Hometown People. Hometown Power.

November 27, 2020

Andrew Wheeler
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Via Email to wheeler.andrew@epa.gov

Re: Request of Site Specific Alternate to Initiation of Closure Due to Lack of Capacity Pursuant to 40 CFR 257.103(f)(1)

Dear Mr. Wheeler:

The Lansing Board of Water and Light (BWL) is submitting the enclosed request for a site-specific alternative deadline to initiate closure of CCR surface impoundments pursuant to 40 CFR 257,103(f)(1). The enclosed demonstration includes documentation that the criteria in paragraphs (i) through (iii) of 40 CFR 257.103(f)(1) have been met.

We appreciate EPA's consideration of this request. Please contact Ms. Cheryl Louden, 517-763-1465 or Cheryl.Louden@LBWL.com, if you have any questions or need additional information.

Sincerely,

Lori Myott
Manager, Environmental Services and Reliability Compliance Department
Lansing Board of Water and Light

Enclosed: Demonstration of Site Specific Alternate to Initiation of Closure Due to Lack of Capacity

Cc: Kirsten Hillyer, U.S. EPA [hillyer.kirsten@epa.gov]
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Demonstration of Site Specific Alternate to Initiation of Closure Due to Lack of Capacity
40 CFR §257.103(f)(1)

for Compliance with the Coal Combustion Residuals (CCR) Rule

Erickson Power Station

Prepare for: Lansing Board of Water and Light

Prepared by: HDR Michigan, Inc., Ann Arbor, Michigan

November 27, 2020

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Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

Lansing Board of Water & Light (BWL) is submitting this Demonstration to the U.S. Environmental Protection Agency (EPA) in order to obtain approval of an alternative site-specific date to initiate closure of the Erickson Power Station ("Erickson" or "Site" or "the Station"), located in the City of Lansing, Delta Township, Eaton County, Michigan.

BWL, with the assistance of HDR Michigan, Inc. (HDR), has been actively pursuing alternative disposal capacity options for CCR and non-CCR wastestreams at Erickson but is requiring extended use of the impoundments until the alternative capacity options selected can be brought online. To comply with CCR Rule at 40 CFR §257.103(f)(1) (Holistic Approach to Closure Part A, August 28, 2020), Erickson will have to make the following modifications:

- CCR streams will need to be segregated from non-CCR streams in the plant sump and rerouted to dedicated CCR treatment equipment or a dedicated compliant CCR surface impoundment or taken off-site.
- CCR streams will need to be treated to remove Total Suspended Solids (TSS) to a level acceptable for discharge as non-CCR waste stream and safe reuse as ash transport water or seal water makeup.
- Treatment of non-CCR flows will be required to provide water that is of a suitable quality for plant re-use. Cost effective options include the use of an existing, repurposed CCR impoundment or a new impoundment.

As certified in Section 3.0, Erickson is compliant with the requirements of the CCR Rule. Regular compliance activities, including required groundwater monitoring, are continuing. All required documents have been placed into the facility's Operating Record and posted on the publicly available website, with notice provided to the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

Potential alternative capacity options were identified, and the preferred alternative has been selected. An onsite treatment of CCR water in settling and surge tanks and new impoundments for non-CCR. Although still technically infeasible to complete by the April 2021 deadline, this option was selected by BWL and therefore is discussed further in this document as the selected alternate capacity.

This Report documents the efforts BWL has made and continues to make to obtain alternative capacity since it is infeasible for BWL to cease CCR and non-CCR wastestream disposal to the existing CCR impoundments until both a CCR tank treatment is constructed and the non-CCR wastestreams are rerouted to a newly constructed, lined impoundment. Given these projects and weather-driven impacts, those actions cannot be completed prior to April 11, 2021. Thus, the conditions at Erickson demonstrate that no alternative disposal capacity is available on-site or off-site, satisfying the requirement of 40 CFR §257.103(f)(1)(i)(A); therefore, BWL respectfully requests EPA establish the alternative deadline of May 25, 2023, for Erickson to cease all waste flows to the three active Coal Combustion Residual (CCR) impoundments: the Forebay, Retention Basin, and Clear Water Pond (CWP) and initiate closure of this coal combustion residual (CCR) unit.

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" or "the Station"), located in the City of Lansing, Delta Township, Eaton County, Michigan (Figure 1), is owned and operated by Lansing Board of Water and Light (BWL) and contains a single coal-fired generator. The CCR (bottom ash) generated at Erickson is stored in dewatering tanks (hydro-bins) and three active CCR impoundments: the Forebay, Retention Basin, and Clear Water Pond (CWP). A 33-acre impoundment was physically closed by removal of CCR in 2014 is now referred to as the Former Impoundment (Figure 2). The three active impoundments are subject to the CCR Rule.

In accordance with the recently revised 40 CFR, Part §257.103(f)(1) (85 FR 53561, August 28, 2020), BWL has prepared this demonstration to support a request for an alternative deadline to initiate closure and continue to receive CCR and non-CCR waste streams at the CCR impoundments based on an ongoing alternate capacity project at Erickson.

1.1 General Site Description and History

Erickson Station is owned and operated by BWL and is located at 3725 South Canal Road in Lansing, Michigan (Figure 1). Erickson was constructed in 1973 and contains one (1) coal-fired generator capable of producing 165 megawatts of electricity. Erickson currently operates three (3) active CCR surface impoundments, one (1) Former Impoundment, as well as monitoring a 44-acre on-site Lake Delta that is leased to Delta Township Parks and Recreation (Figure 2).

Erickson Station is fitted with hydro-bins that remove the majority of the CCR from the plant water effluent prior to being directed to the surface impoundment system. Fly ash is handled dry and collected in on-site silos. Both bottom and fly ash are hauled off-site for either beneficial use or disposal. Any CCR (bottom ash) remaining in the plant water after the hydro-bins is directed to the CCR surface impoundments for further treatment.

Erickson's three (3) CCR surface impoundments consist of the Forebay, Retention Basin, and CWP which together make up a 9½ -acre system designed to treat CCR and non-CCR flows prior to recirculation back to the plant where it is reused as plant water. Figure 2 provides an aerial site view of the CCR surface impoundment system.

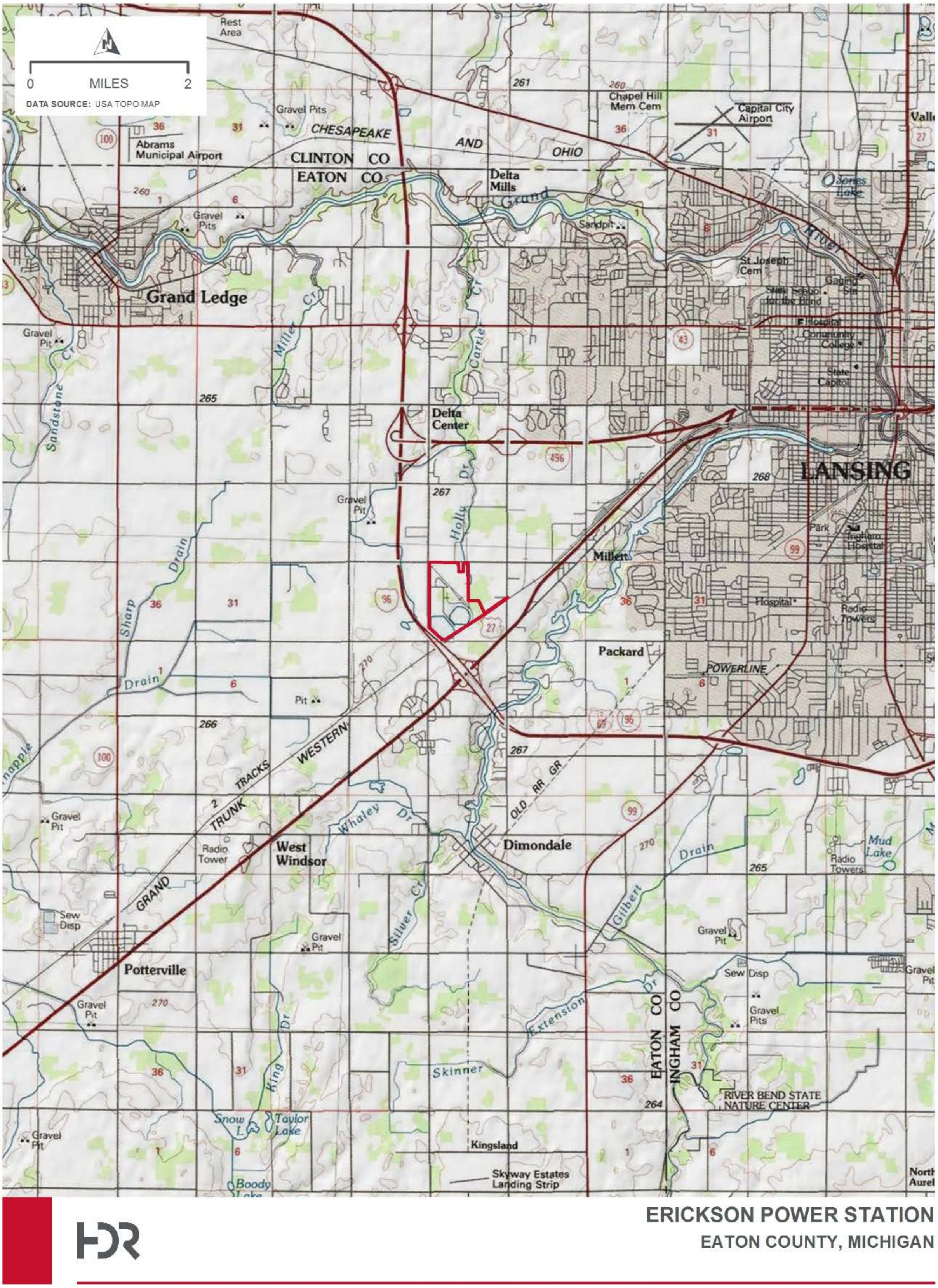


Figure 1. Site Location Map

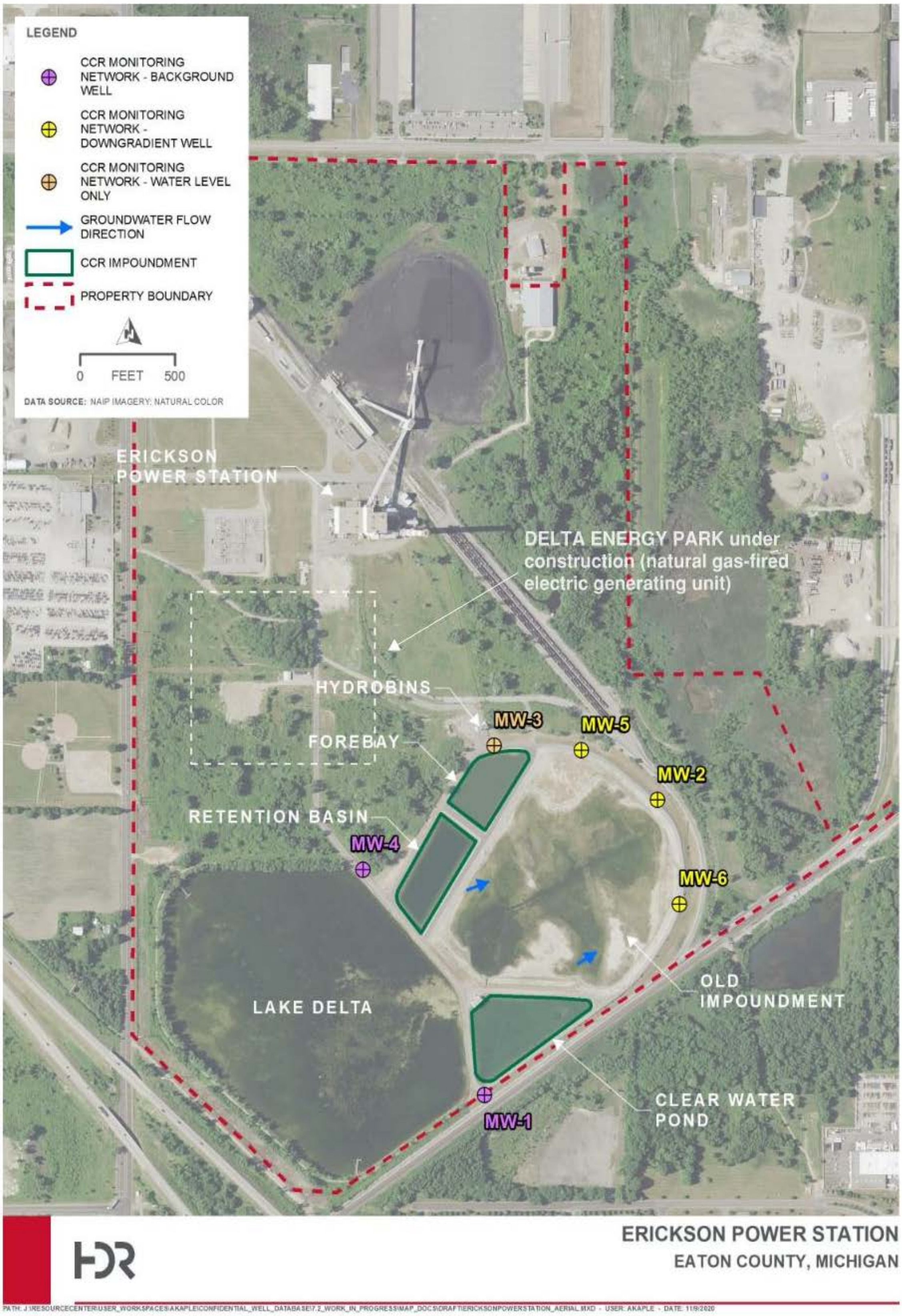


Figure 2. CCR Surface Impoundment System Aerial Site View

1.2 Current Operation

Erickson Station is a 165 megawatt electric power generation station consisting of one coal-fired boiler, designated as Unit 1. Unit 1 is equipped with a pulverized coal-fired furnace. Heavy ash produced during the operation of Unit 1 falls to a water-cooled hopper positioned beneath the boiler (Figure 3). The hopper is attached to the base of Unit 1 by a water-filled seal trough, which accommodates expansion of the boiler and provides an atmospheric seal for the furnace. Seal trough water is continuously drawn from the CWP and overflows to a floor sump within the plant.

