg/kg		0.1					
Nitrate (as N)	mg/kg		-					
pH, lab	s.u.		-					
Sulfide	mg/kg		-					
Total organic carbon (TOC)	mg/kg		-					
Total organic carbon (TOC)	%		-					
Selenium			-					
Aluminum			-					

AVS/SEM Expressed in umol/g

		Molecular Weight
cadmium	umol/gram	112.40
copper	umol/gram	63.54
lead	umol/gram	207.20
mercury	umol/gram	200.59
nickel	umol/gram	58.70
zinc	umol/gram	65.37
total SEM	umol/gram	
Sulfide	umol/gram	33.48
		Estimated from AVS/SEM ratio
		Carbon normalized SEM criteria is 130
		Conclusion

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

**ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	SED-317-13	SO-318-13	SED-319-13	SO-320-13
Sample ID:	S-58502-071713-SSH-317	S-58502-071713-SSH-318	S-58502-071713-SSH-319	S-58502-071713-SSH-320
Sample Date:	7/17/2013	7/17/2013	7/17/2013	7/17/2013
Sample Depth:	(0-1.5) ft BGS	(1.5-1.9) ft BGS	(0-5) ft BGS	(5-9) ft BGS
matrix_code	SE	SO	SE	SO

Parameters:	Units	Statewide Default Background Levels	Res/Non_Res/GW Prot_SW Interface Prot				
Metals							
Aluminum	mg/kg	-	2400	6100	13000	7600	
Antimony	mg/kg	-	94	0.12 J	0.41 J	1.0 J	
Arsenic	mg/kg	5.8	4.6	1.8	5.2	7.5	10
Barium	mg/kg	-	14	44	75	55	
Beryllium	mg/kg	-	0.13 J	0.31	0.76	0.61	
Cadmium	mg/kg	-	0.046 J	0.43	1.2	1.2	
Calcium	mg/kg	-	14000 J	29000 J	51000 J	24000 J	
Chromium	mg/kg	18	3.3	8.9	27	44	75
Cobalt	mg/kg	6.8	2	1.4	3.3	7.2	3.7
Copper	mg/kg	-	7.8	26	51	44	
Iron	mg/kg	-	6500	16000	35000	36000	
Lead	mg/kg	-	6.4 J	52 J	130 J	230 J	
Magnesium	mg/kg	-	3800	7300	14000	3800	
Manganese	mg/kg	-	110	380	1200	1600	
Mercury	mg/kg	0.13	0.05	0.056 U	0.042 J	0.10 J	0.046 J
Nickel	mg/kg	-	6.5	17	29	22	
Potassium	mg/kg	-	310 J	820	1700	500 J	
Selenium	mg/kg	0.41	0.4	0.47	0.98	2.1	1.6
Silver	mg/kg	1.0	0.1	0.021 J	0.10 J	0.32 J	0.43
Sodium	mg/kg	-	88 J	200	430	260	
Thallium	mg/kg	-	4.2	0.057 J	0.10 J	0.20 J	0.18 J
Vanadium	mg/kg	-	190	6.4	13	22	11
Zinc	mg/kg	-	60	730	1800	5000	
Metals - SEM							
Cadmium	mg/kg	-	0.075 J	-	1.3	-	-
Copper	mg/kg	-	7.3	-	49	-	-
Lead	mg/kg	-	6.8	-	160	-	-
Mercury	mg/kg	0.05	0.017 U	-	0.040 U	-	-
Nickel	mg/kg	-	5.0	-	21	-	-
Zinc	mg/kg	-	75	-	2600	-	-
SEM/AVS	none	-	0.87	-	1.4	-	-
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1221 (PCB-1221)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1232 (PCB-1232)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1242 (PCB-1242)	ug/kg	-	0.11 J	0.039 J	0.89 U	0.067 J	
Aroclor-1248 (PCB-1248)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1254 (PCB-1254)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1260 (PCB-1260)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1262 (PCB-1262)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Aroclor-1268 (PCB-1268)	ug/kg	-	0.35 U	0.5 U	0.89 U	0.43 U	
Total PCBs (ND = 0)	ug/kg	-	0.11	0.039	0	0.067	
Total PCBs At 1% OC	ug/kg	-	0.04	0.02	0.00	0.01	
General Chemistry							
Ammonia	mg/kg	-	26 J	120	270	190	
Cyanide (total)	mg/kg	0.1	0.14 J	0.53 J	0.89 J	0.52 J	
Nitrate (as N)	mg/kg	-	340 U	480 U	860 U	410 U	
pH, lab	s.u.	-	7.29 J	7.23 J	7.01 J	7.16 J	
Sulfide	mg/kg	-	51	-	920	-	
Total organic carbon (TOC)	mg/kg	-	28000	26000	120000	57000	
Total organic carbon (TOC)	%	-	0.03	0.03	0.12	0.06	
Selenium	mg/kg	-	0.47	0.98	2.1	1.6	
Aluminum	mg/kg	-	2400	6100	13000	7600	

AVS/SEM Expressed in umol/g			
		Molecular Weight	
cadmium	umol/gram	112.40	0.00
copper	umol/gram	63.54	0.11
lead	umol/gram	207.20	0.03
mercury	umol/gram	200.59	0.00
nickel	umol/gram	58.70	0.09
zinc	umol/gram	65.37	1.15
total SEM	umol/gram	-	1.38
Sulfide	umol/gram	33.48	1.52
		Estimated from AVS/SEM ratio	1.59
		Carbon normalized SEM criteria is 130	-5.09
		Conclusion	Not Toxic

Notes:
J - Estimated concentration.
U - Not present at or above the associated value.

**ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	SED-321-13	SO-322-13	SED-323-13	SED-324-13	SO-325-13	
Sample ID:	S-58502-071713-SSH-321	S-58502-071713-SSH-322	S-58502-071713-SSH-323	S-58502-071713-SSH-324	S-58502-071713-SSH-325	
Sample Date:	7/17/2013	7/17/2013	7/17/2013	7/17/2013	7/17/2013	
Sample Depth:	(0-4) ft BGS	(4-4) ft BGS	(0-1.5) ft BGS	DUP (0-1.5) ft BGS	(1.5-1.5) ft BGS	
matrix_code	SE	SO	SE	SE	SO	
Parameters:	Units	Statewide Default Background Levels	Res/Non_Res/GW Prot_GW SW Interface Prot			
Metals						
Aluminum	mg/kg	-	14000	2800	3200	4900
Antimony	mg/kg	-	0.78 J	0.59 J	0.12 J	0.065 J
Arsenic	mg/kg	5.8	4.6	8.0	2.2	1.8
Barium	mg/kg	-	79	17	17	16
Beryllium	mg/kg	-	0.74	0.25	0.16 J	0.15 J
Cadmium	mg/kg	-	1.4	0.61	0.18	0.14
Calcium	mg/kg	-	61000 J	7100 J	43000 J	41000 J
Chromium	mg/kg	18	3.3	43	11	14
Cobalt	mg/kg	6.8	2	7.7	2.1	1.8
Copper	mg/kg	-	52	18	9.2	6.5
Iron	mg/kg	-	35000	8300	7500	6300
Lead	mg/kg	-	150 J	100 J	16 J	9.5 J
Magnesium	mg/kg	-	16000	1700	14000	13000
Manganese	mg/kg	-	1400	450	300	310
Mercury	mg/kg	0.13	0.05	0.092 J	0.053	0.018 J
Nickel	mg/kg	-	28	6.8	6.6	5.7
Potassium	mg/kg	-	2100	210 J	610	520
Selenium	mg/kg	0.41	0.4	2.0	0.77	0.51
Silver	mg/kg	1.0	0.1	0.40 J	0.24	0.042 J
Sodium	mg/kg	-	400	130	130	130
Thallium	mg/kg	-	4.2	0.23 J	0.11 J	0.090 J
Vanadium	mg/kg	-	190	24	4.8	8.0
Zinc	mg/kg	-	2900	3300	150	140
Metals - SEM						
Cadmium	mg/kg	-	1.3	-	0.078 J	0.10 J
Copper	mg/kg	-	47	-	4.8	6.1
Lead	mg/kg	-	130	-	7.3	8.9
Mercury	mg/kg	0.05	0.0047 J	-	0.016 U	0.017 U
Nickel	mg/kg	-	20	-	3.4	4.0
Zinc	mg/kg	-	2400	-	110	130
SEM/AVS	none	-	2.5	-	1.2	1.6
Polychlorinated Biphenyls						
Aroclor-1016 (PCB-1016)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1221 (PCB-1221)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1232 (PCB-1232)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1242 (PCB-1242)	ug/kg	-	0.85 U	0.044 J	0.34 U	0.36 U
Aroclor-1248 (PCB-1248)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1254 (PCB-1254)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1260 (PCB-1260)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1262 (PCB-1262)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Aroclor-1268 (PCB-1268)	ug/kg	-	0.85 U	0.34 U	0.34 U	0.36 U
Total PCBs (ND = 0)	ug/kg	-	0	0.044	0	0
Total PCBs At 1% OC	ug/kg	-	0.00	0.02	0.00	0.00
General Chemistry						
Ammonia	mg/kg	-	94	81	40 J	66
Cyanide (total)	mg/kg	0.1	2.0	1.4	0.66 U	0.70 U
Nitrate (as N)	mg/kg	-	790 U	320 U	330 U	340 U
pH, lab	s.u.	-	7.03 J	8.12 J	7.17 J	7.20 J
Sulfide	mg/kg	-	490	-	50	46
Total organic carbon (TOC)	mg/kg	-	96000	27000	28000	17000
Total organic carbon (TOC)	%	-	0.10	0.03	0.03	0.02
Selenium		-	2	0.77	0.51	0.51
Aluminum		-	14000	2800	3200	2900
AVS/SEM Expressed in umol/g						
			Molecular Weight			
cadmium	umol/gram		112.40	0.01	0.00	0.00
copper	umol/gram		63.54	0.74	0.08	0.10
lead	umol/gram		207.20	0.63	0.04	0.04
mercury	umol/gram		200.59	0.00	0.00	0.00
nickel	umol/gram		58.70	0.34	0.06	0.07
zinc	umol/gram		65.37	36.71	1.68	1.99
total SEM	umol/gram			38.43	1.85	2.20
Sulfide	umol/gram			33.48	1.49	1.37
			Estimated from AVS/SEM ratio			
				15.37	1.54	1.37
			Carbon normalized SEM criteria is 130			
				247.89	12.81	48.40
			Conclusion			
				Uncertain, probably not toxic	Not Toxic	Not Toxic

Notes:
 J - Estimated concentration.
 U - Not present at or above the associated value.

TABLE 2

**ANALYTICAL RESULTS SUMMARY - SEDIMENT/MATERIAL BENEATH SEDIMENT
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	SED-326-13	SO-327-13	SED328-13
Sample ID:	S-58502-071713-SSH-326	S-58502-071713-SSH-327	S-58502-071713-SSH-328
Sample Date:	7/17/2013	7/17/2013	7/17/2013
Sample Depth:	(0-2.5) ft BGS	(2.5-2.5) ft BGS	-
matrix_code	SE	SO	SE
Parameters:	Units	Statewide Default Background Levels	Res/Non_Res/GW Prot_GW SW Interface Prot
Metals			
Aluminum	mg/kg	-	14000
Antimony	mg/kg	94	0.48 J
Arsenic	mg/kg	5.8	4.6
Barium	mg/kg	-	83
Beryllium	mg/kg	-	0.74
Cadmium	mg/kg	-	1.1
Calcium	mg/kg	-	74000 J
Chromium	mg/kg	18	3.3
Cobalt	mg/kg	6.8	2
Copper	mg/kg	-	43
Iron	mg/kg	-	27000
Lead	mg/kg	-	94 J
Magnesium	mg/kg	-	22000
Manganese	mg/kg	-	1100
Mercury	mg/kg	0.13	0.05
Nickel	mg/kg	-	27
Potassium	mg/kg	-	2400
Selenium	mg/kg	0.41	0.4
Silver	mg/kg	1.0	0.1
Sodium	mg/kg	-	360
Thallium	mg/kg	-	0.23 J
Vanadium	mg/kg	-	190
Zinc	mg/kg	-	1700
Metals - SEM			
Cadmium	mg/kg	-	1.0
Copper	mg/kg	-	37
Lead	mg/kg	-	82
Mercury	mg/kg	0.05	0.0096 J
Nickel	mg/kg	-	19
Zinc	mg/kg	-	1700
SEM/AVS	none	-	2.4
Polychlorinated Biphenyls			
Aroclor-1016 (PCB-1016)	ug/kg	-	0.73 U
Aroclor-1221 (PCB-1221)	ug/kg	-	0.73 U
Aroclor-1232 (PCB-1232)	ug/kg	-	0.73 U
Aroclor-1242 (PCB-1242)	ug/kg	-	0.73 U
Aroclor-1248 (PCB-1248)	ug/kg	-	0.73 U
Aroclor-1254 (PCB-1254)	ug/kg	-	0.73 U
Aroclor-1260 (PCB-1260)	ug/kg	-	0.73 U
Aroclor-1262 (PCB-1262)	ug/kg	-	0.73 U
Aroclor-1268 (PCB-1268)	ug/kg	-	0.73 U
Total PCBs (ND = 0)	ug/kg	-	0
Total PCBs At 1% OC	ug/kg	-	0.00
General Chemistry			
Ammonia	mg/kg	-	54
Cyanide (total)	mg/kg	0.1	0.32 J
Nitrate (as N)	mg/kg	-	690 U
pH, lab	s.u.	-	7.14 J
Sulfide	mg/kg	-	350
Total organic carbon (TOC)	mg/kg	-	57000
Total organic carbon (TOC)	%	-	0.06
Selenium	mg/kg	-	1.9
Aluminum	mg/kg	-	14000
AVS/SEM Expressed in umol/g			
		Molecular Weight	
cadmium	umol/gram	112.40	0.01
copper	umol/gram	63.54	0.58
lead	umol/gram	207.20	0.40
mercury	umol/gram	200.59	0.00
nickel	umol/gram	58.70	0.32
zinc	umol/gram	65.37	26.01
total SEM	umol/gram		27.32
Sulfide	umol/gram		10.45
		Estimated from AVS/SEM ratio	11.38
		Carbon normalized SEM criteria is 130	295.83
		Conclusion	Uncertain, probably not toxic
			Not Toxic

