Groundwater Monitoring Network System Certification

for Compliance with the Coal Combustion Residuals (CCR) Rule

Erickson Power Station

Lansing Board of Water & Light

November 5, 2021

Revised June 18, 2024

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Table of Abbreviations and Acronyms

Abbreviation	Definition
AMSL	above mean sea level
BGS	below ground surface
BTV	background threshold values
BWL	Board of Water & Light
CCR	Coal Combustion Residuals
COI	constituent of interest
CWP	Clear Water Pond
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EPA	U.S. Environmental Protection Agency
Erickson	Erickson Power Station
TDS	total dissolved solids
TOC	top of casing
TSS	total suspended solids

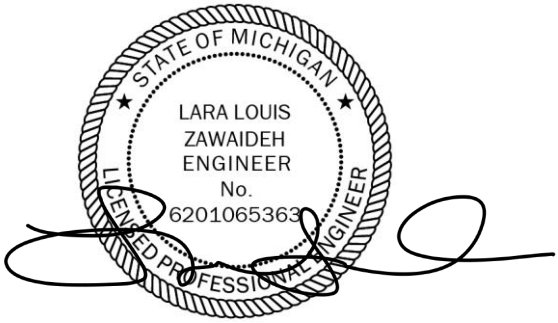
Certification

Groundwater Monitoring System for Compliance with the Coal Combustion Residuals Rule

Lansing Board of Water & Light

Erickson Power Station, Delta Township, Michigan

I hereby certify that the groundwater monitoring system at Erickson Station is designed to meet the performance standard in Sections §257.91 of the Federal Coal Combustion Residuals Rule, and that the groundwater monitoring system has been designed and constructed to ensure that the groundwater monitoring will meet this performance standard for the CCR units located at Erickson Power Station.



Lara Louis Zawaideh, PE ENV SP

Michigan PE License: 6201065363

License Renewal Date: 02/03/2026

Zawaideh, Lara L

Digitally signed by Zawaideh, Lara L
Date: 2024.06.19 10:53:56 -04'00'

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA) final Coal Combustion Residuals (CCR) Rule establishes a comprehensive set of requirements for the management and disposal of CCR (or coal ash) in landfills and surface impoundments by electric utilities. Erickson Power Station ("Erickson" or "Site"), located at 3725 South Canal Road in Delta Township, Eaton County, Michigan is owned and operated by the Lansing Board of Water & Light (BWL) (**Figure 1**). Erickson has three CCR units subject to the CCR Rule: the Forebay, Retention Basin, and Clear Water Pond (CWP).

This document supports compliance with the CCR Rule by demonstrating that the groundwater monitoring system at Erickson Station meets the requirements outlined in Section §257.91 of the Rule, which states:

- Section §257.91(f): *'The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet requirements of this section* [§257.91]. *If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section* [Section § 257.91], *the certification must document the basis supporting this determination*.'

Table 1 summarizes components required by groundwater monitoring systems, per the CCR Rule and the professional engineer's certification of compliance with these requirements. The remainder of this document provides information to support certification for the multiunit groundwater monitoring system at the Erickson Power Station.

Table 1. Summary of 40 CFR Section §257.91 Groundwater Monitoring System Requirements and Site-Specific Compliance

Groundwater Monitoring System Requirements	Compliance with Requirement
(a) *Performance standard.* The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that: (1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where: (i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or (ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and (2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.	**Yes.** A groundwater monitoring system has been established that includes the minimum number of wells at appropriate locations and depths to yield the uppermost groundwater samples surrounding each CCR facility. The uppermost aquifer is in the glacial till strata. See Sections 3.0 and 4.0. The background wells for the facility are MW-1, MW-4, MW-11, and MW-12. The downgradient wells are MW-2, MW-3, MW-5, MW-6, and MW-14.
(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of: (1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and (2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities, and effective porosities.	**Yes.** The monitoring system was designed based on results of technical, site-specific data, including (b)(1) and (b)(2). See Sections 3.0 and 4.0, which describe the hydrogeologic parameters of the Site. In addition, cross sections in Appendix A display the lithologies, stratigraphy, and overlying and underlying geologic units.
(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain: (1) A minimum of one upgradient and three downgradient monitoring wells; and (2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.	**Yes.** Monitoring wells that meet the performance standards are located at the CCR units. The background wells for the facility are MW-1, MW-4, MW-11, and MW-12. The downgradient wells are MW-2, MW-3, MW-5, MW-6, and MW-14. There are ae additional wells for nature and extent. See Section 4.0.

Table 1. Summary of 40 CFR Section §257.91 Groundwater Monitoring System Requirements and Site-Specific Compliance

Groundwater Monitoring System Requirements	Compliance with Requirement
(d) The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit. (1) The multiunit groundwater monitoring system must be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system specified in paragraphs (a) through (c) of this section for each CCR unit based on the following factors:(i) Number, spacing, and orientation of each CCR unit; (ii) Hydrogeologic setting; (iii) Site history; and (iv) Engineering design of the CCR unit. (2) If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by §257.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under §257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under §257.101(a) to retrofit or close.	**Yes.** A multiunit system capable of detecting monitored constituents per (d)(1) was installed for the three active CCR units. See Sections 2.0 and 4.0. There are unlined active CCR units included in the multiunit system, requirements per (d)(2) do apply.
(e) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (*i.e.,* the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater. (1) The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section. (2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring program.	**Yes.** Well design meets requirements (e). Well logs are provided in Appendix B. See Section 4.0. The design, installation, and development of monitoring wells is documented I the Well Installation Report. Groundwater monitoring devices, including pumps and field instruments, are operated and maintained according to manufacturer's recommendations and the monitoring system will be maintained per (e)(2).
(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.	**Yes.** System designed and constructed to meet the requirements of Section §257.91. Technical information to support certification and number of wells, per (c)(1). See Sections 2.0, 3.0 and 4.0. The PE certification of this GMS Cert satisfies paragraph (f).

Figure 1. Vicinity Map for Erickson Power Station

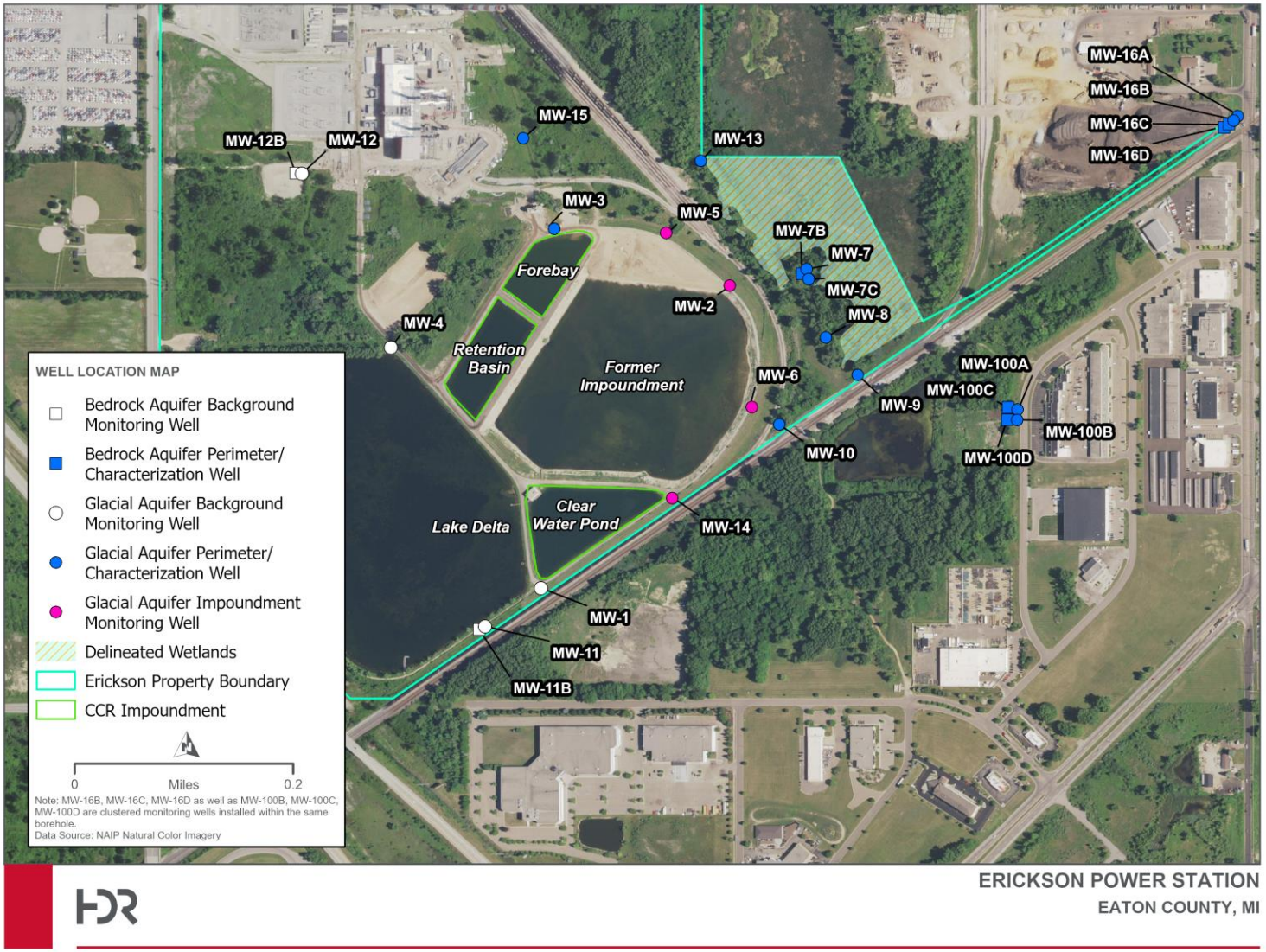


Figure 2. Erickson Power Station – CCR Units and Monitoring Well Location Map

2.0 Facility Description

Erickson Power Station (Erickson or Site) was an electrical power generation facility located at 3725 South Canal Road in Delta Township, Eaton County, Michigan, owned and operated by the Lansing Board of Water & Light (BWL) (Figure 1).

Erickson Power Station was constructed starting in 1970, was completed in 1973, and was closed in 2022 as part of the BWL's move to cleaner energy sources. Erickson Power Station contained a single coal-fired steam turbine/generator capable of producing 165 megawatts of electricity. During active operations (after removal of the previous impoundment ash management system) in 2014 and prior to closure, CCR materials (bottom ash and fly ash) generated at Erickson Power Station were managed separately. Fly ash CCR was handled dry and diverted to an enclosed structure called Millet Ash Facility. Bottom ash CCR from Erickson Power Station was handled wet and sluiced from the plant to dewatering tanks (hydro-bins). After the majority of the CCR was removed from the waste stream at the hydro-bins, the dewatered bottom ash was trucked to an off-site sanitary landfill and the decant water was hydraulically fed through the current impoundment system, which consists of a series of three surface water impoundments in sequence: the Forebay, Retention Basin, and Clear Water Pond. While it was believed that the hydro-bins took care of the CCR disposal, in 2019 BWL determined a small amount of CCR may be discharging to the Forebay. Therefore, there are three units currently subject to the CCR Rule: the Forebay, Retention Basin, and CWP. This system was used at Erickson until the plant ceased operations November 27, 2022.

Historically, CCR management at Erickson Station was handled under a different system. After startup in 1973, fly ash and bottom ash were discharged into a 33-acre acre impoundment system (physically closed in 2014 and renamed the Former Impoundment). From Impoundment the water then flowed hydraulically to the Clear Water Pond. Water from the Clear Water Pond was recycled back to the plant via the Pump House for reuse. In 1979, approximately 30% of the fly ash was diverted from this system and handled dry within the enclosed structure known as the Michigan Ash Facility (subsequently renamed as Millet Ash Facility). The hydro-bins were installed on site and used for active operation starting in 2001 and CCR sluiced from the boiler was diverted to the hydro-bins for dewatering. Similar to operations prior to closure, decanted ash was trucked to an offsite landfill and decant water was sent to the Impoundment. Erickson Power Station switched from eastern coal to western coal in 2004. The hydrobins were designed for eastern coal bottom ash and as a result, the western coal bottom ash sluiced from the boilers was not properly processed as designed and the hydro-bins were taken offline. Additionally, as a result from the swap to western coal at Erickson in 2004, the waste streams for bottom and fly ash generated were separated fully, with 100% of the fly ash generated being handled under a dry system diverted into the enclosed Millet Ash Facility. During this time, bottom ash at Erickson bypassed the hydro-bins, flowing directly to the Impoundment. From 2009 through 2014, the ash was removed from the 33-acre impoundment, and the new system (described previously) encompassing less than 5 acres of the original impoundment (including the construction of the Forebay and Retention Basin) was installed within the footprint of the impoundment. To support the closure of the Impoundment, the hydro-bins were retrofitted to

capture western coal and returned to service between 2010 to 2012. After the closure of the Impoundment system in 2014, the 28-acre area was renamed Former Impoundment and CCR generated at Erickson was managed as described in the previous paragraph.

Erickson Power Station ceased coal-fired power generation operations on November 27, 2022. The plant pipelines were washed down and CCR waste disposal ceased to the CCR impoundments on December 29, 2022. The non-CCR stormwater flows to the impoundments ceased January 3, 2023. A CCR removal contractor was selected and mobilized to the site in February 2023 to begin dewatering operations for the three impoundments. The water removed from the surface impoundments was treated onsite, monitored, and discharged into nearby Lake Delta in compliance with a NPDES permit. Ash and liner material was removed and transported offsite to Granger Wood Street Landfill from all three impoundments. Ash removal verification efforts for the Forebay, Retention Basin, and CWP are expected to be completed by the end of 2024.

2.1 CCR Forebay

During active operations, the decant water from the hydro-bins hydraulically fed through the impoundment system, beginning with the Forebay. Additionally, the plant sump and coal pile stormwater retention pond were pumped to the Forebay as needed. The Forebay and Retention Basin were constructed in 2014 and encompass less than 5 acres between them. The interior embankments and floor of the Forebay was lined with a layer of compacted clay overlain with a 40-millimeter-thick flexible polyvinylchloride membrane liner (FML). The FML was protected with geofabric and a 6- to 12-inch layer of sand. The tops of the embankments that are subject to wave action are protected with an additional layer of geofabric and 6 to 12 inches of stone riprap. The base grade elevation of the Forebay is 871.5 feet above mean sea level (ft. AMSL).

2.2 CCR Retention Basin

The Retention Basin is adjacent to and received flow from the Forebay. The Retention Basin was constructed similar to the Forebay, with the interior embankments and floor lined with a layer of compacted clay overlain with a 40-millimeter-thick FML. The FML was protected with geofabric and a 6- to 12-inch layer of sand. The tops of the embankments that are subject to wave action were protected with an additional layer of geofabric and 6 to 12 inches of stone riprap. The base grade elevation of the Retention Basin was 871.5 ft. AMSL. Flow in the Retention Basin discharged primarily to the CWP, and to the Former Impoundment when Retention Basin water levels exceeded the Former Impoundment culvert invert. The former impoundment is mentioned because it is part of the multiunit groundwater monitoring system described in Section 4.0 below.

2.3 CCR Clear Water Pond

The CWP was constructed in 1970 and is located south-southeast of the Forebay and Retention Basin and is directly south of the Former Impoundment. During active operations, water in the CWP was pumped back to the plant for reuse. The CWP was lined with compacted clay. The base grades of the CWP range from 871 to 874 ft. AMSL. The tops of the interior embankments of the CWP were protected with approximately 6 inches of stone riprap.

2.4 Former Impoundment (Non-CCR)

The former impoundment was constructed in 1970 and was lined with compacted clay. The current base grade of the Former Impoundment is estimated to be 871 ft. AMSL. Historically, it was used to store fly ash and bottom ash from the plant, however between 1979 and 2004, approximately 30% of the fly ash was diverted from the pond due to equipment and shipping issues. In 2004, BWL switched from eastern to western coal and due to changes in the ash composition, all fly ash was handled under a dry system after this date. From 2009 through 2014, the ash was removed from the impoundment and was physically closed in 2014. Therefore, the Former Impoundment is not subject to the CCR Rule. The Forebay and Retention Basin were constructed in the footprint of the Former Impoundment, and the remainder of the Former Impoundment remains a depression that collects stormwater that falls directly within its footprint.

3.0 Site Geology/Hydrogeology

Prior hydrogeologic and geotechnical investigations have been conducted at and near Erickson, as documented in the following reports and summarized in the text below.

- Monitoring Well Installation Report (HDR, 2023)
- Hydrogeologic Characterization Report (HDR, 2019)
- Geotechnical borings described in the Locations Restrictions - Compliance with 40 CFR 257 (MD&E, 2018)
- Test pits and geotechnical borings from Dames & Moore (1969) that were provided in MD&E (2018)
- Geotechnical borings completed north of the impoundments and south of the plant described in SME (2018)
- Summary of Hydrogeologic Conditions by County for the State of Michigan (Apple and Reeves, 2007)
- Water-supply development and management alternatives for Clinton, Eaton, and Ingham County, Michigan (Vanlier, Wood, and Brunett, 1973)

Each of these studies investigated the geology, geotechnical characteristics, and hydrogeology of Erickson or nearby areas.

3.1 Literature

The Tri-County region, where Erickson is located, is underlain by unconsolidated clay, silt, sand, and gravel of glacial origin that rest upon about 10,000 feet of consolidated bedrock sediments deposited in ancient seas. The glacial deposits are at the ground surface and range in thickness from 0 to over 300 feet (Apple and Reeves, 2007). The consolidated bedrock below glacial deposits are composed of limestone, shale, siltstone, sandstone, salt, and gypsum. Two previously existing wells drilled on the Erickson property, one to 380 and one to 420 feet below surface were examined. In well boring logs, the top 36 to 79 feet of subsurface was logged as clay and gravely clay, representing the glacial deposits, overlying sandstone, and shale bedrock down to 420 feet below grade, representing the Saginaw Formation.

