

#### **BASF Corporation**

## **Geophysics Report**

## Point Hennepin Wayne County, Michigan

December 22, 2022

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#### **Prepared By:**

Arcadis of Michigan, LLC 28550 Cabot Drive, Suite 500 Novi Michigan 48377 Phone: 248 994 2240

Our Ref: 30107326 and 30137334

Gredor PE. PG

Geophysics Technical Expert

Jacelyn Saling Technical Expert, PE-MI

Christopher S. Peters, PG Principal Geologist

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Prepared For: Michael Gerdenich Senior Remediation Specialist BASF Corporation 1609 Biddle Avenue Wyandotte, MI 48192

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## **Acronyms and Abbreviations**

Arcadis	Arcadis of Michigan, LLC
ASI	Aqua Survey, Inc.
BASF	BASF Corporation
DBO	distiller blowoff
DGPS	differential global positioning system
EC	electrical conductivity
ECT	electrical conductivity tool
EGLE	Department of Environment, Great Lakes, and Energy
EM	electromagnetic
EM31	Geonics EM31-MK2 electromagnetic induction conductivity meter
ERI	electrical resistivity imaging
GSI Work Plan	Groundwater to Surface Water Interface Assessment Work Plan
HMD	horizontal magnetic dipole
HPT	hydraulic profiling tool
ISA	inverse Schlumberger array
NOAA	National Oceanic and Atmospheric Administration
mS/m	milliSiemen per meter
report	Groundwater to Surface Water Assessment – Geophysics Report
Site	Point Hennepin, located in Wayne County, Michigan
TDS	total dissolved solids
VMD	vertical magnetic dipole

### **1** Introduction

On behalf of BASF Corporation (BASF), Arcadis of Michigan, LLC (Arcadis) prepared this Groundwater to Surface Water Assessment – Geophysics Report (report) for Point Hennepin, located in Wayne County, Michigan (Site; Figure 1). This report presents the results of activities conducted at the Site between November 3, 2021 and July 15, 2022, which were performed according to the Groundwater to Surface Water Interface Assessment Work Plan (GSI Work Plan; Arcadis 2021). The GSI Work Plan was submitted to Michigan's Department of Environment, Great Lakes, and Energy (EGLE) on August 31, 2021. Activities discussed in the GSI Work Plan included electrical resistivity imaging (ERI) on land near the site perimeter, hydraulic profiling tool (HPT)/electrical conductivity tool (ECT) borings and soil borings on land, and an in-river marine electrical conductivity (EC) investigation.

#### 2 Background and Purpose of Investigation

Point Hennepin is a 225-acre island in the Detroit River located immediately north of Grosse IIIe and east of Wyandotte, Michigan, upon which distiller blow off (DBO) was placed from the early to mid-1900s. DBO was a waste product resulting from soda ash production at a facility to the west of the island, across the Detroit River in Wyandotte.

The objective of the investigation activities documented in this report is to refine the conceptual site model for the Site using the following:

- Land-based geophysics
  - Electrical conductivity
  - ERI
- HPT/ECT borings
- Direct-push calibration soil borings
- Marine EC profiling.

The purpose of the geophysical investigation activities was to collect nearly continuous bulk EC of the fill and native geologic materials along the margins of the island, both on land and in the river bottom sediments adjacent to the island. Historical conditions associated with the island have the potential to exhibit elevated electrical conductivity, as such EC was selected as the preferred geophysical method. The geophysics investigation scope of work was provided in the GSI Work Plan (Arcadis 2021).

ERI was the first tool used to around the perimeter of the island. Because ERI is an indirect measurement of the formation bulk EC, it was necessary to calibrate the results. The on-land ERI results were calibrated using:

- Historical soil and groundwater data
- Electrical conductivity and hydraulic conductivity data gathered with direct- push HPT/ECT measurements
- Continuously logged soil borings placed along the ERI lines at anomalous locations.

The combined ERI, historical data, HPT/ECT data, and soil boring data were used to create an interpretation of the geologic conditions, which was used to guide the extent of the in-river marine EC. The in-river marine EC investigation used electromagnetics (EM) to quantify the formation bulk EC of the river bottom sediments.

The results of this investigation will be used to guide the development of a hydraulic investigation to evaluate groundwater flux to surface water in key areas identified by the ERI and EM work. A Hydraulic Investigation Work Plan will be submitted to the EGLE under separate cover.

## **3** Schedule of Site Activities

The following activities were completed and are detailed further in this report:

- November 3, 2021. Site reconnaissance was performed to refine the locations of ERI survey lines presented in the GSI Work Plan (Arcadis 2021) based on practical considerations such as accessibility, ground conditions, potential interferences, and other site conditions.
- November 8 through December 3, 2021. Prepared for land-based ERI data collection.
- December 6 through 10, 2021. Performed land-based ERI data collection field activities.
- December 13, 2021 through March 1, 2022. Completed data processing and interpretation of ERI data, and select HPT/ECT and soil boring locations.
- March 10 through 18, 2022. Prepared for drilling activities, including staking and utility clearance.
- March 22 through April 6, 2022. Advanced HPT/ECT and soil borings.
- April 10 through June 2, 2022. Integrated HPT/ECT and soil boring results into ERI interpretations, and completed final planning of the marine survey.
- June 21 through 25, 2022. Performed the first phase of marine data collection, including use of a single beam echo sounder and a multibeam echo sounder
- July 11 through 15, 2022. Performed the second phase of marine data collection, consisting of EC measurements with a Geonics EM31-MK2 electromagnetic induction conductivity meter (EM31).

#### 4 Investigation Methods

This section discusses the methods used to collect ERI data, advance HPT/ECT and soil borings, and perform a marine geophysical survey.

#### 4.1 Electrical Resistivity Imaging Data Collection

Arcadis collected formation bulk EC measurements via ERI on the western and eastern perimeters of the Site on December 6 through 10, 2021 (see Figure 2 for line locations). The field team conducted the geophysical surveys over approximately 6,600 feet on the west side of the island and over approximately 6,800 feet on the east side of the island. Although the line on the east side was originally planned to run along the entire perimeter, standing water present and lack of access in the southeast area of the island prevented the ERI line from being closer to the perimeter in that location.

Data were collected with an Advanced Geosciences, Inc. SuperSting R8 8-channel earth resistivity meter programmed to collect inverse Schlumberger arrays (ISAs) and dipole-dipole arrays. One hundred twelve electrodes were used, with spacing of approximately 16.4 feet between electrodes. The West Line was placed on the west side of the perimeter road and was a net length of 6,824 feet. There were 59 feet of overlap between segments to improve subsurface coverage. The East Line was placed on the east side of the perimeter road and

separated into north and south halves, each 3,445 feet in length with 197 feet of overlap. The final positions of the resistivity electrodes were obtained using a differentially corrected global positioning system (DGPS) with submeter accuracy.

Quality assurance and control procedures were followed for layout of the electrode cables and the data collection process. Initial layout was performed using engineering tapes marked in meters to an accuracy of 2 millimeters. DGPS surveying verified the electrode positional accuracy. Noncorrosive stainless-steel stakes were placed into the subsurface between 6 and 12 inches in depth. Approximately 500 milliliters of saltwater solution were poured around each stainless-steel stake to improve ground contact. Once all electrode stakes were emplaced and connected to the electrode cable, the resistivity meter was used to collect contact resistance readings, which verified that all electrodes were physically connected to the cable and that contact resistance between electrodes fell within the manufacturer's recommended resistance. Additionally, saltwater was added and, if necessary, stakes were reinserted if resistance criteria were not met. During data collection, the resistivity meter was programed to run two data collection cycles to verify consistency of readings. A rejection threshold of 4 percent difference between readings was used to trigger a repeat data collection. Details on the ERI data processing and ISA modeling procedures are provided in Appendix A.

The cross sections, along with historical borehole data, were used to select the HPT/ECT and soil boring locations by targeting locations with anomalously elevated values. The modeled EC indicated background values less than 50 mS/m and anomalous values in the range of approximately 50 to 10,000 mS/m. Borings were also placed in locations interpreted to be representative of background conditions for making comparisons that were used to calibrate the ERI results. A total of 22 locations (designated W1 through W11 and E1 through E11) were selected for HPT/ECT measurements and 10 of the 22 locations were selected for soil borings. Section 4.2 provides details for the HPT/ ECT and soil borings.

# 4.2 Hydraulic Profiling Tool, Electrical Conductivity Tool, and Soil Borings

A total of 20 Geoprobe<sup>®</sup> HPT/ECT borings were completed based on the results of the ERI data. The HPT/ECT borings identified intervals in the subsurface characterized by high hydraulic conductivity and EC, respectively. These borings were supplemented by conventional Geoprobe<sup>®</sup> soil borings at 16 selected locations to confirm the geology. Boring logs are provided in Appendix B. A description of the HPT/ECT methodologies is provided in Appendix A.

At the Site, the ECT was used as a line of evidence to verify of ERI modeling results associated with the locations of elevated specific conductance. Geoprobe<sup>®</sup> soil cores logged by a geologist were key to differentiating between fill and native materials (see Appendix B for boring logs). The ERI modeling results were joined with the HPT/ECT and geologic logs to develop geologic cross sections. The primary goals of advancing HPT/ECT and soil borings was to provide direct observations to guide the interpretation of the ERI cross sections and provide a refined understanding of the geologic and geochemical conditions along the western and eastern site perimeters.

Logs incorporating HPT/ECT and soil boring results, and ERI modeling results were plotted using WellCAD software to visualize and compare results from the onshore investigation (Appendix C). EC results from the ERI modeling were plotted with depth at electrode locations most proximal to confirmation borings for comparison with the direct-push EC results.

The GSI Work Plan (Arcadis 2021) proposed 10 HPT/ECT boring and 2 Geoprobe<sup>®</sup> soil borings; however, 20 HPT/ECT borings and 16 Geoprobe<sup>®</sup> soil borings were completed. These additional borings were added to the scope of work during the field event to better correlate the geophysics data with the EC from the borings and due to unexpectedly high hydraulic conductivity measured in some of the clay material, most notably where ECT measurements were anomalously high. The borings were advanced from March 22 through April 6, 2022. The continuous soil borings were advanced adjacent (approximately 2 feet) to an HPT/ECT boring to verify correlation between soil type, HPT/ECT data, and ERI results. The maximum depth drilled was 64 feet below ground surface. Due to deep high EC anomalies observed in ERI imaging, the boring termination depths proposed in the GSI Work Plan (Arcadis 2021) were adapted to cover the extent of the anomalies in the model formation bulk electrical resistivity data. Borings were drilled in the dirt and gravel roads a few feet from the ERI line locations.

Before the HPT work was initiated, a pre-test calibration was performed to ensure the HPT pressure response and EC response were consistent between borings. Response tests were completed before and after the first log, and after each subsequent log to verify that the system was responding appropriately. In addition to the response tests, HPT dissipation tests were completed at each boring. A dissipation test consists of pausing the HPT boring, turning off the flow, and allowing the pressure to return to a static condition. These data were used to verify the elevation of the water table, correct for hydrostatic pressure, and calculate estimated hydraulic conductivity. Dissipation tests were completed in at least two depth locations per boring, one within a relatively shallow portion of the aquifer and one within a deeper interval of the aquifer near the total depth of the boring (and in between if additional sands were encountered). The tests were expected to be biased to more hydraulically conductive zones to ensure a static condition could be achieved within a reasonable time frame.

The HPT probe was linked to a control box, where the signal was received by a field computer. HPT parameters such as transducer pressure, flow rate, EC, line pressure, probe rate, and diagnostic parameters were recorded and available for export and evaluation immediately following borehole completion.

The Direct Image<sup>®</sup> Viewer software was used to view the data and to complete corrections for hydrostatic and atmospheric pressure effects, if needed. Once corrected, the software provided a continuous log of estimated hydraulic conductivity.

#### 4.3 Marine Geophysical Survey

The ECT and ERI results indicated anomalous conditions at the north end of the ECT and ERI investigation area; therefore, the area of data collection for the marine EC survey was expanded to encompass the northern tip of the island, beyond the area that was presented in the GSI Work Plan (Arcadis 2021). The data presented in this report includes the area identified in the GSI Work Plan plus the data collected encompassing the northern tip of the island. The goal of the marine EC survey was to quantify the formation bulk EC of the bottom sediments to determine how the anomalous EC on shore relates to the river bottom sediments. An EM31 was mounted in a nonmetallic canoe and towed along transects positionally controlled by a DGPS. The EM31 has a coil separation of 12 feet and a transmitter frequency of 9.8 kilohertz. The data density was sufficient to grid the data and create a contour map of the formation bulk EC.

Because the formation bulk EC in the river setting is a composite (bulk conductivity of both the river water and the bottom sediments), a data correction was necessary to eliminate the influence of the water column for quantification of the bottom sediment formation bulk EC. Therefore, it was necessary to also perform a bathymetric survey for the data correction computations. Single beam echo sounder and a multibeam echo sounder data were gathered for this purpose. In addition, the multibeam echo sounder data were used to create

bottom images, where conditions permitted, with the primary goal of searching for pipelines and other metallic objects that can be a source of interference for the EM instrument. Side-scan sonar data collection was performed in select areas; however, the side-scan sonar dataset is incomplete due to issues associated with thick vegetation in the shallower, near-shore areas and was not incorporated into this project.

#### 4.3.1 Bathymetric Data Collection and Processing

Aqua Survey, Inc. (ASI), under the supervision of Arcadis, conducted a marine bathymetry survey prior to the EM survey from June 21 through 25, 2022. ASI used data gathered with single beam echo sounder and multibeam echo sounder instruments for the bathymetry work. Bathymetry data were primarily needed to obtain water depth data used to correct the EM conductivity data.

Heavy vegetation limited the areas where multibeam echo sounder data collection was feasible (mainly in the deeper water areas away from the shoreline). ASI relied on a series of parallel single beam echo sounder traverses run perpendicular to the shoreline to gather data in the heavily vegetated areas. In some areas, most notably the shoal located southwest of the island, heavy vegetation limited the ability of the vessel to traverse the area due to vegetation enveloping the vessel, binding the propeller, and potentially damaging the motor. The vessel made limited passes and a calibrated sounding pole was used to manually touch the bottom and estimate the water depth.

ASI was able to process a hybrid dataset consisting of multibeam echo sounder, single beam echo sounder,, and manual soundings to create a qualified bathymetry grid that was suitable for performing the EM data corrections (accuracy on the order of 1 foot or more is sufficient). However, ASI does not consider the hybrid dataset to be of survey grade and reliance on the bathymetry beyond the purpose of correcting EM measurements is not recommended. Arcadis used the bathymetry grid provided by ASI and augmented it beyond the boundaries of the ASI grid with bathymetry data provided by the National Oceanic and Atmospheric Administration (NOAA) in electronic format (NOAA, 2001).

#### 4.3.2 Marine Electrical Conductivity Data Collection

Arcadis performed a near-shore marine frequency domain electromagnetics survey with an EM31. Note that EM31 does not require ground contact and data are typically collected continuously as the instrument is conveyed across the study area (in this case, mounted to a canoe). The EM31 is designed to measure and map the formation bulk EC nominally up to 18 feet below the instrument.

The EM31 was mounted to a nonconductive watercraft and towed by a piloted vessel (see Exhibit 1). The navigational path of the cance where formation bulk EC data were collected is shown on Figure 3. The cance was towed along roughly parallel transects, 25 to 50 feet apart, generally parallel to the shoreline. Wind, current, and dense vegetation at times complicated the pilot's ability to maintain a regular grid. The tow paths were reviewed and infill data collection was performed where data gaps existed and where feasible. More than 67 miles of formation bulk EC data were gathered during this phase of the project.



Exhibit 1. EM31 Mounted in a Nonmetallic Canoe<sup>1</sup>

The position of the EM31 system was determined with an on-board DGPS receiver as shown on Exhibit 1. The receiver was equipped with real-time differential correction, resulting in a horizontal accuracy of less than 1 meter. The DGPS and EM31 data streams (1 and 10 hertz, respectively) were automatically merged during data collection by an on-board data logger used to control the data collection process.

To assure accuracy of the data collected with the EM31, Arcadis followed the manufacturer's recommended procedures listed below:

- Daily battery check
- At the beginning of the survey:
  - Instrument zero check and adjustment
  - In-phase zero compensation check and adjustment
  - Phase compensation check.

Periodically during the marine EC survey, the data logger was downloaded and the data were reviewed for completeness by the project geophysicist. As the survey progressed, periodic data review and quality assurance and quality control checks were performed to both assure the proper data were being gathered and to make interpretive analysis of the EC data to assure that the results were geologically consistent with the onshore results of the ERI and HPT/ECT work. Data collection was performed in the center of the river channels several times per day to measure the ambient conductivity, presumably of only river water. By doing this, a measure of data variation related to instrument fluctuations could be evaluated.

The marine EM31 data processing and mapping procedures are provided in Appendix A. The corrected formation bulk EC values in sediments in the shallow water shoals southwest, north, and east of the island fall within a

<sup>&</sup>lt;sup>1</sup> The DGPS unit was mounted at the measurement point in the center of the EM31. The canoe was tethered behind the vessel at an offset distance of 25 feet. Outriggers and a sea anchor were used to limit the pitch and yaw of the canoe. Serial cables were used to connect the EM31 and DGPS to a laptop computer onboard the vessel.

range of approximately 40 to 50 milliSiemens per meter (mS/m). Therefore, anomalous conditions are defined as greater than the value of 50 mS/m. On this basis, the bathymetry corrected formation bulk EC data were gridded and contoured with Surfer mapping, modeling, and analysis software.

## 5 Results

This section summarizes the results of the investigation activities discussed in this report. These results will be used to guide the next steps of a hydraulic investigation to understand groundwater flux.

#### 5.1 Electrical Resistivity Imaging Results

The conductivity cross-section results for the West Line (W1 through W4) are shown on Figure 4. Results for the East Line are split up into two cross-sections, E1-E2 and E3-E4, shown south to north on Figure 5.

The ERI cross sections terminate at an elevation of 480 feet, which corresponds to a variable depth range of approximately 90 to 100 feet, except in the elevated portion of the southern half of the East Line where the maximum depth reaches approximately 130 feet. The general trend is that anomalous conditions exist starting at the ground surface and increase to a peak value, between approximately 560 and 550 feet in elevation, and then gradually decrease to background conditions.

The exceptions to this general trend are in areas of subsidence. During ERI data collection, the electrical current can be drawn out of the vertical plane of investigation toward the subsidence areas at the interior of the island. During the modeling process, the anomalous zone is extended vertically and creates an artifact that reflects the conductive zone in the subsidence area rather than actual conditions along the transect. Select borings were placed in these anomalous zones (W2, W4, and W10) with the finding that the direct-push EC values did not corroborate the depths of anomalies for the ERI modeled values in areas of subsidence.