Over a 24-hour period, under maximum continuous burn-rate conditions, approximately 2,250 tons of subbituminous Powder River Basin (PRB) coal is fed to the Unit 1 furnace. Upon combustion, approximately 5% of the coal is converted to ash and 20% of this ash is bottom ash (i.e., as much as 20-25 tons per day). During boiler operation, ash falls onto and then through quench water to the sloped sidewalls comprising the Unit 1 hopper. Seal-trough water is pumped from the CWP on-demand to maintain an ambient temperature within the hopper. The water volume in the plant sump is controlled by level-activated lift pumps that discharge directly to the Forebay of the CCR impoundment system.

Once daily, the accumulated contents of the bottom-ash hopper are evacuated to the hydro-bins. Quench water is withdrawn from each hopper pant leg, through clinker grinders and sluiced by venturi-nozzles. Pressurized water to feed the venturis is pumped from the CWP pump house.

The pulverized ash slurry is delivered through a 1,500 feet long, 10-inch diameter ductile-iron pipe to the hydro-bins system. A typical ash transfer takes approximately 30 minutes and delivers up to 60,000 gallons of ash water to the hydro-bins at a rate of approximately 2,000 gallons per minute (gpm). The hydro-bins system consists of two (2), 20-feet diameter, 29,920-gallon, open-top, conical-bottom, ash dewatering tanks. Hydro-bin operation requires that only one tank be filled at a time. While one tanks is filled, settled ash in the other tank is dewatered and emptied into trucks for disposal.

During filling operations, ash slurries are conveyed to the center of the top of the tank and discharged onto a bar screen. Coarse ash particles are diverted to the outside of the screen and toward the tank sidewalls; finer particles pass through the center of the screen and fall to the bottom of the tank. The coarser particles that have accumulated around the perimeter of the tank later serve to filter and trap finer particles as they are drawn toward sidewall-mounted decanting elements during ash dewatering operations.

During ash dewatering, water is slowly drawn from the settled ash through four (4) perimeter decanting elements. The open face of each decanter consists of a stainless steel screen (0.06-inch openings) that traps coarse particles. The rate of dewatering is sufficiently low to prevent fines from being drawn through the coarse particle layer and into the screens of the decanters. Ash dewatering in this manner produces a solid that is in a commercially-dry state suitable for off-site transport. The decant water drawn from the ash is discharged directly into the Forebay.

Up to three times per week, bottom ash solids are discharged from the bottom of a hydro-bin and into trucks for off-site disposal to an off-site permitted Type III landfill owned by Granger

Disposal Services or a third party. Up to 120 cubic yards of bottom ash is removed from the hydro-bins on a weekly basis.

After a truck is loaded with bottom ash solids the hydro-bin needs to be rinsed to ensure the four (4) perimeter decanting elements do not plug. The hydro-bin is filled with water from the CWP and the overflow is discharged directly to the Forebay. Rinsing occurs three (3) times per week; each time after a truck hauls away bottom ash solids.

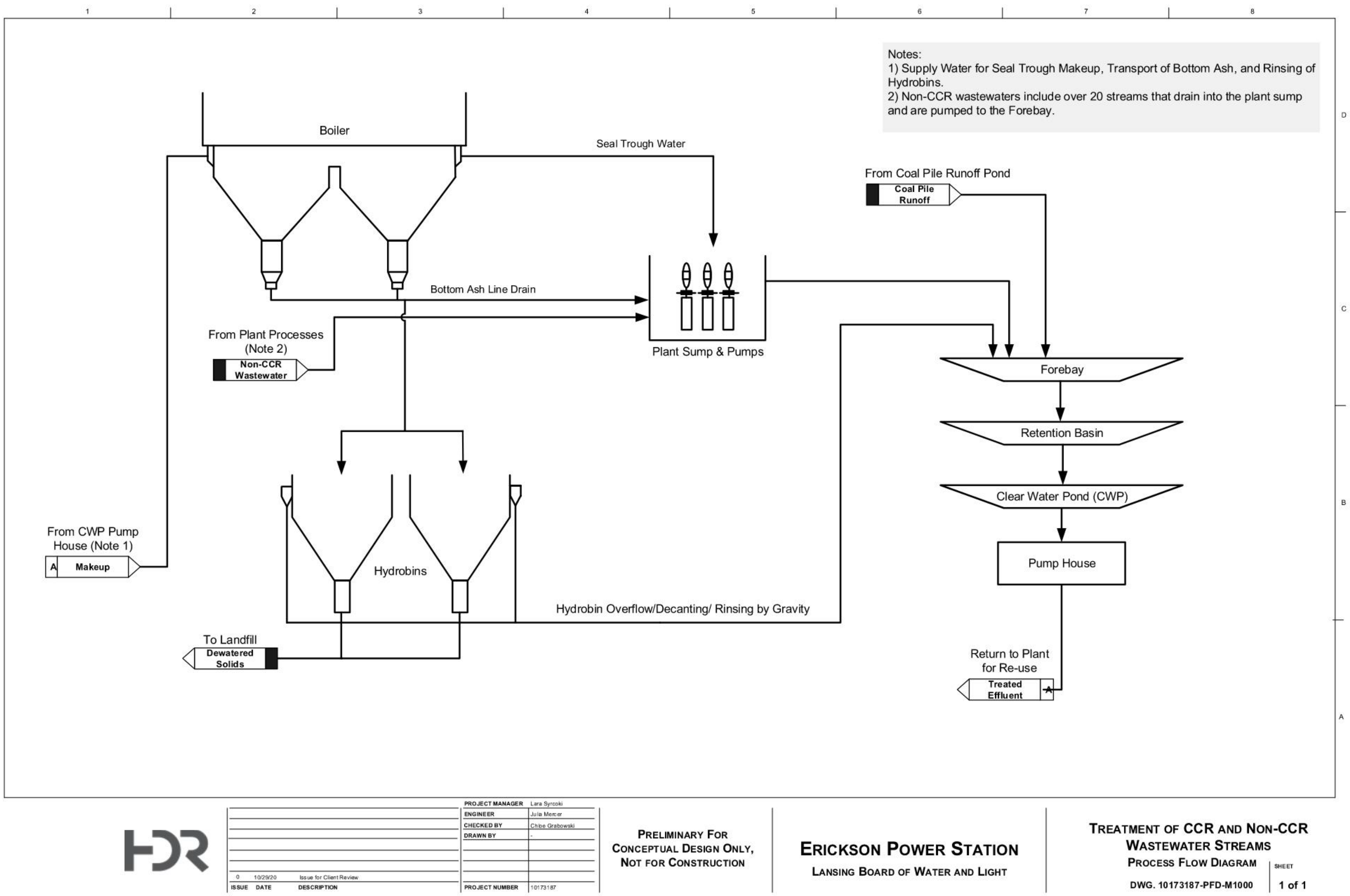


Figure 3. Existing Process Flow Diagram for CCR and non-CCR Wastewater at Erickson

Wastewater, including hydro-bin overflow, decant and rinse water, discharged to the Forebay flows from east to west through culverts at the northwest corner of the Forebay and allows drainage into the Retention Basin. Wastewater entering the Retention Basin also flows from east to west toward an overflow structure that empties into the CWP. As noted previously, water accumulated in the CWP is recycled back to the plant as: 1) seal trough water and 2) bottom ash transport water.

BWL has committed in their 2016 Strategic Plan, approved by the Board of Commissions, to permanently cease operation of the coal-fired boiler by December 31, 2025.

1.3 Description of CCR Surface Impoundments

Erickson has three CCR surface impoundments (listed in Table 1) that receive both CCR and non-CCR wastestreams. A description of the CCR surface impoundments is presented below. Figure 4 shows the surface impoundment system design layout. Per 40 CFR §257.53, each of the surface impoundments are defined as diked CCR surface impoundments because they were constructed using an embankment, berm, or ridge of either natural or man-made materials used to prevent the movement of liquids, sludges, solids, or other materials.

Erickson is unique because it operates its CCR surface impoundments essentially as zero discharge facilities. The CCR surface impoundment system is a closed loop system with evaporation and recirculation back to the plant.

1.3.1 Forebay

The Forebay is an irregularly shaped quadrangle approximately 475 feet long by 260 feet wide that provides a storage capacity of approximately 932,837 cubic feet. The Forebay is designated to capture the heaviest suspended particles allowing them to settle to the bottom of the impoundment. The basin consists of a clay-rich engineered fill, lined with a geosynthetic clay liner (GCL), overlain with a 40 mil thick polyvinylchloride (PVC) flexible membrane liner (FML). As described in the Impoundments Liner System Certification Pursuant to 40 CFR §257.71 (HDR 2020) (available on the BWL CCR Rule Compliance and Data Information web page), historic documentation does not indicate that the existing liner system beneath the Forebay was constructed in compliance with the criteria provided in 40 CFR §257.71(a)(1)(i) – (iii). As described in the Locations Restrictions Supplemental 40 CFR §257.60 (HDR 2020b) (available on the BWL CCR Rule Compliance and Data Information web page), the 2019-2020 groundwater monitoring data indicate that the base of the Forebay is not 5 feet above the uppermost aquifer.

Plant water flows via gravity from the Forebay to the Retention Basin through three (3) 24-inch diameter corrugate plastic pipes.

1.3.2 Retention Basin

The second surface impoundment is the Retention Basin. The Retention Basin is relatively rectangular in shape approximately 560 feet long by 260 feet wide and provides a storage capacity of 1,298,407 cubic feet. The Retention Basin is designated to provide a longer retention time to allow for the settlement of smaller suspended particles. Like the Forebay, the Retention Basin was constructed with a clay-rich engineered fill, lined with a GCL, overlain with a 40 mil thick PVC FML. As described in the Impoundments Liner System Certification Pursuant to 40 CFR §257.71 (HDR 2020), historic documentation does not indicate that the existing liner system beneath the Retention Basin was constructed in compliance with the criteria provided in 40 CFR §257.71(a)(1)(i) – (iii). As described in the Locations Restrictions Supplemental 40 CFR §257.60 (HDR 2020b), the 2019-2020 groundwater monitoring data indicate that the base of the Retention Basin is not 5 feet above the uppermost aquifer.

The Retention Basin discharges to the CWP through a 72-inch diameter pre-cast concrete overflow riser pipe structure at the Retention Basin's southern corner. At the bottom of the riser pipe structure lies a 36-inch diameter corrugated plastic pipe that directs flow to the CWP. The Retention Basin also has a 24-inch diameter emergency overflow pipe that discharges into the Former Impoundment. Under design conditions, no water flows to the Former Impoundment.