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

**ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:
Sample ID:
Sample Date:
Sample Depth:
matrix_code

SO-290-13
S-58502-071613-SSH-290
7/16/2013
(0-0.5) ft BGS
SO

SO-292-13
S-58502-071613-SSH-292
7/16/2013
(0-0.5) ft BGS
SO

SO-294-13
S-58502-071613-SSH-294
7/16/2013
(0-0.5) ft BGS
SO

Parameters:	Units	Statewide Default Background Levels	Direct Contact Criteria & RBSLs (a)	Res/Non_Res/G W Prot_GW SW Interface Prot (b)	SO-290-13	SO-292-13	SO-294-13
Metals							
Aluminum	mg/kg		370000	-	2200	4100	890
Antimony	mg/kg		670	94	0.13 J	0.14 J	0.094 J
Arsenic	mg/kg	5.8	37	4.6	1.1	2.8	3.8
Barium	mg/kg		130000	-	14	65	6.0
Beryllium	mg/kg		1600	-	0.10 J	0.42	0.066 J
Cadmium	mg/kg		2100	-	0.11	0.065 J	0.096
Calcium	mg/kg			-	3600	17000	1600
Chromium	mg/kg	18		3.3	12	70 (b)	5.8
Cobalt	mg/kg	6.8	9000	2	0.82	1.3	0.89
Copper	mg/kg		73000	-	7.5	18	3.6
Iron	mg/kg		90000	-	5300	16000	6100
Lead	mg/kg		900	-	15	11	15
Magnesium	mg/kg		1000000	-	1300	1800	640
Manganese	mg/kg		90000	-	61	940	100
Mercury	mg/kg	0.13	580	0.05	0.055 U	0.058 U	0.050 U
Nickel	mg/kg		150000	-	4.9	13	2.5
Potassium	mg/kg			-	180 J	290 J	450 U
Selenium	mg/kg	0.41	9600	0.4	0.28 J	0.74 (b)	0.22 J
Silver	mg/kg	1.0	9000	0.1	0.013 J	0.081 J	0.019 J
Sodium	mg/kg		1000000	-	100 U	84 U	91 U
Thallium	mg/kg		130	4.2	0.14 J	0.17	0.18 U
Vanadium	mg/kg		5500	190	5.1	6.4	6.7
Zinc	mg/kg		630000	-	99	270	73
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1221 (PCB-1221) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1232 (PCB-1232) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1242 (PCB-1242) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1248 (PCB-1248) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1254 (PCB-1254) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1260 (PCB-1260) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1262 (PCB-1262) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
Aroclor-1268 (PCB-1268) ⁽¹⁾	µg/kg		1000	-	0.35 U	0.35 U	0.33 U
General Chemistry							
Ammonia	mg/kg			-	48 U	49 U	50 U
Cyanide (total)	mg/kg		250	0.1	0.67 U	1.8 (b)	0.64 U
Nitrate (as N)	mg/kg			-	330 U	330 U	310 U
pH, lab	s.u.			-	7.46 J	7.07 J	8.36 J
Total organic carbon (TOC)	mg/kg			-	12000	12000	8200

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

⁽¹⁾ MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

**ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI**

Sample Location:	SO-296-13	SO-298-13	SO-300-13
Sample ID:	S-58502-071613-SSH-296	S-58502-071613-SSH-298	S-58502-071613-SSH-300
Sample Date:	7/16/2013	7/16/2013	7/16/2013
Sample Depth:	(0-0.5) ft BGS	(0-0.5) ft BGS	(0-0.5) ft BGS
matrix_code	SO	SO	SO

Parameters:	Units	Statewide Default Background Levels	Direct Contact Criteria & RBSLs (a)	Res/Non_Res/G W Prot_GW SW Interface Prot (b)			
Metals							
Aluminum	mg/kg		370000	-	3200	5100	7900
Antimony	mg/kg		670	94	0.27 J	0.49 J	0.43 J
Arsenic	mg/kg	5.8	37	4.6	5.4	4.2	6.1 (b)
Barium	mg/kg		130000	-	27	38	79
Beryllium	mg/kg		1600	-	0.22	0.28	0.64
Cadmium	mg/kg		2100	-	0.19	0.081 J	0.19 J
Calcium	mg/kg			-	15000	9200	35000
Chromium	mg/kg	18		3.3	41 (b)	34 (b)	110 (b)
Cobalt	mg/kg	6.8	9000	2	1.9	3.3	4.0
Copper	mg/kg		73000	-	15	28	54
Iron	mg/kg			-	16000	32000	61000
Lead	mg/kg		900	-	29	20	33
Magnesium	mg/kg		1000000	-	3000	2700	5600
Manganese	mg/kg		90000	-	380	580	1400
Mercury	mg/kg	0.13	580	0.05	0.049 U	0.050 U	0.047 U
Nickel	mg/kg		150000	-	13	20	57
Potassium	mg/kg			-	320 J	410 J	610
Selenium	mg/kg	0.41	9600	0.4	0.79 (b)	0.65 (b)	1.1 (b)
Silver	mg/kg	1.0	9000	0.1	0.062 J	0.049 J	0.088 J
Sodium	mg/kg		1000000	-	100 U	92 U	78 U
Thallium	mg/kg		130	4.2	0.22	0.18 U	0.16 U
Vanadium	mg/kg		5500	190	6.9	7.5	9.9
Zinc	mg/kg		630000	-	98	86	370
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1221 (PCB-1221) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1232 (PCB-1232) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1242 (PCB-1242) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.16 J	0.075 J
Aroclor-1248 (PCB-1248) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1254 (PCB-1254) ⁽¹⁾	µg/kg		1000	-	0.037 J	0.17 J	0.049 J
Aroclor-1260 (PCB-1260) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.026 J	0.29 U
Aroclor-1262 (PCB-1262) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
Aroclor-1268 (PCB-1268) ⁽¹⁾	µg/kg		1000	-	0.34 U	0.33 U	0.29 U
General Chemistry							
Ammonia	mg/kg			-	80	50 U	68
Cyanide (total)	mg/kg		250	0.1	0.61 U	0.65 U	5.1 (b)
Nitrate (as N)	mg/kg			-	310 U	310 U	270 U
pH, lab	s.u.			-	8.18 J	7.97 J	8.13 J
Total organic carbon (TOC)	mg/kg			-	23000	18000	44000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

⁽¹⁾ MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

Sample Location:
Sample ID:
Sample Date:
Sample Depth:
matrix_code

	SO-302-13	SO-304-13	SO-306-13
	S-58502-071613-SSH-302	S-58502-071613-SSH-304	S-58502-071613-SSH-306
	7/16/2013	7/16/2013	7/16/2013
	(0-0.5) ft BGS	(0-0.5) ft BGS	(0-0.5) ft BGS
	SO	SO	SO

Parameters:	Units	Statewide Default Background Levels	Direct Contact Criteria & RBSLs (a)	Res/Non_Res/G W Prot_GW SW Interface Prot (b)	SO-302-13	SO-304-13	SO-306-13
Metals							
Aluminum	mg/kg		370000	-	9300	4100	2900
Antimony	mg/kg		670	94	0.15 J	0.11 J	0.16 J
Arsenic	mg/kg	5.8	37	4.6	5.7 (b)	1.6	2.7
Barium	mg/kg		130000	-	59	34	19
Beryllium	mg/kg		1600	-	0.47	0.22	0.20
Cadmium	mg/kg		2100	-	0.24	0.097	0.045 J
Calcium	mg/kg			-	36000	7300	3300
Chromium	mg/kg	18		3.3	23 (b)	7.4	16
Cobalt	mg/kg	6.8	9000	2	5.8	0.88	1.1
Copper	mg/kg		73000	-	19	4.5	6.7
Iron	mg/kg		90000	-	15000	4700	9500
Lead	mg/kg		900	-	23	8.4	12
Magnesium	mg/kg		1000000	-	13000	1600	810
Manganese	mg/kg		90000	-	530	170	240
Mercury	mg/kg	0.13	580	0.05	0.035 J	0.050 U	0.043 U
Nickel	mg/kg		150000	-	18	3.1	5.2
Potassium	mg/kg			-	1700	260 J	280 J
Selenium	mg/kg	0.41	9600	0.4	0.91 (b)	0.57 (b)	0.54 (b)
Silver	mg/kg	1.0	9000	0.1	0.053 J	0.019 J	0.023 J
Sodium	mg/kg		1000000	-	87	80 U	86 U
Thallium	mg/kg		130	4.2	0.17 U	0.16 U	0.17 U
Vanadium	mg/kg		5500	190	20	4.3	4.5
Zinc	mg/kg		630000	-	110	29	35
Polychlorinated Biphenyls							
Aroclor-1016 (PCB-1016) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1221 (PCB-1221) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1232 (PCB-1232) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1242 (PCB-1242) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1248 (PCB-1248) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1254 (PCB-1254) ⁽¹⁾	µg/kg		1000	-	0.065 J	0.29 U	0.3 U
Aroclor-1260 (PCB-1260) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1262 (PCB-1262) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
Aroclor-1268 (PCB-1268) ⁽¹⁾	µg/kg		1000	-	0.31 U	0.29 U	0.3 U
General Chemistry							
Ammonia	mg/kg			-	68	50 U	81
Cyanide (total)	mg/kg		250	0.1	0.59 U	0.53 U	0.55 U
Nitrate (as N)	mg/kg			-	290 U	280 U	280 U
pH, lab	s.u.			-	8.14 J	8.04 J	7.60 J
Total organic carbon (TOC)	mg/kg			-	27000	18000	24000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

⁽¹⁾ MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

ANALYTICAL RESULTS SUMMARY - BANK SOIL
NORTH DITCH
RACER NODULAR INDUSTRIAL LAND (10040)
SAGINAW, MI

<i>Sample Location:</i>		<i>SO-307-13</i>			
<i>Sample ID:</i>		<i>S-58502-071613-SSH-307</i>			
<i>Sample Date:</i>		<i>7/16/2013</i>			
<i>Sample Depth:</i>		<i>(0-0.5) ft BGS</i>			
<i>matrix_code</i>		<i>SO</i>			
		<i>(Duplicate)</i>			
<i>Parameters:</i>	<i>Units</i>	<i>Statewide</i>	<i>Direct</i>	<i>Res/Non_Res/G</i>	
		<i>Default</i>	<i>Contact</i>	<i>W Prot_GW SW</i>	
		<i>Background</i>	<i>Criteria</i>	<i>Interface Prot (b)</i>	
		<i>Levels</i>	<i>& RBSLs (a)</i>		
Metals					
Aluminum	mg/kg		370000	-	2900
Antimony	mg/kg		670	94	0.072 J
Arsenic	mg/kg	5.8	37	4.6	2.1
Barium	mg/kg		130000	-	18
Beryllium	mg/kg		1600	-	0.18
Cadmium	mg/kg		2100	-	0.038 J
Calcium	mg/kg			-	2600
Chromium	mg/kg	18		3.3	10
Cobalt	mg/kg	6.8	9000	2	0.95
Copper	mg/kg		73000	-	5.0
Iron	mg/kg			-	7200
Lead	mg/kg		900	-	11
Magnesium	mg/kg		1000000	-	870
Manganese	mg/kg		90000	-	160
Mercury	mg/kg	0.13	580	0.05	0.043 U
Nickel	mg/kg		150000	-	3.3
Potassium	mg/kg			-	260 J
Selenium	mg/kg	0.41	9600	0.4	0.53 (b)
Silver	mg/kg	1.0	9000	0.1	0.027 J
Sodium	mg/kg		1000000	-	82 U
Thallium	mg/kg		130	4.2	0.16 U
Vanadium	mg/kg		5500	190	4.3
Zinc	mg/kg		630000	-	34
Polychlorinated Biphenyls					
Aroclor-1016 (PCB-1016) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1221 (PCB-1221) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1232 (PCB-1232) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1242 (PCB-1242) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1248 (PCB-1248) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1254 (PCB-1254) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1260 (PCB-1260) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1262 (PCB-1262) ⁽¹⁾	µg/kg		1000	-	0.3 U
Aroclor-1268 (PCB-1268) ⁽¹⁾	µg/kg		1000	-	0.3 U
General Chemistry					
Ammonia	mg/kg			-	49 U
Cyanide (total)	mg/kg		250	0.1	0.54 U
Nitrate (as N)	mg/kg			-	280 U
pH, lab	s.u.			-	7.53 J
Total organic carbon (TOC)	mg/kg			-	21000

Notes:

J - Estimated concentration.

U - Not present at or above the associated value.