#### 5.2 Hydraulic Profiling Tool and Electrical Conductivity Tool Confirmation Boring Results

Detailed, descriptive soil boring logs for locations E1, E2, E3, E5, E7, E8, E9, E11, W2 through W8, and W10 are provided in Appendix B. Logs created in WellCAD, which combine abbreviated soil descriptions with sample photos, direct-push EC, modeled EC from ERI, corrected HPT pressure, HPT maximum flow, estimated hydraulic conductivity, and rate of penetration, are provided in Appendix C. Note that locations E4, E6, W9 and W11 did not have corresponding soil borings, only direct push HPT and ECT results.

Key observations about the boring results are summarized below:

- Comparison of the ECT conductivity values with the ERI modeling values shows that the magnitude of the peak values is generally similar, but that the ERI model values tend to extend deeper than the actual ECT values.
- DBO can have hydraulic conductivity values that are similar to sands in some locations but low hydraulic conductivity in other locations.
- Where ECT values are anomalously high in DBO, the EC tends to extend downward into the underlying clay. Where this deeper penetration of EC occurs in clays, the HPT tool indicates that the clay has higher than

expected hydraulic conductivity. These clays will be further investigated as part of the hydraulic flux investigation.

Arcadis overlaid the HPT/ECT results on the ERI cross sections and performed a joint interpretation of both datasets. The interpretation was constrained with preference for HPT/ECT results and, between borings, by the use of the relative trends in the ERI cross sections. The West Line and East Line are shown on Figures 6 and 7, respectively.

These interpretive sections show the following:

- Zones of conductivity grouped in four ranges (0 to 300, 300 to 500, 500 to 1,000, and greater than 1,000 mS/m)
- Simplified lithology (DBO/fill, clay/silt, and sand)
- Point at which HPT-based hydraulic conductivity values are less than the quantification limit
- Approximate elevation of the Detroit River
- Location of subsidence-related offset.

#### 5.3 Marine Multibeam Echo Sounder Results

The multibeam echo sounder point cloud elevation map created by ASI is shown on Figure 8 and the blended bathymetric elevation map created by Arcadis is shown on Figure 9.

Besides providing bathymetric data used in the correction of the EM31 data, multibeam echo sounder imaged manmade objects on the riverbed. These objects included pipelines and metallic and nonmetallic debris. The confirmation of the metallic nature of the pipelines was provided by a negative deflection in the EM response. Several pipelines were identified, connecting Point Hennepin to the mainland. The locations of these metal pipelines are shown on Figures 3, 8, and 9. Additionally a pipeline off the northeast side of Point Hennepin was identified and appeared to terminate in a bell shape. The bell-shaped pipe termination is detailed in the multibeam echo sounder map shown on Figure 8.

#### 5.4 Marine Geonics EM31-MK2 Electromagnetic Induction Conductivity Meter Results

The bathymetrically corrected data collected in the Detroit River with the EM-31 is shown on Figure 9, which is similar to what would be gathered if the EM31 were towed on the river bottom without water present. Due to the difference in methods used to collect the data off shore versus onshore, the range of conductivity values is narrower than the onshore ECT and ERI values.

A contour map shown on Figure 10 is color coded to indicate where anomalous conductivity values are present in a manner similar to the ERI results shown on Figures 4 and 5. The color scheme on Figures 4 and 5 is the same as Figure 10 because they represent the same variation in anomalous EC. Note this is despite the scale of the values being different as the scale is a function of the type of data being collected. See Appendix A for additional details. Gray indicates background values, and the progression of colors indicates gradational increase in conductivity and the increase in anomalous EC. In general, anomalous conditions are measured around the entire perimeter of the island and decline to background, outwardly. The marine conductivity correlates well with the

the onshore ERI and ECT values. A cross section of the island showing both the land-based ERI with the EM-31 marine work is included as Figure 11.

It is important to note that the EM31 results provide an indication of bulk conductivity in the upper 21 feet of sediments beneath the river. The EM31 results do not specifically indicate the depth distribution of the conductivity in the sediments, and do not provide the location or magnitude of flux into the river. EC is related to TDS, but is not specific to individual anions and cations or their concentrations. However, the EM31 results do indicate the approximate lateral extent of anomalous conductivity.

## 6 Key Findings and Next Steps

Key findings for the work completed are summarized below:

- In-river EM31 anomaly positions and onshore ERI modeling results show a good correlation.
- ERI profiles and HPT/ECT borings on shore (with the exception of the subsidence areas) show a good correlation.

The geophysics work completed does not specifically indicate the depth distribution of the conductivity in the sediments, and does not provide the location or magnitude of flux into the river. Results could be indicative of groundwater flux to the river and/or DBO in contact with the river.

The next step in the investigation will be to conduct a hydraulic investigation to determine groundwater flux in key areas identified during this phase of work. The hydraulic investigation will evaluate groundwater flux and develop next steps for groundwater to surface water interface sampling. A work plan for the hydraulic investigation will be submitted under separate cover. In parallel BASF has been actively working on erosion control efforts on the island and will begin evaluation of early actions that may be completed in the short term (e.g., abandoning utilities, placement of cover or caps in river in high-priority areas).

#### 7 References

- Arcadis. 2021. Groundwater to Surface Water Interface (GSI) Assessment Work Plan. Point Hennepin, Wyandotte, Michigan. August 31.
- NOAA, 2021. zip file named US5MI22M, https://www.charts.noaa.gov/ENCs/ENCsIndv.shtml.





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#### SITE LOCATION MAP

BASF CORPORATION POINT HENNEPIN, WAYNE COUNTY, MICHIGAN

2019 Quad Wyandotte Quadrangle Michigan-Wayne County 7.5-Minute Series









1.) Scale as shown

Notes:

LEGEND

Location of EM31 Data Points

2.) Aerial imagery dated September 2021 downloaded from Google Earth





#### EM31 DATA COLLECTION POINTS















#### Notes:

1.) Scale As Shown

2.) Aerial imagery dated September 2021 downloaded from Google Earth





#### MULTIBEAM ECHO SOUNDER MAP



3.) amsl- Above mean sea level

4.) bathymetry data sources include SBES, MBES and Sounding Pole measurements made for this project combined with publicly available bathymetry provided by NOAA

5.) Note that this is not a certified bathymetry map and accuracy varies.



#### FINAL BATHYMETRIC ELEVATION MAP



50



FIGURE 10

#### **EM31 IN-RIVER FEC MAP**





**Technical Methodology** 

## **ARCADIS**

## **ERI Methodology**

Bulk formation electrical resistivity (FER), and its the mathematical inverse, formation bulk electrical conductivity<sup>1</sup>, is an intrinsic property of geologic materials that varies widely in the subsurface and responds primarily to a combination of porosity, cementation, water chemistry, other factors such presence of clay minerals. Note that FER is a volume-weighted bulk property of the entire mass of geologic material within the measurement volume of the specific geophysical method used. The true electrical resistivity (TER) is the electrical resistivity of the individual strata measured on a scale small enough to be representative of the formation being tested. TER can be measured directly in-situ with devices such as the ECT or borehole geophysical probes. FER data can also be modeled, and an approximation of the TER can be made. Broadly speaking, modeled FER results can often be used to interpret lithology, especially when groundwater chemistry is relatively invariant. The specific conductance (SC) of the groundwater can strongly influence FER values. The geophysical method referred to as ERI is a process of gathering a two-dimensional, vertical cross-section of FER values which are then subjected to a modeling process called inversion modeling. The outcome of inversion modeling is superior to working with raw FER data because it is an estimate of the TER distribution in the subsurface. By inversion modeling the distribution of TER values in the subsurface, geological features can be interpreted in their proper subsurface positions and the TER values can be compared with well-known ranges of values.

One means for collecting FER data is known as galvanic, or direct current (DC), resistivity method. Collection of FER data using DC resistivity consists of injecting a DC electrical current into the subsurface and simultaneously measuring the potential difference within the vicinity of where the current is being injected using a series of electrodes at the ground surface - generally two current electrodes (designated as A and B) and pairs of potential (voltage) electrodes (designated as M and N) in various arrangements and separations called arrays. The injected current (I) and measured potential (V) values are quantified and recorded by the instrument. From these data the electrical resistance (in ohms) is calculated using Ohm's Law (resistance [R] is equal to voltage [V] divided by current [I], or R=V/I]). The FER, also known as the apparent electrical resistivity or  $\rho_a$  (in ohm-meters) is calculated from the resistance (R) using volumetric geometrical scale factors related to the specific electrode arrangement (array). These geometric factors are what distinguish the various array types (see **Exhibit A-1** below).

The horizontal and vertical sensitivities, as well as the penetration ability and efficiency of data collection, vary between array types, and the array type choice is dependent on the project objectives and practical considerations. For this project two array types were used to gather data (see **ExhibitA-1**). For sensitivity to predominantly horizontal features, the inverse-schlumberger array (ISA) was used. The advantages of the ISA include not only sensitivity to horizontal layering, but also a strong signal-to-noise ratio and less susceptibility to interferences. The dipole-dipole array (DDA) was tested as a means to image near vertical features. The DDA generally produces higher data density and resolution of both lateral and vertical heterogeneities, but can be more susceptible to unwanted electrical noise from metallic structures such as pipes than the ISA. Preliminary assessment of the ISA and DDA data sets indicated that the DDA data was subjected to significant interferences from buried metal objects, which were more completely overcome by the ISA. The ISA was also determined to be more appropriate because of the dominance of horizontal features overall. As a result, Arcadis proceeded to work with only the ISA results after completion of field activities.

<sup>&</sup>lt;sup>1</sup> FER (ohm-meters) = 1000/FEC (milliSiemens/meter)

#### Appendix A Groundwater to Surface Water Assessment-Geophysics Report Point Hennepin, Wyandotte, Michigan



**Exhibit C-1**. a. Schlumberger array, where current and potential electrodes are nested around a center point (inverse Schlumberger is places the current electrodes nearest the array center and the potential electrodes at the at the outside). Greater depth is achieved by increasing the separation distance around the center point. b. Dipole-dipole array, where current electrodes are placed beside potential electrode pairs. Greater distance is achieved by increasing the separation between current and potential electrode pairs.

## **ERI Data Processing Methodology**

Once the FER data were collected on land, they were downloaded to a computer and subsequently inversemodeled using the software RES2DINV to obtain an estimate of the TER values in cross-section of the subsurface. The inversion modeling iterates through the process of 1) generating a modeled TER cross-section (using the raw FER data as a starting point), 2) calculating the corresponding FER pseudosection<sup>2</sup> that would result from modeled TER results, 3) differencing the calculated FER pseudosection and the actual field FER pseudosection to calculate the root mean square (RMS) error. Criteria are set to determine if the change in RMS difference from one iteration to the next is smaller than a set percentage, usually less than five percent, otherwise the model is then refined either until the maximum number of iterations has been reached (usually 10 or less) or the percent change has met the threshold. The modeler then reviews the final RMS error and if the RMS error is unreasonably elevated, the raw data points which contributed to the difference can be extracted. The modeling is carried out until culling data no longer provides significant improvement. At this point the model is considered to be a reasonable estimation of the true resistivity structure of the subsurface. The final RMS error values are provided on Figures 4 and 5. The vertical direction on the electrical resistivity cross-sections are portrayed in elevation feet based on laser imaging, detection, and ranging (LIDAR) surface elevations of the individual electrodes. To facilitate comparability with other types of data such as groundwater SC, direct push ECT values, and data collected in the Detroit River with EM, the TER model values converted to true electrical conductivity.

<sup>&</sup>lt;sup>2</sup> A pseudosection indicates how the raw FER values vary as a function of position and electrode separation, which is nonlinearly related to the depth of investigation.

Appendix A Groundwater to Surface Water Assessment-Geophysics Report Point Hennepin, Wyandotte, Michigan

#### **HPT/ECT Methodology**

The Geoprobe<sup>®</sup> HPT is an injection logging tool used to provide a continuous profile of relative soil permeability at the centimeter scale. The resulting profile can be used to correlate hydrostratigraphic units across Pt. Hennepin. The HPT probe is attached to the end of a drill string and advanced by a direct-push drilling rig. A continuous metered injection of small volumes of water (typically between 200 to 300 milliliters per minute) occurs during advancement. At the same time, the fluid backpressure due to injection into the formation, as well as the flow rate, is measured and logged at a frequency of 5 samples per second. A relative measure of hydraulic conductivity (K) can be obtained by recognizing that K is generally proportional to flow divided by pressure (Q/P).

The HPT pressure log provides an inverse pattern to hydraulic conductivity, showing low pressure within permeable soils and high pressure in less permeable material. During advancement, the HPT was periodically paused so a dissipation test would be completed to determine the depth to water via hydrostatic pressure measurements. The flow, pressure, and hydrostatic data are then processed within Geoprobe's software to produce the continuous measure of "Estimated K" through the saturated portion of the profile.

The ECT is integrated into the HPT which consists of a 3-inch long set of four equally spaced electrodes that can be programmed to gather either a 4-electrode wenner array or a 2-electrode dipole array. Similar to the operating principle of ERI, the ECT simultaneously passes current and measures voltage in the formation. The output of the ECT is electrical conductivity which is analogous to true electrical conductivity. Ideally, the conductivity profile created by the ECT should be equivalent to the true electrical conductivity model created in the ERI data processing.

#### **Bathymetric Data Collection and Processing**

Single beam echo sounders (SBES) are also known as depth sounders or fathometers. SBES instruments determine water depth by measuring the travel time of a short sonar pulse, or "ping". The sonar ping is emitted from a transducer positioned just below the water surface, and the SBES listens for the return echo from the bottom. In reality, the sonar energy will be reflected by anything that may be in the path of the pulse – fish, debris, aquatic vegetation and suspended sediment. Areas of heavy vegetation were present in shallower (i.e., less than 15 to 20 feet water depth) portions of the investigation area, which created significant interference for both the SBES and the multibeam echo sounder (MBES).

Unlike SBES, which uses just one transducer to map the river bottom, a multibeam echo sounder (MBES) sends out multiple, simultaneous sonar beams (or sound waves) at once in a fan-shaped pattern. This covers the space both directly under the vessel and out to each side. MBES is used to collect two types of data: seafloor depth and backscatter. The water depth, or bathymetry, is computed by measuring the time it takes for the sound to leave the array, hit the bottom, and return to the array. Backscatter is a measurement of the intensity of the sound echo that reflects back to the multibeam array. A data set similar to a laser imaging, detection and ranging (LIDAR) point cloud is obtained with the MBES, allowing visualization of the river bottom similar to the level of detail offered by LIDAR.

For calibration and quality control purposes, AquaSurvey Inc. (ASI) used a multiparameter sonde to gather temperature, conductivity, and other parameters needed to perform adjustments to the sonic velocity of the water

column. A global positioning system (GPS) unit with survey grade accuracy (sub-centimeter) was used to determine the position of the instruments and the mean elevation of the Detroit River during the survey

## **Marine Electrical Conductivity Data Processing**

The first step in the processing of the EM31 data was the evaluation of instrument variation based on periodic measurements made in deep water channels. **Exhibit A-2** illustrates the variability of the average conductivity of the water. The correction factors applied to the conductivity data are summarized in the upper right. It was assumed that the background conductivity was 24.91 mS/m based on the measurements made immediately after the initial set up. The manufacturer's stated accuracy is +/-5% at 20 mS/m.



Exhibit C-2. EM31 drift correction analysis results. Corrections were made relative to the initial background (deep water) conductivity measured on 7/11/2022.

The water depths in the survey area fall in a range where the EM31 is very sensitive to the conductivity structure and therefore it is expected that measurements made with the EM31 would be affected by the bathymetry. As noted above, the EC of the river water was determined to be approximately 25 mS/m. In areas underlain by anomalously conductive bottom sediments (for example ten times water conductivity, or 250 mS/m), the formation bulk electrical conductivity measured by the EM31 would be expected to decrease with the depth of the more resistive river water. To correct for the variation introduced by varying water depth, Arcadis applied a bathymetric correction documented by Butler et al. (2004).

Appendix A Groundwater to Surface Water Assessment-Geophysics Report Point Hennepin, Wyandotte, Michigan

Assuming a simple 2-layer model consisting of water in Layer 1 and bottom sediment in Layer 2 (assumed to be uniform), the following equation was applied to the drift-corrected EM31 formation bulk electrical conductivity data:

$$\sigma_2 = \frac{\sigma_a - [1 - R_v(Z)]\sigma_1}{R_v(Z)}$$

Where:

 $\sigma_a = FEC$  measured by the EM31

 $\sigma_1 = TEC \text{ of the river water } (24.91 \text{ mS/m})$ 

 $\sigma_2 = FEC of bottom sediments$ 

Z = normalized water depth (water depth divided by instrument coil separation [12 feet])

$$R_{v}(Z) = \frac{1}{\sqrt{4Z^{2} + 1}} = cumulative response function$$

#### References

Butler, K. E., Nadeau, J. C., Parrott, R., & Daigle, A. (2004). Delineating recharge to a river valley aquifer by riverine seismic and EM methods. Journal of Environmental & Engineering Geophysics, 9(2), 95-109.



