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**Sent Via Email Only**

April 26, 2021  
File No. 16.0062961.51

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Re: Wolverine World Wide, Inc. Consent Decree Court Case No. 1:18-cv-00039  
GSI Investigation Summary and Work Plan

Dear Ms. Vorce:

On behalf of Wolverine World Wide, Inc. (Wolverine), Rose & Westra, a Division of GZA GeoEnvironmental, Inc. (R&W/GZA), is submitting this cover letter and enclosure in response to the referenced Consent Decree, effective February 19, 2020.

This submittal includes the GSI Investigation Summary and Work Plan identified in Section 7.10(b) and Appendix S of the Consent Decree.

If you have any questions, please contact us.

Very truly yours,

Rose & Westra, a Division of GZA GeoEnvironmental, Inc.

Mark A. Westra  
Principal

Loretta J. Powers  
Senior Project Manager

maw/ljp

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Enclosure: GSI Investigation Summary and Work Plan

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## GROUNDWATER-SURFACE WATER INTERFACE (GSI) INVESTIGATION SUMMARY AND WORK PLAN (WP) North Kent Study Area

# **DRAFT**

*Disclaimer: This document is a DRAFT document that has not received approval from the Michigan Department of Environment, Great Lakes, and Energy (EGLE). This document was prepared pursuant to a court Consent Decree. The opinions, findings and conclusions expressed are those of the authors and not those of EGLE.*

April 26, 2021  
File No. 16.0062961.51

**PREPARED FOR:**  
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### ACRONYMS

BGT	Below Groundwater Table
CD	Consent Decree
CSM	Conceptual Site Model
DoD	United States Department of Defense
EDD	Electronic Data Deliverable
EGLE	Michigan Department of Environment, Great Lakes and Energy
FCV	Final Chronic Values
GIS	Geographic Information Systems
GSI	Groundwater-Surface Water Interface
HNDV	Human Health Non-Drinking Water Values
HSP	House Street Property
ID	Identification
MDEQ	Michigan Department of Environmental Quality
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NE	Northeast
ng/L	Nanogram per Liter
NKSA	North Kent Study Area
ORP	Oxidation-Reduction Potential
PDF	Portable Document Format
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutane Sulfonic Acid
PFHxA	Perfluorohexanoic Acid
PFHxS	Perfluorohexane Sulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan [ <i>Former Wolverine Tannery, House Street Disposal Area, and Woven/Jewell Area, Per- and Polyfluoroalkyl Substances Investigation Program</i> ]
QA/QC	Quality Assurance/Quality Control
QSM	Quality Systems Manual
R&W/GZA	Rose & Westra, a Division of GZA GeoEnvironmental, Inc.
RAP	Response Activity Plan
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
USGS	United States Geological Survey
VAP	Vertical Aquifer Profiling
Wolverine	Wolverine World Wide, Inc.
WP	Work Plan
WV	Wildlife Values



## 1.0 INTRODUCTION

On behalf of Wolverine, R&W/GZA prepared this Investigation Summary and WP for the GSI RAP in the NKSA. The GSI RAP was prepared pursuant to Sections 7.4, 7.10 (a) and Appendix S of CD No. 1:18-cv-00039-JTN-SJB, effective February 19, 2020. Specifically, this Investigation Summary and WP is established in Section 7.10(b) of the CD and the approved GSI RAP dated September 23, 2020.

The objective of the GSI RAP was to investigate potential environmental risks to the GSI in the Rogue River, due to regulated PFAS in groundwater, originating from the HSP and the Wolven/Jewell area. As established in Paragraph 7.10(a) and Appendix S of the CD, Wolverine will study the potential for groundwater contamination to discharge to surface water at the following three areas: “(i) southeast of the House Street plume(s); (ii) from the Wolven/Jewell plume(s) and the House Street plume(s) to the northwest; and (iii) from the Wolven/Jewell plume(s) toward the Rogue River to the northeast and southeast.”

As set forth in the approved GSI RAP, the three broader areas in the CD were further refined based on conceptual understanding of groundwater flow and potential surface water discharge areas in the HSP and Wolven/Jewell study areas at the following six locations:

1. Downgradient of the HSP to the southeast;
2. Downgradient of the HSP to the south,
3. Wolven northwest;
4. Downgradient of the HSP to the northwest;
5. Wolven northeast; and
6. North Childsdale.

## 2.0 CONCEPTUAL SITE MODEL

Based on interpretation of regional geology and hydrogeology, residential water well sampling data in the NKSA, and groundwater investigations performed associated with the HSP and Wolven/Jewell areas, a CSM was provided in the 2020 GSI RAP (R&W/GZA, 2020). Data collected during the implementation of GSI RAP activities supports the CSM. An updated interpretation of groundwater flow has been included based upon GSI investigation to date.

### 2.1. GROUNDWATER FLOW

Based on the last monitoring well network gauging and sampling event (November 2019 data set), groundwater elevation contours were interpolated from the static water level data. See **Figure 1** for the groundwater elevation contours in the shallow zone and **Figure 2** for the deep zone. Groundwater contours in Cross-sections A-A' (downgradient of the HSP), B-B' (Wolven Northwest) and C-C' (Area 19) were interpreted and plotted in **Figures 3A, 3B and 3C**. Groundwater flowlines to the approximate centerline of the Rogue River were interpreted. Considering groundwater flow on the other side of the Rogue River also discharges to the Rogue River and the flow pattern on either side of the river is generally symmetrical, the groundwater flowline to the Rogue River centerline approximately represents the lower envelope of the vertical groundwater flow discharge zone. The interpreted groundwater table, also a groundwater flowline, represents the upper envelope of the vertical groundwater flow discharge zone.



### 3.0 GSI RAP OBJECTIVES

The purpose of the GSI RAP investigation was to further evaluate PFAS at the GSI. The data collected under the GSI RAP and summarized in this Investigation Summary include samples collected in the vicinity of identified potential surface water discharge areas for the PFAS-containing groundwater in the HSP and Wolven/Jewell study areas.

The investigation of GSI is necessarily iterative. To fulfil the obligation under the CD to study the potential for groundwater contamination from the HSP to discharge to surface water, additional investigation is needed as set forth in this WP. In particular, in evaluating the potential risks to the Rogue River, this GSI WP builds on the work done to date and is intended to continue in the understanding of the following areas:

- Groundwater elevation at the GSI,
- Gradient and flux at the GSI, and,
- PFAS compound concentrations in the groundwater discharging to the Rogue River.

The following sections provide an investigation summary of activities completed to satisfy the project objectives required by Paragraph 7.10(a) and Appendix S of the CD as well as the GSI RAP. Furthermore, as established in Section 7.10(b) of the CD, **Section 11** of this report provides location recommendations for permanent GSI monitoring wells and sets forth the monitoring program.

### 4.0 INVESTIGATION METHODOLOGY

#### 4.1. PIEZOMETER INSTALLATION

In accordance with general procedures outlined in the GSI RAP, stainless steel, 1.25-inch temporary piezometers were hand-driven via fence post driver into the groundwater on the riverbank. The 4-foot stainless steel screens were threaded to galvanized riser pipe as they were driven below grade. The top of the well screen was driven to an approximate depth of 3 feet below the bottom of the river sediment, where possible.

The top of the piezometer was installed above the estimated flood elevation based on observations of vegetation and deposition in each of the locations. An approximate 6- to 12-inch bentonite seal was placed within the borehole over the screen. A 2-inch thick concrete pad was constructed at the surface of the piezometer to prevent infiltration and subsidence of the piezometer casings. An elevational survey collected by a Licensed Professional Surveyor<sup>1</sup> was conducted upon completion of the piezometer installations. Survey data as well as construction information including screen depths and approximate distance to surface water are provided on **Table 1**. A general construction schematic of installed piezometers is depicted in **Appendix A**.

The following GSI piezometers were installed in each study area:

- **HSP Study Area** (Nine locations)
  - Southeast downgradient of the HSP along the Rogue River
    - i. HS-GSI-1 through HS-GSI-5
  - Downgradient of the HSP near the Grand River
    - i. HS-GSI-6 through HS-GSI-8

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<sup>1</sup> Survey completed by State of Michigan licensed professional surveyor, Exxel Engineering Inc., on November 6, 2020.





- Northwest of the HSP
  - i. HS-GSI-9
- **Wolven/Jewell Study Area** (Five locations)
  - Downgradient of Wolven Northeast plume within the Rogue River
    - i. Area19-GSI-1 through Area19-GSI-3
  - Downgradient of the northwest portion of the Wolven/Jewell plume along the Rogue River
    - i. WVNW-GSI-1 and WVNW-GSI-2
- **Wolven/Childsdales Study Area** (Two locations)
  - North Childsdales area, downgradient of the Wolven study area
    - i. WV/CH-GSI-1 and WV/CH-GSI-2

## 5.0 GROUNDWATER AND SURFACE WATER GAUGING

Prior to pore-water sampling, water levels were collected from the newly installed piezometers and network of staff gauges. As established in the GSI RAP, a minimum of two weeks of piezometer and staff-gauge measurements were made to establish groundwater flows to the surface water. An additional week of groundwater gauging levels were completed based upon weather conditions and schedule prior to pore-water sampling; data was collected three times/week for three weeks. Nine groundwater gauging events were completed starting November 9 through November 27, 2020.

Existing staff gauges of the Rogue River were utilized for water level comparison and groundwater flow evaluation in the following locations in the Rogue River:

- Rockford Dam Seawall;
- East Bridge Street Bridge;
- Rogue River Road Bridge; and
- Jericho Avenue Bridge

The water levels measured from these locations were used in combination with USGS gauging station, USGS04118500, to evaluate surface water levels in the Rogue River.

Additional staff gauge locations (11 Mile Bridge, Algoma Avenue Bridge, and 12 Mile Bridge) were added to pair with piezometer locations where existing staff gauges were not present. The gauging measurements were determined to demonstrate general groundwater flow toward the Rogue River. Groundwater and surface water gauging data and associated elevations are provided on **Table 2**.

GSI piezometers and staff gauge locations are provided on **Figure 4**. The locations in each study area are further detailed on **Figures 4A** through **4C**.





## 6.0 PORE-WATER SAMPLING

Pore-water sampling was conducted in accordance with procedures outlined in SOP A27/GSI RAP. A Henry Tube Sampler (i.e., stainless-steel probe) with 1.5-inch slotted screen was pushed into the sediment at discrete depths within the river bottom. A shallow-sample interval (minimum of 12 inches below the river bottom) and a deep-sample interval (minimum 6 inches below the shallow interval) were attempted at each pore-water sample location. Once the Henry Tube was pushed to depth for the shallow-sample interval, a vacuum gauge device was connected to the Henry Tube and a peristaltic pump was used to draw water from the pore space. A second length of tubing was connected to the opposite side of the vacuum gauge in which river water was drawn into the tubing. A system of valves were closed to compare the pressure of pore-water to that of the river water. A higher gradient pressure within the pore-water tubing indicated that up-welling was occurring within the pore space and the pore-water was distinguishable from surface water. Upon confirmation, the vacuum device was removed and a multiparameter meter with a flow-through cell was connected to the Henry Tube sampler.

R&W/GZA collected pH, temperature, conductivity, dissolved oxygen, and ORP from the river water which was then compared to the real-time readings of pore-water. This was an additional confirmation tool indicating pore-water, not surface water, was being drawn through the sample device. Pore-water readings were considered distinguishable from the river readings when the variance was greater than 10% difference for collected parameters from the multiparameter meter, with the exception of temperature. Following the stabilization of parameters, the flow-through cell was disconnected, and pore-water was pumped directly into laboratory-provided sampling containers. Samples analysis is detailed in **Section 6.3**.

As described in the GSI RAP, pore-water samples were collected from the following locations in each study area:

- **HSP Study Area**
  - Nine pore-water sampling locations (HS-PW-1 through HS-PW-9), southeast downgradient of the HSP plume along the Rogue River
  - Two pore-water sampling locations (HS-PW-10 and HS-PW-11), northwest of the HSP
- **Wolven/Jewell Study Area**
  - Four pore-water sampling locations (WVNW-PW-1 through WVNW-PW-4) immediately downgradient of the Wolven northwest plume, along the Rogue River
  - Seven pore-water sampling locations (Area19-PW-1 through Area19-PW-7) downgradient/northeast of the Area 19 plume within the Rogue River
- **Wolven/Childsdales Study Area**
  - Six pore-water sampling locations (WV/CH-PW-1 through WV/CH-PW-6) downgradient to the southeast of the Wolven study area

**Figure 5** summarizes pore-water sample locations in the NKSA.

### 6.1. GROUNDWATER SAMPLING

As identified in the GSI RAP, existing well clusters HS-MW-19S/D and HS-MW-29A (located hydraulically downgradient of the House Street plume) and one existing well installed by EGLE (DEQ-MW-9 well series) were sampled concurrently during the pore-water sampling event. Newly installed piezometers (Area19-GSI-1, Area19-GSI-2, and Area19-GSI-3) were also sampled during the pore-water sampling event. Piezometer sampling was conducted in general accordance with procedures outlined in SOP A29.



## 6.2. RE-SAMPLE EVENT

While not part of the GSI RAP, additional pore-water samples were collected to better delineate PFAS concentrations detected in HS-PW-3, located at the southeast downgradient portion of the HSP plume. A sample was advanced directly adjacent to the original HS-PW-3 location (HS-PW-3R). HS-PW-2.5 was advanced approximately 130 feet upstream of HS-PW-3. HS-PW-3.5 was advanced 480 feet downstream of HS-PW-3. The re-sample event was completed eight weeks after the initial sample location. Samples were collected following the previously identified procedures.

## 7.0 SAMPLING AND ANALYTICAL PROCEDURES

### 7.1. SAMPLING LOCATIONS

As discussed in **Sections 4.0** and **6.0**, the following GSI piezometer, monitoring well, and pore-water samples were collected:

**Table 7.1.1 Sampled GSI Piezometers and Monitoring Wells**

Area of Investigation	Piezometers	Wells
Southeast downgradient of the HSP plume along Rogue River	Out of scope for current investigation	HS-MW-19S/D and HS-MW-29A
Downgradient of Wolven northeast plume within the Rogue River	Area19-GSI-1 through Area19-GSI-3	One EGLE well (DEQ-MW-9 well series)

**Table 7.1.2 Pore-Water Sample Locations**

Area of Investigation	Sample I.D.	Pore-Water (ft) <sup>1</sup>	
		Shallow (A) <sup>2</sup>	Deep (B) <sup>3</sup>
Southeast downgradient of the HSP plume along Rogue River	HS-PW-1	2.00 - 2.13	2.50 - 2.63
	HS-PW-2	1.00 - 1.13	NS
	HS-PW-2.5	0.50 - 0.63	1.00 - 1.13
	HS-PW-3	1.33 - 1.46	NS
	HS-PW-3R	0.50 - 0.63	NS
	HS-PW-3.5	0.83 - 0.96	NS
	HS-PW-4	0.75 - 0.88	NS
	HS-PW-5	1.33 - 1.46	NS
	HS-PW-6	1.00 - 1.13	NS
	HS-PW-7	1.50 - 1.63	NS
	HS-PW-8	1.00 - 1.13	NS
	HS-PW-9	1.00 - 1.13	NS
Northwest of the HSP	HS-PW-10	5.00 - 5.13	NS
	HS-PW-11	4.50 - 4.63	NS



Area of Investigation	Sample I.D.	Pore-Water (ft) <sup>1</sup>	
		Shallow (A) <sup>2</sup>	Deep (B) <sup>3</sup>
Downgradient of Wolven Northeast plume within the Rogue River	Area19-PW-1	1.00 - 1.13	NS
	Area19-PW-2	1.00 - 1.13	1.42 - 1.54
	Area19-PW-3	1.00 - 1.13	NS
	Area19-PW-4	1.00 - 1.13	1.42 - 1.54
	Area19-PW-5	1.00 - 1.13	NS
	Area19-PW-6	1.50 - 1.63	2.00 - 2.13
	Area19-PW-7	5.00 - 5.13	NS
Downgradient of the northwest portion of the Wolven/Jewell plume along the Rogue River	WVNW-PW-1	3.00 - 3.13	4.00 - 4.13
	WVNW-PW-2	2.33 - 2.46	3.33 - 3.46
	WVNW-PW-3	1.50 - 1.63	NS
	WVNW-PW-4	1.67 - 1.79	NS
North Childsdale area, downgradient of the Wolven study area	WV/CH-PW-1	0.75 - 0.88	NS
	WV/CH-PW-2	0.75 - 0.88	NS
	WV/CH-PW-3	1.00 - 1.13	NS
	WV/CH-PW-4	1.00 - 1.13	NS
	WV/CH-PW-5	0.83 - 0.96	NS
	WV/CH-PW-6	1.00 - 1.13	2.00 - 2.13

<sup>1</sup> – Measured in feet below the ground surface of the river bottom

<sup>2</sup> – “A” represents the shallow interval sample collected at each location which was advanced to a minimum of 12-inches below the sediment where conditions allowed.

<sup>3</sup> – “B” represents the deep interval sample collected at each location which was advanced to a minimum of 6-inches below the shallow sample where conditions allowed.

NS – Not Sampled. See **Section 7.2**, Sampling Deviations

## 7.2. GSI RAP SAMPLING ADJUSTMENTS

The intervals at which samples were collected were based upon the results of the vacuum-gauge device and confirmation of up-welling groundwater gradient at each location. In some sample locations, the shallow intervals were at depths greater than 12 inches due to unconsolidated sediment which did not create an adequate seal between pore and river water. The Henry Tube sample device was pushed deeper into the pore space until the vacuum gauge could confirm that pore-water was being collected through the sampling device and river water was not being short circuited.