The principal aquifers in northeastern Eaton County, where Erickson is located, are in the glacial deposits and the Saginaw Formation bedrock below the glacial deposits (Vanlier and others, 1969). Approximately 18 percent of the wells in Eaton County are completed in the glacial deposits, and 69 percent in the bedrock units (Apple and Reeves, 2007). Groundwater flow in the glacial deposits is generally from south to north, away from topographic divides and towards surface water bodies (Holtschlag and others, 1996). Most groundwater flow in the bedrock Saginaw aquifer is from south to north, although a small amount is toward local pumping centers (Holtschlag and others, 1996). These flow directions are consistent with the topography and surface water flow direction of the Grand River watershed.

The estimated transmissivity for glacial aquifer wells in Eaton County ranges from approximately 615 to 127,000 feet squared per day (ft^2/d) (Apple and Reeves, 2007). Holtschlag and others (1996) performed spatial correlations to compute hydraulic conductivity estimates of the glacial deposits indicating initial estimates of horizontal hydraulic conductivity range from 7.06 to 27.5 ft/d. Horizontal hydraulic conductivity is highest in the west-central part of the Tri-state area and lowest in the northern and southern parts of the Tri-county area.

Wells in the Wellogic database within a two-mile radius of Erickson all have geologic logs very similar to those on the property, indicating glacial deposits (clay, sand, and gravel) from 30 to 100 feet below grade overlying shale and sandstone bedrock (HDR 2019). Wells vary in depth between 85 and 460 feet. Of the 160 wells in the vicinity of Erickson, only nine are completed in the glacial aquifer (HDR 2019, and 2023). The remainder of wells are screened in the shale and sandstone of the Saginaw aquifer. Static water levels recorded in the State Wellogic database indicate water level between 7 feet below grade near the Grand River to 70 feet below grade; however, these water levels are only for wells screened in the Saginaw aquifer and may be snapshots immediately after drilling that are not representative of static conditions. The wells completed in the glacial aquifer do not provide static depths in the State Wellogic database. HDR collected sonic water level readings from four private wells west of the site that are completed in the bedrock aquifer (HDR, 2023).

3.2 Site Investigation, Conceptual Site Model

Geotechnical test pits, excavations, and geotechnical and well borings drilled at Erickson reveal shallow subsurface lithology is composed of glacial deposits, sandy clay, silt, clayey sand, sand, and sand with gravel to a depth of 36 to 61 feet below ground surface (HDR 2019). The glacial deposits lie above the sandstone and shale bedrock of the Saginaw Formation. The surface of the bedrock is dipping to the southeast with a general strike in the southwest to northeast orientation. Discontinuous, thin, naturally occurring coal seams were observed in the near vicinity of borings MW-11B, MW-12B, MW-16B, MW-16C, MW-16-D, 100B, 100C, and 100D.

The depth of the uppermost aquifer under the impoundments was determined to be approximately 11 to 17 feet below surface. The groundwater flow direction was determined to be east directly under the impoundments, as depicted in **Figure 5** and then turns north following the wetland and topography. The saturated thickness of the unconfined groundwater unit above the consolidated bedrock in wells ranges from approximately 25 to 80 feet. This variability is

primarily associated with the southeastern dip of the sandstone and shale surface, which is depicted in the cross-section drawings in Appendix A.

Groundwater potentiometric contours of the surficial glacial aquifer, created for conditions observed in June 2023, are consistent with the eastern groundwater flow direction underneath the impoundments. Data collected from the MW-16 well series indicate that groundwater further east of Erickson flows west, back towards the BWL property, indicating the groundwater flow direction under the wetlands on the east side of Erickson is to the north, consistent with the Carrier Creek Subwatershed boundary and topographic contours as shown in **Figure 5**. Groundwater contours for the bedrock aquifer (Saginaw Formation) are shown in **Figure 6** and illustrate that the flow direction in the bedrock aquifer underneath the impoundments is east**.** Based on the higher bedrock groundwater elevation at MW-16C, the groundwater in the bedrock also follows that of the glacial aquifer and turns north under the wetland.

Hydraulic conductivity of the overburden glacial sediments ranges from 1.2×10^{-3} cm/s to 2.6×10^{-5} cm/s based on laboratory testing on undisturbed samples collected during the 2023 well installations. Slug tests performed during each of the 2021, 2022, and 2023 monitoring well installations indicated a geometric mean hydraulic conductivity of 1.3×10^{-3} cm/s for the site (HDR, 2023). Using Darcy's equation, the geometric mean screened interval permeability determined by on-site slug tests, a gradient of 0.0030, and a porosity of 15 percent, the geometric mean groundwater travel velocity of the glacial aquifer is 0.11 feet per day or 39.2 feet per year. With this estimate of velocity, it would take on the order of 41 years for groundwater under the impoundments to travel to the wetland on the east side the eastern property boundary.

Water levels in the co-located glacial and bedrock wells were compared. Bedrock well MW-7B has historically had a slightly higher water level than glacial paired well MW-7, indicating an upward vertical gradient, however, data collected since its installation in 2022 indicate that this trend may be seasonally dependent as the gradient has been inconsistent. Glacial wells MW-11 and MW-12 have higher water levels than the paired bedrock wells MW-11B and MW-12B (approximately 8 feet and 3 feet higher, respectively), indicating a strong downward vertical gradient. Similarly, groundwater elevations in the MW-16 series decrease with well depth, indicating a downward vertical gradient. Wells MW-16B and MW-16C have similar elevations, while MW-16A is three feet higher. Well MW-16D is significantly lower (approximately 10 feet) than the wells it is nested with. Bedrock well MW-16D does not appear to be hydraulically connected to the other wells within its multi-level well series or to other bedrock wells installed at Erickson Power Station. As shown in **Figure 3** below, MW-16D does not demonstrate seasonal fluctuations similar to those observed at other glacial and bedrock wells and has a substantially lower groundwater elevation than other wells despite being completed at a similar elevation and lithology as bedrock wells MW-11B, MW-12, MW-7B, and MW-100D. However, shallow bedrock well MW-16C does have groundwater elevations that fluctuate similarly to the glacial wells and other bedrock wells onsite. Wells MW-100B and MW-100C have similar elevations and show a downward gradient between the wells, however MW-100A and MW-100D are both one foot higher than the other two in the nested set.

Hydraulic conductivity of the bedrock ranges from 6.24 x 10^{-3} cm/s to 1.19 x 10^{-4} cm/s based on slug tests performed in the bedrock monitoring wells. The geometric mean hydraulic conductivity is 2.55 x 10^{-3} cm/s for the bedrock at and near the site. Using Darcy's equation, the geometric mean screened interval permeability determined by on-site slug tests, a geometric mean gradient of 0.0007, and a porosity of 15 percent, the geometric mean groundwater travel velocity of the bedrock aquifer is 0.0032 feet per day or 11.8 ft/year. With this estimate of velocity, it would take on the order of 477 years for groundwater under the impoundments to travel to the wetland on the east side the eastern property boundary.

The vertical gradient observed in the nested monitoring wells across the Site indicate a downward vertical gradient for the background well pairs MW-12/MW-12B at the northwestern boundary of the Site and MW-11/MW-11B at the southern boundary of the Site between the glacial and bedrock aquifers. Downgradient well series MW-7/MW-7B/MW-7C indicate a downward vertical gradient within the glacial shallow aquifer and an upward vertical gradient between the glacial and the bedrock aquifers. The groundwater elevations of the paired glacial/bedrock monitoring wells are shown in **Figure 4**.

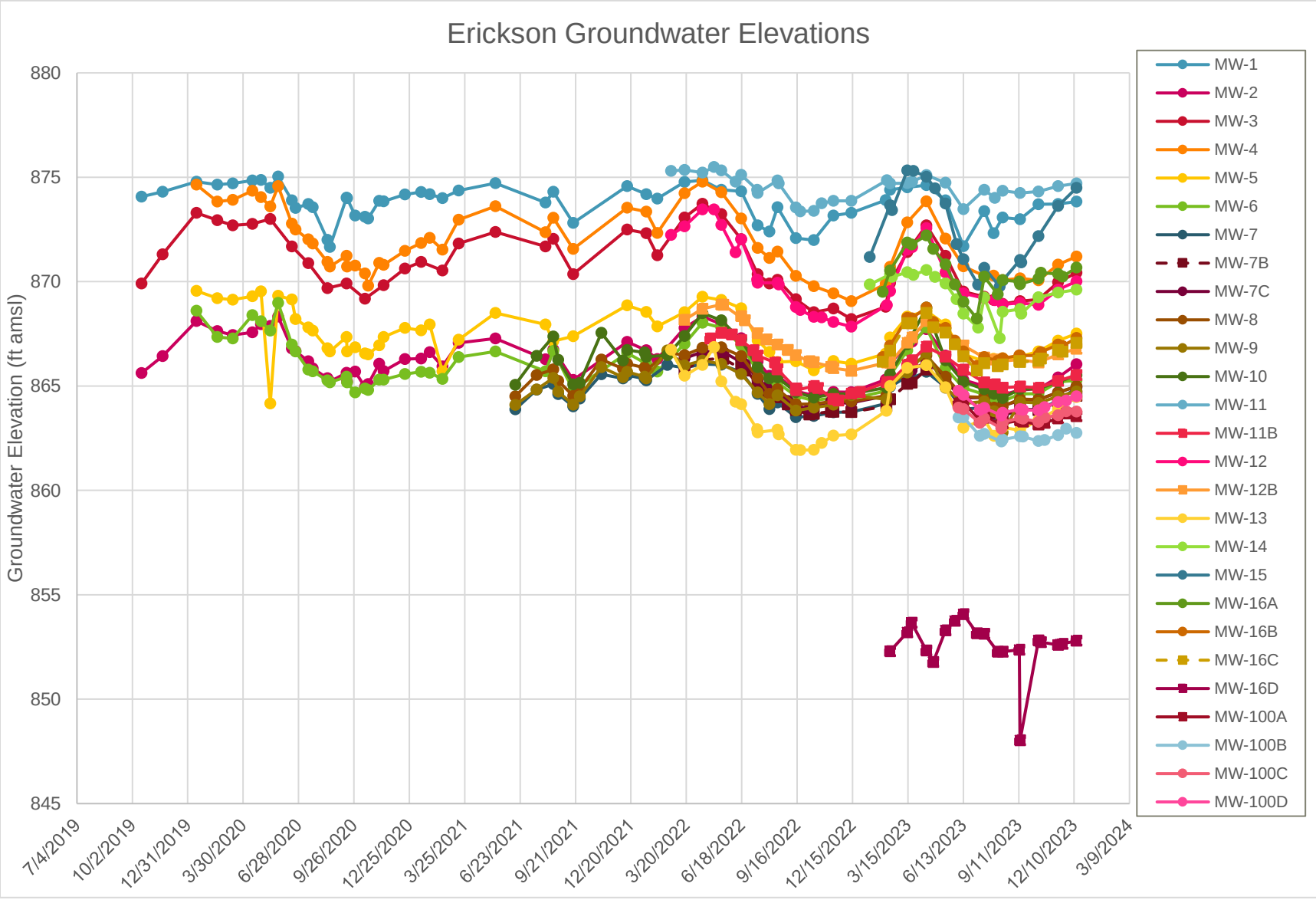


Figure 3. Erickson Power Station Groundwater Elevations

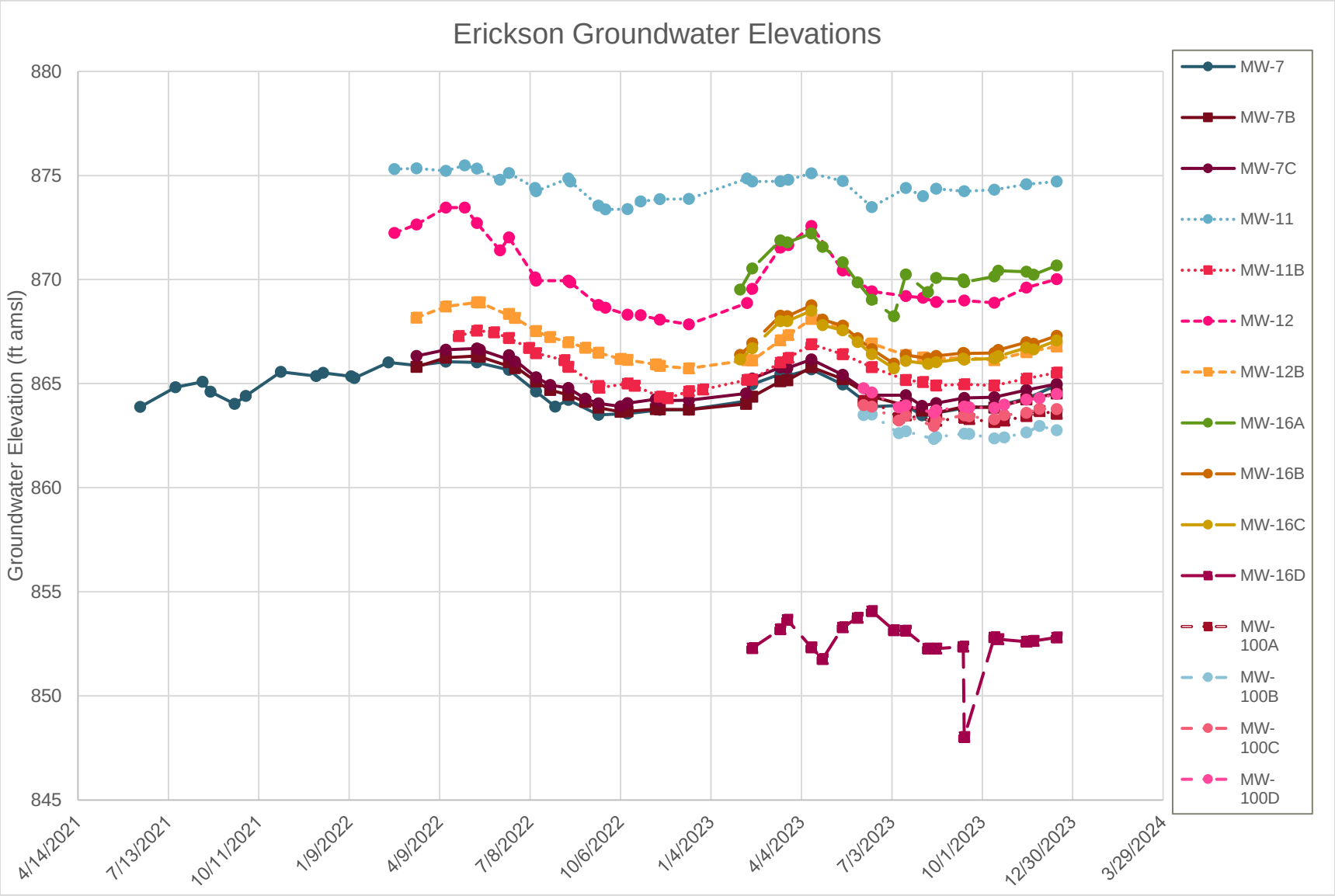


Figure 4. Erickson Power Station Paried Glacial and Bedrock Well Groundwater Elevations