**Boring Logs** 

		<u>SOIL</u>	BORING L	LOG					
В	ORING	NO.:	SB-E1				CADIS		
т	OTAL D	EPTH:	<b>32.0</b> fe	eet bgs					
		PR	OJECT INFO	RMATION		DRILLING INFORMATION			
CL	IENT:	TION	BASF Corpora	ation		DRILLING CO.:	Dakota Technologies		
	TV STAT		Grosse lle Mi	IN ichigan			Andy Kirsch/Robert Tieman		
			R· 30107326	lonigan		DATE STARTED	Direct Fusii 03/31/2022		
LC	GGED E	BY:	K. Donahu	e		DATE COMPLETED:	03/31/2022		
DEPTH (feet)	Recovery (inches) PID (ppm) Soil Symbol USCS Classification		USCS Classification	SOIL DESCRIPTION					
0 -	28 NM		GC	(0.0 coal trac Note	-3.0') CLAY, rse, subangu e silt; poorly e: Roots and	CLAY, no plasticity, rapid dilatancy; and GRAVEL; little sand, very fine to very bangular to subrounded; trace granules to large pebbles, angular to subrounded; poorly sorted; medium stiff; moist; grayish brown (10YR 5/2).			
-			СН	(3.0	-3.9') CLAY,	high plasticity, no dilatancy; trace si	It; medium stiff to stiff; moist; gray		
4-			ML	(3.9	(3.9-4.2') SILT; no plasticity, rapid dilatancy; little clay; trace sand, very fine to medium; soft;				
6-	34.5	NM		(4.2 light	moist; very dark gray (10YR 3/1). (4.2-13.5') SILT, no plasticity, rapid dilatancy; very soft; moist to wet; white (10YR 8/ light gray (10YR 7/1).				
8-				NOR		Sw-On.			
10 -	46	NM							
12 -				(13. gray	5-13.9') SILT / (10YR 3/1).	, no plasticity, rapid dilatancy; little o	slay; very soft; moist to wet; very dark		
14 -	47	NM	ML	Note	<ul> <li>Note: Hard brittle pieces of silt also present.</li> <li>(13.9-19.3) CLAY, high plasticity, no dilatancy: trace silt: trace granules to small pebbles.</li> </ul>				
-			СН	suba	angular to su	brounded; very stiff: moist; brown (1	0YR 5/3) and gray (10YR 5/1).		
-									
18 -	48	NM							
20 -			СН	(19. suba	3-32.0') CLA angular to su	Y, high plasticity, no dilatancy; trace brounded; stiff; moist; gray (10YR 5,	silt; trace granules to large pebbles; /1).		
22 -	48	NM		Note	e: From 22.0	to 24.0' bgs. medium stiff.			
24 -				Note	e: From 24.0	to 28.0' bgs, soft.			
26	48	NM							
28 -				Note	e: From 28.0	3.0 to 32.0' bgs, very soft.			
30	48	NM							
32 -				End	l of boring at	32.0' bgs.			
34 -									
Notes bgs:	3: below ground	d surface		NA: Not Availab NM: Not Measured	le d	ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 1 of 1		
USCS:	USCS: Unified Soil Classification System								

SOIL BORING LOG									
В	ORING	i NO.:	SI	B-	E2			CADIS	
т	OTAL DI	EPTH:	36	6.0	) feet bgs				
		PR	OJEC	T	INFORMATIO	N	DRILLING INFORMATION		
CL	IENT:		BASF	= C	orporation		DRILLING CO.:	Dakota Technologies	
SI	TE LOCA	TION:	Point	He	ennepin		DRILLER:	Andy Kirsch/Seth Miller	
CI	TY, STAT	ΓE:	Gros	se	lle, Michigan		DRILLING METHOD:	Direct Push	
PF	ROJECT	NUMBE	R: <b>30</b>	010	7326		DATE STARTED:	04/06/2022	
LC	GGED B	SY:	К.	. Do	onahue		DATE COMPLETED:	04/06/2022	
DEPTH (feet)	Recovery (inches)	Recovery (inches) PID (ppm) Soil Symbol USCS Lassification		SOIL DESCRIPTION					
	22	NM	GC ML ML			(0.0-2.5') SAND, very fine to very coarse, angular to subrounded; and GRAVEL; some clay, no plasticity, rapid dilatancy; little granules to large pebbles, angular to subrounded; trace silt; poorly sorted; moist; grayish brown (10YR 5/2).			
4-	-					(2.5-5.1) SILT, no plasticity, rapid dilatancy; very soft to soft; moist; very pale brown (10YR 8/3). Note: Distiller Blow-Off.			
-	-				ML	(5.1-5.5') SILT, r (10YR 8/1). Note: Distiller Blo	o plasticity, rapid dilatancy; hard; mo ow-Off.	oist; light gray (10YR 7/1) and white	
6	33.5	NM			ML	(5.5-25.7) SILT, Note: Distiller Blo	no plasticity, rapid dilatancy; very sc ow-Off.	oft to soft; moist; white (10YR 8/1).	
8									
10	46	NM							
12	-								
14	48	NM							
16 -	-								
18 - - - 20	48	NM							
Notes bas:	s: below ground	d surface		11	NA: Not A	vailable	ppm: parts per million	Date: 5/10/2022	
USCS:	Unified Soil	l Classifica	ation Syst	em	NM: Not M	easured	PID: Photo-ionization Detector	Page: 1 of 2	

		<u>SOIL</u>	. BORII	NG LOG						
BORING NO.: SB-E2							CADIS			
T	OTAL DI	EPTH:	36.0	feet bgs						
		PR	OJECT I	NFORMATIC	ON	DRILLING INF	FORMATION			
CLIENT: SITE LOCATION: CITY, STATE: PROJECT NUMBE LOGGED BY:			BASF Co Point He Grosse I R: 3010 K. Do	prporation nnepin le, Michigan 7326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/06/2022 04/06/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION				
	48	NM			Note: From 20.0 Note: From 22.0 Note: From 22.4 6/1).	to 22.0' bgs, very soft. to 22.4' bgs, hard and light gray (10 to 25.7' bgs, color changes to very p	YR 7/1). bale brown (10YR 8/2) and gray (10YR			
26 -	33	NM			ML GM CH OL	Note: At 24.0' bg (25.7-26.0') SILT (10YR 6/2). Note: Organics p (26.0-26.2') SILT very find to grand dark gray (10YR (26.2-27.4') CLA	s, changes to moist to wet. , no plasticity, rapid dilatancy; very some present (roots), likely Distiller Blow-C , no plasticity, rapid dilatancy; and F ules, subangular to subrounded; trace 4/1). Y, high plasticity, no dilatancy; trace	soft; moist to wet; light grayish brown off, and silt transition. PEBBLES, large, subangular; little sand, se clay: poorly sorted; very soft; moist; silt; soft; moist; dark gray (10YR 4/1).		
28 -	24	NM		СН	(27.4-27.9') SILT 2/2). Note: Organics, (27.9-29.5') CLA (10YR 3/1). (29.5-33.0') CLA subangular to su	, no plasticity, rapid dilatancy; little o peat. Y, high plasticity, no dilatancy; trace Y, high plasticity, no dilatancy; trace brounded; medium stiff; moist; gray	silt; soft, moist; very dark brown (10YR silt; soft; moist; very dark gray silt; trace granules to medium pebbles, (10YR 5/1) and brown (10YR 5/3).			
32	48	NM		СН	(33.0-36.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; very stiff; moist; brownish	silt; trace granules to large pebbles, gray (10YR 5/2).			
36 - 38 - 40 Note:	S: below ground	l surface	ation States	NA: Not NM: Not	End of boring at Available Measured	36.0' bgs. ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 2 of 2			
		SOIL	. BC	DR	IN	IG LOG				
--	------------------------------------	---------------------------	--	--------	---	---	---	--	--	--
В	ORING	i NO.:	S	SB	<b>3-</b>	E3			$C\Delta D$	
т	OTAL D	EPTH:	4	8.	.0	feet bgs				
		PR	OJE	СТ	- 11	NFORMATIO	N	DRILLING INFORMATION		
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue			rporation nnepin e, Michigan 326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Mi Direct Push 04/06/2022 04/06/2022	s ller			
DEPTH (feet)	Recovery (inches)	DIA (mdd)	Soil	Symbol		USCS Classification	S	OIL DESCRIPTION		
0	27	NM				GC	(0.0-2.5') SAND, no plasticity, rap silt; poorly sorted (2.5-8.6') SILT, r	very fine to very coarse, angular to s id dilatancy; little granules to large po d; moist; grayish brown (10YR 5/2).	subrounded; and GRAVEL subrounded; angular to subroun t to soft; moist; white (10Y	; some clay, ded; trace R 8/1) and
4							light gray (10YR Note: Distiller Bl	7/1). ow-Off.		,
6- - - - - - -	33.5	NM					Note: From 2.5 to 3.11' bgs, very pale brown (10YR 8/3). Note: Some hard laminations throughout.			
10 -	40.5	NM				ML	(8.6-38.3') SILT,	no plasticity, rapid dilatancy; very sc	ft, moist, white (10YR 8/1)	
12	48	NM								
16 - - - 18 - - -	45.5	NM								
20	43.5	NM					Note: From 20.0	to 28.0' bgs, white (10YR 8/1) and li	ght gray (10YR 7/1).	
Notes bgs: USCS:	5: below ground Unified Soil	d surface l Classifica	ition Sy	rsten	n	NA: Not A NM: Not M	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 1 Page: 1	5/10/2022 . of 2

		<u>SOIL</u>	BORI	NG LOG			
В	ORING	i NO.:	SB-	E3			CADIS
Т		EPTH:	48.0	feet bgs			
		PR	OJECT I	NFORMATIO	N	DRILLING INF	FORMATION
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue			prporation nnepin le, Michigan 7326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/06/2022 04/06/2022	
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION	
26 -	48	NM					
30 -	48	NM					
32	48	NM					
36 -	48	NM		ML OL	Note: From 35.6 Note: At 36.0' bg (38.3-38.6') SILT (10YR 4/1) and y Note: Distiller Bl (38.6-38.8') SILT 2/2).	to 35.7' bgs, gray (GLEY1 6/N). s, moist to wet, very pale brown (10 r, no plasticity, rapid dilatancy; little of very dark brown (10YR 2/2). bw-Off and peat, organics. r, no plasticity, rapid dilatancy; little of	YR 8/2) and gray (10YR 6/1). clay; very soft; moist to wet; dark gray clay; soft; moist; very dark brown (10YR
40 -	42.5	NM		CL ML CH CH CH	Note: Organics, (38.8-39.2') CLA 3/1) and very da Note: trace organ (39.2-39.5') SILT 2/2). Note: Organics, (39.5-40.0') CLA	peat. Y, low plasticity, rapid dilatancy; and k brown (10YR 2/2). nics, clay and peat. , no plasticity, rapid dilatancy; little o peat. Y, high plasticity, no dilatancy; trace	I SILT; soft; moist; very dark gray (10YR clay; soft; moist; very dark brown (10YR silt; soft; moist; dark gray (10YR 4/1).
44 - - 46 - - - -	48	NM			(40.0-42.5') CLA subangular to su 5/3). (42.5-48.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; soft to medium stiff; mois Y, high plasticity, no dilatancy; trace brounded; very stiff; moist; brown (1	silt; trace granules to medium pebbles, t; gray (10YR 5/1) and brown (10YR silt; trace granules to large pebbles, 0YR 5/3).
50 Notes bgs: uscs:	S: below ground Unified Soil	d surface l Classifica	ation System	NA: Not 2 NM: Not N	End of boring at	48.0' bgs. ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 2 of 2

		<u>SOIL</u>	BORING LOG					
BORING NO.: SB-E5				CADIS				
Т	OTAL D	EPTH:	40.0 feet bgs					
		PR	OJECT INFORMATIO	N	DRILLING INFORMATION			
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue		BASF Corporation Point Hennepin Grosse IIe, Michigan R: 30107326 K. Donahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/29/2022 03/29/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol USCS Classification	s	OIL DESCRIPTION			
0 	31	NM	CL ROCK CH	(0.0-0.2') CLAY, trace medium pe Note: Grass at s (0.2-0.5') ROCK (0.5-4.0') CLAY, to large pebbles,	medium plasticity, slow dilatancy; so bbles, subangular; medium stiff; mo urface. core, very fine; hard; very pale brow medium to high plasticity, no dilatan angular to subrounded; stiff; moist;	ome silt; trace sand, very fine to fine; ist, brown (10YR 5/3). n (10YR 8/2). cy; some silt; little gravel; little granules grayish brown (10YR 5/2).		
4	44	NM	ROCK CH ML	<ul> <li>(4.0-4.3') ROCK core, very fine; hard; very pale brown (10YR 8/2).</li> <li>(4.3-6.0') CLAY, medium to high plasticity, no dilatancy; little silt; trace granules to sma pebbles, subangular to subrounded; stiff; moist; grayish brown (10YR 5/2) and brown (75/3).</li> <li>(6.0-10.7') SILT, no plasticity, rapid dilatancy; little sand, very fine to medium, subangul subrounded; trace very coarse sand to small pebbles, subangular to subrounded; moist wet; light gray (10YR 7/1) and white (10YR 8/1). Note: Hard and soft, Distiller Blow-Off.</li> </ul>				
10 -	39	NM	ML	(10.7-11.7') SILT Note: Distiller Blo	, no plasticity, rapid dilatancy; very s ow-Off.	soft; moist to wet; white (10YR 8/1).		
12 -			OL	(11.7-13.0') SILT (10YR 3/1). Note: Organics.	; low plasticity, rapid dilatancy; some	e clay; very soft; moist; very dark gray		
14	30.5	NM	СН	(13.0-15.7') CLA (10YR 4/1).	Y, high plasticity, no dilatancy; trace	silt; medium stiff; moist; dark gray		
16	37.5	NM	CH	(15.7-27.6') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; stiff; moist; (10YR 5/1) ar	silt; trace granules to medium pebbles, nd brown (10YR 5/3).		
20 -				Note: From 20.0	to 37.6 bgs, very stiff.			
Notes bgs: USCS:	B: below ground Unified Soil	l surface l Classifica	NA: Not P NM: Not P ation System	Available	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 2		



		SOIL	<u>BORI</u>	NG LOG				
В	ORING	NO.:	SB-	E7				
т	OTAL D	EPTH:	24.0	) feet bgs				
		PR	OJECT	NFORMATIC	ON	DRILLING INFORMATION		
CL	IENT:		BASF C	orporation		DRILLING CO.:	Dakota Technologies	
SI		TION:	Point He	ennepin		DRILLER:	Andy Kirsch/Seth Miller	
	IY, SIA	IE: NILIMBE		ile, Michigan 7326		DRILLING METHOD:	Direct Push	
	LOGGED BY: K. Donahue						04/06/2022	
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION		
0	-			GC	(0.0-0.7') SAND, clay, no plasticit trace silt; poorly	very fine to very coarse, subangula y, rapid dilatancy; little granules to la sorted; moist; dark gray (10YR 4/1).	r to subrounded; and GRAVEL; some arge pebbles, subangular to subrounded;	
2-	44	NM			Note: At 0.3' bgs, light grayish brown (10YR 10/2). (0.7-2.5') SAND, very fine to very coarse, subangular to subrounded; and GRANULES large PEBBLES, subangular to subrounded; little silt; poorly sorted; moist; black (10YR 2/1) and very dark gray (10YR 3/1).			
-	-			ML	(2.5-4.1') SILT, r subrounded; little moist; light gray Note: Distiller BI	no plasticity rapid dilatancy; some gr e sand, very fine to medium, subang (10YR 7/1) and gray (10YR 6/1). ow-Off, mostly stiff with some very s	anules to large pebbles, subangular to gular to subrounded; poorly sorted; stiff;	
4-					(4.1-4.3') CLAY, high plasticity, no dilatancy; some granules to medium pebbles, subang to subrounded; trace silt; very stiff; moist; gravish brown (10YR 5/2).			
- - 6- -	48	NM		ML	(4.3-12.7') SILT, subrounded; littl moist; light gray Note: Distiller BI	no plasticity rapid dilatancy; some g e sand, very fine to medium, subang (10YR 7/1) and gray (10YR 6/1). ow-Off, mostly stiff with some very s	granules to large pebbles, subangular to gular to subrounded; poorly sorted; stiff; oft to soft components.	
8	-				Note: From 8.0 t	o 12.0' bgs, poor recovery.		
10 -	10	NM						
12 -								
	-			СН	(12.7-17.2') CLA (10YR 5/1).	Y, high plasticity, no dilatancy, little	silt: very soft to soft; moist; gray	
Notes bgs: USCS:	S: below ground Unified Soil	d surface l Classific	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 1 of 2	

		SOIL	BORI	NG LOG				
В	ORING	NO.:	SB-	E7			CADIS	
т	OTAL D	EPTH:	24.0	feet bgs				
		PR	OJECT I	NFORMATIO	N	DRILLING INFORMATION		
CLIENT: BASF Corporati SITE LOCATION: Point Hennepin CITY, STATE: Grosse Ile, Micl PROJECT NUMBER: 30107326 LOGGED BY: K. Donahue		orporation nnepin Ile, Michigan 7326 onahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/06/2022 04/06/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION		
- 16 -	30	NM						
-				СН	Note: From 17.0 to 17.2' bgs, stiff. (17.2-20.0') CLAY, high plasticity, no dilatancy, trace silt; trace granules to medium pebbles			
- 18 -	48	NM			subangular to su	brounded; very stiff; moist; grayish b	prown (10YR 5/2).	
20	48	NM		СН	(20.0-24.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; very stiff; moist; gray (10'	silt; trace granules to large pebbles, YR 5/1).	
24 -					End of boring at	24 0' bas		
26 -						∠τ.υ μγο.		
28 Note:	5: below ground	l surface		NA: Not A NM: Not N	wailable Measured	ppm: parts per million	Date: 5/10/2022 Page: 2 of 2	
USCS:	Unified Soil	l Classifica	ation System	Late Hot P		PID: Photo-ionization Detector		

		<u>SOIL</u>	<u>BORI</u>	NG LOG				
В	ORING	; NO.:	SB-	E8				
т	DTAL D	EPTH:	44.(	) feet bgs				
		PR	OJECT	INFORMATIC	DN	DRILLING INFORMATION		
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichigaPROJECT NUMBER:30107326LOGGED BY:K. Donahue		orporation ennepin Ile, Michigan 7326 onahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/28/2022 03/28/2022			
DEPTH (feet)	UEPTIN (feet) (feet) PID (ppm) Soil Symbol USCS Classification		s	SOIL DESCRIPTION				
0  2  	40.5	NM		SW SW ML	(0.0-1.4') SAND, subrounded; poor (1.4-1.8') SAND, medium pebbles (10YR 2/1). (1.8-11.5') SILT, subrounded; trac light gray (10YR	very fine to fine; some very coarse orly sorted; moist; light grayish brown very fine to coarse, subangular to s s, subangular to subrounded; trace s no plasticity, rapid dilatancy; little sa ce granules to medium pebbles, sub 7/1).	sand to large pebbles, angular to n (10YR 6/2). ubrounded; some very coarse sand to ilt; poorly sorted; moist to wet; black and, very fine to medium, subangular to angular to subrounded; moist to wet;	
- - - 6- - - - - - - - -	48	NM						
- - - 10 - -	48	NM			(11.5-11.8') SAN medium pebbles (10YR 3/1) and (	ID, very fine to fine; and SILT, no pla , subangular to subrounded; poorly grayish brown (10YR 5/2).	asticity, rapid dilatancy; trace granules to sorted; moist; very dark gray	
12 — - - 14 — -	31	NM		SM ML ML CH	(11.8-11.9') SILT (10YR 8/1) Note: Distilled B (11.9-12.2') SILT (10YR 3/1) Note: Trace orga (12.2-26.8') CLA moist; gray (10Y	, no plasticity, rapid dilatancy; very s ow-Off. , no plasticity, rapid dilatancy; some anics. Y, medium to high plasticity, no to s R 5/1).	soft; moist to wet; white e clay; very soft; moist; very dark gray low dilatancy; little silt; very soft to soft;	
16 - - 18 - 20	31	NM						
22 - Notes	32 S: below ground	NM surface		NA: Not NM: Not	Available Measured	ppm: parts per million	Date: 5/11/2022 Page: 1 of 2	