Subsurface conditions (rocky substrate, refusal, etc.) did not allow for the collection of the deep interval at every location. Refusal or inadequate groundwater gradient prevented the sampling deeper intervals at 23 pore-water sampling locations. Proposed pore-water sample locations in the study area northwest of the HSP (HS-PW-10 and HS-PW-11) were required to be moved further downstream. Impassable conditions of the Rogue River combined with limited private landowner access made the locations established in the GSI RAP inaccessible. Following discussion with and approval of EGLE, these locations were shifted to be located upstream and downstream of GSI piezometer HS-GSI-9.



### 7.3. ANALYTICAL METHOD AND PARAMETERS

The samples were analyzed for PFAS using DoD QSM 5.3 guidelines for PFAS by isotope dilution methodology. The analyte list included the 28 PFAS compounds specified in the CD, and reporting limits are provided in Table A.7.7 of the project-specific QAPP.

## 8.0 GSI AND APPLICABLE RULE 57 WATER QUALITY STANDARDS

The potential environmental exposure pathways for impacted surface water in the Rogue River and applicable Part 4 Rule 57 Water Quality Values are identified as follows:

- Human exposure via non-drinking water exposure route – Rule 57 HNDV;
- Aquatic life exposure to impacted water in the Rogue River – Rule 57 FCV; and
- Wildlife exposure to impacted water in the Rogue River – Rule 57 WV.

Parameter	Units	HNDV	FCV	WV
PFOA	ng/L	12,000	880,000	Not Applicable
PFOS	ng/L	12	140,000	Not Applicable

The human health drinking water value is not applicable to this GSI investigation. Rather, the applicable criteria are the generic GSI criteria, which are the lesser of HNDV, FCV, and WV. The GSI criteria are derived using surface-water concentrations, but for the purpose of this evaluation they will be used for the evaluation of pore-water data to aid in evaluating compliance at the surface water compliance point. This does not imply that GSI criteria are necessarily applicable to the pore-water concentrations.

Compound	Threshold Value (µg/L)	Basis for Value
PFOA	12	GSI
PFOS	0.012	GSI

## 9.0 SITE SAMPLING RESULTS

The following section summarizes the analytical results from groundwater and pore-water collected during the investigation activities. During pore-water sampling and the concurrent groundwater sampling event, samples were collected from a total of 46 locations. Of those 46 locations, 0 samples exceeded GSI criteria for PFOA (12,000 ng/L). For PFOS, 32 samples were greater than the GSI criteria (12 ng/l). Likewise, for PFOS, 14 samples were less than 12 ng/l or were non-detect in laboratory analysis. The PFOS concentrations are further described by each area:

- **HSP Study Area (South/Southeast, downgradient of the HSP plume along Rogue River)**

>12 ng/L	HS-PW-2.5A, HS-PW-2.5B, HS-PW-3A, HS-PW-3B, HS-PW-3A, HS-PW-3B, HS-PW-3.5A, HS-PW-3B, HS-PW-4, HS-PW-5, and HS-PW-8
<12 ng/L	HS-PW-1A, HS-PW-1B, HS-PW-2, HS-PW-6, HS-PW-7, and HS-PW-9



- **HSP Study Area (Northwest of the HSP)**

Non-Detect	HS-PW-10, and HS-PW-11
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- **Wolven/Jewell Study Area (downgradient of the Wolven Northwest plume)**

>12 ng/L	WVNW-PW-3, WVNW-PW-4
<12 ng/L	WVNW-PW-1A, WVNW-PW-1B, WVNW-PW-2A, and WVNW-PW-2B

- **Wolven/Jewell Study Area (downgradient/northeast of the Wolven plume)**

>12 ng/L	Area19-GSI-1, Area19-PW-1, Area19-PW-2A, Area19-PW-2B, Area19-PW-3, Area19-PW-4A, Area19-PW-4B, Area19-PW-5, Area19-GSI-2, Area19-PW-6A, Area19-PW-6B, Area19-PW-7, and Area19-GSI-3
<12 ng/L	None
Non-Detect	WV-DEQ-MW9-57

- **Wolven/Childsdales Study Area**

>12 ng/L	WV/CH-PW-1, WV/CH-PW-2, WV/CH-PW-3, WV/CH-PW-4, WV/CH-PW-5, and WV/CH-PW-6A
<12 ng/L	None
Non-Detect	WV/CH-PW-6B

Pore-water sample results are summarized on **Table 3**. Groundwater sample results are summarized on **Table 4**. **Figures 6A** through **6C** summarize pore-water samples results for PFOS concentrations in each study area.

## 10.0 DATA QUALITY ASSURANCE AND CONTROL

QC samples were collected at a rate of one per 20 samples in accordance with the project-specific QAPP and approved GSI WP which included: field blanks, field duplicates, and MS/MSDs. All QA/QC samples were collected using the methods described in the SOPs and analyzed using the same analytical methods used for the primary sample.

Selected GSI data has or will be validated according to performance requirements and the QA/QC limits in Table D.1.1 of Revision 2 of the QAPP. In addition, R&W/GZA consulted the general guidance in the EPA Contract Laboratory Program National Functional Guidance for Organic and Inorganic Superfund Data Review and relevant analytical methods to assess data usability. Approximately 5% of all PFAS samples collected are included for data validation. Sample delivery group WA28027 from pore-water sampling was included within the 5% PFOS samples reviewed for the purpose of data validation. Analytical deficiencies relative to the QAPP requirements will be identified and noted as a result of the data validation. All analytical data has been provided to EGLE via EDD.

## 11.0 GSI WORK PLAN

Based on the groundwater monitoring and pore-water investigation data presented above, the following provides a summary of the WP. The proposed GSI sampling locations are shown on **Figures 6A** to **6C**. Actual monitoring well locations may vary slightly from the proposed locations during installation. While the target locations for the



well clusters are shown, limitations for access on private properties, site conditions, and utilities may require moving monitoring well locations. GSI monitoring locations are proposed to monitor locations of highest PFOS concentrations in each study area. GSI monitoring locations will also be used to monitor the lateral extent of PFOS concentrations greater than 12 ng/L at the upstream and downstream extent of each study area. This WP outlines the initial phase of GSI investigation to further characterize each study area, and additional phases of GSI investigation (well installation) may be performed based on these results.

#### 11.1. GSI RECOMMENDATIONS

As indicated in **Figures 3A, 3B and 3C**, the depth of the vertical groundwater discharge zone becomes less as the location approaches the Rogue River shoreline and becomes greater as the location is away from the Rogue River shoreline. As shown in **Figure 3A**, the limit of the vertical discharge zone at HS-MW-29A/B/C/D cluster is approximately 15 feet below the groundwater table, and only MW-29A appears to be an appropriate monitoring well that is capable of monitoring PFOS venting to the Rogue River. Monitoring well WV-MW-7S/M is located approximately 1,000 feet away from the Rogue River in **Figure 3B**, and the limit of the vertical groundwater discharge zone is approximately 55 feet BGT. Both WV-MW-7S and WV-MW-7M are screened within the estimated groundwater discharge zone and are capable of monitoring PFOS venting to the GSI. In **Figure 3C**, monitoring well cluster WV-DEQ-MW9 is located approximately 400 feet away from the Rogue River, and the shallowest well screen WV-DEQ-MW9-57 is below the estimated groundwater discharge zone, and therefore, is not an appropriate GSI monitoring well for that location. On the other hand, PFOS data collected from the shallow monitoring wells, such as AREA19-GSI-1, AREA19-GSI-2 and AREA19-GSI-3, which are screened within the estimated vertical discharge zone, were consistent with the pore-water sampling data. In short, monitoring wells located close to the Rogue River and screened in the shallow groundwater zone will provide effective GSI monitoring. Based on the groundwater flow evaluation and the existing PFOS groundwater monitoring data, VAP in the top 50 feet of the saturated zone should be sufficient for the proposed GSI monitoring wells if the locations are less than 500 feet away from the Rogue River shoreline.

The GSI monitoring wells are to be placed as close to the Rogue River as possible, within 50 to 500 feet from the Rogue River shoreline. At each location, the soil boring will be advanced to approximately 50 feet BGT and VAP sampling (SOP A25) will be performed by setting a temporary well screen and collecting groundwater samples at an interval of 10 feet in the saturated zone. The VAP intervals will be 5 to 10 feet BGT, 15 to 20 feet BGT, 25 to 30 feet BGT, 35 to 40 feet BGT, and 45 to 50 feet BGT, assuming groundwater is encountered throughout the borehole depth. If fine-grained soil is present or groundwater column is discontinuous, the VAP intervals will be adjusted based on field observations.

The VAP data will be evaluated to determine the appropriate location for the placement of monitoring well screens. The wells in each study area that are located upstream and downstream of the PFOS concentrations currently known to be over 12 ng/L are those used to delineate the lateral extent of each discharge area. If the VAP data from these locations indicates PFOS is found throughout the aquifer at detections greater than GSI criteria, a step-out boring may be completed further from the source area to better delineate the PFOS concentrations prior to the installation of the monitoring well cluster.

Upon the completion of soil boring and VAP sampling, one monitoring well will be installed within the top 10 feet of the saturated zone. If PFOS is not detected in the VAP samples, one well will be installed at the location. If PFOS is detected in the VAP samples, up to three monitoring wells will be installed at depths which will be selected based on PFOS concentrations and vertical monitoring spacing. The screen position of the deeper monitoring well will be selected based on the distance of the monitoring well to the shoreline, geology, and estimated groundwater flow path.



## 11.2. PROPOSED MONITORING LOCATIONS

### **Wolven Northwest**

In the Wolven Northwest area, three GSI monitoring well locations are proposed.

- WVNW-MW-201 is positioned near the pore-water sample location WVNW-PW-3, where the highest PFOS concentration was detected in the pore-water sample in the area.
- Two locations are proposed to delineate the lateral extent of PFOS concentrations exceeding 12 ng/L in this area.
  - WVNW-MW-200 is proposed at the upstream reach of the Wolven Northwest area near WVNW-PW-2
  - WVNW-MW-202 is proposed at the downstream reach of the Wolven Northwest area near WVNW-PW-3

### **Wolven Northeast**

In Wolven Northeast, five GSI monitoring well locations are proposed to spatially cover the river reach from pore-water sample location AREA19-PW-1 to AREA19-PW-5, where PFOS was detected.

- Area19-MW-222 is positioned next to AREA19-PW-5, where the highest PFOS concentration in the pore-water samples was detected.
- The other four locations (Area19-MW-220, 221, 223, and 224) are proposed near AREA19-GSI-1, between AREA19-PW-2 and AREA19-PW-3, near AREA19-PW-6, and south of AREA19-GSI-3 to delineate the PFOS extent upstream and downstream of this study area.

### **Wolven/Childsdales**

In the Wolven/Childsdales study area, three GSI monitoring well locations are proposed.

- WV/CH-MW-241 is positioned next to WV/CH-PW-3 and downstream of WV/CH-PW-2, where the highest PFOS concentration in the pore-water samples was detected in this area.
- Two locations are proposed to delineate the lateral extent of PFOS concentrations exceeding 12 ng/L in this area.
  - WV/CH-MW-240 is proposed at the upstream reach of the Wolven/Childsdales area near WV/CH-PW-1
  - WV/CH-MW-242 is proposed at the downstream reach of the Wolven/Childsdales area near WV/CH-PW-5

### **HSP South/Southeast**

In the HSP area to the southeast, six GSI monitoring well locations are proposed, including one existing monitoring well.

- In the HSP area to the southeast, three GSI monitoring well locations (HS-MW-260, 261, and 262) are proposed centered around HS-PW-3, where the highest PFOS concentration was detected in this area.





- Two locations are proposed to delineate the lateral extent of PFOS concentrations upstream and downstream of HW-PW-3.
  - HS-MW-260 is proposed at the upstream reach of the HSP area near HS-PW-2.5
  - HS-MW-262 is proposed at the downstream reach of the HSP area near HS-PW-4
- Existing groundwater monitoring well HS-MW-29A is located near pore-water sample location HS-PW-3 and will be included as a GSI monitoring well.
- Three locations are proposed for downstream monitoring of the HSP plume:
  - HS-MW-263 is proposed near HS-PW-5
  - HS-MW-264 is proposed near HS-PW-8
  - HS-MW-265 is proposed near the Grand River to monitor potential PFOS migration to the south of the HSP plume.

Proposed GSI monitoring locations are provided on **Figures 6A** through **6C**.

Upon completion of the GSI monitoring well installation, the GSI monitoring wells and the existing groundwater monitoring wells in the HSP and Wolven/Jewell study areas will be sampled and analyzed for PFAS Compounds under the CD. The results of VAP sampling and groundwater sampling results will be evaluated to further determine if additional GSI monitoring wells are necessary. If no additional GSI monitoring wells are needed, the well network will be considered substantially complete. The first round of sampling completed at construction will be considered quarter one and three additional sampling events will take place in that year. If additional wells are needed, the four quarters of monitoring will not commence until the network is deemed substantially complete.

## **12.0 INVESTIGATION METHODOLOGY**

Relevant tasks completed under this WP will be completed in accordance with the most recent revision of the QAPP prepared for Wolverine by R&W/GZA as well as methodologies outlined in the approved GSI WP.

The proposed well cluster locations will be drilled using either hollow-stem auger or roto sonic methods in accordance with SOPs A03 through A06 of the QAPP. When possible, the initial boring at each location will be drilled 50 feet into the groundwater table or upon refusal. The borehole-terminal depth will also be evaluated based on the depths of adjacent water wells and the presence of confining strata.

As the original borings are drilled at each location, VAP samples will be collected for PFAS analysis from water-bearing and permeable formation(s) at an interval of 10 feet. VAP will be completed in accordance with *SOP A25, Vertical Aquifer Profiling* included in the QAPP. The turn-around time for laboratory samples will be approximately three to four weeks.

Well installation depths are not predetermined. Based on the combination of profiling data, encountered geology, and corresponding piezometer and river elevations, R&W/GZA will determine the depth(s) of wells installed at each nest location. The monitoring wells will be developed in accordance with *SOP A13, Well Development* in the QAPP. Upon completion, the wells will also be surveyed by a licensed surveyor.



### 13.0 SAMPLING AND ANALYTICAL PROCEDURES

This section provides a generalized SAP for the GSI monitoring well sampling. Specific information regarding sampling procedures and analytical methods is provided in the site-specific QAPP and approved GSI WP.

Once the GSI well network is substantially complete (as identified in **Section 11**), all newly installed wells will be sampled quarterly for one year.

#### 13.1. SAMPLING LOCATIONS

As discussed in **Section 11.1**, the following GSI monitoring and sampling locations are proposed:

**Table 13.1.1 Proposed GSI Sampling Locations**

Area of Investigation	GSI Monitoring Wells
<b>Wolven Northwest</b> <ul style="list-style-type: none"><li>Downgradient of the northwest portion of the Wolven/Jewell plume along the Rogue River</li></ul>	<ul style="list-style-type: none"><li>WVNW-MW-200</li><li>WVNW-MW-201</li><li>WVNW-MW-202</li></ul>
<b>Wolven Northeast</b> <ul style="list-style-type: none"><li>Downgradient of Wolven Northeast plume within the Rogue River</li></ul>	<ul style="list-style-type: none"><li>Area19-MW-220</li><li>Area19-MW-221</li><li>Area19-MW-222</li><li>Area19-MW-223</li><li>Area19-MW-224</li></ul>
<b>North Childsdales Area</b> <ul style="list-style-type: none"><li>Downgradient of the Wolven study area</li></ul>	<ul style="list-style-type: none"><li>WV/CH-MW-240</li><li>WV/CH-MW-241</li><li>WV/CH-MW-242</li></ul>
<b>Downgradient of the HSP to the southeast</b> <ul style="list-style-type: none"><li>Southeast downgradient of the HSP primary plume along Rogue River</li></ul>	<ul style="list-style-type: none"><li>HS-MW-260</li><li>HS-MW-29A (existing well)</li><li>HS-MW-261</li><li>HS-MW-262</li><li>HS-MW-263</li><li>HS-MW-264</li></ul>
<b>Downgradient of the HSP to the south</b> <ul style="list-style-type: none"><li>Downgradient of the HSP near Grand River</li></ul>	<ul style="list-style-type: none"><li>HS-MW-265</li></ul>

#### 13.2. SAMPLE COLLECTION AND LABELING

Samples will be collected for PFAS analysis following the methods summarized in **Section 13.0** and detailed in the sampling SOPs for Groundwater Monitoring Wells (*SOP A16; Low Flow Sampling*). Detailed field and laboratory requirements are provided in the site-specific QAPP.

Sample identification will consist of nomenclatures that include the unique location identification (see reference table above). If applicable, sample identification for each sample will be repeated for each sampling event with consistent spelling.



To prevent misidentification of samples, legible labels will be affixed to each sample container. The labels will be sufficiently durable to remain legible even when wet. At a minimum, the labels will contain the following information:

- Location ID;
- Name or initials of collector; and
- Date and time of collection.

### 13.3. SAMPLE SHIPPING

Sample bottles will be placed into the cooler and packed with double-bagged wet ice immediately following collection. Packing material will be used as necessary. A temperature blank will be placed in the cooler prior to shipment. The cooler shall be addressed to the appropriate laboratory and dispatched as soon as practical to ensure timely arrival.

### 13.4. ANALYTICAL METHOD AND PARAMETERS

PFAS will be analyzed using DoD QSM 5.3 guidelines for PFAS by isotope dilution methodology. The analyte list will include the 28 PFAS compounds specified in the CD, and reporting limits are provided in Table A.7.7 of the project-specific QAPP.

## 14.0 DATA QUALITY ASSURANCE AND CONTROL

The following field QC samples will be collected at a rate of one per 20 samples in accordance with the project-specific QAPP: Field blanks, field duplicates, and MS/MSDs. Field QC sample collection methodologies are outlined in the approved GSI RAP.