1.3.3 Clear Water Pond

The last of the surface impoundments is the CWP, which is triangular in shape with sides approximately 425 feet, 730 feet, and 640 feet in length and with an area of 189,200 square feet. The storage capacity is approximately 1,772,913 cubic feet. When the plant is in operation, water from the CWP is continuously recycled back to the plant at a rate of 3.8 million gallons per day (MGD) where it is recycled for bottom ash transport water, and seal trough water before being re-routed back to the Forebay for treatment. The CWP was constructed in 1970 (prior to the Forebay and Retention Basin) with a compacted clay liner to limit infiltration. As described in the Impoundments Liner System Certification Pursuant to 40 CFR §257.71 (HDR 2020), historic documentation does not indicate that the existing liner system beneath the CWP was constructed in compliance with the criteria provided in 40 CFR §257.71(a)(1)(i) – (iii). As described in the Locations Restrictions Supplemental 40 CFR §257.60 (HDR 2020b), the 2019-2020 groundwater monitoring data indicate that the base of the CWP is not 5 feet above the uppermost aquifer.

The primary discharge from the CWP is the pump house. The CWP also has an emergency outfall overflow structure on the northeast corner that discharges to a swale that flows north and east and eventually directs flow to Holly Drain. Holly Drain flows north to Carrier Creek which eventually drains to the Grand River (see Figure 1).

Table 1. Erickson CCR Surface Impoundment Summary

CCR Surface Impoundment	Year in Service	Impoundment Size (acres)	CCR Rule Compliant Liner?	Complies with Location Restrictions	Groundwater Status
Forebay	2014	2.76	No	<5 foot groundwater separation	One multiunit-Assessment Monitoring was initiated in November 2020. SSLs were identified for lithium November 2020. The Assessment of corrective measures will be initiated in December 2020.
Retention Basin	2014	3.73	No	<5 foot groundwater separation	
CWP	1970	5.74	No	<5 foot groundwater separation	

*SSLs = statistically significant levels of Appendix IV constituent(s) above site specific groundwater protection standards.

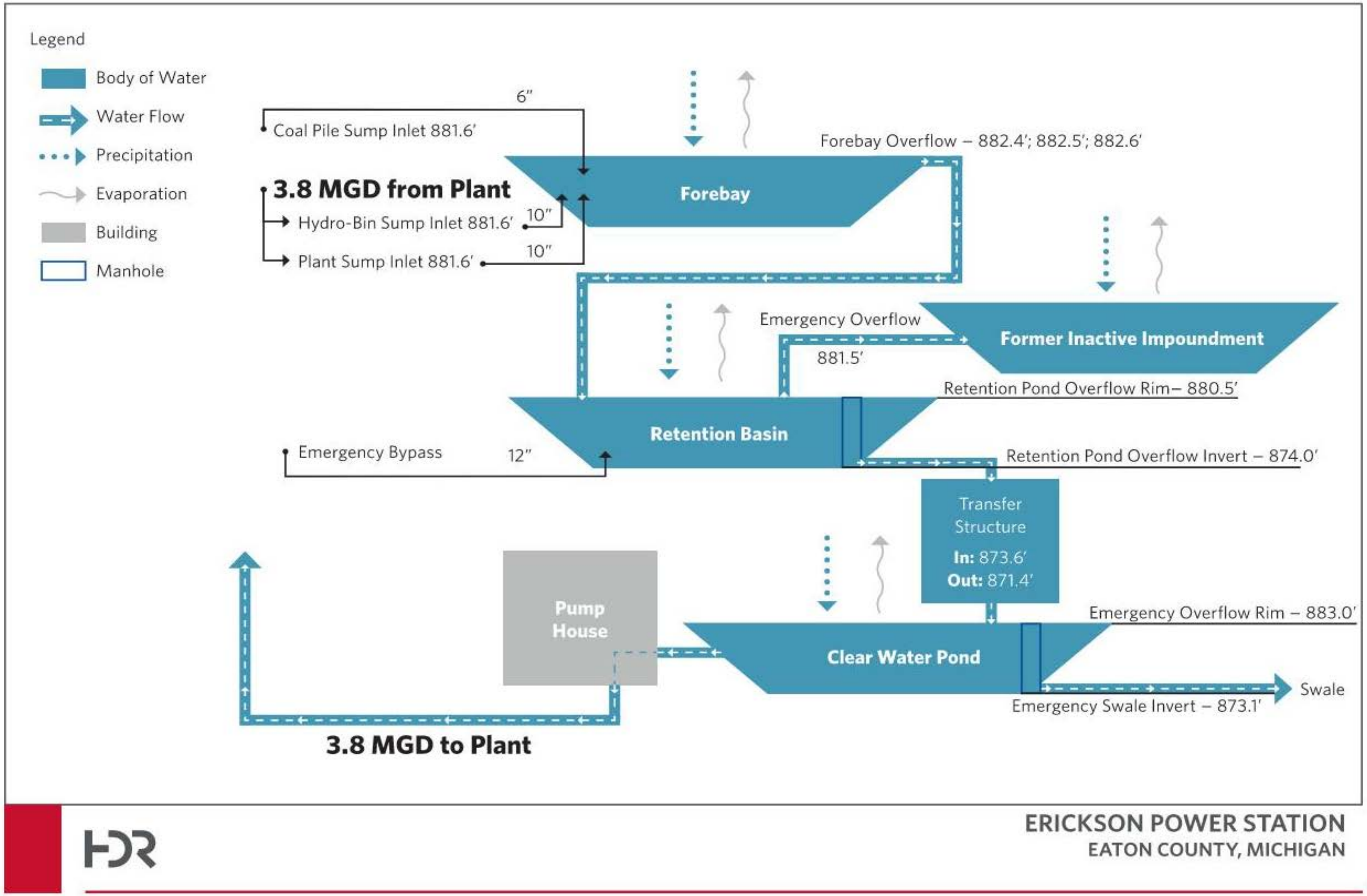


Figure 4. CCR Surface Impoundment System Design Layout

1.4 Description of Non-CCR Facilities

1.4.1 Former Impoundment

The Former Impoundment is 28 acres and was decommissioned in October 2014 with the removal of all CCR. The Former Impoundment clay liner remains. This decommissioning provided the necessary area to construct the current CCR surface impoundment system. The area surrounding the impoundments includes vegetated and paved areas with a top elevation of 886.5 feet that limits stormwater from entering into the impoundment system via overland flow. The Former Impoundment is not fitted with an outlet and the only discharge is from evaporation or flood emergency discharge through a culvert connected to the Retention Basin.

1.4.2 Lake Delta

Lake Delta is not a CCR impoundment. It is a man-made, 44-acre lake that is leased to Delta Township Parks and Recreation.

1.5 Regulatory Basis and Demonstration Summary

On August 28, 2020, the USEPA finalized rulemaking entitled *A Holistic Approach to Closure Part A: Deadline to Initiate Closure* (Federal Register, August 2020). The rule revisions include the following:

- Established a new deadline of April 11, 2021 for all unlined surface impoundments and those surface impoundments that failed the location restriction for placement above the uppermost aquifer to stop receiving waste and begin closure;
- Established procedures for facilities to obtain additional time to develop alternate capacity to manage their waste streams (both CCR and non-CCR) before they must stop receiving waste and initiate closure of their CCR surface impoundments or retrofit them;
- Changed the classification of compacted-soil-lined or clay-lined surface impoundments from "lined" to "unlined"; and
- Specified that all unlined surface impoundments are required to retrofit or close.

The Alternative Closure Requirements of the CCR Rule at 40 CFR §257.103(f)(1) (Holistic Approach to Closure Part A, August 28, 2020) (Final Rule) allow an owner or operator the ability to request a deadline extension for an existing CCR surface impoundment to continue to receive CCR if the owner or operator certifies that the waste streams must continue to be managed in the CCR unit because it is infeasible to complete the measures necessary to obtain alternative disposal capacity by the current Final Rule deadline (April 11, 2021). The owner may request the exact amount of time necessary to complete the measures to obtain alternate capacity (completed no later than October 15, 2023). Thus BWL is submitting this extension request to the EPA Administrator to continue to operate the CCR impoundments until approximately May 25, 2023.

BWL is proposing that an extension of the deadline for ceasing receipt of CCR and non-CCR waste streams at the Erickson CCR surface impoundments system be granted under the provisions of 40 CFR §257.103(f)(1) - *"Development of Alternative Capacity is Technically*

Infeasible ". As per the Final Rule, since the impoundments (separately and cumulatively) are smaller than 40 acres in size, the requested extension would allow for continued disposal operations beyond April 11, 2021 but would require cessation of waste placement by no later than October 15, 2023. In order to obtain this extension, a disposal facility owner or operator must submit a demonstration to USEPA for review and approval that includes the components in 40 CFR §257.103(f)(1)(iv)(A-B):

BWL as the facility owner and operator has prepared this demonstration to fulfill the requirements listed above with the supporting information organized as follows: Section 2.0 presents the on-site and off-site capacity infeasible assessment and proposed alternative capacity plan ("work plan"); and Section 3.0 presents the Erickson compliance status with the CCR Rule.

2.0 Alternate Capacity Plan Workplan

2.1 Site-Specific Conditions Supporting Alternative Capacity Approach – §257.103(f)(1)(iv)(A)(1)(i)

Immediately north of the Erickson Power Station CCR impoundments and Former Impoundment are jurisdictional wetlands. Further north is the ongoing construction of a natural gas plant that is intended to replace the coal-burning at Erickson. To the east of the impoundments is railroad tracks (owned by BWL) and additional jurisdictional wetlands beyond the tracks. Piping crossing the railroad tracks would require adequate overhead and side clearances in an insulated pipe rack configuration or under railroad track boring with associated permits, Michigan Department of Environment, Great Lakes, and Energy (EGLE), and Eaton County Drain Commission. To the west of the existing impoundments is Lake Delta. All piping from CCR and non-CCR waste streams treatment needs to be routed to the CWP pump house to recirculate flows to the plant.

The process for installation of new or repurposed wastewater impoundments (CCR or non-CCR) in Michigan requires permitting through the Michigan Department of Environment, Great Lakes, and Energy (EGLE). The process requires a Joint Permit Application to ensure permitting coverage if multiple divisions require review, for example the Waste and Water Resources divisions. The permitting process can take up to a full year.

BWL cannot cease the flow of CCR and non-CCR wastestreams and initiate closure of the CCR impoundments until both a CCR treatment is constructed and the non-CCR wastestreams are rerouted to a newly constructed, lined impoundment in the footprint of the Former Impoundment. Given these projects, weather-driven impacts, and the need to sequence the activities as shown in the schedules for each of the options considered, those actions cannot be completed prior to April 11, 2021. Thus, the conditions at Erickson Power Station demonstrate that no alternative disposal capacity is available on-site or off-site, satisfying the requirement of 40 CFR §257.103(f)(1)(i)(A), and BWL respectfully requests a site-specific extension of the deadline to initiate.

2.1.1 Impact to Plant Operations if Alternative Capacity Not Obtained – § 257.103(f)(1)(iv)(A)(1)(ii)

As mentioned previously, the three CCR impoundments are required to close based on the Final Rule. There is no technically feasible on or off-site alternative disposal capacity currently available at Erickson to manage the CCR and non-CCR flows that are discharged into the existing CCR impoundments.

Currently there is no dry method of handling CCR available and no other compliant CCR surface impoundment exists on-site that would provide an alternative wet handling option. Furthermore, the EPA clearly states in the CCR Rule that *"while it is possible to transport dry ash off-site to alternate disposal facility that simply is not feasible for wet-generated CCR."* Therefore, BWL has no current alternative wet handling alternatives available prior to April 11, 2021.

In addition to providing bottom ash management, the CWP portion of the existing impoundment system provides seal trough water for the boiler, which makes it impossible to continue operating the boiler if the CWP is taken out of service. For these reasons, retirement of the existing impoundment system before alternative disposal capacity is obtained would mean that the plant would not have a viable alternative source of seal trough water, and this would end the plant operation. BWL is currently building a new, cleaner gas plant to replace the coal burning plant. Until the new gas plant is fully on-line and operating consistently and reliably, coal burning is required to maintain electric capacity to the Lansing area.

If BWL were required to immediately cease placement of CCR and non-CCR wastes into the surface impoundments by April 11, 2021, then BWL would have to cease power production at the Erickson Station because no existing alternate disposal capacity is available on or off-site. BWL has a critical duty to reliably meet the electric service needs of its customers. BWL's Strategic Plan calls for an increase in renewable and natural gas-fired generating resources, in order to retire the Erickson Station by 2025. BWL is currently implementing its Strategic Plan by constructing the Delta Energy Park, which will include a new natural gas-fired electric generating unit. This new natural gas-fired unit must be on-line and reliably operating in order for the BWL to meet its customers' electric service needs in the absence of the Erickson Station. Put simply, if placement of CCR in the existing impoundment system must cease by April 11, 2021, BWL's customers would be placed at significant risk because the new natural gas-fired unit will not yet be on-line and operating reliably, and BWL would not be able to meet its customers' electric capacity needs under all conditions.