		<u>SOIL</u>	BORI	NG LOG				
В	ORING	NO.:	SB-	E8			CADIS	
Т		EPTH:	44.0	feet bgs				
		PR	OJECT I	NFORMATIC	DN	DRILLING INF	FORMATION	
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MicPROJECT NUMBER:30107326LOGGED BY:K. Donahue		orporation ennepin Ile, Michigan )7326 onahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/28/2022 03/28/2022			
DEPTH (feet)	Recovery (inches)	DID (mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION		
24 - - - 26 - -	35	NM		CL	-√ (26.8-27.5') CLA moist; gray (10Y	Y, medium plasticity, slow dilatancy; R 5/1).	; and SILT; trace very fine sand; soft;	
28	39	NM		SP SW CH	<ul> <li>(27.5-28.0') SILT, low plasticity, rapid dilatancy; and SAND, very fine to fine; well sorted; trace clay; moist to wet; gray (10YR 5/1).</li> <li>(28.0-29.3') SAND, very fine to fine; little silt; trace granules to medium pebbles, subang to subrounded; well sorted; wet; gray (10YR 5/1).</li> <li>(29.3-30.0') SAND, very fine to fine; some coarse sand to large pebbles, subangular to subrounded; little silt; poorly sorted, wet; gray (10YR 5/1).</li> <li>(30.0-44.0') CLAY, high plasticity, no dilatancy; trace silt; trace granules to medium pebbles, subangular to subrounded; soft: moist: gray (10YR 5/1).</li> </ul>			
32	41	NM						
36	48	NM						
40 -	48	NM						
44 -					End of boring at	44.0' bgs.		
46 Notes bgs: USCS:	5: below ground Unified Soil	l surface Classifica	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 2	

		<u>SOIL</u>	BORING LOG				
В	ORING	NO.:	SB-E9			CADIS	
т	OTAL D	EPTH:	36.0 feet bgs				
		PR	OJECT INFORMATIO	N	DRILLING INFORMATION		
CLIENT: SITE LOCATION: CITY, STATE: PROJECT NUMBER: LOGGED BY:		ATION: TE: NUMBE 3Y:	BASF Corporation Point Hennepin Grosse Ile, Michigan R: 30107326 K. Donahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/28/2022 03/28/2022	
DEPTH (feet) Recovery (inches) PID (ppm) Soil Symbol USCS Classification		SC	SOIL DESCRIPTION				
0			SW	(0.0-0.8') SAND, very fine to fine; and GRAVEL; trace very coarse sand to medium pe subangular to subrounded; poorly sorted; trace silt; dry to moist; dark gravish brown (			
2	46	NM	ML ML	<ul> <li>(0.8-1.6') SILT, no plasticity, rapid dilatancy; little sand, very fine to coarse, subangular to subrounded; trace very coarse sand to large pebbles, subangular to subrounded; poorly sorted; moist; grayish brown (10YR 5/2).</li> <li>Note: Likely Distiller Blow-Off.</li> <li>(1.6-11.6') SILT, no plasticity, rapid dilatancy; little sand, very fine to medium, subangular to subrounded; trace granules to medium pebbles, subangular to subrounded; moist to wet; gray (10YR 6/1).</li> <li>Note: Hard and soft.</li> </ul>			
	48	NM		Note: At 4.5' bgs, Note: Distiller Blo	light gray (10YR 7/1). w-Off.		
	38	NM		(11.6-11.8') SANI subrounded; trace	D, very fine to fine; little very coarse e silt; poorly sorted; moist; very darl	e sand to large pebbles, subangular to k gray (10YR 3/1).	
12	28	NM	CH	(11.8-24.0') CLAY moist; gray (10YF	⟨, medium to high plasticity, no to sl ₹ 5/1).	low dilatancy trace silt; very soft to soft;	
16	31	NM d surface	NA: Not A NM: Not M	vailable easured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 1 of 2	

		<u>SOIL</u>	. BORIN	IG LOG			
В	ORING	6 NO.:	SB-I	E9			CADIS
т	OTAL D	EPTH:	36.0	feet bgs			
PROJECT INFORMATION					N	DRILLING INF	FORMATION
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichigaPROJECT NUMBER:30107326LOGGED BY:K. Donahue		rporation nnepin le, Michigan 326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/28/2022 03/28/2022		
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION	
20 - - 22 - - - -	36	NM					
24 — - - 26 — - - - -	39	NM		CL	(24.0-27.0') CLA moist to wet; gra (27.0-36.0') CLA subangular to su	Y, no plasticity, rapid dilatancy; and y (10YR 5/1). Y, high plasticity, no dilatancy; trace brounded; stiff; moist; gray (10YR 5	SILT; trace sand, very fine to fine; soft;
28 - - - - - - - - - - - - - - - - - - -	36	NM					
	39.5	NM					
38 Notes bgs: uscs:	5: below ground Unified Soil	l surface l Classifica	ation System	NA: Not NM: Not	End of boring at Available Measured	36.0' bgs. ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 2 of 2

		<u>SOIL</u>	BORING LOG	-					
В	ORING	NO.:	SB-E11			CADIS			
Т	OTAL DI	EPTH:	40.0 feet b	gs					
		PR	OJECT INFORMA	TION	DRILLING INFORMATION				
CL	IENT:		BASF Corporation		DRILLING CO .:	Dakota Technologies			
SI	TE LOCA	TION:	Point Hennepin		DRILLER:	Andy Kirsch/Robert Tieman			
CI	TY, STAT	ſE:	Grosse Ile, Michiga	n	DRILLING METHOD:	Direct Push			
PF	ROJECT	NUMBEI	R: 30107326		DATE STARTED:	03/28/2022			
	GGED B	SY:	K. Donahue		DATE COMPLETED:	03/28/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol USCS Classification	s	OIL DESCRIPTION				
0	-		SW SM	(0.0-0.4') SAND, sorted, moist, ve Note: Organics,	very fine to fine; little granules, suba ry dark grayish brown (10YR 3/2). roots present.	angular to subrounded; trace silt; poorly			
2-	34	NM	ML SW	(0.4-1.2') SAND, medium pebbles (10YR 6/2).	very fine to fine; and SILT, no plasti , subangular to subrounded; poorly s	icity, rapid dilatancy; trace granules to sorted; moist; light grayish brown			
- - 4	-			(1.2-1.8') SILT, r subrounded; trac sorted; moist; lig	Note: Likely Distiller Blow-Off. (1.2-1.8') SILT, no plasticity, rapid dilatancy; little sand, very fine to medium, subangular to subrounded; trace very coarse sand to medium pebbles, subangular to subrounded; poorly sorted; moist; light gray (10YR 7/1) and white (10YR 8/1).				
6-	10	NM	ML	Note: Hard and s (1.8-2.0') SAND, poorly sorted; m Note: Organics a	<ul> <li>Note: Hard and soft, Distiller Blow-Off.</li> <li>(1.8-2.0') SAND, very fine to fine; trace granules, subangular to subrounded; trace silt; poorly sorted; moist; very dark grayish brown (10YR 3/2).</li> <li>Note: Organics and roots present, another topsoil layer.</li> </ul>				
-	-			(2.0-2.7) SAND, medium pebbles (10YR 6/2). Note: Likely Dist	very fine to fine; and SIL1, no plast, , subangular to subrounded; poorly s iller Blow-Off.	city, rapid dilatancy; trace granules to sorted; moist; light grayish brown			
8-				(2.7-4.5') SILT, r subrounded; trac sorted; moist; lig Note: Hard and s	o plasticity, rapid dilatancy; little sar e very coarse sand to medium pebb ht gray (10YR 7/1) and white (10YR soft, Distiller Blow-Off.	nd, very fine to medium, subangular to oles, subangular to subrounded; poorly 8/1).			
10 -	32	NM		(4.5-14.5') SILT, Note: Distiller Bl	no plasticity, rapid dilatancy; very st ow-Off. o 8.2' bos. hard.	iff; moist to wet; white (10YR 8/1).			
12 -	-			Note: From 10.3 Note: From 13.3	to 10.5 <sup>°</sup> bgs, hard. to 13.4' bgs, hard.				
- - 14	30	NM							
- - 16				(14.5-16.2') SILI very dark grayisi	; no plasticity, rapid dilatancy; some b brown (10YR 3/2).	clay; little organics; very soft; moist;			
18 -	31	NM	СН	(16.2-31.5') CLA (10YR 5/1).	Y, medium to high plasticity, no to s	low dilatancy; trace silt; soft; moist; gray			
20 -									
Notes	s:			Not Available	ppm: parts per million	Data: 5/10/000			
bgs: USCS:	below ground Unified Soil	l surface Classifica	NM ation System	Not Measured	PID: Photo-ionization Detector	Page: 1 of 2			

		<u>SOIL</u>		IG LOG			
В	ORING	NO.:	SB-I	E11			CADIS
Т	OTAL D	EPTH:	40.0	feet bgs			
		PR	OJECT II	NFORMATIC	ON	DRILLING INFORMATION	
CLIENT: B SITE LOCATION: P CITY, STATE: G PROJECT NUMBER: LOGGED BY:		BASF Co Point Her Grosse II R: 30107 K. Do	rporation mepin e, Michigan 326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/28/2022 03/28/2022	
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION	
22 -	32.5	NM					
24	36	NM					
28	39	NM					
32	38	NM		CL ML CH CL	(31.5-32.6') CLA moist to wet; gra (32.6-33.0') SILT subrounded; little poorly sorted; we (33.0-33.8') CLA subangular to su	Y; no plasticity, rapid dilatancy; and y (10YR 5/1). , no plasticity, rapid dilatancy; some e clay; trace very coarse sand to sm et; gray (10YR 5/1). Y, high plasticity, no dilatancy, trace brounded: medium stiff: moist: gray	SILT; some sand, very fine to fine; soft; e sand, very fine to coarse, subangular to all pebbles; subangular to subrounded; e silt; trace granules to medium pebbles, (10YR 5/1).
- 36 -	-			CL	(33.8-34.8') CLA coarse, subangu subrounded; sof	Y, no plasticity, rapid dilatancy; and lar to subrounded; trace granules to t; moist; gray (10YR 5/1).	SILT; some sand, very fine to very large pebbles, subangular to
38 -	43	NM		СН	(34.8-36.2') CLA moist to wet; gra (36.2-40.0') CLA subangular to su	Y, no plasticity, rapid dilatancy; and y (10YR 5/1). Y, high plasticity, no dilatancy, trace brounded; medium stiff; moist; gray	SILT: some sand, very fine to fine; soft; e silt; trace granules to medium pebbles, (10YR 5/1).
40					End of boring at	40.0' bgs.	
Notes bgs: USCS:	<b>5:</b> below ground Unified Soi	d surface l Classific	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 2 of 2

		<u>SOIL</u>	BORI	NG LOG				
В	ORING	NO.:	SB-	W2			CADIS	
Т	OTAL D	EPTH:	61.7	75 feet bgs				
		PR	OJECT I	NFORMATIO	N	DRILLING INFORMATION		
CL	IENT:		BASF C	orporation		DRILLING CO.:	Dakota Technologies	
SI		ATION:	Point He	ennepin		DRILLER:	Andy Kirsch/Robert Tieman	
CI	TY, STA	TE:	Grosse	lle, Michigan		DRILLING METHOD:	Direct Push	
PF	ROJECT	NUMBE	R: 3010	7326		DATE STARTED:	03/24/2022	
LC	GGED E	3Y:	K. Do	onahue		DATE COMPLETED:	03/24/2022	
т	2		_	6		L		
DEPT (feet)	cove ches)	DID ppm)	Soil /mbo	JSCS	S	OIL DESCRIPTION		
	(in		S)	Class				
0	-			SW	(0.0-1.1') SAND, trace clay, poorly	very fine to very coarse, subangula / sorted; moist; light brownish gray (	r to subrounded; and GRAVEL; little silt; 10YR 6/2).	
	1			SP	Note: At 0.5' bgs	, fabric; road base.	/	
2-	41	NM			(1.1-6.7) SAND, dilatancy; well so	very fine to fine, subangular to subr orted; moist to wet; light gray (10YR	ounded; and SIL1, no plasticity, rapid 7/1) and white (10YR 8/1).	
-	-				Note: Distiller Bl	ow-Off, hard and soft.		
-								
4-								
-	-							
-								
6-	32	NM			(6.7-7.0') SAND,	very fine to fine, subangular to subr	ounded; little silt; well sorted; moist;	
-	-			<u>en</u>	Note: Hard/brittle	4/1). Ə		
	-			SP	(7.0-7.6') SAND,	very fine to fine, subangular to subr	rounded; and SILT, no plasticity, rapid	
8-				SP	Note: Distiller Bl	ow-Off, hard and soft.	7/1) and white (101R 8/1).	
-	-			SP	(7.6-7.8') SAND,	very fine to fine, subangular to subr	rounded; little silt; well sorted; moist;	
	-			SP	Note: Hard/brittle	4/1). Ə		
10 -	29	NM		ML SD	(7.8-8.0') SAND,	very fine to fine, subangular to subr	rounded; and SILT, no plasticity, rapid	
				CH	Note: Distiller Bl	orted; moist to wet; light gray (10YR)	7/1) and white (10YR 8/1).	
	-			0.11	(8.0-8.5') SAND,	very fine to fine, subangular to subr	ounded; some silt, no plasticity, rapid	
12 -			<del>\////</del>	СН	dilatancy; well so Note: Possible D	orted; moist; (10YR 5/1). Distiller Blow-Off.		
					(8.5-9.0') SILT, r	no plasticity, rapid dilatancy; some s	and, very fine to fine; well sorted; hard;	
	-				Note Distiller Blo	YR 8/1). ww-Off.		
14 -	20	NM			(9.0-10.0') SANE	D, very fine to fine, subangular to sub	prounded; little silt; well sorted; moist to	
	-				(10.0-12.0') CLA	Y, medium to high plasticity, slow di	latancy; little silt; soft; moist; very dark	
16 -				СН	(12.0-16.0') CLA	Y, high plasticity, no dilatancy; trace	e silt; trace granules, subangular to	
	-				(16.0-24.0') CLA	Y, medium to high plasticity, no dila	tancy; trace silt; trace granules to	
-	-				medium pebbles	, subangular to subrounded; very st	iff; moist; dark grayish brown (10YR	
18 -	48	NM			4/2).			
	-		<i>\/////</i>					
	-		<i>\/////</i>					
20 -			<i>\/////</i>					
-	-		\/////					
22			\/////					
Note:	s: below groun	d surface		NA: Not A	Available	ppm: parts per million	Date: 5/11/2022	
USCS:	Unified Soi	l Classific	ation System	NM: Not 1	Measured	PID: Photo-ionization Detector	rage. 1 OI 3	

		<u>SOIL</u>	BORI	NG LOG						
В	ORING	NO.:	SB-	W2						
Т	OTAL D	EPTH:	61.7	5 feet bgs						
		PR	OJECT I	NFORMATIC	N	DRILLING IN	FORMATION			
CLIENT: SITE LOCATION: CITY, STATE: PROJECT NUMBE LOGGED BY:		ATION: TE: NUMBE 3Y:	BASF Corporation Point Hennepin Grosse IIe, Michigan ER: 30107326 K. Donahue			DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/24/2022 03/24/2022			
DEPTH (feet) (feet) Recovery (inches) PID (ppm) Soil Symbol USCS Classification			USCS Classification	s	OIL DESCRIPTION					
	48	NM								
26 -	48	NM		СН	(24.0-48.0') CLAY, high plasticity, no dilatancy; trace silt; trace granules to medium pebbles subangular to subrounded; medium stiff to stiff; moist; gray (10YR 5/1). Note: At 25.0' bgs, gray.					
28	48	NM			Note: At 28.0' bgs, soft.					
32	48	NM			Note: At 32.0' bg	js, very soft.				
36	48	NM								
40	48	d surface		NA: Not J	Available	ppm: parts per million	Date: 5/11/2022			
USCS:	Unified Soi	l Surrace l Classific	ation System	NM: Not 1	Measured	PID: Photo-ionization Detector	Page: 2 of 3			

		<u>SOIL</u>	. BORI	NG LOG					
В	ORING	NO.:	SB-	W2			CADIS		
Т	OTAL DI	EPTH:	61.7	75 feet bgs					
		PR	OJECT	NFORMATIO	N	DRILLING INF	FORMATION		
CLIENT: B SITE LOCATION: P CITY, STATE: G PROJECT NUMBER: LOGGED BY:			BASF Co Point He Grosse R: 3010 K. Do	orporation ennepin Ile, Michigan 7326 onahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/24/2022 03/24/2022		
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION			
46 -	48	NM							
50 -	0	NM		NO RECOVERY	(48.0-56.0') NO RECOVERY.				
54 -	0	NM							
56 - - - 58 - -	35.5	NM		СН	(56.0-59.7') CLAY, high plasticity, no dilatancy; trace silt; trace granules, subangular to subrounded; soft to medium stiff; moist; dark gray (10YR 4/1).				
60 -	10.5	NM		<u>ML</u> ML	<ul> <li>(59.7-60.0') SILT, no plasticity, rapid dilatancy; moist; very pale brown (10YR 8/2).</li> <li>Note: Distiller Blow-Off, sulfur odor, hard and soft.</li> <li>(60.0-61.7') SILT, no plasticity, rapid dilatancy; some granules to large pebbles, angular to subround; soft to hard; wet; gray (10YR 5/1) and light grayish brown (10YR 6/2). Note: Sulfur odor.</li> </ul>				
62					End of boring at	61.75' bgs, refusal.			
Note: bgs: USCS:	S: below ground Unified Soil	l surface . Classifica	ation System	NA: Not i NM: Not i	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 3 of 3		

		<u>SOIL</u>	BORING LOG					
B		NO.:	SB-W3			<b>UADIS</b>		
	JIAL D							
		PR		2IN				
	IENT:		BASF Corporation		DRILLING CO.:	Dakota Technologies		
	TY. STAT	TE:	Grosse lle, Michigan		DRILLING METHOD:	Direct Push		
PF	ROJECT	NUMBE	R: 30107326		DATE STARTED:	04/04/2022		
LC	GGED E	BY:	K. Donahue		DATE COMPLETED:	04/04/2022		
Н Э	PTH et) (ery ss) n)		tion ol					
DEP (fee	Recov (inche	udd) DId	Soil Symb USC Classifica	s	OIL DESCRIPTION			
0	-		GC	(0.0-1.4') CLAY, very coarse, sub subrounded; me	no plasticity, rapid dilatancy; little si angular to subrounded; trace granul dium stiff, poorly sorted; dry to mois	It; and GRAVEL; little sand, very fine to les to large pebbles, angular to t; grayish brown (10YR 5/2).		
2-	40.5	NM	ML	(1.4-1.9') CLAY, fine to very coars	ttle silt; and GRAVEL; trace sand, very poorly sorted; moist; dark gray			
4-				<ul> <li>(10YR 4/2).</li> <li>(1.9-9.2') SILT, no plasticity, rapid dilatancy; little sand, very fine to medium, subangular subrounded; mois to wet; white (10YR 8/1) and light gray (10YR 7/1).</li> <li>Note: Distiller Blow-Off; hard and soft.</li> </ul>				
- - 6- -	36	NM		Note: Distiller Blow-Off, nard and soft.				
- 8				(9.2-12.0') CLAY	. low plasticity, rapid dilatancy; som	e silt: trace granules to small pebbles.		
10	39	NM		subangular to su	brounded; soft; moist; very dark gra	ıy (10YR 3/1).		
12	-		CL	(12.0-20.2') CLA subangular to su	Y, medium plasticity, no to slow dila brounded; soft; moist; dark gray (10	tancy; little silt; trace granules, )YR 4/1).		
14 -	39	NM						
16	-							
18	34	NM						
20 - 22 - 24	32	NM	SC SC SC SC SC SC SC SC SC SC SC SC SC S	(20.2-28.0') SAN trace granules, s	D, very fine to fine; and CLAY, med ubangular to subrounded; soft; well	lium plasticity, rapid dilatancy; trace silt; sorted; moist to wet; gray (10YR 5/1).		
Note: bgs:	<b>S:</b> below ground	d surface	NA: Not . NM: Not .	Available Measured	ppm: parts per million	Date: 5/11/2022 Page: 1 of 2		
USCS:	Unified Soil	l Classific	ation System		PID: Photo-ionization Detector			