## 15.0 INVESTIGATION DERIVED WASTE

Soil cuttings will be containerized and transported to the HSP for staging/storage until off-site treatment/disposal or other approved handling can be arranged. The monitoring well development and purge water will be managed as follows:

- For locations where PFAS concentrations are known to be below Part 201 GRCC, the water can be discharged to the ground surface in accordance with EGLE interoffice communication regarding purge-water disposal from well sampling and development (EGLE, 1999).
- For locations where PFAS concentrations are unknown or known to exceed Part 201 GRCC, the water will be disposed of appropriately in accordance with the EGLE interoffice communication regarding purge water disposal from well sampling and development (EGLE, 1999), and not discharged to the ground surface.

## 16.0 ANTICIPATED SCHEDULE

The schedule for GSI monitoring well installation will depend greatly on R&W/GZA's ability to obtain access to the desired location or proximate alternate. The following table outlines R&W/GZA's current estimates of the steps and approximate timeframes for the tasks in this WP (upon EGLE approval).



Task	Estimated Timeframe per Location
Access	1 to 3 months
Initial Drilling	2 to 3 weeks
VAP analysis	3 weeks
Monitoring Wells Installation	1 to 2 weeks
Development Wait Time	2 weeks
First Groundwater Sampling	1 week
First Laboratory Analysis	3 weeks

Based upon proposed locations in this WP, R&W/GZA estimates this WP will require 17 months to complete drilling, VAP, and installation of the proposed monitoring wells. Additional phases of well installation may be necessary to ensure that the well network is substantially complete. Quarterly sampling of the well network will begin following substantial completion of the network. Following the full year of quarterly sampling of the well network (i.e. receipt of final EDD), Wolverine will submit, within 180 days, a Completion Report per Section 7.12(a)(viii) of the CD.

## 17.0 REFERENCES

- Michigan Department of Environmental Quality. 1999. *Interoffice Communication, Operation Memo Gen-10, Re: Purge Water Disposal from Well Sampling and Development*.  
[https://www.michigan.gov/documents/deq/deq-whm-hwp-Op-Memo-Gen-10-Rev1\\_235127\\_7.pdf](https://www.michigan.gov/documents/deq/deq-whm-hwp-Op-Memo-Gen-10-Rev1_235127_7.pdf)
- R&W/GZA. 2018. *Conceptual Site Model Update and Status Report, Former House Street Disposal Area, Wolverine World Wide, Inc., Rockford, Michigan*.
- R&W/GZA. 2018. *Quality Assurance Project Plan, Former Wolverine Tannery and House Street Disposal Area, Revision 2*. Submitted to EPA August 29, 2018 with errata pages submitted October 31, 2018 and April 15, 2019.
- R&W/GZA. 2019. *Implementation of 2018 Work Plan - Summary Report, Former Wolverine World Wide Tannery Facility*. Submitted to USEPA January 11, 2019.
- R&W/GZA. 2020. *Groundwater-Surface Water Interface (GSI) Response Activity Plan, North Kent Study Area*. Submitted to Michigan Department of Environment, Great Lakes, and Energy (EGLE) September 23, 2020.



## TABLES

**TABLE 1**  
GSI Piezometer Summary  
GSI Investigation

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Algoma and Plainfield Townships, Kent County, Michigan

Piezometer I.D.	Date Installed	Piezometer Easting (ft.)	Piezometer Northing (ft.)	Top of Casing (ft. amsl)	Grade Elevation (ft. amsl)	Top of Screen (ft. bg.)	Total Boring Depth (ft. bg.)	Distance to River (ft.)
WVNW-GS1-1	10/29/2020	12790197.62	598854.06	716.38	711.68	2.20	6.20	4.00
WVNW-GS1-2	10/29/2020	12788280.45	597285.30	719.58	715.49	6.00	10.00	6.00
HS-GS1-1	10/27/2020	12796409.12	580037.74	635.84	631.76	3.00	7.00	3.00
HS-GS1-2	10/27/2020	12794382.15	578575.97	629.76	625.68	2.90	6.90	2.00
HS-GS1-3	10/27/2020	12794540.64	575395.34	622.55	619.47	2.80	6.80	5.00
HS-GS1-4	10/26/2020	12796056.76	572277.56	612.64	610.72	1.30	5.30	6.50
HS-GS1-5	10/26/2020	12796142.39	572339.83	615.42	612.54	4.50	8.50	6.00
HS-GS1-6	10/26/2020	12795200.75	569770.43	611.34	608.72	4.25	8.25	8.00
HS-GS1-7	10/26/2020	12793161.54	570470.86	611.68	608.68	5.00	9.00	12.80
HS-GS1-8	10/26/2020	12791378.50	571769.65	612.03	610.15	7.40	11.40	12.00
HS-GS1-9	10/29/2020	12783447.92	594138.68	722.50	717.75	5.00	9.00	13.00
AREA19-GS1-1	10/29/2020	12803671.73	602250.59	703.04	698.71	3.70	7.70	4.00
AREA19-GS1-2	10/29/2020	12805441.24	598178.39	695.90	692.09	4.00	8.00	4.00
AREA19-GS1-3	10/29/2020	12805120.16	595643.55	695.34	691.50	4.20	8.20	6.70
WV/CH-GS1-1	10/27/2020	12804580.97	590400.63	679.59	675.75	1.00	5.00	3.00
WV/CH-GS1-2	10/27/2020	12803034.54	588938.87	674.84	671.95	2.10	6.10	4.00

**TABLE 2**  
GSI Groundwater and Surface Water Gauging  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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Station ID	Reference Elevation (ft, M.S.L.)	Date	Depth to Water (ft)	Water Elevation (ft, M.S.L.)
<b>Rogue River</b>				
HS-GSI-9	722.5	11/09/20	5.73	716.77
		11/11/20	5.41	717.09
		11/13/20	5.32	717.18
		11/16/20	5.15	717.35
		11/18/20	4.86	717.64
		11/20/20	5.24	717.26
		11/23/20	5.50	717.00
		11/25/20	5.40	717.10
		11/27/20	4.77	717.73
SG-11 Mile Bridge	725.85	11/09/20	12.80	713.05
		11/11/20	12.57	713.28
		11/13/20	12.45	713.40
		11/16/20	12.25	713.60
		11/18/20	12.02	713.83
		11/20/20	12.35	713.50
		11/23/20	12.64	713.21
		11/25/20	12.55	713.30
		11/27/20	11.95	713.90
WV/NW-GSI-2	719.58	11/09/20	7.03	712.55
		11/11/20	6.78	712.80
		11/13/20	6.64	712.94
		11/16/20	6.39	713.19
		11/18/20	6.26	713.32
		11/20/20	6.55	713.03
		11/23/20	6.83	712.75
		11/25/20	6.72	712.86
		11/27/20	6.22	713.36
WV/NW-GSI-1	716.38	11/09/20	5.61	710.77
		11/11/20	5.48	710.90
		11/13/20	5.46	710.92
		11/16/20	5.35	711.03
		11/18/20	5.28	711.10
		11/20/20	5.40	710.98
		11/23/20	5.52	710.86
		11/25/20	5.42	710.96
		11/27/20	5.23	711.15
SG-Algoma Bridge	722.06	11/09/20	12.55	709.51
		11/11/20	12.30	709.76
		11/13/20	12.10	709.96
		11/16/20	12.00	710.06
		11/18/20	11.90	710.16
		11/20/20	12.16	709.90
		11/23/20	12.30	709.76
		11/25/20	12.30	709.76
		11/27/20	11.85	710.21



**TABLE 2**  
GSI Groundwater and Surface Water Gauging  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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Station ID	Reference Elevation (ft, M.S.L.)	Date	Depth to Water (ft)	Water Elevation (ft, M.S.L.)
<b>Rogue River</b>				
SG-12 Mile Bridge	718.41	11/09/20	12.56	705.85
		11/11/20	12.13	706.28
		11/13/20	12.15	706.26
		11/16/20	12.20	706.21
		11/18/20	11.78	706.63
		11/20/20	12.00	706.41
		11/23/20	12.20	706.21
		11/25/20	12.10	706.31
		11/27/20	11.72	706.69
Area-19-GSI-1	703.04	11/09/20	5.50	697.54
		11/11/20	5.37	697.67
		11/13/20	5.39	697.65
		11/16/20	5.26	697.78
		11/18/20	5.24	697.80
		11/20/20	5.33	697.71
		11/23/20	5.44	697.60
		11/25/20	5.40	697.64
Area-19-GSI-2	695.90	11/09/20	4.87	691.03
		11/11/20	4.66	691.24
		11/13/20	4.69	691.21
		11/16/20	4.48	691.42
		11/18/20	4.50	691.40
		11/20/20	4.60	691.30
		11/23/20	4.79	691.11
		11/25/20	4.70	691.20
		11/27/20	4.46	691.44
Area-19-GSI-3	695.34	11/09/20	4.69	690.65
		11/11/20	4.52	690.82
		11/13/20	4.57	690.77
		11/16/20	4.47	690.87
		11/18/20	4.54	690.80
		11/20/20	4.58	690.76
		11/23/20	4.67	690.67
		11/25/20	4.51	690.83
Rum Creek SG	695.11	11/09/20	3.93	691.18
		11/11/20	3.88	691.23
		11/13/20	3.88	691.23
		11/16/20	3.79	691.32
		11/18/20	2.90	692.21
		11/20/20	2.90	692.21
		11/23/20	N/A	N/A
		11/25/20	3.60	691.51
		11/27/20	3.80	691.31

**TABLE 2**  
GSI Groundwater and Surface Water Gauging  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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Station ID	Reference Elevation (ft, M.S.L.)	Date	Depth to Water (ft)	Water Elevation (ft, M.S.L.)
<b>Rogue River</b>				
Dam Seawall	681.06	11/09/20	2.02	679.04
		11/11/20	1.80	679.26
		11/13/20	1.85	679.21
		11/16/20	1.67	679.39
		11/18/20	1.70	679.36
		11/20/20	1.81	679.25
		11/23/20	1.94	679.12
		11/25/20	1.85	679.21
		11/27/20	1.64	679.42
Bridge Street Bridge	694.33	11/09/20	15.60	678.73
		11/11/20	15.30	679.03
		11/13/20	15.40	678.93
		11/16/20	15.23	679.10
		11/18/20	15.27	679.06
		11/20/20	15.32	679.01
		11/23/20	15.40	678.93
		11/25/20	15.35	678.98
		11/27/20	15.15	679.18
WV/CH-GSI-1	679.59	11/09/20	4.60	674.99
		11/11/20	4.47	675.12
		11/13/20	4.55	675.04
		11/16/20	4.36	675.23
		11/18/20	4.43	675.16
		11/20/20	4.48	675.11
		11/23/20	4.54	675.05
		11/25/20	4.51	675.08
		11/27/20	4.37	675.22
Jericho Road Bridge	687.48	11/09/20	17.25	670.23
		11/11/20	17.03	670.45
		11/13/20	17.10	670.38
		11/16/20	16.90	670.58
		11/18/20	16.92	670.56
		11/20/20	17.03	670.45
		11/23/20	17.15	670.33
		11/25/20	17.05	670.43
		11/27/20	16.85	670.63
WV/CH-GSI-2	674.84	11/09/20	4.65	670.19
		11/11/20	3.48	671.36
		11/13/20	3.54	671.30
		11/16/20	3.36	671.48
		11/18/20	3.40	671.44
		11/20/20	3.51	671.33
		11/23/20	3.61	671.23
		11/25/20	3.52	671.32
		11/27/20	3.35	671.49

**TABLE 2**  
GSI Groundwater and Surface Water Gauging  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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Station ID	Reference Elevation (ft, M.S.L.)	Date	Depth to Water (ft)	Water Elevation (ft, M.S.L.)
<b>Rogue River</b>				
HS-GSI-1	635.84	11/09/20	5.30	630.54
		11/11/20	5.12	630.72
		11/13/20	5.22	630.62
		11/16/20	5.02	630.82
		11/18/20	5.04	630.80
		11/20/20	5.13	630.71
		11/23/20	5.23	630.61
		11/25/20	5.18	630.66
		11/27/20	5.02	630.82
Packer Bridge	N/A	11/09/20	N/A	628.76
		11/11/20		629.03
		11/13/20		628.99
		11/16/20		629.23
		11/18/20		629.21
		11/20/20		629.04
		11/23/20		628.89
		11/25/20		629.03
		11/27/20		629.27
HS-GSI-2	629.76	11/09/20	4.73	625.03
		11/11/20	4.55	625.21
		11/13/20	4.60	625.16
		11/16/20	4.48	625.28
		11/18/20	4.50	625.26
		11/20/20	4.56	625.20
		11/23/20	4.64	625.12
		11/25/20	4.60	625.16
		11/27/20	4.46	625.30
HS-GSI-3	622.55	11/09/20	4.70	617.85
		11/11/20	4.56	617.99
		11/13/20	4.60	617.95
		11/16/20	4.48	618.07
		11/18/20	4.50	618.05
		11/20/20	4.59	617.96
		11/23/20	4.68	617.87
		11/25/20	4.55	618.00
		11/27/20	4.44	618.11
Rogue River Bridge	628.35	11/09/20	10.55	617.80
		11/11/20	10.40	617.95
		11/13/20	10.45	617.90
		11/16/20	10.34	618.01
		11/18/20	10.38	617.97
		11/20/20	10.43	617.92
		11/23/20	10.51	617.84
		11/25/20	10.45	617.90
		11/27/20	10.31	618.04

**TABLE 2**  
GSI Groundwater and Surface Water Gauging  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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Station ID	Reference Elevation (ft, M.S.L.)	Date	Depth to Water (ft)	Water Elevation (ft, M.S.L.)
Rogue River				
HS-GSI-4	612.64	11/09/20	3.80	608.84
		11/11/20	3.66	608.98
		11/13/20	3.71	608.93
		11/16/20	3.60	609.04
		11/18/20	3.60	609.04
		11/20/20	3.68	608.96
		11/23/20	3.78	608.86
		11/25/20	3.72	608.92
		11/27/20	3.57	609.07
HS-GSI-5	615.42	11/09/20	6.50	608.92
		11/11/20	6.30	609.12
		11/13/20	6.74	608.68
		11/16/20	6.20	609.22
		11/18/20	6.20	609.22
		11/20/20	6.27	609.15
		11/23/20	6.39	609.03
		11/25/20	6.33	609.09
		11/27/20	6.17	609.25
Grand River				
HS-GSI-6	611.34	11/09/20	5.30	606.04
		11/11/20	4.94	606.40
		11/13/20	5.02	606.32
		11/16/20	4.80	606.54
		11/18/20	4.78	606.56
		11/20/20	4.78	606.56
		11/23/20	5.03	606.31
		11/25/20	4.98	606.36
		11/27/20	4.72	606.62
HS-GSI-7	611.68	11/09/20	5.80	605.88
		11/11/20	5.49	606.19
		11/13/20	5.58	606.10
		11/16/20	5.31	606.37
		11/18/20	5.31	606.37
		11/20/20	5.31	606.37
		11/23/20	5.60	606.08
		11/25/20	5.56	606.12
		11/27/20	5.29	606.39
HS-GSI-8	612.03	11/09/20	6.00	606.03
		11/11/20	5.67	606.36
		11/13/20	5.73	606.30
		11/16/20	5.43	606.60
		11/18/20	5.48	606.55
		11/20/20	5.54	606.49
		11/23/20	5.85	606.18
		11/25/20	5.65	606.38
		11/27/20	5.38	606.65

**TABLE 3**  
SUMMARY OF GROUNDWATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 3 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast
Location		AREA19-GSI-1	AREA19-GSI-2	AREA19-GSI-3	WV-DEQ-MW9-57	HS-MW-19S	HS-MW-19D	HS-MW-29A	HS-MW-29A
Sample Name		AREA19-GSI-1	AREA19-GSI-2	AREA19-GSI-3	DEQ-MW-9-57	HS-MW-19S	HS-MW-19D	HS-MW-29A	HS-MW-29A-DUP
Screen Interval (feet below the ground surface)		3.7-7.7	4-8	4.2-8.2	51.85-56.85	58.4-61.4	85.9-95.9	3.5-13.5	3.5-13.5
Laboratory Sample ID		VL11070-002	VL11070-003	VL11070-004	VL11070-007	VL11070-008	VL11070-009	VL11070-005	VL11070-006
Sample Date		12/08/2020	12/08/2020	12/08/2020	12/09/2020	12/09/2020	12/09/2020	12/09/2020	12/09/2020
Parameter (µg/L)									
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ON5)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUd5)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
Perfluorobutane sulfonic acid (PFBS)	NA	0.012	0.021	0.017	0.0067	<0.0035	<0.0034	0.012	0.012
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0035	0.0079	0.0046	<0.0035	<0.0035	<0.0034	0.0066	0.0058
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.0035	0.0044	<0.0037	<0.0035	<0.0035	<0.0034	0.0036	0.0036
Perfluorohexane sulfonic acid (PFHxS)	NA	0.0076	0.018	0.013	0.0053	<0.0035	<0.0034	0.02	0.023
Perfluorobutanoic acid (PFBA)	NCL	<0.0035	0.012	0.0052	<0.0035	<0.0035	<0.0034	0.01	0.01
Perfluorodecanoic acid (PFDA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0035	0.0075	0.0074	<0.0035	<0.0035	<0.0034	0.0056	0.0053
Perfluorohexanoic acid (PFHxA)	NA	<0.0035	0.011	0.0074	<0.0035	<0.0035	<0.0034	0.017	0.017
Perfluorononanoic acid (PFNA)	NA	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluorooctanoic acid (PFOA)	12	0.016	0.084	0.058	0.0091	<0.0035	<0.0034	0.03	0.029
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	<b>0.017</b>	<b>0.17</b>	<b>0.13</b>	<0.0035	<0.0035	<0.0034	<b>0.28</b>	<b>0.29</b>
PFOA + PFOS (Calculated)	NCL	0.033	0.25	0.19	0.0091	ND	ND	0.31	0.32
Perfluoropentanoic acid (PFPeA)	NCL	<0.0035	0.0054	0.0039	<0.0035	<0.0035	<0.0034	0.0099	0.011
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0035	<0.0036	<0.0037	<0.0035	<0.0035	<0.0034	<0.0036	<0.0036
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0071	<0.0073	<0.0074	<0.0069	<0.007	<0.0067	<0.0072	<0.0072
Total PFAS (Calculated)	NCL	0.053	0.34	0.25	0.021	ND	ND	0.39	0.41

**TABLE 3 NOTES**  
GSI Investigation  
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**NOTES:**

1. Concentration and criteria units are micrograms per Liter ( $\mu\text{g/L}$ ) or parts per billion (ppb). Calculated criteria and concentrations are rounded to two significant digits. "ND" indicates the parameters used in the calculation were not detected.
2. Michigan Part 201 Groundwater Cleanup Criteria are based on "Table 1, Groundwater: Residential and Nonresidential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Tier I Risk Based Screening Levels," Michigan Administrative Code, Cleanup Criteria Requirements for Response Activity, Rules 299.44 and 299.49, effective December 30, 2013; last updated December 20, 2020.  
Abbreviations Include:  
"NCL" indicates no criterion listed in EGLE Table 1.  
"NA" indicates not available.
3. Bold, italic number with thick line border or italic parameter name indicates that parameter was detected above the Michigan Part 201 Groundwater Cleanup Criteria listed.
4. Abbreviations include:  
"< RL" indicates the parameter was analyzed for but not detected above the method detection limit; RL = Reporting Limit.  
"DUP" indicates a duplicate sample.  
"-" indicates the parameter was not analyzed.
5. Screen interval presented is the top of the screen to the bottom of the screen in feet below ground surface.