2.1.2 Options Considered Both On and Off-Site to Obtain Alternative Capacity

The Final Rule at 40 CFR §257.103(f)(1) (Holistic Approach to Closure Part A, August 28, 2020) allows an owner or operator the ability to request a deadline extension for an impoundment to continue to receive CCR beyond April 11, 2021. The Final Rule also requires that impoundments that contain ash must be clean closed appropriate for intended future use. The BWL has committed to permanently cease operation of the coal-fired boilers by December 31, 2025. Therefore, the Final Rule means that Erickson will have to make the following modifications:

- CCR streams will need to be segregated from non-CCR streams in the plant sump and rerouted to dedicated CCR treatment equipment or a dedicated compliant CCR surface impoundment or taken off-site.
- CCR streams will need to be treated to remove Total Suspended Solids (TSS) to a level acceptable for discharge as non-CCR waste stream and safe reuse as ash transport water or seal water makeup.
- All the impoundments (Forebay, Retention Basin and CWP) will have to be dewatered and cleaned of historic ash prior to repurposing or closure.
- Treatment of non-CCR flows will be required to provide water that is of a suitable quality for plant re-use. Cost effective options include the use of an existing, repurposed CCR impoundment or a new impoundment.

The BWL worked with an engineering consultant, HDR, to identify and evaluate the potential alternative capacity options for CCR and non-CCR flows at Erickson for continued coal combustion operations beyond the April 11, 2021 deadline. This evaluation initially identified nine (9) alternate capacity options for treatment and handling of CCR. Potential alternative capacity Options identified included:

- Option 1: Hauling all CCR water offsite,
- Option 2: Conversion to dry ash handling,
- Option 3: Onsite treatment of CCR water in settling and surge tanks and repurposed or new impoundments for non-CCR,
- Option 4: Onsite treatment of CCR water in mix tank and clarifier and repurposed or new impoundments for non-CCR,
- Option 5: Onsite treatment of CCR water submerged grind conveyor and repurposed impoundments for non-CCR,
- Option 6: Onsite treatment of CCR water in a CCR-Rule compliant impoundment and repurposed impoundments for non-CCR,
- Option 7: Pretreat and discharge bottom ash transport water to City sewer,
- Option 8: Onsite treatment of CCR water in mix tank and clarifier and Onsite treatment of non-CCR water in a mix tank and clarifier, and
- Option 9: Temporary (leased, tanks on rollers) onsite treatment of CCR water in tank(s) and clarifier and repurposed impoundments for non-CCR.

Options 1, 2, and 8 above were eliminated from further review as highly impractical. Subsequently, BWL further evaluated the remaining alternative capacity options for Erickson:

- Option 3: Physical Treatment of bottom ash water using settling and surge tanks
- Option 4: Physical/Chemical Treatment using tanks and a clarifier
- Option 5: Submerged grind conveyor for dry ash handling
- Option 6: Physical/Chemical Treatment of bottom ash water using a new CCR impoundment
- Option 7: Sewer Disposal of bottom ash water
- Option 9: Temporary tank system for bottom ash water treatment

A description of each of the options considered, including why none of them would meet the April 11, 2021 deadline, is addressed in Section 2.1.3.

2.1.3 Technical Infeasibility of Obtaining Alternative Capacity prior to April 11, 2021

Based on the physical site conditions at Erickson, stormwater management and the plant operation, BWL cannot cease the flow of CCR and non-CCR waste streams and initiate closure of the CCR impoundments until the CCR treatment plan construction is complete and the non-CCR waste streams are rerouted to a newly constructed, lined impoundment in the footprint of the Former Impoundment. Given these projects, weather-driven impacts, and the need to sequence the activities as shown in the schedule in Appendices A and B, those actions cannot be completed prior to April 11, 2021. BWL began its selected compliance project execution and is in the process of executing the preferred alternative. This work is in progress but has not yet been completed. It is not possible to procure the equipment, perform the necessary detailed design, receive state permit approvals, and complete the pre-outage construction activities over the course of the next six months.

Consequently, it is not possible to implement the measures discussed above by April 11, 2021. BWL made concerted efforts to review all options and determine if any could meet the deadline. The timeline associated with each of the options considered is discussed below.

After review of the initial nine (9) options, three (3) of the options (Options 1, 2, and 8) were eliminated as highly impractical. These alternatives were eliminated as a result of the following descriptions below in Sections 2.1.3.1-2.1.3.3. Subsequently, BWL completed the remainder of the alternatives analysis but completed a more detailed study of each of the remaining alternatives. Section 2.2 describes the *selected* alternate capacity and resulting extension request. The other options studied but *not selected* are described below in Sections 2.1.1.5 – 2.1.1.8.

2.1.3.1 VENDOR TO HAUL CCR WATER OFFSITE

The option would require contracting a trucking company to haul away approximately 954,000 gallons per day of plant CCR water under maximum conditions and 666,000 gallons per day under average conditions. Existing impoundments will continue to be needed to handle non-CCR flows. All 3 CCR impoundments would be clean closed through ash removal and in the footprint of the Former Impoundment a new non-CCR impoundment would be constructed. Given the volume per day, and assumed 4,000 gallon tanker trucks, it would require 239 truck trips (i.e. 10 trucks per hour, every hour of the day) each day under maximum conditions and 167 trucks per day under average conditions. Other facilities' CCR surface impoundments and wastewater treatment plants would not have the capacity to accept Erickson's CCR waste streams. In addition, municipal solid waste landfills, even if permitted to take bulk liquids, would not be able to handle this quantity of liquid waste. This effort is considered not technically feasible.

2.1.3.2 CONVERSION TO DRY-HANDLING

This option would require a significant retrofit to the boiler to produce dry bottom ash handling, and yet would still require another alternative capacity option for the remaining seal trough water CCR stream. Erickson hosted a representative from a dry-ash handling equipment supply company in 2020 to measure the boiler dimensions to determine suitability of different dry-handling technologies and to determine extent of boiler house structural changes needed. It was determined for this option that the boiler would have to be shut down for construction for an extended period and many structural changes would be required to be performed in the boiler itself and in the boiler house building. Such modifications include abandoning current soot blowers (boiler air compressors), penetrating walls, moving staircases, excavating underneath the boiler and moving piping. This option would require extensive modifications that are not feasible given the fact that the plant must be retired in 2025.

2.1.3.3 HANDLING CCR WATER AND NON-CCR WATER SEPARATELY IN TANKS (NO IMPOUNDMENTS)

This option would separate CCR streams from non-CCR streams and use tanks and clarifiers for treatment of both streams, and not include any impoundments. While this would allow the impoundments to not require repurposing, the tanks would allow much shorter retention time for treatment as compared to the impoundments. Currently it is estimated that the hydraulic retention time in the impoundments is approximately 10 days; with tanks and clarifiers hydraulic retention time would be a matter of hours. The shorter retention time in tanks may result in heat and chemistry cycling that could damage plant equipment. The possibility for corrosion, scale and deposition in the boiler and water transport pumps and piping is a safety risk that is exacerbated with a zero liquid discharge system as currently Erickson does not discharge wastewater from the site. This unknown was significant enough to take this option off the table from further consideration.

2.1.3.4 PHYSICAL TREATMENT OF BOTTOM ASH WATER USING SETTLING AND SURGE TANKS

BWL reviewed the option to install settling and surge tanks for treatment of CCR flows and non-CCR flows would be treated in a new non-CCR impoundment. Although still technically infeasible to complete by the April 2021 deadline, this option was selected by BWL and therefore is discussed further as the selected alternate capacity below in Section 2.2.

2.1.1.5 PHYSICAL/CHEMICAL TREATMENT USING TANKS AND A CLARIFIER

BWL developed an aggressive schedule for implementation of this option. This alternative would require design, construction and permitting for segregation and installation of necessary CCR stream rerouting with new sump and lines. It would require design and construction of mixing and flocculation tanks with associated chemical dosing equipment. It would also require design and construction of clarifier and mixed equalization tank and ancillary tanks and pumps. In addition, this alternative includes design, construction, and permitting of the non-CCR impoundment for treatment and piping effluent to the Pump House to recirculate flows back to the plant. Given the schedule of tasks required for the design, procurement, construction, and permitting for the non-CCR impoundment and tanks and clarifier for the CCR treatment, flows would completely cease disposal in the existing CCR impoundments by approximately May 25, 2023. To expedite the process as much as feasible, BWL would concurrently design and construct the CCR treatment, in this case the tanks and clarifier, and the non-CCR impoundment. While this alternative is feasible for Erickson, this schedule (Appendix B) demonstrates that it is infeasible for this alternate capacity option to meet the April 11, 2021 deadline for both CCR and non-CCR flows.

2.1.1.6 SUBMERGED GRIND CONVEYOR FOR DRY ASH HANDLING

This alternative would require two separate treatment technologies for CCR water; seal trough water would be directly recirculated via tanks and pumps after being processed through a heat exchanger and bottom ash would be transferred to a concrete dewatering bunker after being transported from the boiler through the submerged grind conveyor. Ash dewatering water would be collected and recycled through a heat exchanger before taken back to the boiler. In addition, this alternative includes design, construction, and permitting of the non-CCR impoundment for treatment and piping effluent to the pump house to recirculate flows back to the plant. To expedite the process as much as feasible, BWL would concurrently design and construct the CCR alternate capacity treatment, in this case use of a submerged grind conveyor, at the same time as the non-CCR impoundment. Given the schedule of tasks required, CCR and non-CCR flows would completely cease disposal in the existing CCR impoundments by approximately May 25, 2023. All of the options involve construction of a new impoundment for non-CCR streams, and this construction represents the limiting factor on all of the timelines. A schedule is not displayed for the CCR treatment alternative because this alternative would take longer than the tank options described above and cost more. Therefore this alternative did not have enough benefits relative to the other CCR tank treatment alternatives to continue with the more detailed scheduling. While this alternative is feasible for Erickson, the schedule (Appendix B) demonstrates that it is infeasible for this alternate capacity option to meet the April 11, 2021 deadline for both CCR and non-CCR flows.

2.1.1.7 PHYSICAL/CHEMICAL TREATMENT OF BOTTOM ASH WATER USING A NEW CCR IMPOUNDMENT

This alternative would require design, construction and permitting for segregation and installation of necessary CCR stream rerouting with new sump and lines. It would require design and construction of mixing and flocculation tanks with associated chemical dosing equipment. It would also require design and construction of the CCR impoundment including raising the bottom of the impoundment to be 5 feet minimum above the water table, a 2 feet recompacted clay linter with hydraulic conductivity of $1x10^{-7}$ cm/sec or less, a 60-mil HDPE liner or suitable alternative and a 6-inch layer of fill sand to provide a buffer to prevent damage to the liner. In addition this alternative includes design, construction, and permitting of the non-CCR impoundment for treatment and piping effluent to the pump house to recirculate flows back to the plant. Given the schedule of tasks required to design, construct and permit, the CCR impoundment and non-CCR impoundment would be completed and put into service on May 25, 2023. This schedule is shown in Appendix B. To expedite the process as much as feasible, BWL would concurrently design and construct the non-CCR impoundment and the new CCR impoundment. While this alternative is feasible for Erickson, this schedule (Appendix B) demonstrates that it is infeasible for this alternate capacity option to meet the April 11, 2021 deadline for both CCR and non-CCR flows.

2.1.1.8 SEWER DISPOSAL OF BOTTOM ASH WATER

The water quality sampling confirmed that seal trough water meets all Delta Township Wastewater Treatment Plant limits without treatment. Bottom ash does not meet Delta Township Wastewater Treatment Plant limits for TSS but meets all other criteria. Therefore bottom ash water under this alternative would require suspended solids removal prior to discharging to the sewer. It is anticipated that the use of a settling tank could remove solids. An additional evaluation would be required to confirm that the target TSS is achievable without chemical addition. Seal trough water would be directly recycled for reuse at the plant. A transfer tank would be required to collect the seal trough overflow and feed the pumps for return to the seal trough for re-use. In addition a heat exchanger will need to remove heat from the cycled stream to protect the boiler internals, and instrumentation and controls would be required as needed to support operations and monitor system performance. Makeup water would be required from Lake Delta or the CWP Pump House to the transfer tank to account for system losses and ensure the seal trough always has sufficient water. Publicly available municipal wastewater treatment disposal fees were used to estimate that discharge to the city sewer would cost approximately $201,000/year. In this option, non-CCR flows would be segregated and a non-CCR impoundment would be designed, constructed and permitted.

