

Project name:
Camp Grayling – Lake Margrethe

Project ref:
60563409

From:
Lauren McNeely, AECOM

Date:
April 22, 2019

To:
Mr. Randy Rothe
Department of Environmental Quality
Remediation and Redevelopment Division
2100 West M-32
Gaylord, MI, 49735

CC:
John Cuthbertson, AECOM
Mike Wolf, AECOM

Memo

Subject: Camp Grayling – Lake Margrethe PFAS Remedial Investigation

1. Introduction

AECOM has prepared this Technical Memorandum (TM) to present the results of the Remedial Investigation (RI) performed at the Camp Grayling – Lake Margrethe PFAS Site. The RI Investigation Area is located near the southeast corner of Lake Margrethe, near Camp Grayling, in Grayling, Michigan (**Figure 1**).

AECOM understands that the Michigan Department of Environmental Quality (MDEQ) is the regulatory authority in charge of protection of human health and the environment with regard to contamination present in and migrating from the Investigation Area. The MDEQ requested AECOM perform an RI to delineate the degree and extent of Per- and Polyfluoroalkyl Substances (PFAS) contamination potentially present in groundwater within the Investigation Area. This TM summarizes the findings of the Phase I RI completed in November, 2018.

2. Project Background

As a result of high concentrations of PFAS detected in foam samples collected from Lake Margrethe in Grayling, Michigan, the MDEQ requested AECOM collect residential drinking water samples around Lake Margrethe. Lake Margrethe is located approximately 3.7 miles southwest of the Grayling Army Airfield, where the South Post of Camp Grayling facilities are located. The South Post contains support facilities including barracks, range control, officers club, Post Exchange, parade grounds, athletic fields, and administrative buildings. Recreational areas and residential properties are also present along the shore of Lake Margrethe. Fire training areas and other locations where PFAS-containing, aqueous film forming foam (AFFF) was potentially released have been identified at the South Post. Additionally, a private residence, located north of the South Post facility boundary, had caught fire and foam was reportedly used to extinguish the fire. However, the type of foam (Class A or AFFF), the concentration used, and the date of the fire, are not known.

A total of 447 residential drinking water samples were collected from around Lake Margrethe during 2018 and analyzed for PFAS using USEPA Method 537 Rev 1.1. Of the 447 samples analyzed, 384 samples did not contain detections of PFAS. Sixty-one samples had detections of combined Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonic Acid (PFOS) that were below the Part 201 Residential Drinking Water Criterion of 70

nanograms per liter (ng/L). Two samples contained concentrations that exceeded the Part 201 Residential Drinking Water Criterion. These two residences are located on the southeast side of Lake Margrethe, directly north of the base boundary. Based on these results, the MDEQ requested AECOM to conduct a remedial investigation to delineate PFAS in groundwater to assist in understanding the potential risk to human health and the environment.

This TM presents the results of the RI which included installation of nested groundwater monitoring wells, collection of groundwater samples, installation of a staff gauge, and collection of groundwater, surface water, and pore water samples.

3. Field Investigation

The RI included the installation of multilevel, nested groundwater monitoring wells at five (5) locations on the southeast side of Lake Margrethe, north of the Camp Grayling base boundary. Monitoring well locations are shown on **Figure 2**. The monitoring well locations were based on analytical results from residential drinking water samples and residential drinking well records.

All monitoring wells were located on private property and required MDEQ access agreements from property owners.

The RI investigation also included the installation of a staff gauge on the southeast corner of Lake Margrethe, near the property with the residential well PFAS exceedance. The staff gauge location is shown on **Figure 2**.

3.1 Monitoring Well Installation and Development

Borings at each location were drilled with a Geoprobe® Rotosonic/continuous core drill rig, owned and operated by Mateco Drilling Company. Soils were continuously logged by AECOM personnel using Environmental Sequence Stratigraphy, including lithology, grain-size, sorting, moisture, and color. Sample descriptions and monitoring well construction information were documented on boring-specific, field log sheets. Boreholes were terminated after encountering three feet of clay to avoid penetrating the competent clay layer.

Photographs of soil cores and the finished wells are provided in **Appendix A**. Soil boring logs are included in **Appendix B**. Soil samples were not collected for laboratory analyses as part of this scope of work.

Three, two-inch diameter wells were installed at four locations (CG-MW001, CG-MW002, CG-MW004, and CG-MW005) and two wells were installed at a fifth location (CG-MW003). All of the monitoring wells at each location were installed within a single borehole. In general, the wells were screened across the water table, directly above the clay and a medium depth between the shallow and deep wells. The two wells at location CG-MW003 were installed across the water table and directly above the clay. **Table 1** provides the screen interval for each of the monitoring wells.

The annular space was filled with sand pack to a minimum of 2-ft below and 1-ft above each of the well screens and sealed with hydrated bentonite chips between the well screens. The shallow wells were completed with sand pack to the surface. All monitoring wells were completed at-grade (flush mount) with a steel cover and a 2-ft by 2-ft concrete pad and sealed with a j-plug type cap.

The monitoring wells were developed no sooner than 24 hours post installation by pumping and surging using a submersible pump. The pump intake was periodically raised and lowered to develop the entire portion of the submerged screen. Water quality parameters were monitored during development and recorded at periodic intervals. Monitoring wells were considered adequately developed when the following conditions were met:

1. Water quality parameters stabilized;
2. An appropriate volume of water was removed (approximately 5 well volumes or amount equal to volume of water used during installation, whichever was greater); and
3. Water pumped from the monitoring well was relatively clear).

A copy of the development forms are provided in **Appendix C**. Monitoring well development water was containerized in Department of Transportation - approved 55-gallon drums and moved to a centralized storage area prior to characterization and disposal.

3.2 Staff Gauge Installation

A steel post was driven into the bottom of Lake Margrethe near the shore at █████ Borchers Way. The top of the post was surveyed and an electronic measuring tape was used to measure the distance to surface water to determine the elevation of Lake Margrethe. The staff gauge location is shown on **Figure 2**.

3.3 Groundwater Sampling

Following monitoring well development one round of groundwater sampling was conducted. The sampling event took place at least 48 hours after monitoring well development. Prior to sampling, static water levels were measured in all wells to determine the groundwater potentiometric surface (**Table 1**). Wells were sampled using MDEQ-approved, low-flow, groundwater sampling techniques. Water quality parameters (i.e., pH, temperature, specific conductance, oxidation reduction potential [ORP], turbidity and dissolved oxygen [DO]) were monitored and recorded approximately every 5 minutes during purging. Groundwater samples were collected after water quality parameters stabilized for three consecutive readings. Stabilization parameters were as follows: depth to water drawdown <0.33 feet, pH +/-0.1, Conductivity +/- 3%, Turbidity +/- 10%, DO +/- 10%, Temperature +/- 5%, and ORP +/- 10mV. If water quality parameters did not stabilize after ten readings, the well was sampled and this deviation was documented on the groundwater sample record sheet. Groundwater Sampling Forms are included in **Appendix C**. **Table 2** presents the final water quality read prior to sampling each monitoring well.

Samples were collected in certified PFAS-free sample containers (provided by the laboratory), labeled, transferred to a cooler on ice, and submitted to the laboratory under chain-of-custody documentation for analysis. Sample collection and handling followed procedures outlined in MDEQ PFAS Sampling Guidance documents. The groundwater samples were analyzed for PFAS by Vista Analytical Laboratory (Vista) of El Dorado Hills, California using isotope dilution.

One duplicate sample was collected for every 20 ground water samples collected as part of the overall Camp Graying project. Field and equipment blanks were also collected at a rate of one per every 20 samples;

All non-dedicated equipment that came into contact with soil was decontaminated with a Liquinox-deionized water mixture. Field personnel performing the collection procedures donned a new pair of gloves prior to handling any sampling equipment, between sampling and decontamination procedures, and between sampling locations.

3.4 Surface Water/Pore Water Sampling

The MDEQ Geological Services Unit (GSU) performed pore water sampling at 9 locations and surface water sampling at 5 of those 9 locations. If a surface water sample was collect at a given location it was co-located with the corresponding pore water sample. The pore water and surface water sampling locations are shown on **Figure 3**. Note that only surface water location SW-02 and pore water locations PW-01, PW-02, PW-03, and PW-09Anom are within the investigation area.

Surface water samples were collected by gently submerging the sample bottle in the surface water and allowing the water to fill the container. Care was taken to not include floating debris. Pore water samples were collected by installing a Henry Sampler® in the sediment and purging the pore water using the low-flow sampling technique.

The pore water and surface water samples were analyzed for PFAS by Vista using isotope dilution methods.

3.5 Investigation Derived Waste

Investigation Derived Waste generated during the investigation included the following:

- Disposable material such as soil core liners, personal protective equipment (PPE), plastic sheeting, etc.
- Drill cuttings
- Well development water
- Purge water
- Decontamination water

Minimally-contaminated disposable sampling materials and PPE were containerized and disposed of as ordinary solid waste. Drill cuttings, excess soil from sampling, well development water, purge water, and decontamination water were containerized in 55-gallon drums and transported by Clean Harbors to a licensed facility for disposal. The waste disposal manifest is included in **Appendix D**.

3.6 Deviations from Scope of Work

The following deviations from the original scope of work occurred during the course of the project:

- Three of the monitoring well locations were adjusted due to private property owners denying access.
- An intermediate well screen was not installed in CG-MW003 due to the competent clay layer being much shallower than other monitoring well locations.
- The surface and pore water samples were collected by the MDEQ GSU instead of AECOM.

No deviations to the scope of work affected the investigation objectives.

4. Environmental Setting

4.1 Geology

The regional, surficial geology of the Investigation area consists of glacial outwash sand and gravel with postglacial alluvium. The glacial outwash sands and gravels are underlain by glacial lacustrine deposits of primarily clay in the Investigation area. Boring logs from residential wells and RI monitoring wells generally indicate fine to medium-grained, shallow sand underlain by clay. Geologic cross-sections created using boring logs from this investigation and residential well records are presented in **Figures 4** through **7**. The clay layer encountered during the RI ranged in depth between 30-feet and 45-feet below ground surface (bgs). All borings completed during this investigation stopped within the first three feet of this clay layer; however, the geologic log from the residential well installed at [REDACTED] Borchers Way (which was installed below the bottom of the clay) indicated the clay was approximately 95-feet thick.

4.2 Surface Water Hydrology

Lake Margrethe is located adjacent to the investigation area. The lake is a large kettle lake, formed by an ice block buried in sandy, glacial outwash over clay lacustrine deposits. The lake level is set by a 1973 court order and is controlled by a lake level control structure operated seasonally by the Lake Margrethe Property Owners Association. The Lake Margrethe lake level control structure is shown on **Figure 8**. During winter months, the structure is opened and the level of the lake is dropped to prevent ice damage to the shoreline.

5. Hydrogeology

Locally, groundwater flows into Lake Margrethe from the southwest, southeast, and northeast; on the northwest side of the lake groundwater flows to the west with the lake discharge (**Figure 8**). Within the investigation area there are two distinct aquifers. The shallow phreatic aquifer flows from the east to west towards Lake Margrethe at an average horizontal gradient of approximately 0.01 feet/feet (ft/ft) (**Figure 9**). The deeper aquifer is locally under artesian conditions. Only one residential well installed in the investigation area is completed below the clay aquitard, so groundwater flow-direction is unknown but expected to be similar to the shallow aquifer, toward Lake Margrethe.

6. Monitoring Well Sampling Results

Groundwater analytical results ranged from below detection limits for all 24 PFAS analytes (CG-MW0005-25.0 and CG-MW0005-43.0) to a maximum of 432 ng/L total PFAS in CG-MW0001-20.0. The analytical results are described in further detail below and are summarized in **Table 3**. Laboratory analytical reports are included as **Appendix E**.

Total PFAS concentrations detected in the monitoring well samples are summarized below:

- CG-MW001-12.0 (181.9 ng/L)
- CG-MW001-20.0 (432.1 ng/L)
- CG-MW001-40.0 (119.4 ng/L)
- CG-MW002-14.0 (302.6 ng/L)
- CG-MW002-25.0 (141.5 ng/L)
- CG-MW002-35.0 (112.8 ng/L)
- CG-MW003-14.0 (26.7 ng/L)
- CG-MW003-32.0 (3.9 ng/L)
- CG-MW004-14.0 (314.9 ng/L)
- CG-MW004-30.0 (268.1 ng/L)
- CG-MW004-40.0 (49.3 ng/L)
- CG-MW005-12.0 (7.5 ng/L)

No criterion exists for Total PFAS.

PFOA + PFOS exceeded the Part 201 Drinking Water Criterion of 70 ng/L in the following locations:

- CG-MW001-20.0 (134.3 ng/L)
- CG-MW002-14.0 (119.8 ng/L)
- CG-MW004-14.0 (104.4 ng/L)

The extent of PFAS impact is defined to the east by CG-MW0005 and CG-MW0003 as shown in **Figure 10**. Total PFAS concentrations decrease with depth at locations CG-MW0002 and CG-MW0004; however, the maximum PFAS concentration is detected in the intermediate well screen at CG-MW0001. **Figures 11** through **14** superimpose the PFAS concentrations on the geologic cross sections.

The Part 201 Residential Drinking Water Criterion for PFOS + PFOA is exceeded at locations CG-MW0001, CG-MW0002, and CG-MW0004. The Criterion is exceeded in the shallow well screen interval at CG-MW0002 and CG-MW0004, and the intermediate well screen interval at CG-MW0001.

Perfluorohexanesulfonic acid (PFHxS) is the primary contributor to Total PFAS in the Study Area. PFHxS is found in AFFF and is commonly detected both in and downgradient of areas where AFFF has been historically applied.

Based on the vertical distribution of the PFAS data, the shallow Criterion exceedances suggest that the PFAS source is in close proximity to the monitoring wells. However, the well interval with the maximum concentration, CG-MW0001, is located at depth within a gravel layer (**Figure 11**). In addition, the monitoring well locations are located upgradient of the residential wells (**Figure 9**), including the residence that potentially had AFFF used to extinguish a house fire.

7. Surface Water/Pore Water Sampling Results

The surface water data ranges from 13 ng/L total PFAS in SW-04 to a maximum of 420 ng/L in SW-02 (**Table 4** and **Figure 15**). The pore water data ranges from non-detect total PFAS in PW-01, PW-04, PW-06, and PW-07 to a maximum of 500 ng/L in PW-03.

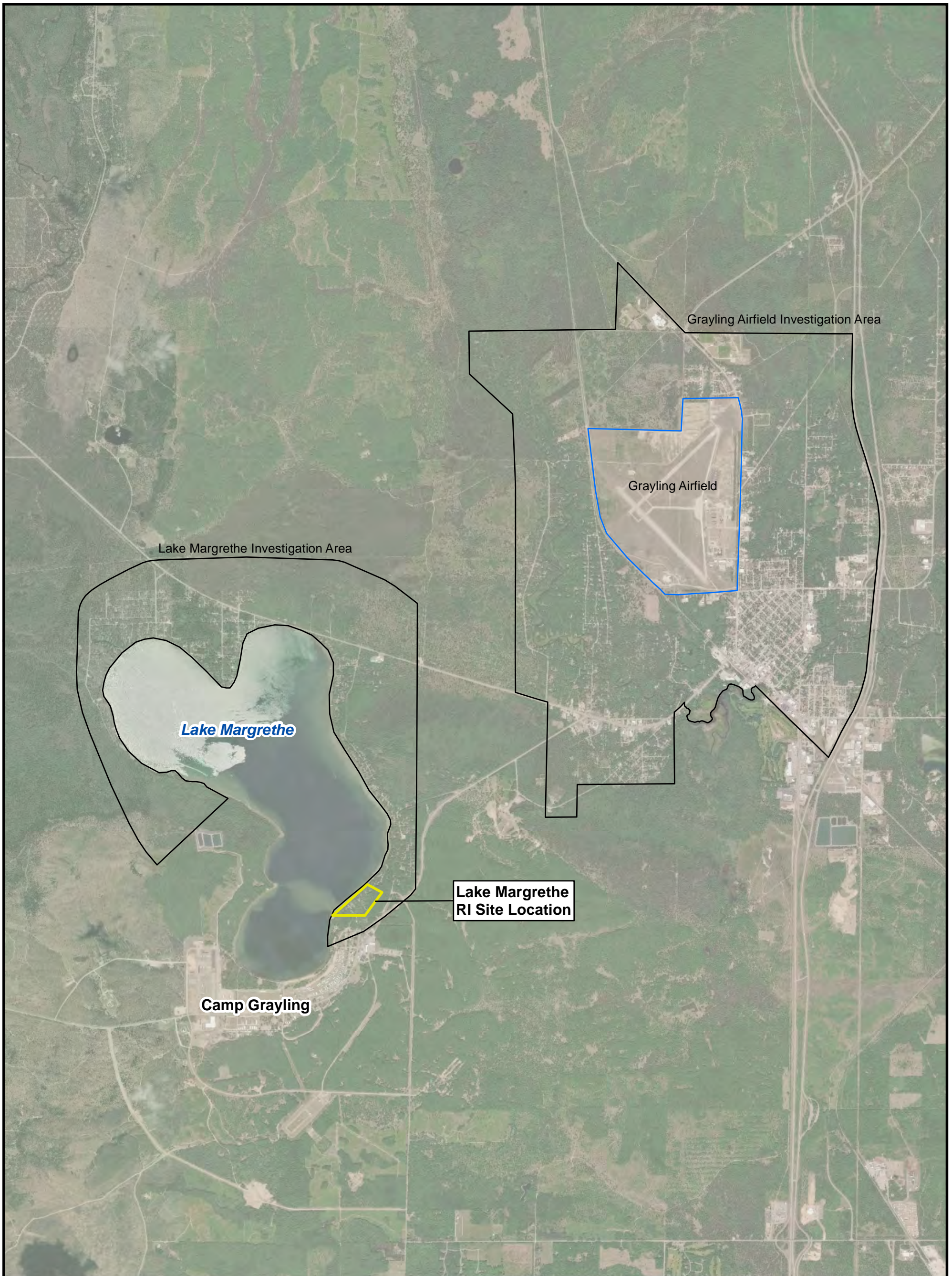
The Part 201 Groundwater Surface Water Interface (GSI) Criterion for PFOS (12 ng/L) is exceeded at SW-02 and PW-03. The extent of PFAS impact based on the surface water and pore water data corroborates well the groundwater data from the residential and monitoring wells.

8. Conclusions and Recommendations

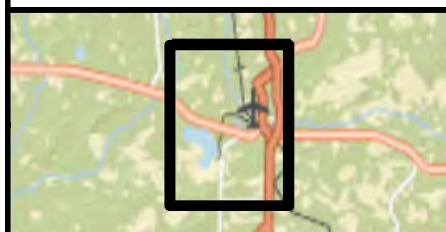
The combination of monitoring well, residential groundwater, pore water, and surface water data collected to date appear to have defined the general extent of PFAS impact to groundwater within the RI investigation area in the east and west directions. However, the upgradient (southern) extent of groundwater impact has not been defined based on PFAS and PFOS concentrations that exceed Part 201 Residential Drinking Water Criterion in monitoring wells CG-MW001 and CG-MW002. The maximum PFAS and PFOS concentrations detected in the intermediate well screen interval in monitoring well CG-MW001 suggests that an upgradient source is possible. The northern extent of groundwater impact has not been defined based on PFAS and PFOS concentrations detected in CG-MW004.

Further investigation of this area is recommended, including the installation of additional monitoring wells to the south and north of the initial investigation area, and quarterly sampling of existing groundwater monitoring wells and select residential wells. This additional work will more accurately delineate the extent of PFAS in the groundwater, determine if there is seasonal variation in PFAS groundwater concentrations, identify additional potential source areas to the south, and determine the presence and orientation of a potential preferential pathway.

Figures



- Legend**
- Lake Margrethe RI Site Location
 - Grayling Airfield Boundary
 - Investigation Areas



Prepared: 4/1/2019

0 0.5 1 2 Miles



FIGURE 1
RI SITE OVERVIEW
CAMP GRAYLING - LAKE MARGRETHE
PFAS SITE
CRAWFORD COUNTY, MICHIGAN



Legend



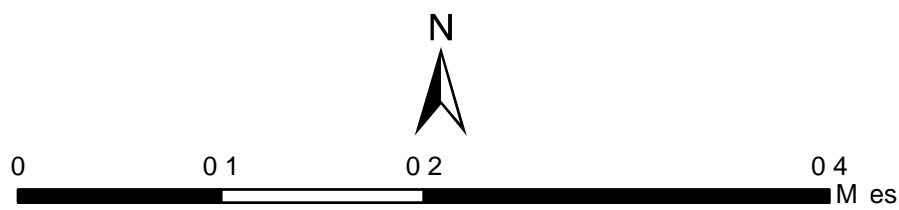
-  Phase II Monitoring Well Locations
-  Staff Gauge Location