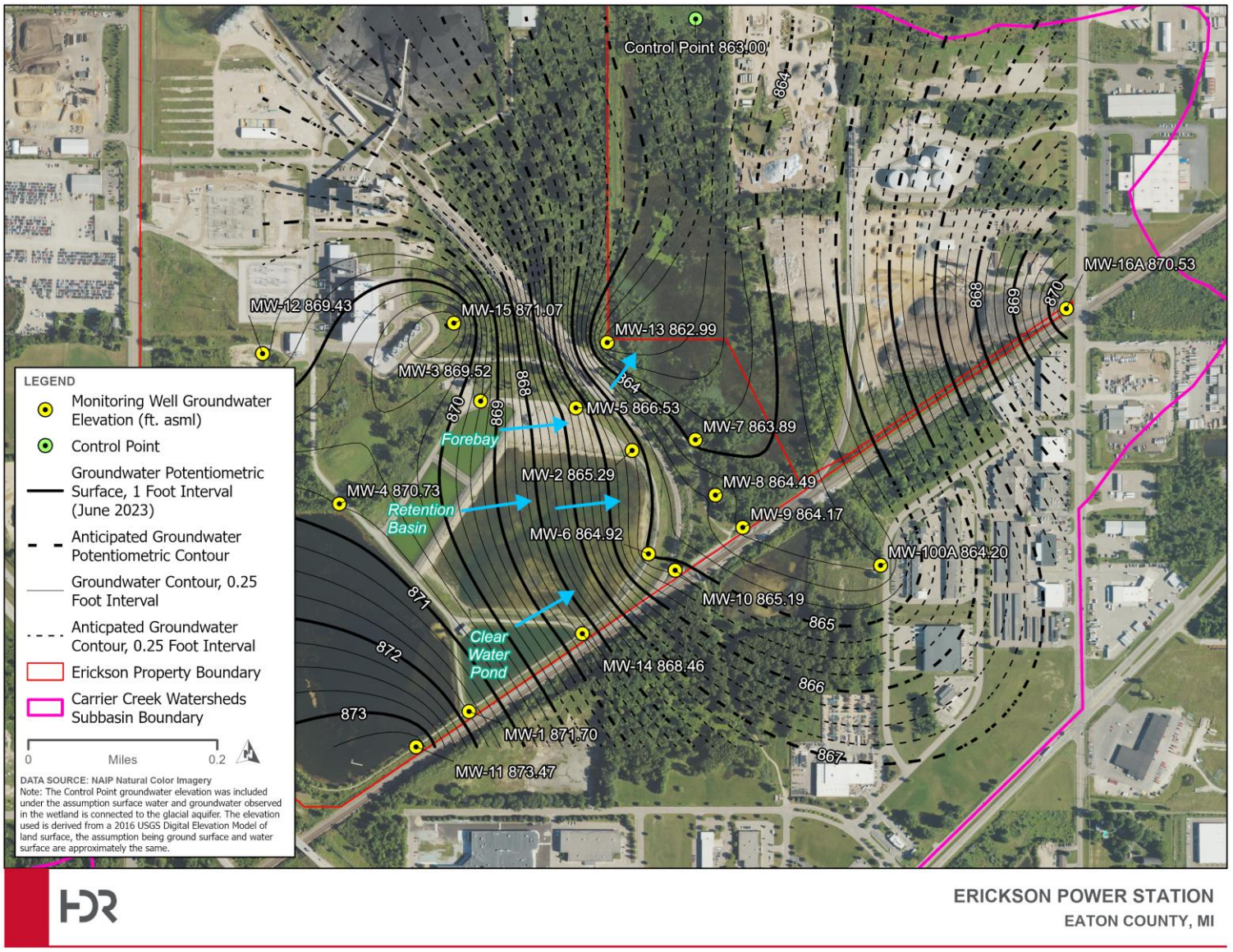


Figure 5. Glacial Aquifer Groundwater Contours – June 2023

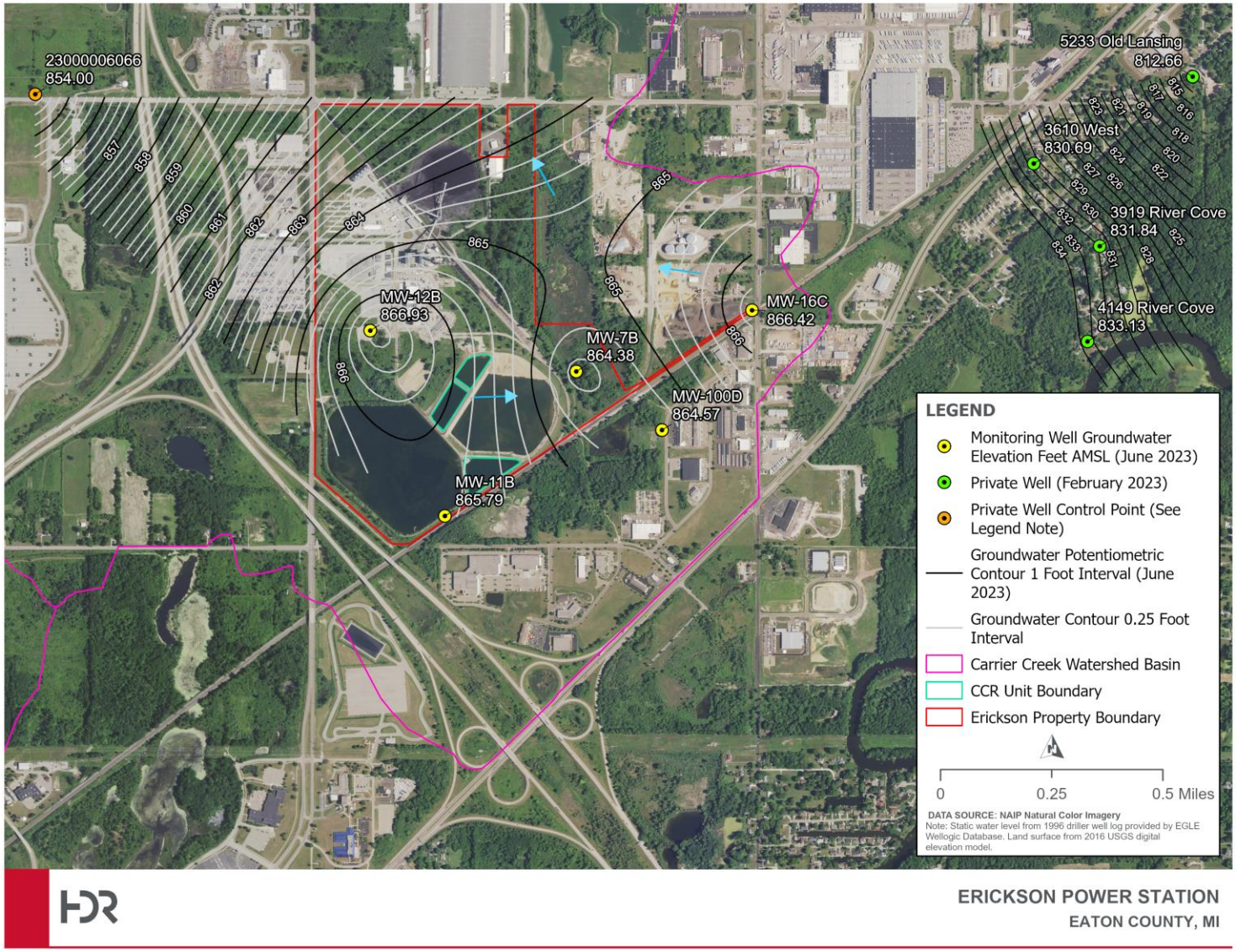


Figure 6. Bedrock Aquifer Groundwater Contours – June 2023

4.0 Groundwater Monitoring System Wells

The CCR Rule requires, at a minimum, one upgradient and three downgradient monitoring wells per CCR unit to be completed in the uppermost aquifer. Section §257.91 of the Rule states that the operator: "*…may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit."* In addition, the CCR Rule states that downgradient monitoring wells should be installed to: *"accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer."*

Based on the CCR requirements, hydrogeological data, and site visits, there are a total of twenty-seven (27) wells in the certified monitoring system (Figure 2), including:

- Nine compliance wells sampled in the uppermost (glacial) aquifer at the CCR multi-unit. These wells are at the waste boundary and used to initially identify an SSI and SSL:
    - Glacial background (upgradient) wells: MW-1, MW-4, MW-11, MW-12
    - Glacial downgradient compliance wells: MW-2, MW-5, MW-6, and MW-14
- Eleven characterization wells to evaluate groundwater in the glacial aquifer further downgradient of the impoundments in response to SSLs in the compliance wells: MW-3, MW-7, MW-7C, MW-8, MW-9, MW-10, MW-13, MW-15, MW-16A, MW-16B, MW-100A, MW-100B.
- Seven characterization wells to evaluate impacts to groundwater in the bedrock aquifer.
    - Bedrock background (upgradient) wells: MW-11B, MW-12B
    - Bedrock downgradient wells: MW-7B, MW-16C, MW-16D, MW-100C, MW-100D

The monitoring system at the CCR multiunit meet the requirements of the CCR rule and provide a sufficient number and spacing of wells at depths and screened intervals to accurately represent the quality of groundwater passing the waste boundary of the CCR units to ensure detection of groundwater contaminants in the uppermost aquifer and monitor all potential contaminant pathways from the CCR units.

Figure 2 displays the monitoring well locations. The Forebay, Retention Basin, and CWP are separated from the Former Impoundment by embankments. The BWL determined monitoring wells would not be installed in the embankments of active impoundments to maintain active embankment structural integrity. Additionally, monitoring wells would not be located within the footprint of the Former Impoundment because it remains a depression that impounds stormwater that falls within it. Based on the CCR requirements, hydrogeological data, site visits, well access, stormwater impoundment, and the embankments separating impoundments, three wells were originally sited to confirm the uppermost aquifer under the impoundments and determine the groundwater flow direction under the Site. The first three monitoring wells installed on site in 2019 were MW-1, MW-2, and MW-3. Groundwater flow direction was not known prior to this. The groundwater flow direction was confirmed as east under the CCR impoundments. The purpose of the initial three monitoring wells was to triangulate the gradient

and direction of groundwater flow; therefore, the location of MW-3 was not sited as a downgradient well but merely a well to determine flow direction. Initial monitoring identified MW-3 as cross-gradient to the CCR impoundments. Later monitoring continues to confirm MW-3 as cross-gradient (Figure 3). Its location on all groundwater contour maps over time demonstrates that a designation of “downgradient monitoring well” for MW-3 was (and is) inappropriate as one of the primary downgradient wells (e.g., certified network waste boundary downgradient well). Additional monitoring wells MW-4, MW-5, and MW-6 were installed in January 2020 to serve as additional upgradient and downgradient monitoring wells. Given the limited suitable space near the waste boundary, the configuration of the CCR impoundments and embankments not allowing for wells, and east flow direction, BWL sited monitoring wells MW-5 and MW-6 downstream of the three active CCR units. Three monitoring wells (MW-2, MW-5, and MW-6) were designated as downgradient locations. This monitoring network layout represents the most conservative method for monitoring groundwater impacts, especially considering the close proximity of the ponds to each other, which would otherwise make it difficult to discern which pond might be affecting groundwater quality. Furthermore, this network allows for the monitoring of residual impacts stemming from previous CCR storage within the Former Impoundment. Consequently, distinguishing potential impacts between the three CCR impoundments and the Former Impoundment would be exceedingly challenging, further solidifying the multi-unit approach as the most conservative strategy.

After SSLs were identified in November 2020, this began the process of BWL installing characterization wells east, north and south, as well as deeper (in the Saginaw bedrock aquifer) for plume delineation. Well MW-3 was added to the monitoring network in May 2021 as a characterization well and four new monitoring wells (MW-7, MW-8, MW-9, MW-10) were installed in June 2021 to monitor downgradient groundwater quality conditions further downgradient and as close to the property boundary as possible given the wetland constraints.

In spring 2022 monitoring wells MW-7B, MW-7C, MW-11, MW-11B, MW-12, MW-12B, and MW-13 were installed. The “B” series wells are completed between 120 and 135 feet below ground surface to monitor groundwater within the bedrock Saginaw aquifer. MW-12 serves the purpose of an upgradient surficial aquifer monitoring well for the Forebay and Retention Basin, MW-11 was installed upgradient of the Clear Water Pond as a background well, and MW-13 is an additional downgradient well on the property boundary.

In February and April 2022 five new monitoring wells (MW-11, MW-11B, MW-12, MW-12B, and MW-13) were installed to further delineate the extents of the groundwater protection standard exceedances in compliance with the CCR Rule §257.95(g)(1), and to characterize the hydrologic connection with between the uppermost glacial aquifer and the bedrock aquifer.

In January and February 2023 ten new monitoring wells (MW-14, MW-15, MW-16A, MW-16B, MW-16C, MW-16D, MW-100A, MW-100B, MW-100C, and MW-100D) were installed to collect geologic and hydrogeologic data east and south of the CCR impoundments and delineate plume migration and constituents of interest.

4.1 Background Monitoring Wells

- Background wells in the glacial aquifer are MW-1, MW-4, MW-11, and MW-12.
- Background wells in the bedrock aquifer are MW-11B and MW-12B.

The wells are located upgradient of the CCR impoundments (**Figures 4 and 5**). Well locations will capture background water quality in their respective aquifers before passing under the impoundments and reaching the downgradient wells.

4.2 Downgradient Monitoring Wells

- Waste boundary wells for the impoundments in the glacial aquifer are MW-2, MW-5, MW-6, and MW-14.

A multiunit monitoring network was installed, consisting of four wells (MW-2, MW-5, MW-6, and MW-14) along the downgradient perimeter of the Former Impoundment in the uppermost aquifer (glacial aquifer) to serve as waste boundary downgradient wells (**Figure** 2**4**). Wells MW-2, MW-5, MW-6, and MW-14 were sited as close to the waste boundary of the CCR impoundments as possible; however, BWL determined monitoring wells would not be installed in the embankments of active impoundments to maintain active embankment structural integrity. As a result, the Former Impoundment is included within the multiunit area, although the Former impoundment is not a CCR Impoundment. The downgradient well locations will detect constituents of interest from the CCR units, if present, as well as constituents of interest from the Former Impoundment.

4.3 Perimeter and Characterization Wells

- Glacial downgradient wells to evaluate extent of GPS exceedances: MW-3, MW-7, MW-7C, MW-8, MW-9, MW-10, MW-13, MW-15, MW-16A, MW-16B, MW-100A, MW-100B
- Bedrock downgradient wells to evaluate extent of GPS exceedances: MW-7B, MW-16C, MW-16D, MW-100C, and MW-100D

Glacial wells MW-7, MW-7B, MW-7C MW-8, MW-9, and MW-13 are perimeter wells sited as close to the downgradient property boundary as possible; however, the space between the property boundary and these well locations are wetlands and extremely thick brush. Wells MW-15, MW-16A, MW-16B, MW-100A, and MW-100B were installed on January 25, 2023 to further delineate the eastern and southern extents of the plume.

Bedrock well MW-7B was sited as close to the downgradient property boundary as possible, similar to the other wells in it's well series. Wells MW-16C, MW-16D were installed on January 25, 2023 and wells MW-100C and MW-100D were installed on May 15, 2023 to further delineate the vertical extent of the plume.

4.4 Well Construction

The CCR monitoring wells were drilled by a licensed well driller using a nominal 8-inch diameter hollow-stem auger or sonic drilling methods, and for bedrock wells PQ coring. Boreholes were

drilled to depths ranging from 28 to 136 feet below ground surface range to accommodate at least 10 feet of saturated screen in each well. The glacial monitoring wells targeted the uppermost section of the uppermost aquifer, screening the well immediately below the water table (as observed during drilling). Downgradient well MW-7C however, is a glacial well screened deeper in the glacial aquifer just above the top of bedrock. Once the target drilling depth was reached at each borehole, the 2-inch diameter, Schedule 40 PVC casing and well screen (0.010-inch slots) were assembled and installed. Screen length was variable depending on the well, well construction details for all CCR wells are summarized in Error! Reference s ource not found.. Additional details regarding the installation of all monitoring wells at Erickson Station can be found in the latest updated Monitoring Well Installation Report for the site (HDR, 2023).

Table 2. Monitoring Well Construction											
Well	**Easting**	**Northing**	**Well Location**	**Aquifer Monitored**	**Elevation TOC** (feet)	**Depth to Water During Drilling** (feet bgs)	**Depth of Screen Interval** (feet bgs)	**Well Total Depth** (feet bgs)	**Well Stickup** (feet)	**Static Depth to Water*** (feet BTOC)	**Static Water Elevation*** (feet)
MW-1	13045806.541	431808.209	Background/Upgradient	Glacial	888.74	17.5	20-30	30	2.79	17.04	871.70
MW-2	13046719.984	433282.326	Downgradient	Glacial	885.97	20	24-34	34	-0.17	20.68	865.29
MW-3	13045857.629	433553.031	Cross gradient	Glacial	884.81	15	24-34	34	-0.31	15.29	869.52
MW-4	13045090.91	432991.23	Background/Upgradient	Glacial	889.15	13	18-28	28	3.92	18.42	870.73
MW-5	13046389.871	433515.653	Downgradient	Glacial	885.50	13	19-29	29	-0.31	18.97	866.53
MW-6	13046831.843	432685.738	Downgradient	Glacial	885.53	18	18-28	28	-0.33	20.61	864.92
MW-7	13047058.39	433336.993	Downgradient	Glacial	870.14	3	4-14	14	1.82	6.25	863.89
MW-7B	13047054.18	433335.643	Downgradient	Bedrock	870.28	7	110-120	120	2.12	5.90	864.38
MW-7C	13047061.79	433320.63	Downgradient	Glacial	871.53	7	50-60	60	2.53	7.09	864.44
MW-8	13047170.01	433027.26	Downgradient	Glacial	873.74	4	7-17	17	2.60	9.25	864.49
MW-9	13047322.77	432846.467	Downgradient	Glacial	872.6	4	6-16	16	2.82	8.43	864.17
MW-10	13046982.69	432581.163	Downgradient	Glacial	875.65	8	7-17	17	2.22	10.46	865.19
MW-11	13045510.3	431605.96	Background/Upgradient	Glacial	885.64	10	20-25	25	-0.13	12.16	873.48
MW-11B	13045517.355	431611.719	Background/Upgradient	Bedrock	885.58	11	115-135	135	-0.33	19.79	865.79
MW-12	13044669.1	433814.67	Background/Upgradient	Glacial	886.19	20	21-26	26	2.98	16.75	869.44
MW-12B	13044662.5	433813.67	Background/Upgradient	Bedrock	886.27	20	105-120	120	2.67	19.34	866.93
MW-13	13046618.7	433844.94	Downgradient	Glacial	871.80	7	7-12	12	2.71	8.80	863.00
MW-14	13046436.532	432238.260	Downgradient	Glacial	884.594	19	18-28	28	-0.43	16.13	868.46
MW-15	13045735.453	433994.760	Downgradient	Glacial	880.237	6	8-18	18	3.20	9.16	871.08
MW-16A	13049162.536	434087.317	Downgradient	Glacial	877.48	17	10-20	20	2.95	8.46	869.02
MW-16B	13049166.037	434084.519	Downgradient	Glacial	877.49	17	32-42	42	2.95	10.84	866.65
MW-16C	13049165.998	434084.245	Downgradient	Bedrock	877.49	17	56-65	65	2.95	11.07	866.42
MW-16D	13049166.064	434084.217	Downgradient	Bedrock	877.53	17	116-126	126	2.99	23.45	854.08
MW-100A	13048093.4	432634.373	Downgradient	Glacial	879.94	30	25-35	35	-0.17	15.57	864.20
MW-100B	13048092.96	432637.925	Downgradient	Glacial	879.94	30	41-46	46	-0.20	16.23	863.51
MW-100C	13048093.09	432638.171	Downgradient	Bedrock	879.94	30	56-66	66	-0.22	15.83	863.89
MW-100D	13048093.18	432637.91	Downgradient	Bedrock	879.94	30	114-124	124	-0.24	15.13	864.573

Notes: TOC = top of casing; bgs = below ground surface; BTOC = below top of casing; *Static depth to water measured, June 13, 2023. Casings of all wells consist of 2-inch Schedule 40 PVC.