⁽¹⁾ MDEQ guidance references TSCA regulations. 1000ppb PCBs is the criteria for unrestricted use

TABLE 4

**GROUNDWATER AMMONIA AND pH RESULTS SUMMARY
ADDITIONAL GROUNDWATER MONITORING
SAGINAW NODULAR INDUSTRIAL LAND
SAGINAW, MICHIGAN**

<i>Monitoring Well</i>	<i>Approximate distance from the River (ft)</i>	<i>Measured Total NH₃ (mg/L)</i>	<i>Groundwater Temperature (° C)</i>	<i>Groundwater pH</i>	<i>Saginaw River Temperature (° C)⁴</i>	<i>Saginaw River pH</i>	<i>Average Temperature (° C)¹</i>	<i>Average pH²</i>	<i>% Unionized NH₃³</i>	<i>Calculated Unionized NH₃ (mg/L)</i>
MW-04757	400	1.7	17.92	8.40	24.90	8.30	21.4	8.35	8.89%	0.15
MW-04257	100	0.45	22.02	7.22	24.90	8.30	23.5	7.49	1.53%	0.01
MW-03945	50	9.1	18.63	6.68	24.90	8.30	21.8	6.97	0.42%	0.04
MW-04051	50	NA	17.95	6.85	24.90	8.30	21.4	7.14	0.60%	NA
MW-04250R	600	2.5	18.74	10.83	24.90	8.30	21.8	8.60	15.24%	0.38
MW-04836	1,500	11	17.07	7.72	24.90	8.30	21.0	7.92	3.41%	0.38
MW-05036	2,000	3.1	15.38	12.25	24.90	8.30	20.1	8.60	13.76%	0.43
MW-05443	2,000	7.2	16.49	7.21	24.90	8.30	20.7	7.48	1.23%	0.09
MW-05452	1,500	1.7	16.51	9.89	24.90	8.30	20.7	8.59	13.95%	0.24
MW-15457	1,750	1.4	14.75	7.09	24.90	8.30	19.8	7.37	0.90%	0.01
MW-4	1,700	3.3	17.72	9.06	24.90	8.30	21.3	8.53	12.89%	0.43
MW-8	2,000	17	17.33	11.35	24.90	8.30	21.1	8.60	14.61%	2.48
MW-9	1,800	14	17.38	8.32	24.90	8.30	21.1	8.31	8.07%	1.13
MW-17	2,000	1.7	19.64	8.42	24.90	8.30	22.3	8.36	9.58%	0.16
MW-18	2,000	12	19.94	12.08	24.90	8.30	22.4	8.60	15.84%	1.90

Notes:

¹ Temperature is the average of the groundwater temperature and the Saginaw river temperature

² pH value for average of groundwater and Saginaw River H⁺ concentrations

³ Ammonia toxicity equations taken from Steven C. Chapra "Surface Water-Quality Modeling", McGraw-Hill Series in Water Resources and Environmental Engineering 1997

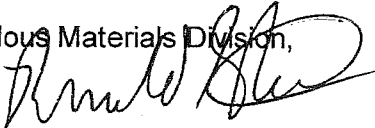
 Boxed Value indicates exceedance of Final Acute Value criteria of 0.42 mg/L for ammonia and less than 6.5 or greater than 9.0 for pH

ATTACHMENT 1

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Nate Nemani, Resource Conservation and Recovery Act of 1976 Corrective Action Project Manager, Land and Chemicals Division, Remediation and Reuse Branch, U.S. Environmental Protection Agency

FROM: Ronald Stone, Senior Geologist, Waste and Hazardous Materials Division, Michigan Department of Environmental Quality 

DATE: January 12, 2010

SUBJECT: Implementation of a Mixing Zone Request; General Motors - Saginaw Metal Castings Operation (GM-SMCO); MID 041 793 340

The Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from GM-SMCO in Saginaw County, Michigan and forwarded that request to the MDEQ, Water Bureau (WB). The attached response provided by the WB identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

Based on the information provided by the WB, it is determined that there is a reasonable potential for the discharge of some chemicals to cause or contribute to water quality standards (WQS) being exceeded.

Recommended mixing zone-based groundwater surface water interface (GSI) values are summarized in the table below:

Table 1: Plume Venting to the Saginaw River

Parameter	Final Acute Value	Final Chronic Value	Reported Worst Case Maximum Site Concentration
pH	6.5 - 9.0 S.U.		
Ammonia Nitrogen	3.1 mg/l		

General Comments

1. The final acute values listed above are the acute mixing zone-based GSI criteria. These limits are provided for chemicals determined to have a reasonable potential to exceed the acute mixing zone-based GSI criteria. These values (as well as the generic GSI criteria for other chemicals not specifically identified in the mixing zone request) must not be exceeded at the GSI compliance monitoring wells; if they are, further remedial action will be required. The facility has the following options in regards to parameters that exceed the acute mixing zone-based GSI criteria in site monitoring wells:
 - a. If any existing exceedances are upgradient of the compliance monitoring wells, GM-SMCO must demonstrate that data from all of the compliance monitoring wells in the Mixing Zone Compliance Monitoring Plan are, and will be, in compliance with acute

mixing zone-based GSI criteria for those parameters. Averaging of groundwater data is not allowed for comparison to generic GSI or acute mixing zone-based GSI criteria, nor is it allowed for bioaccumulative contaminants of concern. Acute mixing zone-based or generic GSI criteria may not be exceeded in any individual GSI compliance monitoring well.

- b. Prevent the discharge of all parameters that exceed the acute mixing zone-based GSI criteria in the GSI compliance monitoring wells. This option would require the focus of subsequent site investigations to hydrogeologically define remediation designs for capturing the groundwater discharge, further plume characterization, and identification of sources for source control measures.
2. It has been determined that any other parameter on the mixing zone request form, not given a recommended mixing zone-based GSI criteria in the table above (if any) or in the attached memorandum, will not cause or contribute to WQS being exceeded at this time. This determination is based upon the reported maximum values in the mixing zone request, which was submitted to the WB by the WHMD.

In order to demonstrate the groundwater discharge long-term compliance with the mixing zone-based GSI criteria, GM-SMCO will need to submit a Mixing Zone Compliance Monitoring Plan for review and approval. The Mixing Zone Compliance Monitoring Plan should include a Sampling and Analysis Plan (to address both mixing zone chemicals and other chemicals reported in the mixing zone request), identification of the wells that GM-SMCO proposes to sample to show compliance with the mixing zone-based GSI criteria (along the GSI at the GSI point of compliance) and any sentinel wells within the appropriate portions of the plume, and provide an explanation of the monitoring schedule and reporting process.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me via e-mail at stoner@michigan.gov or by telephone at 517-373-7141.

Attachment

cc/att: Ms. Cheryl Howe, WHMD
Ms. Rhonda Klann, Remediation and Redevelopment Division
Mr. David Slayton, WHMD
Corrective Action File

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Liane Shekter Smith, Assistant Division Chief
Waste and Hazardous Materials Division

FROM: Erik Sunday, Surface Water Assessment Section, Water Bureau

DATE: December 11, 2009 *ES*

SUBJECT: General Motors Corp-Saginaw Metal Casting Operations (GM-SMCO)
Groundwater venting discharge

The Surface Water Assessment Section has evaluated Water Quality-Based Effluent Limits (WQBELs) for the GM-SMCO groundwater venting discharge. The existing GM-SMCO facility is continuously venting groundwater to the Saginaw River from four groundwater-surface water interfaces (GSIs) as described in the November 12, 2009, Mixing Zone Determination Request (MZDR) forwarded to SWAS by Waste and Hazardous Materials Division (WHMD):

Ammonia Part 1 – 1.73 cubic feet per second (cfs) (1.12 million gallons per day (MGD))
Ammonia Part 2 – 0.81 cfs (0.52 MGD)
pH-High – 0.76 cfs (0.49 MGD)
pH-Low – 2.05 cfs (1.33 MGD)

The above venting flow rates are maximum flows. The vents are located in Sections 7, 17, and 18 of T12N, R5E of Saginaw County. The pH-High groundwater venting flows to the Saginaw River through the Ammonia Part 1 venting area. Therefore, these two vents have been treated as a single vent with a maximum flow rate of 2.49 cfs (1.73 cfs + 0.76 cfs) in developing WQBELs. The combined Ammonia Part 1 and pH-High vent discharges to the Saginaw River downstream of the Carrolton Bar, while the Ammonia Part 2 and pH-Low vents discharge to a channel of the Saginaw River southeast of the Carrolton Bar.

The monthly exceedance flows (in cfs) for the Saginaw River below the Carrolton Bar at the point of discharge of the combined Ammonia Part 1 and pH-High vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	2200	2510	6950	6830	3640	1880
95%	750	800	1560	2220	1180	740
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	1150	980	1000	1250	2010	2380
95%	550	500	510	600	750	780

The monthly exceedance flows (in cfs) for the channel of the Saginaw River southeast of the Carrolton Bar at the point of discharge of the Ammonia Part 2 and pH-Low vents are as follows:

	<u>JAN.</u>	<u>FEB.</u>	<u>MAR.</u>	<u>APR.</u>	<u>MAY</u>	<u>JUNE</u>
50%	1630	1860	5140	5050	2700	1390
95%	560	590	1160	1640	870	550
	<u>JULY</u>	<u>AUG.</u>	<u>SEP.</u>	<u>OCT.</u>	<u>NOV.</u>	<u>DEC.</u>
50%	850	730	740	930	1490	1760
95%	410	370	380	440	560	580

The Saginaw River is protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

Ammonia concentrations and pH are the primary concerns for this facility's venting groundwater. Average values of groundwater pH in the four venting areas were computed from data contained in the MZDR:

Ammonia Part 1 – 7.06 S.U.
 Ammonia Part 2 – 6.86
 pH-High – 11.19
 pH-Low – 5.48

SWAS recommends a pH range of 6.5 to 9.0 S.U. for all venting groundwater discharges to the Saginaw River year-round. Table 1 contains total ammonia recommendations based on meeting the 0.420 mg/l warmwater un-ionized ammonia acute toxicity criterion in the combined Ammonia Part 1 and pH-High venting. No ammonia recommendations for any other GM-SMCO groundwater venting should be necessary to protect against acute or chronic un-ionized ammonia toxicity based on data provided in the MZDR. Pollutants affecting dissolved oxygen in the receiving water are not expected to be present at problematic levels in the venting discharges.

The fraction of total ammonia existing as un-ionized ammonia is calculated, in part, from the pH of the venting groundwater. For the combined Ammonia Part 1 and pH-High venting, the upper value of the WQBEL pH range, 9.0 S.U., was used in the calculation of WQBELs based on un-ionized ammonia toxicity. The recommendations in Table 1 apply for groundwater pH's of 9.0 S.U. or lower. If the groundwater venting is permitted to discharge at a pH greater than 9.0 S.U., WQBELs for the combined Ammonia Part 1 and pH-High venting will need to be recalculated. For evaluation of the pH-Low and Ammonia Part 2 ventings, a pH of 7.1 S.U. was used based on the calculated average pH for the Ammonia Part 1 venting.

The attached effluent limit recommendations are based on water quality standards. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits.

**Table 1. GM-SMCO pH and ammonia toxicity-based WQBEL recommendations
 Combined Ammonia Part 1 and pH-High groundwater venting
 WQBELs assume a pH of 9.0 S.U. or less in venting groundwater**

Parameter	Months	Conc. (mg/l)	Load (lb/d)	Basis	Rationale
NH3-N	Year round	3.1	42	Daily Max.	Acute warmwater toxicity

Design Flow = 2.49 cfs (1.61 MGD)

cc: Jon Bloemker, Saginaw Bay District Supervisor, SWAS, WB
 Eric Alexander/Groundwater Venting File, SWAS, WB

Attachment 7

**Implementation of Mixing Zone
Reauthorization Request**



GRETCHEN WHITMER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY
LANSING



LIESL EICHLER CLARK
DIRECTOR

October 26, 2022

VIA EMAIL

Michael Beedle, Supervisor
United States Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, Illinois, 60604

Dear Michael Beedle:

Subject: Implementation of a Mixing Zone Reauthorization Request; RACER Saginaw Nodular Industrial Land; Saginaw, Michigan; MID 041 793 340; Waste Data System Number 355505

The Michigan Department of Environment, Great Lakes, and Energy (EGLE), Materials Management Division (MMD), has reviewed the request for a Mixing Zone Determination for venting groundwater to the Saginaw River from RACER Saginaw Nodular Industrial Land, in Saginaw County, Michigan and forwarded that request to the Water Resources Division (WRD), EGLE. The response WRD provided identifies the acceptable concentration limits for discharge of the various chemicals characterized in the mixing zone request to the Saginaw River.

The following recommendations are based on the information the WRD provided:

- 1) The predicted worst-case maximum groundwater/surface water interface (GSI) discharge concentrations for pH are 6.56 Standard Units (S.U.) as a low (MW-03945), and 12.25 S.U. as a high (MW-05036). To ensure the Saginaw River is meeting Michigan Water Quality Standards for pH, we recommend a **daily minimum pH limit of 6.5 S.U. and a daily maximum pH limit of 9.0 S.U.**
- 2) The venting ammonia from the site was evaluated to determine if there is a concern for chronic ammonia toxicity. EGLE adopted new criteria for ammonia toxicity in 2019; those updated criteria are applied here. The new ammonia toxicity criteria still result in tighter limits at higher temperatures and pH; however, the new criteria are based on total ammonia instead of the calculated un-ionized ammonia fraction. Limits at the groundwater-surface water interface (GSI) were calculated using a total venting groundwater flow of 2.54 cubic feet per second. The lowest monthly 95th percentile exceedance flow in the Saginaw River is 570 cfs, based on Low Flow Discharge Request Record 10044. There is significant dilution available to the venting groundwater into the Saginaw River. At critical conditions in the summer season the venting groundwater represents less than 0.5% of the total flow in the Saginaw River.

There are locations with high ammonia concentrations in the monitoring wells on the site. The highest ammonia concentrations measured was 51 mg/l at MW-04836, with two additional readings at this well greater than 30 mg/l. The groundwater pH was generally low at this site, which lowers the risk of toxicity. Ammonia concentrations of 10-21 mg/l measured at MW-8, and MW-8R, coincide with higher levels of pH.

The ammonia concentrations are lower at the monitoring wells closer to the GSI. This implies that some nitrification is occurring in the groundwater as it moved toward the river. Concentrations at these wells is typically 10 mg/l or less. **The calculated ammonia toxicity limit at the GSI to prevent chronic toxicity in the summer season is 79 mg/l**, due to the high level of dilution available in the Saginaw River. None of the monitoring well samples exceed this concentration.