FIGURE 2
PHASE II MONITORING WELL &
STAFF GAUGE LOCATIONS

CAMP GRAYLING - LAKE MARGRETHE
PFAS SITE
CRAWFORD COUNTY, MICHIGAN





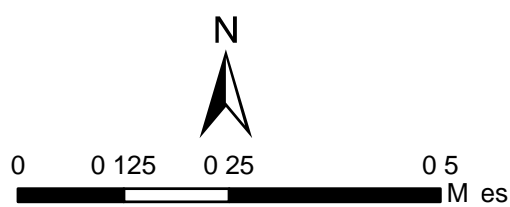
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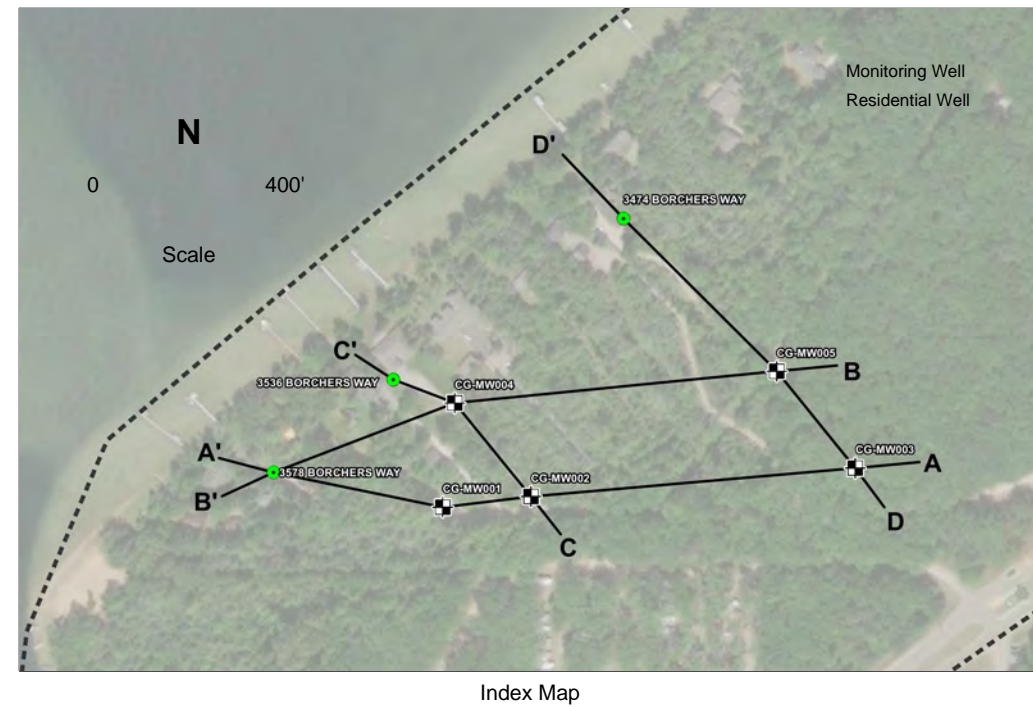
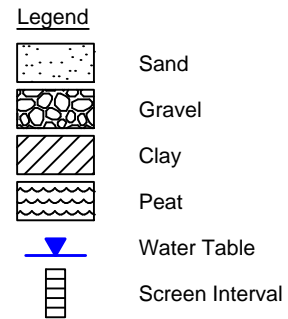
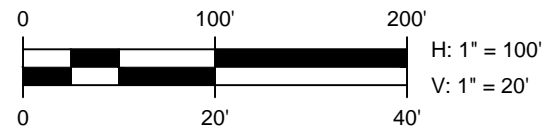
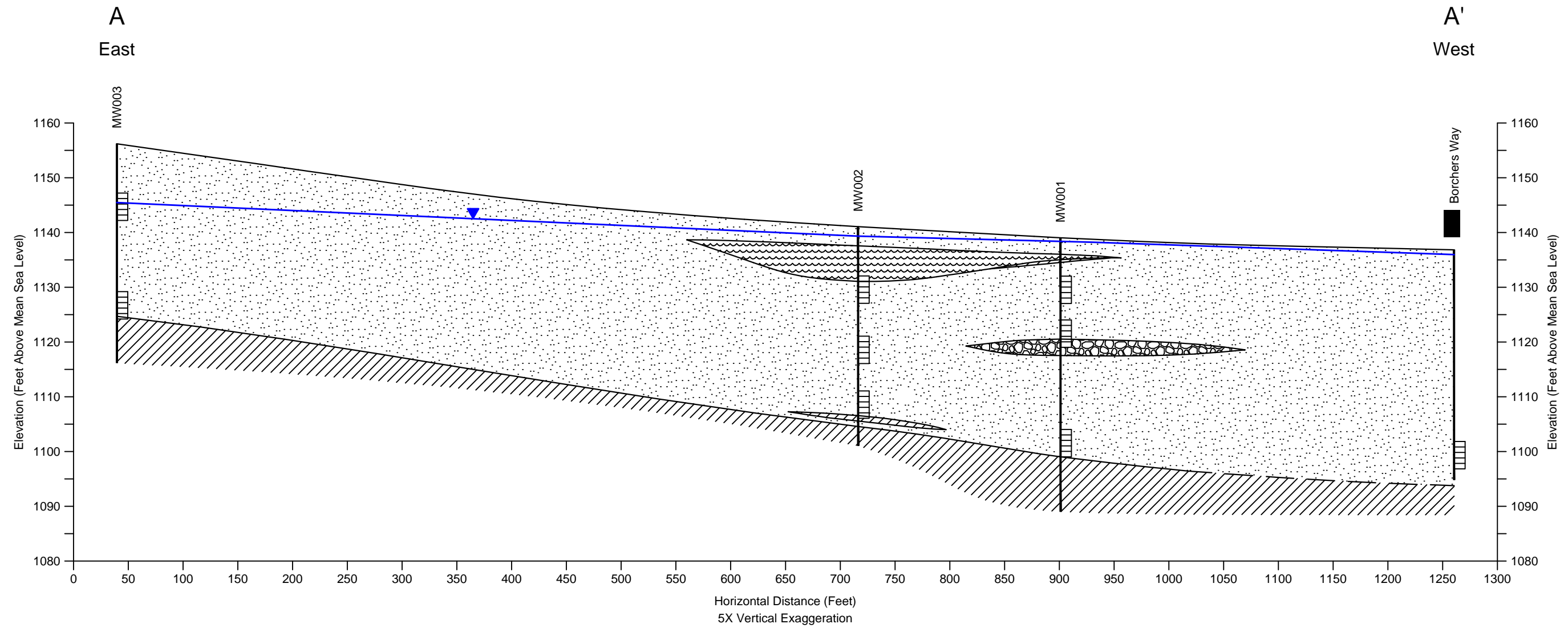
- Pore Water Sample Location
- ▲ Surface Water Sample Location
- Lake Margrethe Initial Sampling Area

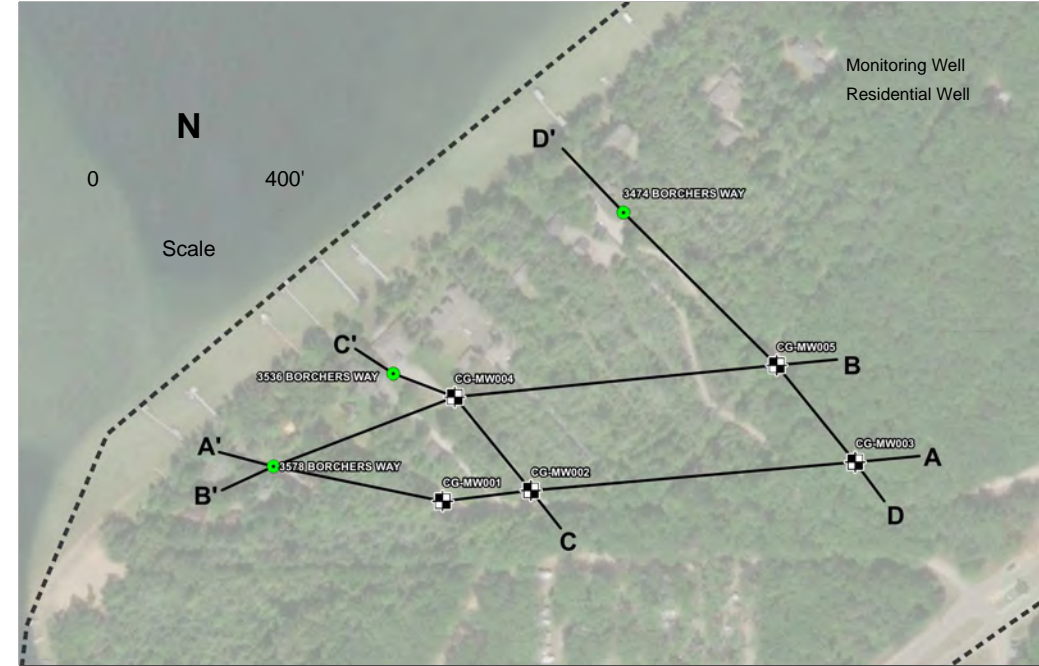
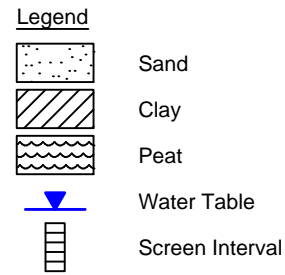
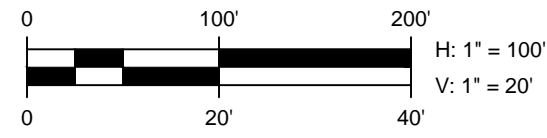
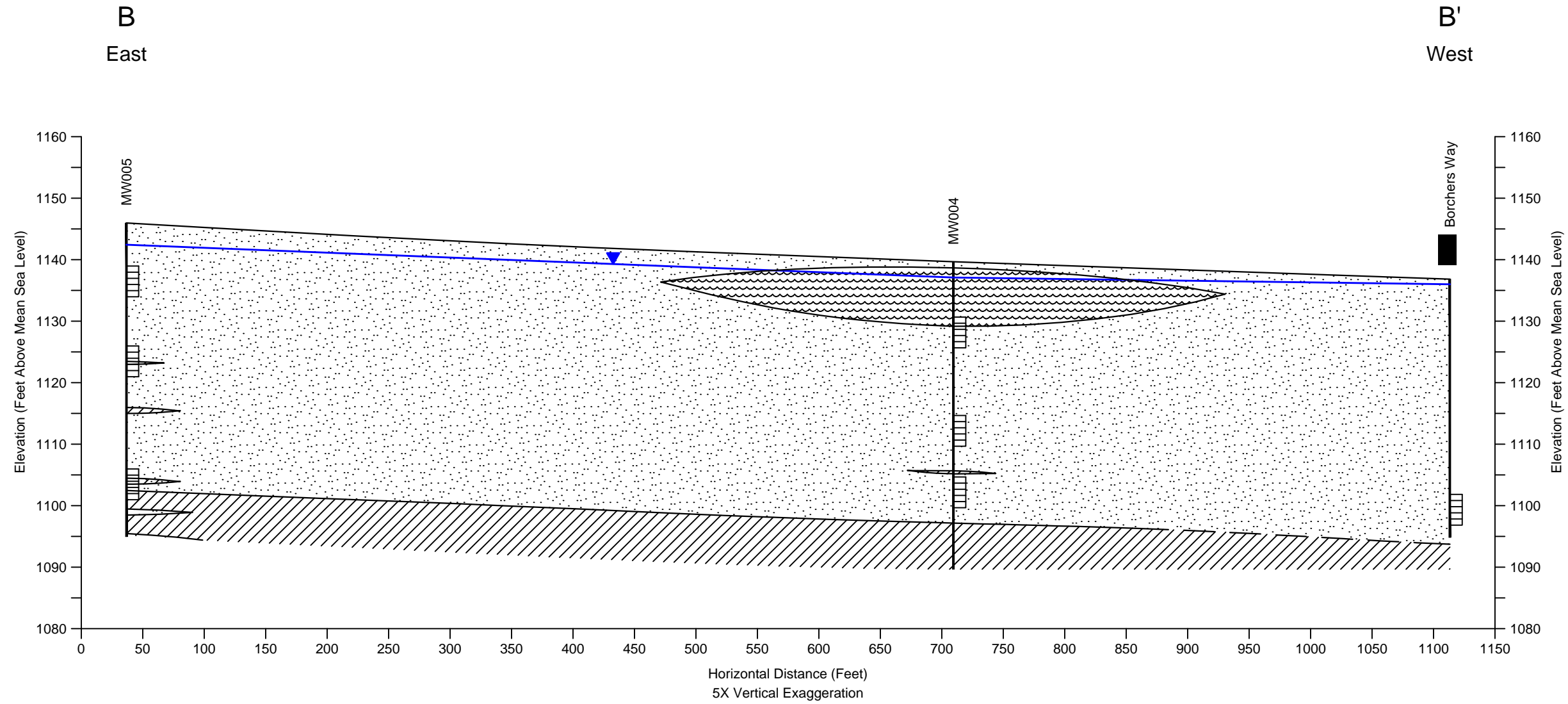
FIGURE 3
 DEQ-RDD-GSU PORE WATER &
 SURFACE WATER SAMPLES
 OCTOBER 8 TO 10, 2018
 CAMP GRAYLING - LAKE MARGRETHE
 PFAS SITE
 CRAWFORD COUNTY, MICHIGAN

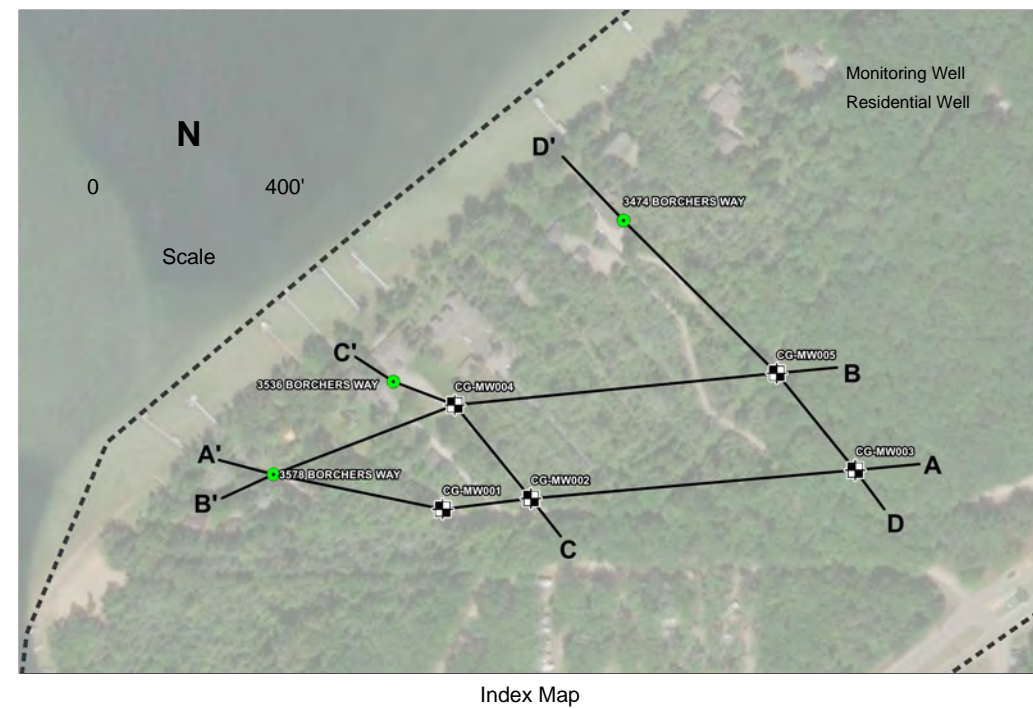
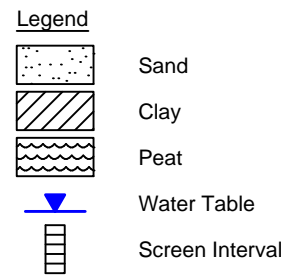
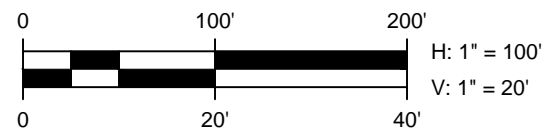
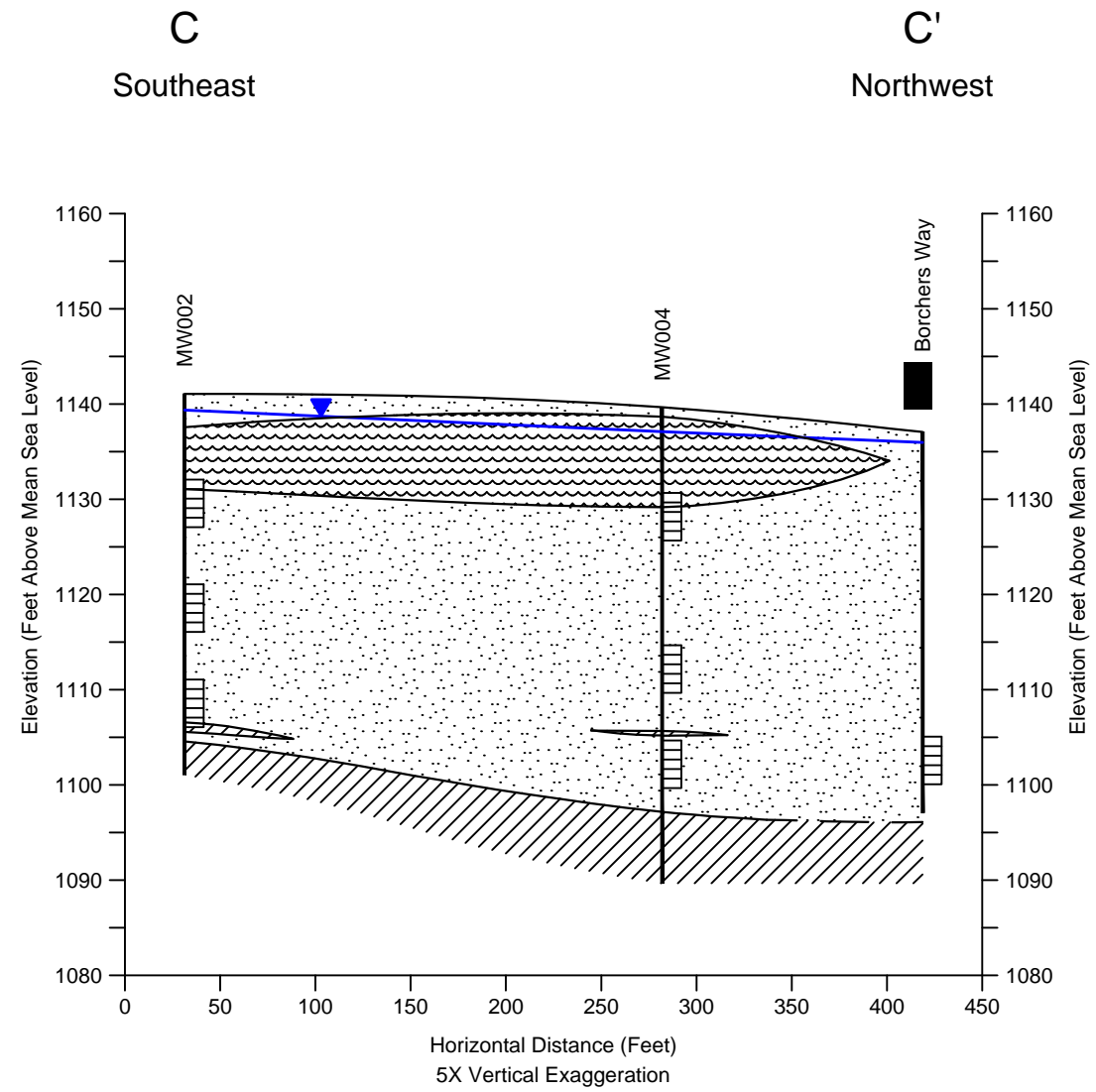


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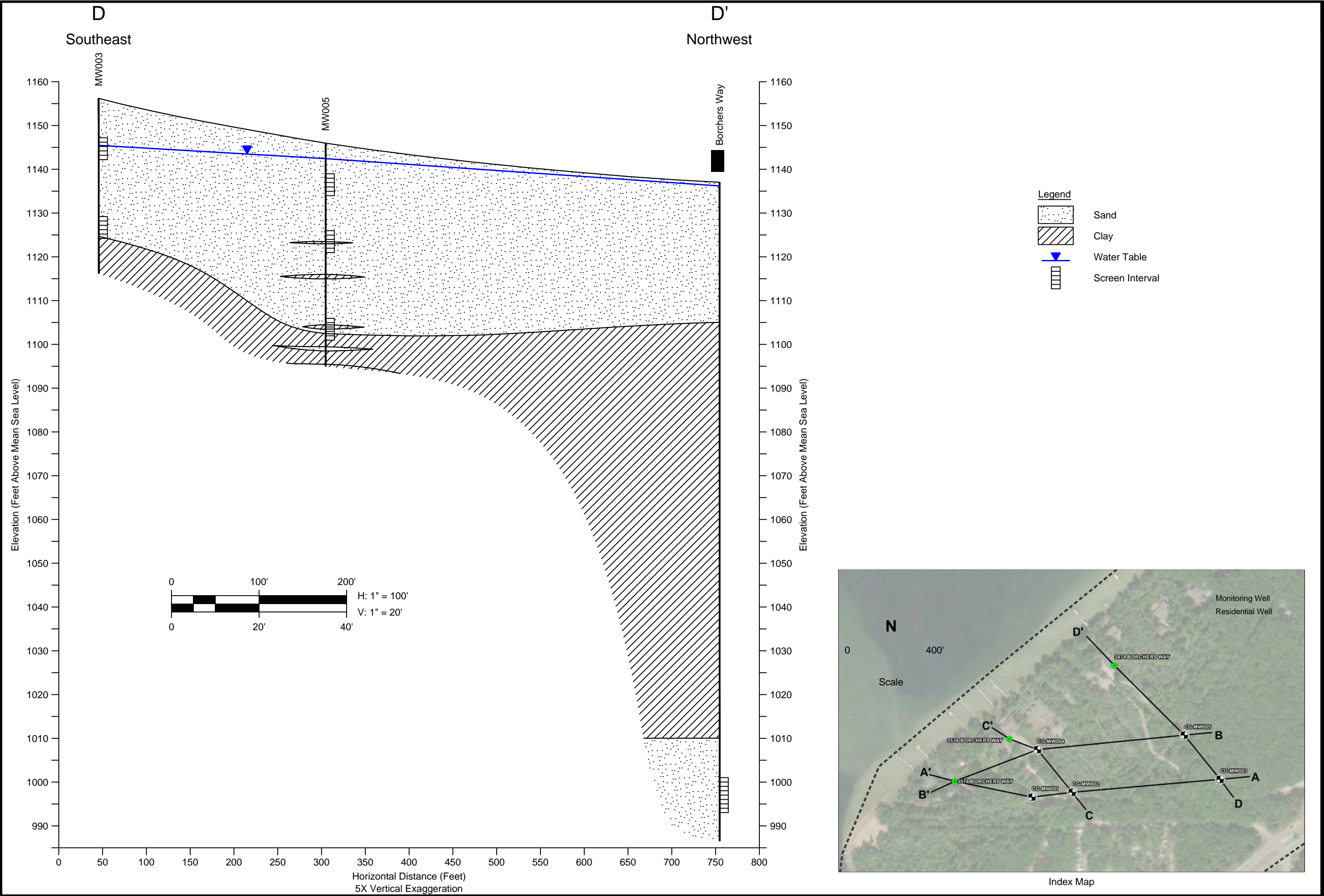








Index Map





Legend

- Lake Margrethe RI Site Location
- Lake Margrethe Control Structure
- Shallow Groundwater Elevation (ft above mean sea level)
- Portage Creek
- ➔ Groundwater Flow Direction