5.0 Groundwater Quality Sampling

5.1 Schedule

Sampling is conducted at a frequency compliant with CCR Part §257.94. Eight rounds of upgradient and downgradient monitoring well sampling for the original well network was completed in 2020 to represent background water quality and establish background threshold values (BTVs) for each constituent of interest (COI) in **Table 3.** . Groundwater quality sampling will be conducted in all upgradient, and downgradient monitoring wells and samples will be analyzed for the parameters in Appendix III and IV of Part §257, plus TSS, as described below. Groundwater monitoring will continue as appropriate based upon the results of sampling.

After performing eight rounds of sampling to establish background water quality, semi-annual (twice per year) groundwater detection monitoring was initiated. Groundwater quality sampling will be conducted in all upgradient and downgradient monitoring wells and samples will be analyzed for the parameters in Appendix III of Part §257, plus TSS, as described below in compliance with CCR Part 257.94 and 257.95. Every time a new well is installed, it is sampled at a higher frequency for 8 weeks to establish statistical dataset as quickly as possible.

5.2 Sample Collection

Samples are collected following the protocol in the Groundwater Monitoring Plan for Compliance with the Coal Combustion Residuals (CCR) Rule at Erickson Power Station (HDR, 2020a). Groundwater quality sampling is conducted in all upgradient and downgradient monitoring wells unless wells are dry. In accordance with the CCR Rule and the approved Groundwater Monitoring Plan, groundwater samples are not field filtered. The field parameters of turbidity, pH, ORP, and temperature are measured using a YSI Professional Plus (or an equivalent) portable water quality instrument that has been calibrated prior to use.

5.3 Analytical Testing

Analytical testing of groundwater samples will be performed by an independent certified laboratory. For the initial eight background sample events, samples are analyzed for the constituents shown on **Table 3.** , which include the constituents in Appendices III and IV of Part §257, plus Total Suspended Solids (TSS). For detection monitoring, the constituents listed in Appendix III will be analyzed. Subsequent sampling events will be analyzed for the constituents listed in Appendix III or IV as appropriate, based upon the results of previous sampling and statistical evaluation of results. For quality control, one field duplicate sample and one field equipment blank sample will be collected for each sample event.

Table 3. Groundwater Quality Constituents
Appendix III Constituents for Detection Monitoring
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids (TDS)
Appendix IV Constituents for Assessment Monitoring
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined
Additional Parameters
Total Suspended Solids (TSS)

6.0 Reporting

The CCR Part §297.90(e) identifies the reporting requirements for the groundwater monitoring program for the CCR units by January 31 each year. Annual reports summarize key monitoring actions completed, describe any problems encountered and well modifications or repairs, actions to resolve problems, and project key activities for the upcoming year. The statistical methods used to analyze each specified constituent in each monitoring well is described in a separate Statistical Methods Certification document. The BWL will comply with the CCR Rule recordkeeping requirements specified in §257.105(h), notification requirements specified in §257.106(h), and internet requirements specified in §257.107(h).

7.0 References

Apple, B.A. and Reeves, H.W., 2007, Summary of Hydrogeologic Conditions by County for the State of Michigan: U.S. Geological Survey Open-File Report 2007-1236, 79 p.

HDR, 2019. Hydrogeologic Characterization Report. October 31, 2019.

HDR, 2019a. Groundwater Level Monitoring Standard Operating Procedure (SOP). November 18, 2019.

HDR, 2020. Groundwater Monitoring 2019 Annual Report for Compliance with the Coal Combustion Residuals (CCR) Rule, Lansing Board of Water and Light, Erickson Power Station. January 30, 2020.

HDR, 2020a. Groundwater Monitoring Plan for Compliance with the Coal Combustion Residuals (CCR) Rule, Lansing Board of Water and Light, Erickson Power Station. March 11, 2020.

HDR, 2022. Monitoring Well Installation Report for Compliance with the Coal Combustion Residuals (CCR) Rule, Lansing Board of Water and Light, Erickson Power Station. June 29, 2021. Revised June 6, 2022

HDR, 2023. Monitoring Well Installation Report for Compliance with the Coal Combustion Residuals (CCR) Rule, Lansing Board of Water and Light, Erickson Power Station. March 25, 2020. Revised July 21, 2023.

HDR, 2023. Private Well Sampling Report, Lansing Board of Water and Light ,Erickson Power Station. April 16, 2023.

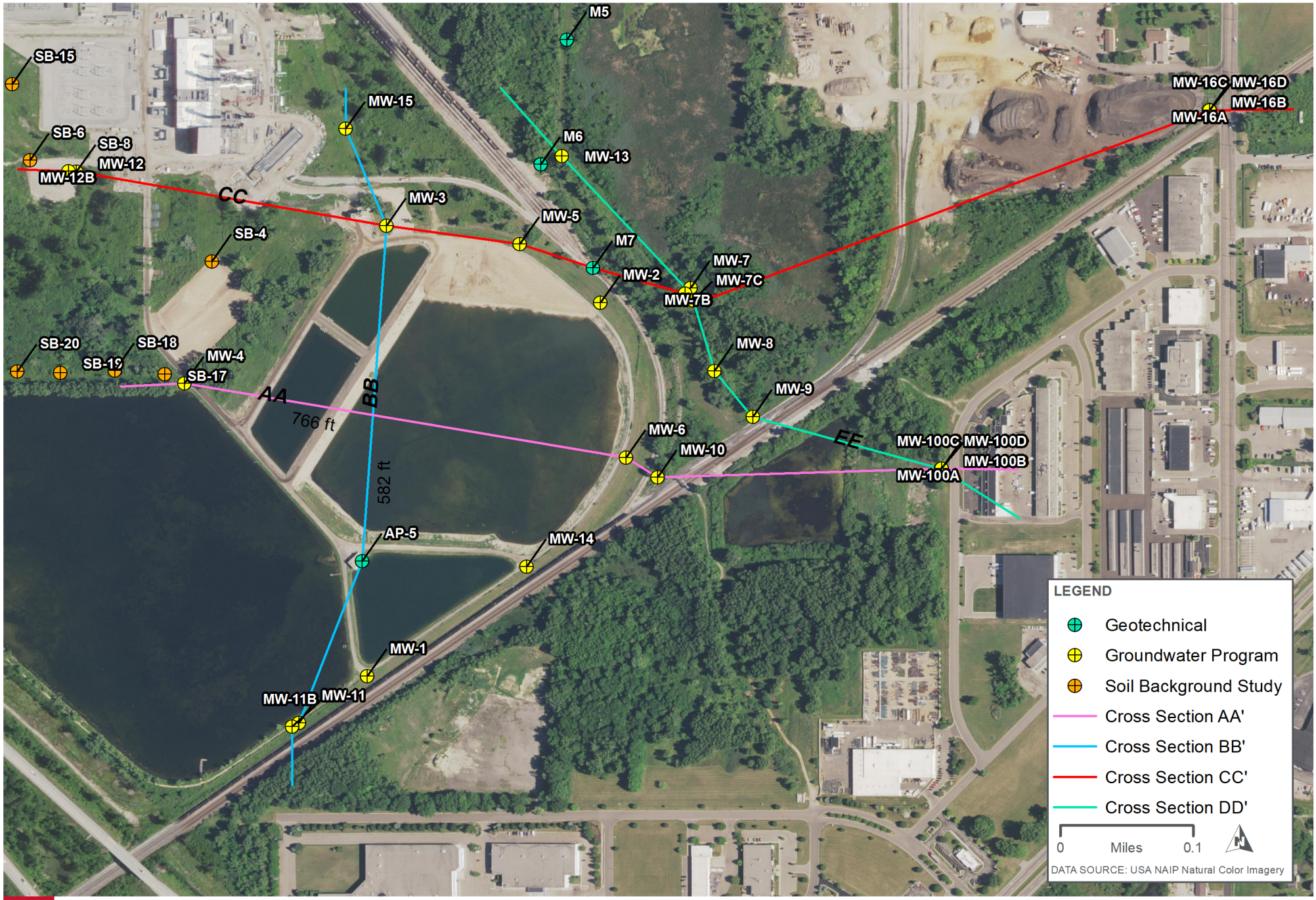
Mayotte Design & Engineering, P.C, 2018. Compliance with 40CFR257-Locations Restrictions. Lansing Board of Water & Light Erickson Power Station. October 10, 2018.

SME, 2018. Geotechnical Data Report, New Gas Combined Cycle Plant, Delta Township, Michigan. August 16, 2018.

Vanlier, K. E., Wood, W. W., and Brunett, J. O., 1973, Water-supply development and management alternatives for Clinton, Eaton, and Ingham County, Michigan: U.S. Geological Survey Water-Supply Paper 1969, 111 p.