In order to demonstrate compliance with the mixing zone-based GSI criteria, RACER Saginaw Nodular Industrial Land must continue implementation of its mixing zone compliance monitoring program.

Should you have any questions regarding this letter or the Mixing Zone Determination, please contact me at ErberN@Michigan.gov; or 517-256-6063.

Sincerely,



Nathan R. Erber, PhD, Senior Geologist
Technical Support Unit
Hazardous Waste Section
Materials Management Division
517-256-6063

cc: Rich Conforti, MMD
Dale Bridgford, MMD
Mixing Zone File

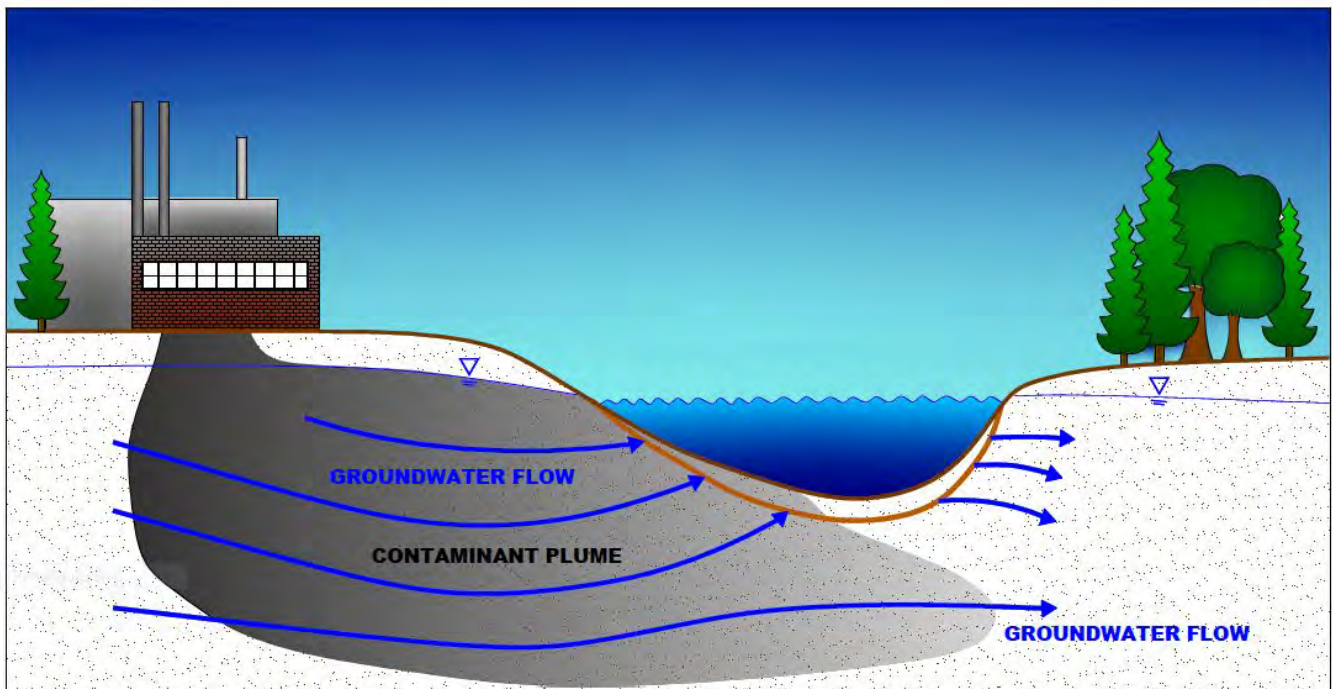
Attachment 8

Groundwater-surface Water Interface Pathway Compliance Options



GROUNDWATER-SURFACE WATER INTERFACE PATHWAY COMPLIANCE OPTIONS

REMEDIATION AND REDEVELOPMENT DIVISION
RESOURCE MATERIALS



Adapted from US EPA, Proceedings of the Groundwater/Surface-Water Interactions Workshop, EPA/542/R-00/007, July 2000

Prepared by:
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
525 West Allegan Street
Lansing, Michigan 48933
RRD-RESOURCE MATERIALS
April 2018




Remediation and Redevelopment Division
Michigan Department of Environmental Quality

In order to promote a consistent and informed approach for Michigan Department of Environmental Quality (MDEQ) staff, this document was developed to provide information to MDEQ staff and contractors on compliance options the groundwater/surface water (GSI) pathway.

This document is available as a technical reference to assist any party conducting investigations and assessing the GSI pathway to demonstrate compliance and support risk management decisions.

This document is explanatory and does not contain any regulatory requirements. It does not establish or affect the legal rights or obligations for the GSI pathway. It does not have the force or effect of law and is not legally binding on the public or the regulated community. Any regulatory decisions made by the MDEQ regarding GSI compliance will be made by applying the governing statutes and Administrative Rules to relevant facts.

Approved:



Kathleen Shirey, Acting Director
Remediation and Redevelopment Division
April 23, 2018



TABLE OF CONTENTS

Page

1.0 INTRODUCTION	4
2.0 CONCEPTUAL SITE MODEL (CSM).....	4
3.0 GSI PATHWAY RELEVANCY	5
4.0 WATER QUALITY STANDARDS (WQS).....	6
4.1 Applicable RBSLs/Criteria	7
4.2 Whole Effluent Toxicity (WET) Testing.....	8
4.3 Site-Specific Criteria Development	9
5.0 MUNICIPAL SEPARATE STORM SEWERS (MS4)	9
6.0 INDUSTRY STANDARD FOR IMPERVIOUS SEWERS.....	10
7.0 GSI PATHWAY COMPLIANCE OPTIONS	11
7.1 Generic GSI Criteria	11
7.2 Variances	11
7.3 Mixing Zones.....	12
7.4 Site-Specific Criteria	13
7.5 Alternative Monitoring Points.....	13
7.6 Ecological Assessment	14
7.7 Modeling Assessment.....	15
7.8 De Minimis Effect Demonstration	15
7.9 Technical Impracticability (TI) Waivers	17
7.10 Natural Attenuation	17
7.11 Use Attainability Analysis (Wetlands)	18
7.12 Groundwater Venting to Sewers	18
7.13 MDEQ Submittals	19
Appendix A.....	20
Appendix B.....	21
Appendix C.....	23
Appendix D.....	24
Appendix E.....	26



1.0 INTRODUCTION

This document is provided as a resource for environmental professionals interested in identifying compliance options for the groundwater-surface water interface (GSI) pathway. The GSI pathway plays a critical role in Michigan's environmental cleanup program due to complex hydrogeology across the state.

Glaciers advancing across the Michigan basin carved and shaped the landscape creating the Great Lakes and thousands of inland lakes, rivers, streams, and wetlands. The glaciers also deposited thick layers of unconsolidated drift where groundwater is present in numerous aquifers that are directly connected to surface water bodies. The groundwater/surface water interface (GSI) pathway defines this connection. The GSI is the location at which groundwater enters (vents) to a surface water body¹. Contaminant plumes resulting from releases of hazardous substances from thousands of sites across the state of Michigan migrate with groundwater and may pose a threat to surface water bodies. Characterization, evaluation, and management of contaminant plumes where the GSI pathway is relevant are statutorily required to ensure protection of surface waters of the state.

The scope of this document is to describe, in general terms:

- *Conceptual Site Model (CSM)*
- *GSI Pathway Relevancy*
- *Water Quality Standards*
- *Acute Toxicity Requirements*
- *Municipal Separate Storm Sewer Systems (MS4)*
- *Industry Standard for Impervious Storm Sewer*
- *GSI Pathway Compliance Options*

This document is not intended to comprehensively describe all concepts or strategies regarding the GSI pathway and options for achieving compliance. This document serves as a reference to help describe some of the methods and means for achieving compliance for the GSI pathway and to point to other resources that may be helpful. A list of selected definitions is provided in Appendix A. A list of selected references, which provide a more thorough discussion of the concepts presented in this document, is presented in Appendix B. Statutory references in Appendix B provide regulatory requirements for the venting groundwater pathway.

2.0 CONCEPTUAL SITE MODEL (CSM)

Site characterization sufficient to provide a clear understanding of the site conditions, and the physical, chemical and biological processes that control the transport of contaminants from areas with high concentrations of contaminants through environmental media to human and/or ecological receptors is necessary for making risk based decisions at sites with environmental contamination. The organization of this information into a readily understandable written and/or pictorial representation of site conditions and processes is a conceptual site model (CSM). It is very useful to have an adequate CSM developed and utilized for site decisions such as outlined in the ASTM Standard Guide for Development of Conceptual Site Models (See Appendix B).

A CSM is a very powerful tool that can relay site specific information in a very expeditious and concise manner. The information depicted in the CSM can be used to demonstrate GSI pathway relevancy, show plume venting area, and depict the magnitude of the discharge so that all parties quickly

¹ MCL 324.20120e(23)(c)



understand the site conditions. The CSM is also useful for identifying any data gaps and evaluating the potential effect they may have on final site decisions.

An accurate and complete CSM will evolve as information is gathered throughout the life of the project and should support scientific and technical interpretations and decisions for the site. Conditions at contaminated sites vary greatly from one site to another; therefore, the complexity of a CSM should be consistent with the complexity of the pathway for the site.

The CSM for each site will be unique. The CSM could be developed using existing site data, or it may require new data collection to adequately characterize and understand the risks at the GSI. The surface water body hydrogeological complexity and the potential risks to waters of the state posed by a site will determine the precision and amount of data necessary to complete the CSM.

The CSM may consist of a tabulated historical summary of contaminant concentrations in soil, groundwater and pore water; and groundwater and surface water elevations. Additional details may be provided in written format describing the site history (if available), source area(s) and the identification of site contaminants and applicable pathways. Descriptions of data collection methods and field screening procedures utilized with supporting documentation in the form of lithological boring logs, hydrographs illustrating groundwater flow conditions and interactions with surface water, geological cross sections, plan view maps identifying the source area(s), groundwater flow direction and contaminant distribution, current and future structures, property boundaries, surrounding land use and any other relevant field observations are all considered important components of a complete CSM for evaluating the GSI pathway.

Complete and accurate CSMs pave the way for faster, easier, and better informed decisions when evaluating proposed and completed response activities or corrective action related to releases of hazardous substances. The CSM also serves as the primary instrument to communicate effectively between all parties about the decision making process and final remedial outcomes.

3.0 GSI PATHWAY RELEVANCY

The GSI pathway is relevant when a remedial investigation or application of best professional judgment leads to the conclusion that a hazardous substance in groundwater can be reasonably expected to vent to surface waters of the state² in concentrations that exceed the generic GSI criteria currently or in the future (See 4.0 Water Quality Standards for further information on generic GSI criteria)³. The GSI pathway may be relevant for all land uses if there is a hydraulic connection between the groundwater and surface water. The Water Resources Division (WRD) of the MDEQ is charged with determining whether a water body meets the criteria for being classified as surface waters of the state. Surface waters of the state include intermittent or ephemeral streams, creeks, brooks, ditches, drains and wetlands, including unregulated wetlands.

Some key elements in determining pathway relevancy include the following:

- There must be a hydraulic connection between the contaminated groundwater and surface water to have a groundwater/surface water interface. This includes an intermittent stream or water body that has flow until the groundwater table drops below the stream bottom. Intermittent streams are protected for acute and chronic risks. An ephemeral stream or water body only has flow during periods of surface runoff (rain or snowmelt). By definition an ephemeral stream would not have a groundwater surface water interface.

² See Appendix A definitions

³ Section 20120e(3) of the NREPA



- The hydraulic connection must transport contaminated groundwater to the surface water; a 'losing' surface water body would have a hydraulic connection with groundwater but would not transport contaminated groundwater to the surface water body.
- The designation of groundwater "not in an aquifer" does not eliminate the need to evaluate the GSI pathway. Groundwater "not in an aquifer" may be hydraulically connected to a surface water body and may vent or be reasonably expected to vent in concentrations that exceed generic GSI risk-based screening levels (RBSLs)/criteria (See Appendix A).
- The applicable generic GSI RBSLs/criteria for all appropriate hazardous substances released or otherwise affected (reactions, breakdown byproducts, etc.) and appropriate WQS for physical characteristics are or could be exceeded in representative samples at GSI monitoring points.
- Contaminated groundwater is discharging into a separate storm sewer that discharges to a surface water body.

If the pathway for venting groundwater is determined to be not relevant, further evaluation is not necessary. The GSI pathway may be determined to be not relevant with supporting site conditions documentation that includes consideration of the statutory factors⁴ that may be used to demonstrate that there will not be an exceedance of GSI RBSLs/criteria at the point the groundwater contaminant plume vents to surface waters. For the remaining circumstances where the pathway is relevant and contaminant concentrations exceed the generic GSI RBSLs/criteria, there are statutory options⁵ available to assess and achieve compliance for contaminated venting groundwater [See 7.0 Compliance Options].

4.0 WATER QUALITY STANDARDS (WQS)

The MDEQ has promulgated rules that establish WQS for hazardous substances pursuant to Part 31, Water Resources Protection (Part 31), of NREPA. The WQS are the generic GSI RBSLs/criteria. The surface WQS establish water quality requirements applicable to the surface waters of the state that protect the public health and welfare, enhance and maintain the quality of water, and protect the state's natural resources. All surface waters of the state are designated and protected for the following uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption⁶. Additional designated uses, including total body contact, coldwater fisheries, public water supply sources, etc., are listed in the Part 31 WQS Rules.