DRAFT

Prepared: 4/22/2019

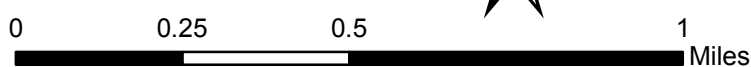








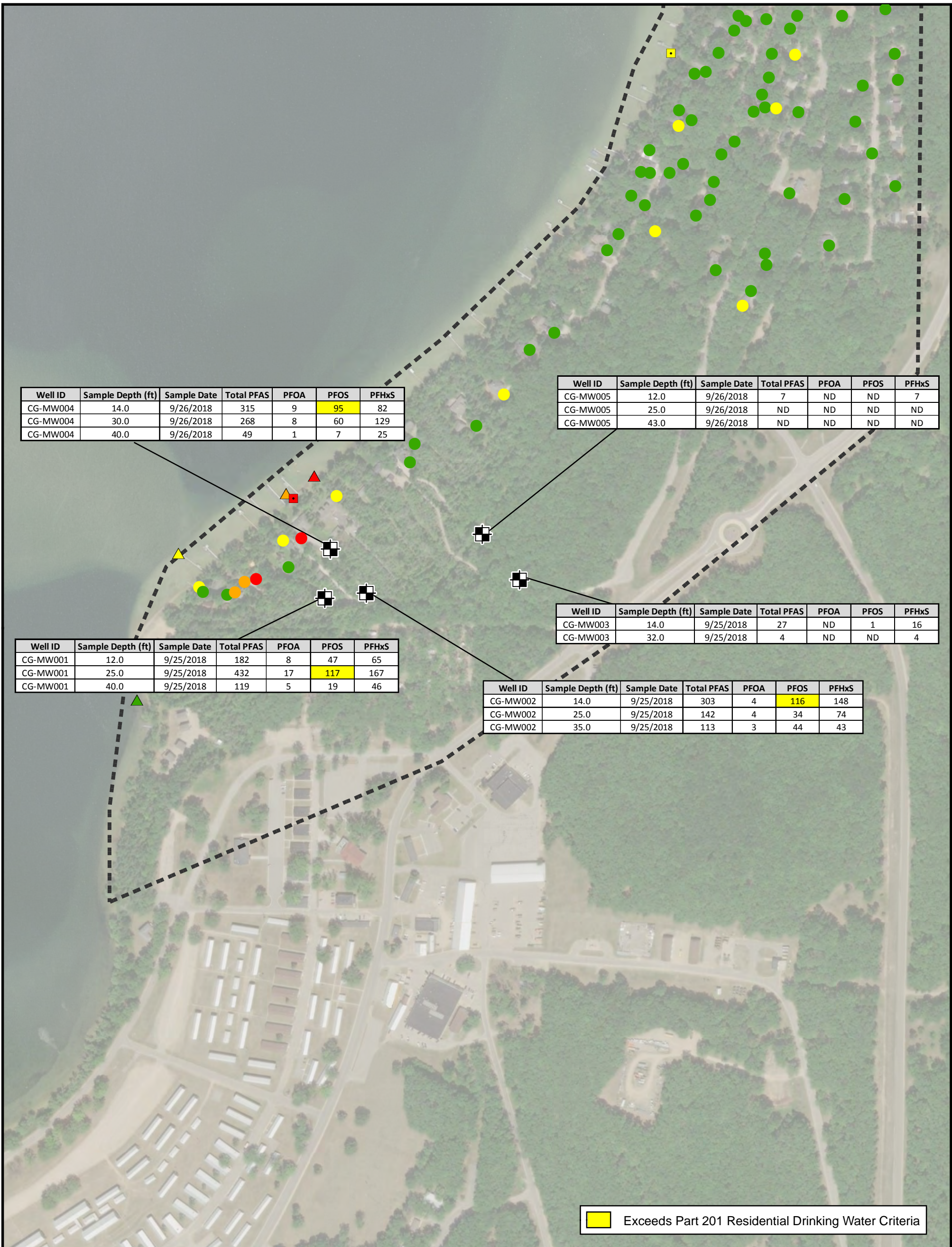


FIGURE 8
REGIONAL GROUNDWATER ELEVATION
CAMP GRAYLING - LAKE MARGRETHE
PFAS SITE
CRAWFORD COUNTY, MICHIGAN



	<p>Map Location</p> 	<p>Legend</p> <p>TYPE</p> <ul style="list-style-type: none">  Monitoring Well  Staff Gauge  October 2018 Groundwater Contours (2' interval) <p> Groundwater Flow Direction</p> <p> Well ID</p> <p> Groundwater Elevation (ft-AMSL)</p> <p><small>AMSL - Above Mean Sea Level</small></p> <p>0 0.05 0.1 Miles</p> <p style="text-align: right;">N</p>	<p style="text-align: center;">FIGURE 9 RI BORINGS GROUNDWATER ELEVATION</p> <p style="text-align: center;">CAMP GRAYLING - LAKE MARGRETHE PFAS SITE CRAWFORD COUNTY, MICHIGAN</p>
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Legend
Sample Results (PFOA + PFOS ppt)

- Non-Detect
- <10 (9)
- 10 - <70
- > 70

- Residential Sample
- ◻ Surface Water Sample
- △ Pore Water Sample
- ⊠ Monitoring Well Sample
- ◻ Lake Margrethe Initial Sampling Area

FIGURE 10
REMEDIAL INVESTIGATION
SAMPLING RESULTS

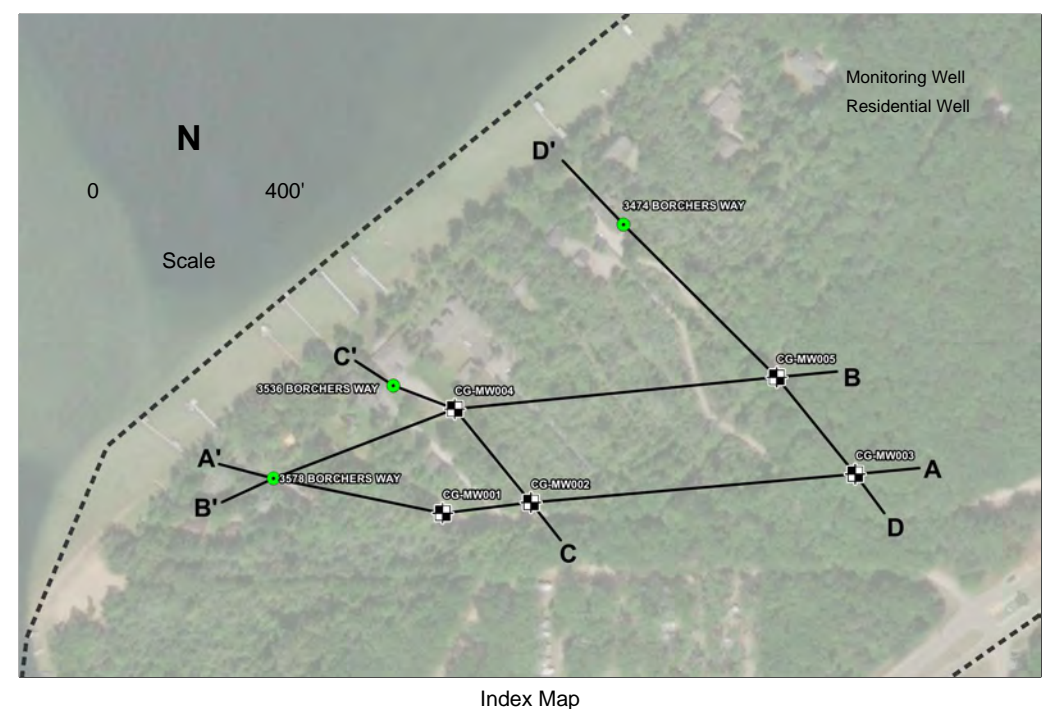
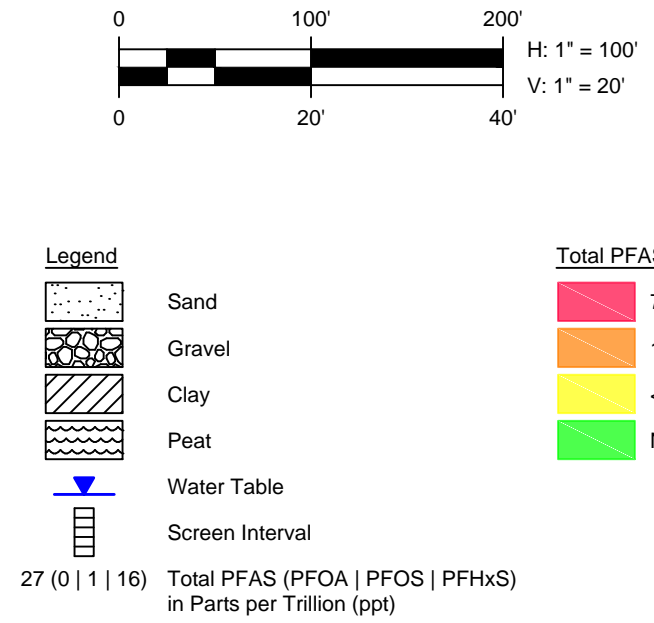
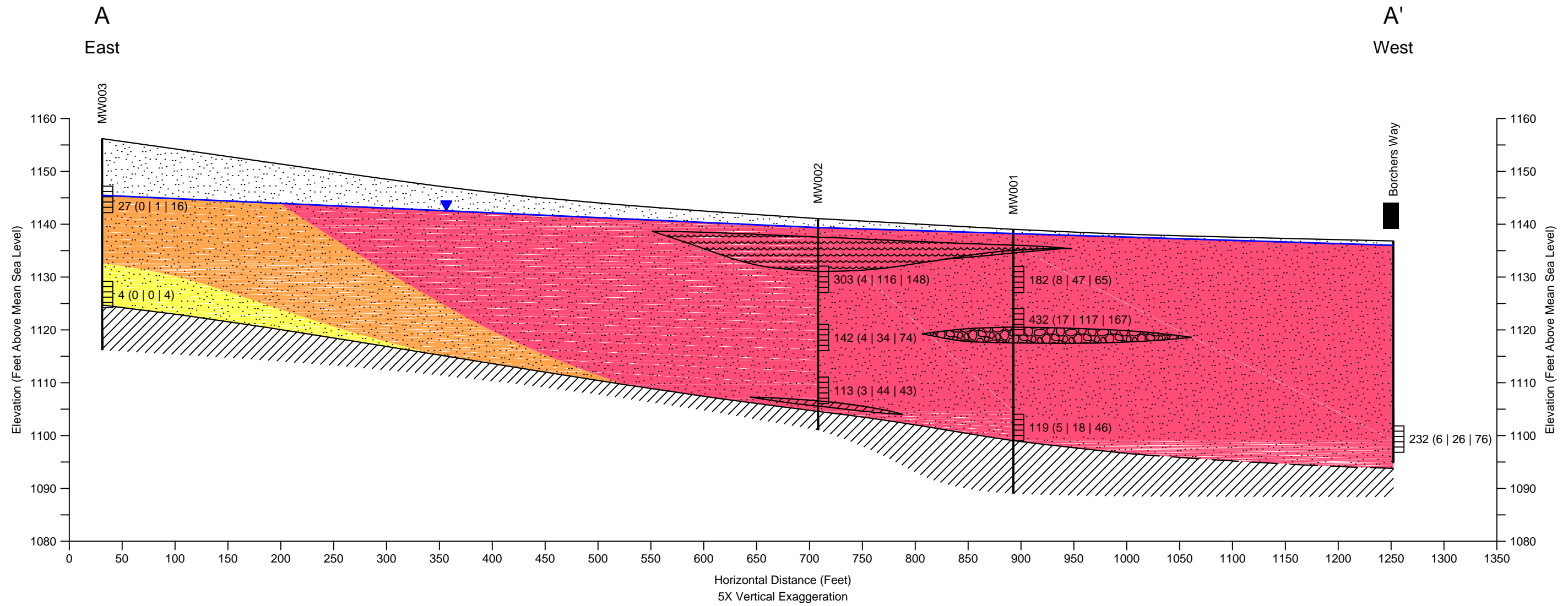
CAMP GRAYLING - LAKE MARGRETHE
PFAS SITE
CRAWFORD COUNTY, MICHIGAN

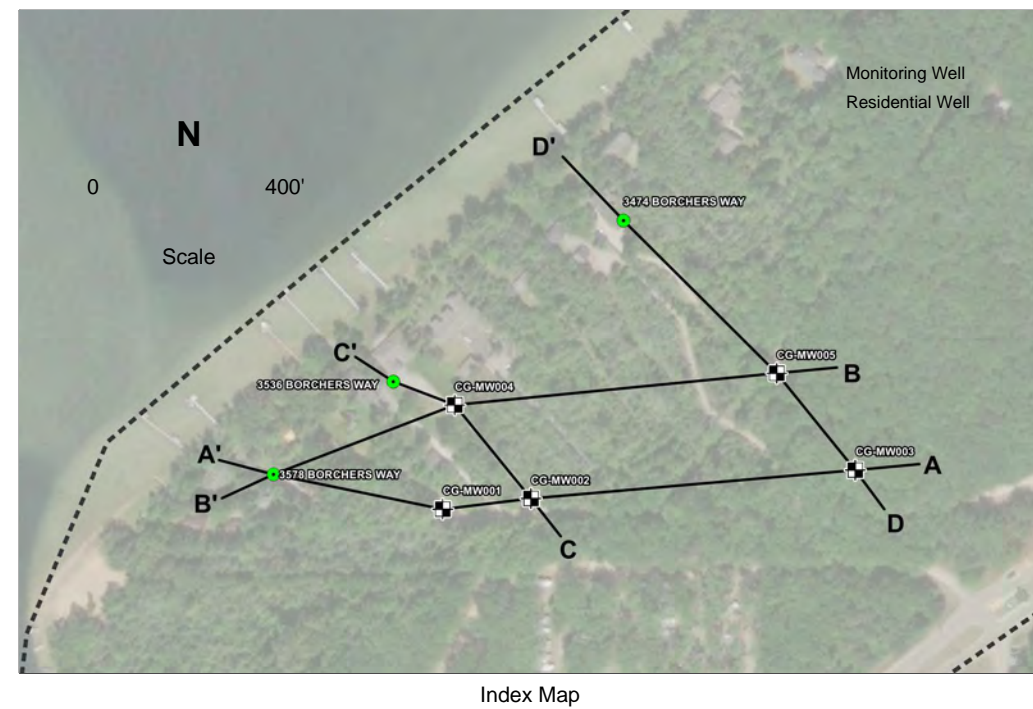
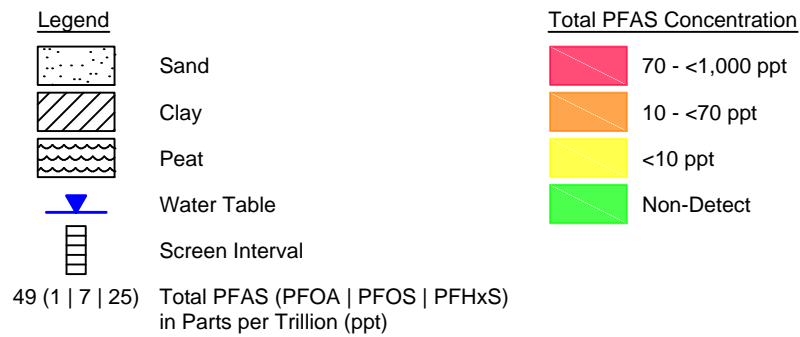
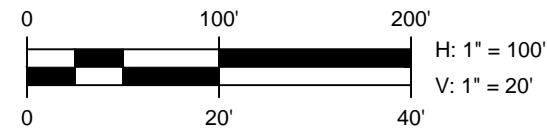
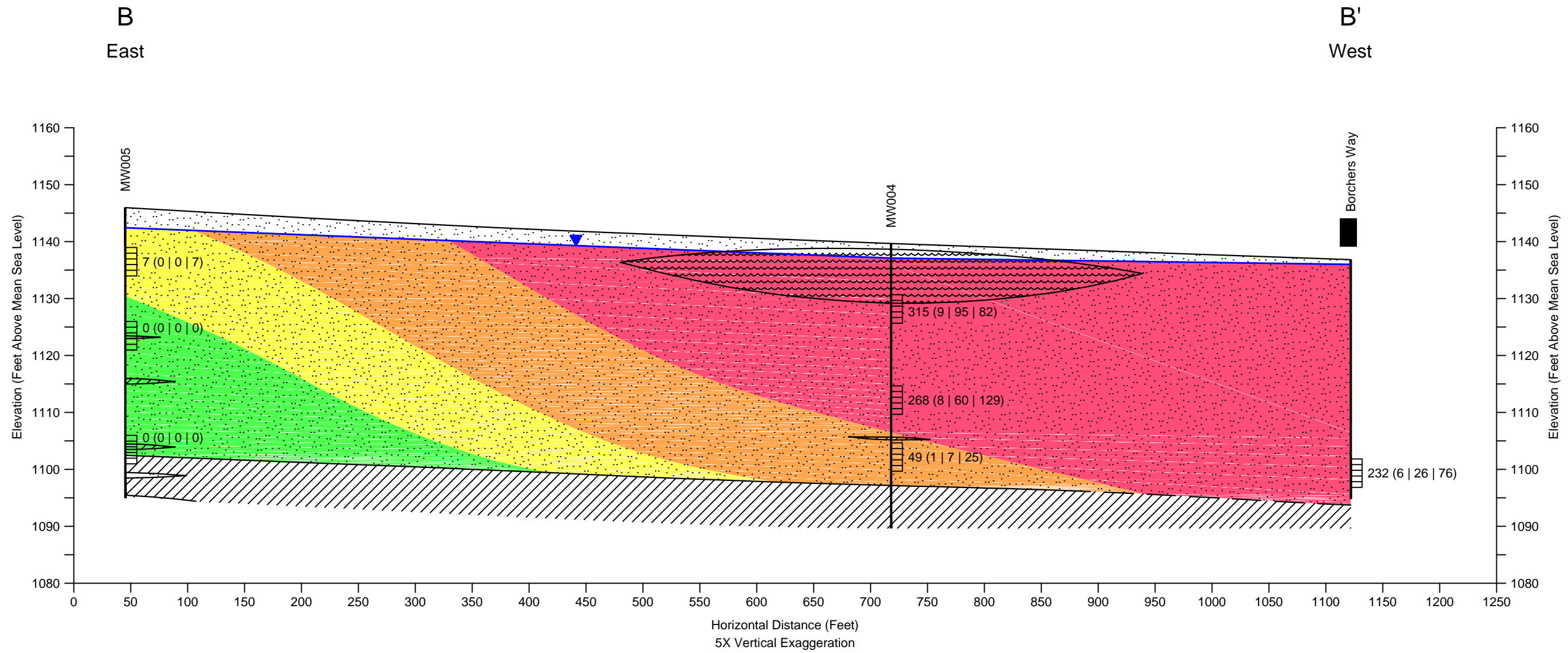