A

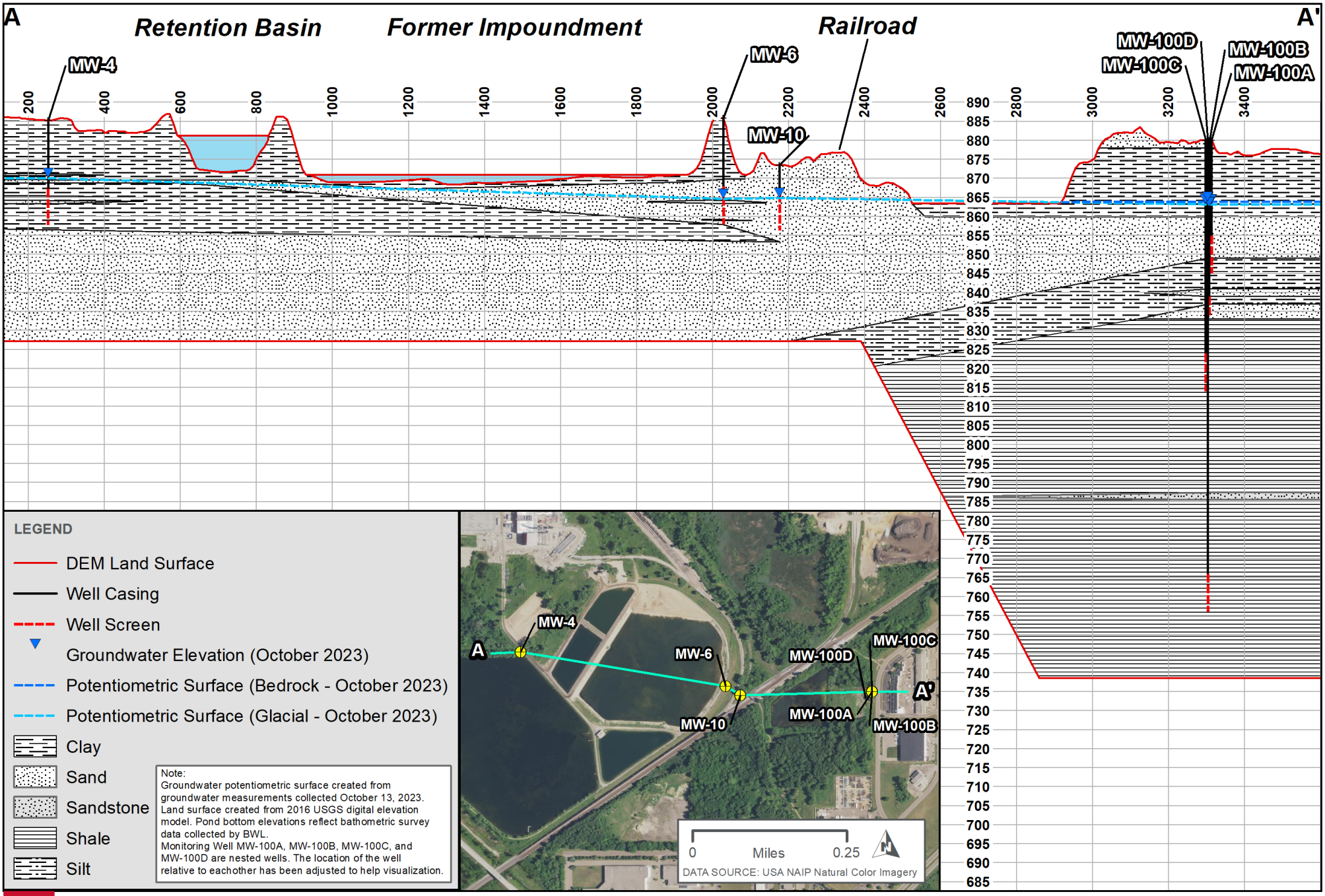
Geological Cross-sections



HDR

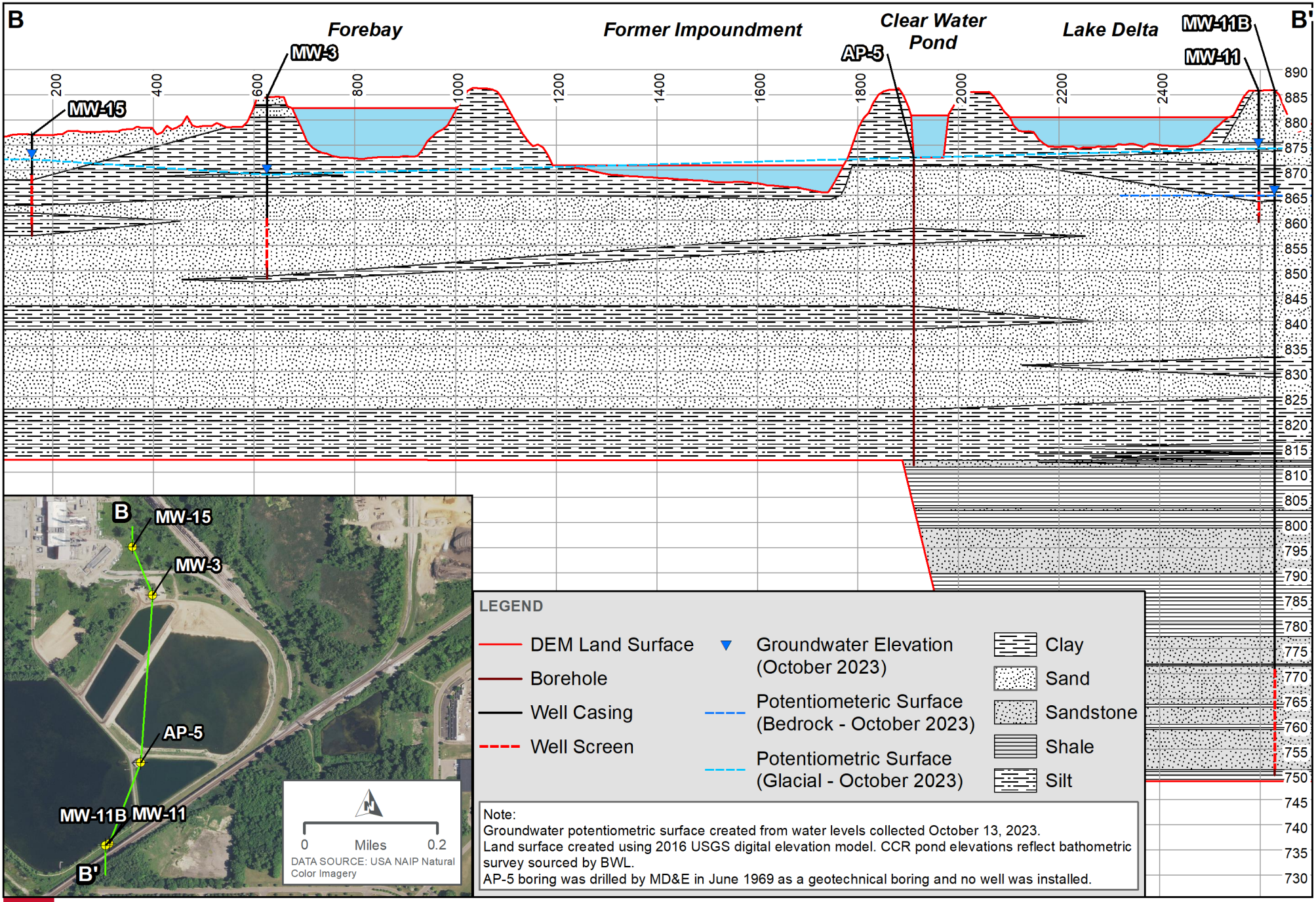
ERICKSON POWER STATION

EATON COUNTY, MI



ERICKSON POWER STATION

EATON COUNTY, MI



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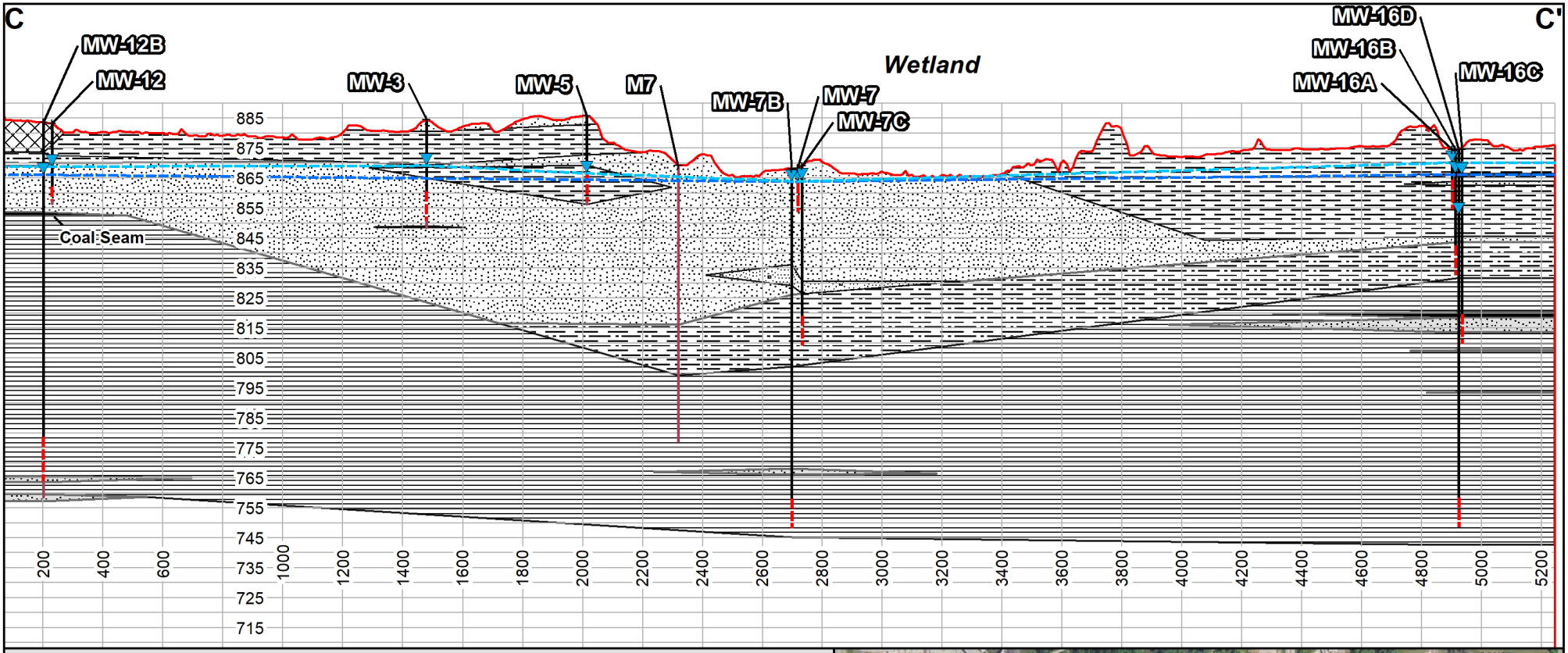
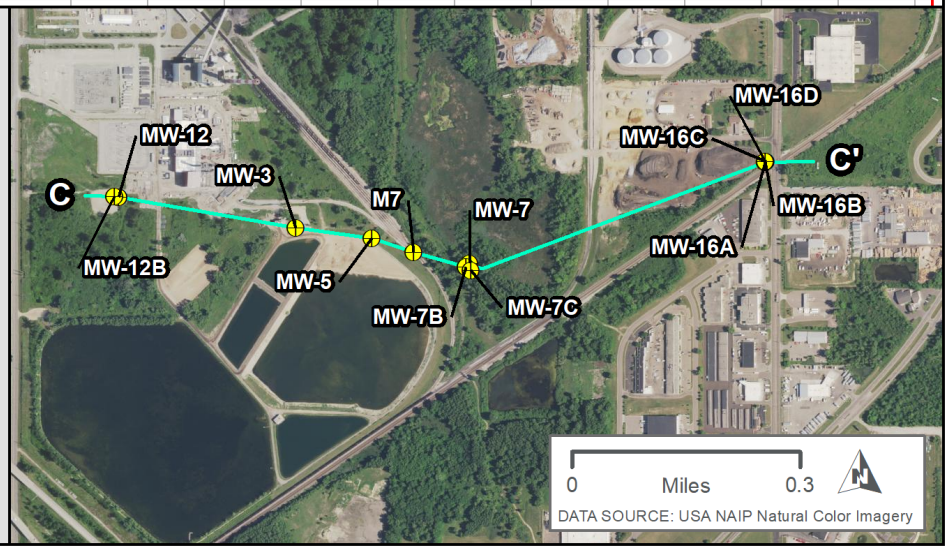
EATON COUNTY, MI



LEGEND

- DEM Land Surface
- Borehole
- Well Casing
- Well Screen
- Groundwater Elevation (October 2023)
- Potentiometric Surface (Bedrock - October 2023)
- Potentiometric Surface (Glacial - October 2023)
- Clay
- Coal
- Fill
- Gravel
- Sand
- Sandstone
- Shale
- Silt

Note:
Poteniometric surface created from groundwater measurements collected October 13, 2023.
Land surface created using 2016 USGS digital elevation model.
Soil boring M7 from 1982 Soil Testing Services hydrogeologic study.



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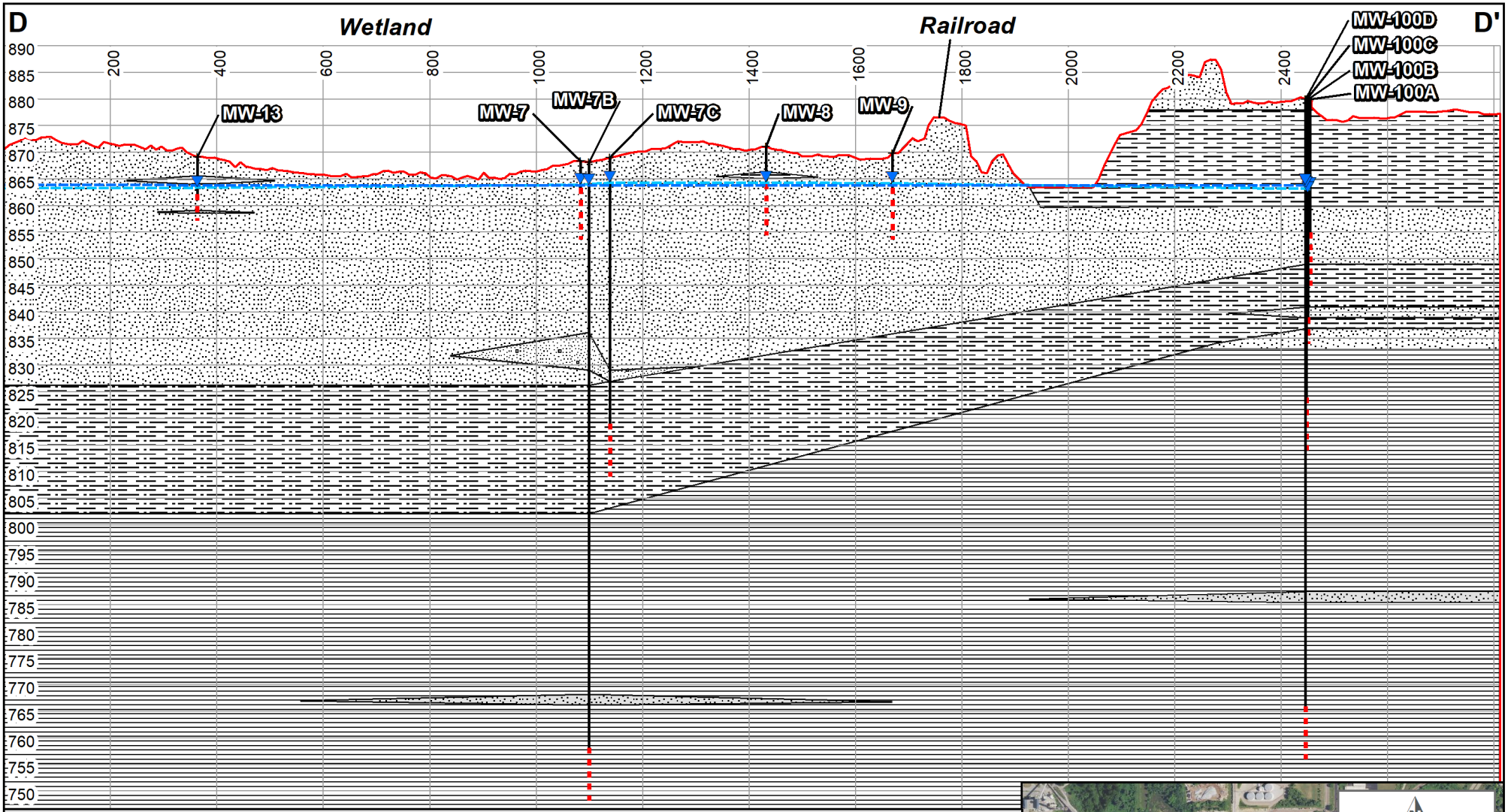
ERICKSON POWER STATION

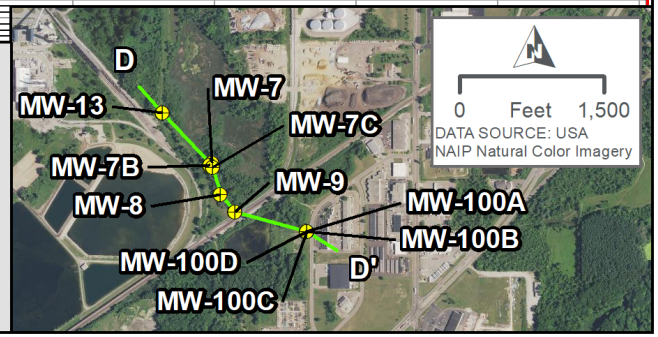
EATON COUNTY, MI



LEGEND

- DEM Land Surface
- Well Casing
- Well Screen
- October 2023 Groundwater Elevations
- Potentiometric Surface (Bedrock - October 2023)
- Potentiometric Surface (Glacial - October 2023)
- Clay
- Gravel
- Sand
- Sandstone
- Shale
- Silt

Note:
Groundwater potentiometric surface created from water levels collected October 13, 2023. Land surface created using 2026 USGS digital elevation model.
Monitoring Well MW-100A, MW-100B, MW-100C, and MW-100D are nested wells. The location of the well has been adjusted to help visualization.



HDR

ERICKSON POWER STATION

EATON COUNTY, MI

B

Well Logs

MW-1

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 10/15/19 11:00 **COMPLETED** 10/15/19 12:30
GROUND ELEVATION 885.97 ft MSL **HOLE DIAMETER** 7"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 17.50 ft / Elev 868.47 ft
LOGGED BY Emily Munoz **CHECKED BY**
▼ **75 HRS AFTER DRILLING** 11.85 ft / Elev 874.12 ft
NOTES Sample ID prefix LBWL-MW1-. Driller recorded blow counts on SME logs.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 888.74 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY LEAN CLAY WITH GRAVEL, (CL) brown (10YR 5/3), dry, stiff, low plasticity	885.5	
			SANDY LEAN CLAY WITH GRAVEL, (CL) yellowish brown (10YR 5/4), dry, medium stiff, mottled, low plasticity		
5					
					Bentonite Chips (Hydrated in Lifts)
10					
			11.0	875.0	
			▼ SANDY LEAN CLAY WITH GRAVEL, (CL) yellowish brown (10YR 5/4), moist, medium stiff, mottled, low plasticity		
15			15.0	871.0	
			SANDY LEAN CLAY, (CL) very dark gray (2.5Y 3/1), moist, stiff, low plasticity		
			16.0	870.0	
			CLAYEY SAND, (SC) dark greenish gray (10GY 4/1), poorly graded, fine grained, moist, medium dense, iron oxide staining		
			17.5 ▽	868.5	
			18.0 CLAYEY SAND, (SC) dark greenish gray (10GY 4/1), poorly graded, fine grained, wet, medium dense, iron oxide staining	868.0	
20			POORLY GRADED SAND WITH CLAY, (SP) gray (5Y 5/1), fine to medium grained, wet, medium dense		
	SS 20-22				Silica Sand Filter Pack
			23.5	862.5	
			CLAYEY SAND, (SC) gray (5Y 5/1), poorly graded, fine grained, wet, medium dense		
25					Screen, 0.010" Slot Size
			26.0	860.0	
	SS 26-28		LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine grained, wet, soft, low plasticity		
30			30.0	856.0	
			FAT CLAY, (CH) gray (5Y 5/1), wet, stiff, medium plasticity		Endcap
			31.0	855.0	
			LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine to medium grained, wet, soft, low plasticity		
			32.0	854.0	

Bottom of borehole at 32.0 feet.

MW-2

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 10/16/19 08:40 **COMPLETED** 10/16/19 10:18
GROUND ELEVATION 886.14 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
AT TIME OF DRILLING 20.00 ft / Elev 866.14 ft
LOGGED BY Emily Munoz **CHECKED BY**
48 HRS AFTER DRILLING 20.52 ft / Elev 865.62 ft
NOTES Sample ID prefix LBWL-MW2-. Driller recorded blow counts on SME logs.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 885.97 (ft) Casing Type: 2" Sch 40 PVC
			LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand		
				884.1	
2.0			LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand, fine gravel		
4.0				882.1	
4.5			LEAN CLAY, SILTY, (CL) dark gray (10YR 4/1), dry, stiff, low plasticity, fine sand	881.6	
5			LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand		
7.5				878.6	
8.5			LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, stiff, medium plasticity	877.6	Bentonite Chips (Hydrated in Lifts)
10			LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand		
10.5				875.6	
11.0			LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, medium stiff, medium plasticity	875.1	
			LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand		
13.5				872.6	
14.0			LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, medium stiff, medium plasticity	872.1	
15					
15.0			LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand	871.1	
			LEAN CLAY, SILTY, (CL) dark grayish brown (2.5Y 4/2), moist, soft to medium stiff, low plasticity, fine sand, fine gravel		
19.0				867.1	
20			CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine grained, moist, dense		
20.0				866.1	
20.5			POORLY GRADED SAND, (SP) brown (10YR 5/4), fine to medium grained, wet, loose	865.6	
			LEAN CLAY, SILTY, (CL) brown to olive (10YR 5/4), wet, medium stiff, low plasticity, lenses of fine sand		
23.5				862.6	
24.0			POORLY GRADED SAND, (SP) brown (10YR 5/4), fine to medium grained, wet, loose	862.1	
25	SS 24-26		POORLY GRADED SAND, (SP) light olive (2.5YR 5/3), fine to medium grained, wet, loose		Silica Sand Filter Pack
27.5				858.6	
28.0			LEAN CLAY, SILTY, (CL) gray (2.5Y 5/1), moist, soft, low plasticity, fine sand	858.1	
	SS 28-30		POORLY GRADED SAND, CLAYEY, (SP) grayish brown (2.5Y 5/2), fine to medium grained, wet, loose		Slot Size 0.010"
30				856.1	
			CLAYEY SAND, (SC) grayish brown (2.5Y 5/2), fine grained, wet, loose, grades into sandy clay over depth		
32.0				854.1	
32.5	SS 32-34		WELL GRADED SAND WITH GRAVEL, (SW) grayish brown (2.5Y 5/2), fine to coarse grained, wet, loose	853.6	
			LEAN CLAY, SILTY, (CL) grayish brown (2.5Y 5/2), wet, stiff, low plasticity, fine sand		
34.5				851.6	Endcap

Bottom of borehole at 34.5 feet.

MW-3

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 10/15/19 10:36 **COMPLETED** 10/15/19 12:30
GROUND ELEVATION 885.12 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
AT TIME OF DRILLING 15.00 ft / Elev 870.12 ft
LOGGED BY Emily Munoz **CHECKED BY**
72 HRS AFTER DRILLING 15.52 ft / Elev 869.60 ft
NOTES Sample ID prefix LBWL-MW3-. Driller recorded blow counts on SME logs.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 884.81 (ft) Casing Type: 2" Sch 40 PVC
			CLAYEY SAND, (SC) brown (10YR 4/3), poorly graded, fine grained, moist, dense	883.6	
1.5					
2.0			LEAN CLAY, (CL) grayish brown (10YR 5/2), moist, medium stiff, low plasticity, sand	883.1	
4.0			POORLY GRADED SAND, (SP) brown (10YR 4/3), fine to medium grained, moist, dense, clay	881.1	
4.5			LEAN CLAY, SILTY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity, sand	880.6	
6.0			LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, medium stiff, mottled, low plasticity	879.1	
7.0			LEAN CLAY, (CL) very dark grayish brown (2.5Y 3/2), moist, medium stiff, low plasticity, sand	878.1	
8.0			LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, stiff, mottled, low plasticity, gravel	877.1	
8.5			LEAN CLAY, SANDY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity	876.6	
10.0			LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, soft, mottled, low plasticity, sand	875.1	
10.8			LEAN CLAY, SANDY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity	874.4	
12.0			LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, soft, mottled, low plasticity, sand	873.1	
15.0			LEAN CLAY, SANDY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity	870.1	
16.0			LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, soft, low plasticity, fine gravel	869.1	
			LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, medium stiff, low plasticity, sand, gravel		
19.5			CLAYEY SAND, (SC) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, loose	865.6	
			LEAN CLAY, SANDY, (CL) very dark grayish brown (10YR 3/2), wet, soft, low plasticity		
			CLAYEY SAND, (SC) very dark grayish brown (10YR 3/2), poorly graded, fine grained, wet, loose, gravel		
	SS 26-28				
	SS 28-30				
34.5				850.6	
35.5			POORLY GRADED SAND WITH CLAY, (SP) very dark grayish brown (10YR 3/2), fine to medium grained, wet, loose	849.6	
36.0			LEAN CLAY, SILTY, (CL) very dark grayish brown (10YR 3/2), moist, soft, low plasticity, fine sand, Stiff, plastic fat clay (CH) in shoe.	849.1	

Bentonite Chips (Hydrated in Lifts)
Silica Sand Filter Pack
Slot Size 0.010"
Endcap

Bottom of borehole at 36.0 feet.