WQS include chronic chemical-specific values that represent the most restrictive of the water quality values protective for aquatic life, human health, or wildlife; acute chemical-specific values protective of aquatic life; acute and chronic toxic units protective of aquatic life; standards for water quality characteristics such as pH, nutrients, or dissolved oxygen; and include physical characteristics such as, color, foam or sheens, taste, and odor (See WQS Part 31, Part 4 Rules Appendix B). The current chronic chemical-specific GSI criteria are listed in the RBSLs/criteria tables and the associated footnotes. Acute chemical-specific GSI RBSLs/criteria protective of aquatic life are included in the Part 31, Part 4 Rule 57, Water Quality Values spreadsheet available from the MDEQ web page (See Appendix B). Note that the Rule 57 values are updated periodically and the most current values are applicable criteria. In addition to the chemical-specific WQS, a discharge may not exceed 1.0 acute toxic units at the GSI and venting groundwater may not cause or contribute to an exceedance of 1.0 chronic toxic units in the surface waters outside of any MDEQ allocated mixing zone⁷.

⁴ Section 20120e(3) of NREPA

⁵ Section 20120e of NREPA

⁶ R 323.1100 Designated uses

⁷ R 323.1219(1) Whole effluent toxicity



Generic chemical-specific GSI RBSLs/criteria may be based upon Tier I or Tier II water quality values depending on the amount of toxicity data available at the time that the WQS were developed. Tier I values represent a complete toxicity set, and Tier II values are based on at least minimum toxicity data set. The Tier I or Tier II designation is indicated in the Part 31, Rule 57, Water Quality Values spreadsheet. Additional information on the toxicity data used to calculate a Tier 1 or Tier II water quality value for a hazardous substance is included in the Part 31 rules. Where the generic GSI criteria are based upon a Tier II value, additional mammalian or aquatic toxicity data to reduce the uncertainty factor would need to be generated to calculate Tier I values.

4.1 Applicable Generic RBSLs/Criteria

If the GSI pathway is determined to be relevant, the generic GSI RBSLs/criteria are applicable. Applicable RBSL/criteria apply to all appropriate hazardous substances released and appropriate water quality characteristics affected by the release. In cases where a target detection limit for a hazardous substance is greater than the risk-based GSI value, the target detection limit is substituted for the risk-based value as the RBSL/criterion. If the background groundwater concentration for a hazardous substance is greater than the risk-based GSI RBSL/criterion, the background concentration is substituted for the risk-based criterion as the RBSL/ criterion. Background in groundwater means the concentration or level of a hazardous substance which exists in the groundwater at or regionally proximate to a site that is not attributable to any release at or regionally proximate to the site. Background in groundwater may be determined on a facility-specific basis if proposed to be substituted for a cleanup criterion.

GSI RBSLs/criteria include generic GSI RBSLs/criteria, mixing zone-based RBSLs/GSI criteria, and site-specific criteria. Development of mixing zone-based GSI RBSLs/criteria may be proposed if there is, or there is expected to be, an exceedance of generic RBSLs/criteria. If this option is selected for demonstration of compliance, the requirements for calculation of mixing zone-based GSI RBSLs/criteria are included in the MDEQ Procedure [RRD-32]. See further discussion 7.3 Mixing zones, and 4.3 Site-specific criteria.

Some generic chemical-specific GSI RBSLs/criteria are based upon the hardness or pH of the receiving waters. For these chemicals, representative site-specific surface water samples are collected for hardness or pH measurements and the values used as input to the criteria formulas. A spreadsheet is available to calculate these GSI and GSI protection RBSLs/criteria from the MDEQ-RRD webpage (See Appendix B). To establish a value that can be used for evaluating the potential need for remedial activities, estimated hardness values of 50 milligrams per liter (mg/l) for the Upper Peninsula surface waters, 100 mg/l for northern Lower Peninsula surface waters, and 150 mg/l for southern Lower Peninsula surface waters may be used as input to the spreadsheet. To estimate a GSI criterion for pentachlorophenol, 7.0 standard units may be used to represent the pH of the receiving water. Final determination of compliance with these generic GSI RBSLs/criteria is based on RBSLs/criteria calculated with site-specific surface water hardness or pH values. Available public sources of surface water quality may be used for site-specific determinations.

Compliance with the generic GSI RBSLs/criteria for ammonia is determined by multiplying the total ammonia-nitrogen concentration in the groundwater by a default value to represent unionized ammonia. The default value for unionized ammonia is based upon pH and temperature of the receiving waters. For the generic GSI RBSL/criterion the default for temperature depends upon the designation of coldwater surface waters. To determine compliance with the RBSLs/criteria, the designation of the receiving surface water must be identified. The Michigan Department of Natural Resources designates coldwater lakes and trout streams. Copies of the designations are available from the MDEQ district



offices. If the surface water is not designated as coldwater, it is protected as warmwater. Representative site-specific surface water measurements may be collected for temperature or pH and the maximum values used rather than the default pH of 8 standard units and default surface water temperatures of 68°F for coldwater and 85°F for warmwater to estimate an alternative default value.

Some generic chemical-specific GSI criteria depend upon whether the surface water is protected as a drinking water source. The Great Lakes and their connecting waters are protected as a drinking water source. The Great Lakes connecting waters are defined as: the St. Mary's River, the Keweenaw waterway, the Detroit River, the St. Clair River, and Lake St. Clair. A listing of public water supply intakes on inland lakes and rivers is available from the MDEQ district offices.

4.2 Whole Effluent Toxicity (WET) Testing

Consistent with the federal Clean Water Act's (CWA) prohibition of the discharge of toxic pollutants in toxic amounts, in addition to chemical-specific WQS the Part 31 WQS do not allow a discharge to exceed 1.0 acute toxic units, and to cause or contribute to an exceedance of 1.0 chronic toxic units in the surface waters outside of any MDEQ allocated mixing zone.

WET refers to the aggregate toxic effect to aquatic organisms from all pollutants contained in a discharge (effluent). The United States Environmental Protection Agency (US EPA) WET aquatic toxicity test methods consist of exposing living aquatic organisms (plants, vertebrates, and invertebrates) to various concentrations of aqueous samples to measure adverse (deleterious) effect on the specific test organisms' ability to survive, grow, and reproduce.

Data on the toxicity of individual hazardous substances to aquatic organisms are used in the development of the Part 31, Rule 57, WQS. However, the chemical-specific toxicity values do not address additive or potentiation toxic effects of the compounds that could be present in a venting groundwater plume. Frequently the actual contaminant mixture is unknown or many discharge components are not analytically identifiable, which may not allow adequate assessment of the toxicity of the venting groundwater using chemical-specific criteria. WET testing may be an acceptable method to determine the collective effect of unknown components and contaminant mixtures. WET testing can be used to assess the potential risks associated with unknown components and contaminant mixtures and assist in determining when remediation may be necessary.

Site-specific factors influence the decision to conduct WET testing, and decisions are typically made on a case-by-case basis. WET Testing is most likely to be incorporated into monitoring programs when any of the following circumstances exist at a site with contaminated venting groundwater:

- The venting groundwater at the GSI contains several chemicals whose toxicity is unknown;
- The venting groundwater at the GSI contains a significant number of unknown/unidentified chemicals;
- The venting groundwater at the GSI contains a number of chemicals known to be toxic to aquatic organisms, but may not exceed their individually toxicity limitations;
- The venting groundwater at the GSI contains elevated concentrations of Total Dissolved Solids (TDS), or the chemical constituents of total dissolved solids (e.g., chlorides, sulfate);
- Adverse bio-survey findings; or
- The venting of groundwater at the GSI contains a mixture of chemicals from multiple releases or areas of high contamination and the toxicity of the combined mixture cannot be predicted.



WET testing is only applicable for evaluating compliance of venting groundwater at the GSI. If GSI monitoring wells are relied upon for demonstrating compliance, then a person may elect to use WET testing at those wells.

4.3 Site-Specific Criteria Development

Development of numeric or nonnumeric site-specific GSI criterion may be proposed for MDEQ approval. Numeric site-specific WQS may be developed under provisions of the Part 31 rules:

- Aquatic life values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions. Modifications may be derived using the US EPA recalculation procedure, water effect ratio procedures, or resident species procedure and the specific implementation provisions for recalculation and resident species.⁸
- Wildlife values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions using appropriate site-specific adjustments to the methodology.⁹
- Human health values may be modified on a site-specific basis to be more or less stringent to reflect local environmental conditions or local human exposure using appropriate site-specific adjustments to the methodology. Less stringent human health values must be protective of designated uses of the surface waters of the state and must be based on sound scientific rationale.¹⁰

Site-specific criteria may also include biological criteria. The site-specific criteria provisions of Part 201¹¹ may allow other proposals, including nonnumeric criteria, if the proposed criteria, in comparison the generic criteria (WQS), better reflect best available information concerning the toxicity or exposure risk posed by the hazardous substance.

If a generic criteria (WQS) has not been developed under Part 31 for a hazardous substance that is present in venting groundwater, then when the necessary data for the MDEQ to establish a criterion under Part 31 is available a WQS will be developed, unless the MDEQ can:

- Establish criterion based upon comparison to a hazardous substance criterion with similar fate and toxicity,
- Determine that a numerical criterion is not required to assure remedial action will be protective,
- Or it is otherwise demonstrated that nonnumeric site-specific criteria is appropriate through a modeling demonstration and/or an ecological demonstration.

5.0 MUNICIPAL SEPARATE STORM SEWERS (MS4)

Under the federal CWA, MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States (waters of the state) and is designed or used for collecting or conveying storm water. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels, and conduits. Open drains used solely for conveyance of storm water may be considered part of a regulated conveyance system. A regulated conveyance system does not include combined sewer systems and publicly owned treatment works. The MS4 requirements apply to medium or large cities and can apply to other entities such as MDOT (See Appendix B).

The CWA requires storm water discharges from certain types of urbanized areas that meet certain population thresholds to be permitted under the National Pollutant Discharge Elimination System

⁸ R 323.1057(2)(r)-Toxic substances

⁹ R 323.1057(3)(n)

¹⁰ R 323.1057(4)(h)

¹¹ Section 20120a(2) and 20120b of NREPA



(NPDES) program. A list and maps of MS4 communities is available from the MDEQ webpage (See Appendix B).

The discharge of contaminants into a regulated municipal separate storm sewer system is an illicit discharge in accordance with Part 31 and the CWA. A contaminant plume containing concentrations of hazardous substances that comply with Part 201 and Part 213 may still be considered an illicit discharge in accordance with Part 31 and the CWA. MS4 permittees are required to detect, eliminate, and effectively prohibit illicit discharges into their MS4. The MDEQ has developed options to address illicit discharges that will help MS4 permittee's maintain compliance as part of their compliance assistance program (See Appendix C). The party responsible for the illicit discharge and the MS4 permit holder will need to work together to implement an available option. The options available to MS4 permittees where illicit discharges of contaminated groundwater are occurring include:

- Eliminate the infiltration into the MS4 sewer; options include lining the storm sewer, lowering the water table in the area of the storm sewer, or moving the storm sewer.
- Require an NPDES permit be obtained for discharge via the storm sewer.
- Require treatment of the contaminated groundwater to uncontaminated levels prior to discharge to the storm sewer.
- Develop a plan to eliminate the illicit discharge as part of the Illicit Discharge Elimination Program; including a reasonable period of time for pollutant concentrations to be reduced.

Discharges from storm sewer systems that are not subject to MS4 regulations are required to comply with Part 31 and the CWA.

6.0 INDUSTRY STANDARD FOR IMPERVIOUS SEWERS

Provisions to be considered in determining if the GSI pathway is relevant with regard to groundwater discharges to sewers include the use of an "industry standard" in determining if a sewer may be considered impervious.¹² The provision is based upon the concept that a sewer may be "impervious" to groundwater and groundwater seepage into the sewer is not reasonably expected to occur. The "industry standard" applies in determining if the sewer can be considered "impervious." The term "impervious" implies that the sewer is *impenetrable or prevents passage*, and the term applies to situations where a sewer is lined or constructed to be "impervious." Sewers are generally constructed of porous material with joints designed to allow leakage.

Migration of groundwater into a storm sewer can be prevented if the sewer is constructed to be impervious based on industry standard. Suggested lines-of-evidence include showing the sewers:

- Have been designed to prevent infiltration of water into (or out of) the sewer;
- Have a permeability that would prevent infiltration of groundwater into the sewer; typically less than 1×10^{-7} cm/sec, overall (including joints);
- Have a design life that is either the replacement time determined by the municipality or thirty years, whichever is longer; and
- Be compatible with the contamination such that the contamination will not significantly affect the permeability over the design life.

Supporting documentation including the above information and any other supporting lines-of-evidence to demonstrate the "impervious" nature of sewer are critical for making this determination. (See 7.12 Groundwater Venting to Sewers for discussion of options when the pathway is relevant.)

¹² Section 20120e(3)(h) & (19) of NREPA



7.0 GSI PATHWAY COMPLIANCE OPTIONS

The GSI statutory provisions provide for two basic approaches in determining compliance for the GSI pathway. This includes direct measurement of contamination in venting groundwater using various methods and locations; and indirect methods that use a lines-of-evidence approach to demonstrate the venting groundwater does not require remediation.

Pursuant to Part 201, all compliance options must assure protection of public health, safety, welfare and the environment and attain a degree of cleanup and control of the environmental contamination addressed that complies with all applicable or relevant and appropriate requirements of state and federal environmental law¹³.

Options to demonstrate compliance may be used singularly or in combination. The following summarizes these options.

7.1 Generic GSI Criteria

Compliance may be demonstrated if groundwater contaminant concentrations are below the Generic GSI criteria, which are the WQS, in GSI monitoring wells or alternative monitoring points and there are no existing unacceptable water quality characteristics, such as nutrients, or dissolved oxygen or physical characteristics. Compliance with generic GSI criteria prior to entering a storm sewer, or at the storm sewer outfall, may demonstrate compliance for Part 201 or Part 213. However, a contaminant plume containing concentrations of hazardous substances that comply with Part 201 and Part 213 may still be considered an illicit discharge in accordance with Part 31 and the CWA (see 5.0 Municipal Separate Storm Sewers and 7.12 Storm Water Sewer Sampling).