A schedule is not displayed for this CCR treatment and sewer disposal alternative because this alternative requires more tanks and treatment streams than the other CCR treatment alternatives. Given the schedule of tasks required to design, construct and permit, the treatment for sewer disposal and non-CCR impoundment would be completed and put into service May 25, 2023. Therefore this alternative did not have enough benefits to continue with the more detailed Gantt scheduling. While this alternative is feasible for Erickson, the schedule demonstrates that it is infeasible for this alternate capacity option to meet the April 11, 2021 deadline for both CCR and non-CCR flows.

2.1.1.9 TEMPORARY TANK SYSTEM FOR BOTTOM ASH WATER TREATMENT

BWL worked with vendors to determine temporary options to meet the April 11, 2021 deadline. These are treatment tanks for the treatment of CCR flows; however the difference between this option and the tank options described above are that the tanks are on rollers, they are leased, have designated monthly or per gallon charges, and where the equipment returns to the vendor at the end of the lease period, resulting in a slightly faster implementation for CCR flow treatment and a higher financial burden. BWL developed an aggressive schedule for implementation of this option in coordination with vendors. This alternative would require balance of plant engineering design around the temporary equipment including design, construction and permitting for segregation and installation of necessary CCR stream rerouting with new sump and lines. It would require design and construction of surge or equalization tanks. It would require design and construction of coagulation and flocculation tanks with associated chemical dosing equipment. Finally it would require interconnecting support pumps and pipes to connect to the rental equipment. In addition this alternative includes design, construction, and permitting of the non-CCR impoundment for treatment and piping effluent to the CWP Pump House to recirculate flows back to the plant. Given the tasks required to design, construct and permit, the temporary CCR treatment tanks and the non-CCR impoundment would be completed and put into service on May 25, 2023. This schedule is shown in Appendix B. To expedite the process as much as feasible, BWL would concurrently design and install the temporary (rental equipment) CCR treatment process and the non-CCR impoundment. While this alternative is feasible for Erickson, the schedule (Appendix B) demonstrates that CCR flows would cease disposal in the existing CCR impoundment in October 2021 and non-CCR flows in May 2023; therefore it is infeasible to meet the April 11, 2021 deadline. Therefore the significantly higher costs associated with the temporary system would not significantly benefit the CCR impoundment operation and potential for impact to groundwater, which is the ultimate objective (the selected alternative will cease disposal of both CCR and non-CCR to existing impoundments by May 25, 2023).

2.1.4 Justification for Time Needed to Complete Development of Alternative Capacity Approach - § 257.103(f)(1)(iv)(A)(1)(iii)

The schedule for developing the selected alternative disposal capacity is described in more detail in Sections 2.2 and 2.3. The milestones for progress of the selected alternative are summarized in Table 2-6 below. BWL is requesting an alternative site-specific deadline to cease disposal of May 25, 2023, for the CCR surface impoundments system, to allow for the continued placement of CCR and non-CCR waste streams in the CCR surface impoundments system while the new treatment system and non-CCR impoundment are completed.

The primary factor affecting the compliance schedule at Erickson is the ability to manage CCR and non-CCR wastestreams throughout construction in a way that allows the plant to continue to operate and recycle the wastewaters to ensure no offsite wastewater discharge occurs and to meet the plant water quality requirements for wastewater recycling; namely that adequate boiler contact water quality is produced for continued safe boiler operation.

2.2 Alternative Capacity Selected Option

The selected alternative capacity option was to use Option 3: Settling and Surge Tanks to capture CCR streams so they can be directly reused in the plant. This option will not comingle the treated CCR water with the existing impoundments or with new non-CCR impoundment (process water impoundment). This option will segregate CCR contact water from non-CCR contact water for the remainder of the plant life. A process flow diagram is provided as Figure 5. It requires construction of a water treatment plant for CCR streams and a new non-CCR process impoundment for non-CCR streams. Use of surge and settling tanks does not require chemical feed systems but will require a new sump to capture bottom ash line drain water, seal trough water as well as new pumps and lines to sluice CCR streams to the new settling and surge tanks and to return dedicated discharge flows back to the seal trough and bottom ash sluicing operations.

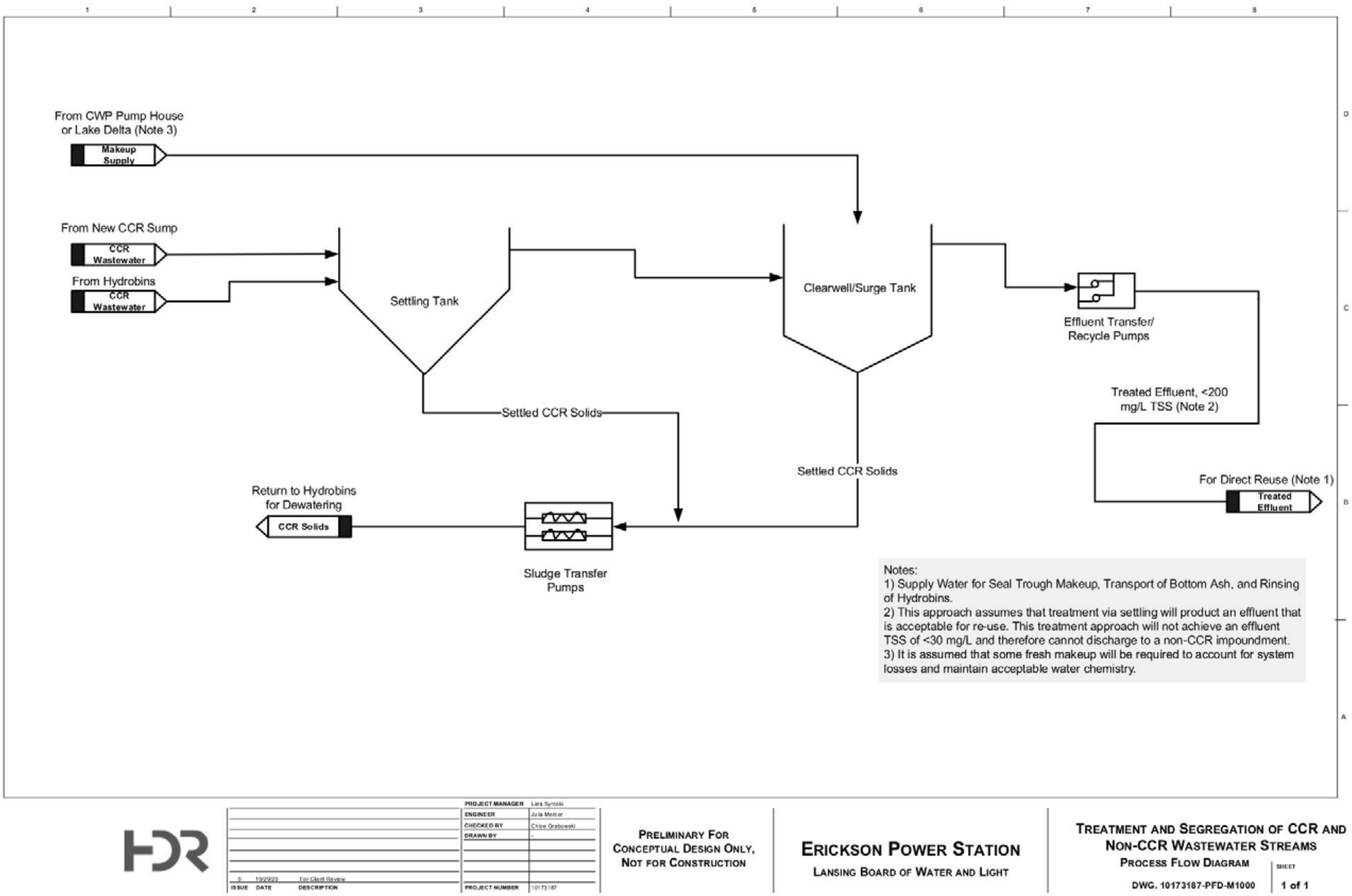


Figure 5. Process Flow Diagram for the Selected Alternate Capacity (Option 3) for Erickson that will be installed- Settling and surge tanks for CCR wastewater treatment. Non-CCR flows will go to a newly constructed non-CCR impoundment.

BWL developed an aggressive schedule for implementation of this option. This alternative would require design, construction and permitting for segregation and installation of necessary CCR stream rerouting with new sump and lines. It would also require design and construction of settling and surge tanks and ancillary pumps.

In addition, this alternative includes design, construction, and permitting of the non-CCR impoundment for treatment and piping effluent to the CWP pump house to recirculate flows back to the plant. Given the schedule of tasks required to design, construct and permit, the non-CCR impoundment would be put into service on May 25, 2023. This schedule is shown in Appendix A and is the same schedule for non-CCR impoundment development for all of the options. To expedite the process as much as feasible, BWL would concurrently design and construct the CCR alternate capacity treatment, in this case using settling and surge tanks (Option 3) to meet the direct reuse objective for discharge flows in boiler for ash transport water and seal trough water (200 mg/L Total suspended solids (TSS) or less). The schedule for design, construction, permitting and vendor requirements would allow for tank system testing between July 20 and August 10, 2022.

While this alternative is feasible for Erickson and is selected, the schedule (Appendix A) demonstrates that, like all other options, it is infeasible for this alternate capacity option to meet the April 11, 2021 deadline for both CCR and non-CCR flows.

Site specific conditions that led to the decision of the selected option were as follows:

- The hydro-bins function well to remove the bulk of the bottom ash solids. It was desired to continue operations of the hydro-bins to remove the bulk of the bottom ash solids so only solids polishing would be required for water reuse.
- The hydro-bins are located approximately 1,500 feet from the boiler and the CWP Pump House is approximately 2,500 feet from the boiler. It is desirable to minimize long piping distances of new piping lines for safety. With this option the current sluicing lines to the hydro-bins will be maintained and only new return CCR treatment discharge piping would need to be constructed (approximately 1500 feet one-way back to the plant).
- Location of the settling and surge tanks could be constructed near the hydro-bins assuming any necessary wetland permits are obtained. Due to the new gas plant construction onsite and footprint restrictions near the Unit 1 boiler, there was more available footprint for equipment near the hydro-bins.
- Hydro-bin discharge was tested through the consulting engineer’s laboratory treatability study that chemical dosing could augment solids settling if necessary. This option would have the ability to add chemical dosing if needed to treat water to achieve boiler return water quality standards. There is footprint available to add chemical dosing if needed in the footprint near the hydro-bins.

2.3 Detailed Visual Alternative Capacity Schedule – § 257.103(f)(1)(iv)(A)(2)

The required visual timeline representation of the schedule is included in Appendix A of this demonstration and described further in Section 2.4 below.

2.4 Narrative Description of Alternative Capacity Schedule – §257.103(f)(1)(iv)(A)(3)

2.4.1 CCR Treatment Facility

To address the cessation of using the three CCR surface impoundments at Erickson, as required by the Final Rule, new settling and surge tanks will be constructed to manage CCR wastestreams. The critical tasks necessary to implement this project, along with an estimated and approximate timeframe for completing those tasks, is provided below.

2.4.1.1 ENGINEERING DESIGN AND DATA COLLECTION

The engineering and design phase will take approximately seven (7) months from the decision on the preferred alternate to complete. This includes:

- Engineering and design of the tanks and ancillary equipment,
- Survey
- Geotechnical data acquisition and design of foundation for equipment
- Wetlands delineation and data gathering,
- Structural, electrical , mechanical d, and process design for rerouting of lines and design of new sumps
- Site grading plans, and stormwater management controls.
- Evaluation of flocculant/ coagulant injection

To further explain, BWL began evaluations for the tanks, pumps and ancillary equipment with preliminary process and mechanical design and determined what supplemental investigations and data collection were determined necessary. In parallel, the water sampling campaign as well as a laboratory treatability study analysis is underway to determine appropriate equipment, flocculant/coagulant types and ratios for treatment, and associated resultant effluent expectations. This analysis was further used to determine in-plant alterations necessary as well as to determine preliminary equipment sizing for pumps and piping and tanks. In addition, expected solids dewatering operations for bottom ash fines removal such as disposal into the hydro-bins, dewatering in a bunker and dewatering in a permanent or rental filter press were considered. In areas where design elements could proceed in parallel, efforts have been made to do so. The iterative design process is necessary to ensure that the process, structural, mechanical, electrical, and operational aspects of the overall performance needs are met.

2.4.1.2 EQUIPMENT PROCUREMENT

The major equipment procurement process requires development of specification, preparation of bid packages, issuance of bid packages to vendors, vendor responses, negotiation and contract award, equipment fabrication by the vendor all prior to equipment delivery. Consistent with BWL's internal mandates and in the pursuit of the most cost-competitive pricing, BWL will obtain multiple competitive bids for the design and wastewater treatment systems and equipment. Following bid issuance and prior to vendor selection, time is needed for activities including, but not limited to, finalizing of the design basis, preparation of bid package with drawings, pre-bid meetings, vendor document review, clarifications, bid submittals, and potentially vendor interviews. This phase requires over a year from design through equipment delivery.