**TABLE 4**  
SUMMARY OF PORE WATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 4 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	Wolven Northwest	Wolven Northwest	Wolven Northwest	Wolven Northwest	Wolven Northwest	Wolven Northwest	Wolven Northwest	Wolven Northeast	Wolven Northeast
Location		WVNW-PW-1	WVNW-PW-1	WVNW-PW-2	WVNW-PW-2	WVNW-PW-3	WVNW-PW-4	WVNW-PW-4	AREA19-PW-1	AREA19-PW-2
Sample Name		WVNW-PW-1(A)	WVNW-PW-1(B)	WVNW-PW-2(A)	WVNW-PW-2(B)	WVNW-PW-3(A)	WVNW-PW-4(A)	WVNW-PW-4(A)- DUP	Area19-PW-1(A)	Area19-PW-2(A)
Sample Depth (feet below the ground surface of the river bottom)		3 - 3.13	4 - 4.13	2.33 - 2.46	3.33 - 3.46	1.5 - 1.63	1.67 - 1.79	1.67 - 1.79	1 - 1.13	1 - 1.13
Laboratory Sample ID		VL11053-012	VL11053-014	VL11053-010	VL11053-011	VL06012-013	VL06012-011	VL06012-012	VL06012-001	VL06012-002
Sample Date		12/09/2020	12/09/2020	12/09/2020	12/09/2020	12/02/2020	12/02/2020	12/02/2020	11/30/2020	11/30/2020
Parameter (µg/L)										
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
Perfluorobutane sulfonic acid (PFBS)	NA	0.0038	0.0045	0.0046	<0.0037	0.0051	0.01	0.011	0.013	0.016
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	0.0054	0.0069	0.0061	0.0093	<0.0054
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	0.0053	0.0042	<0.0037	<0.0054
Perfluorohexane sulfonic acid (PFHxS)	NA	<0.0038	<0.0038	<0.0039	<0.0037	0.0092	0.019	0.019	0.017	0.011
Perfluorobutanoic acid (PFBA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	0.0063	0.0057	0.012	0.011
Perfluorodecanoic acid (PFDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	0.0088	0.0092	0.015	<0.0054
Perfluorohexanoic acid (PFHxA)	NA	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	0.0068	0.0076	0.013	0.0069
Perfluorononanoic acid (PFNA)	NA	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluorooctanoic acid (PFOA)	12	0.0055	0.0073	0.012	0.0075	0.028	0.066	0.065	0.11	0.03
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	0.007	0.0097	0.01	0.011	<b>0.26</b>	<b>0.1</b>	<b>0.094</b>	<b>0.13</b>	<b>0.03</b>
PFOA + PFOS (Calculated)	NCL	0.013	0.017	0.022	0.019	0.29	0.17	0.16	0.24	0.06
Perfluoropentanoic acid (PFPeA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	0.004	<0.0036	0.0055	<0.0054
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0037	<0.0041	<0.0036	<0.0036	<0.0037	<0.0054
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0076	<0.0076	<0.0078	<0.0075	<0.0082	<0.0072	<0.0073	<0.0073	<0.011
<b>Total PFAS (Calculated)</b>	NCL	0.016	0.022	0.027	0.019	0.31	0.23	0.22	0.32	0.1



**TABLE 4**  
SUMMARY OF PORE WATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 4 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven Northeast	Wolven-North Childsdales
Location		AREA19-PW-2	AREA19-PW-3	AREA19-PW-4	AREA19-PW-4	AREA19-PW-5	AREA19-PW-6	AREA19-PW-6	AREA19-PW-7	WV/CH-PW-1
Sample Name		Area19-PW-2(B)	Area19-PW-3(A)	Area19-PW-4(A)	Area19-PW-4(B)	Area19-PW-5(A)	Area19-PW-6(A)	Area19-PW-6(B)	Area19-PW-7(A)	WV/CH-PW-1(A)
Sample Depth (feet below the ground surface of the river bottom)		1.42 - 1.54	1 - 1.13	1 - 1.13	1.42 - 1.54	1 - 1.13	1.5 - 1.63	2 - 2.13	5 - 5.13	0.75 - 0.88
Laboratory Sample ID		VL06012-003	VL06012-004	VL06012-005	VL06012-006	VL06012-007	VL06012-008	VL06012-009	VL06012-010	VL11053-001
Sample Date		11/30/2020	11/30/2020	12/01/2020	12/01/2020	12/01/2020	12/01/2020	12/01/2020	12/01/2020	12/07/2020
Parameter (µg/L)										
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUD5)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
4,8-dioxo-3H-perfluorononanoic acid (ADONA)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
Perfluorobutane sulfonic acid (PFBS)	NA	0.012	0.015	0.015	0.013	0.022	0.017	0.016	0.022	0.031
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0038	0.0041	0.0053	0.0054	0.013	0.0083	0.0086	0.0052	<0.0039
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	0.0043	0.0038	<0.0037	0.0049	0.014
Perfluorohexane sulfonic acid (PFHxS)	NA	0.0083	0.011	0.016	0.013	0.022	0.014	0.014	0.021	0.018
Perfluorobutanoic acid (PFBA)	NCL	0.0075	0.0039	<0.0037	<0.0037	0.0083	0.0053	0.0051	0.0071	<0.0039
Perfluorodecanoic acid (PFDA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0038	0.004	<0.0037	<0.0037	0.0076	0.01	0.0093	0.013	0.0086
Perfluorohexanoic acid (PFHxA)	NA	0.0053	<0.0037	<0.0037	<0.0037	0.009	0.0084	0.0087	0.011	0.0068
Perfluorononanoic acid (PFNA)	NA	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluorooctanoic acid (PFOA)	12	0.019	0.033	0.031	0.029	0.095	0.08	0.081	0.084	0.044
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	<b>0.024</b>	<b>0.089</b>	<b>0.067</b>	<b>0.064</b>	<b>0.23</b>	<b>0.06</b>	<b>0.064</b>	<b>0.02</b>	<b>0.016</b>
PFOA + PFOS (Calculated)	NCL	0.043	0.12	0.098	0.093	0.33	0.14	0.15	0.1	0.06
Perfluoropentanoic acid (PFPeA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	0.0041	<0.0037	<0.0037	0.0051	<0.0039
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0038	<0.0037	<0.0037	<0.0037	<0.0038	<0.0037	<0.0037	<0.0037	<0.0039
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0077	<0.0075	<0.0074	<0.0074	<0.0075	<0.0074	<0.0074	<0.0075	<0.0078
<b>Total PFAS (Calculated)</b>	NCL	<b>0.076</b>	<b>0.16</b>	<b>0.13</b>	<b>0.12</b>	<b>0.42</b>	<b>0.21</b>	<b>0.21</b>	<b>0.19</b>	<b>0.14</b>

**TABLE 4**  
SUMMARY OF PORE WATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 4 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	Wolven-North Childsdales	Wolven-North Childsdales	Wolven-North Childsdales	Wolven-North Childsdales	Wolven-North Childsdales	Wolven-North Childsdales	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast
Location		WV/CH-PW-2	WV/CH-PW-3	WV/CH-PW-4	WV/CH-PW-5	WV/CH-PW-6	WV/CH-PW-6	HS-PW-1	HS-PW-1	HS-PW-2
Sample Name		WV/CH-PW-2(A)	WV/CH-PW-3(A)	WV/CH-PW-4(A)	WV/CH-PW-5(A)	WV/CH-PW-6(A)	WV/CH-PW-6(B)	HS-PW-1(A)	HS-PW-1(B)	HS-PW-2(A)
Sample Depth (feet below the ground surface of the river bottom)		0.75 - 0.88	1 - 1.13	1 - 1.13	0.83 - 0.96	1 - 1.13	2 - 2.13	2 - 2.13	2.5 - 2.63	1 - 1.13
Laboratory Sample ID		VL11053-002	VL11053-003	VL11053-004	VL11053-005	VL11053-006	VL11053-007	VL06031-001	VL06031-002	VL06031-003
Sample Date		12/07/2020	12/07/2020	12/07/2020	12/08/2020	12/08/2020	12/08/2020	12/03/2020	12/03/2020	12/03/2020
Parameter (µg/L)										
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OudS)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
4,8-dioxo-3H-perfluorononanoic acid (ADONA)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
Perfluorobutane sulfonic acid (PFBS)	NA	0.011	0.0045	0.015	0.017	0.0098	0.0095	0.0087	0.0083	<0.0038
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluoroheptane sulfonic acid (PFHpS)	NCL	0.0054	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.0038	<0.0038	0.0041	0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorohexane sulfonic acid (PFHxS)	NA	0.011	<0.0038	0.012	0.012	0.0087	0.0099	<0.0038	<0.0036	<0.0038
Perfluorobutanoic acid (PFBA)	NCL	<0.0038	<0.0038	0.0059	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorodecanoic acid (PFDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorohexanoic acid (PFHxA)	NA	0.0041	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorononanoic acid (PFNA)	NA	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorooctanoic acid (PFOA)	12	0.043	0.01	0.024	0.019	0.01	0.008	<0.0038	<0.0036	0.0046
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	<b>0.079</b>	<b>0.032</b>	<b>0.02</b>	<b>0.032</b>	<b>0.015</b>	<0.0038	<0.0038	<0.0036	0.0052
PFOA + PFOS (Calculated)	NCL	0.12	0.042	0.044	0.051	0.025	0.008	ND	ND	0.0098
Perfluoropentanoic acid (PFPeA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0038	<0.0038	<0.0039	<0.0038	<0.0038	<0.0038	<0.0038	<0.0036	<0.0038
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0077	<0.0077	<0.0078	<0.0076	<0.0076	<0.0077	<0.0076	<0.0073	<0.0077
<b>Total PFAS (Calculated)</b>	NCL	0.15	0.047	0.081	0.084	0.044	0.027	0.0087	0.0083	0.0098

**TABLE 4**  
SUMMARY OF PORE WATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 4 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast
Location		HS-PW-2.5	HS-PW-2.5	HS-PW-3	HS-PW-3R	HS-PW-3R	HS-PW-3.5	HS-PW-4	HS-PW-5	HS-PW-6	
Sample Name		HS-PW-2.5 (A)	HS-PW-2.5 (B)	HS-PW-3(A)	HS-PW-3 (A)	HS-PW-3 (A) DUP	HS-PW-3.5 (A)	HS-PW-4(A)	HS-PW-5(A)	HS-PW-6(A)	
Sample Depth (feet below the ground surface of the river bottom)		0.5 - 0.63	1 - 1.13	1.33 - 1.46	0.5 - 0.63	0.5 - 0.63	0.83 - 0.96	0.75 - 0.88	1.33 - 1.46	1 - 1.13	
Laboratory Sample ID		WA28027-001	WA28027-002	VL06031-006	WA28027-003	WA28027-004	WA28027-005	VL06031-007	VL06031-008	VL06031-009	
Sample Date		01/26/2021	01/26/2021	12/04/2020	01/26/2021	01/26/2021	01/26/2021	12/04/2020	12/04/2020	12/04/2020	
Parameter (µg/L)											
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUD5)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
4,8-dioxo-3H-perfluorononanoic acid (ADONA)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
Perfluorobutane sulfonic acid (PFBS)	NA	<0.018	0.0075	0.011	<0.019	<0.017	0.032	0.05	<0.0039	<0.0038	
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.018	0.0074	0.023	0.019	0.018	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluorononane sulfonic acid (PFNS)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluorooctane sulfonamide (FOSA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.018	0.0056	0.0068	<0.019	<0.017	0.017	0.035	<0.0039	<0.0038	
Perfluorohexane sulfonic acid (PFHxS)	NA	0.025	0.02	0.042	0.028	0.026	0.019	0.056	<0.0039	<0.0038	
Perfluorobutanoic acid (PFBA)	NCL	0.021	0.0091	0.022	0.021	0.02	0.0095	0.015	<0.0039	<0.0038	
Perfluorodecanoic acid (PFDA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluorododecanoic acid (PFDDA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluoroheptanoic acid (PFHpA)	NCL	<0.018	0.0056	0.016	<0.019	<0.017	0.0072	0.022	<0.0039	<0.0038	
Perfluorohexanoic acid (PFHxA)	NA	0.033	0.015	0.045	0.041	0.038	0.012	0.027	<0.0039	<0.0038	
Perfluorononanoic acid (PFNA)	NA	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluorooctanoic acid (PFOA)	12	0.054	0.025	0.074	0.077	0.071	0.021	0.074	0.0079	0.007	
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	<b>0.82</b>	<b>0.56</b>	<b>1.1</b>	<b>0.9</b>	<b>0.9</b>	<b>0.092</b>	<b>0.013</b>	<b>0.03</b>	0.0046	
PFOA + PFOS (Calculated)	NCL	0.87	0.59	1.2	0.98	0.97	0.11	0.087	0.038	0.012	
Perfluoropentanoic acid (PFPeA)	NCL	0.027	0.011	0.027	0.023	0.022	0.006	0.015	<0.0039	<0.0038	
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.018	<0.0035	<0.0039	<0.019	<0.017	<0.0036	<0.0037	<0.0039	<0.0038	
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.035	<0.0071	<0.0078	<0.037	<0.035	<0.0072	<0.0075	<0.0079	<0.0076	
<b>Total PFAS (Calculated)</b>	NCL	<b>0.98</b>	<b>0.67</b>	<b>1.4</b>	<b>1.1</b>	<b>1.1</b>	<b>0.22</b>	<b>0.31</b>	<b>0.038</b>	<b>0.012</b>	

**TABLE 4**  
SUMMARY OF PORE WATER SAMPLE ANALYSIS - PFAS  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

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See After Table 4 For Notes

Area	Part 201 Generic Groundwater Cleanup Criteria – Groundwater Surface Water Interface <sup>2</sup>	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast	House Street Property South/Southeast
Location		HS-PW-7	HS-PW-8	HS-PW-9	HS-PW-10	HS-PW-11
Sample Name		HS-PW-7(A)	HS-PW-8(A)	HS-PW-9(A)	HS-PW-10(A)	HS-PW-11(A)
Sample Depth (feet below the ground surface of the river bottom)		1.5 - 1.63	1 - 1.13	1 - 1.13	5 - 5.13	4.5 - 4.63
Laboratory Sample ID		VL06031-004	VL11053-008	VL11070-001	VL11070-010	VL11053-009
Sample Date		12/03/2020	12/08/2020	12/08/2020	12/09/2020	12/09/2020
Parameter (µg/L)						
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9CI-PF3ONS)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11CL-PF3OUdS)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
1H,1H,2H,2H-perfluorohexane sulfonate (4:2FTS)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NCL	0.078	0.044	<0.0072	<0.0073	<0.0075
N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NCL	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
Perfluorobutane sulfonic acid (PFBS)	NA	0.0095	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorodecane sulfonic acid (PFDS)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluoroheptane sulfonic acid (PFHpS)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorononane sulfonic acid (PFNS)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorooctane sulfonamide (FOSA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluoropentane sulfonic acid (PFPeS)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorohexane sulfonic acid (PFHxS)	NA	0.0058	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorobutanoic acid (PFBA)	NCL	0.0047	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorodecanoic acid (PFDA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorododecanoic acid (PFDoDA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluoroheptanoic acid (PFHpA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorohexanoic acid (PFHxA)	NA	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorononanoic acid (PFNA)	NA	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorooctanoic acid (PFOA)	12	0.0038	0.007	<0.0036	<0.0036	<0.0038
<b>Perfluorooctane sulfonic acid (PFOS)</b>	0.012	0.0089	<b>0.026</b>	0.0082	<0.0036	<0.0038
PFOA + PFOS (Calculated)	NCL	0.013	0.033	0.0082	ND	ND
Perfluoropentanoic acid (PFPeA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorotetradecanoic acid (PFTeDA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluorotridecanoic acid (PFTrDA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Perfluoroundecanoic acid (PFUnDA)	NCL	<0.0037	<0.0036	<0.0036	<0.0036	<0.0038
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid (GenX)	NA	<0.0075	<0.0072	<0.0072	<0.0073	<0.0075
Total PFAS (Calculated)	NCL	0.11	0.077	0.0082	ND	ND