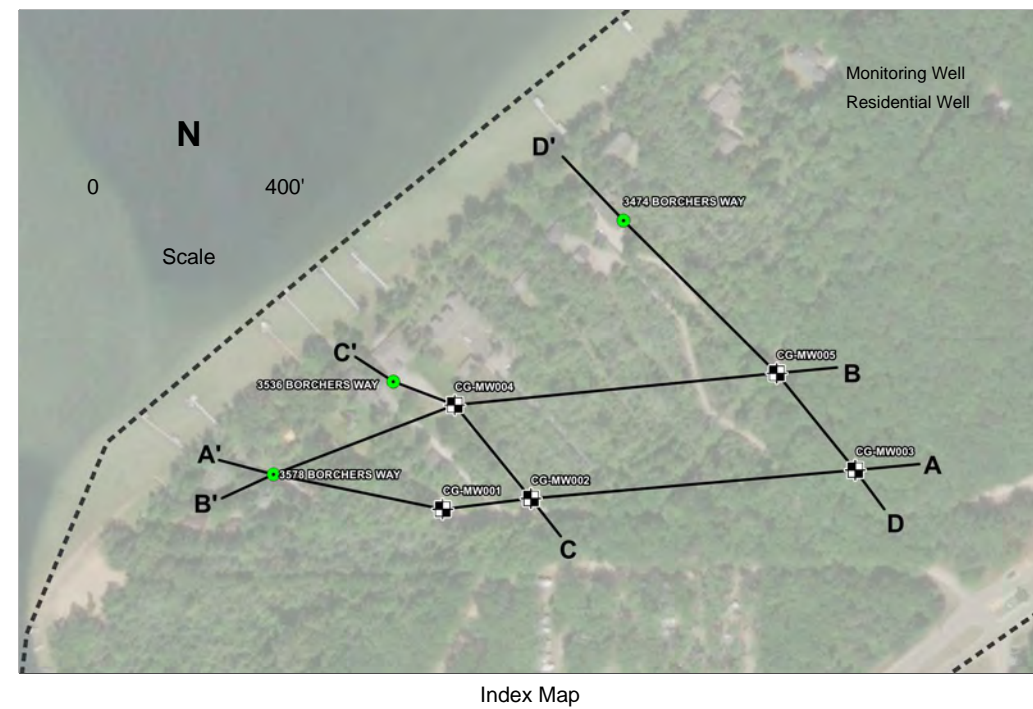
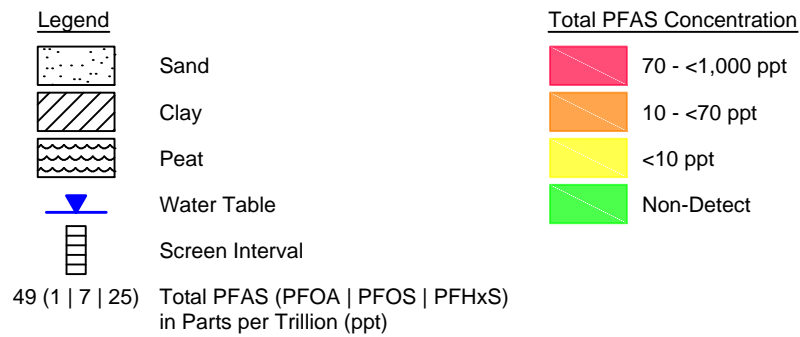
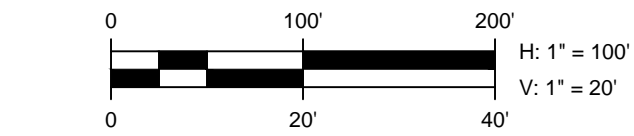
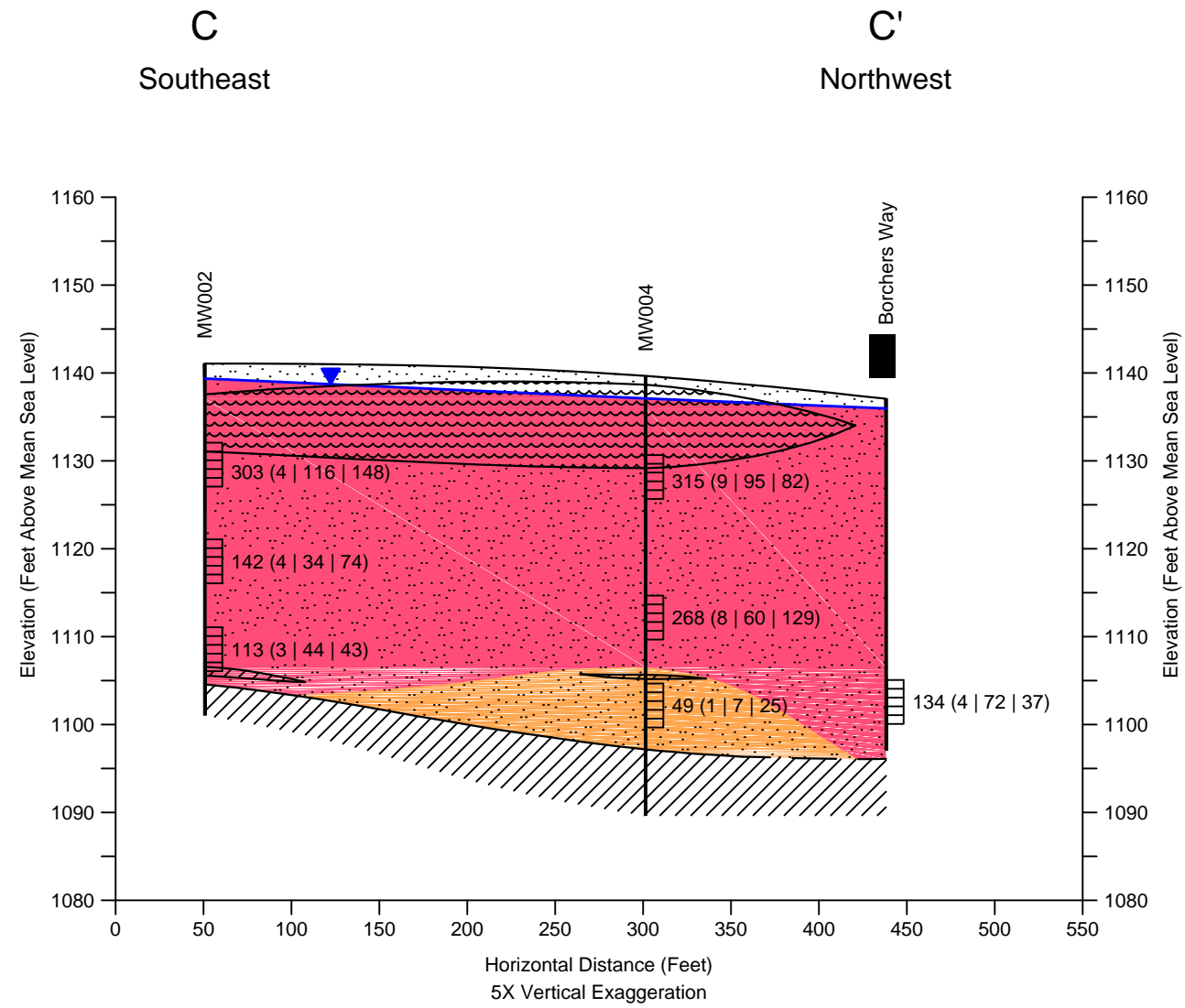
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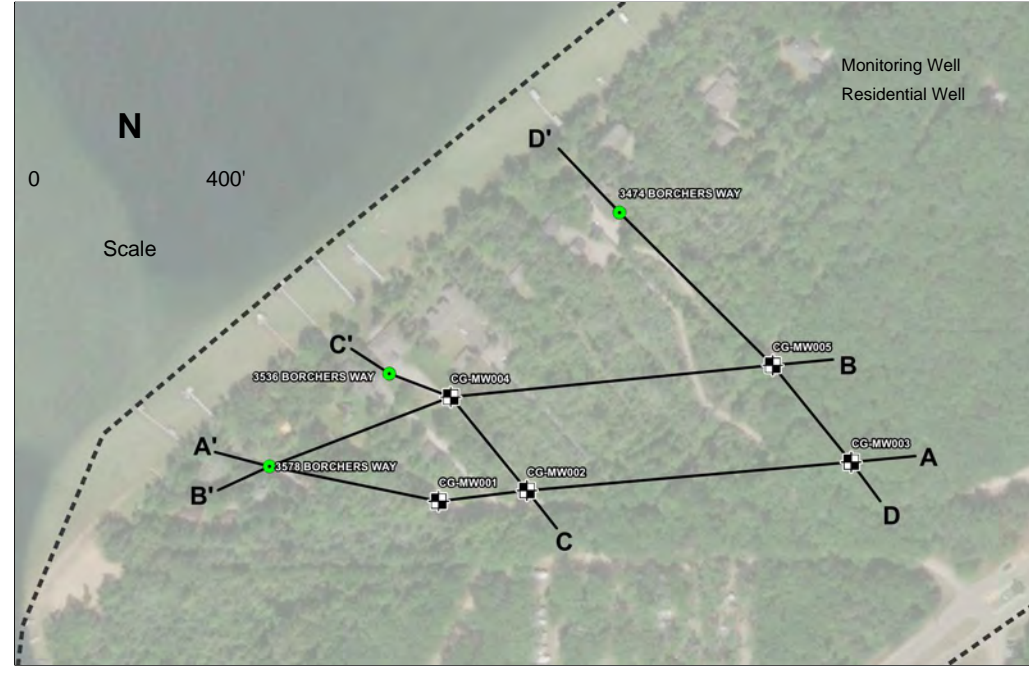
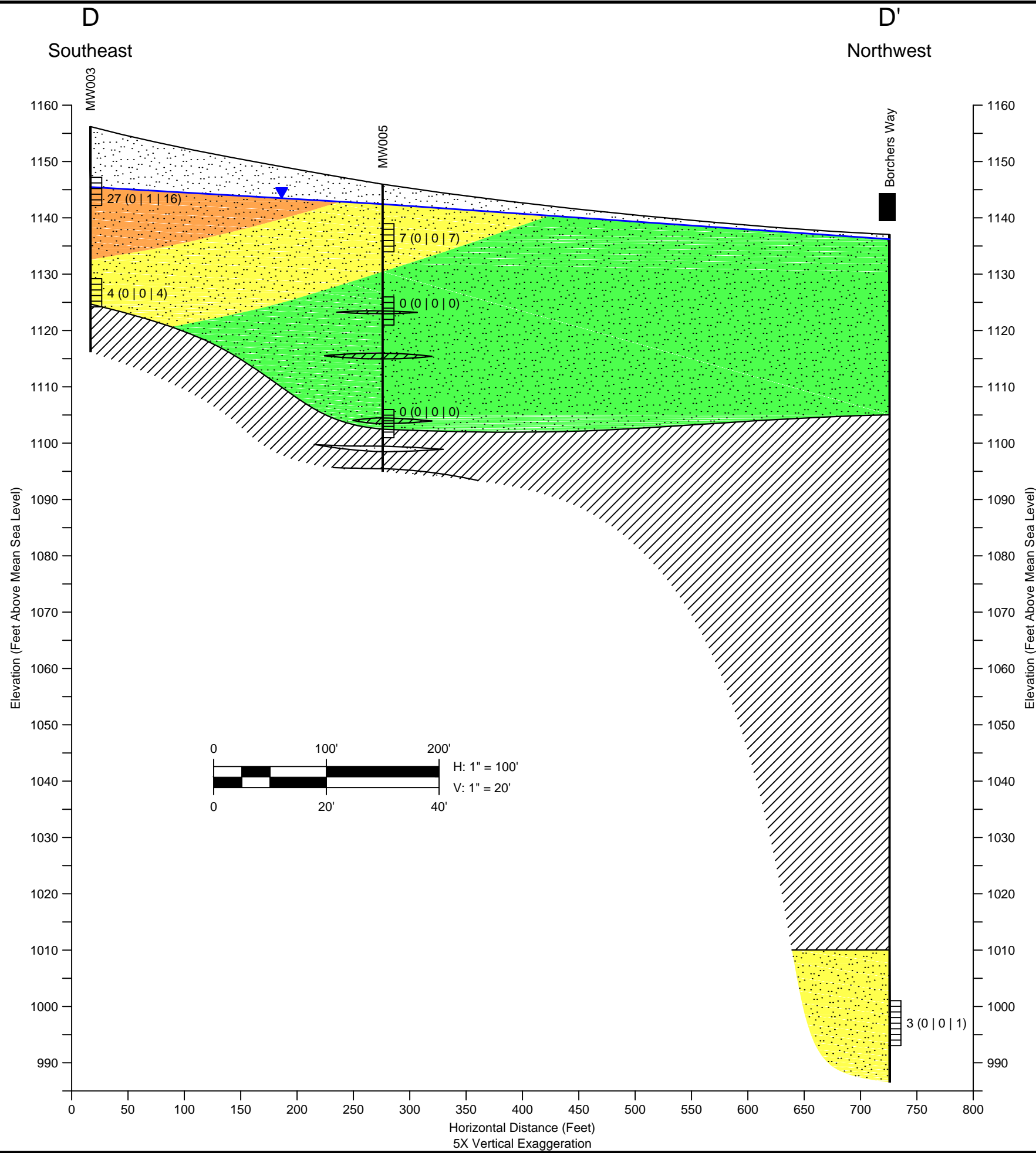
Prepared: 4/1/2019

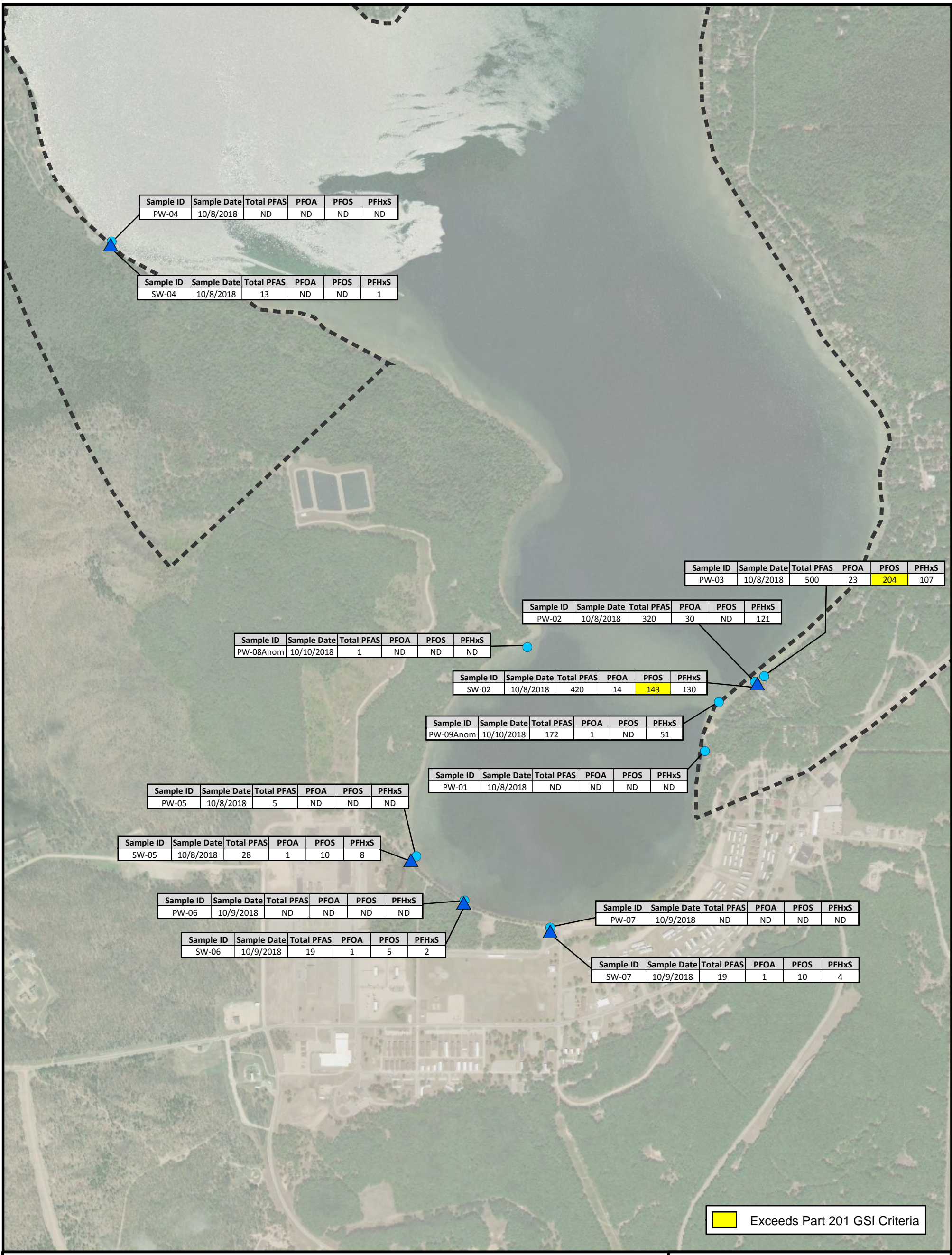










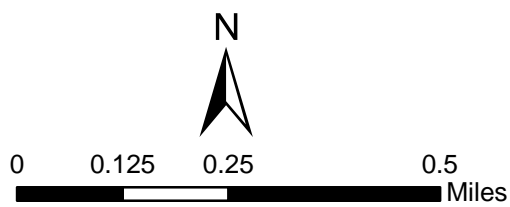


Exceeds Part 201 GSI Criteria

Legend

- Pore Water Sample Location
- ▲ Surface Water Sample Location
- Lake Margrethe Initial Sampling Area

FIGURE 15
 DEQ-RDD-GSU PORE WATER &
 SURFACE WATER SAMPLES
 OCTOBER 8 TO 10, 2018
 CAMP GRAYLING - LAKE MARGRETHE
 PFAS SITE
 CRAWFORD COUNTY, MICHIGAN



Tables

**Table 1 - Groundwater Elevations
Camp Grayling - Lake Margrethe
Grayling, Crawford County, Michigan**

Location	Monitoring Well	Screened Interval	Y	X	TOC Elevation	Ground Elevation	*DTW (ft below TOC) September 2018	Groundwater Elevation September 2018
CG-MW001	CG-MW001-12	7-12	480723.345	19577990.25	1138.83	1138.6	0.6	1138.23
	CG-MW001-20	15-20	480723.345	19577990.25	1138.90	1138.6	0.8	1138.10
	CG-MW001-40	35-40	480723.345	19577990.25	1138.88	1138.6	1.6	1137.28
CG-MW002	CG-MW002-14	9-14	480745.398	19578173.34	1140.66	1141	1.31	1139.35
	CG-MW002-25	20-25	480745.398	19578173.34	1140.55	1141	1.19	1139.36
	CG-MW002-35	30-35	480745.398	19578173.34	1140.70	1141	1.34	1139.36
CG-MW003	CG-MW003-14	9-14	480804.737	19578848.03	1153.43	1153.5	7.97	1145.46
	CG-MW003-32	27-32	480804.737	19578848.03	1153.50	1153.5	7.96	1145.54
CG-MW004	CG-MW004-14	9-14	480939.7	19578015.2	1139.33	1139.6	2.24	1137.09
	CG-MW004-30	25-30	480939.7	19578015.2	1139.29	1139.6	2.26	1137.03
	CG-MW004-40	35-40	480939.7	19578015.2	1139.34	1139.6	2.26	1137.08
CG-MW005	CG-MW005-12	7-12	481005.651	19578684.25	1145.86	1146	3.45	1142.41
	CG-MW005-25	20-25	481005.651	19578684.25	1145.95	1146	3.44	1142.51
	CG-MW005-43	38-43	481005.651	19578684.25	1145.85	1146	2.75	1143.10
RI Staff Gauge	NA	NA	481156.921	19577851.2	1136.07	NA	2.2	1133.87
Lake Margrethe Control Structure	NA	NA	489958.901	19567498.83	1133.35	NA	3.96	1129.39

*DTW - Depth to Water measured from Top of Casing (TOC)

*TOC - Top of Casing

*Total Depth and Screen Elevation are measured from TOC

ft = feet

NA = Not applicable

RI = Remedial Investigation

*Wells surveyed in reference to the North American Datum (NAD) 1983 State Plane Michigan Zone 2112

**Table 2 - Stabilized Water Quality Parameters
Camp Grayling - Lake Margrethe
Grayling, Crawford County, Michigan**

Well ID	Date	Sample Interval	Time Collected	pH	Specific Cond.	Turbidity	D.O.	Temp	ORP
		ft	24hr	SU	uS/cm	NTU	mg/L	°C	mV
CG-MW001-12.0	9/25/2018	7-12	10:40	7.22	754	1.14	1.57	12.92	-70.4
CG-MW001-20.0	9/25/2018	15-20	11:35	8.1	603	1.43	6.06	11.41	76.5
CG-MW001-40.0	9/25/2018	35-40	12:30	8.02	368	1.35	6.3	10.95	133.5
CG-MW002-14.0	9/25/2018	9-14	12:15	6.76	550	0.33	3.04	12.5	30.2
CG-MW002-25.0	9/25/2018	20-25	12:50	7.32	474	4.57	9.55	10.4	64
CG-MW002-35.0	9/25/2018	30-35	15:55	7.42	352	3.65	12.43	10.4	102.2
CG-MW003-14.0	9/25/2018	9-14	14:45	7.58	570	1.29	9.22	12.5	-54.6
CG-MW003-32.0	9/25/2018	27-32	16:35	8.07	369	1.64	8.51	10.54	73.4
CG-MW004-14.0	9/26/2018	9-14	11:30	6.65	560	2.07	3.04	10.7	-51.4
CG-MW004-30.0	9/26/2018	25-30	10:45	7.55	482	81.5	3.8	10	-163.5
CG-MW004-40.0	9/26/2018	35-40	9:40	7.35	340	0.91	9.22	10.2	53.1
CG-MW005-12.0	9/26/2018	7-12	10:30	7.76	548	1.32	5.53	11.3	-15.2
CG-MW005-25.0	9/26/2018	20-25	11:30	7.85	322	0.2	5.59	8.65	-17
CG-MW005-45.0	9/26/2018	40-45	12:15	8.13	300	5.86	1.4	8.76	-78.9

Notes:

* Values in this table are the final "Stabilized" parameters

DO = Dissolved Oxygen

ft = Feet

mg/L = Milligrams/Liter

mV = Millivolt

MW = Monitoring Well Sample

NTU = Nephelometric Turbidity Units

°C = Degrees Celsius

ORP = Oxidation Reduction Potential

SU = Standard Unit

uS/cm = Microsiemens/centimeter

**Table 3 - Phase I RI Groundwater PFAS Results
Camp Grayling - Lake Margrethe
Grayling, Crawford County, Michigan**

Location	CG-MW001			CG-MW002			CG-MW003		CG-MW004			CG-MW005		
	CG-MW001-12.0	CG-MW001-20.0	CG-MW001-40.0	CG-MW002-14.0	CG-MW002-25.0	CG-MW002-35.0	CG-MW003-14.0	CG-MW003-32.0	CG-MW004-14.0	CG-MW004-30.0	CG-MW004-40.0	CG-MW005-12.0	CG-MW005-25.0	CG-MW005-43.0
Sample ID	GW1809251040MK	GW1809251135MK	GW1809251230MK	GW1809251215KE	GW1809251250KE	GW1809251555KE	GW1809251545MK	GW1809251635MK	GW1809261130KE	GW1809261045KE	GW1809260940KE	GW1809261030MK	GW1809261130MK	GW1809261215MK
Date Collected	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/26/2018	9/26/2018	9/26/2018	9/26/2018	9/26/2018	9/26/2018
Units	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l
Report	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179	1803179
PFBA	8.32	11.7	4.12	1.55J	2.45J	1.24J	2.33J	0.37J	13.4	6.80	1.31J	0.62J	< 4.02	< 4.04
PFPeA	15.3	34.7	13.0	3.66J	4.94	4.05	< 3.98	< 3.92	44.6	14.4	3.57J	< 3.87	< 4.02	< 4.04
PFHxA	18.5	38.5	14.9	7.41	6.94	5.12	< 3.98	< 3.92	36.2	19.4	4.66	< 3.87	< 4.02	< 4.04
PFHpA	7.68	18.5	5.61	4.02	5.32	7.10	< 3.98	< 3.92	18.3	15.9	3.33J	< 3.87	< 4.02	< 4.04
PFOA	7.70	17.3	4.62	3.76J	3.58J	2.65J	< 3.98	< 3.92	9.25	8.09	1.18J	< 3.87	< 4.02	< 4.04
PFNA	< 3.99	0.74J	< 3.95	0.743J	< 4.14	0.410J	< 3.98	< 3.92	1.36J	0.70J	< 3.84	< 3.87	< 4.02	< 4.04
PFDA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFUnDA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFDoDA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFTTrDA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFTeDA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFBS	2.88	3.40J	1.87J	2.53J	2.03J	0.984J	4.27	< 3.92	3.63J	2.62J	1.08J	< 3.87	< 4.02	< 4.04
PFPeS	6.88	14.1	6.47	11.8	4.83	2.52J	3.55J	< 3.92	6.25	9.57	2.33J	< 3.87	< 4.02	< 4.04
PFHxS	65.3	167	45.7	148	74.4	43.3	15.7	3.51J	81.7	129	24.9	6.85	< 4.02	< 4.04
PFHpS	2.71	9.15	4.57	3.16J	2.65J	1.14J	< 3.98	< 3.92	1.67J	1.84J	< 3.84	< 3.87	< 4.02	< 4.04
PFOS	46.7	117	18.5	116	34.4	44.3	0.852J	< 3.92	95.1	59.8	6.98	< 3.87	< 4.02	< 4.04
PFNS	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFDS	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
PFOSA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
4:2 FTS	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
6:2 FTS	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	3.46J	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
8:2 FTS	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
EtFOSAA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
MeFOSAA	< 3.99	< 3.91	< 3.95	< 4.01	< 4.14	< 4.00	< 3.98	< 3.92	< 4.20	< 4.00	< 3.84	< 3.87	< 4.02	< 4.04
Total PFAS	181.97	432.1	119.36	302.63	141.54	112.81	26.7	3.88J	314.92	268.12	49.34	7.47	ND	ND
PFOA + PFOS	54.4	134.3	23.12	119.76	37.98	46.95	0.85	ND	104.35	67.89	8.16	ND	ND	ND

Concentrations are reported as ng/L or ppt

"-" = Analyte not sampled

DWC = Drinking Water Criteria (*70ppt combined or individual PFOA + PFOS)

GSIC = Groundwater Surface Water Interface Criteria

FAV = Final Acute Value

	Perfluoroalkyl Carboxylic Acids (PFCAAs)
	Perfluoroalkane Sulfonic Acids (PFSAAs)
	Perfluoroalkane Sulfonamides (FASAs)
	Fluorotelomer Sulfonic Acids (FTSAs)
	N-Ethyl Perfluoroalkane Sulfonamidoacetic Acids (EtFASAAs)
	N-Methyl Perfluoroalkane Sulfonamidoacetic Acids (MeFASAAs)

PFBA = Perfluorobutanoic acid

PFPeA = Perfluoropentanoic acid

PFPeS = Perfluoropentane sulfonic acid

PFHxA = Perfluorohexanoic acid

PFHpA = Perfluoroheptanoic acid

PFOA = Perfluorooctanoic acid

PFNA = Perfluorononanoic acid

PFDA = Perfluorodecanoic acid

PFUnDA = Perfluoroundecanoic acid

PFDoDA = Perfluorododecanoic acid

PFTTrDA = Perfluorotridecanoic acid

PFTeDA = Perfluorotetradecanoic acid

PFBS = Perfluorobutane sulfonic acid

PFHxS = Perfluorohexane sulfonic acid

PFHpS = Perfluoroheptane sulfonic acid

PFNS = Perfluorononane sulfonic acid

PFOS = Perfluorooctane sulfonic acid

PFDS = Perfluorodecane sulfonic acid

Contaminant exceeds GSIC
Contaminant exceeds DWC & GSIC
Contaminant exceeds FAV
Shaded values indicate criteria exceedance

Criteria (ppt)	PFOS	PFOA
GSIC	12	12,000
DWC	70	70
FAV	1,600,000	15,000,000

4:2 FTSA = 4:2 Fluorotelomer sulfonic acid

6:2 FTSA = 6:2 Fluorotelomer sulfonic acid

8:2 FTSA = 8:2 Fluorotelomer sulfonic acid

PFOSA = Perfluorooctane sulfonamide

EtFOSAA - N-Ethyl Perfluorooctane sulfonamidoacetic acid

MeFOSAA = N-Methyl Perfluorooctane sulfonamide

**Table 4 - Phase I RI Pore Water and Surface Water PFAS Results
Camp Grayling - Lake Margrethe
Grayling, Crawford County, Michigan**