MW-4

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/06/20 10:09 **COMPLETED** 01/06/20 11:05
GROUND ELEVATION 885.23 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 13.00 ft / Elev 872.23 ft
LOGGED BY Emily Munoz **CHECKED BY**
▼ **94.3 HRS AFTER DRILLING** 11.51 ft / Elev 873.72 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 889.15 (ft) Casing Type: 2" Sch 40 PVC
			LEAN CLAY, SILTY, (CL) very dark brown (7.5YR 2.5/2), moist, soft, low plasticity, fine sand	884.2	
1.0			LEAN CLAY, SILTY, (CL) brown (10YR 4/3), moist, soft, low plasticity		
5					
5.0				880.2	
6.0			LEAN CLAY, SILTY, (CL) dark brown (7.5YR 3/2), moist, soft, low plasticity, fine sand	879.2	
7.0			LEAN CLAY, SILTY, (CL) brown with dark brown (10YR 5/3), moist, medium stiff, mottled, low plasticity, fine sand, fine gravel	878.2	
9.0			LEAN CLAY, SILTY, (CL) dark yellowish brown with dark grayish brown (10YR 4/6), moist, soft, mottled, low plasticity, fine sand, fine gravel	876.2	Bentonite Chips (Hydrated)
10			LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), moist, soft, medium plasticity, fine sand, fine gravel		
13.0			▽	872.2	
14.0			LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), wet, soft, medium plasticity, fine sand, fine gravel	871.2	
14.5			WELL GRADED SAND WITH GRAVEL, (SW) brown (10YR 4/3), fine to coarse grained, wet, loose	870.7	
15					
15.5			LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), wet, stiff, medium plasticity, fine sand, fine gravel	869.7	
16.5			CLAYEY SAND, (SP) yellowish brown (10YR 5/4), fine grained, wet, loose, fine gravel	868.7	
19.8			LEAN CLAY, (CL) brown (7.5YR 4/2), wet, medium stiff, low plasticity, fine sand, fine gravel	865.5	
20					
20.0			CLAYEY SAND, (SP) brown (7.5YR 5/2), fine to coarse grained, wet, loose, fine gravel	865.2	
20.3				865.0	
21.0			CLAYEY SAND, (SP) brown (7.5YR 5/2), fine grained, wet, loose	864.2	
22.0			LEAN CLAY, (CL) brown (7.5YR 5/2), wet, soft, low plasticity, fine sand	863.2	
23.0	GB		POORLY GRADED SAND, (SP) dark gray (7.5YR 4/1), coarse grained, wet, loose, fine gravel	862.2	0.010" Slotted PVC Screen
25			LEAN CLAY, (CL) gray (7.5YR 5/1), moist, stiff, low plasticity, fine sand, fine gravel		
26.3			LEAN CLAY, (CL) brown (7.5YR 5/2), wet, stiff, low plasticity, fine sand	859.0	
28.0			LEAN CLAY, SANDY, (CL) dark gray to black (7.5YR 4/1), wet, medium stiff, low plasticity	857.2	Endcap

Bottom of borehole at 28.0 feet.

MW-5

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/07/20 09:00 **COMPLETED** 01/07/20 10:35
GROUND ELEVATION 885.81 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 12.50 ft / Elev 873.31 ft
LOGGED BY Emily Munoz **CHECKED BY**
▼ **71.25 HRS AFTER DRILLING** 17.18 ft / Elev 868.63 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 885.5 (ft) Casing Type: 2" Sch 40 PVC
			CLAYEY SAND, (SP) dark yellowish brown (10YR 4/4), poorly graded, fine grained, moist, dense		
3.0				882.8	
			LEAN CLAY, SANDY, (CL) brown to very dark grayish brown (10YR 5/3), dry to moist, stiff, low plasticity, gravel		
5					
7.0				878.8	Bentonite Chips (Hydrated)
			LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, stiff, low plasticity, gravel		
9.0				876.8	
10			LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, soft, low plasticity, gravel		
12.0				873.8	
13.0			▽ LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), wet, soft, low plasticity, gravel	872.8	
			CLAYEY SAND, (SC) yellowish brown (10YR 5/4), poorly graded, fine to coarse grained, wet, loose, lenses of sandy clay		
15					
15.0				870.8	
			WELL GRADED SAND, (SW) yellowish brown (10YR 5/4), well graded, fine to coarse grained, wet, loose		
16.5				869.3	
			▼ FAT CLAY, (CH) dark gray (10YR 4/1), wet, soft, high plasticity, trace fine sand and gravel		
20					
20.3				865.6	
21.0			LEAN CLAY, SANDY, (CL) dark gray (10YR 4/1), moist, stiff, low plasticity, fine gravel	864.8	
			LEAN CLAY, SANDY, (CL) grayish brown (10YR 5/2), wet, stiff, low plasticity, fine gravel		
23.0	GB			862.8	
			LEAN CLAY, SANDY, (CL) grayish brown (10YR 5/2), wet, soft, low plasticity		0.010" Slotted PVC Screen
25					
29.5				856.3	Endcap

Bottom of borehole at 29.5 feet.

MW-6

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/07/20 11:40 **COMPLETED** 01/07/20 13:00
GROUND ELEVATION 885.86 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 18.00 ft / Elev 867.86 ft
LOGGED BY Emily Munoz **CHECKED BY**
▼ **68.8 HRS AFTER DRILLING** 18.84 ft / Elev 867.02 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 885.53 (ft) Casing Type: 2" Sch 40 PVC
			LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), dry to moist, stiff, low plasticity, gravel		
5					
			6.3	879.6	
			LEAN CLAY, SANDY, (CL) dark gray (10YR 4/1), moist, stiff, low plasticity, gravel, iron oxide staining		
			7.5	878.4	Bentonite Chips (Hydrated)
			LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, stiff, low plasticity, gravel		
10					
			12.0	873.9	
			LEAN CLAY, SANDY, (CL) dark gray to black (10YR 4/1), moist, medium stiff, low plasticity, gravel		
			13.0	872.9	
			LEAN CLAY, SANDY, (CL) dark gray to yellowish brown (10YR 4/1), moist, medium stiff, mottled, low plasticity, gravel		
15					
			16.0	869.9	
			POORLY GRADED SAND, (SP) yellowish brown to brown (10YR 5/6), fine grained, moist, loose to medium dense		
			18.0 ▽	867.9	
			POORLY GRADED SAND, (SP) yellowish brown to brown (10YR 5/6), fine grained, wet, loose to medium dense, mottled, iron oxide staining		
			19.0 ▼	866.9	
20			POORLY GRADED SAND, (SP) yellowish brown to dark yellowish brown (10YR 5/4), fine grained, wet, loose to medium dense, mottled, iron oxide staining		
			21.0	864.9	
			21.5	864.4	
			WELL GRADED SAND, (SW) dark yellowish brown (10YR 4/4), fine to coarse grained, wet, loose		Silica Sand Filter Pack
			22.5	863.4	
	GB		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), wet, soft, low plasticity		0.010" Slotted PVC Screen
			POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), fine to medium grained, wet, medium dense		
25					
			26.8	859.1	
			27.0	858.9	
			LEAN CLAY, (CL) yellowish brown to grayish brown (10YR 5/4), wet, medium stiff, low plasticity, fine sand		
			28.0	857.9	Endcap
			POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), fine to medium grained, wet, medium dense		
			29.0	856.9	
			LEAN CLAY, (CL) dark grayish brown (10YR 4/2), moist, stiff, medium plasticity, some silt and fine sand		

Bottom of borehole at 29.0 feet.

MW-7

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 06/07/21 12:00 **COMPLETED** 06/07/21 16:00
GROUND ELEVATION 868.32 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 3.00 ft / Elev 865.32 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **92 HRS AFTER DRILLING** 4.24 ft / Elev 864.08 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0.0					Casing Top Elev: 870.74 (ft) Casing Type: 2" Sch 40 PVC
			0.2 ORGANIC SOIL WITH SAND, (CL) dark olive to (2.5Y 4/4), dry, loose	868.2	
			LEAN CLAY WITH SAND, (CL-ML) dark grayish brown (2.5Y 4/2), dry, loose		
			1.0	867.3	
2.5	SS		SILTY SAND, (SP-SM) dark grayish brown (2.5Y 4/2), fine grained, moist, medium dense		Bentonite Chips
	SS		▽ ▼		
5.0	SS				
			6.5	861.8	
			6.8 SILT, (ML) dark gray (10YR 4/1), fine grained, wet, medium dense	861.5	
			7.0 SILTY SAND, (SP-SM) dark gray (10YR 4/1), fine grained, wet, medium dense	861.3	
7.5	SS		POORLY GRADED SAND, (SP) dark gray (10YR 4/1), poorly graded, fine to medium grained, wet, medium dense		
			9.0	859.3	Silica Sand Filter Pack
10.0	SS		POORLY GRADED SAND, (SP) dark grayish brown (2.5Y 4/2), poorly graded, fine to medium grained, wet, medium dense		Screen, 0.010" Slot Size
12.5	SS				
			13.0	855.3	
	SS		POORLY GRADED SAND, (SP) dark gray (2.5Y 5/1), poorly graded, medium to coarse grained, wet, medium dense		
			14.0	854.3	
			14.3 SILT, (ML) dark gray (2.5Y 5/1), wet, medium dense	854.0	
15.0			POORLY GRADED SAND, (SP) dark gray (2.5Y 5/1), poorly graded, fine to medium grained, wet, medium dense		Endcap
			15.0	853.3	

Bottom of borehole at 15.0 feet.

MW-7B

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 03/01/22 09:00 **COMPLETED** 03/03/22 12:00
GROUND ELEVATION 868.16 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
▽ **AT TIME OF DRILLING** 4.00 ft / Elev 864.16 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 4.48 ft / Elev 863.68 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 870.28 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY ORGANIC SOIL, CLAYEY SAND, (SC-SM) black (7.5YR 2.5/1), poorly graded, fine to medium grained, moist, topsoil fill	867.7	
			3.0 POORLY GRADED SAND WITH SILT, SILTY SAND, (SM) gray (7.5YR 5/1), poorly graded, fine to medium grained, moist	865.2	
			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, moist		
			6.0 POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated	862.2	Bentonite Chips
10					
20					
30					
			32.0 POORLY GRADED GRAVEL WITH CLAY AND SAND, GRAVEL, (GP-GC) gray (7.5YR 5/1), poorly graded, coarse grained, saturated	836.2	
			35.5	832.7	
			36.0 FAT CLAY WITH GRAVEL, GRAVELLY CLAY, (CH) gray (7.5YR 5/1), coarse grained, saturated	832.2	
			39.0 POORLY GRADED GRAVEL WITH CLAY AND SAND, GRAVEL, (GP-GC) gray (7.5YR 5/1), poorly graded, coarse grained, saturated	829.2	
40			40.0 POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, coarse grained, saturated	828.2	
			42.0 POORLY GRADED SAND WITH SILT, SILTY SAND, (SM) gray (2.5Y 5/1), poorly graded, fine grained, moist	826.2	
			SILT WITH SAND, SANDY SILT, (CL-ML) gray (2.5Y 5/1), poorly graded, fine grained, moist		
50					

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CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50			51.5	816.7	
			52.0 POORLY GRADED SAND, SAND, (SP) gray (2.5Y 5/1), poorly graded, fine to medium grained, moist	816.2	
			SILT WITH SAND, SANDY SILT, (CL-ML) gray (2.5Y 5/1), poorly graded, fine grained, moist		Well Casing
					Bentonite Cement Slurry
60					
			64.0	804.2	
			64.5 FAT CLAY, CLAY, (CH) gray (2.5Y 4/1), dry, Shale fragment artifacts	803.7	
			66.0 SILT WITH SAND, SANDY SILT, (CL-ML) gray (2.5Y 5/1), poorly graded, fine grained, dry	802.2	
			SHALE, highly weathered, very thinly laminated, light gray (10B 8/1), dry, [Saginaw] Trace angular gravel inclusions. No scructure was retained, sample completely broken upon retrival.		
70			70.0	798.2	
			SHALE, moderately weathered, thinly bedded, dark gray (7.5YR 2.5/1), dry, [Saginaw] Alternating beds of consolidated shale and weathered shale.		
			76.0	792.2	
			SHALE, slightly weathered, thinly bedded, dark gray (7.5YR 2.5/1), dry, [Saginaw] Trace angular gravel		
80					
			89.0	779.2	
90			SHALE, slightly weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Interbedded black shale and sandstone. Unable to differentiate between drilling enduced fractures and naturally occuring.		
			100.0	768.2	
100			SANDSTONE, unweathered, massive, light gray (7.5YR 5/1), dry, [Saginaw]		
			102.0	766.2	
			SHALE, slightly weathered, thinly bedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Interbedded black shale and sandstone		
			105.0	763.2	Bentonite Chips

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
110			109.0 SHALE, moderately weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Majority black shale interbedded with sandstone. Highly weathered 105-106 with loose gravel. *(continued)* 759.2	Filter Pack
120			SHALE, highly weathered, thinly interbedded, dark gray with light gray (7.5YR 2.5/1), dry, [Saginaw] Core extreamly weathered upon retrival, clay content within breaks in core, angular/semi angular inclusions. Unable to identify natural fractures due to drilling method. 120.0 748.2	Well Screen

Bottom of borehole at 120.0 feet.

MW-7C

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 03/08/22 11:30 **COMPLETED** 03/08/22 16:00
GROUND ELEVATION 869 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
▽ **AT TIME OF DRILLING** 5.00 ft / Elev 864.00 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 5.20 ft / Elev 863.80 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 871.53 (ft) Casing Type: 2" Sch 40 PVC
			0.5 POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC) dark brown (7.5YR 2.5/2), fine grained, dry, topsoil fill	868.5	
			2.0 POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC-SM) brown (7.5YR 4/3), poorly graded, fine to medium grained, moist	867.0	
5			POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) brown (7.5YR 4/3), poorly graded, fine to medium grained, moist ▼		
			6.0 POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated	863.0	
10					
15			15.0	854.0	
			16.0 POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, medium to coarse grained, saturated	853.0	
			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated		
20					
25			25.0	844.0	Bentonite Cement Slurry Well Casing
			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated, Trace clay and gravel within sample		
30					
35					

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CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
35			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated, Trace clay and gravel within sample *(continued)*		
40					
				829.0	
			POORLY GRADED GRAVEL WITH SAND, SAND, (GP) gray (7.5YR 5/1), poorly graded, medium to coarse grained, saturated		
				827.0	
45			SILT, SILT, (ML) gray (7.5YR 5/1), dry, dense, non plastic, Trace sand and gravel		
50					
55					Filter Pack Well Screen
60					
				809.0	

40.0

42.0

60.0

Bottom of borehole at 60.0 feet.

MW-8

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 06/08/21 08:30 **COMPLETED** 06/08/21 09:45
GROUND ELEVATION 871.14 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 4.00 ft / Elev 867.14 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **92 HRS AFTER DRILLING** 6.46 ft / Elev 864.68 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 873.74 (ft) Casing Type: 2" Sch 40 PVC
	SS		1.0	870.1	
			POORLY GRADED SAND, (SP) dark yellowish brown (10YR 4/4), poorly graded, fine grained, dry, very loose		Bentonite Chips
	SS		4.0 ▽	867.1	
			POORLY GRADED SAND, (SP) brown (10YR 5/3), poorly graded, fine to medium grained, moist, very loose		
5			4.8	866.4	
	SS		POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (CH) yellowish brown (10YR 5/4), poorly graded, fine to medium grained, wet, loose		
			6.0	865.1	
	SS		▼ POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, medium dense		
			7.0	864.1	
	SS		CLAYEY SAND, SAND, (SP-SC) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, loose		
			7.8	863.4	
			8.0 POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), poorly graded, medium grained, wet, loose	863.1	
			9.0 CLAYEY SAND, CLAYEY SAND, (SP-SC) yellowish brown (10YR 5/4), poorly graded, fine to medium grained, wet, loose	862.1	
			9.5 FAT CLAY WITH SAND, SANDY CLAY, (SW-SC) grayish brown (10YR 5/2), poorly graded, fine grained, wet, loose	861.6	
10	SS		POORLY GRADED SAND, SILTY, (SP-SC) yellowish brown (10YR 5/4), poorly graded, fine to coarse grained, wet, loose		Silica Sand Filter Pack
			11.0	860.1	
	SS		POORLY GRADED SAND, (SP) dark yellowish brown (10YR 5/4), poorly graded, fine grained, wet, medium dense		Screen, 0.010" Slot Size
	SS				
15			15.0	856.1	
	SS		POORLY GRADED SAND WITH GRAVEL, GRAVELLY SAND, (SP) dark yellowish brown (10YR 5/4), poorly graded, fine to coarse grained, wet, loose		Endcap
			17.5	853.6	

Bottom of borehole at 17.5 feet.

MW-9

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 06/08/21 10:00 **COMPLETED** 06/08/21 11:00
GROUND ELEVATION 869.78 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 4.00 ft / Elev 865.78 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **96 HRS AFTER DRILLING** 5.54 ft / Elev 864.24 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 872.6 (ft) Casing Type: 2" Sch 40 PVC
			0.3 ORGANIC SOIL WITH SAND, (OH) dark yellowish brown (10YR 3/4), dry, medium dense	869.5	
			1.0	868.8	
	SS		POORLY GRADED SAND, (SP) yellowish brown (10YR 5/6), poorly graded, fine grained, dry, medium dense		
	SS		1.8 SILTY SAND, (SM) brown (7.5YR 4/4), poorly graded, fine grained, moist, loose	868.0	Bentonite Chips
	SS		4.0 ▽ SILTY SAND, (SM) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, loose	865.8	
5	SS		▼		
	SS		6.8	863.0	
	SS		7.0 FAT CLAY, (CH) yellowish brown (10YR 5/4), wet, medium stiff	862.8	
	SS		SILTY SAND, (SM) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, loose		
	SS		8.5 POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), poorly graded, fine to medium grained, wet, loose	861.3	
10	SS		10.5	859.3	Silica Sand Filter Pack
	SS		11.0 POORLY GRADED SAND WITH CLAY, (SP-SC) brown (10YR 5/3), poorly graded, fine grained, wet, medium dense	858.8	Screen, 0.010" Slot Size
	SS		POORLY GRADED SAND, (SP) brown (10YR 5/3), poorly graded, fine to medium grained, wet, loose		
	SS		12.5 SILTY SAND, (SM) brown (10YR 5/3), poorly graded, fine grained, wet, loose	857.3	
	SS		14.0 POORLY GRADED SAND, (SP) dark gray (10YR 4/1), poorly graded, fine to coarse grained, wet, loose	855.8	
15	SS				
	SS		17.0	852.8	Endcap

Bottom of borehole at 17.0 feet.