**TABLE 4 NOTES**  
GSI Investigation  
Algoma and Plainfield Townships, Kent County, Michigan

16.0062961.51  
Page 1 of 1

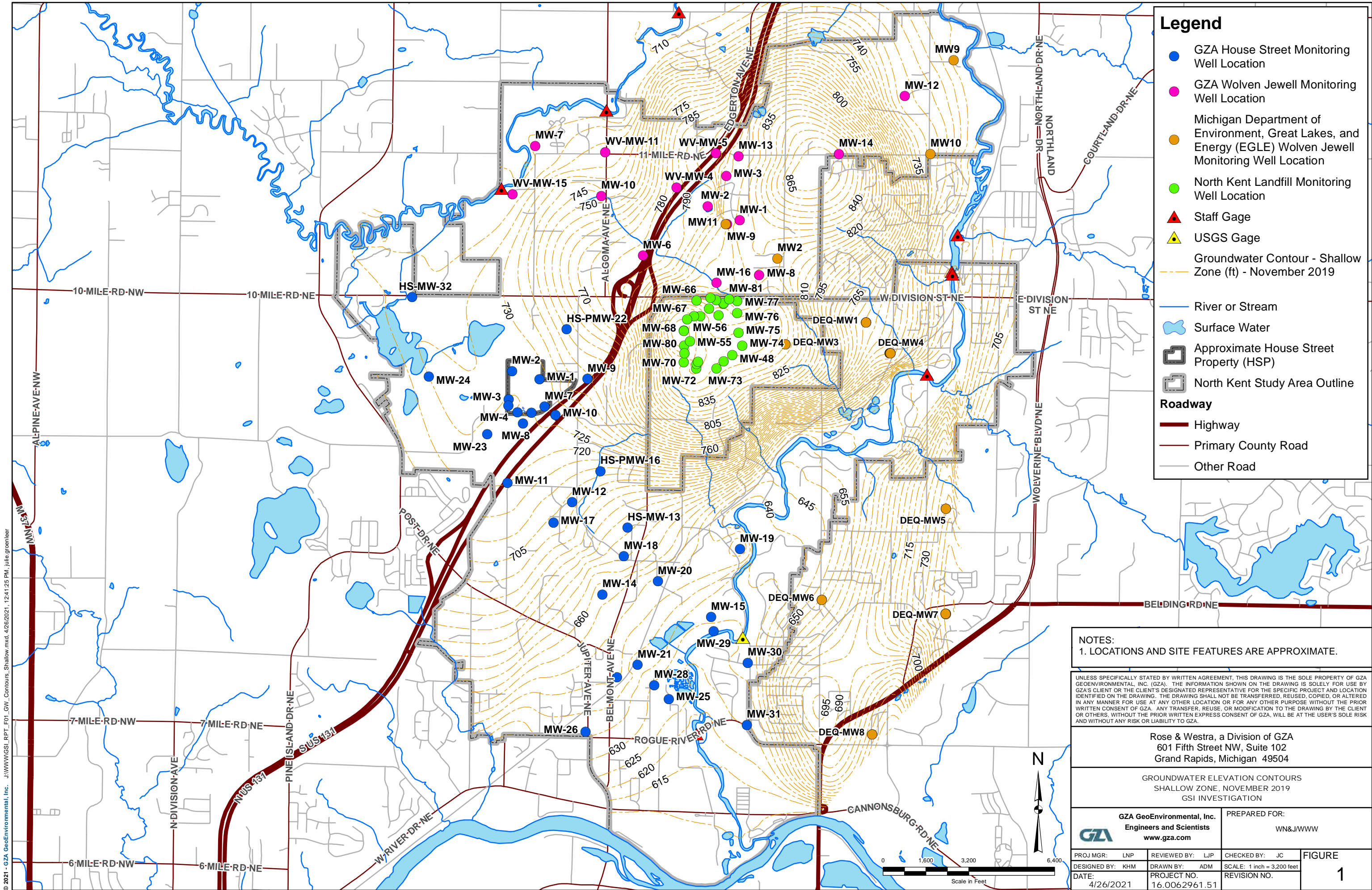
**NOTES:**

1. Concentration and criteria units are micrograms per Liter ( $\mu\text{g/L}$ ) or parts per billion (ppb). Calculated criteria and concentrations are rounded to two significant digits. "ND" indicates the parameters used in the calculation were not detected.
2. Michigan Part 201 Groundwater Cleanup Criteria are based on "Table 1, Groundwater: Residential and Nonresidential Part 201 Generic Cleanup Criteria and Screening Levels/Part 213 Tier I Risk Based Screening Levels," Michigan Administrative Code, Cleanup Criteria Requirements for Response Activity, Rules 299.44 and 299.49, effective December 30, 2013; last updated December 20, 2020.  
Abbreviations Include:  
"NCL" indicates no criterion listed in EGLE Table 1.  
"NA" indicates not available.
3. Bold, italic number with thick line border or italic parameter name indicates that parameter was detected above the Michigan Part 201 Groundwater Cleanup Criteria listed.
4. Abbreviations include:  
"< RL" indicates the parameter was analyzed for but not detected above the method detection limit; RL = Reporting Limit.  
"DUP" indicates a duplicate sample.  
"-" indicates the parameter was not analyzed.
5. Screen interval presented is the top of the screen to the bottom of the screen in feet below ground surface of the river bottom.



## FIGURES

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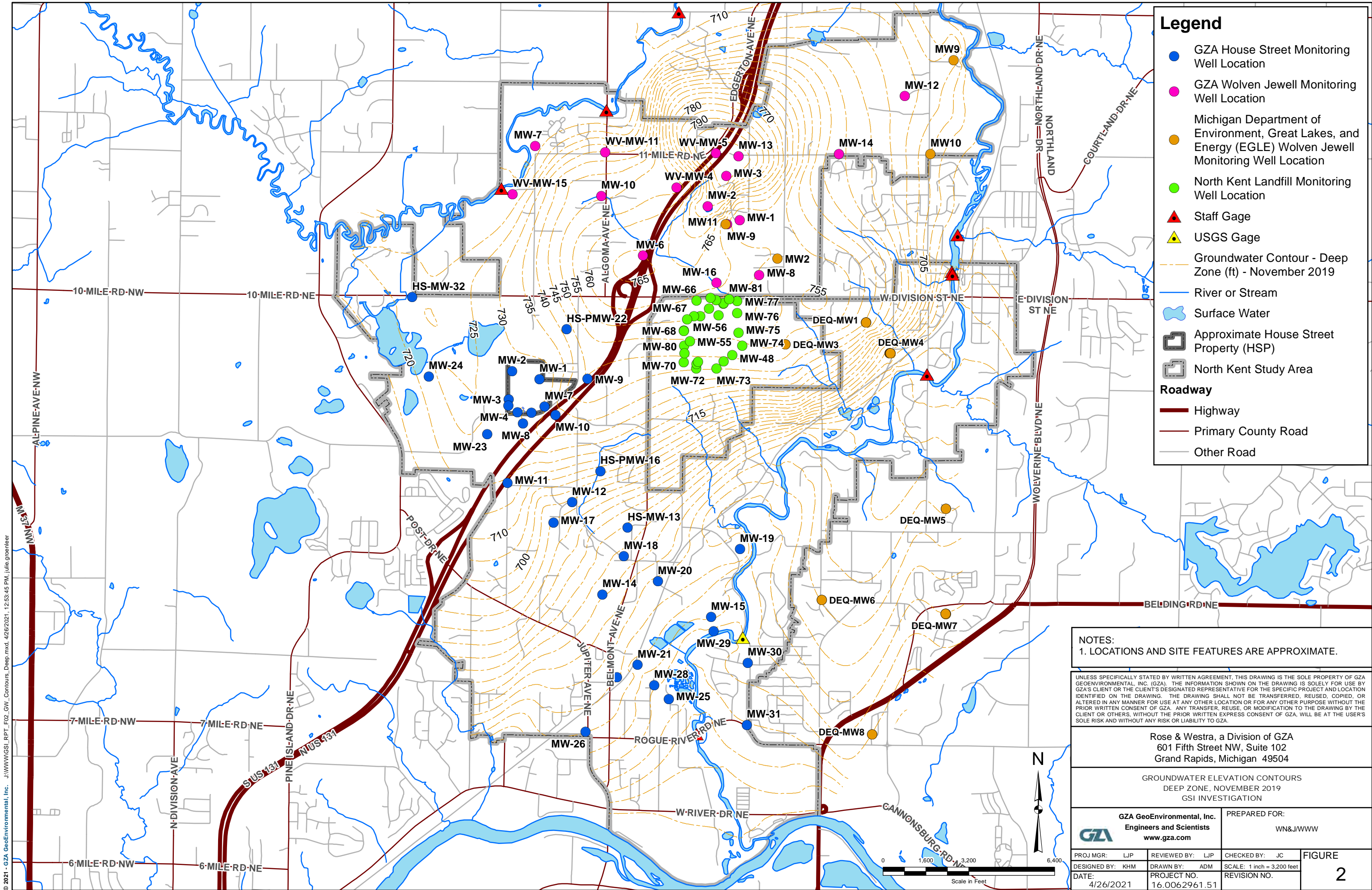
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601 Fifth Street NW, Suite 102  
Grand Rapids, Michigan 49504

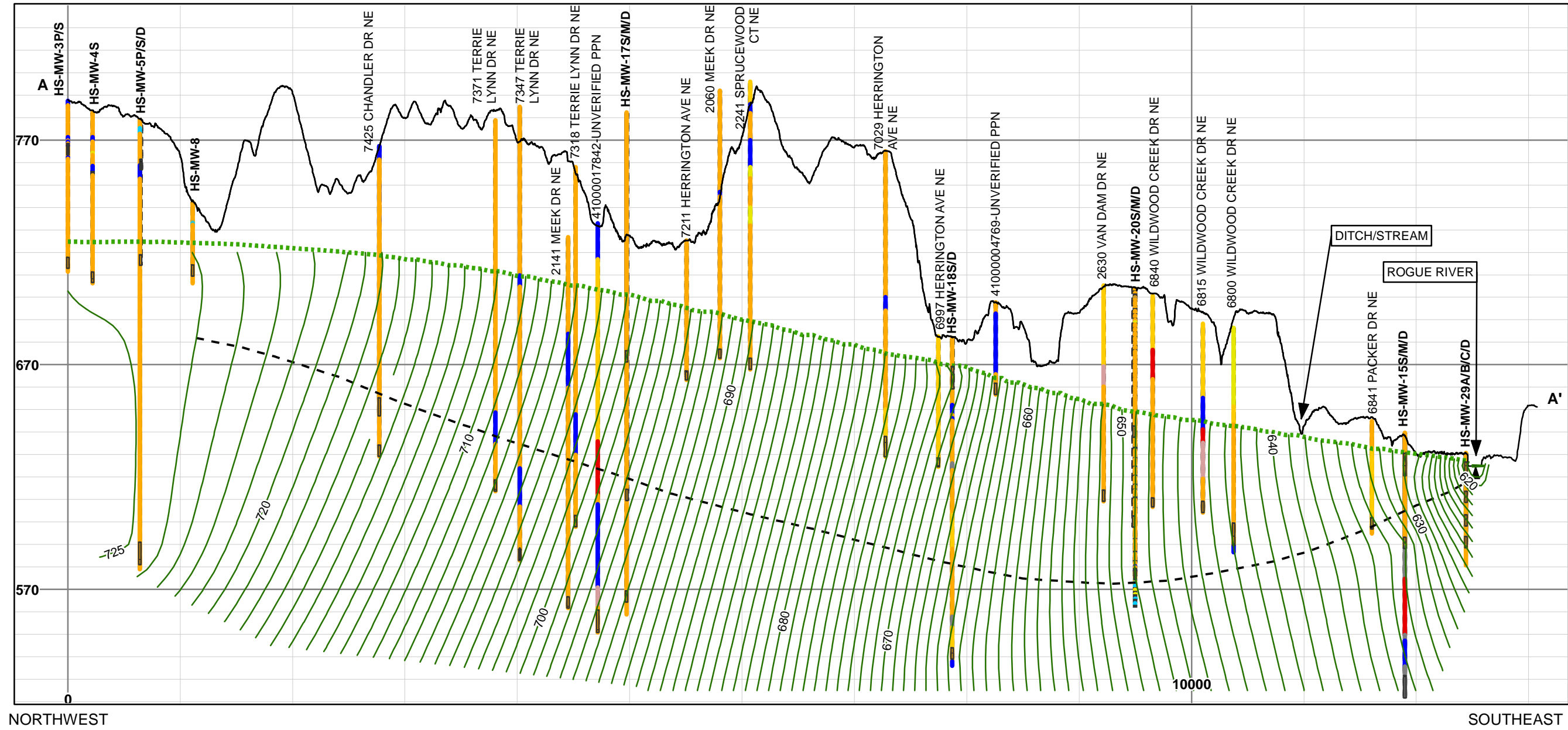
GROUNDWATER ELEVATION CONTOURS  
SHALLOW ZONE, NOVEMBER 2019  
GSI INVESTIGATION

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WN&J/WWW	
PROJ MGR: LNP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 1
DESIGNED BY: KHM	DRAWN BY: ADM	SCALE: 1 inch = 3,200 feet	
DATE: 4/26/2021	PROJECT NO. 16.0062961.51	REVISION NO.	



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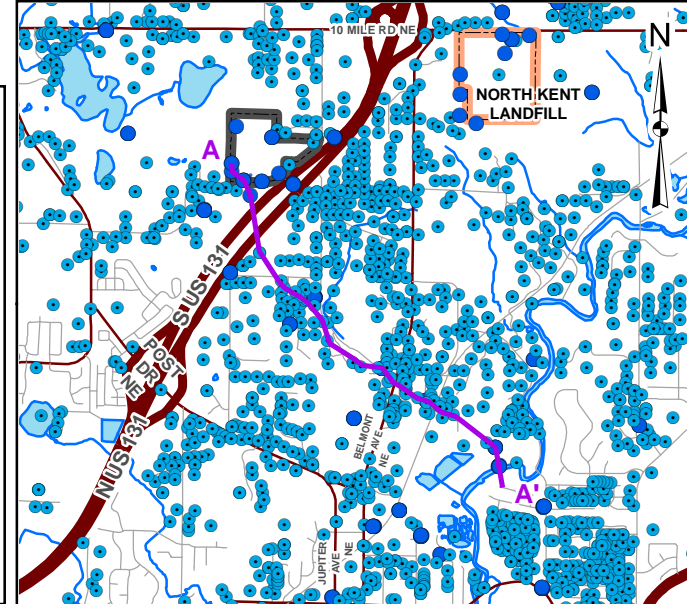
### CROSS SECTION LEGEND

- GROUND SURFACE
  - ESTIMATED POTENTIOMETRIC SURFACE (11/2019)
  - GROUNDWATER CONTOUR, FT (INTERVAL = 1 FT)
  - INTERPRETED GROUNDWATER FLOWLINE
  - WELL SCREEN
- BOREHOLE LITHOLOGY**
- GRAVEL
  - SAND AND GRAVEL
  - SAND
  - SAND/GRAVEL W/ CLAY/SILT
  - CLAY/SILT W/ SAND/GRAVEL
  - SILT
  - CLAY AND SILT
  - CLAY
  - NOT AVAILABLE

### OVERVIEW MAP LEGEND

- RESIDENTIAL WATER WELL
- MONITORING WELL
- CROSS SECTION LINE
- HIGHWAY
- PRIMARY COUNTY ROAD
- OTHER ROAD
- RIVER OR STREAM
- SURFACE WATER
- APPROXIMATE HOUSE STREET PROPERTY (HSP)
- NORTH KENT LANDFILL

### OVERVIEW MAP



NOTES:

1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

2. GROUND SURFACE ELEVATIONS ARE BASED ON DIGITAL RASTER FILES OF BARE EARTH DIGITAL ELEVATION MODELS (DEMS), GENERATED FROM LIDAR DATA WITH 1-METER HORIZONTAL ACCURACY AND 18.5-CENTIMETER VERTICAL ACCURACY. DIGITAL FILES OF DEMS AND LIDAR DATA WERE PROVIDED BY KENT COUNTY.

3. ESTIMATED POTENTIOMETRIC SURFACE WAS DEVELOPED BASED ON MEASUREMENTS MADE IN GROUNDWATER MONITORING WELLS IN NOVEMBER 2019. GROUNDWATER ELEVATIONS WERE NOT MEASURED FROM RESIDENTIAL WATER SUPPLY WELLS.

4. WELL SCREEN ELEVATIONS PROVIDED IN FEET ABOVE MEAN SEA LEVEL, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). RESIDENTIAL WELL SCREEN ELEVATIONS AND BOREHOLE LITHOLOGY ELEVATIONS WERE CALCULATED USING WELL INFORMATION PROVIDED BY THE STATE OF MICHIGAN'S WELLOGIC DATABASE AND GROUND SURFACE ELEVATIONS OF THE CENTER OF THE PPN GENERATED FROM LIDAR DATA PROVIDED BY KENT COUNTY. ELEVATIONS ARE ROUNDED TO THE NEAREST FOOT.