	Porewater									Surface Water				
Location	PW-01	PW-02	PW-03	PW-04	PW-05	PW-06	PW-07	PW-08	PW-09	SW-02	SW-04	SW-05	SW-06	SW-07
Sample ID	PW-01-181008	PW-02-181008	PW-03-181008	PW-04-181008	PW-05-181008	PW-06-181009	PW-07-181009	PW-08ANOM-181010	PW-09ANOM-181010	SW-02-181008	SW-04-181008	SW-05-181008	SW-06-181009	SW-07-181009
Date Collected	10/8/2018	10/8/2018	10/8/2018	10/8/2018	10/8/2018	10/9/2018	10/9/2018	10/10/2018	10/10/2018	10/8/2018	10/8/2018	10/8/2018	10/9/2018	10/9/2018
Units	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l
Report	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320	1803320
PFBA	< 3.89	14.2	13.2	< 3.85	0.84J	< 4.01	< 4.01	0.896J	10.6	11.6	2.28	1.79J	2.15J	1.06J
PFPeA	< 3.89	46.5	34.2	< 3.85	2.16J	< 4.01	< 4.01	< 3.91	31.4	30.8	10.2	2.68J	3.49J	0.907J
PFHxA	< 3.89	47.1	33.1	< 3.85	1.64J	< 4.01	< 4.01	< 3.91	41.9	30.8	< 4.49	2.49J	3.26J	1.31J
PFHpA	< 3.89	51.0	63.3	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	5.99	38.4	< 4.49	1.12J	1.14J	0.616J
PFOA	< 3.89	29.6	23.1	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	1.40J	13.8	< 4.49	1.15J	1.05J	1.08J
PFNA	< 3.89	< 4.00	3.65J	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	3.02J	< 4.49	< 4.13	< 3.89	< 3.94
PFDA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFUnDA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFDoDA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFTTrDA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFTeDA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFBS	< 3.89	3.21J	3.55J	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	13.2	6.39	< 4.49	1.30J	0.897J	< 3.94
PFPeS	< 3.89	7.03	2.94J	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	16.1	8.64	< 4.49	< 4.13	< 3.89	< 3.94
PFHxS	< 3.89	121	107	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	50.9	130	0.608J	7.73	2.33J	3.95
PFHpS	< 3.89	< 4.00	1.41J	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	2.49J	< 4.49	< 4.13	< 3.89	< 3.94
PFOS	< 3.89	< 4.00	204	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	143	< 4.49	9.71	4.82	10.3
PFNS	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFDS	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
PFOSA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
4:2 FTS	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
6:2 FTS	< 3.89	< 4.00	6.01	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	1.27J	< 4.49	< 4.13	< 3.89	< 3.94
8:2 FTS	< 3.89	< 4.00	4.27	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
EtFOSAA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
MeFOSAA	< 3.89	< 4.00	< 3.78	< 3.85	< 3.75	< 4.01	< 4.01	< 3.91	< 3.77	< 4.03	< 4.49	< 4.13	< 3.89	< 3.94
Total PFAS	0	319.64	499.73	0	4.641	0	0	0.896	171.49	420.21	13.09	27.97	19.137	19.22

Concentrations are reported as ng/L or ppt
 "--" = Analyte not sampled
 GSIC = Groundwater Surface Water Interface Criteria

	Perfluoroalkyl Carboxylic Acids (PFCA)s
	Perfluoroalkane Sulfonic Acids (PFSA)s
	Perfluoroalkane Sulfonamides (FASA)s
	Fluorotelomer Sulfonic Acids (FTSA)s
	N-Ethyl Perfluoroalkane Sulfonamidoacetic Acids (EtFASAAs)
	N-Methyl Perfluoroalkane Sulfonamidoacetic Acids (MeFASAAs)

PFBA = Perfluorobutanoic acid
 PFPeA = Perfluoropentanoic acid
 PFPeS = Perfluoropentane sulfonic acid
 PFHxA = Perfluorohexanoic acid
 PFHpA = Perfluoroheptanoic acid
 PFOA = Perfluorooctanoic acid
 PFNA = Perfluorononanoic acid
 PFDA = Perfluorodecanoic acid
 PFUnDA = Perfluoroundecanoic acid
 PFDoDA = Perfluorododecanoic acid
 PFTTrDA = Perfluorotridecanoic acid
 PFTeDA = Perfluorotetradecanoic acid
 PFBS = Perfluorobutane sulfonic acid
 PFHxS = Perfluorohexane sulfonic acid
 PFHpS = Perfluoroheptane sulfonic acid
 PFNS = Pefluorononane sulfonic acid
 PFOS = Perfluorooctane sulfonic acid
 PFDS = Perfluorodecane sulfonic acid

Contaminant exceeds GSIC
 Shaded values indicate criteria

Criteria (ppt)	PFOS	PFOA
GSIC	12	12,000

4:2 FTSA = 4:2 Fluorotelomer sulfonic acid
 6:2 FTSA = 6:2 Fluorotelomer sulfonic acid
 8:2 FTSA = 8:2 Fluorotelomer sulfonic acid
 PFOSA = Perfluorooctane sulfonamide
 EtFOSAA - N-Ethyl Perfluorooctane sulfonamidoacetic acid
 MeFOSAA = N-Methyl Perfluorooctane sulfonamide

Appendix A – Photo Log



PHOTOGRAPH LOG

Project Name:
MDEQ Lake Margrethe

Site Location:
Grayling, MI

Project No.
60563409

Photo No.
1

Date:
08/22/18

Direction Photo Taken:

N/A

Description:

B-002



Photo No.
2

Date:
08/22/18

Direction Photo Taken:

N/A

Description:

B-004





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
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Photo No.: 3	Date: 08/22/18
Direction Photo Taken: N/A	
Description: B-005	



Photo No.: 4	Date: 08/07/18
Direction Photo Taken: N/A	
Description: B-004 Drilling Location	





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
---	---------------------------------------	---------------------------------

Photo No.: 5	Date: 08/10/18
Direction Photo Taken: N/A	
Description: B-004 Developing/surging well with stainless steel bailer.	



Photo No.: 6	Date: 08/07/18
Direction Photo Taken: N/A	
Description: B-004 5-9'	





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
---	---------------------------------------	---------------------------------

Photo No.: 7	Date: 08/08/18
Direction Photo Taken: N/A	
Description: B-002 35-40'	



Photo No.: 8	Date: 08/14/18
Direction Photo Taken: N/A	
Description: B-001 40-45' (right side)	





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
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Photo No.: 9	Date: 08/14/18
Direction Photo Taken: N/A	
Description: B-001 (left side) 45-50'	



Photo No.: 10	Date: 08/16/18
Direction Photo Taken: N/A	
Description: B-005 40-45' Sand pack at 43'	





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
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Photo No. 11	Date: 08/02/18
Direction Photo Taken: N/A	
Description: B-003 30-35' (left side) Sand pack at 32'	



Photo No. 12	Date: 08/02/18
Direction Photo Taken: N/A	
Description: B-003 30-35' (right side)	





PHOTOGRAPH LOG

Project Name: MDEQ Lake Margrethe	Site Location: Grayling, MI	Project No.: 60563409
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Photo No.: 13	Date: 08/02/18
Direction Photo Taken: N/A	
Description: B-003 35-40'	



Photo No.: 14	Date: 8/02/18
Direction Photo Taken: N/A	
Description: B-003 35-40'	



Appendix B – Boring Logs

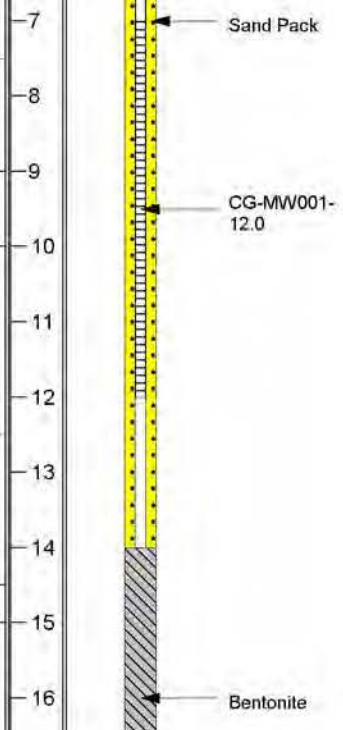


FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW001**
 TOTAL DEPTH: **50'**

PROJECT INFORMATION				DRILLING INFORMATION			
PROJECT:	Camp Grayling - Lake Margrethe			CONTRACTOR:	Mateco		
SITE LOCATION:	Grayling, MI			CREW CHIEF:	J. Croel		
PROJECT NO.:	60563409			DRILL RIG TYPE:	Geoprobe 8140DT		
PROJECT MANAGER:	John Cuthbertson			DRILLING METHOD:	N/A		
LOGGED BY:	Stanley Krenz			HOLE DIAMETER:	8"		
CREATED BY:	Kaitlyn Eicholtz			DATE START:	8/14/18		
				DATE END:	8/14/18		

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID (ppm)	SOIL DESCRIPTION	WELL CONSTRUCTION
0	Hand Auger	/	/	[Symbol]	SM		Topsoil, grass, roots, and organics	0
1				[Symbol]	SM		SM: 10YR 4/4 MEDIUM WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 30% silt, 25% fine sand, 45% medium sand, moist	1
2				[Symbol]	SM		SM: 10YR 6/4 MEDIUM WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 15% silt, 25% fine sand, 60% medium sand, trace coarse sand, moist	2
3				[Symbol]	Peat		Peat: 10YR 2/2 WELL SORTED PEAT; non plastic, 100% silt, peat, organics, wood debris, wet	3
4				[Symbol]	Peat		Peat: 10 YR 2/2 WELL SORTED PEAT with CLAY; non plastic, 50% clay, 50% silt, peat with clay; organics	4
5				[Symbol]	SM		SM: 10YR 5/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 25% silt, 60% fine sand, 15% medium sand, wet	5
6				[Symbol]	SM		SM: 10YR 6/3 MEDIUM WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 25% silt, 15% fine sand, 60% medium sand, trace coarse sand, wet, coarsening downward	6
7				[Symbol]	SM			7
8				[Symbol]	SM		SM: 10YR 6/3 MEDIUM WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 15% silt, 20% fine sand, 60% medium sand, 5% coarse sand, wet	8
9				[Symbol]	No Recovery			9
10	Sonic	/	/	[Symbol]	SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 25% silt, 55% fine sand, 20% medium sand, trace coarse sand, trace fine gravel (ranges 7 to 15mm), wet	10
11				[Symbol]	SM		SM: 10YR 6/4 MEDIUM WELL SORTED SILTY SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 15% silt, 40% fine sand, 45% medium sand, trace coarse sand, trace fine gravel (ranges 8 to 14mm), wet	11
12				[Symbol]	SM			12
13				[Symbol]	SM			13
14				[Symbol]	SM			14
15	[Symbol]	No Recovery			15			
16	[Symbol]	SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 25% silt, 55% fine sand, 20% medium sand, trace coarse sand, trace fine gravel (ranges 3 to 7mm), wet	16			
17	[Symbol]	SM			17			
18	[Symbol]	SM			18			



NOTES:

Water level during drilling

Water level in completed well

FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW001**
TOTAL DEPTH: **50'**

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID	SOIL DESCRIPTION	WELL CONSTRUCTION	SAMPLE
20	Sonic				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 25% medium sand, 20% coarse sand, 35% fine gravel (ranges 5 to 19mm), trace coarse gravel (ranges to a max of 20mm)	19	
						No Recovery	20		
21	Sonic				SW		SW: 10YR 6/14 COARSE POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 20% medium sand, 25% coarse sand, 30% fine gravel (ranges 5 to 19 mm), 5% coarse gravel (ranges to a max of 30mm), wet	21	
							22		
22	Sonic				SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 15% silt, 45% fine sand, 30% medium sand, 10% coarse sand, wet	23	
							24		
25	Sonic				SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 5% clay, 20% silt, 50% fine sand, 25% medium sand, wet	25	
							26		
27	Sonic				SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 25% silt, 60% fine sand, 15% medium sand, trace coarse sand, wet, fining downward	27	
							28		
28	Sonic				SW-SM		SW-SM: 10YR 6/4 MEDIUM MODERATELY SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 30% fine sand, 50% medium sand, trace coarse sand, 10% fine gravel (ranges 5 to 19mm), trace coarse gravel (ranges 19 to 38mm), wet	29	
							30		
30	Sonic						No Recovery	30	
							31		
35	Sonic				SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, trace silt, 15% fine sand, 60% medium sand, 10% coarse sand, 10% fine gravel (ranges 5 to 19mm), 5% coarse gravel (ranges 19 to 27mm), wet	35	
							36		
38	Sonic				SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 10% fine sand, 65% medium sand, 15% coarse sand, 5% fine gravel (ranges 8 to 19mm), 5% coarse gravel (ranges 19 to 25mm), cobble at 38.6' (67 by 33mm in size), wet	38	
							39		
40							No Recovery	40	

CG-MW001-20.0
Sand Pack

Bentonite

CG-MW001-40.0
Sand Pack

NOTES:

Water level during drilling

Water level in completed well

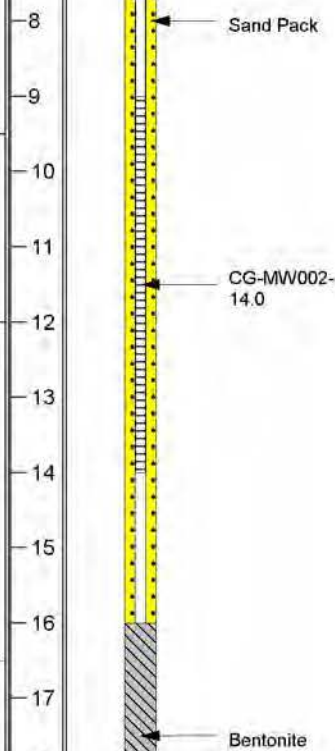


FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW002**
 TOTAL DEPTH: **40'**

PROJECT INFORMATION				DRILLING INFORMATION			
PROJECT:	Camp Grayling - Lake Margrethe			CONTRACTOR:	Mateco		
SITE LOCATION:	Grayling, MI			CREW CHIEF:	J. Croel		
PROJECT NO.:	60563409			DRILL RIG TYPE:	Geoprobe 8140DT		
PROJECT MANAGER:	John Cuthbertson			DRILLING METHOD:	N/A		
LOGGED BY:	Stanley Krenz			HOLE DIAMETER:	8"		
CREATED BY:	Kaitlyn Eicholtz			DATE START:	8/8/18		
				DATE END:	8/8/18		

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID (ppm)	SOIL DESCRIPTION	WELL CONSTRUCTION
0	Hand Auger			[Symbol]	SM		SM: Topsoil, 10YR 4/2 FINE WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 50% fine sand, 50% medium sand, trace coarse gravel, moist	0
				[Symbol]	SM		SM: 10YR 4/2 FINE MODERATELY SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 10% clay, 20% silt, 25% fine sand, 40% medium sand, trace coarse gravel, trace cobble (50 by 20mm max in size), moist	1
				[Symbol]	SP-SM		SP-SM: 10YR 4/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 25% fine sand, 45% medium sand, 5% coarse sand, 10% fine gravel (ranges 3 to 7mm), 5% coarse gravel, cobble at 1.8' (55 by 38mm in size), moist	2
				[Symbol]	Peat		Peat: 10YR 2/2 SANDY PEAT; non plastic, sub rounded sand grains, 65% peat, 35% medium sand, peat dominately organics, wood debris, moist, wet from 3.5'	3
5	Sonic			[Symbol]	Peat			4
				[Symbol]	Peat			5
				[Symbol]	Peat			6
				[Symbol]	Peat			7
				[Symbol]	Peat			8
				[Symbol]	Peat			9
10				[Symbol]	SM		SM: 10YR 6/3 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 15% silt, 85% fine sand, wet	10
				[Symbol]	SM		SM: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 15% silt, 40% fine sand, 45% medium sand, wet	11
	[Symbol]	SM		SM: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, trace clay, 20% silt, 35% fine sand, 40% medium sand, 5% coarse sand, trace fine gravel (ranges 5 to 9mm), wet	12			
	[Symbol]	SM		SM: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, trace clay, 20% silt, 35% fine sand, 40% medium sand, 5% coarse sand, trace fine gravel (ranges 5 to 9mm), wet	13			
15				[Symbol]	SM			14
				[Symbol]	SM			15
				[Symbol]	SM			16
				[Symbol]	SM			17
				[Symbol]	SM			18



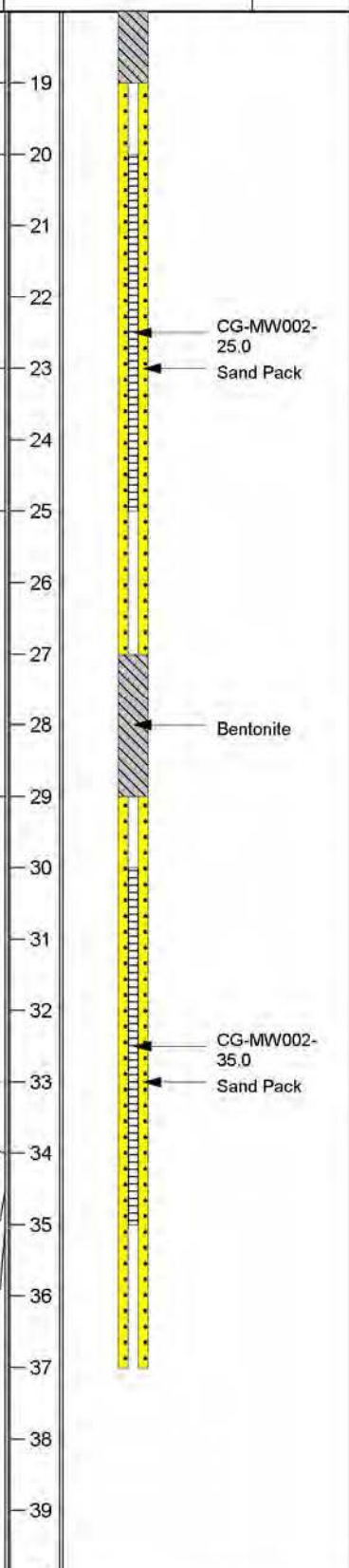
NOTES:

Water level during drilling

Water level in completed well

FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW002**
TOTAL DEPTH: **40'**

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID	SOIL DESCRIPTION	WELL CONSTRUCTION	SAMPLE
19	Sonic						No Recovery		
20									SW-SM: 10YR 6/4 MEDIUM POORLY SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 25% fine sand, 50% medium sand, 5% coarse sand, 10% fine gravel (ranges 2 to 9mm), trace coarse gravel, wet
21					SW-SM			CG-MW002-25.0 Sand Pack	
22									
23					SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 25% fine sand, 70% medium sand, trace fine gravel, wet		
24									
25					SM		SM: 10 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 5% clay, 15% silt, 35% fine sand, 35% medium sand, trace coarse sand, wet		
26									
27					SM				
28								Bentonite	
29									
30	Sonic				SP-SM		SP-SM: 10YR 6/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 35% fine sand, 55% medium sand, trace coarse sand, trace fine gravel, wet		
31									
32									
33					SP		SP: 10YR 6/8 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 25% fine sand 65% medium sand, 5% coarse sand, trace fine gravel, wet		CG-MW002-35.0 Sand Pack
34					CL		CL: 10YR 6/3 MODERATELY SORTED LEAN CLAY with SAND; low to moderate plasticity, sub rounded sand grains, 75% clay, 25% medium sand, moist, stiff		
35					SP		SP: 10YR 6/8 FINE WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 25% fine sand, 65% medium sand, 5% coarse sand, trace fine gravel, wet		
36					CH		CH: 10YR 6/1 WELL SORTED FAT CLAY; high plasticity, 100% clay, moist, stiff		
37	Sonic								
38									
39									
40									

NOTES:

Water level during drilling

Water level in completed well

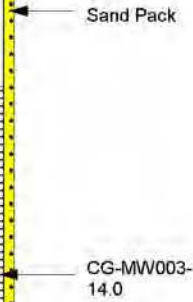


FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW003**
 TOTAL DEPTH: **40'**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Camp Grayling - Lake Margrethe	CONTRACTOR:	Mateco
SITE LOCATION:	Grayling, MI	CREW CHIEF:	J. Croel
PROJECT NO.:	60563409	DRILL RIG TYPE:	Geoprobe 8140DT
PROJECT MANAGER:	John Cuthbertson	DRILLING METHOD:	N/A
LOGGED BY:	Stanley Krenz	HOLE DIAMETER:	8"
CREATED BY:	Kaitlyn Eicholtz	DATE START:	8/20/18
		DATE END:	8/20/18

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID (ppm)	SOIL DESCRIPTION	WELL CONSTRUCTION
0	Hand Auger	[Hatched]	[Hatched]	[Yellow]	SM		SM: Topsoil, 10YR 4/3 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 30% silt, 70% fine sand, trace coarse sand, trace fine gravel, dry, with roots, leaves, twigs, sharp color change below	0
1					SM		SM: 10YR 5/6 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 30% silt, 70% fine sand, trace coarse sand, trace fine gravel, dry, roots	1
2					SM		SM: 10YR 6/6 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 25% silt, 75% fine sand, trace coarse sand, trace fine gravel, dry, moist from 4'	2
3					SM		SM: 10YR 4/4 FINE MODERATELY SORTED SILTY SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 15% silt, 70% fine sand, 15% medium sand, trace coarse sand, trace fine gravel (ranges 6 to 17mm), a cobble (68 by 32mm), moist	3
4					SM		No Recovery	4
5	Sonic	[Hatched]	[Hatched]	[Yellow]				5
6								6
7								7
8								8
9								9
10					SP-SM		SP-SM: 10YR 6/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 10% silt, 20% fine sand, 60% medium sand, 10% coarse sand, trace fine and coarse gravel, moist	10
11					SW-SM		SW-SM: 10YR 6/4 MEDIUM MODERATELY SORTED SAND with SILT; non plastic sub rounded sand grains with sub rounded to sub angular gravel, 10% silt, 20% fine sand, 50% medium sand, 10% coarse sand, 5% fine gravel, 5% coarse gravel, gravel ranges 11 to 25mm, wet	11
12					SW-SM		SW-SM: 10YR 6/4 MEDIUM POORLY SORTED SAND with SILT; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 10% silt, 10% fine sand, 50% medium sand, 15% coarse sand, 5% fine gravel, 10% coarse gravel, gravel ranges 5 to 26mm, one cobble (50 by 25mm), wet	12
13	SW-SM		SW-SM: 10YR 4/4 MEDIUM POORLY SORTED SAND with SILT and GRAVEL; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 10% silt, 10% fine sand, 40% medium sand, 15% coarse sand, 10% fine gravel (ranges 5 to 19mm), 15% coarse gravel (ranges 19 to 38mm), wet	13				
14				14				
15				15				
16				16				
17				17				
18				18				



NOTES:

Water level during drilling

Water level in completed well

FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW003**
TOTAL DEPTH: **40'**

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID	SOIL DESCRIPTION	WELL CONSTRUCTION	SAMPLE		
19	Sonic				SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, 5% silt, 10% fine sand, 60% medium sand, 20% coarse sand, 5% fine gravel, trace coarse gravel, gravel range 3 to 14mm				
20				No Recovery							
21	Sonic				SW-SM		SW-SM: 10YR 6/4 MEDIUM MODERATELY SORTED SAND with SILT; non plastic sub rounded sand grains with sub rounded to sub angular gravel, 10% silt, 15% fine sand, 60% medium sand, 5% coarse sand, 5% fine gravel, 5% coarse gravel, gravel ranges 5 to 21mm, one cobble (65 by 32mm), wet	Bentonite			
22											
23											
24								SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains with sub rounded to sub angular gravel, trace silt, 10% fine sand, 55% medium sand, 15% coarse sand, 10% fine gravel (ranges 4 to 16mm), 10% coarse gravel (ranges 22 to 31mm), wet	
25	Sonic				SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 15% fine sand, 70% medium sand, 15% coarse sand, trace fine and coarse gravel, wet				
26											
27								SW		SW: 10YR 6/6 MEDIUM POORLY SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 15% fine sand, 70% medium sand, 15% coarse sand, trace fine gravel (ranges 3 to 5mm), trace coarse gravel, wet cobble seam at 27 (ranges 25 to 45mm [0.2']), fine gravel lens at 27.8 to 28.0', clay lens at 28.6' (0.05 in thickness)	
28	Sonic						No Recovery				
29											
30								SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 25% fine sand, 70% medium sand, wet	Sand Pack CG-MW003-32.0
31								SP		SP: 10YR 5/6 FINE WELL SORTED CLAYEY SAND; non plastic, sub rounded sand grains, 30% clay, 30% silt, 25% fine sand, 15% medium sand, wet	
32	Sonic				CH		CH: 10YR 6/1 WELL SORTED FAT CLAY; high plasticity, 100% clay, moist, stiff				
33											
34											
35											
36											
37											
38											
39											
40											