		<u>SOIL</u>	BORIN	<u>G LOG</u>					
В	ORING	NO.:	SB-V	V3			CADIS		
т	OTAL D	EPTH:	46.0	feet bgs					
		PR	OJECT IN	IFORMATIO	N	DRILLING INF	FORMATION		
CLIENT:BASF CorporatiSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichPROJECT NUMBER:30107326LOGGED BY:K. Donahue			poration nepin e, Michigan 326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/04/2022 04/04/2022			
DEPTH (feet) Recovery (inches) PID (ppm) Soil Symbol USCS Classification			s	OIL DESCRIPTION					
- - 26 - - - - -	48	NM							
30 -	20	NM		SP	(28.0-31.7') SAND, very fine to fine; trace clay; well sorted; moist to wet; dark gray (10YF 4/1).				
32	48	NM		SW CH SP CH	(31.9-32.0') CLA (32.0-33.3') SAN (33.3-46.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace ID, very fine to fine; little clay; well so Y, high plasticity; no dilatancy; trace brounded; very soft to soft; moist; g	e silt; soft; moist; gray (10YR 5/1). orted; wet; dark gray (10YR 4/1). e silt; trace granules to medium pebbles, ray (10YR 5/1).		
36	48	NM							
40	46	NM							
46	46	NM			Note: Driller pushed 2.0', from 44.0-46.0' bgs, but recovered 46" due to clay exp				
48					End of boring at	46.0' bgs.			
Notes bgs: USCS:	<b>3:</b> below groun Unified Soi	d surface l Classifica	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 2		

		<u>SOIL</u>	BORI	NG LOG						
В	ORING	NO.:	SB-	W4			CADIS			
Т	OTAL D	EPTH:	58.0	feet bgs						
		PR	OJECT I	NFORMATIC	N	DRILLING INF	FORMATION			
CL SI <sup>-</sup> CI <sup>-</sup> PF	CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue			prporation nnepin le, Michigan 7326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/24/2022 03/24/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION				
0	48	NM		SW SC SP	(0.0-1.0') SAND, trace clay; poorly Note: At 0.5' bgs (1.0-2.2') CLAY.	(0.0-1.0') SAND, very fine to very coarse, subangular to subrounded; and GRAVEL; little silt trace clay; poorly sorted; moist; light brownish gray (10YR 6/2). Note: At 0.5' bgs, fabric; road base.				
4	48	NM			<ul> <li>(1.0-2.2.) CLAY, medium to nigh plasticity, slow dilatancy; and SAND, very fine to coarse, subangular to subrounded; little pebbles, small to medium; subangular; trace silt; poorly sorted; soft to medium stiff; moist; dark gray (10YR 4/1).</li> <li>(2.2-7.2') SAND, very fine to fine, subangular to subrounded; trace silt; well sorted; dry; light gray (10YR 7/1).</li> <li>Note: Distiller Blow-Off, hard.</li> </ul>					
8- 8- 10-	26	NM		CL CH	<ul> <li>(7.2-8.0') CLAY, no plasticity, rapid dilatancy; and SILT; trace sand, very fine to medium, subangular to subrounded; stiff; dry to moist; very dark gray (10YR 3/1) and gray (10YR 5/1).</li> <li>(8.0-9.7') CLAY, high plasticity, no dilatancy; trace silt; soft; moist; gray (10YR 5/1).</li> <li>(9.7-13.8') CLAY, medium to high plasticity, no to slow dilatancy; little silt; soft; moist; gray (10YR 5.1) and very dark gray (10YR 3/1).</li> </ul>					
- - 12 -										
14	24	NM		СН	(13.8-16.8') CLA (10YR 5/1).	Y, medium to high plasticity, no dilat	tancy; little silt; medium stiff; moist; gray			
18 -	36	NM		CL CH	<ul> <li>(16.8-18.0') CLA subangular to su wet; gray (10YR</li> <li>(18.0-28.0') CLA</li> </ul>	Y, low plasticity, rapid dilatancy; son brounded; little silt; trace medium pe 5/1). Y, medium to high plasticity, no dilat	ne sand, very fine to medium, ebbles, subangular; very soft; moist to tancy; trace silt; very stiff; moist; dark			
20	48	NM			grayish brown (1 Note: At 20.0' bg	UYR 4/2). is, color changes to gray (10YR 5/1)				
24	48	NM								
28	48	NM		СН	(28.0-55.0') CLAY, high plasticity, no dilatancy; trace silt; trace granules to medium pebbles subangular to subrounded; very soft to soft; moist to wet; gray (10YR 5/1).					
Notes bgs: USCS:	B: below groun Unified Soi	d surface l Classifica	ation System	NA: Not . NM: Not !	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 2			

		<u>SOIL</u>	. BORIN	NG LOG			
В	ORING	NO.:	SB-	W4			CADIS
т	OTAL D	EPTH:	58.0	feet bgs			
		PR	OJECT I	NFORMATIC	DN	DRILLING INFORMATION	
CLIENT: BASF Corporation SITE LOCATION: Point Hennepin CITY, STATE: Grosse Ile, Michiga PROJECT NUMBER: 30107326 LOGGED BY: K. Donahue			prporation nnepin le, Michigan 7326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/24/2022 03/24/2022	
DEPTH (feet)	DEPTH (feet) (feet) (inches) PID (ppm) Soil Symbol USCS USCS		S	SOIL DESCRIPTION			
32 -	-						
34 -	48	NM					
36	48	NM					
40 -	48						
44	48	NM					
48 -	48	NM					
52	48	NM		СН	(55.0-56.0') CLA to subrounded; t (10YR 5/1).	Y, high plasticity, no dilatancy; little race silt; trace sand, very fine to fine	granules to medium pebbles, subangular ; soft; poorly sorted; moist to wet; gray
56	5	NM		ML	(56.0-58.0') SILT subrounded; har Note: Sulfur odo	Γ, no plasticity, rapid dilatancy; some d; dry to moist; gray (10YR 5/1). r.	granules to large pebbles, angular to
58 - - - 60 -	-				Note: From 56.0 large pebble in t End of boring at	to 58.0' bgs, poor recovery, wrinkled ube. 58.0' bgs, hit refusal.	d tube, very hard material unable to drill,
62 Notes bgs: USCS:	s: below ground Unified Soil	l surface Classifica	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 2

		<u>SOIL</u>	BORING LOG				
В	ORING	NO.:	SB-W5				
т	DTAL D	EPTH:	32.0 feet bgs				
		PR	OJECT INFORMATION	N DRILLING INFORMATION			
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue				DRILLING CO.:Dakota TechnologiesDRILLER:Andy Kirsch/Seth MillerDRILLING METHOD:Direct PushDATE STARTED:04/04/2022DATE COMPLETED:04/04/2022			
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol USCS Classification	SOIL DESCRIPTION			
0	32.5	NM	GC GM ML ML	<ul> <li>(0.0-2.6') CLAY, no plasticity, rapid dilatancy; and GRAVEL; little silt; little sand, very fine to very coarse, subangular to subrounded; trace granules to large pebbles, subangular to subrounded; stiff; poorly sorted; dry to moist; grayish brown (10YR 5/2).</li> <li>Note: At 1.5' bgs, fabric; road base.</li> <li>(2.6-2.9') SILT, no plasticity, rapid dilatancy; and GRAVEL; trace clay; trace sand, very fine to coarse; subangular to subrounded; moist; black (10YR 2/1).</li> <li>(2.9-3.0') SILT, no plasticity, rapid dilatancy; little sand, very fine to very coarse, subangular to subrounded; moist; black (10YR 2/1).</li> <li>(2.9-3.0') SILT, no plasticity, rapid dilatancy; little sand, very fine to very coarse, subangular to subrounded; moist; grayish brown (10YR 5/2).</li> </ul>			
4	48	NM		(3.0-4.7') SILT, no plasticity, rapid dilatancy, some coarse sand to large pebbles, angular to subrounded; trace clay; medium stiff; moist; dusky red (10YR 3/2) and very dark gray (10YR 3/1). (4.7-8.0') SILT, no plasticity, rapid dilatancy; some sand, very fine to medium, subangular to subrounded; hard; gray (10YR 5/1) and light gray (10YR 7/1). Note: Distiller Blow-Off.			
8 - - 10 - - 12-	24	NM	ML	(8.0-14.1') SILT, no plasticity, rapid dilatancy; very soft to soft; moist to wet; white (10YR 8/1). Note: Distiller Blow-Off.			
- - 14 - 16	29	NM		(14.1-18.0') SILT, no to low plasticity, rapid dilatancy; and CLAY; very soft; moist to wet; v dark gray (10YR 3/1).			
Notes bgs: 1 USCS:	5: below ground Unified Soil	d surface l Classific:	NA: Not Av NM: Not Av NM: Not Me	ailable ppm: parts per million Date: 5/10/2022 asured PID: Photo-ionization Detector Page: 1 of 2			

		<u>SOIL</u>	BORIN	IG LOG					
В	ORING	NO.:	SB-\	N5			CADIS		
Т	OTAL D	EPTH:	32.0	feet bgs					
		PR		NFORMATIC	N	DRILLING INF	FORMATION		
CLIENT:BASF CorporationSITE LOCATION:Point HennepinCITY, STATE:Grosse Ile, MichiganPROJECT NUMBER:30107326LOGGED BY:K. Donahue			rporation mepin e, Michigan 326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/04/2022 04/04/2022			
DEPTH (feet) (feet) Recovery (inches) PID (ppm) (ppm) Symbol USCS Classification			USCS Classification	s	OIL DESCRIPTION				
18 -	32	NM		СН	(18.0-28.7') CLA pebbles, subang	Y, medium to high plasticity, no dila ular to subrounded; soft to very soft	tancy; trace silt; trace granules to large ; moist; gray (10YR 5/1).		
20 -	40	NM							
24	34	NM							
28 -	27	NM		SP CH	(28.7-30.0') SAN subrounded; trac Note: Shell fragr (30.0-32.0') CLA subangular to su	ID, very fine to fine; some clay; trace ce silt; well sorted; moist to wet; gray nents. Y, high plasticity, no dilatancy; trace brounded; soft; moist; gray (10YR 5	e granules to small pebbles; / (10YR 5/1). e silt; trace granules to medium pebbles, /1).		
32 - 34 Note: bgs: uscs:	s: below ground Unified Soil	i surface 1 Classifica	ation System	NA: Not NM: Not	End of boring at	32.0' bgs. ppm: parts per million PID: Photo-ionization Detector	Date: 5/10/2022 Page: 2 of 2		

		<u>SOIL</u>	BORING LOG				
В	ORING	NO.:	SB-W6			CADIS	
т	OTAL DI	EPTH:	28.0 feet bgs				
		PR	OJECT INFORMATIO	N	DRILLING INF	FORMATION	
CL SI <sup>T</sup> CI <sup>T</sup> PR	IENT: TE LOCA TY, STAT ROJECT I DGGED B	TION: E: NUMBE Y:	BASF Corporation Point Hennepin Grosse IIe, Michigan R: 30107326 K. Donahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/04/2022 04/04/2022	
DEPTH (feet)	DEPTH (feet) Recovery (inches) PID (ppm) (ppm) Soil Symbol USCS USCS		Soil Symbol USCS Classification	SOIL DESCRIPTION			
0			GC	(0.0-1.9') CLAY, very coarse, sub subrounded; stiff Note: Road mate	no plasticity, rapid dilatancy; and GF angular to subrounded; trace granul ; poorly sorted; dry to moist; grayish rial.	RAVEL; little silt; little sand, very fine to es to very large pebbles, subangular to brown (10YR 5/2).	
2-	39	NM	ML	(1.9-2.8') SILT, r to subrounded; li poorly sorted; dr	and, very fine to very coarse, subangular ngular to subrounded; trace clay; hard; 10YR 3/2).		
- - 4			ML	(2.8-5.2') SILT, no plasticity, rapid dilatancy; and SAND, very fine to coarse, subangu subrounded; hard; well sorted; moist; light gray (10YR 7/2). Note: Distiller Blow-Off.			
- - 6-	6 – 42 NM		ML	(5.2-6.8') SILT, no plasticity, rapid dilatancy; very soft; moist to wet; white (10YR 8/1). Note: Distiller Blow-Off.			
- 8-			- XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	(6.8-8.3') SAND, to wet; gray (10Y Note: Distiller Blo	very fine to coarse, subangular to s (R 6/1). ow-Off.	ubrounded; little silt; well sorted; moist	
- - 10 -	8 		ML	(8.3-11.0') SILT, gray (10YR 4/1). Note: Little orgar	no to low plasticity, rapid dilatancy; nics present, roots, etc.	and CLAY; very soft; moist to wet; dark	
-			СН	(11.0-23.0') CLA (10YR 5/1).	Y, medium to high plasticity, no dilat	ancy; trace silt; very soft; moist; gray	
14 -	42.5	NM		Available	ppm: parts per million	Data: 7/11/2022	
bgs: USCS:	below ground Unified Soil	l surface Classific	NA: Not ) NM: Not Mation System	Avaliadie Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 2	

В									
BORING NO.: <b>SB-W6</b>				V6			CADIS		
тс	DTAL DI	EPTH:	28.0	feet bgs					
		PR	OJECT IN	FORMATIO	N	DRILLING INF	FORMATION		
CLIENT: BASF Corp SITE LOCATION: Point Henn CITY, STATE: Grosse Ile, PROJECT NUMBER: 3010732 LOGGED BY: K. Dona		orporation nnepin Ile, Michigan 7326 onahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/04/2022 04/04/2022				
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION			
16 -									
	42	NM							
22 -	42	NM		;P	(23.0-24.5') SAN sorted; wet; dark	D, very fine to coarse, subangular to gray (10YR 4/1).	o subrounded; little clay; little silt; well		
24	41	NM		SW CH	(24.5-27.4') SAND, very fine to very coarse, subangular to subrounded; trace granules, subangular to subrounded; trace silt; poorly sorted; wet; dark gray (10YR 4/1). Note: Drill brow out on last run 24.0 to 28.0' bgs, first 5 feet is likely from bottom of the 20.0 to 24.0' bgs run. (27.4-28.0') CLAY, high plasticity, no dilatancy; trace silt; medium stiff; moist; gray				
28 - - 30 Notes bgs: t	: elow ground	l surface		NA: Not J NM: Not N	(1UYR 5/1). End of boring at	28.0' bgs. ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 2		

		<u>SOIL</u>	BORING L	<u>OG</u>		
В	ORING	NO.:	SB-W7			CADIS
т	DTAL D	EPTH:	<b>28.0</b> fee	et bgs		
		PR	OJECT INFOR	RMATION	DRILLING INF	ORMATION
CL SI <sup>-</sup> CI <sup>-</sup> PR LC	CLIENT: SITE LOCATION: CITY, STATE: PROJECT NUMBE LOGGED BY:		BASF Corporat Point Hennepin Grosse IIe, Mic R: 30107326 K. Donahue	tion higan	DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Seth Miller Direct Push 04/04/2022 04/04/2022
DEPTH (feet) Recovery (inches) PID (ppm)		(mqq)	Soil Symbol USCS	Classification	SOIL DESCRIPTION	
0 	43	NM	GC SW SW SW SW SW ML	(0.0-1.0') CLAY, medium, subarg subrounded; trad Note: At 0.4' bgs (1.0-1.6') SAND, pebbles, subarg (1.6-2.5') SAND, dilatancy; little g dark gray (10YR Note: Hard mate (2.5-2.8') SAND, dilatancy; some gray (10YR 5/1). (2.8-3.8') SAND, dilatancy; little g dark gray (10YR	no plasticity, rapid dilatancy; and GR gular to subrounded; little granules to ce silt; stiff; poorly sorted, dry to mois s, fabric; road base material. very fine to coarse, subangular to su lar to subrounded; little silt; poorly so very fine to coarse, subangular to su ranules to medium pebbles, angular to 4/1). verial, red (2.5YR 5/6) present at 21.0' very fine to coarse, subangular to su granules to large pebbles, subangular very fine to coarse, subangular to su ranules to medium pebbles, angular very fine to coarse, subangular to su ranules to medium pebbles, angular very fine to coarse, subangular to su ranules to medium pebbles, angular to 4/1).	RAVEL; some sand, very fine to large pebbles, subangular to st; grayish brown (10YR 5/2). ubrounded; some granules to medium, orted; moist; black (10YR 2/1). ubrounded; and SILT, no plasticity, rapid to subrounded; poorly sorted; moist; bgs. ubrounded; and SILT, no plasticity, rapid ar to subrounded; poorly sorted; moist; ubrounded; and SILT, no plasticity, rapid to subrounded; poorly sorted; moist;
- 6   8 	32.5	NM		Note: Man-made (3.8-10.5') SILT, (10YR 8/1). Note: Hard and	e máterial at 3.0' bgs, red (2.5YR 4/8) no plasticity, rapid dilatancy; very so light gray (10YR 7/1) at 3.8 to 4.4' bg	). ft to soft; moist to wet; white s, 5.7 to 5.8' bgs, and 6.3 to 6.5' bgs.
- - 10 - - - - -	35	NM	GM CH	(10.5-10.7') SILT to subrounded; I (10.7-15.2') CLA (10YR 4/1).	Γ, no plasticity, rapid dilatancy; and G ittle clay; very soft; moist to wet; very Υ, medium to high plasticity, no dilata	RANULES to large PEBBLES, angular dark gray (10YR 3/1). ancy; some silt; soft; moist; dark gray
14	14.5	NM		NA: Not Available NM: Not Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 2