2.4.1.3 CONSTRUCTION PROCUREMENT

Consistent with BWL's internal mandates and in the pursuit of the most cost-competitive pricing, BWL will obtain multiple competitive bids for the design, site/civil construction, and concrete work.

A contractor bidding package and procurement documents will be developed, and the completed bid package will be issued by BWL for bid. Following bid issuance and prior to contractor selection, substantial time is needed for activities including, but not limited to, finalizing of the design basis, preparation of bid package with drawings, pre-bid meetings, contractor document review, clarifications, bid submittals, and contractor interviews. This phase requires approximately six (6) months to complete.

2.4.1.4 CONSTRUCTION ACTIVITIES

The approximate time to complete construction of the surge and settling tanks treatment plant is approximately 12 months. This includes three months break for winter (December through February). This timeframe spans from the time a contract is awarded to an equipment vendor, during equipment fabrication and through construction.

The construction activities portion includes the vendor submittals required before vendor procures raw materials for fabrication of pumps and tanks. After agreed upon vendor submittals, raw materials are procured and fabricated in the equipment vendors' shop. Equipment is then delivered to the site and erected. Before construction can occur BWL must also procure a contractor to install the equipment per the construction package instructions. The contractor would be responsible for the site clearing and excavation, site grading, local construction permit acquisitions, tank foundations, concrete framing, pouring, and finishing, utilities and mechanical controls, mass grading, access roads, and piping. The total time provided in the schedule (Appendix A) includes the potential delays due to weather, equipment lead time and freight and supplier issues. There is the potential for a completion sooner than the total timeframe if those delays do not actually occur.

Weather is another significant factor that has impacted timing considerations for this project. Of primary impact is winter weather that has potential to reduce productivity. Seasonal changes can be planned for, though severe or off-season weather events cannot be controlled and can substantially affect project timing. Construction work that involves ground excavation, soil compaction, or filling or pouring concrete will be limited or impractical to perform during winter months (i.e., between late November and March).

2.4.1.5 RELIABILITY AND OUTAGE TIMING

The conversion to surge and settling tanks at Erickson will require approximately six (6) days of outage for Unit 1 to switch over the hydro-bin overflow lines and new CCR sump to the settling and surge tanks. Longer outage than anticipated or unplanned outages in event of equipment failure will have severe, negative impact to grid reliability and significantly impact BWL's ability to provide electricity to member owners.

2.4.1.6 STARTUP, COMMISSIONING, AND OPERATIONAL TRANSITION

Startup will include use of the new piping lines, sump pump operation, new equipment operation and new non-CCR impoundment with return flows back to the plant. This process is estimated to take with the surge and settling tanks and sixteen (16) days to complete and is dependent on BWL outage schedule. Recirculating water to the plant and achieving an overall suspended solids removal balance and temperature balance will be key to plant operations and boiler safety. BWL anticipates that there may be potential impacts requiring alteration or redesign to certain components or system operations especially with regards to cycling of contaminants causing scaling, corrosion or deposition.

2.4.2 New Non-CCR Surface Impoundment

To address the cessation of using the three CCR surface impoundments at Erickson, as required by the Final Rule, a new non-CCR impoundment will be constructed to manage non-CCR wastestreams, including treatment required for recycling back to the plant. The critical tasks necessary to implement this project, along with an estimated and approximate timeframe for completing those tasks, is provided below.

2.4.2.1 ENGINEERING DESIGN AND DATA COLLECTION

The engineering and design phase will take approximately four (4) months to complete. The engineering phase includes:

- Engineering and design of the impoundment configuration
- Geotechnical/geologic/hydrogeologic investigations including laboratory testing, soil borrow source evaluation, impoundment liner systems, stormwater runoff modeling, process water runoff, and conduit / piping.
- Supplemental flocculant/ coagulant injection will also be evaluated.

A sampling event will be conducted as well. The non-CCR surface impoundment design is critical to determine that there is proper residence time and the construction materials selected are compatible with the water chemistry of the non-CCR waste streams. It is also important to properly design the non-CCR surface impoundment for proper management of large surges of coal pile runoff that is high in total suspended solids as well as small flows of high salt water and outage streams. The residence time needs to be evaluated and is the necessary time for any reactions or settling to be completed before the wastewater is recycled back to the plant.

2.4.2.2 NPDES OPERATING PERMIT MODIFICATION

The non-CCR surface impoundment will require to be added to the plant current National Pollutant Discharge Elimination System (NPDES) permit. EGLE, process for obtaining a wastewater impoundment permit requires a Joint Permit Application (JPA), which results in a single NPDES permit that covers both the plant cooling tower outfall discharge and any impoundments. Therefore, construction of a new non-CCR impoundment will require an NPDES permit modification and a JPA application with EGLE.

The existing NPDES permit for the impoundments required liner compliance with Michigan Rule 323.2237 (Section R. 323.2237 - Wastewater treatment or storage lagoons). BWL will work with EGLE to complete modifications to the existing NPDES operating permit to allow for construction of the non-CCR surface impoundment that will include a liner compliant with Michigan Statute Part 22 Groundwater Quality, Rule 323.2237. It is BWL's experience that this process takes one year.

2.4.2.3 BIDDING AND CONTRACTOR SELECTION

Following the completion of the engineering and design phase, the design drawings and contract documents will be released for competitive bid. Following bid issuance and prior to contractor selection, substantial time is needed for activities including, but not limited to, pre-bid meetings, contractor document review, clarifications, bid submittals, and contractor interviews. The bidding and contractor selection process requires approximately seven (7) months to complete.

2.4.2.5 CONSTRUCTION ACTIVITIES

The approximate time to complete construction for the reconfigured non-CCR surface impoundment is estimated to take approximately twelve (12) months. This timeframe includes the dewatering of the Former Impoundment, soil borrow import, subgrade development, liner installations, protective cover installations, access layer (concrete/aggregate) installation, berm construction, access roads, channel lining, and conduits/piping. The total time includes the potential delays due to weather, equipment lead time and freight, and supplier issues. There is the potential for a completion sooner than the total timeframe if those delays do not actually occur.

As stated previously, weather is another significant factor that can impact timing considerations for this project. Of primary impact is winter weather and the timeline includes a break from November through February to halt construction until ground conditions are not frozen to allow for preservation of the liner and to increase productivity and decrease dewatering efforts. Seasonal changes can be planned for, though severe or off-season weather events cannot be controlled and can substantially affect project timing. Construction work that involves ground excavation, soil compaction, or filling or pouring concrete will be limited or impractical to be performed during winter months.

2.4.2.6 STARTUP AND OPERATIONAL TRANSITION

Following construction, BWL will need to introduce flows, commence operational activities, and evaluate plant flows for a period of up to two (2) months to confirm that the non-CCR impoundment will not require any alternations or rectification of design. Alterations to system operation may be required. Once proper suspended solids settling times are achieved, the reconfigured non-CCR surface impoundment will be considered fully operational.

2.4.3 Anticipated Worker Schedules

During construction of the CCR treatment facilities, the anticipated worker schedules consists of straight time 40-hour weeks. During construction of the impoundment reconfiguration, the anticipated worker schedules consists of five (5) days per week, working approximately eight to ten hours per day. If weather days are encountered, a weekend day may be worked to attempt to make up for lost construction days.

2.5 Progress Towards Obtaining Alternative Capacity Schedule – §257.103(f)(1)(iv)(A)(4)

The BWL has committed to permanently cease operation of the coal-fired boilers by December 31, 2025. With the planned cessation of coal fired operation at Erickson, BWL had initiated allocating funds and initial alternative planning for alternative capacity in preparation for the finalization of the Part A Final Rule. In 2020 BWL contracted with an engineering consultant to identify and evaluate the potential alternative capacity options for CCR and non-CCR flows at Erickson for continued coal combustion operations beyond the April 11, 2021 deadline. This feasibility study process included multiple steps:

- BWL developed and implemented a Sampling Plan to measure both flows and water quality of the CCR flows to support the design basis. To proceed with design, laboratory testing was necessary to understand which constituents required treatment and to what degree. Laboratory testing was necessary for conceptual sizing calculations, cost development estimates and specification writing. Most importantly, it was desired to understand the water quality of CCR streams for sizing of the CCR treatment equipment. Finally, it was necessary to test CCR streams for suitability for disposal to the sewer compared to the sewer discharge criteria. Flow monitoring of the CCR streams was also implemented in an effort to accurately gather operational flows.
- Several contractor site visits were implemented by the design engineer in effort to ensure system operation and flows were accurately represented.
- The design engineer performed a treatability study to identify best treatment practices and chemical dosing and projected influent quality.
- Once flows and chemistry were better understood, a design basis was developed to support each conceptual design option carried forward for further analysis.
- After identification of all appropriate vendors, including Clear Creek, Ground Water Treatment Technology, Alan Sherman Hoff, United Conveyor Corporation, Suez and Westech, the testing information relevant to equipment sizing and design basis was shared with vendors. Each vendor evaluated design basis information given by the consulting engineer to develop their proposals. Permanent system costs including capital and installed costs were developed based on the actual quotes received.
- Process flow diagrams and technical descriptions of each alternate capacity option.
- Plan implementation requirements, schedule and considerations.
- Development of treatment goals for CCR.
- Class 5 Opinion of Probable Construction Cost (OPCC) Estimates including capital costs, installed cost, and operations and maintenance costs.

Alternative capacity options were presented to BWL for review and selection of the preferred option. The procurement time once the BWL's decision was made requires several months for approval and allocation of funds. Immediately upon authorization to proceed with the chosen alternate capacity, BWL contracted with a design engineer to complete the design for both the CCR and non-CCR flows.

At the time of this submittal, BWL is working with the design engineer to continue development of the design basis, specification, and task development for the preferred alternative

3.0 CCR Rule Compliance Certification - §257.103(f)(1)(iv)(B)(1)

The Erickson Station historically sent both fly ash and bottom ash to the Former Impoundment. Fly ash from the Erickson Station has been controlled via a dry system and disposed off-site for over fifteen years. In 2009, BWL commenced a voluntary, four-year project to remove all ash from the Former Impoundment and built a new system intended to dispose of newly generated bottom ash (CCR) offsite in an appropriately designed Type II permitted landfill. Between 2009 and 2014, approximately 562,663 cubic yards of historic coal ash was removed from the 33-acre Former Impoundment and disposed in an offsite landfill. The existing impoundment system, described in Section 1.3 above, went online in December 2014 and was designed to clarify the process water to make it suitable for reuse in the plant. It was not designed to store or dispose of residual bottom ash because all ash was intended to be captured in the hydro-bins.

BWL anticipated that CCR quantities transferred in the decant water to the new system would be considered de minimis. Consequently, at the time the CCR Rule became effective in October 2015, BWL assumed that the CCR from Erickson was being disposed offsite and, therefore, the existing impoundments (Forebay, Retention Basin, and CWP) were not subject to the CCR Rule. However, BWL became aware that the hydro-bins, though effective in removing the vast majority of CCR, were allowing more than a de minimis quantity of fine CCR to pass through to the existing impoundments. Between 2016 and 2017, BWL completed a review of CCR Rule applicability and completed a feasibility study of compliance options. Although it did not meet some initial deadlines required by the CCR Rule, BWL has now completed the various compliance tasks required by the CCR Rule, including implementing the groundwater monitoring program, which commenced in 2019, and is now in Assessment of Corrective Measures.

Notwithstanding the above, I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for the CCR surface impoundments at Erickson Power Station, the facilities are in compliance with all of the requirements contained in 40 CFR. Part §257, Subpart D – Standards for the Disposal of Coal

Combustion Residuals in Landfills and Surface Impoundments. Erickson's CCR compliance website is up-to-date and contains all the necessary documentation and notification postings.

Lansing Board of Water & Light

Lori Myott, Manager, Environmental Services and Reliability Compliance
November 27, 2020

3.1 Groundwater Monitoring Program - § 257.103(f)(1)(iv)(B)(2-6)

3.1.1 Hydrogeology § 257.103(f)(1)(iv)(B)(4)

BWL completed a Hydrogeologic Characterization to review all available data in literature, State well logs, site specific geotechnical borings, and site-specific well logs to develop the hydrogeologic conceptual model and determine where the monitoring well network for the impoundments should be located.

The Tri-County region, where Erickson is located, is underlain by unconsolidated clay, silt, sand, and gravel of glacial origin that sit above approximately 10,000 feet of consolidated bedrock 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. According to Vanlier and others (1973) 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. According to the Michigan Wellogic Database, 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).