02750550011000

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HOUSE STREET AREA  
GEOLOGICAL CROSS SECTION A-A'  
GSI INVESTIGATION

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Engineers and Scientists  
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PREPARED FOR:  
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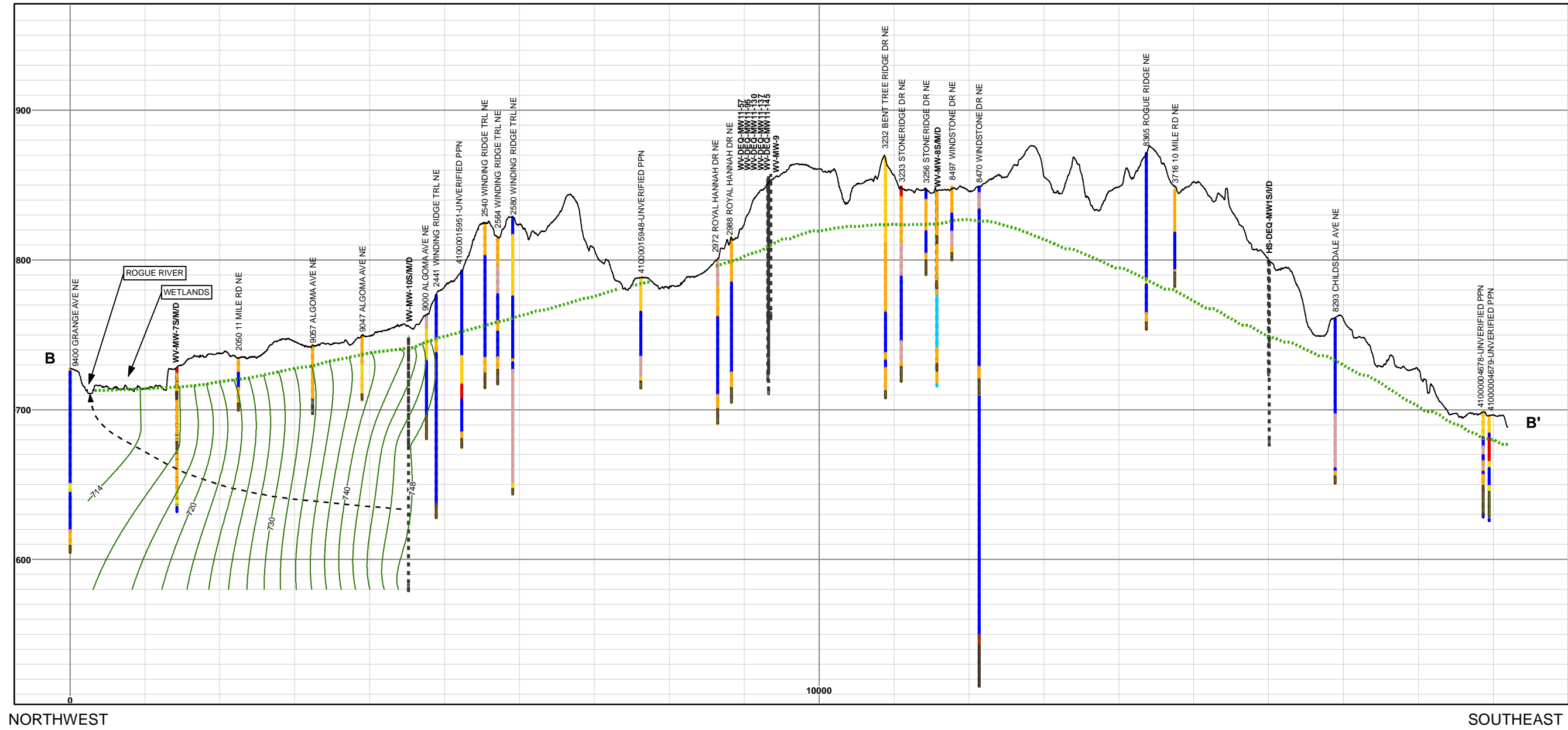
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DESIGNED BY: JC  
DATE: 04/22/2021

REVIEWED BY: MW  
DRAWN BY: JMG  
PROJECT NO: 16.0062961.51

CHECKED BY: LMN  
SCALE: 1 in = 5,500 ft  
REVISION NO:

FIGURE  
3A





### CROSS SECTION LEGEND

- GROUND SURFACE
  - ESTIMATED POTENTIOMETRIC SURFACE (11/2019)
  - GROUNDWATER CONTOUR, FT (INTERVAL = 1 FT)
  - INTERPRETED GROUNDWATER FLOWLINE
  - WELL SCREEN
- BOREHOLE LITHOLOGY**
- GRAVEL
  - SAND AND GRAVEL
  - SAND
  - SAND/GRAVEL W/ CLAY/SILT
  - CLAY/SILT W/ SAND/GRAVEL
  - SILT
  - CLAY AND SILT
  - CLAY
  - BEDROCK
  - NOT AVAILABLE

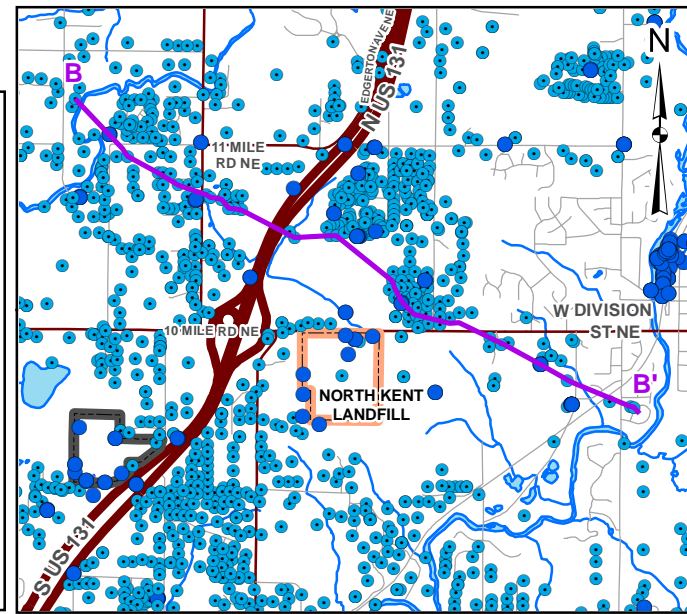
### OVERVIEW MAP LEGEND

- RESIDENTIAL WATER WELL
- MONITORING WELL
- CROSS SECTION LINE
- HIGHWAY
- PRIMARY COUNTY ROAD
- OTHER ROAD
- RIVER OR STREAM
- SURFACE WATER
- APPROXIMATE HOUSE STREET PROPERTY (HSP)
- NORTH KENT LANDFILL

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### OVERVIEW MAP



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WOLVEN NORTHWEST STUDY AREA  
GEOLOGICAL CROSS SECTION B-B'  
GSI INVESTIGATION

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Engineers and Scientists  
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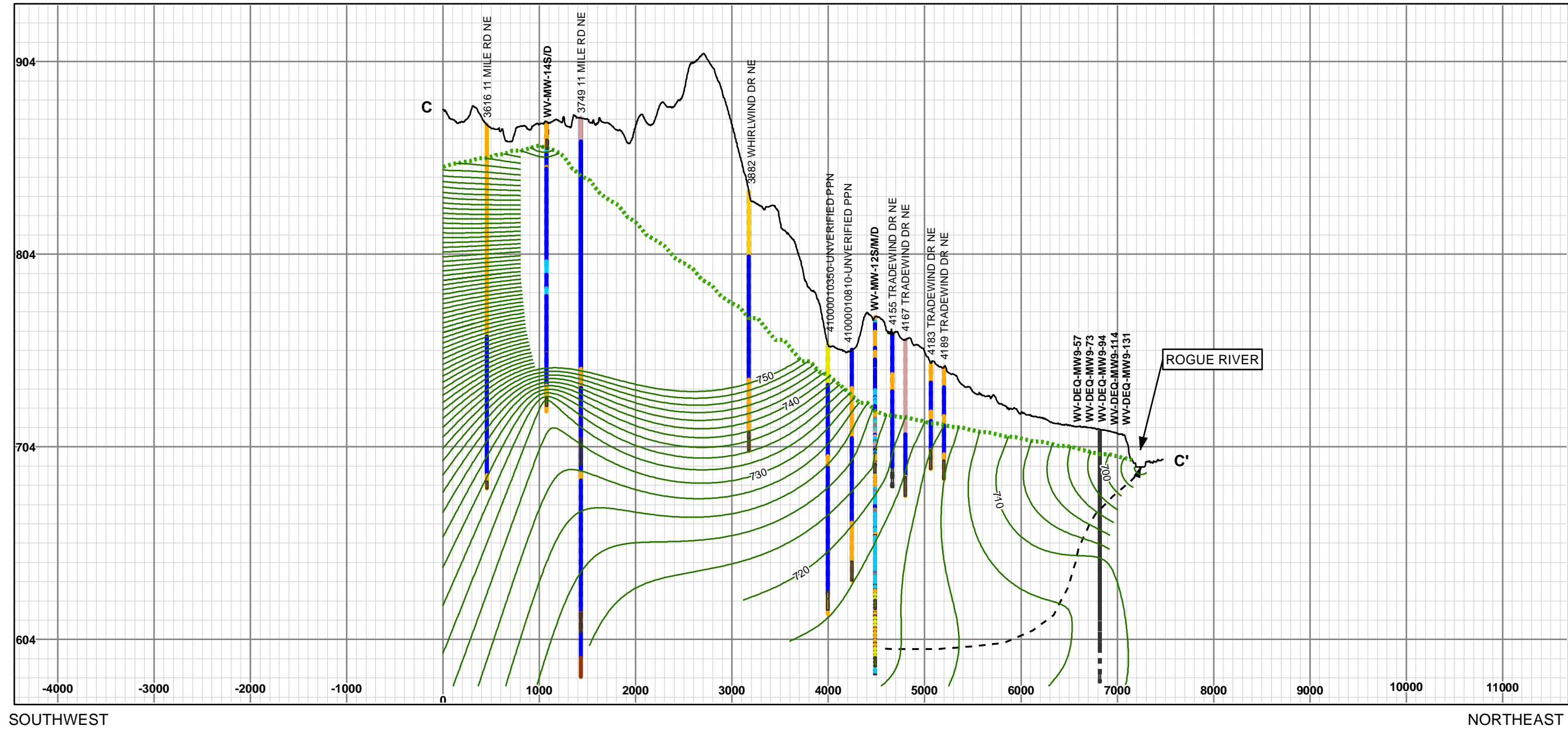
PROJ MGR: LJP  
DESIGNED BY: JC  
DATE: 04/22/2021

REVIEWED BY: MW  
DRAWN BY: JMG  
PROJECT NO: 16.0062961.51

CHECKED BY: LMN  
SCALE: 1 in = 5,500 ft  
REVISION NO:

FIGURE  
3B

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### CROSS SECTION LEGEND

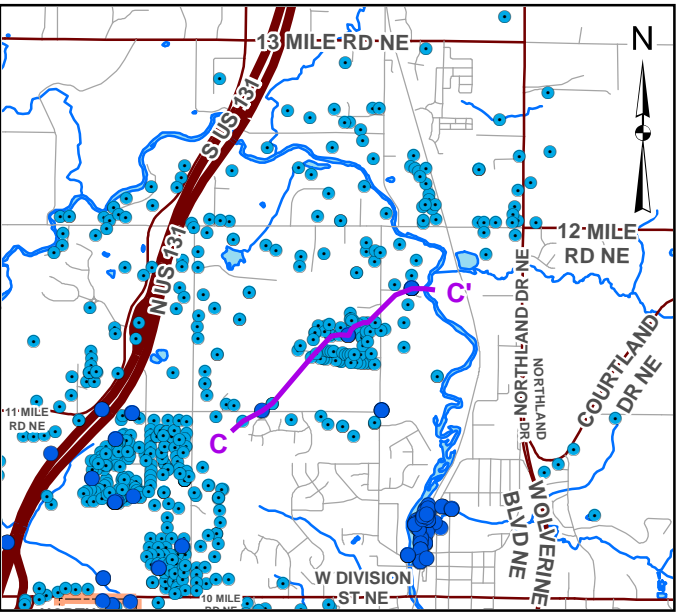
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|--|----------------------------|---------------------|
| — GROUND SURFACE                                 | <b>BOREHOLE LITHOLOGY</b>  | — SILT              |
| ..... ESTIMATED POTENTIOMETRIC SURFACE (11/2019) | — GRAVEL                   | — CLAY AND SILT     |
| — GROUNDWATER CONTOUR, FT (INTERVAL = 1 FT)      | — SAND AND GRAVEL          | — CLAY              |
| — INTERPRETED GROUNDWATER FLOWLINE               | — SAND                     | — BEDROCK           |
| □ WELL SCREEN                                    | — CLAY/SILT W/ SAND/GRAVEL | ■ ■ ■ NOT AVAILABLE |


### OVERVIEW MAP LEGEND

- |                          |                       |
|--------------------------|-----------------------|
| ● RESIDENTIAL WATER WELL | — RIVER OR STREAM     |
| ● MONITORING WELL        | — SURFACE WATER       |
| — CROSS SECTION LINE     | □ NORTH KENT LANDFILL |
| — HIGHWAY                |                       |
| — PRIMARY COUNTY ROAD    |                       |
| — OTHER ROAD             |                       |

NOTES:  
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.  
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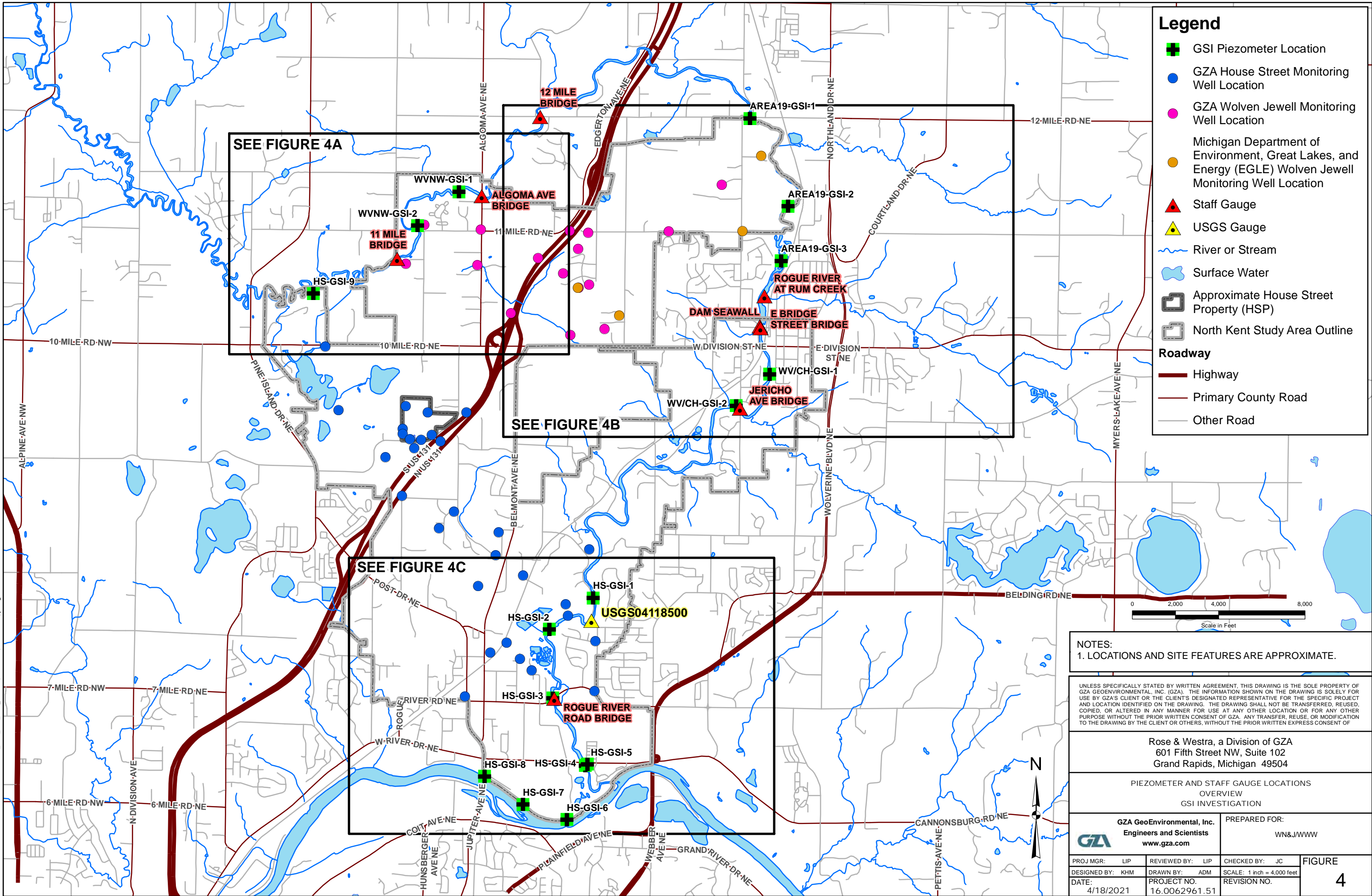
### OVERVIEW MAP