7.2 Variations

The GSI statutory provisions include the option to request a variance from the surface WQS. MDEQ approval of a variance is described in Part 31¹⁴. The information needed to request a variance is available from the Part 31 WQS rules. A WQS variance applies only to the person requesting the variance and only to the pollutant or pollutants specified in the variance. The variance does not modify the surface WQS for the water body as a whole, or apply to other water bodies.

A WQS variance may be granted if demonstrated to the MDEQ that attaining the WQS is not feasible for several reasons. The most applicable to venting groundwater is that human-caused conditions or sources of pollution prevent the attainment of the WQS and cannot be remedied or more environmental damage would occur in correcting the conditions or sources of pollution than would occur by leaving the conditions or sources in place. Any request for a variance is required to show that the variance requested conforms to antidegradation demonstration requirements and characterize the extent of any increased risk to human health and the environment associated with granting the variance compared with compliance with WQS without the variance in a way that enables the MDEQ to conclude that the increased risk is consistent with the protection of the public health, safety, and welfare and environment.

Issuance of a WQS variance requires public notice of the preliminary variance decision including notification of the other Great Lakes states. The variance decision will contain all conditions needed to implement the variance, including, at a minimum:

¹³ Section 20118(3) of NREPA

¹⁴ Section 20120e(1)(b) of NREPA; R 323.1103-Variations



- Compliance with an effluent limitation that at the time the variance is granted represents the level currently achievable.
- Reasonable progress is made toward attaining the WQS. If the variance is approved for any bioaccumulative chemicals of concern (BCC), implementation of a pollutant minimization program consistent with Part 31 provisions.
- The duration of a WQS variance cannot exceed 5 years¹⁵. A variance may be renewed. As part of a renewal request the requester will need to again demonstrate that attaining WQS is not feasible based on the rule requirements.

Response activity plans have been approved that rely upon a variance to the mercury WQS where during evaluation concentrations exceeded those determined as de minimis by the MDEQ Policy Number 09-014. In these instances, contaminated materials have been removed so that there is no longer a recognized source of mercury, natural attenuation is expected to allow progress toward achieving the WQS, and the level currently achievable has been demonstrated to be ten parts per trillion, or less.

7.3 Mixing Zones

Compliance with the GSI Pathway can be determined using mixing zone-based criteria. If samples from representative GSI sampling points exceed the generic GSI criteria or indicate that generic GSI criteria could be exceeded in the future, one option to pursue could be to obtain and comply with mixing zone-based GSI criteria.

A mixing zone is the allocated portion of the receiving surface water body where venting groundwater discharge is mixed with surface waters. The mixing zone is used to develop mixing zone-based GSI criteria.

Exposures in mixing zones cannot result in deleterious effects to the populations of aquatic life and wildlife. The mixing zone cannot prevent the passage of fish or fish food organisms in a manner that would result in adverse effects on the immediate or future populations of the fish or fish food organisms. The area of the mixing zone must be minimized. Devices for rapid mixing, dilution, and dispersion are encouraged where practical¹⁶, but are often not practical for venting groundwater.

As a minimum restriction, the final acute value for aquatic life must not be exceeded when developing mixing zone-based GSI criteria, unless the MDEQ determines or it is demonstrated to the MDEQ that a level higher is acceptable in accordance with the mixing zone rule provisions. An acute mixing zone is allowed under specific rule provisions¹⁷.

For Part 213 corrective action a request for calculation of mixing zone-based GSI criteria should be submitted to the MDEQ independent of and prior to the submittal a Final Assessment Report (FAR) or Closure Report to allow the resulting criteria to be factored into the corrective action necessary to address the pathway.

For Part 201 response activities, a request for calculation of mixing zone-based GSI criteria should be submitted to the MDEQ independent of and prior to a NFA Report. It may be advantageous to request calculation of mixing zone-based GSI criteria early in the remedy evaluation to allow the resulting criteria to be used as part of the compliance assessment of the pathway.

¹⁵ R 323.1103(1)(e)-Variances

¹⁶ R 323.1082(1)-Mixing zones

¹⁷ R 323.1082(7)



Sufficient information will need to be available to process a request for mixing zone-based criteria. The information necessary to process a request to calculate mixing zone-based criteria is included in the MDEQ Procedure [RRD-32].

7.4 Site-Specific Criteria

Compliance may be demonstrated using MDEQ approved site-specific criteria (see 4.3 Site-specific criteria for discussion on development). Approved site-specific criteria may be used in the development of mixing zone-based criteria. Biological criteria may be used as site-specific criteria.

7.5 Alternative Monitoring Points

Alternative monitoring points are an option to demonstrate compliance with the GSI Pathway for comparison of data to Surface WQs, mixing zone-based GSI criteria, or site specific criteria in lieu of data collected from conventional upland vertical monitor wells. They are designed to allow for the collection of samples representative of the venting groundwater at the GSI.

Alternative monitoring points are physically placed in locations where the contaminated groundwater vents to the surface water body. For example, a contaminant plume may be discharging to the surface water body some distance from the shoreline as opposed to directly venting along the shore due to regional groundwater flow paths, and alternative monitoring points could be used to collect samples at the location where the contaminated groundwater is actually venting to the surface water body.

Prior to installing any alternative monitoring points in surface waters, applicable permit requirements need to be evaluated. Part 301, Inland Lakes & Streams, Part 303, Wetlands Protection, Part 325, Great Lake Submerged Lands of NREPA, may have applicable permitting requirements, along with Part 404 of the CWA.

Characterization of the area where the contaminated groundwater is venting is critical to determining that the alternative monitoring points are located in the areas that are reasonably representative of the higher concentrations of hazardous substances venting to the surface water. Alternative samples from points or devices that are clearly installed within venting groundwater area can be used for determining compliance with GSI criteria. Alternative samples collected from the transition zone between groundwater and surface water will need additional documentation.

Documentation that the alternative samples are representative of venting groundwater in the transition zone through an evaluation of hydraulic head conditions and of the water sample geochemistry (e.g., static water levels, temperature, dissolved oxygen, conductivity, etc.) are appropriate. Static water levels higher than the elevation of the surface water body are indicators of conditions where groundwater vents to the surface water. Typical geochemical ranges or thresholds are not readily available. A site-specific lines-of-evidence proposal would be appropriate to support the determination that the sampling location is representative of the venting groundwater.

Documentation of the venting area also includes the characterization of the substrate and geology, and the spatial and temporal variability of the discharge, as well as the magnitude. The vertical location of this venting (and the appropriate depth for sampling) is variable and will be influenced by the type of water body into which the discharge is occurring, as well as local hydrologic and geologic conditions.

Additionally, the transition zone represents a unique and important ecosystem that exists between surface water and the underlying groundwater and must be considered to assure protection of public



health, safety, welfare and the environment¹⁸. Before alternative samples collected from the transition zone can be used for determining compliance, an evaluation of the potential impacts of venting groundwater on surface water protected designated uses is necessary. Indigenous aquatic life (aquatic biota) is a protected designated use for all surface waters of the state. Because of the important ecological role of the transition zone discharge areas, venting groundwater could result in adverse ecological impacts to aquatic biota utilizing those areas. To assure protection of the environment, specifically aquatic biota, subsurface sampling depths should include an assessment of where in the transition zone aquatic biota occur or utilize the area. Sampling locations should be located so the results demonstrate that there would be no direct or indirect effect on the biota.

Specialized sampling devices may be used to collect representative samples. Tools available to locate areas of contaminated groundwater discharge are identified in US EPA publications (See Appendix B).

Sentinel monitoring points (including monitoring points upland of the surface water body in the appropriate flow path(s)) are used in conjunction with the alternative monitoring points for a period as needed to assure that any potential exceedance of an applicable surface WQS can be identified with sufficient notice to allow for additional response activity or corrective action, if needed, so that the exceedance can be appropriately addressed before discharging, and contingencies can be implemented.

Alternative monitoring points may be used to demonstrate that there is no need to take additional response activity to address the GSI pathway. Appendix D provides a summary of when alternative monitoring points may be self-implemented, when the MDEQ must be provided notices, and when submittals must be made to the MDEQ for approval.

7.6 Ecological Assessment

The GSI statutory provisions allow the use of an ecological demonstration to evaluate and to determine compliance with the GSI pathway using scientifically valid methods. An ecological demonstration consists of an ecological assessment using multiple lines of evidence to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure of aquatic life and/or wildlife to contaminants from venting groundwater.

Ecological assessments generally are conducted to understand why and how organisms behave, survive and reproduce, to assess the ecosystem health and determine its sustainability. There are different ways of conducting ecological assessments in terms of approaches and levels of biological organization examined. Regardless of the complexity or rigor of the assessment, all start with descriptions of species presence, abundance, interactions, ecological structure or processes, contaminant levels, and possible adverse effects. All involve inventories of the status of species, populations, communities or ecosystems, as well as changes and trends in species and ecosystem health and abnormalities. To be most effective, information on trends over space and time provide the necessary background for appropriate ecological assessment and management.

Ecological assessments will need to evaluate the potential impacts of venting groundwater on surface water protected designated uses. To appropriately assess the GSI pathway, an ecological assessment can only evaluate and determine compliance for ecological (i.e., aquatic life and/or wildlife) driven GSI criterion. In determining whether an ecological assessment is appropriate for the conditions at a facility, consideration must be given to the designated uses and available GSI criteria protective of the

¹⁸ Section 20118(3) of NREPA



designated uses¹⁹. Water quality standards for most hazardous substances are developed to be protective for aquatic life, human health and wildlife, and the most sensitive of these values represent the generic GSI criterion²⁰. An ecological assessment should only be conducted when the GSI criterion is based on an aquatic life or wildlife value and the concentration in venting groundwater does not exceed the human health value. Examples of the necessary considerations to determine if an ecological demonstration is appropriate follow:

- The contaminant exceeded is arsenic, the arsenic GSI generic criterion is based on human health; an *ecological* assessment would not address the potential human health-risk and would not demonstrate compliance for the pathway.
- The contaminant exceeded is trichloroethylene (TCE), the TCE GSI generic criterion of 200 is based on aquatic life, the water quality value for human health is 370; if contaminant concentrations exceed 370 an ecological assessment would not demonstrate compliance with the pathway since the surface water must be protected for all designated uses.

Indigenous aquatic life (aquatic biota) is a protected designated use for all surface waters of the state. Because the GSI pathway addresses venting groundwater, the transition zone between groundwater and surface water represents a critical part of an ecological assessment. Biota inhabiting, or otherwise dependent on, the transition zone may be adversely affected by contaminated groundwater discharging through the transition zone into overlying surface waters. Ecological risks to the transition zone are characterized after collection and analysis of physical, chemical, and ecological data have been completed. The risks can be characterized using the lines-of-evidence approach commonly used in ecological risk assessments.

Prior to initiating an ecological assessment, necessary permit requirements should be evaluated.

The US EPA has developed comprehensive guidance on ecological assessments that can be relied upon (Appendix B). Other approaches can be proposed. Ecological assessments are based upon site-specific physical, chemical and ecological data. Staff of the MDEQ is available to assist with the development of a proposal for this type of assessment, upon request.

7.7 Modeling Assessment

Modeling may be used to determine compliance with the GSI pathway when a generally recognized and scientifically valid method uses calibrated and verified site-specific field measured data. The scientifically valid method may be demonstrated by the use of a method generally recognized as an acceptable means to model venting groundwater plumes. Innovative methods can be proposed as long as the method is scientifically justifiable for the intended purpose. Representative site-specific field data are used to calibrate and verify the model. As in most cases with models, the level of effort needs to be commensurate with the objective of the model. Additional information regarding the application of models (including calibration and verification) is available in the Groundwater Modeling Resource Materials document (See Appendix B).

7.8 De Minimis Effect Demonstration

The GSI statutory provisions allow for the demonstration of a “de minimis effect” on surface waters of the state in determining if a response activity is necessary to address the GSI pathway. This provision is based upon the concept that some discharges to surface waters may be so small or of such short duration as to have no effect or little effect on the surface water. While the term de minimis is not

¹⁹ Discussion regarding surface water designated uses is included in Section 4.0

²⁰ Reference to the current spreadsheet of water quality values is included in Appendix B



defined by statute or rule, an applicable definition of de minimis effect would be *insignificant or of no concern*. Best professional judgment, lines-of-evidence, and applicable or relevant appropriate requirements (ARARs) regarding protection of surface waters may be used to support this determination.

A conceptual site model (CSM) and other data necessary to determine the mass flow of the contaminants and the expected maximum contaminant concentrations at the GSI is an acceptable approach to documenting the site conditions and providing the lines-of-evidence for the demonstration. Plume characterization data is similar to that collected for a mixing zone request, including the low flow conditions of the receiving water. De minimis determinations rely on the concentrations and mass flow of contaminants entering the surface water, in conjunction with the expected duration of the discharge. The existing conditions of an already degraded surface water body do not serve as a line-of-evidence for determining whether a contribution is de minimis.