		<u>SOIL</u>	BORIN	IG LOG					
В	ORING	NO.:	SB-V	N8					
т		EPTH:	64.0	feet bgs					
		PR	OJECT IN	FORMATIO	N	DRILLING INF	FORMATION		
CL	IENT:		BASF Co	rporation		DRILLING CO.:	Dakota Technologies		
SI	TE LOCA	TION:	Point Hen	inepin		DRILLER:	Andy Kirsch/Robert Tieman		
CI	TY, STAT	ſE:	Grosse II	e, Michigan		DRILLING METHOD:	Direct Push		
PF	ROJECT	NUMBE	R: <b>30107</b>	326		DATE STARTED:	03/25/2022		
LOGGED BY: K. Donahue				nahue		DATE COMPLETED:	03/25/2022		
DEPTH (feet)	DEPTH (feet) Recovery (inches) PID (ppm) Soil Symbol USCS Classification		s	SOIL DESCRIPTION					
				sw sw	(0.0-0.5') SAND, subangular to su Note: Grass and	very fine to fine; some gravel; little r brounded; trace silt; poorly sorted; n twigs at surface.	medium sand to medium pebbles, noist; dark gray (10YR 4/1).		
2-	2 34 NM		(0.5-1.6') SAND, subrounded; trac	very fine to fine; little granules to me e silt; poorly sorted; moist; black (10	edium pebbles, subangular to DYR 2/1).				
-				SW ML	(1.6-1.8') SAND, pebbles, subang 5/2).	very fine to medium, subangular to ular to subrounded; trace silt; poorly	subrounded; some granules to small sorted; moist; grayish brown (10YR		
4-				ML	(1.8-2.0') SAND, very fine to fine; little granules to medium pebbles, subangular to subrounded; trace silt; poorly sorted; moist; black (10YR 2/1).				
6-	31.5	NM			<ul> <li>subrounded; trace silt; poorly sorted; moist; black (10YR 2/1).</li> <li>(2.0-3.3') SILT, no plasticity, rapid dilatancy; some granules to medium pebbles, subangul to subrounded; little sand, very fine to fine; trace clay; soft; poorly sorted; moist; brown (10YR 5/3) and dark gray (10YR 4/1).</li> <li>(3.3-3.6') SILT, no plasticity, rapid dilatancy; some sand, very fine to fine, subrounded to subangular; well sorted; moist; gray (10YR 5/1).</li> </ul>				
8-			-		(3.6-23.2') SILT, Note: Distiller Blo	soft, likely start of the Distiller Blow-C no plasticity, rapid dilatancy; very so pw-Off.	off; moist to wet; white (10YR 8/1).		
- 10	46	NM			Note: From 4.0 t	o 6.0' bgs, hard			
12 - - 14 -	47	NM							
16									
18	48	NM							
20									
bgs: USCS:	•• below ground Unified Soil	l surface l Classifica	ation System	NA: Not A NM: Not M	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 3		

		<u>SOIL</u>	BORI	NG LOG			
В	ORING	6 NO.:	SB-	W8			CADIS
Т	OTAL D	EPTH:	64.0	feet bgs			
		PR	OJECT I	NFORMATIC	DN	DRILLING INF	FORMATION
CL SI CI PF LC	IENT: TE LOCA TY, STA <sup>-</sup> ROJECT 9GGED E	ATION: TE: NUMBE BY:	BASF Co Point He Grosse I R: 3010 K. Do	prporation nnepin le, Michigan 7326 nahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/25/2022 03/25/2022
DEPTH (feet)	Recovery (inches)	(mqq)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION	
- - 24	45	NM		СН	(23.2-24.0') CLA moist; very dark Note: From 23.7	Y, medium to high plasticity, no dilat gray (10YR 3/1). to 23.8' bgs, more silt and organics.	ancy; little silt; trace organics; very stiff; \
- - 26	39	NM		СН	(24.0-26.6') CLA moist; dark gray	Y, high plasticity, no dilatancy; trace (10YR 4/1) and very dark gray (10Y	silt; trace organics; stiff to very stiff; R 3/1).
- - 28				CL	(26.6-27.7') CLA medium stiff; mc (27.7-29.2') CLA	Y, low plasticity, slow to rapid dilatar ist; gray (10YR 5/1). Y, no to low plasticity, rapid dilatanc	ncy; and SILT; trace sand, very fine; y; and SILT; some sand, very fine to fine;
30 -	38	NM		SM CH	(29.2-29.3') SAN plasticity, rapid c (29.3-32.0') CLA granules, subrou	t; gray (10YR 5/1). is, large pebble. ID, very fine to very coarse, subroun lilatancy; little clay; poorly sorted; so Y, medium to high plasticity, no dilat inded to subangular; very stiff; moist	ded to subangular; and SILT , no ft; wet; very dark gray (10YR 3/1). tancy; little silt; trace very fine sand to r; dark grayish brown (10YR 4/2).
32	48	NM		СН	(32.0-64.0') CLA subrounded to s	Y, high plasticity, no dilatancy; trace ubangular; stiff to very stiff; moist; gi	silt; trace granules to medium pebbles, ay (10YR 5/1).
36 - - - 38 - - - - - - - - - - - - - - - -	48	NM			Noto: At 40 0' bo	e changes to modium stiff	
42	48	NM		ND: Not	Available	pom: parts per million	Date: 5/11/0000
bgs: USCS:	below ground Unified Soi	d surface l Classific	ation System	NA: NOU NM: Not	Measured	PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 3



		<u>SOIL</u>	BORING LOG								
В	ORING	i NO.:	SB-W10			CADIS					
т		EPTH:	56.0 feet bgs								
		PR	OJECT INFORMATIO	N	DRILLING INF	FORMATION					
CL	IENT:		BASF Corporation		DRILLING CO .:	Dakota Technologies					
SI		TION:	Point Hennepin		DRILLER:	Andy Kirsch/Robert Tieman					
	TY, STAT	re:	Grosse lle, Michigan		DRILLING METHOD:	Direct Push					
			R: SUIU/320		DATE STARTED:	03/25/2022					
		) r. T	K. Donanue		DATE COMPLETED.	03/25/2022					
DEPTH (feet)	Recovery (inches)	DIA (mqq)	Soil Symbol USCS Classification	s	OIL DESCRIPTION						
0			SM SW	(0.0-0.5') SAND, sorted; moist; br Note: Grass and	very fine; and SILT, no plasticity, rapown (10YR 5/3). roots at surface.	pid dilatancy; some gravel; poorly					
2-	32	NM		(0.5-1.5') SAND, pebbles, subang	very fine to coarse, subangular to su ular to subrounded; little silt; poorly s	ubrounded; some granules to medium sorted; moist; black (10YR 2/1) and					
4-			ML	dark gray (10YŘ (1.5-2.0') SAND,	4/1). very fine to fine; and SILT, no plasti	city, rapid dilatancy; trace granules,					
-			ML	subangular to su 7/1).	brounded; poorly sorted; hard; moist	t; gray (10YR 5/1) and light gray (10YR					
6-	19	NM		(2.0-2.4') SAND,	very fine to coarse, subangular to su	ubrounded; some granules to medium					
-				pebbles, subang dark gray (10YR	ebbles, subangular to subrounded; little silt; poorly sorted; moist; black (10YR 2/1) and lark gray (10YR 4/1).						
		NIM		(2.4-4.5') SILT, r subrounded; little moist; light gray Note: Distiller Ble	2.4-4.5') SILT, no plasticity, rapid dilatancy; some sand, very fine to medium, subangular to ubrounded; little granules to large pebbles, subangular to subrounded; poorly sorted; hard; noist; light gray (10YR 7/1). lote: Distiller Blow-Off.						
				(4.5-15.7') SILT, Note: Distiller Ble Note: Hard at 9.8	no plasticity, rapid dilatancy; very sc ow-Off. 3 to 10.2' bgs, 11.4 to 11.5' bgs, and	oft; moist to wet; white (10YR 8/1). 11.9 to 12.0' bgs.					
- - - 14 - -	39	NM									
16			OL	(15.7-18.0') SILT wet; very dark gr Note: Organics,	, no plasticity, rapid dilatancy; some ay (10YR 3/1). peat.	clay: little organics; very soft; moist to					
18	35	NM	ОН	(18.0-19.7') CLA very dark gray (1 Note Organics, p	Y, medium plasticity, rapid dilatancy 0YR 3/1). eat.	; some silt: little organics; soft; moist;					
20			СН	(19.7-22.0') CLA very dark gray (1	Y, high plasticity, no dilatancy; trace 0YR 3/1).	silt; stiff; moist; gray (10YR 5/1) and					
-	30	NIVI	СН	(22.0-23.6') CLA	Y, high plasticity, no dilatancy; trace	silt; soft; moist; gray (10YR 5/1).					
24				(23.6-26.3') SAN plasticity, slow d	D, very fine to medium, subangular t ilatancy; little silt; well sorted; wet; gr	to subrounded; and CLAY, medium ayish brown (10YR 5/2).					
- 20	36	NM	SP	(26.3-27.4') SAN sorted; wet; very	D, very fine to coarse, subangular to dark gray (10YR 3/1).	subrounded; little clay; trace silt; well					
28 -	 	<u> </u>	СН	(27.4-46.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; stiff to very stiff; moist; gr	silt; trace granules to medium pebbles, ay (10YR 5/1).					
Notes bgs: USCS:	<b>5:</b> below ground Unified Soil	l surface l Classific:	NA: Not A NM: Not M ation System	vailable Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 1 of 2					

		<u>SOIL</u>		<u>G LOG</u>							
В	ORING	i NO.:	SB-V	V10			CADIS				
Т	OTAL D	EPTH:	56.0	feet bgs							
		PR	OJECT IN	FORMATIC	ON	DRILLING INFORMATION					
CL SI CI PF LC	LIENT: TE LOCA TY, STA <sup>-</sup> ROJECT DGGED E	NUMBE	BASF Corp Point Henn Grosse Ile R: 301073 K. Don	poration nepin , Michigan 26 ahue		DRILLING CO.: DRILLER: DRILLING METHOD: DATE STARTED: DATE COMPLETED:	Dakota Technologies Andy Kirsch/Robert Tieman Direct Push 03/25/2022 03/25/2022				
DEPTH (feet)	Recovery (inches)	DIA (mdd)	Soil Symbol	USCS Classification	s	OIL DESCRIPTION					
30 -	48	NM									
34 -	47	NM									
36 -	48	NM									
40 -	48	NM			Note: At 40.0' bg	is, changes to medium stiff.					
44	44	NM		4	(40.0.47.0)) 0117						
48 -	-			n CL	(46.0-47.2) SIL1 (47.2-50.2') CLA gray (10YR 5/1).	Y, no to low plasticity, rapid dilatancy, little c	y; and SILT; soft to stiff; moist to wet;				
50 -	48	NM		CH	(50.2-56.0') CLA subangular to su	Y, high plasticity, no dilatancy; trace brounded; soft; moist; gray (10YR 5,	silt; trace granules to medium pebbles, /1).				
52	48	NM									
- 00	-				End of boring at	56.0' bgs.					
58 Notes bgs: USCS:	S: below ground Unified Soil	d surface l Classific	ation System	NA: Not NM: Not	Available Measured	ppm: parts per million PID: Photo-ionization Detector	Date: 5/11/2022 Page: 2 of 2				



Combined Soil Logs with Hydraulic Profiling Tool, Electrical Resistivity Imaging Electrical Conductivity, and Hydraulic Conductivity

## ARCADIS HPT / ERI EC / Confirmation Soil Boring Log

Arcadis of Michigan, LLC 28550 Cabot Drive Suite 500 Novi, MI 48377

BORIN PROJI DATE	IG NAME ECT NAW LOGGEE	E: E1 IE: BASF Point Hennepin D: 03/31/2022	CLIENT: BASF PROJECT NUMBER: 30107326 Arcadis - SB and Geophysics Dakota - HPT	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration
BORIN PROJE SURFA ELEVA	IG COOF ECTION: ACE ELE	X 322536.23 Y 4672165.76 Universal Transverse Mercator (UTM) VATION: 758.5 ft amsl XTUM: World Geodetic System 1984	HPT TOTAL DEPTH: 31.5 ft bgs SB TOTAL DEPTH: 32 ft bgs See Appendix A for more detailed soil description	<ul> <li>HPT Electrical Conductivity (EC)</li> <li>Electrical Resistivity Imaging (ERI)</li> <li>Electrical Conductivity (EC)</li> </ul>
Depth 1ft:50ft	Elevation (ft amsI)	Abbreviated Soil Description	HPT EC Corr. HPT Press. HPT mS/m 2500 ERI EC 0 psi 100 0 r mS/m 2500	T Flow Max Est. K ROP mL/min 500 0 ft/day 100 0 mm/sec 50
- 2.5 -	578 - 577 - 577 - 576 - 575 - 575 - 574 - 573 - 573 - 572 - 571 -	(0.0-3.0 ft) CL/GW: CLAY, np; and GRAVEL; little sand, vf-vc (3.0-3.9 ft) CH: CLAY, hp (3.9-4.2 ft) ML: SILT, np; little clay (4.2-13.5 ft) ML: SILT, np NOTE: DBO		
- 10.0 -	- 570 - - 569 - - 569 - - 568 - - 568 - - 567 - - 566 -			
- 15.0 -	- 565 - - 564 - - 564 - - 563 - - 563 -  - 562 - 	(13.5-13.9 ft) ML: SILT, np; little clay (13.9-32.0 ft) CH: CLAY, hp		
- 20.0 -	- 560 - - 559 - - 559 - - 558 -  - 557 -			



## ARCADIS HPT / ERI EC / Confirmation Soil Boring Log

Arcadis of Michigan, LLC 28550 Cabot Drive Suite 500 Novi, MI 48377

BORING NAME: E2 PROJECT NAME: BASF Point Hennepin DATE LOGGED: 04/06/2022 BORING COORDINATES: X 322613.54 Y 4672255.04 PROJECTION: Universal Transverse Mercator (UTM) SURFACE ELEVATION: 595.5 ft amsl ELEVATION DATUM: World Geodetic System 1984					CLIENT: BASF         PROJECT NUMBER: 30107326         Arcadis - SB and         LOGGED BY:       Geophysics         Dakota - HPT         HPT TOTAL DEPTH:       51.3 ft bgs         SB TOTAL DEPTH:       36 ft bgs         See Appendix A for more         REMARKS:       Getailed soil description						Conductivity ty (EC) ing (ERI) C)			
						I				1				
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	0 mS/r 0 mS/r	n 2500 n 2500	Corr 0	HPT Press. psi 100	ren 0 r	Flow Max nL/min 500	0	Est. K ft/day	100	ROP 0 mm/sec	50
- 2.5 - - 2.5 - - 5.0 - - 7.5 - - 10.0 - - 12.5 - - 15.0 - - 17.5 - - 20.0 -	- 595 - - 594 - - 593 - - 592 - - 591 - - 590 - - 589 - - 588 - - 578 - - 578 - - 576 - - 577 - - 577 -	(0.0-2.5 ft) SW/GW: SAND, vf-vc; and GRAVEL; some clay, np; little granulles-large pebbles (2.5-25.7 ft) ML: SILT, np NOTE: DBO, soft-very soft, hard at 5.1-5.5 ft				and the second of the second o							M M M M M M M M M M M M M M M M M M M	



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		- 557 -				ł		Ž	
	10.0	- 556 -				{			
	- 40.0 -	- 555 -			5				
		- 554 -							
	- 42.5 -	- 553 -						 $- \leq$	
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	- 45.0 -	- 551 -							
	43.0	- 550 -			$\mathbf{z}$				
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	- 47.5 -	- 548 -						 (	
		- 547 -			5			5	
	- 50.0 -	546			3				
	50.0 -	- 545 -							
		- 544 -	ſ						

## ARCADIS HPT / ERI EC / Confirmation Soil Boring Log

Arcadis of Michigan, LLC 28550 Cabot Drive Suite 500 Novi, MI 48377

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BORIN PROJE DATE	IG NAME ECT NAN LOGGEI	E: E3 IE: BASF Point Hennepin D: 04/06/2022	CLIENT: PROJEC LOGGEI	BASF <b>T NUMB</b> D BY: G	ER: 301073 cadis - SB and eophysics akota - HPT	326	Loc Soil D Samp HPT I HPT I HPT I	Description Description De Photo Pressure Flow Max Estimated Rate of Pe	<u>thods</u> Hydraulic enetration	c Conductivity	у	
BORIN PROJE SURFA ELEVA	IG COOF ECTION: ACE ELE	<b>RDINATES:</b> X 322808.40 Y 4672529.12 Universal Transverse Mercator <b>EVATION:</b> 606.1 ft amsl <b>ATUM:</b> World Geodetic System 1	HPT TOT SB TOTA REMARA	TAL DEPT AL DEPTI See A Se detaile	TH: 64.6 ft H: 48 ft b opendix A for mo d soil description	bgs gs <sup>re</sup>	Electr	ical Resist ical Condι	ivity Imag	ing (EC) ging (ERI) C)		
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC 0 mS/m 2 ERI EC 0 mS/m 2	2500 0 2500	orr. HPT Press. psi 10		Flow Max nL/min 500	O ft/d	к ау 100	ROP 0 mm/sec	; 50
- 2.5 -	- 608 - - 605 -  - 604 -  - 603 -	(0.0-2.5 ft) SW: SAND, vf-vc; and GRAVEL; some clay, np (2.5-38.3 ft) ML: SILT, np									- And	
- 5.0 -	- 602 - - 601 - - 600 - - 599 - - 598 -	NOTE: DBO					_					
- 10.0 -	- 597 - 596 - 595 - - 595 - 						_	Mar and a second				
- 12.5 -	- 593 - - 592 - - 592 - - 591 - - 590 -											
- 17.5 -	- 589 - - 588 - - 588 - - 587 - - 587 - 					>						
	- 585 - - 584 -										$\left  \begin{array}{c} \zeta \\ \zeta \end{array} \right $	



- 37.5 -		: SILT, np; little clay,				
	np NOTE: DBO and Peat	Organics			3	
- 40.0 -	(38.6-39.5 ft) OL/PT: S	LT, np; and CLAY				
	NOTE: Organics, Peat			}		
	(39.5-48.0 ft) CH: CLA <sup>\</sup> - 564 -	r, hp			3	
- 42.5 -						5
- 45.0 -						
	 - 560 -			م جم		
47.5	 - 559 -					$\left\{ \right\}$
- 47.5 -	- 558 -					< label{eq:states}
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- 52.5 -	- 554 -		<u> </u>			
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- 55.0 -	- 551					< l
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- 62.5 -	- 543 -					
	- 542 -					
65.0						
Arcadis of Michigan, LLC 28550 Cabot Drive Suite 500 Novi, MI 48377