MW-10

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 06/08/21 11:30 **COMPLETED** 08/09/21 12:30
GROUND ELEVATION 873.43 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 8.00 ft / Elev 865.43 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **96 HRS AFTER DRILLING** 8.22 ft / Elev 865.21 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 875.65 (ft) Casing Type: 2" Sch 40 PVC
			1.0	872.4	
	SS		SILTY SAND, (SM) dark yellowish brown (10YR 4/6), poorly graded, fine grained, dry, loose		
			2.0	871.4	
			POORLY GRADED SAND, (SP) brown (10YR 5/3), poorly graded, fine to medium grained, dry, loose		
			3.0	870.4	
	SS		POORLY GRADED SAND, (SP) yellow (10YR 7/6), poorly graded, fine grained, dry, medium dense		Bentonite Chips
			4.0	869.4	
5			CLAYEY SAND, (SC) very dark grayish brown (10YR 3/2), poorly graded, fine to medium grained, moist, medium dense		
	SS		5.4	868.0	
			POORLY GRADED SAND, (SP) dark yellowish brown (10YR 4/6), poorly graded, fine grained, moist, medium dense		
			6.5	866.9	
			6.9	866.5	
	SS		SILTY SAND, (SM) gray (10YR 5/1), poorly graded, fine grained, moist, medium dense		
			POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), poorly graded, fine grained, moist, loose ▽		
10	SS				
			11.0	862.4	
	SS		POORLY GRADED SAND, (SP) brown (10YR 4/3), poorly graded, fine to medium grained, wet, medium dense		Silica Sand Filter Pack Screen, 0.010" Slot Size
	SS				
15					
	SS				Endcap
			18.0	855.4	
	SS		SILTY SAND, (SP) dark gray (10YR 4/1), poorly graded, fine grained, wet, medium dense		
			19.0	854.4	

Bottom of borehole at 19.0 feet.

MW-11

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 02/17/22 12:00 **COMPLETED** 02/17/22 14:00
GROUND ELEVATION 885.77 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 22.50 ft / Elev 863.27 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 10.29 ft / Elev 875.48 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 885.64 (ft) Casing Type: 2" Sch 40 PVC
			POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC-SM) light brown (7.5YR 4/3), poorly graded, fine to medium grained, dry, fill fill		Flush Mount
				883.8	
	SS		POORLY GRADED SAND WITH SILT AND GRAVEL, SILTY SAND, (SP-SC) dark brown (7.5YR 4/3), poorly graded, fine grained, dry		
				881.8	
5	SS		LEAN CLAY WITH SAND, SANDY CLAY, (SP-SC) brown (7.5YR 4/3), fine to medium grained, dry		
	SS				
	SS				Bentonite Chip
10	SS		▼		Well Casing
	SS				
				872.3	
			CLAYEY SAND, CLAYEY SAND, (SC) very dark brown (7.5YR 2.5/2), poorly graded, fine grained, moist	871.8	
15	SS		LEAN CLAY WITH SAND, SANDY CLAY, (SP-SC) brown (7.5YR 4/3), fine to medium grained, moist	870.3	
			FAT CLAY WITH GRAVEL, GRAVELLY CLAY, (CH) gray (7.5YR 6/1), medium to coarse grained, moist	869.8	
	SS		POORLY GRADED SAND, (SP) gray (7.5YR 6/1), poorly graded, coarse grained, moist	869.6	
	SS		FAT CLAY WITH SAND, SANDY CLAY, (CH) gray (7.5YR 6/1), fine grained, moist		
20	SS				Filter Pack
				863.8	
	SS		▽ POORLY GRADED SAND WITH GRAVEL, GRAVELLY SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to coarse grained, saturated		Well Screen
25	SS				
				859.9	
			SANDY SILT, SANDY SILT, (ML) brown (7.5YR 4/3), fine grained, saturated	859.8	
			Bottom of borehole at 26.0 feet.		

MW-11B

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 04/22/22 10:00 **COMPLETED** 04/26/22 14:00
GROUND ELEVATION 885.77 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic/PQ Core **EQUIPMENT**
▽ **AT TIME OF DRILLING** 22.00 ft / Elev 863.77 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 18.01 ft / Elev 867.76 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 885.58 (ft) Casing Type: 2" Sch 40 PVC
			CLAYEY SAND, (SC) brown (7.5YR 4/4), poorly graded, fine to medium grained, dry		
10					
			10.5	875.3	
			SANDY FAT CLAY, (CH) brown (7.5YR 4/4), fine to medium grained, dry		
			12.0	873.8	
			CLAYEY SAND, (SC) dark brown (7.5YR 3/2), poorly graded, fine to medium grained, dry		
			15.0	870.8	
			GRAVELLY FAT CLAY WITH SAND, (CL) gray (7.5YR 4/1), poorly graded, fine to coarse grained, dry		
20			▼		
			22.0 ▽	863.8	
			POORLY GRADED SAND, (SP) gray (10YR 5/1), poorly graded, medium to coarse grained, saturated		
			28.0	857.8	
30			POORLY GRADED SAND WITH SILT, (SM) gray (10YR 5/1), poorly graded, medium to coarse grained, saturated		
			34.0	851.8	
			SILTY SAND WITH GRAVEL, (SM) gray (10YR 5/1), poorly graded, fine grained, saturated		
40					
50					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
50			SILTY SAND WITH GRAVEL, (SM) gray (10YR 5/1), poorly graded, fine grained, saturated *(continued)*		
			53.0	832.8	
			CLAYEY SAND, (CH) dark gray (10YR 4/1), poorly graded, fine to coarse grained, saturated		
			57.0	828.8	Bentonite Seal
			POORLY GRADED SAND WITH SILT, (SM) dark gray (10YR 4/1), poorly graded, fine to coarse grained, saturated		Well Casing
60			61.0	824.8	
			GRAVELLY SILT, (ML) black (10YR 3/1), dry, Coal seam at 61'		
			65.0	820.8	
			(ML) SHALE, moderately weathered, light gray, dry		
70			70.0	815.8	
			SHALE, slightly weathered, dark gray, dry, Interbedded with light grey sandstone (1mm> thickness)		
			72.0	813.8	
			72.2 SANDSTONE, light gray, dry, Interbedded with dark grey/black shale, mostly Sandstone	813.6	
			73.5	812.3	
			73.9	811.9	
			74.5 SHALE, unweathered, dark gray, dry, No observable beds, trace light grey sandstone beds (1mm> thickness)	811.3	
			74.9	810.9	
			SANDSTONE, light gray, dry, Interbedded with shale, laminations are dipping.		
			SHALE, laminated, dark gray, dry		
			SANDSTONE, light gray, dry, Trace dark grey/black shale, pyrite deposit		
80			SHALE, moderately weathered, dark gray and light gray, dry, Transition from dark grey to light grey with depth, drop stone inclusions, brittle. Dipping fracture observed at 80' bgs.		
			83.0	802.8	
			83.5 SANDSTONE, light gray, dry, Interbedded with dark grey/black shale, variable bed thickness (1mm - 30mm)	802.3	
			86.0 SHALE, highly weathered, light gray, soft, damp	799.8	
			87.0 SHALE, unweathered, massive, dark gray, hard, dry	798.8	
90			SHALE, interbedded, dark gray and light gray, dry, Highly variable bed thickness (1mm - 30mm), approximatly 50/50 shale and sandstone, inclusions at 88'		
			92.5	793.3	
			SANDSTONE, unweathered, light gray, dry, Trace dark grey/black shale laminations		
			96.0	789.8	
			96.5 SHALE, unweathered, dark gray, hard, damp, Pyrite deposit observed at 96'	789.3	
100			SHALE, laminated, dark gray and light gray, dry, Observed inclusions and pyrite deposit at 99' and 106'		
			107.0	778.8	

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CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
			107.5 SHALE, completely weathered, black, soft, damp, Clayey silt with shale fragments, coal deposit *(continued)*	778.3	
			108.5	777.3	
110			SHALE, unweathered, black, hard, dry		
			SANDSTONE, dark gray and light gray, damp, Interbedded with shale, iron staining at 109', 110', 111', inclusions. Closed fracture observed at 111' bgs.		
			114.0	771.8	
			114.3 SHALE, completely weathered, gray, soft, dry, Brittle	771.5	
			SANDSTONE, light gray, fine, hard, damp, Well cemented, trace black shale beds		
120					
			122.0	763.8	
			122.5 SHALE, completely weathered, dark gray, dry, Clayey silt with shale fragments	763.3	
			SANDSTONE, light gray, fine, hard, damp, Trace black shale beds, poorly cemented sandstone at 123'		Filter Pack Well Screen
			126.0	759.8	
			127.0 SHALE, unweathered, massive, black, hard, dry, Coal seam observed at 126'	758.8	
			SANDSTONE, light gray, fine, hard, damp, Trace black shale beds, well cemented, pyrite deposit at 127.5'		
130					
			133.0	752.8	
			SANDSTONE, light gray, dry, Interbedded with black shale, approximatly 50/50 sandstone and shale		
			135.0	750.8	
			136.0 SHALE, massive, black, hard, dry	749.8	

Bottom of borehole at 136.0 feet.

MW-12

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 02/17/22 13:30 **COMPLETED** 02/17/22 18:00
GROUND ELEVATION 883.21 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 20.50 ft / Elev 862.71 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 13.54 ft / Elev 869.67 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 886.19 (ft) Casing Type: 2" Sch 40 PVC
	SS		CLAYEY SAND, CLAYEY SAND, (SC) brown (7.5YR 4/2), poorly graded, fine to coarse grained, dry, fill fill		
5	SS				
	SS			876.7	
	SS		FAT CLAY WITH SAND, SANDY CLAY, (CH) gray (7.5YR 4/1), fine to medium grained, moist		
10	SS			873.2	Bentonite Chip
	SS		POORLY GRADED SAND WITH SILT, SILTY SAND, (SM) brown (7.5YR 5/3), fine to medium grained, dry		Well Casing
	SS			870.7	
	SS		FAT CLAY WITH SAND, SANDY CLAY, (CH) gray (7.5YR 5/1), fine grained, moist ▼		
15	SS				
	SS				
	SS				
20	SS			863.5	
	SS		SANDSTONE, moderately weathered, massive, pale blue (10B 5/1), coarse, damp, [Saginaw] ▽	863.2	
	SS		POORLY GRADED SAND WITH GRAVEL, (SP-SM) brown (7.5YR 4/3), fine to medium grained, saturated		Filter Pack
25	SS				Well Screen
				858.0	
			SANDSTONE, slightly weathered, massive, pale blue (10B 5/1), coarse, wet, [Saginaw]	857.2	

Bottom of borehole at 26.0 feet.

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 03/03/22 14:00 **COMPLETED** 03/04/22 15:00
GROUND ELEVATION 883.6 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
▽ **AT TIME OF DRILLING** 20.00 ft / Elev 863.60 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 14.65 ft / Elev 868.95 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 886.27 (ft) Casing Type: 2" Sch 40 PVC
			POORLY GRADED SAND WITH CLAY, CLAYEY SAND, (SC) brown (7.5YR 4/3), poorly graded, fine to medium grained, dry, fill fill		
10				873.6	
			SILTY SAND, SILTY SAND, (ML) light brown (7.5YR 6/3), poorly graded, fine to medium grained, moist		
15			14.5 ▼	869.1	
			15.0 POORLY GRADED SAND, SAND, (SP) brown (7.5YR 4/3), poorly graded, medium to coarse grained, moist	868.6	
			POORLY GRADED SAND WITH SILT, SILTY SAND, (SM) dark brown (7.5YR 3/2), poorly graded, fine to medium grained, moist		
20			20.0 ▽	863.6	
			POORLY GRADED SAND, SAND, (SP) gray (7.5YR 5/1), poorly graded, fine to coarse grained, saturated		
			22.0	861.6	
			POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) gray (7.5YR 5/1), poorly graded, fine to medium grained, saturated		
25			25.0	858.6	
			25.2 SANDSTONE, unweathered, light blueish gray (10B 5/1), fine, dry	858.4	
			POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) gray (7.5YR 5/1), poorly graded, fine to medium grained, moist, Alternating layers of silty sand with gravel and competent sandstone		
30			30.0	853.6	
			31.0 ANTHRACITE COAL, moderately weathered, massive, black (7.5YR 2.5/1), damp	852.6	
			SHALE, moderately weathered, light gray (7.5YR 5/1), dry, [Saginaw] Color transitions to dark grey with depth, trace gravel		
35					
40					
45					

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CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
45			SHALE, moderately weathered, light gray (7.5YR 5/1), dry, [Saginaw] Color transitions to dark grey with depth, trace gravel *(continued)*		
50					Bentonite Cement Slurry
			51.0	832.6	
			SHALE, highly weathered, dark gray (7.5YR 4/1), damp, [Saginaw] Higher clay content, trace angular gravel and shale fragments.		Well Casing
			53.0	830.6	
55			SHALE, moderately weathered, bedded, light gray (7.5YR 7/1), dry, [Saginaw] 60-68' core washed out during initial extraction.		
60					
65					
			68.0	815.6	
70			SHALE, moderately weathered, massive, light gray (7.5YR 7/1), dry, [Saginaw] Sample was competent with no observable bedding.		
			72.0	811.6	
			SHALE, highly weathered, light gray (7.5YR 5/1), dry, [Saginaw] Sample coated clay derived from drilling process, black shale fragements within.		
75			75.0	808.6	
			SHALE, moderately weathered, laminated, gray (7.5YR 5/1), damp, [Saginaw] Unable to identify natural moisture due to drilling process		
80			80.0	803.6	
			80-90' sample was not recovered on the first attempt. Second attempt recovered 8' of sample consisting of drilling process derived clays and gravel.		
			82.0	801.6	
85			SHALE, moderately weathered, laminated, light gray (7.5YR 5/1), damp, [Saginaw] Moisture content unknown due to drilling process. Horiztonal breaks in core, unable to differentiate between natural breaks or drilling enduced.		
90					
95					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG		MATERIAL DESCRIPTION		WELL DIAGRAM
			98.0		785.6	
100			100.0	SHALE, highly weathered, light gray (7.5YR 5/1), dry, [Saginaw] Degree of weathering unknown due to drilling method, sample was recovered in extremely weathered state.	783.6	Bentonite Chip
				SHALE, No competent sample recovered on first attempt, upon second retrival attempt black shale fragments and pieces of interbedded black shale and sandstone were recovered. The driller noted indicate loss of drilling water at depth.		
105						
110						Filter Pack
						Well Screen
115			115.0		768.6	
			116.0	SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), dry, [Saginaw]	767.6	
			118.0	SANDSTONE, unweathered, light gray (10B 5/1), medium, dry, [Saginaw]	765.6	
120			120.0	SHALE, unweathered, bedded, light gray with black (10B 5/1), medium, Interbedded sandstone and shale, varved pattern	763.6	
				SHALE, moderately weathered, laminated, light gray (7.5YR 5/1), dry, [Saginaw]		
			124.0		759.6	
125			125.0	SANDSTONE, unweathered, light blueish gray (10B 5/1), fine, dry, [Saginaw] Sample structure was not retained during retrival. Sandstone fragments were brittle and poorly cemented.	758.6	

Bottom of borehole at 125.0 feet.

MW-13

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 02/14/22 11:30 **COMPLETED** 02/14/22 13:00
GROUND ELEVATION 869.09 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR SME **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT**
▽ **AT TIME OF DRILLING** 7.00 ft / Elev 862.09 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 6.30 ft / Elev 862.79 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0.0					Casing Top Elev: 871.8 (ft) Casing Type: 2" Sch 40 PVC
			ORGANIC SOIL WITH SAND, CLAYEY SAND, (SC) blackish brown, dry, topsoil fill		
			0.8	868.3	
			POORLY GRADED SAND WITH SILT, SILTY SAND, (SP-SM) dark brown (7.5YR 2.5/1), poorly graded, fine grained, dry		
2.5	SS				Bentonite Chip
			3.5	865.6	Well Casing
			FAT CLAY WITH SAND, SANDY CLAY, (CL) gray (5Y 5/1), fine grained, moist		
5.0	SS		5.1	864.0	
			POORLY GRADED SAND, GRAVELLY SAND, (SP) brown (7.5YR 5/4), poorly graded, fine to coarse grained, saturated		
			▼		
			▽		
7.5	SS				Filter Pack
					Well Screen
10.0	SS		10.0	859.1	
			POORLY GRADED GRAVEL, SANDY FAT CLAY, (GP) brown (7.5YR 5/4), poorly graded, coarse grained, saturated		
			10.5	858.6	
			POORLY GRADED SAND, SAND, (SP) brown (7.5YR 5/4), poorly graded, fine to medium grained, saturated		
	SS		12.0	857.1	
12.5			SILT WITH SAND, SANDY SILT, (SM) gray (7.5YR 5/1), poorly graded, fine grained, saturated		
			13.0	856.1	

Bottom of borehole at 13.0 feet.