Geotechnical test pits and borings at Erickson reveal shallow subsurface lithology is composed of glacial deposits including sandy clay, silt, clayey sand, sand, and sand with gravel to a depth of 36 to 61 feet below ground surface. The glacial deposits on site lie above the sandstone and shale bedrock of the Saginaw Formation.

Three wells (MW-1, MW-2, and MW-3) were drilled in around the impoundments at Erickson to determine the uppermost aquifer under the impoundments, evaluate the groundwater flow direction; and to serve as monitoring wells for the CCR Rule compliance groundwater monitoring network for the CCR impoundments (Figure 3). Wells were surveyed, and water level data was collected. Based on the site-specific groundwater conditions determined by several months of water level data from initial wells, MW-1, MW-2, and MW-3, BWL installed additional monitoring wells (MW-4, MW-5, and MW-6) in January 2020 to complete the groundwater monitoring network for the CCR multiunit (Figure 6). Well construction is further described below.

Geologic boring logs and well construction logs for all six wells are provided in Appendix C. A geologic cross section through one part of the CCR unit is provided in Appendix D.

During well drilling the uppermost groundwater at the site was identified as the glacial deposits and therefore monitoring wells are screened at the top of the saturated unit, which is in the glacial derived sandy clay, silt, clayey sand, sand, and sand with gravel. The depth to the uppermost groundwater under the impoundments was determined to be approximately 14 to 20 feet below surface. Given the bedrock surface between 36 and 61 feet below surface, the upper glacial aquifer thickness at the Site is approximately between 16 and 47 feet thick. To date, BWL has collected water levels for a year and the groundwater flow direction was determined to be northeast under the impoundments (Appendix E). The gradient and flow direction are consistent across seasons (Figure 6), and therefore only the January and July 2020 contour maps are provided in Appendix E. Slug tests were conducted in each well and hydraulic conductivity values ranged from $2.76E^{-05}$ to $5.94E^{-06}$ centimeters per second (cm/s), with a geomean hydraulic conductivity of $2.19E^{-05}$ cm/s.

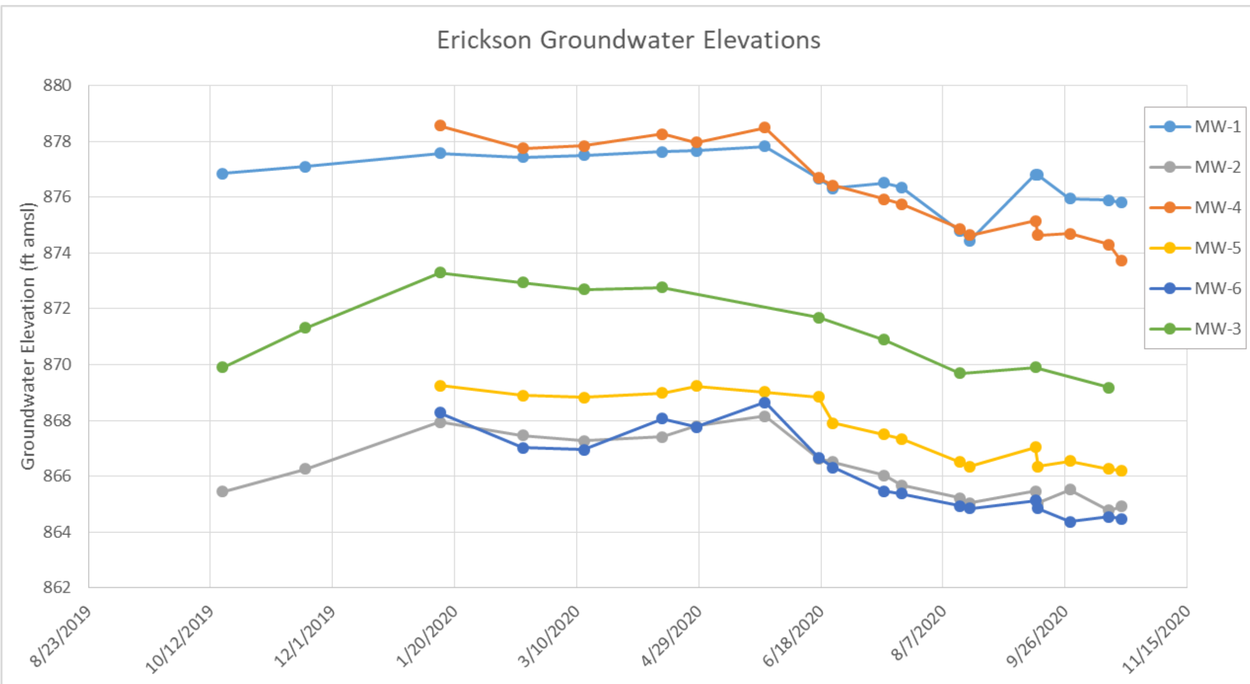


Figure 6. Groundwater Elevations of Monitoring Wells in 2019 and 2020

3.1.2 Certified Groundwater Monitoring Network

The federal CCR Rule requires, at a minimum, one upgradient and three downgradient monitoring wells per CCR unit to be completed in the uppermost aquifer. Section §257.90 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 order to develop the certified monitoring network at Erickson, BWL first completed a hydrogeologic study and installed three wells in October 2019 (MW-1, MW-2, and MW-3) around the outside of the impoundments to evaluate groundwater conditions at the site before the additional monitoring wells (MW-4, MW-

5, and MW-6) were drilled in early January 2020. The groundwater flow direction was established to be northeast. The impoundments are not incised and are separated by narrow embankments that are not recommended for well installation. To install downgradient wells directly at the waste boundary, wells would need to be installed on the eastern and northern embankments and/or installed within the footprint of the excavated Former Impoundment (Figure 2). The Former Impoundment maintains water in the low points most of the year and stormwater can pond within all of the footprint at various times throughout the year; therefore wells within the Former Impoundment footprint would not be accessible for drilling nor groundwater monitoring and maintenance access. Therefore, a multiunit groundwater monitoring system was established that would monitor groundwater downgradient of all three CCR impoundments in addition to the Former Impoundment. The locations were spaced on the outside boundary of the area containing the Forebay, Retention Basin, CWP, and Former Impoundment footprint. The locations were also spaced to potentially serve as upgradient (MW-1 and MW-4) and downgradient (MW-2, MW-3, MW-5, and MW-6) well locations for the CCR unit based on the northeast groundwater flow direction.

3.1.2.1 BACKGROUND MONITORING LOCATIONS

Two wells (MW-1 and MW-4) are installed west and southwest of impoundments to evaluate groundwater quality unaffected by the CCR unit. Figure 6 and Appendix E maps illustrate that these background wells are upgradient of the CCR impoundments and therefore appropriate background wells. The water level in MW-3 was determined to be cross-gradient to the impoundments during the first few months of water level monitoring and therefore is monitored only for water level.

3.1.2.2 POINT OF COMPLIANCE MONITORING LOCATIONS

Three wells (MW-2, MW-5, and MW-6) are installed downgradient of the CCR multiunit (Forebay, Retention Basin, and CWP) to sample the quality of groundwater passing the waste boundary of the CCR unit. These downgradient well locations will detect any groundwater contamination in the uppermost aquifer resulting from the CCR unit, if present.

3.1.2.3 WELL CONSTRUCTION

All of the certified network monitoring were constructed by BWL for compliance with the federal CCR Rule. Monitoring wells are constructed as 2-inch diameter poly vinyl chloride (PVC) wells completed in 7- or 8-inch diameter boreholes. The screen depths were targeted for placement at or just below the top of the water table. Boreholes were drilled to a depth of approximately 10 to 15 feet below the uppermost saturated zone to accommodate 10 feet of saturated screen in each well. This resulted in borehole depths between 28 and 34.5 feet below ground surface (bgs). Once the target drilling depth was reached at each borehole, the 2-inch diameter, Schedule 40 PVC casing and 10 foot well screen (0.010-inch slots) were assembled and installed. After well placement in the borehole, the filter pack sand and the bentonite pellet seal was placed via gravity feed from the surface into the annular space. The filter pack consisted of 10-20 (sieve size) washed silica sand emplaced from the bottom of the hole to a minimum of 2 feet above the well screen. An annular seal of bentonite chips was placed above the top of the filter pack, hydrated in lifts up to ground surface and left to hydrate for a minimum of 12 hours. Wells MW-1 and MW-4 were finished with 2-foot-by-2-foot concrete pads and locking stick-up well monuments. Wells MW-2, MW-3, MW-5, and MW-6 were completed with circular, flush-mounted well pads of approximately 2-foot diameter. Boring logs and well construction logs are provided in Appendix C. Each well was developed by surging and purging until turbidity readings were below 10 nephelometric turbidity units (NTUs).

3.1.3 Monitoring Methods and Results - § 257.103(f)(1)(iv)(B)(3)

3.1.3.1 FREQUENCY

In 2019 and 2020, monthly water level monitoring was conducted on the monitoring wells. As stipulated in the CCR Rule, eight rounds of background groundwater sampling were completed. Background sampling was completed between April 14 and October 12, 2020. In addition, the first detection monitoring event was performed on October 19, 2020 and the first assessment monitoring event was performed on November 6, 2020. Table 2 provides the well identification, number of groundwater samples that were collected from the monitoring wells for analysis for each well, the dates the samples were collected, the constituents analyzed, and whether the sample was required by the CCR Rule for the background sampling, detection monitoring or assessment monitoring programs.

Table 2. Dates of groundwater level and/or sample data collected for each well and the required monitoring programs for the Erickson Impoundments (§257.90(e)(3))

Monitoring Well I.D.	Well Location	Dates Monitored for Water Level	Dates Sampled	CCR Rule Monitoring Purpose	Constituents Analyzed
MW-1	Background/ Upgradient	October 17, 2019 November 20, 2019 December 13, 2019 January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020	April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 12, 2020	Background Monitoring	Appendix III and IV and TSS
		October 19, 2020	October 19, 2020	Detection Monitoring	Appendix III and IV and TSS
		November 6, 2020	November 6, 2020	Assessment Monitoring	Appendix IV and TSS

Monitoring Well I.D.	Well Location	Dates Monitored for Water Level	Dates Sampled	CCR Rule Monitoring Purpose	Constituents Analyzed
MW-2	Downgradient	October 17, 2019 November 20, 2019 December 13, 2019 January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020	April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 12, 2020	Background Monitoring	Appendix III and IV and TSS
		October 19, 2020	October 19, 2020	Detection Monitoring	Appendix III and IV and TSS
		November 6, 2020	November 6, 2020	Assessment Monitoring	Appendix IV and TSS
MW-3	Downgradient	October 17, 2019 November 20, 2019 December 13, 2019 January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020 October 19, 2020 November 6, 2020	N/A - only monitor water levels	Background Monitoring	N/A
MW-4	Background/ Upgradient	January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020	April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 12, 2020	Background Monitoring	Appendix III and IV and TSS
		October 19, 2020	October 19, 2020	Detection Monitoring	Appendix III and IV and TSS
		November 6, 2020	November 6, 2020	Assessment Monitoring	Appendix IV and TSS

Monitoring Well I.D.	Well Location	Dates Monitored for Water Level	Dates Sampled	CCR Rule Monitoring Purpose	Constituents Analyzed
MW-5	Downgradient	January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020	April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 12, 2020	Background Monitoring	Appendix III and IV and TSS
		October 19, 2020	October 19, 2020	Detection Monitoring	Appendix III and IV and TSS
		November 6, 2020	November 6, 2020	Assessment Monitoring	Appendix IV and TSS
MW-6	Downgradient	January 14, 2020 February 17, 2020 March 13, 2020 April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 14, 2020	April 14, 2020 May 13, 2020 June 17, 2020 July 14, 2020 August 14, 2020 September 14, 2020 September 28, 2020 October 12, 2020	Background Monitoring	Appendix III and IV and TSS
		October 19, 2020	October 19, 2020	Detection Monitoring	Appendix III and IV and TSS
		November 6, 2020	November 6, 2020	Assessment Monitoring	Appendix IV and TSS

WATER LEVELS AND SAMPLE COLLECTION

Water levels were collected in each well prior to sample collection. The water samples were collected using a peristaltic pump, with dedicated tubing. Each well was purged until field parameters stabilized in accordance with the sampling SOP. In accordance with the CCR Rule, groundwater samples were not field filtered. The field parameters of turbidity, pH, conductivity, Oxidation Reduction Potential (ORP), and temperature were measured using a YSI Professional Plus (or an equivalent) portable water quality instrument that was calibrated prior to use each day of sampling. The results of field measurements were recorded on a field data form, which is maintained as part of the field sampling records. For quality control, one field duplicate sample was collected during each sample event. Water samples were delivered under Chain of Custody to Merit Laboratories, Inc. in Lansing, Michigan.