BORIN PROJI DATE	IG NAME ECT NAM LOGGED	: E4 E: BASF Point Hennepin : 04/01/2022		CLIENT: BA PROJECT N LOGGED BY	SF JMBER: 30107326 Arcadis - Geophysics : Dakota - HPT	Logging Methods         Soil Description         Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration					
BORIN PROJE SURFA ELEVA	IG COOR ECTION: ACE ELEN	DINATES: X 322866.00 Y 4672606.21 Universal Transverse Mercator ( VATION: 593.2 ft amsl TUM: World Geodetic System 19	(UTM) 984	HPT TOTAL I SB TOTAL D REMARKS:	HPT TOTAL DEPTH: 51.0 ft bgs SB TOTAL DEPTH: NA REMARKS:						
<b>Depth</b> 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC 0 mS/m 2500 ERI EC 0 mS/m 2500	Corr. HPT Press. H	IPT Flow Max mL/min 500	Est. K 0 ft/day 100	ROP 0 mm/sec 50			
- 2.5 -	- 593 - - 592 - - 592 - - 591 - - 590 - - 589 -							MMM			
- 5.0 - - 7.5 -	588 588 587 586 585					han					
- 10.0 - - 12.5 -	- 584 - - 583 - - 582 - - 582 - - 581 - - 581 - - 580 -					m have been have					
- 15.0 - - 17.5 -	- 579 - - 578 - - 578 - - 577 - - 577 - - 576 -										
- 20.0 -	- 575 - - 574 - - 573 - - 573 - - 572 - - 572										



	- 557 -							
- 37.5 -	- 555 -							
40.0	- 554 -					/		
- 40.0 -				7	~			2
12.5								
42.5	- 550 -							
- 45.0 -	- 549 -							
43.0	- 548 -  - 547 -		1					
- 47.5 -	546 -				5			
	- 545 -	ľ						
- 50.0 -	- 544 -							
	- 542 -							
50.5	– – – 541 –							

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BORI PROJ DATE	NG NAME ECT NAM LOGGEE	E: E5 IE: BASF Point Hennepin D: 03/29/2022		CLIENT: BASF PROJECT NUMBER: 3010 Arcadis - SB an Geophysics Dakota - HPT	07326 nd	Logging Methods ✓ Soil Description ✓ Sample Photo ✓ HPT Pressure ✓ HPT Flow Max ✓ HPT Estimated Hydraulic Conductivity ✓ HPT Rate of Penetration ✓ HPT Electrical Conductivity (EC)							
BORI PROJ SURF ELEV	NG COOF ECTION: ACE ELE ATION DA	X 322934.52         Y 4672970.93         Universal Transverse Mercator         VATION:       581.4 ft amsl         ATUM:       World Geodetic System 1	(UTM) 984	HPT TOTAL DEPTH: 41.4 SB TOTAL DEPTH: 40 See Appendix A for REMARKS: See Appendix A for detailed soil descrip	4 ft bgs ft bgs more <sup>thion</sup>	Electr	rical Resistivity Ima	ging (ERI) C)					
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC Corr. HPT Press mS/m 2500 ERI EC 0 psi	5. HPT F 100 0 ml	Flow Max L/min 500	Est. K 0 ft/day 100	ROP 0 mm/sec 50					
- 2.5	- 581 - - 580 - - 579 - - 577 - - 577 - - 577 - - 576 - - 575 -	(0.0-4.3 ft) CL: CLAY, mp; some silt (4.3-6.0 ft) CH: CLAY, mp-hp; little silt (6.0-10.7 ft) ML: SILT, np; little sand, vf-med	In the first of the second			a de la compañía de							
- 7.5 - 10.0 - 12.5	- 574 - - 573 - - 573 - - 572 - - 571 - - 570 - - 570 - - 569 -	NOTE: DBO (10.7-11.7 ft) ML: SILT, np NOTE: DBO (11.7-13.0 ft) ML: SILT, np; some clay NOTE: Organics											
- 15.0 - 17.5 - 20.0	- 568 - - 567 - - 566 - - 565 - - 565 - - 564 - - 563 - 562 - 562 - 562 - 561 -	(13.0-40.0 ft) CH: CLAY, hp											



27.5			
- 57.5			
- 40.0			
40.5	- 540 -  - 539 -		

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BORIN PROJE DATE	IG NAME ECT NAM LOGGED	: E6 E: BASF Point Hennepin : 04/01/2022		CLIENT: BASF       Logging Methods         PROJECT NUMBER: 30107326       Soil Description         Arcadis - Geophysics       Sample Photo         Dakota - HPT       HPT Pressure         HPT Flow Max       HPT Estimated Hydraulic Conductivity         HPT Rate of Penetration       HPT Electrical Conductivity (EC)
BORIN PROJE SURFA ELEVA	IG COOR ECTION: ACE ELEY	X 323103.42 DINATES: Y 4673099.98 Universal Transverse Mercator ( VATION: 576.0 ft amsl TUM: World Geodetic System 19	(UTM) 984	HPT TOTAL DEPTH: 35.0 ft bgs SB TOTAL DEPTH: NA REMARKS: HPT Electrical Conductivity (EC) Electrical Conductivity (EC) Electrical Conductivity (EC)
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC       Corr. HPT Press.       HPT Flow Max       Est. K       ROP         0       mS/m       2500       0       psi       100       mL/min       500       0       ft/day       100       0       mm/sec       50         0       mS/m       2500       0       psi       100       0       mL/min       500       0       ft/day       100       0       mm/sec       50
- 2.5 -	576 - 575 - 575 - 574 - 573 - 573 - 572 -			
- 5.0 -	- 571 - - 570 - - 569 - - 568 - - 567 -			
- 10.0 -	- 566 - - 565 - - 564 - - 563 - - 563 - - 562 -			
- 15.0 - - 17.5 -	- 561 - - 560 - - 559 - - 558 - - 558 - - 557 - - 557 - - 556 - 			
	- 55 <i>1</i> -			



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BORIN PROJE DATE BORIN PROJE	IG NAME ECT NAM LOGGEI IG COOF ECTION:	E: E7 IE: BASF Point Hennepin D: 04/06/2022 RDINATES: X 323098.38 Y 4673354.55 Universal Transverse Mercator (UTM)	CLIENT: BASF PROJECT NUMBER: 30107326 Arcadis - SB and Geophysics Dakota - HPT HPT TOTAL DEPTH: 35.8 ft bgs SB TOTAL DEPTH: 24.0 ft bgs	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration         ✓       HPT Electrical Conductivity (EC)         ✓       Electrical Resistivity Imaging (ERI)         Electrical Conductivity (EC)
SURFA	ACE ELE	VATION: 576.3 ft amsl	See Appendix A for more detailed soil description	
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description S Supple B O O	HPT EC mS/m 2500 ERI EC mS/m 2500 ERI S/m 2500	T Flow Max Est. K ROP nL/min 500 0 ft/day 100 0 mm/sec 50
- 2.5 -	- 576 - 575 - - 574 - - 574 - 	(0.0-2.5 ft) SW: SAND, vf-vc; and gravel; little clay; little silt; little gravel, granules to large pebbles (2.5-4.1 ft) ML: SILT, np; some gravel, granules to large pebbles; little sand, vf-med		
- 5.0 -	- 572 - - 571 - - 570 -	NOTE: DBO (4.1-4.3 ft) CH: CLAY, hp; some gravel, granules to med. pebbles (4.3-12.7 ft) ML: SILT, np; some gravel, granules to large pebbles; little sand, vf-med		
- 7.5 -	- 569 - - 568 - - 567 - - 567 - - 566 -			
- 12.5 -	- 565 - 564 - 	(12.7-17.2 ft) CH: CLAY, hp; little silt		
- 15.0 -	- 562 - - 562 - - 561 - - 560 -			
- 17.5 -	- 559 - - 558 - - 557 - - 557 -	(17.2-24.0 ft) CH: CLAY, hp		
	- 556 -  - 555 - 			



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BORIN PROJE DATE I	IG NAME ECT NAM	E: E8 IE: BASF Point Hennepin D: 03/28/2022		CLIENT: BASF PROJECT NUMBER: 30107326 Arcadis - SB and Geophysics Dakota - HPT	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration         ✓       HPT Electrical Conductivity (EC)
		X 323096.38 RDINATES: Y 4673548.70	NA)	HPT TOTAL DEPTH: 45.2 ft bgs	<ul> <li>Electrical Resistivity Imaging (ERI)</li> <li>Electrical Conductivity (EC)</li> </ul>
SURFA	CE ELE	VATION: 576.4 ft amsl	IVI <i>)</i>	SBTOTAL DEPTH. 44.0 It bgs See Appendix A for more REMARKS: detailed soil description	
Depth	(I)		SO	HPT EC	IPT Flow Max Est. K ROP
1ft:50ft	Elevation (ft ams	Abbreviated Soil Description	Sample Photo	0 mS/m 2500 ERIEC 0 psi 100 0 mS/m 2500	mL/min 500 0 ft/day 100 0 mm/sec 50
-0.0 -	- 576 - 	(0.0-1.8 ft) SW: SAND, vf-vc; some gravel, granules-large pebbles			
- 2.5 -	- 574 -  - 573 -	NOTE: DBO			
- 5.0 -	- 572 - - 571 - - 571 - - 570 -				
- 7.5 -	- 569 - 				
- 10.0 -	- 567 -				
-	- 566 -  - 565 -	(11.5-11.8 ft) SW: SAND, vf-f; and silt			
- 12.5 -	- 564 -	(11.8-11.9 ft) ML: SILT, np	SI.		
- 15.0 - - -	- 563 - - 562 - - 561 - - 561 - - 560 -	(11.9-12.2 ft) ML: SILT, np; some clay (12.2-26.8 ft) CH: CLAY, mp-hp; little silt			
- 17.5 -	- 559 -  - 558 -				
- 20.0 -	- 557 -				



- 540				
- 40.0 - 537 - 536 - 536 -				
- 535		A A A A A A A A A A A A A A A A A A A		
- 533				

Arcadis of Michigan, LLC 28550 Cabot Drive Suite 500 Novi, MI 48377

BORIN PROJI DATE	ig name Ect nan Loggei	E: E9 IE: BASF Point Hennepin D: 03/28/2022	CLIENT: BASF PROJECT NUMBER: 30107326 LOGGED BY: Arcadis - SB and Geophysics Dakota - HPT	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration         ✓       HPT Electrical Conductivity (EC)
BORIN	IG COOF	X 323119.00 Y 4673657.09	HPT TOTAL DEPTH: 37.0 ft bgs	Electrical Resistivity Imaging (ERI) Electrical Conductivity (EC)
PROJ	ECTION:	Universal Transverse Mercator (UTM)	SB TOTAL DEPTH: 36.0 ft bgs	
SURF/	ACE ELE	VATION: 575.7 ft amsl	See Appendix A for more detailed soil description	
			HPT EC	
Depth	(Ism		Corr. HPT Press. HPT	T Flow Max Est. K ROP
1ft:50ft	n (ft a		0 psi 100 0 r	mL/min 500 0 ft/day 100 0 mm/sec 50
	levatic	Sam		
	Ш	0	mS/m 2500	
0.0 -	 - 575 -	(0.0-0.8 ft) SW/GW: SAND, vf-f; and GRAVEL, granules to med. pebbles		
	- 574 -	(0.8-1.6 ft) ML: SILT, np; little sand, vf-c		
- 2.5 -	- 573 -	(1.6-11.6 ft) ML: SILT, np; little sand, vf-med		
	- 572 · 	NOTE: DBO		
- 5.0 -	- 570 ·			
	- 569 -			
- 7.5 -	- 568 -			
	- 567 -			
- 10.0 -	- 566 · - ·			
	 	(11.6-11.8 ft) SW: SAND, vf-f; little sand, vc;		
- 12.5 -	- 563 -	(11.8-24.0 ft) CH: CLAY, mp-hp		
	- 562 -			
- 15.0 -	- 561 -			
	- 560 -			
- 17.5 -	- 559 -  - 558 -			
	 - 557 -			
- 20.0 -	- 556 -			
	_ 555 - _ 5			
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BORIN PROJI DATE	IG NAME ECT NAN LOGGEI	E: E11 IE: BASF Point Hennepin D: 03/28/2022	CLIENT: BASF       Logging Methods         PROJECT NUMBER: 30107326       ✓       Soil Description         Arcadis - SB and Geophysics Dakota - HPT       ✓       HPT Pressure         HPT Flow Max       ✓       HPT Estimated Hydraulic Conductivity         HPT Rate of Penetration       ✓       HPT Electrical Conductivity (EC)
BORIN	IG COOF	X 323161.09 RDINATES: Y 4673973.88	HPT TOTAL DEPTH: 39.4 ft bgs Electrical Resistivity Imaging (ERI) Electrical Conductivity (EC)
PROJE	ECTION:	Universal Transverse Mercator (UTM)	SB TOTAL DEPTH: 40.0 ft bgs
SURFA	ACE ELE	VATION: 580.8 ft amsl	See Appendix A for more REMARKS: detailed soil description
			HPT EC
Depth	(Isn	■ Solos	Corr. HPT Press. HPT Flow Max Est. K ROP
1ft:50ft	n (ft ar	Abbreviated Soil Description 2 0	mS/m 2500 0 psi 100 0 mL/min 500 0 ft/day 100 0 mm/sec 50
	evatio	Samp	
	Ξ	0	mS/m 2500
- 0.0 -	- 581 -	(0.0-0.4 ft) SW: SAND, vf-f; some silt; little	
	- 580 -	(0.4-4.5 ft) SW/ML: SAND, vf-f; and SILT	
- 2.5 -	- 5/9 -  - 578 -	NOTE: DBO	
	- 576 - - 577 -		
50	 	:	
5.0	 - 575 -	NOTE: DBO	
	- 574 -		
- 7.5 -	- 573 -		
	- 572 -		
- 10.0 -	- 571 -		
	- 570 -		
- 12.5 -	- 569 - 		
- 150 -	- 566 -	(14.5-16.2 ft) ML: SILT, np; some clay: little	
10.0	 - 565 -	organics	
	 - 564 -	(16.2-31.5 ft) CH: CLAY, mp-hp	
- 17.5 -	- 563 - 		
	- 562 -		
- 20.0 -	- 561 -		
	- 560 - 		



27.5	- 545 - 544 (36.2-40.0 ft) CH: CLAY, hp		
- 37.5	- 543 - - 542 - - 541 -		

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BORIN PROJE DATE BORIN PROJE SURFA ELEVA	IG NAME ECT NAM LOGGEE IG COOF ECTION: ACE ELE	E: W2 ME: BASF Point Hennepin D: 03/24/2022 RDINATES: X 322468.48 Y 4672540.45 Universal Transverse Mercator ( VATION: 576.8 ft amsl ATUM: World Geodetic System 19	UTM) 184	CLIENT: B/ PROJECT N LOGGED BY HPT TOTAL SB TOTAL D REMARKS:	ASF UMBER: 30107326 Arcadis - SB and Geophysics Dakota - HPT DEPTH: 62.4 ft bgs DEPTH: 61.8 ft bgs See Appendix A for more detailed soil description	Log ✓ Soil D ✓ Samp ✓ HPT I ✓ HPT I ✓ HPT I ✓ HPT I ✓ Electr	<b>gging Methods</b> Description De Photo Pressure Flow Max Estimated Hydraulio Rate of Penetration Electrical Conductive rical Resistivity Imag- rical Conductivity (E	c Conductivity rity (EC) ging (ERI) C)
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC 0 mS/m 2500 ERI EC 0 mS/m 2500	Corr. HPT Press. 0 psi 100 0	HPT Flow Max mL/min 500	Est. K 0 ft/day 100	ROP 0 mm/sec 50
- 2.5 -	- 576 - - 575 - - 575 - - 574 - - 573 -	(0.0-1.1 ft) SW/GW: SAND, vf-vc; and GRAVEL; little silt (1.1-8.0 ft) SP/ML: SAND, vf-f; and SILT NOTE: DBO						
- 5.0 -	- 572 - - 571 -							
- 7.5 -	- 570 -  - 569 -  - 568 -	(8.0-8.5 ft) SP: SAND, vf-f; some silt						
- 10.0 -	- 567 - - 566 - - 566 -	(8.5-9.0 ft) ML: SILT, np; some sand, vf-f NOTE: DBO (9.0-10.0 ft) SP: SAND, vf-f; little silt						
- 12.5 -	- 505 -  - 564 - 	(12.0-48.0 ft) CH: CLAY, mp-hp	an de					
- 15.0 -	- 503 -  562 - 		51 (01 P					
- 17.5 -	- 561 - 560 - 						<b>F</b>	
	- 559 - - 558 - 							
- 20.0 -	- 557 -  556 -  - 555 -							



	- 541	_				
	- 540					
- 37.5	- 539		F	 -		
	- 538					5
40.0	- 537					
- 40.0	- 536			F		2
	- 535		1			
- 42.5	- 534			 }		
	- 533		F	<u> </u>		
45.0	- 532		24	Ì		
- 45.0	- 531		5			
	- 530		No.			
- 47.5	- 529	-				
	- - 528	– (48.0-56.0 ft) No Recovery	in the			
- 50.0	_ 527	-				
00.0	- - 526	-	24h	and the second se		
	- - 525	-		5		
- 52.5	- 524	-	188			
	- 523					
- 55.0	522	-		$\sim$		
	- 521			- A		
	- 520			<pre></pre>		
- 57.5	- 519					
	- 518					
- 60.0	517	(59.7-60.0 ft) ML: SILT, np		 }		
	- 516	(60.0-61.8 ft) ML: SILT, np; some granules to	E T			
	- 515	large pebbles				
- 62.5	514					
	- 513					
65.0	- 512	4				

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OGGE	D: 04/04/2022	PROJECT NUMBER: 30107326         Arcadis - SB and         Geophysics         Dakota - HPT         HPT Flow Max         HPT Estimated Hydraulic         HPT Rate of Penetration         HPT Electrical Conductive	<ul> <li>Soil Description</li> <li>Sample Photo</li> <li>HPT Pressure</li> <li>HPT Flow Max</li> <li>HPT Estimated Hydraulic Conductivity</li> <li>HPT Rate of Penetration</li> <li>HPT Electrical Conductivity (EC)</li> <li>Electrical Resistivity Imaging (ERI)</li> </ul>					
G COOF CTION: CE ELE FION D/	RDINATES:       X 322461.27         Y 4672614.29         :       Universal Transverse Mercator (UTM)         EVATION:       576.1 ft amsl         ATUM:       World Geodetic System 1984	HPT TOTAL DEPTH: 45.1 ft bgs SB TOTAL DEPTH: 46.0 ft bgs See Appendix A for more REMARKS: detailed soil description	ging (ERI) C)					
Elevation (ft amsl)	Abbreviated Soil Description	HPT EC     Corr. HPT Press.     HPT Flow Max     Est. K       0     mS/m     2500     0     psi     100     0     mL/min     500     0     ft/day     100       0     mS/m     2500     0     Image: state	ROP 0 mm/sec 50					
576 575 574 573 572 571 570 569 568	(0.0-1.4 ft) CL: CLAY, np; and GRAVEL; little sand, vf-vc (1.4-1.9 ft) CL: CLAY, mp; and GRAVEL; little silt (1.9-9.2 ft) ML: SILT, np; little sand, vf-med NOTE: DBO, hard and soft							
567 566 565 564	(9.2-12.0 ft) CL: CLAY, lp; some silt (12.0-20.2 ft) CL: CLAY, mp; little silt		And a start					
563 562 561 560 559 558 557 556								
	COO CINAL COO CINAL CON CINAL	a       COORDINATES: X 322461.27 Y 4672614.29         CTION: Universal Transverse Mercator (UTM) <b>E ELEVATION:</b> 576.1 ft amsl         ION DATUM: World Geodetic System 1984         (gue         Abbreviated Soil Description         (gue         (14.1:9 ft) CL: CLAY, np: and GRAVEL; little sand, vFvc         (14.1:9 ft) CL: CLAY, np: and GRAVEL; little         (14.1:9 ft) CL: CLAY, np: and GRAVEL; little         (1992 ft) ML: SILT, np: little sand, vf-med         NOTE: DBO, hard and soft         (12.0-20.2 ft) CL: CLAY, mp; little sailt         (12.0-20.2 ft) CL: CLAY, mp; little silt         (12.0-20.2 ft) CL: CLAY, mp; little silt         (12.0-20.2 ft) SC: SAND, vf-f; and CLAY, mp	Image: Strate of the strat					