NOTES:

Water level during drilling

Water level in completed well

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Camp Grayling - Lake Margrethe	CONTRACTOR:	Mateco
SITE LOCATION:	Grayling, MI	CREW CHIEF:	J. Croel
PROJECT NO.:	60563409	DRILL RIG TYPE:	Geoprobe 8140DT
PROJECT MANAGER:	John Cuthbertson	DRILLING METHOD:	N/A
LOGGED BY:	Stanley Krenz	HOLE DIAMETER:	8"
CREATED BY:	Kaitlyn Eicholtz	DATE START:	8/7/18
		DATE END:	8/7/18

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID (ppm)	SOIL DESCRIPTION	WELL CONSTRUCTION
0	Hand Auger	/	/	[Symbol]	SP		SP: 10YR 4/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 15% fine sand, 85% medium sand, trace fine gravel, trace coarse gravel, gravel ranges 5 to 20mm, dry	0
1				[Symbol]	ML		ML: 10YR 2/2 SILTY PEAT with SAND; non plastic, sub rounded sand grains, trace clay, 80% silt (PEAT), 20% medium sand, wet, with organics and woody debris (located at 3.5' and 4.0'); sharp contact below	1
2				[Symbol]	ML		ML: 10YR 2/2 SILTY PEAT with SAND; non plastic, sub rounded sand grains, trace clay, 75% silt (PEAT), 25% medium sand, wet, with organics and woody debris (located at 3.5' and 4.0'); sharp contact below	2
3				[Symbol]	ML			3
4				[Symbol]	ML			4
5				[Symbol]	ML			5
6				[Symbol]	ML			6
7				[Symbol]	ML			7
8				[Symbol]	ML			8
9				[Symbol]	ML			9
10	Sonic	/	/	[Symbol]	SP		SP: 10YR 4/1 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 15% fine sand, 80% medium sand, wet	10
11				[Symbol]	SP		No Recovery	11
12				[Symbol]	SP		SP: 10YR 4/1 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 15% fine sand, 80% medium sand, wet	12
13				[Symbol]	SP		SP: 10YR 6/2 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 20% fine sand, 80% medium sand, wet	13
14				[Symbol]	SP		SP: 10YR 6/2 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 15% fine sand, 70% medium sand, 15% coarse sand, wet	14
15				[Symbol]	SP		SP: 10YR 6/3 COARSE WELL SORTED SAND; non plastic, sub rounded sand grains, 40% medium sand, 60% coarse sand, wet, at 14' color stain of 7.5YR 5/6	15
16				[Symbol]	SP-SM		SP-SM: 10YR 6/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains, 10% silt, 15% fine sand, 75% medium sand, trace coarse sand, wet, at 15.2' lens of color stain of 7.5YR 5/6 (0.1' in thickness)	16
17				[Symbol]	SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 25% fine sand, 40% medium sand, 25% coarse sand, 5% fine gravel (ranges 8 to 19mm), trace coarse gravel (ranges 19 to 20mm), wet,	17
18	[Symbol]	SM		SM: 10YR 6/4 FINE WELL SORTED SAND with SILT; non plastic, sub	18			



NOTES:

Water level during drilling

Water level in completed well

FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW004**
TOTAL DEPTH: **50'**

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID	SOIL DESCRIPTION	WELL CONSTRUCTION	SAMPLE	
19	Sonic	/	/		SM		rounded sand grains, 15% silt, 65% fine sand, 20% medium sand, wet			
20				No Recovery						Bentonite
21					SP-SM		SP-SM: 10YR 6/4 FINE WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 75% fine sand, 15% medium sand, trace fine gravel (ranges 2 to 7mm), trace coarse gravel (ranges to a max of 30mm), wet			
22					SP		SP: 10YR 6/4 FINE WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 60% fine sand, 20% medium sand, 15% coarse sand, wet, fining upward			
23					SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 30% fine sand, 50% medium sand, 15% coarse sand, wet			
24										
25					SM		SM: 10YR 6/4 FINE WELL SORTED SAND with SILT; non plastic, sub rounded sand grains, 15% silt, 60% fine sand, 15% medium sand, 10% coarse sand, wet			
26					SW-SM		SW-SM: 10YR 6/4 FINE WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 45% fine sand, 35% medium sand, 10% coarse sand, trace fine gravel (ranges 3 to 19mm), wet			
27										
28				No Recovery						
29	Sonic	/	/		SP-SM		SP-SM: 10YR 6/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains, trace clay, 15% silt, 25% fine sand, 55% medium sand, 5% coarse sand, wet			
30										
31										
32										
33										Bentonite
34					CL		CL: 10YR 6/2 WELL SORTED LEAN CLAY with SILT; non plastic, 60% clay, 40% silt, dry			
35					SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 75% medium sand, 5% coarse sand, trace fine gravel (ranges 4 to 9mm), wet			
36										
37					SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains, 5% silt, 15% fine sand, 70% medium sand, 10% coarse sand, wet			
38				No Recovery						CG-MW004-40.0 Sand Pack
39	Sonic	/	/							
40										

NOTES:

Water level during drilling

Water level in completed well

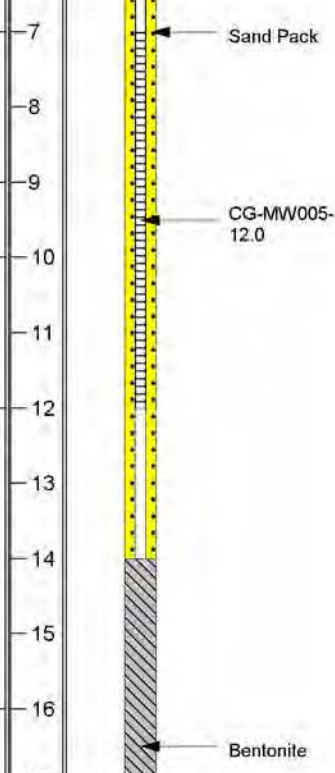


FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW005**
 TOTAL DEPTH: **50.3'**

PROJECT INFORMATION				DRILLING INFORMATION			
PROJECT:	Camp Grayling - Lake Margrethe			CONTRACTOR:	Mateco		
SITE LOCATION:	Grayling, MI			CREW CHIEF:	J. Croel		
PROJECT NO.:	60563409			DRILL RIG TYPE:	Geoprobe 8140DT		
PROJECT MANAGER:	John Cuthbertson			DRILLING METHOD:	N/A		
LOGGED BY:	Stanley Krenz			HOLE DIAMETER:	8"		
CREATED BY:	Kaitlyn Eicholtz			DATE START:	8/15/18		
				DATE END:	8/16/18		

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID (ppm)	SOIL DESCRIPTION	WELL CONSTRUCTION			
0	Hand Auger	[Hatched]	[Dotted]	[Symbol]	SM		SM: 10YR 4/2 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains, 40% silt, 60% sand, dry, with occasional roots	0			
1				[Symbol]	SP		SP: 10YR 4/4 FINE WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 95% fine sand, trace coarse sand, trace fine gravel, dry, coarsening downward	1			
2				[Symbol]	SP		SP: 10YR 5/8 FINE WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 65% fine sand, 30% medium sand, trace coarse sand, dry	2			
3				[Symbol]						3	
4				[Symbol]				SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 40% fine sand, 50% medium sand, trace coarse sand, 5% fine gravel (ranges 5 to 13mm), trace coarse gravel (ranges to max of 21mm), wet	4
5				[Symbol]				SM		SM: 10YR 6/4 FINE MEDIUM MODERATELY SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 15% silt, 60% fine sand, 15% medium sand, trace coarse sand, 5% fine gravel (ranges 6-15mm), 5% coarse gravel (ranges to a max of 30mm), wet	5
6				[Symbol]				SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 30% silt, 50% fine sand, 10% medium sand, trace coarse sand, 5% fine gravel (ranges 2-11mm), 5% coarse gravel, few cobbles (max of 46mm in size), wet	6
7				[Symbol]				SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 30% silt, 50% fine sand, 10% medium sand, trace coarse sand, 5% fine gravel (ranges 2-11mm), 5% coarse gravel, few cobbles (max of 46mm in size), wet	7
8	Sonic	[Hatched]	[Dotted]	[Symbol]	SM		SM: 10YR 6/4 FINE WELL SORTED SILTY SAND; non plastic, sub rounded sand grains and gravel, 30% silt, 50% fine sand, 10% medium sand, trace coarse sand, 5% fine gravel (ranges 2-11mm), 5% coarse gravel, few cobbles (max of 46mm in size), wet	8			
9									No Recovery	9	
10				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 25% fine sand, 60% medium sand, 5% coarse sand, 5% fine gravel, 5% coarse gravel, wet, coarsening downward	10
11				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, trace silt, 20% fine sand, 55% medium sand, 10% coarse sand, 5% fine gravel (ranges 7 to 19mm), 10% coarse gravel (ranges 19 to 32mm), few cobbles (max of 62mm), wet	11
12				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, trace silt, 20% fine sand, 55% medium sand, 10% coarse sand, 5% fine gravel (ranges 7 to 19mm), 10% coarse gravel (ranges 19 to 32mm), few cobbles (max of 62mm), wet	12
13				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, trace silt, 20% fine sand, 55% medium sand, 10% coarse sand, 5% fine gravel (ranges 7 to 19mm), 10% coarse gravel (ranges 19 to 32mm), few cobbles (max of 62mm), wet	13
14				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, trace silt, 20% fine sand, 55% medium sand, 10% coarse sand, 5% fine gravel (ranges 7 to 19mm), 10% coarse gravel (ranges 19 to 32mm), few cobbles (max of 62mm), wet	14
15				[Symbol]				SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND with GRAVEL; non plastic, sub rounded sand grains and gravel, trace silt, 20% fine sand, 55% medium sand, 10% coarse sand, 5% fine gravel (ranges 7 to 19mm), 10% coarse gravel (ranges 19 to 32mm), few cobbles (max of 62mm), wet	15
16				[Symbol]	SP-SM		SP-SM: 10YR 6/4 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 20% fine sand, 60% medium sand, trace coarse sand, 5% fine gravel (ranges 7 to 19mm), 5% coarse gravel (ranges to a max of 21mm), trace cobbles, wet	16			
17				[Symbol]				17			
18				[Symbol]				18			



NOTES:

Water level during drilling

Water level in completed well

FIELD BOREHOLE LOG

BOREHOLE NO: **CG-MW005**
TOTAL DEPTH: **50.3'**

DEPTH	SAMPLE TYPE	ATTEMPT	RECOVERY	SOIL SYMBOLS	USCS	PID	SOIL DESCRIPTION	WELL CONSTRUCTION	SAMPLE
20	Sonic				SP-SM		SP-SM: 10YR 6/6 MEDIUM WELL SORTED SAND with SILT; non plastic, sub rounded sand grains and gravel, 10% silt, 20% fine sand, 70% medium sand, trace coarse sand, trace fine gravel, wet		
21				SP	SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 20% fine sand, 60% medium sand, 10% coarse sand, trace fine gravel (ranges 10 to 19mm), 5% coarse gravel (ranges to a max of 42mm), wet				
22				CL	CL: 10YR 6/3 WELL SORTED FAT CLAY; high plasticity, 100% clay, moist, stiff				
23				SP	SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 65% medium sand, 15% coarse sand, trace fine gravel, wet				
25	Sonic				SP		SP: 10YR 6/4 MEDIUM WELL SORTED SAND; non plastic, sub rounded sand grains and gravel, trace silt, 15% fine sand, 65% medium sand, 15% coarse sand, trace fine and coarse gravel (ranges 6 to 27mm), wet		
26				SP					
27				SP					
28				SP					
30	Sonic				CL		CL: 10YR 6/4 WELL SORTED LEAN CLAY with SILT; non plastic, 50% clay, 50% silt, moist		
31					No Recovery				
32									
35	Sonic				SW		SW: 10YR 6/4 MEDIUM MODERATELY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 70% medium sand, 10% coarse sand, trace fine gravel (ranges +5 to 12mm), trace coarse gravel (ranges to a max of 21mm)		
36				SW					
37				SW					
38				SW					
40					SW		SW: 10YR 6/4 MEDIUM POORLY SORTED SAND; non plastic, sub rounded sand grains and gravel, 5% silt, 15% fine sand, 60% medium sand, 10% coarse sand, trace fine gravel (ranges 10 to 19mm), 10% coarse gravel (ranges 19 to 40mm), wet		

NOTES:

Water level during drilling

Water level in completed well

Appendix C – Field Forms



Well/Piezometer Development Record

Well/Piez. ID:
B-001 MW-1

Client: MDEQ

Site Location: Lake Margrethe, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: ~~80518528~~
60563409

Date: 8-22-18

Developer Stanley Krenz

WELL/PIEZOMETER DATA

Well : X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 7.12'

Depth to Bottom of Screen (ft.) 12.12'

Time of Development Completion 1650

Total Well Depth (ft.) 12.12'

Calculated Purge Volume (gal.) 225

Depth to Static Water Level (ft.) 1.44'

Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (_____ well volumes) or 930 gallons

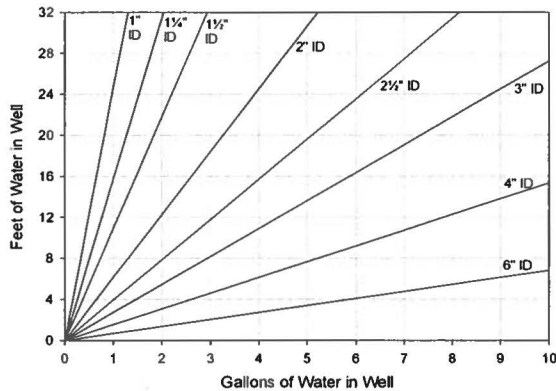
Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 930 gal total out of 3 wells

Total Gallons of Development Water 225

Signature *Stanley Krenz*

Date: 8-22-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID:
B-001 MW-2

Client: MDEQ

Site Location: Lake Margrethe, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: 60548528
60563409

Date: 8-22-18

Developer Stanley Krenz

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 20.25'
 Depth to Bottom of Screen (ft.) 25.25' Time of Development Completion 1435
 Total Well Depth (ft.) 25.25' Calculated Purge Volume (gal.) 375
 Depth to Static Water Level (ft.) 1.60' Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

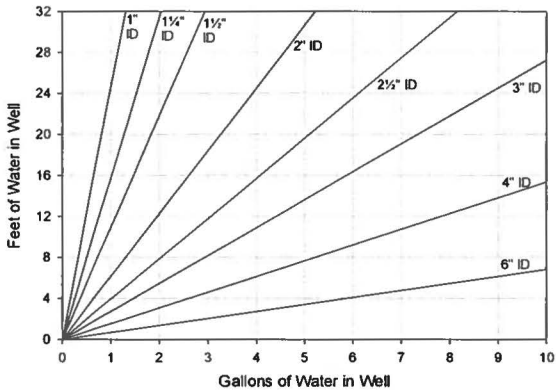
Min. Purge Volume (_____ well volumes) or 930 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 930 gallons total from 3 wells

Total Gallons of Development Water 375

Signature Stanley Krenz

Date: 8-22-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: **B-001 MW-3**

Client: MDEQ

Site Location: Lake Marynthe, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: ~~80648528~~
60563409

Date: 8-22-18

Developer Stanley Krenz

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 35'

Depth to Bottom of Screen (ft.) 40'

Time of Development Completion 2105

Total Well Depth (ft.) 40'

Calculated Purge Volume (gal.) 375

Depth to Static Water Level (ft.) 1.68'

Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (_____ well volumes) or 930 gallons

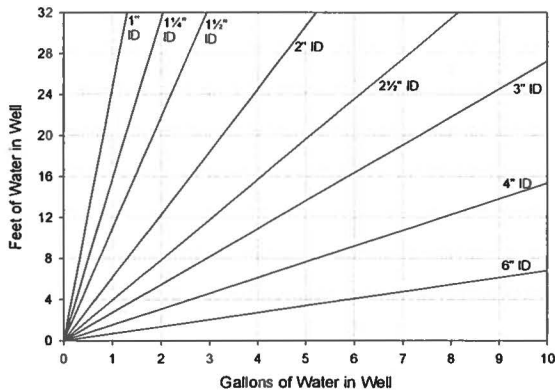
Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 930 gallons total from 3 wells

Total Gallons of Development Water 375

Signature Stanley Krenz

Date: 8-22-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: B-002 MW-1

Client: MDEQ

Site Location: Lake M., Grayling, MI
Wurtsmith, Oscoda, MI

Project No: ~~60548528~~
60563409

Date: 8-10-18

Developer: Stanley Krenz
Mateco

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 9.06'

Depth to Bottom of Screen (ft.) 14.06' Time of Development Completion 1230

Total Well Depth (ft.) 14.06' Calculated Purge Volume (gal.) 225

Depth to Static Water Level (ft.) 1.79' Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

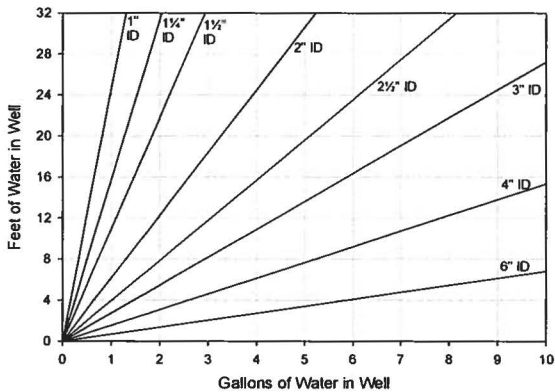
ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (_____ well volumes) or 600 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 600 gallons between 3 wells

Total Gallons of Development Water 225

Signature [Signature] Date: 8-10-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: **B-002 MW-2**

Client: MDEQ

Site Location: Lake M, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: ~~60518528~~
60548409

Date: 8-13-18

Developer Stanley Krenz
Mateco

WELL/PIEZOMETER DATA

Well : X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 47^{SK} 20.26'

Depth to Bottom of Screen (ft.) 25.26'

Time of Development Completion 1600

Total Well Depth (ft.) 25.26'

Calculated Purge Volume (gal.) 225

Depth to Static Water Level (ft.) 1.87'

Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (_____ well volumes) or 600 gallons

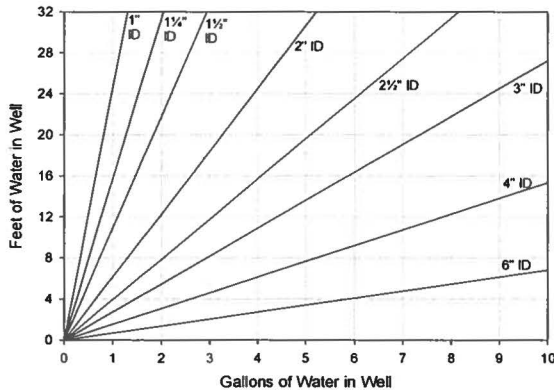
Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 600 gallons total needs to be removed from 3 wells

Total Gallons of Development Water 225

Signature Stanley Krenz

Date: 8-13-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: Brook MW-3

Client: MDEQ

Site Location: Lake M., Grayling, MI
~~Wurtsmith, Oshtemo, MI~~

Project No: ~~60518529~~
60563409

Date: 8-13-18

Developer: Stanley Kreng
Inteco

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.)	<u>29.33'</u>	Time of Development Completion	<u>1250</u>
Depth to Bottom of Screen (ft.)	<u>34.33'</u>	Calculated Purge Volume (gal.)	<u>225</u>
Total Well Depth (ft.)	<u>34.33'</u>	Disposal Method	<u>55 Gallon Drum</u>
Depth to Static Water Level (ft.)	<u>1.90'</u>		

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

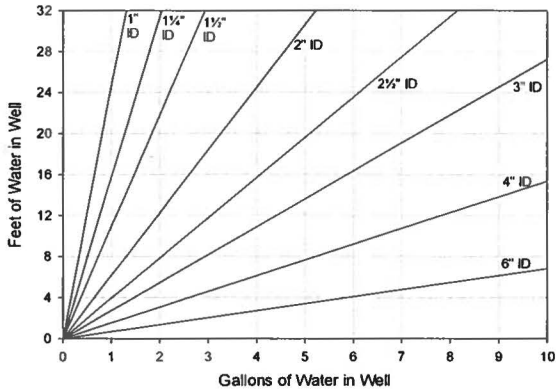
Min. Purge Volume (_____ well volumes) or 600 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 250 gallons pulled from MW-1; 600 gal total needed from combined wells

Total Gallons of Development Water 225

Signature Stanley Kreng

Date: 8-13-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: B-004
MW-1

Client: MDEQ

Site Location: Lake Margrethe, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: ~~60548526~~
60563409

Date: 8-10-18

Developer: Stanley Krenz
Mateco

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 8.76'

Depth to Bottom of Screen (ft.) 13.76'

Time of Development Completion 0930

Total Well Depth (ft.) 13.76'

Calculated Purge Volume (gal.) 250 gal

Depth to Static Water Level (ft.) 3.13'

Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

Min. Purge Volume (_____ well volumes) or 500 gallons

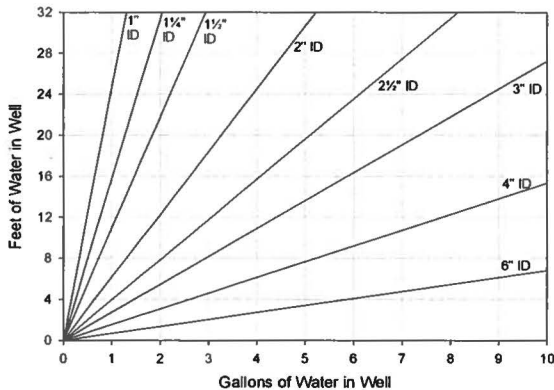
Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 500 gallons total (min) from all wells

Total Gallons of Development Water 250

Signature [Signature]

Date: 8-10-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: B-004
MW-2

Client: MDEQ

Site Location: Lake Margrette, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: ~~60518528~~
60563409

Date: 8-9-18

Developer: Stanley Krenz
mateco

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 25^{SK} 24.79'
Depth to Bottom of Screen (ft.) 29.79'
Total Well Depth (ft.) 29.79'
Depth to Static Water Level (ft.) 2.94'

Time of Development Completion 1715
Calculated Purge Volume (gal.) 300
Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

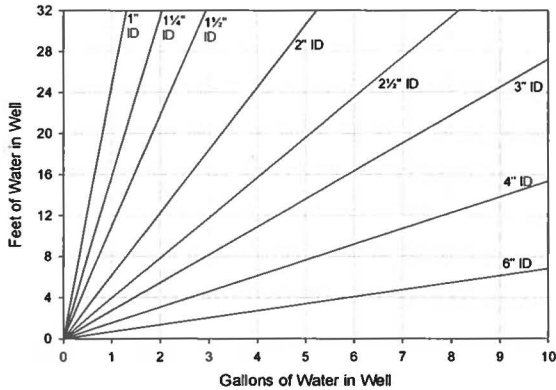
Min. Purge Volume (_____ well volumes) or 500 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 500 gallons between 3 wells