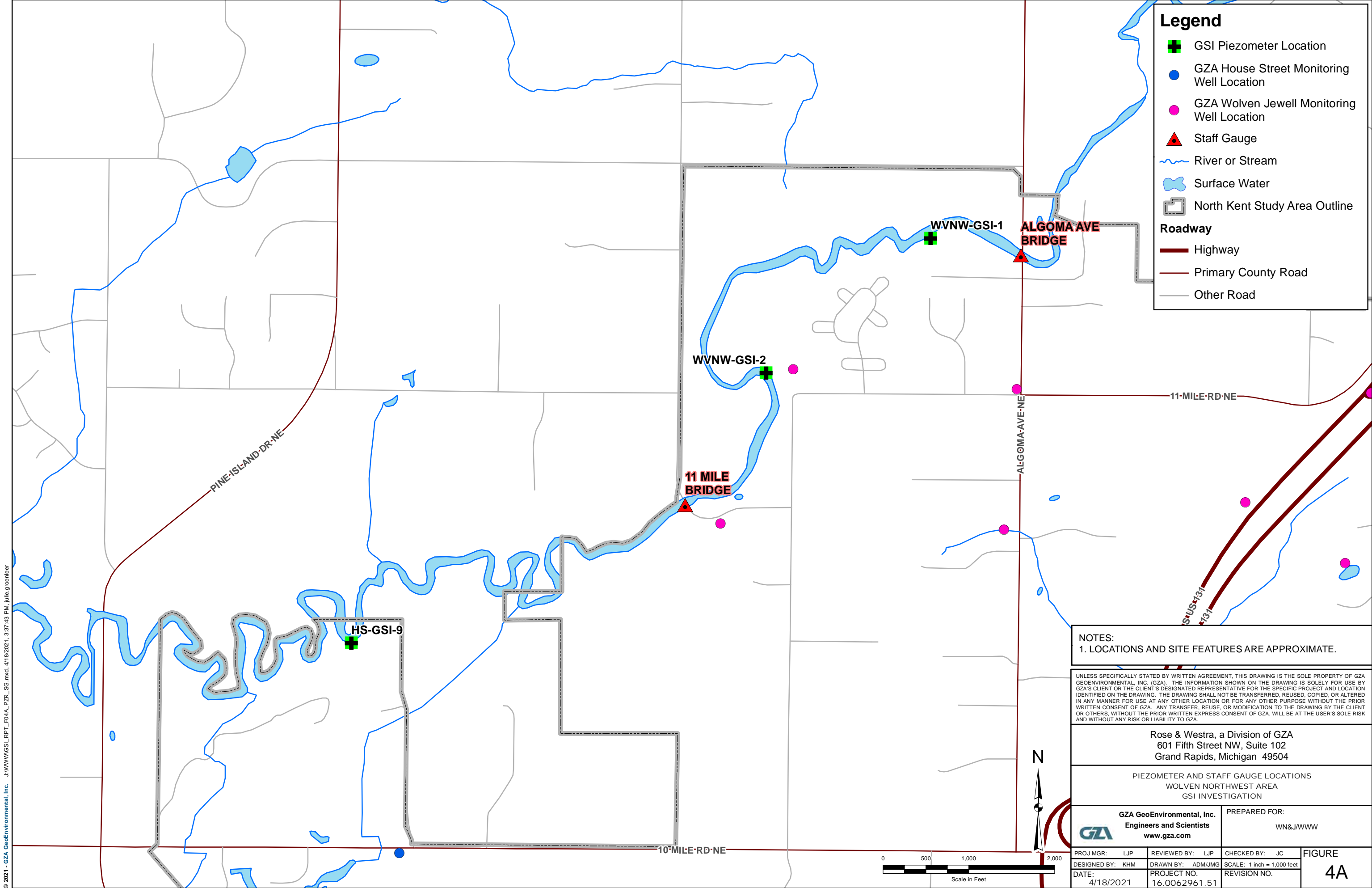
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WOLVEN NORTHEAST GEOLOGICAL CROSS SECTION C-C' GSI INVESTIGATION			
PREPARED BY:  <b>GZA GeoEnvironmental, Inc.</b> <b>Engineers and Scientists</b> <b>www.gza.com</b>		PREPARED FOR:  WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: MW	CHECKED BY: LMN	FIGURE  3C
DESIGNED BY: JC	DRAWN BY: JMG	SCALE: 1 in = 5,500 ft	
DATE: 04/26/2021	PROJECT NO: 16.0062961.51	REVISION NO:	



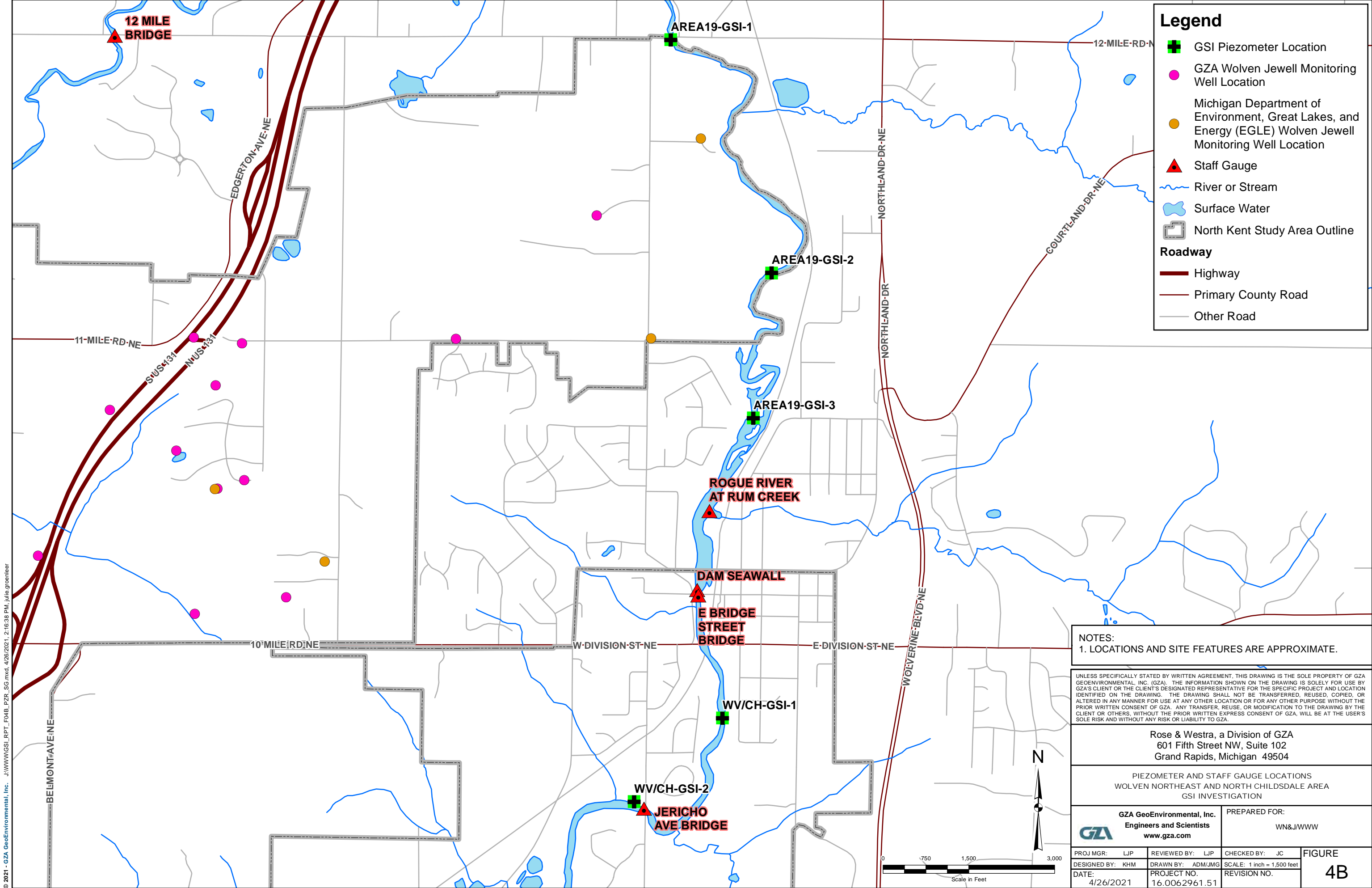
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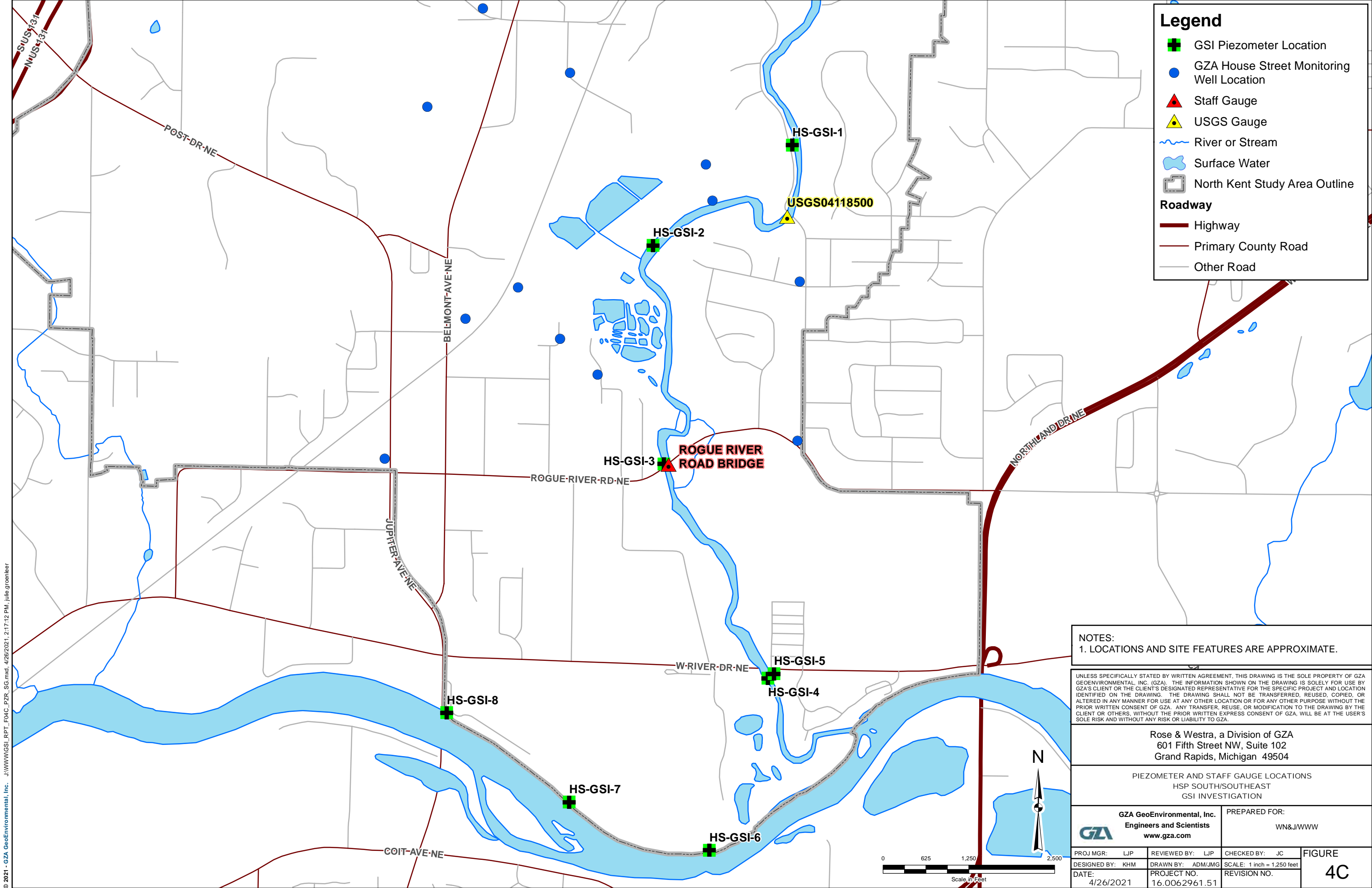


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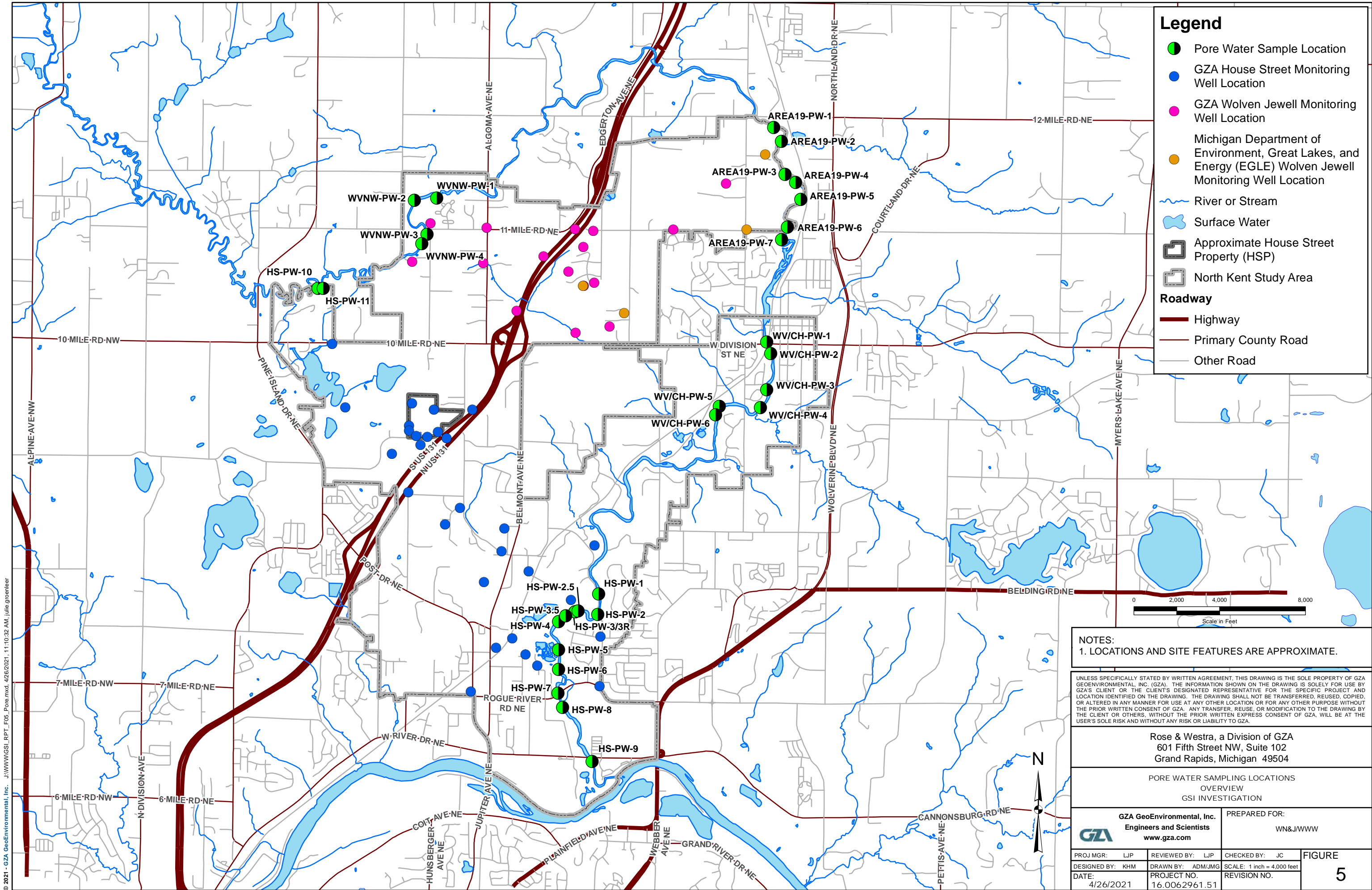


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**Legend**

Pore Water Sample Location

GZA House Street Monitoring Well Location

GZA Woven Jewell Monitoring Well Location

Michigan Department of Environment, Great Lakes, and Energy (EGLE) Woven Jewell Monitoring Well Location

River or Stream

Surface Water

Approximate House Street Property (HSP)

North Kent Study Area

**Roadway**

Highway

Primary County Road


Other Road

NOTES:  
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.

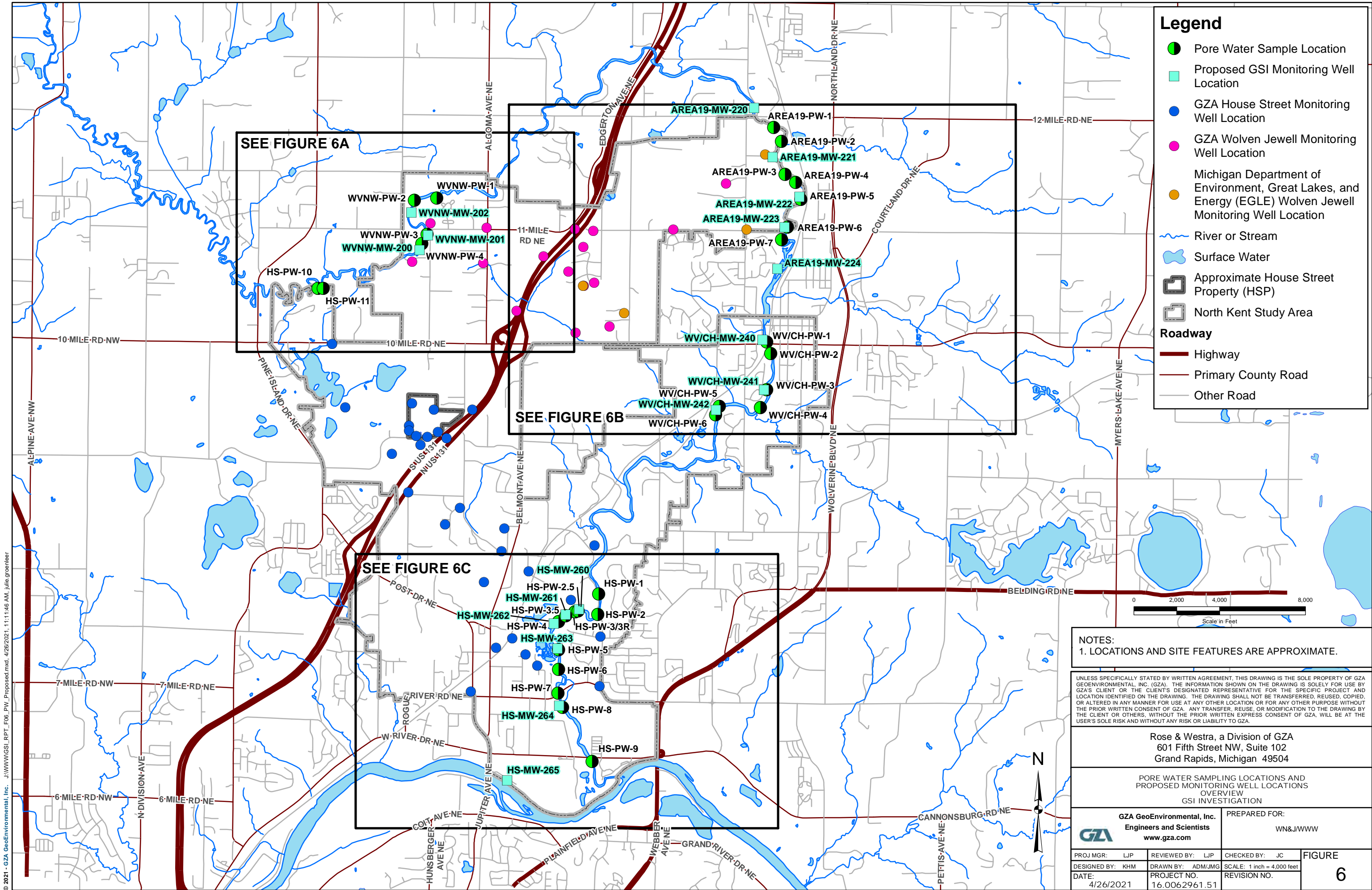
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PORE WATER SAMPLING LOCATIONS  
OVERVIEW  
GSI INVESTIGATION

 <b>GZA GeoEnvironmental, Inc.</b> Engineers and Scientists <a href="http://www.gza.com">www.gza.com</a>		PREPARED FOR:  WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	<b>FIGURE</b>  <b>5</b>
DESIGNED BY: KHM	DRAWN BY: ADM/JMG	SCALE: 1 inch = 4,000 feet	
DATE: 4/26/2021	PROJECT NO. 16.0062961.51	REVISION NO.	