The surface WQS establish levels to protect the public health and welfare, enhance and maintain the quality of water, and protect the state's natural resources. These protections along with the designated uses of all surface waters are part of the site-specific analysis of whether the venting groundwater will have no effect or only a de minimis effect on surface waters. Specific WQS provisions may affect the determination as follows:

- Part 31 provisions set expectations that bioaccumulative chemicals of concern (BCCs) concentrations will be reduced whenever a discharge is occurring. Therefore, a de minimis effect determination may not be possible in situations where BCCs identified in the WQS are being evaluated. An exception to this is mercury where the MDEQ policy 09-014 acknowledges that the mercury contribution from the GSI pathway is significantly lower than mercury from more widespread atmospheric deposition.
- A de minimis effect determination may not be applicable in situations where the relevant GSI criteria is significantly higher than the risk-based WQS as a result of target detection limits not being available to measure the hazardous substance at concentrations at or below RBSLs/criteria. In these cases, when concentrations are detected, the evaluation based upon the risk-based WQS would not normally support a de minimis effect determination. Conversely, in instances where compliance with the GSI pathway would be based on the target detection limit rather than the risk-based WQS, and there are no detectable concentrations, compliance has been met without the need for a de minimis determination.
- In situations where the concentrations exceed a WQS at the GSI based upon acute effects to aquatic organisms, a de minimis determination would normally be inconsistent with a de minimis effect determination (See 4.0 WQS and 7.6 Alternative Monitoring Locations for related discussion on surface waters designated use protection for aquatic life).
- De minimis determinations account for all surface WQS including the physical properties and aesthetics at the GSI.

Examples of de minimis demonstrations include:

- Mercury when concentrations met conditions outlined in the MDEQ Policy Number 09-014.
- A situation that included numerous contaminants above generic criteria in GSI monitoring wells. The MDEQ review included a review of the extensive available groundwater concentrations of the contaminants of concern. The analysis indicated there was no reasonable potential for concentrations to exceed WQS for the venting groundwater. In conjunction with the reasonable potential analysis, the following were considered in determining that the on-going contaminant plume venting would have only a de minimis effect on the surface water:
 - The location where the groundwater vents is a concrete channel;
 - The thorough characterization of the site conditions and well developed CSM;



- The existing site-wide removal of contaminated materials; and
- The existing groundwater flow paths and remaining contaminated materials including:
 - (a) The integrity of an adjacent dam and the likelihood that it remains in place, and
 - (b) The proposed restrictions for the area to avoid changes in flow conditions.

The MDEQ has disapproved de minimis determinations in situations where it was determined that the GSI pathway was not relevant, the GSI was not properly located, or site characterization was incomplete to support the determination.

7.9 Technical Impracticability (TI) Waivers

Technically impracticable means the inability to achieve certain remedial requirements and is based upon engineering feasibility and reliability, cost effectiveness, and risk-based considerations. The GSI statutory provisions include the option for a TI waiver request for cases where areas of highest concentrations of soil and/or groundwater contamination have been controlled and compliance with GSI RBSLs/criteria remains unachievable.

In certain situations, remediation of contaminated groundwater to GSI RBSLs/criteria may be technically impracticable from an engineering perspective. This may be due to site-specific characteristics contributing to complex site conditions that may limit the effectiveness of subsurface remediation. Factors such as the nature of the release, chemical properties, contaminant distribution, geology, and aquifer hydraulics or a combination of these may critically limit the potential to achieve GSI RBSLs/criteria in some situations. The DEQ considers technical impracticability guidance published by the US EPA to be relevant in a TI waiver determination (see Appendix B).

In some cases a TI waiver may be considered an option prior to remedy implementation when supported adequately by detailed site characterization and data analysis or robust CSM that define the most critical limitations to meeting GSI RBSLs.

A TI waiver request includes lines-of-evidence, data, and analysis to demonstrate to the MDEQ to determine that compliance with GSI RBSLs/criteria is unachievable.

TI waiver requests typically include the specific compounds that are subject to waiver request, conceptual site model, the spatial area of the GSI where the waiver will apply, the release locations or areas with high contaminant concentrations that have been identified and will be or have been contained, any ongoing response activities or corrective action, and a demonstration that no other remedial technologies could reliably achieve GSI criteria within a reasonable timeframe, and estimate of costs.

7.10 Natural Attenuation

The GSI statutory provisions provide that natural attenuation of hazardous substances upgradient of the GSI is an acceptable form of remediation and may be relied upon in lieu of any active remediation of the groundwater. Numerous hazardous substances naturally attenuate in the environment over time. The attenuation is generally demonstrated by monitoring the trends of contaminant concentrations over time and analyzing for breakdown or daughter products and other geochemical indicator parameters. The MDEQ *Monitored Natural Attenuation Resource Materials* document may be used as a reference for developing plans to use this approach as a remedial strategy. ASTM International, the Interstate Technology and Regulatory Council (ITRC), and the US EPA have published numerous reference documents that may be used to guide a natural attenuation demonstration. A list of some of these reference documents is provided in Appendix B.



7.11 Use Attainability Analysis (Wetlands)

The GSI statutory provisions protect wetlands for the groundwater to surface water pathway for all of the uses that apply to that wetland as specified by reference to Part 31. Part 31 regulates wetlands as defined surface waters of the state, (see Appendix A) and contains the designated uses for which they are protected. The designated uses include, but are not limited, to the following: agriculture, navigation, industrial water supply, warm-water fishery, other indigenous aquatic biota, partial body contact, recreation, and fish consumption. Designated uses are specified in R 323.1100 (See Appendix B).

Venting groundwater discharges resulting in water quality that impairs one or more designated uses of a wetland may be allowed if a use attainability analysis (UAA) shows that those designated uses are not or cannot be attained. A UAA is a structured scientific assessment of the factors affecting the attainment of designated uses. The factors to be considered in such an analysis include the physical, chemical, biological, and economic use removal criteria described in the WQS regulation by the US EPA. A UAA clearly shows or demonstrates why those designated uses are not attainable or cannot be attained. The analysis requires US EPA and MDEQ approval.

Wetlands not regulated by Part 303, Wetlands Protection, of the NREPA, 1994 PA 451, as amended, are considered waters of the state by Part 31 and are subject to GSI compliance statutory provisions.

7.12 Groundwater Venting to Sewers

The GSI statutory provisions allow several options to demonstrate compliance with Part 201 or Part 213 for the situation where the GSI pathway is relevant and a groundwater contamination plume enters a sewer that discharges to surface water.

If the plume enters a separate sanitary sewer or combined sanitary storm sewer the discharge is regulated by Part 31 NPDES permits, not Part 201 or Part 213.

The GSI pathway may be determined not to be relevant by demonstrating a storm sewer is sufficiently tight to prevent inflow where the venting groundwater intersects the sewer or that the sewer is otherwise impervious based on industry standards (see 6.0 Industry Standard for Impervious Storm Sewers for additional discussion).

In cases where groundwater discharges to a storm sewer and the storm sewer in turn discharges to a surface water body, the compliance point under Part 201 and Part 213 is at the storm sewer outfall. However, this does not negate the obligations of MS4 permit holders to eliminate illicit discharges or meet the requirements of the CWA. (See 5.0 Municipal Separate Storm Sewer Systems for options to assist with compliance for these conditions.) When the plume enters a separate storm sewer options to demonstrate compliance for Part 201 and Part 213 include:

- The use of groundwater monitoring wells.
- Mixing zone-based criteria developed that account for the mixing that occurs in the receiving surface water.
- Natural attenuation that occurs in storm sewer system prior to the outfall to surface waters.
- A de minimis determination.
- Monitoring performed within the storm sewer at a location where the plume enters the storm sewer; downstream from where the plume enters but upstream of the outfall to surface waters; or at the outfall to the receiving surface waters.



Sampling at the storm sewer outfall (point of discharge) to surface water may demonstrate compliance with Part 201 and Part 213. Samples collected from the storm sewer, not the receiving surface water, are collected during dry weather or low flow periods to ensure that water collected represents the discharges from the groundwater plume into the sewer, not surface water runoff. Representative samples collected within the storm sewer that are considered upstream and downstream of the groundwater contaminant plume may also be used to assess the concentration and volume of contamination that might be entering from the plume and if there are other contributions from other hazardous substance releases.

Authorization from the owner or operator of the storm sewer system should be obtained prior to sampling in the storm sewer system.

Appendix E provides a checklist for reference purposes when evaluating contaminated groundwater discharging to storm sewers.

7.13 MDEQ Submittals

Throughout the Part 201 GSI statutory provisions, there are references to when response activity may be self-implemented, when the MDEQ must be provided notices, and when submittals must be provided to the MDEQ for approval. Tables summarizing these provisions for ease of reference are included in Appendix D. MDEQ denial of a response activity plan containing a proposal for alternative monitoring points, an ecological demonstration, or modeling demonstration, or any combination, scientific or technical dispute may be appealed to Response Activity Review Panel.



Appendix A

DEFINITIONS

GSI¹: Groundwater Surface Water Interface that is the location at which groundwater enters a surface water body.

GSI Monitoring Well²: A vertical well installed in the saturated zone as close as practicable to surface water with a screened interval or intervals that are representative of the groundwater venting to the surface water.

Generic GSI RBSLs/Criteria³: The water quality standards for surface waters developed by the MDEQ pursuant to Part 31.

Mixing Zone⁴: A mixing zone is the portion of a surface water body in which venting groundwater is mixed with the receiving water.

NPDES Permit: National Pollutant Discharge Elimination System (NPDES) permit issued pursuant to Part 31.

Source: For purposes of this document source is not used as defined by Part 201, rather it means a hazardous substance or combination of hazardous substances in a quantity or concentration that acts as a reservoir that sustains and/or increases contamination within a single environmental media or from one media to another media through dispersion, migration or any other physical, chemical, or biological process. Source includes non-aqueous phase liquids (NAPL) and other highly concentrated areas of contamination such as residual NAPL.

Surface Waters of the State⁵: Includes all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment or control:

- The Great Lakes and their connecting waters.
- All inland lakes.
- Rivers.
- Streams.
- Impoundments.
- Open drains.
- Wetlands.
- Other surface bodies of water within the confines of the state.

Surface water⁶ means all of the following, but does not include groundwater or an enclosed sewer, other utility line, storm water retention basin, or drainage ditch:

- The Great Lakes and their connecting waters.
- All inland lakes.
- Rivers.
- Streams.
- Impoundments.

Surface water⁷ does not include:

- Groundwater.
- Hyporheic zone water.
- Water in enclosed sewers.
- Water in drainage ways and ponds used solely for wastewater or storm water conveyance, treatment or control.
- Water in subgrade utility runs and utility lines and permeable fill in and around them.

¹ Section 20120e(23)(c) of NREPA

² Section 20120e(23)(d) of NREPA

³ Section 20120a(1)(a), Section 21303(j) and Section 21304a(5)(b) of NREPA

⁴ Section 3109(3)(a) of NREPA & R 323.1044(b) [Part 31 definition of mixing zone]

⁵ R 323.1044(u) [Part 31 rule definition]

⁶ Section 21303(m) of NREPA

⁷ Section 20120e(23)(g) of NREPA



Appendix B

REFERENCES

Conceptual Site Models:

ASTM. 2008. *Standard Guide for Developing Conceptual Site Models for Contaminated Sites*. ASTM E1689-95 (Reapproved 2008). ASTM International, West Conshohocken, PA.
www.astm.org/Standards/E1689.htm

Water Quality Standards: Part 31, Part 4 Rules, R 323.1041 to R 323.1117

http://dmbinternet.state.mi.us/DMB/ORRDocs/AdminCode/302_10280_AdminCode.pdf

Rule 57 Water Quality Values Spreadsheet

http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-11383--,00.html

MDEQ Designated Use Information

Designated uses are specified in R 323.1100 [Water Quality Standards: Part 31, Part 4 Rules page 67]

WATER QUALITY AND POLLUTION CONTROL IN MICHIGAN SECTIONS 303(d), 305(b), AND 314 INTEGRATED REPORT

A primary objective of the integrated report is to describe attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's water quality standards. Chapter 4 provides information regarding how the designated uses are assessed; a narrative of the assessment for the Great Lakes, Inland Lakes and reservoirs, rivers, and wetlands are included in following chapters; additional information for specific surface water bodies are contained in the document's appendix.

http://www.michigan.gov/deq/0,4561,7-135-3313_3686_3728-12711--,00.html

GSI and GSI Protection Calculator

http://www.michigan.gov/documents/deq/deq-rrd-GSICriteriaForFootnoteGCalulator_487674_7.xls

Municipal Separate Storm Sewer Systems (MS4) Communities

http://www.michigan.gov/deq/0,4561,7-135-3313_3682_3716-24366--,00.html

Variances

Provisions for granting a variance are specified in R 323.1103

Alternative Monitoring Sampling Devices Ecological Risk Assessments

US EPA ECO Update/Ground Water Forum Issue Paper "Evaluating Ground-Water/Surface-Water Transition Zones in Ecological Risk Assessments" July 2008 Publication 9285.6-17 EPA-540-R-06-072.

ASTM. 2009. *Standard Guide for Risk-Based Corrective Action for Protection of Ecological Resources*. ASTM E2205/E 2205M-02 (Reapproved 2009). ASTM International, West Conshohocken, PA.
<https://www.astm.org/Standards/E2205.htm>

US EPA *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* June 1997 Publication 9285 7.25 EPA 540-R-97-006

USEPA. 1992. Framework for Ecological Risk Assessment. EPA/630/R-92/001

USEPA. 1998. Guidelines for Ecological Risk Assessment. EPA/30/R-95/002F



REFERENCES CONTINUED

Groundwater Modeling

GROUNDWATER MODELING, REMEDIATION AND REDEVELOPMENT DIVISION
RESOURCE MATERIALS February 2014

http://www.michigan.gov/documents/deq/deq-rrd-GroundwaterModelingGuidance_447643_7.pdf

Mass Flow and Mass Discharge

ITRC, Technology Overview *Use and Measurements of Mass Flux and Mass Discharge*. August 2010

Technical Impracticability

Guidance for Evaluating the Technical Impracticability of Groundwater Restoration;
US EPA September 1993; Directive 9234.2-25.

Use Attainability Analysis

<https://www.epa.gov/wqs-tech/use-attainability-analysis-uaa>

Natural Attenuation

ASTM. 2010. *Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites*. ASTM E1943-98(2010) ASTM International, West Conshohocken, PA.

www.astm.org/Standards/E1943.htm.