Total Gallons of Development Water 300

Signature Stanley Krenz

Date: 8-9-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

B-004
Well/Piez. ID:
MW-3

Client: MDEQ

Site Location: Lake Margrethe, Gayling, MI
Wurtsmith, Oscoda, MI

Project No: ~~60548528~~
60563409

Date: 8-9-18

Developer: Stanley Krenz
Mateco

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 35'
Depth to Bottom of Screen (ft.) 39.85'
Total Well Depth (ft.) 39.85'
Depth to Static Water Level (ft.) 2.99'

Time of Development Completion 1840
Calculated Purge Volume (gal.) 200
Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

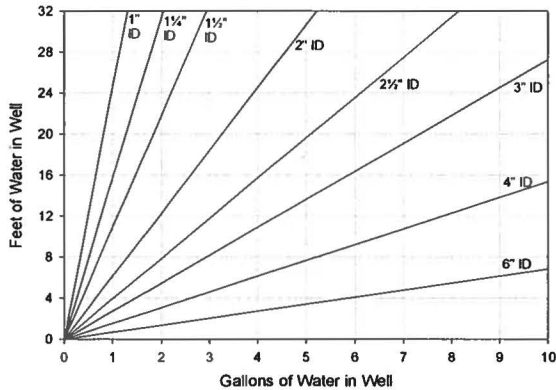
Min. Purge Volume (_____ well volumes) or 500 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 500 gal between 3 wells

Total Gallons of Development Water 200

Signature Stanley Krenz

Date: 8-9-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: MW-1 B005

Client: MDEQ

Site Location: Lake Marguerite, Grayling, MI
~~Wurtsmith, Oscoda, MI~~

Project No: 60518528
60563409

Date: 8-21-18

Developer Stanley Krenz

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 7.16'

Depth to Bottom of Screen (ft.) 12.16' Time of Development Completion 1015

Total Well Depth (ft.) 12.16' Calculated Purge Volume (gal.) 100

Depth to Static Water Level (ft.) 5.01' Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

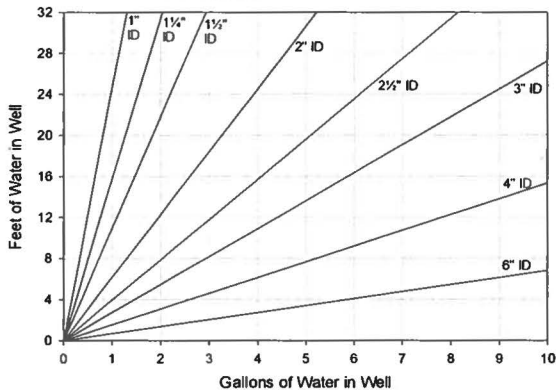
Min. Purge Volume (_____ well volumes) or 640 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 640 gal to be removed from 3 wells (total)

Total Gallons of Development Water 100

Signature [Signature]

Date: 8-21-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID:
B-005 MW-2

Client: MDEQ

Site Location: Lake Marguette, Grayling, MI
~~Wurtsmith, Oshtemo, MI~~

Project No: ~~60518328~~
60563409

Date: 8-21-18

Developer: Stanley Krenz

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter 2 Material PVC

Depth to Top of Screen (ft.) 20.26'

Depth to Bottom of Screen (ft.) 25.26'

Time of Development Completion 1655

Total Well Depth (ft.) 25.26'

Calculated Purge Volume (gal.) 225

Depth to Static Water Level (ft.) 4.11'

Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)
Min. Purge Volume (_____ well volumes) or 640 gallons

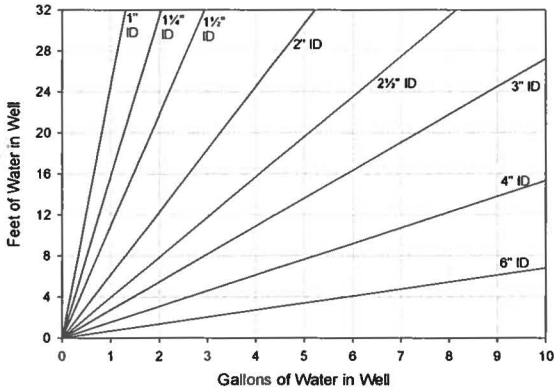
Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 640 total from 3 wells

Total Gallons of Development Water 225

Signature Stanley Krenz

Date: 8-21-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844



Well/Piezometer Development Record

Well/Piez. ID: B-005 MW-3

Client: MDEQ

Site Location: Lake Margrethe, Grayling, MI
~~Wurtsmith, Oshtemo, MI~~

Project No: 00518528
60563409

Date: 8-21-18

Developer: Stanley Krenz

WELL/PIEZOMETER DATA

Well: X Piezometer: _____ Diameter: 2 Material: PVC

Depth to Top of Screen (ft.) 38.12'
 Depth to Bottom of Screen (ft.) 43.12' Time of Development Completion 1420
 Total Well Depth (ft.) 43.12' Calculated Purge Volume (gal.) 350
 Depth to Static Water Level (ft.) 3.14' Disposal Method 55 Gallon Drum

DEVELOPMENT METHOD Submersible Pump

ACCEPTANCE CRITERIA (from workplan)

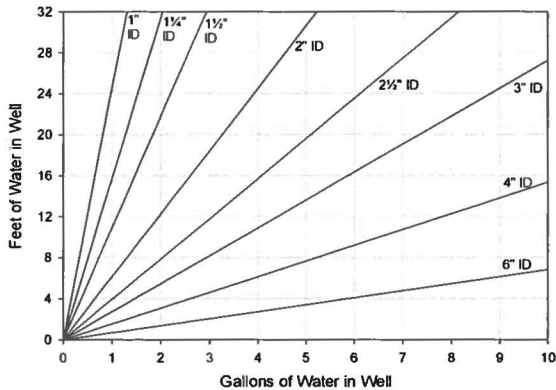
Min. Purge Volume (_____ well volumes) or 640 gallons Has required volume been removed? Yes No N/A

OTHER CRITERIA FOR DEVELOPMENT: 640 total between 3 wells

Total Gallons of Development Water 350

Signature Stanley Krenz

Date: 8-21-18



Volume / Linear Ft. of Pipe		
ID (in)	Gallon	Liter
0.25	0.0025	0.0097
0.375	0.0057	0.0217
0.5	0.0102	0.0386
0.75	0.0229	0.0869
1	0.0408	0.1544
1.25	0.0637	0.2413
1.5	0.0918	0.3475
2	0.1632	0.6178
2.5	0.2550	0.9653
3	0.3672	1.3900
4	0.6528	2.4711
6	1.4688	5.5600
7	1.9992	7.5678
8	2.6112	9.8844

Well ID: B-001 MW-1

Client: MDEQ
 Project: Watermitt, Oscoda, MI Lake M., Grayling, MI
 Project #: 60540525

INSPECTION

Label on well? YES NA Is cap locked? YES NA
 Is reference mark visible? YES NA Standing water present? YES NA
 Condition of well perfect Any indication of surface runoff in well? YES NA
 Weather SUNNY Air Temperature: 70's

Notes:
Well development

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-22-18 Time: 0725 AM/PM
 Depth to Water: 1.44' Measured with: Electronic Tape Chalk & Steel Tape
 Length of Well: 12.12' Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: _____ Begin Time: 1524 AM/PM Purging Equipment: Submersible Peristaltic Pump
 End Time: _____ AM/PM Decontamination: Pre Steam Cleaned DI Water Other
New Tubing

CALCULATION OF 1 CASING VOLUME

12.12 ft. Length of well Yield: HIGH LOW
1.44 ft. - depth of water (before purge start) If low, recovery time: _____
10.68 ft. = length of water column
 x conversion factor (2" well) 0.16 Actual volume purged _____ gallons
 Gal. = 1 casing volume Actual purge flow rate: 2 gpm gal/min

Notes: readings taken as grab readings

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +/-10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
1640	-	-	8.20	0.818	2	12.23	13.34	-145
1645	-	-	8.17	0.829	3	12.41	12.78	-153
1650	-	-	8.15	0.809	1	11.92	12.17	-146
Final:								

SAMPLE COLLECTION

Date: _____ Time: _____ AM/PM Method: Peristaltic Pump
 Appearance of Sample: _____ Actual Sample Flow Rate: _____ ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)

SAMPLING PERSONNEL

Name Stanley Krenz Company: AESOM

Well ID: B-001 MW-2

Client: MDEQ
 Project: Went Smith, Oscoda, MI Lake M. Grayling MDE
 Project #: 00518528 60863409

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well: perfect
 Weather: Sunny
 Air Temperature: 60's
 Notes: Well Development

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-22-18 Time: 0725 AM PM
 Depth to Water: 1.60'
 Length of Well: 25.25'
 Measured with: Electronic Tape
 Decontamination: Pre Steam Cleaned Chalk & Steel Tape DI Water Other

WELL PURGING

Date: 8-22-18 Begin Time: 1115 AM PM
 End Time: _____
 Purging Equipment: Peristaltic Pump
 Decontamination: New Tubing Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

25.25 ft. Length of well
1.60 ft. - depth of water (before purge start)
 = length of water column
 x conversion factor (2" well) 0.16
 Gal. = 1 casing volume
 Yield: HIGH LOW
 If low, recovery time: _____
 Actual volume purged: 375 gallons
 Actual purge flow rate: 2 ^{min}/_{min} gal/min
 Notes: readings taken as grab readings due to high flow rate

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>1425</u>	<u>-</u>	<u>-</u>	<u>8.20</u>	<u>0.632</u>	<u>6</u>	<u>22.61</u>	<u>12.27</u>	<u>47</u>
<u>1430</u>	<u>-</u>	<u>-</u>	<u>8.06</u>	<u>0.648</u>	<u>7</u>	<u>18.01</u>	<u>11.84</u>	<u>-10</u>
<u>1435</u>	<u>-</u>	<u>-</u>	<u>8.07</u>	<u>0.649</u>	<u>7</u>	<u>14.35</u>	<u>10.94</u>	<u>-36</u>
Final:								

SAMPLE COLLECTION

Date: _____ Time: _____ AM/PM _____ Method: Peristaltic Pump
 Appearance of Sample: _____ Actual Sample Flow Rate: _____ ml/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)
SAMPLING PERSONNEL
 Name: Stanley Krenz Company: AECOM

Well ID: B-001 MW-3

Client: MDEQ
 Project: Wurtsmith, Oscoda, MI Lake Margrethe, Grayling, MI
 Project #: 60516528-60563409

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well Perfect
 Weather Sunny
 Notes: Well Development

Is cap locked? YES NA
 Standing water present? YES NA
 Any indication of surface runoff in well? YES NA
 Air Temperature: 60's

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-22-18 Time: 0725 AM/PM
 Depth to Water: 7.68'
 Length of Well: 40.00'
 Measured with: Electronic Tape
 Decontamination: Pre Steam Cleaned
 Chalk & Steel Tape
 DI Water Other

WELL PURGING

Date: 8-22-18 Begin Time: 0730 AM/PM
 End Time: _____ AM/PM
 Purging Equipment: Peristaltic Pump
 Decontamination: Pre Steam Cleaned DI Water Other
New Tubing

CALCULATION OF 1 CASING VOLUME

40' ft. Length of well
7.68' ft. - depth of water (before purge start)
38.32' ft. =length of water column
 x conversion factor (2" well) 0.16
6.13 Gal. = 1 casing volume x 10 = 61.30
 Yield: HIGH LOW
 If low, recovery time: _____
 Actual volume purged 375 gallons
 Actual purge flow rate 2 gal/min

Notes: readings taken as grab readings due to high flow rate

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>1055</u>	<u>-</u>	<u>-</u>	<u>8.11</u>	<u>0.487</u>	<u>4</u>	<u>19.68</u>	<u>11.41</u>	<u>83</u>
<u>1100</u>	<u>-</u>	<u>-</u>	<u>8.13</u>	<u>0.489</u>	<u>2</u>	<u>18.94</u>	<u>11.17</u>	<u>60</u>
<u>1105</u>	<u>-</u>	<u>-</u>	<u>8.10</u>	<u>0.487</u>	<u>3</u>	<u>17.70</u>	<u>10.60</u>	<u>38</u>
Final:								

SAMPLE COLLECTION

Date: _____ Time: _____ AM/PM Method: Peristaltic Pump
 Appearance of Sample: _____ Actual Sample Flow Rate: _____ ml/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)
SAMPLING PERSONNEL
 Name: Stanley Krenz Company: AECOM

Well ID: B-002 MW-1

Client: MDEQ
 Project: ~~Wurtsmith, Oscoda, MI~~ Lake M. Grayling, MI
 Project #: ~~60518528~~ 60563409

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well perfect
 Weather sunny
 Notes: Well development

Is cap locked? YES NO NA
 Standing water present? YES NO NA
 Any indication of surface runoff in well? YES NO NA
 Air Temperature: 70's

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-10-18 Time: 1050 AM PM
 Depth to Water: 1.79'
 Length of Well: 14.06'
 Measured with: Electronic Tape Chalk & Steel Tape
 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 8-10-18 Begin Time: 1055 AM PM
 End Time: AM PM
 Purging Equipment: Submersible Peristaltic Pump
 Decontamination: Pre Steam Cleaned DI Water Other
 New Tubing

CALCULATION OF 1 CASING VOLUME

ft. Length of well
 ft. - depth of water (before purge start)
 ft. = length of water column
 x conversion factor (2" well) 0.16
 Gal. = 1 casing volume

Yield: HIGH LOW
 If low, recovery time:
 Actual volume purged gallons
 Actual purge flow rate 2 ml/min l/min gal/min

Notes: 8⁵ measurements collected as grab measurements due to the high flow rate giving variable measurements

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>1215</u>	<u>-</u>	<u>-</u>	<u>7.58</u>	<u>0.938</u>	<u>17</u>	<u>14.41</u>	<u>13.02</u>	<u>-108</u>
<u>1220</u>	<u>-</u>	<u>-</u>	<u>7.55</u>	<u>0.949</u>	<u>12</u>	<u>13.63</u>	<u>12.69</u>	<u>-105</u>
<u>1225</u>	<u>-</u>	<u>-</u>	<u>7.55</u>	<u>0.952</u>	<u>9</u>	<u>12.43</u>	<u>12.58</u>	<u>-107</u>
<u>1230</u>	<u>-</u>	<u>-</u>	<u>7.55</u>	<u>0.957</u>	<u>7</u>	<u>12.29</u>	<u>12.41</u>	<u>-107</u>
Final:								

SAMPLE COLLECTION

Date: Time: AM PM Method: Peristaltic Pump
 Appearance of Sample: Actual Sample Flow Rate: ml/min or l/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)
SAMPLING PERSONNEL
 Name: Stanley Krenz Company: AECOM

Well ID: B-002 MW-2

Client: MDEQ
 Project: Wurtsmith, Decoda, Mt Lake M, Grayling, MI
 Project #: 60518528-60563409

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well perfect
 Weather Sunny
 Notes: Well development

Is cap locked? YES NO NA
 Standing water present? YES NO NA
 Any indication of surface runoff in well? YES NO NA
 Air Temperature: 80's

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-13-18 Time: 1400 AM/PM
 Depth to Water: 1.87' Measured with: Electronic Tape Chalk & Steel Tape
 Length of Well: 25.26' Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 8-13-18 Begin Time: 1405 AM/PM
 End Time: _____ AM/PM _____
 Purging Equipment: Peristaltic Pump
 Decontamination: Pre Steam Cleaned New Tubing DI Water Other

CALCULATION OF 1 CASING VOLUME

ft. Length of well Yield: HIGH LOW
 ft. - depth of water (before purge start) If low, recovery time: _____
 ft. =length of water column
 x conversion factor (2" well) 0.16 Actual volume purged _____ gallons
 Gal. =1 casing volume Actual purge flow rate _____ ml/min or L/min

Notes: readings taken as grab readings due to high flow rate giving variable readings

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>1545</u>			<u>7.34</u>	<u>0.625</u>	<u>8</u>	<u>45.43</u>	<u>13.72</u>	<u>-61</u>
<u>1550</u>			<u>7.46</u>	<u>0.609</u>	<u>5</u>	<u>17.41</u>	<u>14.67</u>	<u>-58</u>
<u>1555</u>			<u>7.45</u>	<u>0.602</u>	<u>6</u>	<u>14.81</u>	<u>12.55</u>	<u>-60</u>
Final:								

SAMPLE COLLECTION

Date: _____ Time: _____ AM/PM Method Peristaltic Pump
 Appearance of Sample: _____ Actual Sample Flow Rate: _____ ml/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)

SAMPLING PERSONNEL

Name Stanley Krenz Company: AECOM

Well ID: B-004 MW-1

Client: MDEQ
 Project: Wurtsmith, Oscoda, MI
 Project #: 60518528

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well perfect
 Weather Sunny
 Air Temperature: Leo's

Notes: WELL Development

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-10-18 Time: 0805 AM PM
 Depth to Water: 3.13' Measured with: Electronic Tape Chalk & Steel Tape
 Length of Well: 13.76' Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 8-10-18 Begin Time: 0805 AM PM Purging Equipment: Peristaltic Pump
 End Time: AM PM Decontamination: Pre Steam Cleaned DI Water Other New Tubing

CALCULATION OF 1 CASING VOLUME

 ft. Length of well Yield: HIGH LOW
 ft. - depth of water (before purge start) If low, recovery time:
 ft. =length of water column
 x conversion factor (2" well) 0.16 Actual volume purged gallons
 Gal. =1 casing volume Actual purge flow rate 2 ~~gal/min~~ gal/min

Notes: Measurements are taken by filling flow cell to take grab measurements due to high flow rate giving variable readings

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>0045</u>			<u>7.13</u>	<u>0.757</u>	<u>5</u>	<u>15.67</u>	<u>10.30</u>	<u>9</u>
<u>0948</u>			<u>7.16</u>	<u>0.727</u>	<u>5</u>	<u>15.58</u>	<u>10.27</u>	<u>-13</u>
Final:								

SAMPLE COLLECTION

Date: Time: AM PM Method Peristaltic Pump
 Appearance of Sample: Actual Sample Flow Rate: ml/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)

SAMPLING PERSONNEL

Name Stanley Krenz Company: AECOM

Well ID: B-005 MW-1

Client: MDEQ
Project: Wurtsmith, Woods, MI Lake Margrethe, Grayling, MI
Project #: 60548622 00663409

INSPECTION
Label on well? YES (NO) NA
Is reference mark visible? YES (NO) NA
Condition of well: Perfect
Weather: rain
Notes: Well development

STATIC WATER LEVEL PRIOR TO PURGING
Date: 8-21-18 Time: 0837 (AM/PM)
Depth to Water: 5.01'
Length of Well: 12.16'
Measured with: Electronic Tap
Decontamination: Pre Steam Cleaned, Water, Other

WELL PURGING
Date: 8-21-18 Begin Time: 0840 (AM/PM) End Time: 1015 (AM/PM)
Purging Equipment: Peristaltic Pump
Decontamination: Pre Steam Cleaned, DI Water, Other, New Tubing

CALCULATION OF 1 CASING VOLUME
12.16' ft. Length of well
5.01' ft. - depth of water (before purge start)
7.15' ft. =length of water column
x conversion factor (2" well) 0.16
1.1 Gal. =1 casing volume x 10 = 11.44 gal
Actual volume purged: 100 gallons
Actual purge flow rate: 2901 ml/min or 91/min

Notes: readings taken as good readings due to inconsistent flow rate

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Data rows for times 1005, 1010, 1015.

SAMPLE COLLECTION
Date: Time: AM/PM Method: Peristaltic Pump
Appearance of Sample: Actual Sample Flow Rate: ml/min or l/min
SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)
SAMPLING PERSONNEL
Name: Stanley Krenz Company: AECOM

Well ID: B-005 MW-2

Client: MDEQ
Project: ~~West Smith, Woods, MI~~ Lake Marguerite, Grayling, MI
Project #: ~~60546528~~ 60563409

INSPECTION

Label on well? YES NO NA
 Is reference mark visible? YES NO NA
 Condition of well perfect
 Weather overcast/rain
 Air Temperature: 60's

Notes: Well Development

STATIC WATER LEVEL PRIOR TO PURGING

Date: 8-21-18 Time: 1510 AM/PM
 Depth to Water: 4.11'
 Length of Well: 25.26'
 Measured with: Electronic Tape
 Decontamination: Pre Steam Cleaned Chalk & Steel Tape DI Water Other

WELL PURGING

Date: 8-21-18 Begin Time: 1515 AM/PM Purging Equipment: Submersible Pump
 End Time: AM/PM Decontamination: Pre Steam Cleaned DI Water Other
New Tubing

CALCULATION OF 1 CASING VOLUME

25.26 ft. Length of well
4.11 ft. - depth of water (before purge start)
21.15 ft. = length of water column
 x conversion factor (2" well) 0.16
3.38 Gal. = 1 casing volume 33.84 gal

Yield: HIGH LOW
 If low, recovery time:
 Actual volume purged: 225 gallons
 Actual purge flow rate: 2 m/min or gal/min
 L/min

Notes: readings taken as grab samples

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start:								
<u>1645</u>	-	-	<u>7.95</u>	<u>0.318</u>	<u>17</u>	<u>45.21</u>	<u>11.01</u>	<u>-8</u>
<u>1650</u>	-	-	<u>7.01</u>	<u>0.318</u>	<u>13</u>	<u>23.25</u>	<u>10.60</u>	<u>-17</u>
<u>1655</u>	-	-	<u>7.05</u>	<u>0.319</u>	<u>5</u>	<u>11.83</u>	<u>10.72</u>	<u>-28</u>
Final:								

SAMPLE COLLECTION

Date: _____ Time: _____ AM/PM Method: Peristaltic Pump
 Appearance of Sample: _____ Actual Sample Flow Rate: _____ m/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250 ML HDPE (no preservative)

SAMPLING PERSONNEL

Name: Stanley Krenz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW001 B (12.0)

Client:
Location:
Project #:

INSPECTION
Label on well? YES NO
Is reference mark visible? YES NO
Condition of well G.O.P.
Weather Clear
Air Temperature: 65

STATIC WATER LEVEL PRIOR TO PURGING
Date: 09/25/18 Time: 0938 AM/PM
Depth to Water: 11.95
Length of Well: 1.14
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned DI Water

WELL PURGING
Date: 09/25/18 Begin Time: 0945 AM/PM End Time: 1040 AM/PM
Purging Equipment: Peristaltic
Decontamination: Pre Steam Cleaned DI Water New Tubing

CALCULATION OF 1 CASING VOLUME
11.95 ft. Length of well
.14 ft. - depth of water (before purge start)
Yield: HIGH LOW
Actual volume purged 5.2 gallons
Actual purge flow rate 300 ml/min or L/min

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Rows include start and final data points.

SAMPLE COLLECTION
Date: 09/25/18 Time: 1040 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL
Name: Michael Kosciarz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW001-20.0

Client:
Location:
Project #:

INSPECTION
Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Go!
Weather: Clear
Notes:

STATIC WATER LEVEL PRIOR TO PURGING
Date: 09/25/18 Time: 0935 AM/PM
Depth to Water: 1.20
Length of Well: 25.01
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned

WELL PURGING
Date: 10/25 09/25/18 Begin Time: 1050 AM/PM
End Time: 1135 AM/PM
Purging Equipment: Peristaltic Pump
Decontamination: Pre Steam Cleaned, DI Water, Other

CALCULATION OF 1 CASING VOLUME
25.01 ft. Length of well
1.20 ft. - depth of water (before purge start)
Yield: HIGH LOW
Actual volume purged: 5.4 gallons
Actual purge flow rate: 300 ml/min or L/min

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), and ORP. Data points are recorded from 1105 to 1130.