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NOTES:  
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.  
2. PFOS = PERFLUOROOCTANE SULFONATE  
3. NG/L = NANOGRAM PER LITER; ND = NOT DETECTED  
4. MAXIMUM CONCENTRATION FROM SAMPLING INTERVAL IS SHOWN.  
5. ABBREVIATIONS FOR MICHIGAN PART 201 GENERIC CLEANUP CRITERIA FOR RESIDENTIAL USES:  
GSI = GROUNDWATER - SURFACE WATER INTERFACE CRITERIA.  
6. ESTIMATED POTENTIOMETRIC SURFACE WAS DEVELOPED USING INTERPOLATION IN AQUAVEO GROUNDWATER MODELING SYSTEM (GMS) VERSION 10.4 BASED ON MEASUREMENTS MADE IN GROUNDWATER MONITORING WELLS IN NOVEMBER 2019. ESTIMATED POTENTIOMETRIC SURFACE IS BASED ON LIMITED WELL INSTALLATIONS, AND DATA GAPS MAY ALTER THE POTENTIOMETRIC SURFACE. POTENTIOMETRIC SURFACE WAS NOT EXTRAPOLATED OUTSIDE OF THE AREAS OF MEASURED ELEVATIONS.  
7. PERFLUORO-N-OCTANOIC ACID (PFOA) CONCENTRATIONS ARE NOT SHOWN BECAUSE THERE WERE NO EXCEEDANCES OF THE PFOA GSI CRITERIA OF 12,000 NG/L.

Legend

Pore Water PFOS Sample < 12 ng/L (GSI)

Pore Water PFOS Sample > 12 ng/L (GSI)

Proposed GSI Monitoring Well Location

Groundwater Potentiometric Surface - Shallow Zone (ft) - November 2019

River or Stream

Surface Water

North Kent Study Area Outline

Roadway

Highway

Primary County Road

Other Road

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PORE WATER PFOS CONCENTRATIONS AND PROPOSED MONITORING WELL LOCATIONS  
WOLVEN NORTHWEST AREA  
GSI INVESTIGATION

GZA GeoEnvironmental, Inc.  
Engineers and Scientists  
www.gza.com

PREPARED FOR:  
WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 6A
DESIGNED BY: KHM	DRAWN BY: ADM/JMG	SCALE: 1 inch = 1,000 feet	
DATE: 4/19/2021	PROJECT NO. 16.0062961.51	REVISION NO.	

The map displays the North Kent Study Area with various monitoring wells and surface features. Key elements include:

- Monitoring Wells:**
  - WVNW-PW-1 (3 - 3.13 FT, PFOS: 7 ng/L) and WVNW-PW-1 (4 - 4.13 FT, PFOS: 9.7 ng/L) are located near the top right.
  - WVNW-PW-2 (2.33 - 2.46 FT, PFOS: 10 ng/L) and WVNW-PW-2 (3.33 - 3.46 FT, PFOS: 11 ng/L) are located near the center left.
  - WVNW-PW-3 (1.5 - 1.63 FT, PFOS: 260 ng/L) and WVNW-PW-4 (1.67 - 1.79 FT, PFOS: 100 ng/L) are located near the center right.
  - HS-PW-10 (5 - 5.13 FT, PFOS: ND) and HS-PW-11 (4.5 - 4.63 FT, PFOS: ND) are located near the bottom left.
- Proposed Monitoring Wells:** WVNW-MW-202, WVNW-MW-201, and WVNW-MW-200 are marked with green squares.
- Potentiometric Surface:** Contours are shown as dashed yellow lines with elevations ranging from 720 to 780 feet.
- Surface Water:** Represented by blue areas and lines, including a river or stream running through the center.
- Roads:** PINE ISLAND DR-NE, 11-MILE RD-NE, and 10-MILE RD-NE are shown as red lines. Other roads are shown as grey lines.
- Legend:** Located in the top right, defining symbols for wells, surfaces, water, and roads.
- Scale and Orientation:** A scale bar (0 to 2,000 feet) and a north arrow are located in the bottom right.

NOTES:  
1. LOCATIONS AND SITE FEATURES ARE APPROXIMATE.  
2. PFOS = PERFLUOROOCTANE SULFONATE  
3. NG/L = NANOGRAM PER LITER; ND = NOT DETECTED  
4. MAXIMUM CONCENTRATION FROM SAMPLING INTERVAL IS SHOWN.  
5. ABBREVIATIONS FOR MICHIGAN PART 201 GENERIC CLEANUP CRITERIA FOR RESIDENTIAL USES:  
GSI = GROUNDWATER - SURFACE WATER INTERFACE CRITERIA.  
6. ESTIMATED POTENTIOMETRIC SURFACE WAS DEVELOPED USING INTERPOLATION IN AQUAVEO GROUNDWATER MODELING SYSTEM (GMS) VERSION 10.4 BASED ON MEASUREMENTS MADE IN GROUNDWATER MONITORING WELLS IN NOVEMBER 2019. ESTIMATED POTENTIOMETRIC SURFACE IS BASED ON LIMITED WELL INSTALLATIONS, AND DATA GAPS MAY ALTER THE POTENTIOMETRIC SURFACE. POTENTIOMETRIC SURFACE WAS NOT EXTRAPOLATED OUTSIDE OF THE AREAS OF MEASURED ELEVATIONS.  
7. PERFLUORO-N-OCTANOIC ACID (PFOA) CONCENTRATIONS ARE NOT SHOWN BECAUSE THERE WERE NO EXCEEDANCES OF THE PFOA GSI CRITERIA OF 12,000 NG/L.

Legend

Pore Water PFOS Sample < 12 ng/L (GSI)

Pore Water PFOS Sample > 12 ng/L (GSI)

Monitoring Well PFOS Sample < 12 ng/L (GSI)

Piezometer PFOS Sample > 12 ng/L (GSI)

Proposed GSI Monitoring Well Location

Groundwater Potentiometric Surface - Shallow Zone (ft) - November 2019

River or Stream

Surface Water

North Kent Study Area

Roadway

Highway

Primary County Road

Other Road

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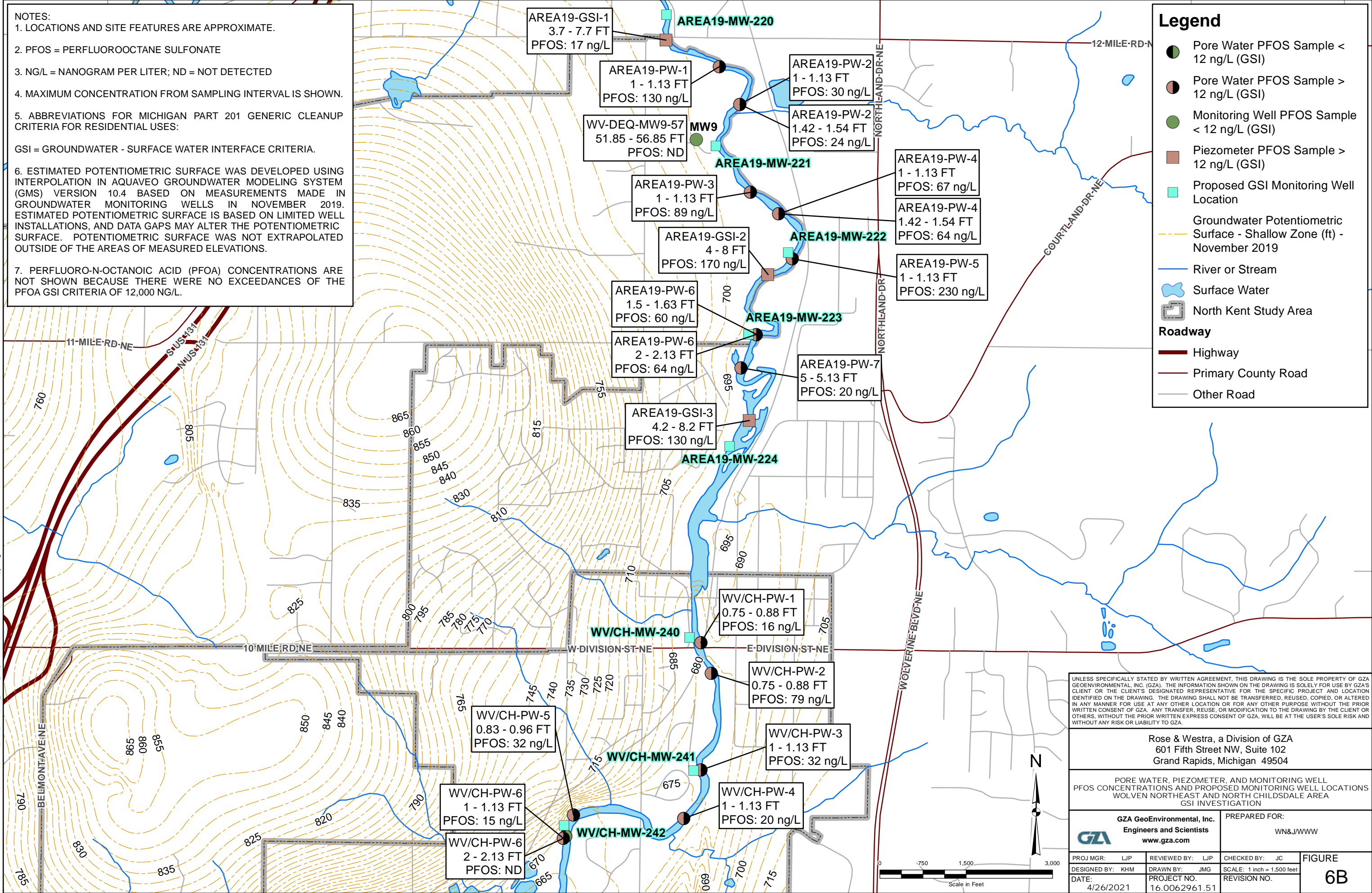
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PORE WATER, PIEZOMETER, AND MONITORING WELL  
PFOS CONCENTRATIONS AND PROPOSED MONITORING WELL LOCATIONS  
WOLVEN NORTHEAST AND NORTH CHILDSDALE AREA  
GSI INVESTIGATION

GZA GeoEnvironmental, Inc.  
Engineers and Scientists  
www.gza.com

PREPARED FOR:  
WN&J/WWW

PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 6B
DESIGNED BY: KHM	DRAWN BY: JMG	SCALE: 1 inch = 1,500 feet	
DATE: 4/26/2021	PROJECT NO. 16.0062961.51	REVISION NO.	





NOTES:  
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7. PERFLUORO-N-OCTANOIC ACID (PFOA) CONCENTRATIONS ARE NOT SHOWN BECAUSE THERE WERE NO EXCEEDANCES OF THE PFOA GSI CRITERIA OF 12,000 NG/L.

Legend

Pore Water PFOS Sample < 12 ng/L (GSI)

Pore Water PFOS Sample > 12 ng/L (GSI)

Monitoring Well PFOS Sample < 12 ng/L (GSI)

Monitoring Well PFOS Sample > 12 ng/L (GSI)

Proposed GSI Monitoring Well Location

Groundwater Potentiometric Surface - Shallow Zone (ft) - November 2019

River or Stream

Surface Water

Roadway

Highway

Primary County Road

Other Road

The map displays the locations of monitoring wells and the estimated potentiometric surface for PFOS in the shallow zone as of November 2019. The wells are categorized by their PFOS concentrations relative to the GSI criteria of 12 ng/L. The map also shows the locations of proposed GSI monitoring wells. The potentiometric surface is shown as a dashed yellow line. The map includes a legend, notes, and a title block.

Well ID	Sampling Interval (FT)	PFOS Concentration (ng/L)
HS-MW-19S	58.4 - 61.4	ND
HS-MW-19D	85.9 - 95.9	ND
HS-PW-1	2 - 2.13	0
HS-PW-1	2.5 - 2.63	0
HS-PW-2.5	0.5 - 0.63	820
HS-PW-2.5	1 - 1.13	560
HS-PW-2	1 - 1.125	5.2
HS-PW-3.5	0.83 - 0.96	92
HS-PW-3R	0.5 - 0.63	900
HS-PW-3	1.33 - 1.46	1,100
HS-PW-4	0.75 - 0.88	13
HS-PW-5	1.33 - 1.46	30
HS-PW-6	1 - 1.13	4.6
HS-PW-7	1.5 - 1.63	8.9
HS-PW-8	1 - 1.13	26
HS-PW-9	1 - 1.13	8.2
HS-MW-29A	3.5 - 13.5	290
HS-MW-260	-	-
HS-MW-261	-	-
HS-MW-262	-	-
HS-MW-263	-	-
HS-MW-264	-	-
HS-MW-265	-	-

Legend:

- Pore Water PFOS Sample < 12 ng/L (GSI)
- Pore Water PFOS Sample > 12 ng/L (GSI)
- Monitoring Well PFOS Sample < 12 ng/L (GSI)
- Monitoring Well PFOS Sample > 12 ng/L (GSI)
- Proposed GSI Monitoring Well Location
- Groundwater Potentiometric Surface - Shallow Zone (ft) - November 2019
- River or Stream
- Surface Water
- Roadway
  - Highway
  - Primary County Road
  - Other Road

Notes:

- LOCATIONS AND SITE FEATURES ARE APPROXIMATE.
- PFOS = PERFLUOROOCTANE SULFONATE
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- PERFLUORO-N-OCTANOIC ACID (PFOA) CONCENTRATIONS ARE NOT SHOWN BECAUSE THERE WERE NO EXCEEDANCES OF THE PFOA GSI CRITERIA OF 12,000 NG/L.

Scale: 1 inch = 1,250 feet

Scale in Feet: 0, 625, 1,250, 2,500

North Arrow: N

Map Labels: JUPITER-AVE-NE, BELMONT-AVE-NE, ROGUE-RIVER-RD-NE, W-RIVER-DR-NE, NORTHLAND-DRIVE

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PORE WATER AND MONITORING WELL PFOS CONCENTRATIONS AND  
PROPOSED MONITORING WELL LOCATIONS  
HSP SOUTH/SOUTHEAST  
GSI INVESTIGATION

GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		PREPARED FOR: WN&J/WWW	
PROJ MGR: LJP	REVIEWED BY: LJP	CHECKED BY: JC	FIGURE 6C
DESIGNED BY: KHM	DRAWN BY: ADM/JMG	SCALE: 1 inch = 1,250 feet	
DATE: 4/26/2021	PROJECT NO. 16.0062961.51	REVISION NO.	

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## **APPENDIX A**

### **GENERAL PIEZOMETER CONSTRUCTION DETAIL**

# General Piezometer Construction Detail



GZA  
GeoEnvironmental, Inc.  
Engineers and Scientists

Elevation/Depth

See Table 1 /

Top of Well  
Screen Casing

See Table 1 / (0.0 FT)

Top of Well  
Screen Casing

Grout/  
Backfill

N/A

Bentonite  
Seal

6-12"

Screen 4'

Filter  
Pack

See Table 1

Total  
Boring  
Depth

## MONITORING WELL DETAILS

Wellscreen Dia: 1.25" Type: Steel

Slot Size: 80 gauze Well Screen Length: 4'

Well Riser Dia: 1.25" Type: Galvanized

Pipe Connections: Couplings Well Riser Length: Varies

Filter Sand Type: #1 Sand Other: \_\_\_\_\_

Protective Casing (Circle): YES ☒ NO

Locked Cap (Circle): YES ☒ NO Lock No: \_\_\_\_\_

## DESCRIPTION OF MATERIAL BEING MONITORED

Groundwater Flow to Rogue & Grand Rivers



GZA GeoEnvironmental, Inc.