MW-14

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/09/23 08:00 **COMPLETED** 01/09/23 13:00
GROUND ELEVATION 885.028 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
▽ **AT TIME OF DRILLING** 19.00 ft / Elev 866.03 ft
LOGGED BY Tanten Buszka **CHECKED BY**
▼ **AFTER DRILLING** 15.48 ft / Elev 869.55 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 884.594 (ft) Casing Type: 2" Sch 40 PVC
			SANDY LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, dry, stiff, low plasticity, Gravel noted at 10 - 15'		
15					Bentonite Chip Well Casing
				870.0	
			▼ SANDY LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, dry, loose, high plasticity		
			▽	866.0	
20			POORLY GRADED SAND, (SP) gray (GLEY 1 5/N), poorly graded, fine to medium grained, wet	865.0	
			SANDY LEAN CLAY, (CL) gray (GLEY 1 5/2), poorly graded, fine grained, wet, loose, low plasticity, Trace silt		Filter Pack Well Screen
25					
30				855.0	

15.0 — 19.0 — 20.0 — 30.0

Bottom of borehole at 30.0 feet.

MW-15

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/09/23 14:30 **COMPLETED** 01/09/23 18:00
GROUND ELEVATION 877.037 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
AT TIME OF DRILLING 6.00 ft / Elev 871.04 ft
LOGGED BY Tanten Buszka **CHECKED BY**
AFTER DRILLING 4.36 ft / Elev 872.68 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 880.237 (ft) Casing Type: 2" Sch 40 PVC
			0.2 SILTY SAND, (SM) dark brown (10YR 4/3), poorly graded, fine to medium grained, dry, Some organic sediment and roots	876.8	
			0.8 POORLY GRADED SAND, (SP) gray (10YR 5/1), poorly graded, fine to coarse grained, dry, iron oxide staining	876.2	
			CLAYEY SAND, (SC) brown (10YR 4/4), poorly graded, fine to medium grained, dry		Bentonite Chip
			4.0	873.0	Well Casing
5			POORLY GRADED SAND, (SP) dark brown (10YR 4/6), poorly graded, fine to medium grained, wet, loose		
			9.0	868.0	
10			SANDY LEAN CLAY, (CL) brown (10YR 4/6), poorly graded, fine to medium grained, wet		Filter Pack Well Screen
			14.0	863.0	
15			POORLY GRADED SAND, (SP) gray (10YR 5/1), poorly graded, fine to medium grained, wet, 12' - 14' Gravel (1-4 cm)		
			15.5	861.5	
20			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, wet, Trace gravel		
			20.0	857.0	

Bottom of borehole at 20.0 feet.

MW-16A

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/24/23 08:00 **COMPLETED** 01/25/23 16:00
GROUND ELEVATION 874.538 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Andrew Byks **CHECKED BY** TB
AFTER DRILLING ---
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 877.484 (ft) Casing Type: 2" Sch 40 PVC
			LEAN CLAY WITH SAND, (CL) brown (10YR 5/4), fine to medium grained, dry, stiff, Trace gravel		Bentonite Chip
5					Well Casing
10					
15					Filter Pack
				859.5	Well Screen
		15.0	LEAN CLAY WITH SAND, (CL) brown (10YR 5/4), fine to medium grained, moist, loose		
		19.0		855.5	
			POORLY GRADED SAND, (SP) gray (GLEY 1 5/N), fine to medium grained, wet		
20		20.0		854.5	
			SANDY LEAN CLAY, (CL) gray (GLEY 1 5/2), fine grained, wet, loose, Trace silt		
		22.0		852.5	

Bottom of borehole at 22.0 feet.

MW-16B

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/17/23 08:00 **COMPLETED** 01/25/23 12:00
GROUND ELEVATION 874.538 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - Initial borehole was 6" and reamed to 8" to accommodate additional well materials.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 877.492 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY ORGANIC SOIL, (OL) fine to medium grained, moist	874.0	
			LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel		
5					
			8.0	866.5	
			8.5 POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel	866.0	
			LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard		
10			10.5	864.0	
			POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated		
			12.0	862.5	
			LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel		
15					Bentonite Chip
					Well Casing
			17.0	857.5	
			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'		
20					
25					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
25			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28' *(continued)*		
			29.0	845.5	
			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel		
30			31.0	843.5	
			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.		
35					Filter Pack
					Well Screen
			38.0	836.5	
			Coal seam		
40			40.0	834.5	
			SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel		
			43.0	831.5	

Bottom of borehole at 43.0 feet.

MW-16C

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/17/23 08:00 **COMPLETED** 01/25/23 12:00
GROUND ELEVATION 874.538 ft MSL **HOLE DIAMETER** 7"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic/PQ Core **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - 8" borehole to 44' and 7" borehole to 67'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 877.485 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY ORGANIC SOIL, (OL) fine to medium grained, moist	874.0	
			LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel		
5					
			8.0	866.5	
			8.5 POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel	866.0	
10			LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard		
			10.5	864.0	
			POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated		
			12.0	862.5	
			LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel		
15					
			17.0	857.5	
			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'		
20					
25					Bentonite Chip
					Well Casing
			29.0	845.5	
			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel		
30					
			31.0	843.5	
			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.		
35					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
35			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand. *(continued)*		
			38.0	836.5	
			Coal seam		
40			40.0	834.5	
			SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), dry, contained coal fragments		
			43.0	831.5	
			SHALE, moderately weathered, laminated, black (10YR 3/1), dry, contained coal fragments		
			44.0	830.5	
45			SHALE, highly weathered, laminated, light gray (10YR 5/1), wet, fractured		
50			52.0	822.5	
			SHALE, moderately weathered, laminated, dark gray		
			54.0	820.5	
55			Coal Seam		
			56.0	818.5	
			SANDSTONE, moderately weathered, bedded, gray, wet, fractured		Filter Pack
60					Well Screen
			61.0	813.5	
			SHALE, highly weathered, interbedded, dark gray, wet, fractured. 1-3mm beds of sandstone		
			64.0	810.5	
65			SHALE, unweathered, bedded, black (7.5YR 2.5/1), dry		
			66.0	808.5	

Bottom of borehole at 66.0 feet.

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 01/17/23 08:00 **COMPLETED** 01/25/23 12:00
GROUND ELEVATION 874.538 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic/PQ Core **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - 8" borehole to 44', 7" borehole to 67', 6" borehole to 129'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 877.526 (ft) Casing Type: 2" Sch 40 PVC
			0.5 SANDY ORGANIC SOIL, (OL) fine to medium grained, moist	874.0	
			LEAN CLAY, (CL) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, loose, with Sand and Gravel		
5					
			8.0	866.5	
			8.5 POORLY GRADED SAND, (SP) brown (10YR 5/4), poorly graded, fine to medium grained, saturated, with Gravel	866.0	
10			10.5 LEAN CLAY, (CL) brown (10YR 6/4), poorly graded, fine to medium grained, saturated, hard	864.0	
			12.0 POORLY GRADED SAND, (SP) gray (10YR 6/1), poorly graded, fine to medium grained, saturated	862.5	
			LEAN CLAY, (CL) gray (10YR 7/1), poorly graded, fine grained, dry, hard, with Gravel		
15					
			17.0	857.5	
			LEAN CLAY, (CL) gray (10YR 7/1), well graded, fine to medium grained, saturated, loose, graded from top to bottom, gravel at 28'		
20					
25					
			29.0	845.5	
30			POORLY GRADED SAND, (SP) gray (10YR 7/1), poorly graded, fine to medium grained, saturated, with trace clay and gravel		
			31.0	843.5	
			SILT, (ML) gray (7.5YR 5/1), moist, hard, with fine sand.		
35					
			38.0	836.5	
			Coal seam		
40			40.0	834.5	
			SILT, (ML) gray (7.5YR 5/1), dry, dense, with fine sand and gravel		
			43.0	831.5	
			44.0 SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), dry, contained coal fragments	830.5	
45					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
45			SHALE, highly weathered, laminated, light gray (7.5YR 5/1), wet, fractured *(continued)*		
50					
			52.0	822.5	
			SHALE, moderately weathered, laminated, dark gray (7.5YR 4/1)		
			54.0	820.5	
55			Coal seam		
			56.0	818.5	
			SANDSTONE, moderately weathered, bedded, gray (7.5YR 4/1), wet, fractured		Well Casing
60					Bentonite Chip
			61.0	813.5	
			SHALE, highly weathered, interbedded, dark gray (7.5YR 4/1), wet, fractured. 1-3mm beds of sandstone		
			64.0	810.5	
65			SHALE, unweathered, bedded, black (7.5YR 2.5/1), dry		
			67.0	807.5	
			67.3	807.2	
			SHALE, highly weathered, bedded, dark gray (7.5YR 4/1), wet, vertical fractures, 70-71 interbedded with sandstone		
70					
			71.0	803.5	
			SANDSTONE, unweathered, massive, light gray (7.5YR 5/1), wet		
75			75.0	799.5	
			SHALE, unweathered, interbedded, dark gray (7.5YR 4/1), wet		
			78.0	796.5	
			SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), wet, fractured, pyrite deposits		
80					
			81.0	793.5	
			81.2	793.3	
			SHALE, unweathered, bedded, light gray (7.5YR 5/1), dry, alternating light and dark grey beds		
85					
			87.0	787.5	
			SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), wet, stone inclusions, packer test confirms presence of fractures, pyrite deposite (100')		
90					
95					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100			SHALE, slightly weathered, laminated, black (7.5YR 2.5/1), wet, stone inclusions, packer test confirms presence of fractures, pyrite deposite (100') *(continued)*		
105					
110					
115					
120					
			119.0	755.5	
			SHALE, highly weathered, bedded, light gray (7.5YR 5/1), wet, alternating light and dark grey shale		Well Screen
			122.0	752.5	Filter Pack
			123.0 SHALE, slightly weathered, laminated, dark gray (7.5YR 4/1), wet, fractured	751.5	
125			SHALE, moderately weathered, laminated, black (7.5YR 2.5/1), wet, fractured, pyrite deposit (126 to 127, and 128.5 to 129)		
			129.0	745.5	

Bottom of borehole at 129.0 feet.

MW-100A

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 05/08/23 00:00 **COMPLETED** 05/15/23 00:00
GROUND ELEVATION 879.939 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 879.77 (ft) Casing Type: 2" Sch 40 PVC
			0.5 CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	879.4	
			2.0 CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	877.9	
			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.		
5					
			7.0 SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.	872.9	
10					Bentonite Seal
					Well Casing
15					
20			20.0 CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.	859.9	
25					
30					Filter Pack
					Well Screen
			31.0 SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel	848.9	
35					
			36.0	843.9	

Bottom of borehole at 36.0 feet.

MW-100B

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 05/08/23 00:00 **COMPLETED** 05/15/23 00:00
GROUND ELEVATION 879.939 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - Initial borehole was 6" and reamed to 8" to accommodate additional well materials.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 879.74 (ft) Casing Type: 2" Sch 40 PVC
			0.5 CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	879.4	
			CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense		
			2.0	877.9	
			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.		
5					
			7.0	872.9	
			SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.		
10					
15					
20			20.0	859.9	Bentonite Seal
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.		Well Casing
25					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
25			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs. *(continued)*		
30					
				848.9	
			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel		
35					
				840.9	
			POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose		
40					
				838.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)		Filter Pack
				836.9	Well Screen
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs		
45					
				832.9	

Bottom of borehole at 47.0 feet.

MW-100C

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 05/08/23 00:00 **COMPLETED** 05/15/23 00:00
GROUND ELEVATION 879.939 ft MSL **HOLE DIAMETER** 7"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic/PQ Core **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - 8" borehole to 44' and 7" borehole to 67'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 879.72 (ft) Casing Type: 2" Sch 40 PVC
			0.5 CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	879.4	
			2.0 CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	877.9	
5			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.		
			7.0 SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.	872.9	
10					
15					
20			20.0 CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.	859.9	
25					Bentonite Seal
30					Well Casing
			31.0 SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel	848.9	
35					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
35			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel *(continued)*		
				39.0 / 840.9	
40			POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose		
				41.0 / 838.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)		
				43.0 / 836.9	
45			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs		
				47.0 / 832.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, dry, dense, some gravel		
50				50.0 / 829.9	
			SHALE, highly weathered, gray, dry, top 5 feet were drilled with sonic, structure is unknown.		
55					
				57.0 / 822.9	
			SHALE, moderately weathered, light gray, dry, 3" sandstone layer at 57 ft bgs. Large stones (2-6 inches) observed at 58 ft bgs.		
60				60.0 / 819.9	Filter Pack
			SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water.		Well Screen
65					
				67.0 / 812.9	

Bottom of borehole at 67.0 feet.

MW-100D

CLIENT Lansing Board of Water & Light
PROJECT NAME Erickson Power Station
PROJECT NUMBER 10173187
PROJECT LOCATION Eaton County, MI
DATE STARTED 05/08/23 00:00 **COMPLETED** 05/15/23 00:00
GROUND ELEVATION 879.939 ft MSL **HOLE DIAMETER** 6"
DRILLING CONTRACTOR Cascade **DRILLER**
GROUND WATER LEVELS:
DRILLING METHOD Sonic/PQ Core **EQUIPMENT**
AT TIME OF DRILLING ---
LOGGED BY Tanten Buszka **CHECKED BY** AB
AFTER DRILLING ---
NOTES Borehole drilled telescopically - 8" borehole to 44', 7" borehole to 67', 6" borehole to 129'. Bedrock was initially PQ cored then reamed out to 6".

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0					Casing Top Elev: 879.7 (ft) Casing Type: 2" Sch 40 PVC
			0.5 CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine to coarse grained, dry	879.4	
			2.0 CLAYEY SAND WITH GRAVEL, (SC) dark brown (10YR 4/1), poorly graded, fine to medium grained, dry, dense	877.9	
			CLAYEY GRAVEL WITH SAND, (CL) light brown (10YR 4/3), poorly graded, fine to coarse grained, dry, dense, iron oxide staining, white leached layer at 3.5 ft bgs.		
5					
			7.0	872.9	
			SANDY LEAN CLAY, (CL) gray (10YR 5/1), poorly graded, fine grained, dry, dense, consistency transitioned with depth lean to plastic near 18 ft bgs.		
10					
15					
20			20.0	859.9	
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, loose, trace silt, saturation began at 30 ft bgs.		
25					
30					

(Continued Next Page)

CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
30					
			31.0	848.9	
			SANDY SILT, (ML) gray (10YR 5/1), poorly graded, fine to medium grained, saturated, dense, trace gravel		
35					
			39.0	840.9	
			POORLY GRADED SAND, (SP) brown (10YR 4/2), poorly graded, fine to coarse grained, saturated, loose		
40			41.0	838.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, dense, trace gravel (2-6 mm)		
			43.0	836.9	
			CLAYEY SAND, (SC) gray (10YR 5/1), poorly graded, fine to coarse grained, saturated, loose, Coal seam at 47 ft bgs		
45					
			47.0	832.9	
			SILT WITH SAND, (ML) gray (10YR 5/1), poorly graded, fine to coarse grained, dry, dense, some gravel		
50			50.0	829.9	
			SHALE, highly weathered, gray, dry, top 5 feet were drilled with sonic, structure is unknown.		
55					
			57.0	822.9	◄Bentonite Seal ◄Well Casing
			SHALE, moderately weathered, light gray, dry, 3" sandstone layer at 57 ft bgs. Large stones (2-6 inches) observed at 58 ft bgs.		
60			60.0	819.9	
			SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water.		

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CLIENT Lansing Board of Water & Light **PROJECT NAME** Erickson Power Station

PROJECT NUMBER 10173187 **PROJECT LOCATION** Eaton County, MI

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
65			SHALE, moderately weathered, dark gray, dry, Weathered zones between 60 and 65 ft bgs contained water. *(continued)*		
70			70.5	809.4	
			SHALE, moderately weathered, laminated, black, dry, wet fractures and large number of pyrite deposits observed between 76 and 77 ft bgs.		
75			77.0	802.9	
			SHALE, unweathered, laminated, black, dry		
80			81.0	798.9	
			SHALE, moderately weathered, laminated, black, dry, pyrite deposits and moisture observed in fractures		
			84.0	795.9	
85			SHALE, unweathered, black, dry, 84-86.5 feet interbedded with sandstone		
90			90.0	789.9	
			Black, wet, Coal seam with abundance of pyrite deposites		
			92.5	787.4	
			SANDSTONE, unweathered, gray, wet, fractured with pyrite deposites		
95			94.5	785.4	
			SHALE, unweathered, black, dry, interbedded with sandstone, moisture observed in bedding planes		
			96.0	783.9	
			SHALE, unweathered, laminated, black, dry, fractures observed 97-100 feet bgs, moisture in fractured zone		

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DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
100			SHALE, unweathered, laminated, black, dry, fractures observed 97-100 feet bgs, moisture in fractured zone *(continued)*		
			100.0	779.9	
			SHALE, unweathered, laminated, black, dry, fractures observed 104-106 feet bgs, moisture and pyrite deposites observed in fractured zone		
105					
			106.0	773.9	
			SHALE, unweathered, laminated, black, dry, 112-117 feet bgs was cored twice, unable to identify natural fractures		
110					
115					
			117.0	762.9	
			SHALE, moderately weathered, laminated, light gray, dry, material between 119-121 feet bgs is soft and weak, moisture observed in fractured zone		Filter Pack
120					Well Screen
			121.0	758.9	
			SHALE, slightly weathered, laminated, light gray, dry		
125					
			125.0	754.9	
			SHALE, moderately weathered, laminated, black, dry, fractures with moisture observed over entire interval		
130			130.0	749.9	

Bottom of borehole at 130.0 feet.

1000 Oakbrook Dr.
Suite 200
Ann Arbor, MI 48104-6815
(734) 332-6300

hdrinc.com