- 540		3
		W
- 40.0 - 536 -		
- 45.0 - 531 -		

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BORIN PROJE DATE BORIN PROJE SURFA	IG NAME ECT NAM LOGGEE IG COOF ECTION: ACE ELE	E: W4 IE: BASF Point Hennepin D: 03/24/2022 RDINATES: X 322532.36 Y 4672795.34 Universal Transverse Mercator (U VATION: 576.4 ft amsl ATUM: World Geodetic System 198-	TM) 4	CLIENT: E PROJECT N LOGGED B HPT TOTAL SB TOTAL N REMARKS:	ASF NUME Y: C DEPT See / detail	BER: 3010732 Arcadis - SB and Beophysics Dakota - HPT TH: 59.7 ft b TH: 58.0 ft b Appendix A for more ed soil description	26 ogs ogs	L Soi Sai HP HP HP HP Ele Ele	ogg I Des mple T Pro T Flo T Els Ctrica	ting Met scription Photo essure ow Max timated H te of Pene ectrical Co al Resistiv al Conduc	hods ydraulic etration inductiv ity Imaç tivity (E	: Conductivit ity (EC) ging (ERI) C)	ý
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC mS/m 2500 ERI EC mS/m 2500	0	Corr. HPT Press. psi 100	HPT 0 r	Flow Max		Est. K ) ft/day	100	ROP 0 mm/sec	; 50
- 2.5 -	- 576 - - 575 - - 575 - - 574 - - 573 - - 573 - - 572 -	(0.0-1.0 ft) SW/GW: SAND, vf-vc; and GRAVEL; little silt (1.0-2.2 ft) CH/SC: CLAY, mp-hp; and SAND (2.2-7.2 ft) SP: SAND, vf-f NOTE: DBO						- And				- And	
- 5.0 -	- 571 - - 571 - - 570 - - 569 - - 568 -	(7.2-8.0 ft) CL/ML: CLAY; and SILT (8.0-13.8 ft) CH: CLAY, mp-hp							_			- And Mar	>
- 10.0 -	- 567 - - 566 - - 566 - - 565 -								_				<u> </u>
- 12.5 -	- 564 -  - 563 -  - 562 -	(13.8-16.8 ft) CH: CLAY, mp-hp; little silt											
- 15.0 -	- 561 - - 560 - - 560 - 	(16.8-18.0 ft) CL/SC: CLAY, lp; some sand,											
- 20.0 -	- 558 - - 557 - - 557 - - 556 -  - 555 -	(18.0-58.0 ft) CH: CLAY, mp-hp NOTE: Poor Recovery and Sulfur Odor at 56-58 ft											





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BORIN PROJI DATE	IG NAME ECT NAM LOGGEE	E: W 1E: E D: (	5 BASF Point Hennepin 04/04/2022			CLI PR LO	IENT OJE( GGE	: BA CTN DBY	ASF UMBE Arca ': Gec Dak	R: 3 adis - SI ophysics ota - HF	010732 B and	26	оо́о́о́нннн 1	Loc oil D amp PT F PT F PT F PT F	escrip le Pho Pressi Flow N Estima Rate c	<b>Meth</b> otion oto ure Max ated Hyd f Penet	ods draulic ration ductiv	: Conductivity	,
BORIN	IG COOF	RDIN	X 322561.98 ATES: Y 4672888.34	UTM) <b>SB TOTAL DEPTH:</b> 40.8 ft bgs SB TOTAL DEPTH: 32.0 ft bgs See Appendix A for more REMARKS: detailed soil description										ectr ectr	ical R ical C	esistivit onductiv	y Imaę /itv (E	ging (ERI)	
PROJE	ECTION:	Uı	niversal Transverse Mercator (L	JTM)	SB TOTAL DEPTH: 32.0 ft bgs See Appendix A for more											onduou	, (=		
SURF		νδτι	<b>ON:</b> 573.9 ft amsl	·		RF	MAR	ĸs∙	See App detailed	endix A soil des	for more	•							
ELEVA			1: World Geodetic System 19	84							·								
Denth				S		HP	T EC		0							<b>5</b>		DOD	
1ft:50ft	ft amsl		Abbreviated Soil Description	Photo	0	Corr. HPT Press.							I FIOW Max			EST. K		ROP	
11.501	ation (			ample		ER	I EC		0	psi	100	0 r	mL/min	500	0	ft/day	100	0 mm/sec	50
	Elev				0	m	S/m	2500											
-0.0			(0.0-2.6 ft) CL/GC: CLAY, np; and GRAVEL; little silt; little sand, vf-vc															N I	
				a la la									}						
- 2.5 -	- 571 -	0000	(2.6-2.9 ft) GM: SILT, np; and GRAVEL							_							>	X	
	- 570 -		NOTE: Possibly DBO	1	Į.				$\sim$				A A		A			2	
- 5.0 -	- 569 -		(3.0-4.7 ft) ML/SM: SILT, np; some sand,									-	<u>}</u>				_	5	
	- 568 -		(4.7-8.0 ft) ML/SM: SILT, np; some sand,						5				Ž						
- 75 -	- 567 -								$\sim$	~			X		2			<pre></pre>	
1.0	- 566 -		(8.0-14.1 ft) ML: SILT, np	-	N <sub>2</sub>				5				A A					5	
	- 565 -		NOTE: DBO	A. A.															
- 10.0 -	- 564 -			1.2.5		R			+				}				_		_
	- 563 -																	3	
- 12.5 -	- 562 -																		
	- 561 -												E E						
	- 560 -		(14.1-18.0 ft) ML/CL: SILT, np-lp; and clay	No.			N						ł						
- 15.0 -	- 559 - 			the t								-	Ļ		4				
	- 558 - 												~		Ę			$\langle$	
- 17.5 -	- 557 - 												{						
	- 556 - 		(18.0-28.7 ft) CH: CLAY, mp-hp										ł		5			5	
20.0	- 555 -  - 551								3						3			$\left \right\rangle$	
20.0	- 554 - 														5			5	
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27.5	- 538 - - 537 -									
- 37.5	- 536 - - 535 -				L Z			}		~
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40.5	- 532 -	l								

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BORING NAME: W6 PROJECT NAME: BASF Point Hennepin DATE LOGGED: 04/04/2022 BORING COORDINATES: X 322585.04 Y 4672961.39 PROJECTION: Universal Transverse Mercator (UTM) SURFACE ELEVATION: 574.0 ft amsl	<text><text><text><text><text></text></text></text></text></text>	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration         ✓       HPT Electrical Conductivity (EC)         ✓       Electrical Resistivity Imaging (ERI)         Electrical Conductivity (EC)
ELEVATION DATUM: World Geodetic System 1984		
Depth     (î)       1ft:50ft     (i)       Heroarding     Abbreviated Soil Description	HPT EC     Corr. HPT Press.     HPT       mS/m     2500     0     n       ERI EC     0     psi     100     0     n       mS/m     2500     0     n     100     0     n	r Flow Max Est. K ROP nL/min 500 0 ft/day 100 0 mm/sec 50
- 2.5 - 577 - (0.0-1.9 ft) CL/GC: CLAY, np; and GRAVEL; ititle said, vf-vc - 572 - (1.9-2.8 ft) ML/SM: SILT, np; some sand, vf-vc; ititle granules-large pebbles (2.8-5.2 ft) ML/SM: SILT, np; and SAND		
- 5.0 - 569 - (5.2-6.8 ft) ML: SILT, np - 568 - NOTE: DBO - 7.5 - 567 - (5.2-6.8 ft) SM: SAND, vf-c; little silt		
- 10.0 - 564		



- 538 -  - 537 -									
- 536 -				{		{			

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BORIN PROJE DATE	IG NAMI ECT NAM LOGGEI	E: W7 IE: BASF Point Hennepin D: 04/04/2022		CLIE PRC LOG	ENT: DJEC BGEI	BA CT N D BY	ASF UMBER: Arcadis - Geophysi Dakota -	3010732 SB and cs -1PT	26	Loc ✓ Soil D ✓ Samp ✓ HPT I ✓ HPT I ✓ HPT I	Pescription le Photo Pressure Flow Max Estimated H Rate of Pen	hods lydraulic etration	c Condu	ctivity	/
BORIN PROJE SURFA ELEVA	IG COOF ECTION: ACE ELE	X 322612.09 Y 4673046.90Universal Transverse Mercator (UTM)VATION:575.9 ft amslATUM:World Geodetic System 1984		HPT SB 1 REM		TAL D	DEPTH: EPTH: See Appendix detailed soil d	45.0 ft b 28.0 ft b A for more escription	ogs ogs	<ul> <li>✓ HPT I</li> <li>✓ Electr</li> <li>Electr</li> </ul>	Electrical Co ical Resistiv	nductiv vity Imag tivity (E	/ity (EC) ging (ER ⋮C)	(I) 	
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description Source S	0	HPT mS/ ERI I mS/	EC /m 2 EC /m 2	2500	Corr. HPT	Press. 100	0 n	Flow Max	Est. K O ft/day	, 100	0 n	ROP nm/sec	50
- 0.0 -	- 576 - 575	(0.0-1.0 ft) CL/GC: CLAY, np; and GRAVEL; some sand, vf-med; little gravel, granules-large pebbles													
- 2.5 -	- 574 - 573	(1.0-1.6 ft) SW: SAND, vf-c; some gravel, granules-med pebbles; little silt (1.6-3.8 ft) SW/SM: SAND, vf-c; and silt, np;			4				_	}		<u> </u>			
	- 572	(3.8-10.5 ft) ML: SILT, np								A A A A A A A A A A A A A A A A A A A		-	$\left  \right\rangle$		
- 5.0 -	- 571	NOTE: DBO			+		E		_	<u>}</u>				$\vdash$	
-	- 570			2			- And			-	A		W	3	
- 7.5 -	- 568					$\mathbf{L}$	<u> </u>							$\left  \right $	-
	- 567												}		
- 10.0 -	- 566	1     <b> </b>					$ \downarrow                                   $							$\square$	
	- 565	(10.5-10.7 ft) ML/GM: SILT, np; and GRAVEL, granules-large pebbles; little clay								2			3		
	- 564	(10.7-15.2 ft) CH/CL: CLAY; some silt, mp-hp											4		
- 12.5 -	- 563										5				
	- 562									{					
- 15.0 -	- 561	(15.2-28.0 #) CH: CLAV bp												$\vdash$	
	- 560	(13.2-20.0 t) CH. CLAT, II)											}		
- 17.5 -	- 559				_									$\square$	
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BORIN PROJI DATE	NG NAME ECT NAN LOGGEE	E: W8 IE: BASF Point Hennepin D: 03/25/2022		CLIEN PROJE LOGG	T: BAS ECT NUI ED BY:	F MBER: 30 Arcadis - SB Geophysics Dakota - HP	1 <b>107326</b> and T	<ul> <li>Soil Description</li> <li>Sample Photo</li> <li>HPT Pressure</li> <li>HPT Flow Max</li> <li>HPT Estimated Hydraulic Conductivity</li> <li>HPT Rate of Penetration</li> <li>HPT Electrical Conductivity (EC)</li> </ul>							
BORIN PROJE SURFA ELEVA	IG COOF ECTION: ACE ELE	X 322696.49 Y 4673278.09Universal Transverse Mercator (VATION:589.3 ft amslATUM:World Geodetic System 19	UTM) 984	HPT TO SB TO REMA	DTAL DE TAL DEI RKS: de	EPTH: 62 PTH: 64 Bee Appendix A to stailed soil desc	2.8 ft bgs 4.0 ft bgs for more rription	Electr	ical Resistivity	/ Imaç	jing (EC) C)				
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	HPT EC 0 mS/m ERI EC 0 mS/m	25000 2500	Corr. HPT Pre	255. 100 0	HPT Flow Max mL/min 500	Est. K 0 ft/day	100	ROP 0 mm/sec	50			
- 2.5 - - 5.0 - - 7.5 - - 10.0 - - 12.5 - - 15.0 - - 17.5 - - 20.0 -		(0.0-2.0 ft) SW: SAND, vf-f; some gravel, granules to med. pebbles (2.0-3.3 ft) ML: SILT, np; some gravel, granules to med. pebbles; little sand, vf-f (3.3-3.6 ft) ML: SILT, np; some sand, vf-f NOTE: Likely start of the DBO (3.6-23.2 ft) ML: SILT, np NOTE: DBO									MMM				



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- 62.5	- 526 -				
	- 525 -				
65.0					

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BORING NAME: W9 PROJECT NAME: BASF Point Hennepin DATE LOGGED: 03/30/2022 BORING COORDINATES: X 322744.59 Y 4673506.84 PROJECTION: Universal Transverse Mercator (UTM) SURFACE ELEVATION: 582.1 ft amsl ELEVATION DATUM: World Geodetic System 1984					CLIENT: BASF PROJECT NUMBER: 30107326 Arcadis - SB and Geophysics Dakota - HPT HPT TOTAL DEPTH: 14.3 ft bgs SB TOTAL DEPTH: NA REMARKS:							Logging Methods         Soil Description         Sample Photo         ✓         HPT Pressure         ✓         HPT Flow Max         ✓         HPT Rate of Penetration         ✓         HPT Electrical Conductivity (EC)         ✓         Electrical Resistivity Imaging (ERI)         Electrical Conductivity (EC)						
Depth (ft amsl) Elevation (ft amsl)	Abbreviated Soil Description	Sample Photos	0	HPT EC mS/m ERI EC mS/m	2500	0	Corr.	HPT Press. psi 100	ні 0	PT Flow Max mL/min 500	0	Est. K ft/day	100	0 mm/	)P 'sec 50			
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BORIN PROJ DATE	NG NAME ECT NAN LOGGEI	E: W10 IE: BASF Point Hennepin D: 03/25/2022	CLIENT: BASF PROJECT NUMBER: 30107326 LOGGED BY: Arcadis - SB and Geophysics Dakota - HPT	Logging Methods         ✓       Soil Description         ✓       Sample Photo         ✓       HPT Pressure         ✓       HPT Flow Max         ✓       HPT Estimated Hydraulic Conductivity         ✓       HPT Rate of Penetration         ✓       HPT Electrical Conductivity (EC)						
BORIN PROJI SURFA ELEVA	NG COOF ECTION: ACE ELE ATION D/	X 322840.99 Y 4673919.77Universal Transverse Mercator (UTM)VATION:583.3 ft amslATUM:World Geodetic System 1984	HPT TOTAL DEPTH: 55.2 ft bgs SB TOTAL DEPTH: 56.0 ft bgs See Appendix A for more REMARKS: detailed soil description							
Depth 1ft:50ft	Elevation (ft amsl)	Abbreviated Soil Description	HPT EC     Corr. HPT Press.     HPT       mS/m     2500     0     psi     100     0     r       ERI EC     MS/m     2500     0     r     0     r	T Flow Max Est. K ROP mL/min 500 0 ft/day 100 0 mm/sec 50						
- 2.5 -	- 583 - - 582 - - 581 - - 581 - - 580 - - 579 -	(0.0-2.4 ft) SW: SAND, vf-f; some silt; little gravel (2.4-4.5 ft) ML: SILT, np; some sand, vf-med; little granules to large pebbles NOTE: DBO (4.5-15.7 ft) ML: SILT, np								
- 7.5 -	- 578 - - 577 - - 576 - - 575 - - 575 - - 574 -	NOTE: DBO								
- 12.5 - - 15.0 -	- 572 - - 572 - - 571 - - 570 - - 569 - - 568 -									
- 17.5 - - 20.0 -	- 567 - - 566 - - 566 - - 565 - - 564 - - 563 -  	(15.7-18.0 ft) ML: SILT, np; some clay NOTE: Peat and Organics (18.0-19.7 ft) CL: CLAY, mp; some silt NOTE: Peat and Organics (19.7-23.6 ft) CH: CLAY, hp								





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BORIN PROJE DATE I BORIN	IG NAME ECT NAM LOGGED	: W11 E: BASF Point Hennepin : 03/30/2022 MATES: X 322893.15 Y 4674101.92		CLIENT: BASF       Logging Methods         PROJECT NUMBER: 30107326       Soil Description         Arcadis - SB and       Sample Photo         LOGGED BY:       Geophysics         Dakota - HPT       HPT Flow Max         HPT TOTAL DEPTH:       39.8 ft bgs	Logging Methods         Soil Description         Sample Photo         ✓         HPT Pressure         ✓         HPT Flow Max         ✓         HPT Estimated Hydraulic Conductivity         ✓         HPT Rate of Penetration         ✓         HPT Electrical Conductivity (EC)         ✓         Electrical Resistivity Imaging (ERI)         Electrical Conductivity (EC)						
<b>PROJECTION:</b> Universal Transverse Mercator (UTM)				SB TOTAL DEPTH: NA							
SURFACE ELEVATION: 580.9 ft amsl ELEVATION DATUM: World Geodetic System 1984				REMARKS:							
Denth	(1		S	HPT EC							
1ft:50ft	ion (ft ams	Abbreviated Soil Description	nple Photo	0         mS/m         2500         0         psi         100         0         mL/min         500         0         ft/day         100         0         mm/sec	50						
	Elevati		San	0 mS/m 2500							
- 2.5 -	- 580 - - 580 - - 579 - - 578 - - 578 - 	No boring log installed at this location for soil description.									
- 5.0 -	- 576 -  575 -  - 574 -										
- 7.5 -	- 573 -  - 572 -										
- 10.0 -	- 571 -  - 570 - 										
- 12.5 -	- 569 -  - 568 -  - 567 -										
- 15.0 -	- 566 - - 565 - - 565 -										
- 17.5 -	- 564 - 563 - 										
- 20.0 -	- 262 - - 561 - - 560 - - 559 -										



- 37.5	- 545 -  - 544 -  - 543 -  				_				
- 40.0	- 541 - - 540 - - 539 -	No boring log installed at this location for soil description.							

Arcadis of Michigan, LLC 28550 Cabot Drive, Suite 500 Novi Michigan 48377 Phone: 248 994 2240 Fax: www.arcadis.com