SAMPLE COLLECTION
Date: 09/25/18 Time: 1135 AM/PM
Method: Peristaltic Pump
Appearance of Sample: Clear
Actual Sample Flow Rate: 300 ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL
Name: Michel Roscio
Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW001-40.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well Good
Weather Clear
Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 65°

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 0930 AM/PM
Depth to Water: 1.24
Length of Well: 39.66
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned

WELL PURGING

Date: 09/25/18 Begin Time: 1145 AM/PM Purging Equipment: Peristaltic P.o.p
End Time: 1230 AM/PM Decontamination: Pre Steam Cleaned, DI Water, New Tubing

CALCULATION OF 1 CASING VOLUME

39.66 ft Length of well
1.24 ft depth of water (before purge start)
Yield: HIGH
Actual volume purged: 3.9 gallons
Actual purge flow rate: 300 ml/min or L/min

Notes

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Rows include start and final data points.

SAMPLE COLLECTION

Date: 09/25/18 Time: 1230 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL

Name: Michael Kosciusz Company: AECOM

Well ID: CG-MW002-14.0

Client: DEQ
 Location: Grayling, MI
 Project #: 62563409.02

INSPECTION

Label on well? YES NO
 Is reference mark visible? YES NO
 Condition of well: Good
 Weather: Sunny
 Notes: _____

Is cap locked? Bolts YES NO
 Standing water present? YES NO
 Any indication of surface runoff in well? YES NO
 Air Temperature: 73°F

STATIC WATER LEVEL PRIOR TO PURGING

Date: 9/25/10 Time: 1:02 AM PM
 Depth to Water: 1.53
 Length of Well: 14.04
 Measured with: Electronic Tape Chalk & Steel Tape
 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 9/25/10 Begin Time: 11:40 AM PM
 End Time: 12:15 AM PM
 Purging Equipment: Peristaltic
 Decontamination: New Tubing Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

14.04 ft. Length of well
1.53 ft. - depth of water (before purge start)
12.51 ft. = length of water column
2.0 Gal. = 1 casing volume (x conversion factor (2" well) 0.16)

Yield: HIGH LOW
 If low, recovery time: NA
 Actual volume purged: 1.7 gallons
 Actual purge flow rate: 350 ml/min or L/min

Notes: _____

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +/-3%	Turbidity (NTU) +/-10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start: 11:50	0.3	1.60	6.67	0.55	0.21	3.71	12.6	+92.9
11:55	0.6	1.60	6.72	0.55	0.37	3.33	12.6	+64.5
12:00	0.9	1.60	6.72	0.55	0.34	3.20	12.6	+53.1
12:05	1.2	1.60	6.74	0.55	0.36	3.18	12.4	+44.1
12:10	1.3	1.60	6.75	0.55	0.33	3.03	12.6	+35.1
12:15	1.6	1.60	6.76	0.55	0.33	3.04	12.5	+30.2
Final:								

SAMPLE COLLECTION

Date: 9/25/10 Time: _____ AM/PM Method: Peristaltic
 Appearance of Sample: clear Actual Sample Flow Rate: 350 ml/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250ml

SAMPLING PERSONNEL

Name: K. Eicholtz Company: AECOM

Well ID: CG-MNW02-25.0

Client: DEW
 Location: Grayling, MI
 Project #: 60563409.02

INSPECTION

Label on well? YES NO
 Is reference mark visible? YES NO
 Condition of well: Good
 Weather: Sunny
 Notes: _____

Is cap locked? YES NO
 Standing water present? YES NO
 Any indication of surface runoff in well? YES NO
 Air Temperature: 73 °F

STATIC WATER LEVEL PRIOR TO PURGING

Date: 9/25/18 Time: 1000 AM PM
 Depth to Water: 1.44
 Length of Well: 25.19
 Measured with: Electronic Tape Chalk & Steel Tape
 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 9/25/18 Begin Time: 1220 AM PM
 End Time: 1250 AM PM
 Purging Equipment: Peristaltic
 Decontamination: Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

25.19 ft. Length of well
1.44 ft. - depth of water (before purge start)
23.75 ft. = length of water column
3.8 Gal. = 1 casing volume x conversion factor (2" well) 0.16

Yield: HIGH LOW
 If low, recovery time: NA
 Actual volume purged: 2.3 gallons
 Actual purge flow rate: 350 mL/min or L/min

Notes: _____

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +/-3%	Turbidity (NTU) +/-10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start: 1230	0.8	1.59	7.20	0.401	25.0	10.21	10.2	+50.8
1235	1.1	1.59	7.27	0.472	10.7	10.36	10.0	+56.6
1240	1.4	1.59	7.29	0.472	6.84	10.34	10.0	+58.8
1245	1.7	1.59	7.30	0.477	5.89	9.84	10.4	+61.5
1250	2.0	1.59	7.32	0.474	4.57	9.55	10.4	+64.0
Final:								

SAMPLE COLLECTION

Date: 9/25/18 Time: 1250 AM PM Method: Peristaltic
 Appearance of Sample: clear Actual Sample Flow Rate: 350 mL/min or L/min
 SAMPLE BOTTLE COLLECTED: 2-250ML

SAMPLING PERSONNEL

Name: K. Echoltz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW002-35.φ

Client: DEQ
Location: Grayling, MI
Project #: 60563409.02

INSPECTION
Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: Sunny
Air Temperature: 75.0 F

STATIC WATER LEVEL PRIOR TO PURGING
Date: 9/25/18 Time: 09:58 AM/PM
Depth to Water: 1.63
Length of Well: 34.4φ
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned, DI Water

WELL PURGING
Date: 9/25/18 Begin Time: 15:25 AM/PM End Time: 15:55 AM/PM
Purging Equipment: Peristaltic
Decontamination: Pre Steam Cleaned, DI Water, New Tubing

CALCULATION OF 1 CASING VOLUME
34.4φ ft. Length of well
1.63 ft. - depth of water (before purge start)
32.77 ft. =length of water column
x conversion factor (2" well) 0.16
5.2 Gal. =1 casing volume
Yield: HIGH LOW NA
Actual volume purged: 2.4 gallons
Actual purge flow rate: 3φφ ml/min or L/min

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Contains multiple rows of data points from 15:35 to 15:55.

SAMPLE COLLECTION
Date: 9/25/18 Time: 15:55 AM/PM Method: Peristaltic
Appearance of Sample: clear Actual Sample Flow Rate: 3φφ ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2-250ML

SAMPLING PERSONNEL
Name: K. Eicholtz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW003-14.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: Clear
Air Temperature: 70

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 1036 AM/PM
Depth to Water: 8.20
Length of Well: 15.11
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned

WELL PURGING

Date: 09/25/18 Begin Time: 1505 AM/PM End Time: 1545 AM/PM
Purging Equipment: Peristaltic Pump
Decontamination: Pre Steam Cleaned, DI Water, Other

CALCULATION OF 1 CASING VOLUME

15.11 ft. Length of well
8.20 ft. - depth of water (before purge start)
Yield: HIGH LOW
Actual volume purged: 2.7 gallons
Actual purge flow rate: 300 ml/min or L/min

Notes

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Contains 5 rows of data from 1520 to 1540.

SAMPLE COLLECTION

Date: 09/25/18 Time: 1545 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2 250 mL sample bottles

SAMPLING PERSONNEL

Name: Michal Kosciarz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW003-32.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES
Is reference mark visible? YES
Condition of well: Good
Weather: Clear
Is cap locked? YES
Standing water present? YES
Any indication of surface runoff in well? YES
Air Temperature: 70

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 1035 AM/PM
Depth to Water: 8.50
Length of Well: 31.98
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned, DI Water

WELL PURGING

Date: 09/25/18 Begin Time: 1600 AM/PM End Time: 1635 AM/PM
Purging Equipment: Peristaltic Pump
Decontamination: Pre Steam Cleaned, DI Water, New Tubing

CALCULATION OF 1 CASING VOLUME

31.98 ft. Length of well
8.50 ft. - depth of water (before purge start)
Yield: HIGH
Actual volume purged: 2.4 gallons
Actual purge flow rate: 300 ml/min or L/min

Notes

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Data rows show measurements from 1615 to 1630.

SAMPLE COLLECTION

Date: 09/25/18 Time: 1635 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL

Name: Michl Kosciq Company: AECOM

Well ID: CG-MW004-14.0

Client: DEQ
 Location: Grayling, MI
 Project #: 60563409

INSPECTION

Label on well? YES NO Is cap locked? YES NO

Is reference mark visible? YES NO Standing water present? YES NO

Condition of well: Good Any indication of surface runoff in well? YES NO

Weather: Rainy / overcast Air Temperature: 54°F

Notes: _____

STATIC WATER LEVEL PRIOR TO PURGING

Date: 9/26/18 Time: 1019 AM PM

Depth to Water: 2.89 Measured with: Electronic Tape Chalk & Steel Tape

Length of Well: 13.74 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 9/26/18 Begin Time: 1055 AM PM Purging Equipment: Peristaltic

End Time: 1130 AM PM Decontamination: Pre Steam Cleaned DI Water Other

New Tubing

CALCULATION OF 1 CASING VOLUME

13.74 ft. Length of well Yield: HIGH LOW

2.89 ft. - depth of water (before purge start) If low, recovery time: NA

10.85 ft. = length of water column

1.7 Gal. = 1 casing volume x conversion factor (2" well) 0.16

Actual volume purged _____ gallons

Actual purge flow rate: 400 ml/min or L/min

Notes: _____

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +/-3%	Turbidity (NTU) +/-10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start: <u>1105</u>	<u>0.8</u>	<u>2.93</u>	<u>6.76</u>	<u>0.56</u>	<u>3.28</u>	<u>3.41</u>	<u>10.4</u>	<u>-50.4</u>
<u>1110</u>	<u>1.2</u>	<u>2.93</u>	<u>6.68</u>	<u>0.55</u>	<u>3.17</u>	<u>4.00</u>	<u>10.5</u>	<u>-50.6</u>
<u>1115</u>	<u>1.6</u>	<u>2.93</u>	<u>6.68</u>	<u>0.55</u>	<u>1.98</u>	<u>3.49</u>	<u>10.5</u>	<u>-51.3</u>
<u>1120</u>	<u>2.0</u>	<u>2.93</u>	<u>6.66</u>	<u>0.56</u>	<u>1.37</u>	<u>3.09</u>	<u>10.6</u>	<u>-51.3</u>
<u>1125</u>	<u>2.3</u>	<u>2.93</u>	<u>6.67</u>	<u>0.56</u>	<u>1.29</u>	<u>3.09</u>	<u>10.6</u>	<u>-51.6</u>
<u>1130</u>	<u>2.7</u>	<u>2.93</u>	<u>6.65</u>	<u>0.56</u>	<u>2.07</u>	<u>3.04</u>	<u>10.7</u>	<u>-51.4</u>
Final: <u>1130</u>	<u>2.7</u>	<u>2.93</u>	<u>6.65</u>	<u>0.56</u>	<u>2.07</u>	<u>3.04</u>	<u>10.7</u>	<u>-51.4</u>

SAMPLE COLLECTION

Date: 9/26/18 Time: 1130 AM PM Method: Peristaltic

Appearance of Sample: clear Actual Sample Flow Rate: 400 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2 - 250 mLs

SAMPLING PERSONNEL

Name: K. Eicholtz Company: AECOM

Well ID: CG-MW 004 - 30.0

Client: DEQ
 Location: Grayling MT
 Project #: 60563409

INSPECTION

Label on well? YES NO Is cap locked? YES NO

Is reference mark visible? YES NO Standing water present? YES NO

Condition of well: Good Any indication of surface runoff in well? YES NO

Weather: Rainy/overcast Air Temperature: 53.0F

Notes: _____

STATIC WATER LEVEL PRIOR TO PURGING

Date: 9/25/18 Time: 1021 AM PM

Depth to Water: 2.74 Measured with: Electronic Tape Chalk & Steel Tape

Length of Well: 29.72 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 9/26/18 Begin Time: 0945 AM PM Purging Equipment: Peristaltic

End Time: 1045 AM/PM Decontamination: Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

29.72 ft. Length of well Yield: HIGH LOW

2.74 ft. - depth of water (before purge start) If low, recovery time: NA

26.98 ft. = length of water column

4.3 Gal. = 1 casing volume x conversion factor (2" well) 0.16

Actual volume purged: 4.3 gallons

Actual purge flow rate: 300 ml/min or L/min

Notes: Nearly stabilized @ 1010 then turbidity increased. Took sample 7 min from beginning of purge / After 10 Readings.

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start: <u>1000</u>	<u>0.8</u>	<u>2.95</u>	<u>7.55</u>	<u>0.472</u>	<u>10.0</u>	<u>3.84</u>	<u>9.9</u>	<u>-113.0</u>
<u>1005</u>	<u>1.1</u>	<u>2.95</u>	<u>7.59</u>	<u>0.467</u>	<u>9.05</u>	<u>3.55</u>	<u>9.9</u>	<u>-116.6</u>
<u>1010</u>	<u>1.4</u>	<u>2.95</u>	<u>7.57</u>	<u>0.464</u>	<u>9.17</u>	<u>3.68</u>	<u>9.8</u>	<u>-136.0</u>
<u>1015</u>	<u>1.7</u>	<u>2.95</u>	<u>7.56</u>	<u>0.477</u>	<u>11.3</u>	<u>3.84</u>	<u>9.8</u>	<u>-146.0</u>
<u>1020</u>	<u>2.0</u>	<u>2.95</u>	<u>7.57</u>	<u>0.466</u>	<u>16.9</u>	<u>3.87</u>	<u>9.8</u>	<u>-154.7</u>
<u>1025</u>	<u>2.3</u>	<u>2.95</u>	<u>7.54</u>	<u>0.489</u>	<u>14.1</u>	<u>3.88</u>	<u>9.9</u>	<u>-154.1</u>
<u>1030</u>	<u>2.7</u>	<u>2.95</u>	<u>7.58</u>	<u>0.458</u>	<u>24.2</u>	<u>3.89</u>	<u>10.0</u>	<u>-150.0</u>
<u>1035</u>	<u>3.0</u>	<u>2.95</u>	<u>7.56</u>	<u>0.466</u>	<u>29.4</u>	<u>3.88</u>	<u>10.0</u>	<u>-164.8</u>
<u>1040</u>	<u>3.3</u>	<u>2.95</u>	<u>7.55</u>	<u>0.474</u>	<u>42.6</u>	<u>3.86</u>	<u>10.0</u>	<u>-161.6</u>
<u>1045</u>	<u>3.7</u>	<u>2.95</u>	<u>7.55</u>	<u>0.482</u>	<u>81.5</u>	<u>3.80</u>	<u>10.0</u>	<u>-163.5</u>
Final: <u>1045</u>	<u>3.7</u>	<u>2.95</u>	<u>7.55</u>	<u>0.482</u>	<u>81.5</u>	<u>3.80</u>	<u>10.0</u>	<u>-163.5</u>

SAMPLE COLLECTION

Date: 9/26/18 Time: 1045 AM PM Method: Peristaltic

Appearance of Sample: clear Actual Sample Flow Rate: 300 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-250ml

SAMPLING PERSONNEL

Name: K. Gicholtz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW004-40.0

Client: DEQ
Location: Ensayling, MI
Project #: 60563409

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well: Good
Weather: Overcast/Rainy
Notes: _____
Is cap locked? YES Bolts NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 52°F

STATIC WATER LEVEL PRIOR TO PURGING

Date: 9/25/18 Time: 1014 AM/PM
Depth to Water: 2.74 Measured with: Electronic Tape Chalk & Steel Tape
Length of Well: 39.85 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 9/26/18 Begin Time: 0955 AM/PM Purging Equipment: Peristaltic
End Time: 0940 AM/PM Decontamination: Pre Steam Cleaned DI Water Other
New Tubing

CALCULATION OF 1 CASING VOLUME

39.85 ft. Length of well Yield: HIGH LOW
2.74 ft. - depth of water (before purge start) If low, recovery time: NA
37.11 ft. =length of water column
x conversion factor (2" well) 0.16
5.9 Gal. =1 casing volume Actual volume purged: 2.0 gallons
Actual purge flow rate: 350 ml/min or L/min

Notes: _____

Time	Volume (gallons)	Depth to Water (Feet) <0.33'	pH (SU) +/- 0.1	Conductivity (mS/cm) +3%	Turbidity (NTU) +-10%	D.O. (mg/L) +/- 10%	Temp (°C) +/- 5%	ORP +/- 10 mV
Start: <u>0920</u>	<u>0.5</u>	<u>2.95</u>	<u>7.31</u>	<u>0.337</u>	<u>1.08</u>	<u>9.92</u>	<u>10.0</u>	<u>+118.9</u>
<u>0925</u>	<u>0.8</u>	<u>2.95</u>	<u>7.32</u>	<u>0.334</u>	<u>0.66</u>	<u>9.70</u>	<u>9.9</u>	<u>+96.9</u>
<u>0930</u>	<u>1.1</u>	<u>2.95</u>	<u>7.32</u>	<u>0.335</u>	<u>1.07</u>	<u>9.58</u>	<u>9.9</u>	<u>+70.9</u>
<u>0935</u>	<u>1.4</u>	<u>2.95</u>	<u>7.34</u>	<u>0.339</u>	<u>0.91</u>	<u>9.23</u>	<u>10.1</u>	<u>+62.5</u>
<u>0940</u>	<u>1.7</u>	<u>2.95</u>	<u>7.35</u>	<u>0.340</u>	<u>0.91</u>	<u>9.22</u>	<u>10.2</u>	<u>+53.1</u>
Final: <u>0940</u>	<u>1.7</u>	<u>2.95</u>	<u>7.35</u>	<u>0.340</u>	<u>0.91</u>	<u>9.22</u>	<u>10.2</u>	<u>+53.1</u>

SAMPLE COLLECTION

Date: 9/26/18 Time: AM/PM Method: Peristaltic
Appearance of Sample: clear Actual Sample Flow Rate: 350 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2-250 ML

SAMPLING PERSONNEL

Name: [Signature] K. Gicholtz Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW005-12.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well Good
Weather Cloudy
Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 50°

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 1028 AM/PM
Depth to Water: 3.63
Length of Well: 11.12
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned

WELL PURGING

Date: 09/26/18 Begin Time: 0950 AM/PM
End Time: 1030 AM/PM
Purging Equipment: Peristaltic Pump
Decontamination: Pre Steam Cleaned, DI Water, Other

CALCULATION OF 1 CASING VOLUME

11.12 ft. Length of well
3.63 ft. - depth of water (before purge start)
Yield: HIGH LOW
Actual volume purged: 5.5 gallons
Actual purge flow rate: 300 ml/min or L/min

Notes

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP (+/- 10 mV). Rows include start and end times with data points.

SAMPLE COLLECTION

Date: 09/26/18 Time: 1030 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL

Name: Michl Kosci Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW005-25.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well Good
Weather Rainy
Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 50°

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 1030 AM/PM
Depth to Water: 3.60 Measured with: Electronic Tape
Length of Well: 24.70 Decontamination: Pre Steam Cleaned DI Water Other

WELL PURGING

Date: 09/25/18 Begin Time: 1035 AM/PM Purging Equipment: Peristaltic Pump
End Time: 1130 AM/PM Decontamination: Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

24.70 ft Length of well Yield: HIGH LOW
3.60 ft - depth of water (before purge start) If low, recovery time: -
=length of water column
x conversion factor (2" well) 0.16 Actual volume purged - gallons
Actual purge flow rate 300 ml/min or L/min

Notes

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Rows include start and final data points and a series of time-based measurements.

SAMPLE COLLECTION

Date: 09/26/18 Time: 1130 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min

SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL

Name: Michel Koscin Company: AECOM



Low Flow Ground Water Sample Collection Record

Well ID: CG-MW005-45.0

Client:
Location:
Project #:

INSPECTION

Label on well? YES NO
Is reference mark visible? YES NO
Condition of well Good
Weather Rain
Is cap locked? YES NO
Standing water present? YES NO
Any indication of surface runoff in well? YES NO
Air Temperature: 50

Notes:

STATIC WATER LEVEL PRIOR TO PURGING

Date: 09/25/18 Time: 1032 AM/PM
Depth to Water:
Length of Well:
Measured with: Electronic Tape
Decontamination: Pre Steam Cleaned

WELL PURGING

Date: 09/26/18 Begin Time: 1140 AM/PM Purging Equipment: Peristaltic Pump
End Time: 1215 AM/PM Decontamination: Pre Steam Cleaned DI Water Other

CALCULATION OF 1 CASING VOLUME

42.81 ft. Length of well
2.92 ft. - depth of water (before purge start)
Yield: HIGH LOW
Actual volume purged 5.2 gallons
Actual purge flow rate 300 ml/min or L/min

Notes:

Table with 9 columns: Time, Volume (gallons), Depth to Water (Feet), pH (SU), Conductivity (mS/cm), Turbidity (NTU), D.O. (mg/L), Temp (°C), ORP. Rows include start and four data points.

SAMPLE COLLECTION

Date: 09/26/18 Time: 1215 AM/PM Method: Peristaltic Pump
Appearance of Sample: Clear Actual Sample Flow Rate: 300 ml/min or L/min
SAMPLE BOTTLE COLLECTED: 2 250 mL bottles

SAMPLING PERSONNEL

Name: Michal Kuscia Company: AECOM

Appendix D – Waste Manifest

Please print or type.

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number MICES00	2. Page 1 of 1	3. Emergency Response Phone (800)483-3718	4. Manifest Tracking Number 012593234 FLE			
5. Generator's Name and Mailing Address Grayling DPW 1020 City Blvd Grayling, MI 49738 (616)574-8300				Generator's Site Address (if different than mailing address) Grayling DPW 2471 Industrial Street Grayling, MI 49738				
6. Transporter 1 Company Name Clean Harbors Environmental Services, Inc.				U.S. EPA ID Number MA8039322200				
7. Transporter 2 Company Name				U.S. EPA ID Number				
8. Designated Facility Name and Site Address Clean Harbors Canada, Inc. 551 Avonhead Road Mississauga, ON L5J 4B1 Facility's Phone: (905)822-3781				U.S. EPA ID Number MIR000037201				
9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers		11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	1. NON DOT REGULATED MATERIAL, (SOIL)	No.	Type					
	2. NON DOT REGULATED MATERIAL, (GROUNDWATER)	15	DM	15,000	P			
		33	DM	17,000	P			
	3.							
	4.							
14. Special Handling Instructions and Additional Information 1. CH1750989 15 X 55 2. CH1750991 33 X 55								
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.								
Generator's/Offoror's Printed/Typed Name Michal Kosciak, Director of Environmental Quality				Signature <i>Michal Kosciak</i>		Month	Day	Year
						12	05	18
16. International Shipments <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S. Port of entry/exit: _____ Date leaving U.S.: _____								
17. Transporter Acknowledgment of Receipt of Materials								
Transporter 1 Printed/Typed Name JEEZ S. DILLIQUIN				Signature Jeez S. Dilliquin		Month	Day	Year
						12	05	18
Transporter 2 Printed/Typed Name				Signature		Month	Day	Year
18. Discrepancy								
18a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection								
Manifest Reference Number: _____								
18b. Alternate Facility (or Generator)				U.S. EPA ID Number				
Facility's Phone:								
18c. Signature of Alternate Facility (or Generator)						Month	Day	Year
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)								
1.	2.	3.	4.					
H141	H141							
20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a								
Printed/Typed Name				Signature		Month	Day	Year

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

Appendix E –
Laboratory Analytical
Results