ITRC. *Natural Attenuation of Chlorinated Solvents in Groundwater: Principles and Practices*.
September 1999. www.itrc.org

U.S. EPA, "How to Evaluate Alternative Technologies for Underground Storage Tank Site: A Guide for Corrective Action Plan Reviewers", EPA510-R-04-002, Solid Waste and Emergency Response 5401G, May 2004 (www.epa.gov/oust/pubs/tums.htm)

US EPA. *Performance Monitoring of MNA Remedies for VOCs in Groundwater*. April 2004. Publication EPA-600-R-04-027.

US EPA. *Monitored Natural Attenuation of MTBE as a Risk Management Option at Leaking Underground Storage Tank Sites*. January 2005. Publication EPA-600-R-04-179.

US EPA. *Natural Attenuation of the Lead Scavengers 1,2-Dibromoethane (EDB) and 1,2-Dichloroethane (1,2-DCA) at Motor Fuel Release Sites and Implications for Risk Management*. September 2008. Publication EPA-600-R-08-107.

US EPA. *Site Characterization to Support Use of Monitored Natural Attenuation for Remediation of Inorganic Contaminants in Ground Water*. November 2008. Publication EPA-600-R-08-114.

US EPA. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*. September 1998. Publication EPA-600-R-98-128.

Response Activity Providing for Venting Groundwater

Section 324.20120e, Part 201, Environmental Remediation, Natural Resources and Environmental Protection Act (NREPA), PA 451, 1994, as amended.

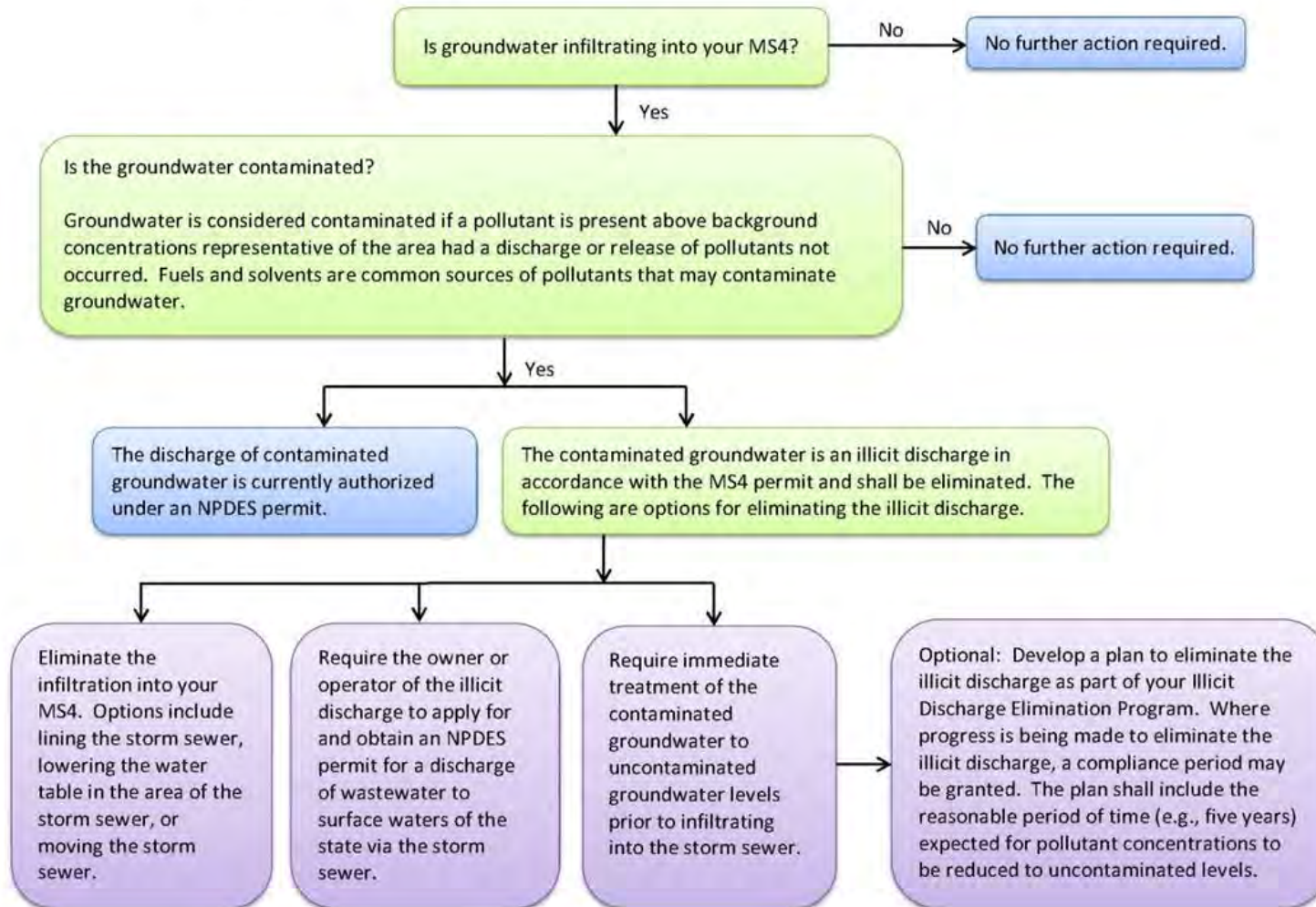
<http://legislature.mi.gov/doc.aspx?mcl-324-20120e>

Section 324.21304a, Part 213, Environmental Remediation, Natural Resources and Environmental Protection Act (NREPA), PA 451, 1994, as amended.

<http://legislature.mi.gov/doc.aspx?mcl-324-21304a>

Appendix C

Options for Eliminating an Illicit Discharge of Contaminated Groundwater into your MS4





Appendix D

SELF-IMPLEMENTATION PROVISIONS

Section 20120e Compliance Method	Response Activity Plan (RAP) ¹ Required		Statute Reference(s)
	Liable Party	Non-liable Party	
GENERIC GSI CRITERIA			
Evaluation	No	No	Subsection (5) (a) allows for a person to undertake evaluation activities without a RAP that include alternative monitoring points, an ecological demonstration, or a modeling demonstration. However, a notice is required from a liable party only if the conclusion of the evaluation is that no additional response activity is needed.
GSI Wells	No	No	Subsection (5) (b) allows for a person to use GSI monitoring wells to demonstrate compliance with generic criteria without a RAP. Note this includes sensitive environments.
Alternative Monitoring Points (excluding sensitive environments)	No	No	Subsection (5) (c) allows for response activity to include monitoring from an alternative monitoring point to demonstrate compliance with generic criteria without a RAP. A notice of alternative monitoring points is required. However, subsection (6) requires a RAP if a sensitive environment is present.
Ecological Demonstration (excluding sensitive environments)	Not Applicable	No	Subsection (5) (d) allows non-liable parties to conduct response activity that rely on an ecological demonstration to demonstrate compliance with generic criteria without a RAP. Note that subsection (9) requires sentinel wells. However, subsection (6) requires a RAP if a sensitive environment is present.
Modeling Demonstration (excluding sensitive environments)	Not Applicable	No	Subsection (5) (d) allows non-liable parties to conduct response activity that rely on a modeling demonstration to demonstrate compliance with generic criteria without a RAP. Note that subsection (10) requires field measurements. However, subsection (6) requires a RAP if a sensitive environment is present.
Sensitive Environments (AMPs, ED, MD only)	Yes	Yes	Subsection (6) requires a person to submit a RAP for any response activity relying on monitoring from alternative monitoring points, an ecological demonstration, or modeling demonstration to demonstrate compliance with generic criteria where a sensitive environment is applicable. Sensitive environments are listed in subsection (6) and include surface waters protected for coldwater fisheries. Note that a plan is not required if GSI wells are used to demonstrate compliance for sensitive environments.

¹ For the purposes of this document “RAP” represents a Response Activity Plan, not the traditional acronym for Remedial Action Plan.



SELF-IMPLEMENTATION PROVISIONS CONTINUED

Section 20120e Compliance Method	Response Activity Plan (RAP) Required		Statute Reference(s)
	Liable Party	Non-liable Party	
NON-GENERIC GSI CRITERIA			
Variance	Yes	Yes	Subsection (7) requires a person to submit a RAP for any response activity relying on compliance methods other than generic criteria (e.g. variance, mixing zone, site specific, ecological, modeling). Only compliance with generic criteria is excluded.
Mixing-zone	Yes	Yes	
Site-specific	Yes	Yes	
Ecological Demonstration	Yes	Yes	
Modeling Demonstration	Yes	Yes	

REQUIRED MDEQ NOTICES				
Liabe Party	Non-liable Party	Timeframe	Statute Reference	
Yes	Yes	7 days	Section 20120e(13)(a)	A person implementing a response activity is required to submit a notice to the MDEQ within 7 days of obtaining knowledge that there is an acute toxicity criterion exceedance at a GSI compliance monitoring point.
Yes	Yes	30 days	Section 20120e(5)(c)	A person is required to submit a notice of alternative monitoring points to the MDEQ 30 days prior to relying on those alternative monitoring points.
Yes	Yes	90 days	Section 20120e(14)	A person is required to submit a notice to the MDEQ if evaluations determine that venting groundwater has no effect or a de minimis effect on a surface water body. The MDEQ may disapprove the determination within 90 days after receipt of the determination.
Yes	No	None	Section 20120e(5)(a)	A person liable under Section 20126 is required to notify the department and request approval if evaluations determine that additional response activity is not required and are based on alternative monitoring points, an ecological demonstration, a modeling demonstration, or de minimis determination.
Yes	No	30 days	Section 20120e(13)(b)	Within 30 days of the date of the acute toxicity notification, a person liable under Section 20126 is required to submit a notice of intent to the MDEQ if proposing an alternative monitoring point, ecological demonstration, modeling demonstration, site-specific criterion, or mixing-zone criterion to address acute toxicity exceedance.



Appendix E

STORM SEWER SAMPLING CHECKLIST

This checklist provides items that are useful when evaluating if contaminated groundwater is discharging from a site into storm sewers. Samples collected from the storm sewer are expected to be representative of contaminated groundwater discharging to the sewer.

This checklist has been prepared assuming that an adequate CSM to assess the pathway has been prepared and that a groundwater contaminant plume intersects a pervious storm sewer either continuously or seasonally due to water table fluctuations.

	YES	NO
Has authorization to collect samples from the storm sewers from the owner of the system been obtained?		
Have you made arrangements to provide data to the owner of the storm sewer system?		
Have all of storm sewers that may be impacted by the contaminant plume been located? <i>This information is available from storm sewer system maps and/or as-built drawings of storm sewer infrastructure; public works personnel and facility staff. Field inspections may be performed to verify locations of infrastructure.</i>		
Are the storm sewer and sanitary sewer combined or separated? <i>Combined sanitary and storm sewers are otherwise regulated under the NPDES program.</i>		
Do you know the age and physical condition of the storm sewers? <i>Downpipe cameras can be used to complete a visual inspection of the storm sewer and identify if/where groundwater discharges are entering the storm sewer, and to identify possible sampling locations.</i>		
Do you know where the storm sewers discharge? <i>Does the storm sewer discharge to a surface water of the state, or to a separate storm sewer system and then to a surface water of the state? Part 31 defines a surface water of the state, as "a Great Lake and their connecting waters, all inland lakes, rivers, streams and wetlands."</i>		
Do you understand the hydraulic connection between the storm sewer, groundwater and the contaminant plume? <i>What variability is there in the groundwater elevation? Would a large storm event cause an increase in groundwater elevation and increase the discharge of the contaminant plume into the storm sewer, or could it reverse the flow causing water to flow out of the storm sewer and into the formation?</i>		
Where will you collect your samples? <i>Have you identified where the discharge is entering the storm sewer? Is this location near a catch basin or manhole, allowing sampling? Will you collect samples up-gradient and down-gradient of the discharge to identify if there are other releases contributing to the contaminant load? Will you sample at the end of the pipe, prior to discharge to waters of the state?</i>		



STORM SEWER SAMPLING CHECKLIST CONTINUED

When will you collect your samples?

*Storm sewer samples must be representative of the contaminated groundwater plume entering the storm sewer, not surface runoff entering the storm sewer. **Therefore**, sampling events will need to be scheduled with weather events taken into consideration.*

How often will you collect your samples?

Although it is standard to collect quarterly monitoring well samples to track seasonal trends in contaminant concentrations and groundwater elevations, this is not the case for sampling storm sewers. It is important that you identify a sampling schedule for your site (e.g. weekly, monthly, quarterly, etc.) with supporting reasoning behind it. Your sampling schedule should be flexible to accommodate storm events and other activities that may affect storm runoff and/or discharge into the storm sewer.

How will you sample the storm sewer? Grab samples or automatic samplers?

The sample must be collected from the storm sewer at the point of groundwater discharge into the storm sewer or at a down gradient location from this discharge, or at the end of the pipe. A sample can't be collected in ambient waters after the storm water discharges into waters of the state (e.g. at the end of pipe with river or lake water mixing up into the pipe). Grab samples may be necessary for certain pollutants which cannot be collected using automated samplers due to cross-contamination concerns, these include: bacteria, oil and grease, and volatile organic compounds (VOCs). It is also important to collect a grab sample in the container it will be analyzed from and not to collect in one bottle and then distribute into lab containers. It is also important to not dip the bottle into any sediment collected on the bottom or side of the storm sewer and to minimize volatilization from the sample as much as possible.

What Quality Control Procedures will you utilize during sampling and how will you accomplish this?

It is important that the samples collected are valid and representative of the groundwater discharging into the storm sewer. Therefore, it is important that you abide by sample preservation, hold times, duplicate samples, and blank samples.