The water levels at monitoring wells were recorded during monitoring events. The water levels (Figure 6) and contour maps (Appendix E) confirm that monitoring wells MW-1 and MW-4 are located upgradient of the landfill and are appropriate to represent background water quality. To demonstrate that the groundwater flow direction and gradient changed little through the seasons a contour map from January and July 2020 are included in Appendix E. Groundwater flow under the impoundments was generally to the northeast.

ANALYTICAL TESTING AND WATER QUALITY -

Groundwater samples for each type of monitoring were analyzed for the COIs shown in Table 3. Background monitoring analyses include all of the parameters in Appendices III and IV of CCR Rule Part §257, plus TSS. Initial assessment monitoring, and subsequent annual assessment monitoring samples are analyzed for all Appendix IV COIs to determine what constituent of interest (COI) are detected.

In accordance with 257.93(h)(2), BWL completed statistics on the background water quality data collected and developed background threshold values (BTVs) (95 percent upper prediction limit) for each COI. Table 4 below lists the CCR Rule COIs. The Background Statistical Certification Memorandum for the Erickson site is available on BWL CCR Rule Compliance and Data Information web page (HDR 2020c). The detection monitoring laboratory results from each downgradient well were compared against the background threshold values for each COI to determine if there was a statistically significant increase (SSI) of any Appendix III COI. On November 4, 2020, BWL determined there was a statistically significant increase (SSI) of Appendix III constituents of interest (COIs) and established an Assessment Monitoring Program for the Erickson site. As described in the SSI Memorandum Pursuant to 40 CFR §257.94 (HDR 2020d) (available on the BWL CCR Rule Compliance and Data Information web page), monitoring wells MW-2 and MW-5 had SSIs for boron, calcium, sulfate, and total dissolved solids (TDS); and well MW-6 had SSIs for boron, sulfate, and TDS.

Constituent concentrations, summarized in table form at each groundwater monitoring well monitored during each sampling event are provided in Appendix G.

As described in HDR (2020d), BWL established an Assessment Monitoring Program for the Erickson Power Station, and performed the initial assessment monitoring sample event on November 6, 2020. In accordance with CCR Rule §257.95(h), GPS were established for each detected Appendix IV COI and documented in the November 23, 2020 memorandum *Groundwater Protection Standards and Determination of SSLs per §257.95(g)* (HDR 2020e). For each detected COI, Table 5 lists the EPA established Maximum Contaminant Level (MCL) from 40 CFR §141.62 and §141.66, the BTV (upper tolerance limit) for the Erickson CCR unit, and the GPS.

In accordance with CCR Rule 257.95(e), downgradient well concentrations from the assessment monitoring event were compared against background values, and concentrations were found to be above background values. In accordance with CCR Rule §257.95(f), detected Appendix IV COI concentrations in downgradient wells were compared against GPS and were found to exceed Groundwater Protection Standards (GPS). Therefore, in accordance with CCR Rule §257.95(g), downgradient well concentrations were statistically evaluated to determine "if one or more constituents in Appendix IV to this part are detected at statistically significant levels above the groundwater protection standard." As described in *Groundwater Protection Standards* *and Determination of SSLs per §257.95(g)* downgradient wells MW-2, MW-5, and MW-6 was found to have concentrations of lithium at SSLs above the GPS.

In the remainder of 2021, BWL will initiate and complete the assessment of corrective measures in accordance with §257.96 and continue to monitor groundwater in accordance with the assessment monitoring program and consistent with §257.93(e).

Table 3. Groundwater Quality Parameters

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

Table 4. Groundwater Protection Standards for Detected Appendix IV COIs for the Erickson CCR Unit §257.95(d)(3)

Constituent	Unit	MCL	BTV (95 UTL)	GPS
Antimony	mg/l	0.006	0.00260	0.006
Arsenic	mg/l	0.0100	0.0112	0.0112
Barium	mg/l	2.00	0.187	2.00
Beryllium	mg/l	0.00400	0.000220	0.00400
Cadmium	mg/l	0.00500	0.000190	0.00500
Chromium, Total	mg/l	0.100	0.000750	0.100
Cobalt	mg/l	0.00600*	0.000150	0.00600*
Fluoride	mg/l	4.00	0.130	4.00
Lead	mg/l	0.0150*	0.000190	0.0150*
Lithium	mg/l	0.0400*	0.0390	0.0400*
Mercury	mg/l	0.002	0.0000160	0.002
Molybdenum	mg/l	0.100*	0.00500	0.100*
Radium-226-228	pci/l	5.0^	4.31	5.0^
Selenium	mg/l	0.0500	0.00210	0.0500
Thallium	mg/l	0.002	0.000100	0.002

3.1.4 Groundwater Monitoring Program Status

As described above the Erickson groundwater monitoring program for the CCR unit has completed the monitoring and statistical analysis steps required in 40 CFR §257.91 through 40 CFR §257.95. BWL has completed the following steps to comply with the CCR Rule:

- a hydrogeologic study to characterize the uppermost aquifer,
- installed a compliant groundwater monitoring network or wells and reported the Groundwater Monitoring Network Certification (40 CFR §257.91(f)),
- completed eight background sampling events (40 CFR §257.94(b)),
- calculated background groundwater quality and the Background Statistical Certification (40 CFR §257.93(f)(6)),
- completed detection monitoring (40 CFR §257.94(b)),
- statistically compared the detection monitoring results to background and reported an SSI (40 CFR §257.94(e)),
- documented establishment of an Assessment Monitoring Program (40 CFR 257.94(e)(1)),
- completed the first assessment monitoring event (40 CFR §257.95(b)),

- developed GPS for detected Appendix IV COIs (40 CFR §257.95(d)(2)),
- compared the assessment monitoring results to background and to GPS, statistically compared the assessment monitoring results to GPS, and reported an SSL over GPS (40 CFR §257.95(e-g)),
- completed annual groundwater monitoring reporting (40 CFR §257.90(e)), and
- posted required documents completed to this point in the monitoring program progress to the BWL CCR compliance webpage (40 CFR §257.107).

3.2 CCR Rule Compliance Documentation

BWL has managed a comprehensive CCR Rule compliance program for the Erickson CCR Impoundments. The CCR Rule compliance program has been, is currently, and will continue to address all applicable engineering, groundwater monitoring (described in Section 3.1), recordkeeping, notification, and public information accessibility requirements of the Rule. Table 5 summarizes the various inspections, records, plans, reports, notifications, and other supporting information prepared for the impoundment through November 30, 2020 (except for the groundwater program which is described in Section 3.1), all of which are available on the BWL publicly accessible CCR Compliance website.

Table 5. CCR Rule Compliance Summary (through early May 2020)

CCR Rule Citation Engineering Requirements	Description	Reporting Date
40 CFR §257.60-257.64	Location restrictions	October 10, 2018 December 20, 2019 Supplemental March 23, 2020
40 CFR §257.71	Liner Design	March 26, 2020
40 CFR §257.73(c)	History of Construction	June 12, 2020
40 CFR §257.73(d-e)	Structural Stability and Safety Factor Assessment	June 12, 2020
40 CFR §257.83(a)(2)	Hazard Potential Classification	June 19, 2020
40 CFR §257.80(b)	Fugitive Dust Management Plan	June 2018
40 CFR §257.80(c)	Fugitive Dust Annual Reports	2016, 2017, 2018, 2019
40 CFR §257.82	Inflow Design	June 9, 2020
40 CFR §257.83(b)(2)	Initial Inspection Report	June 12, 2020 August 10, 2020
40 CFR §257.102(b)(1)	Closure Plan	August 16, 2019

3.2.1 Structural Stability Assessment - § 257.103(f)(1)(iv)(B)(7)

Pursuant to §257.73(d), the initial structural stability assessment report for the CCR surface impoundments was prepared and is included as Appendix G.

3.2.2 Safety Factor Assessment - §257.103(f)(1)(iv)(B)(8)

Pursuant to §257.73(e), the initial safety factor assessment report for the CCR surface impoundments was prepared and is included as Appendix G.

4.0 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, 2020. Erickson Station Impoundments Liner System Certification Pursuant to 40 CFR §257.71. March 26, 2020.

HDR, 2020b. Erickson Station Locations Restrictions Supplemental 40 CFR §257.60. March 23, 2020.

HDR, 2020c. Background Statistical Certification, Erickson Station. November 19, 2020.\

HDR, 2020d. Erickson Power Station CCR Units Determination of Statistically Significant Increases over Background per §257.93(h)(2). November 19, 2020.

HDR, 2020e. Erickson Power Station CCR Unit Groundwater Protection Standards and Determination of SSLs per §257.95(g). November 23, 2020.

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.

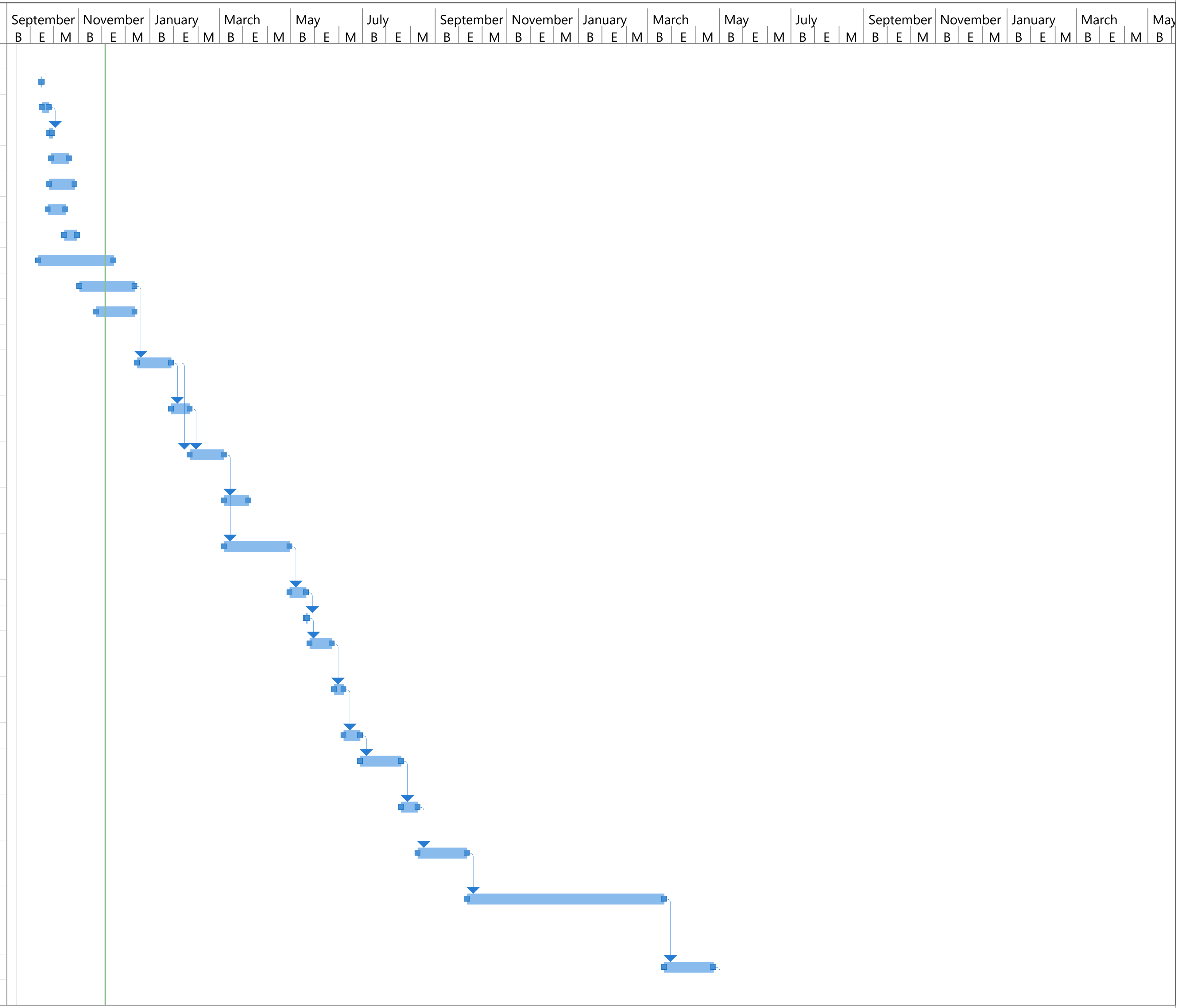
A

Selected Alternative Schedule

Lansing Board of Water & Light

CCR Alternative Capacity System Timeline

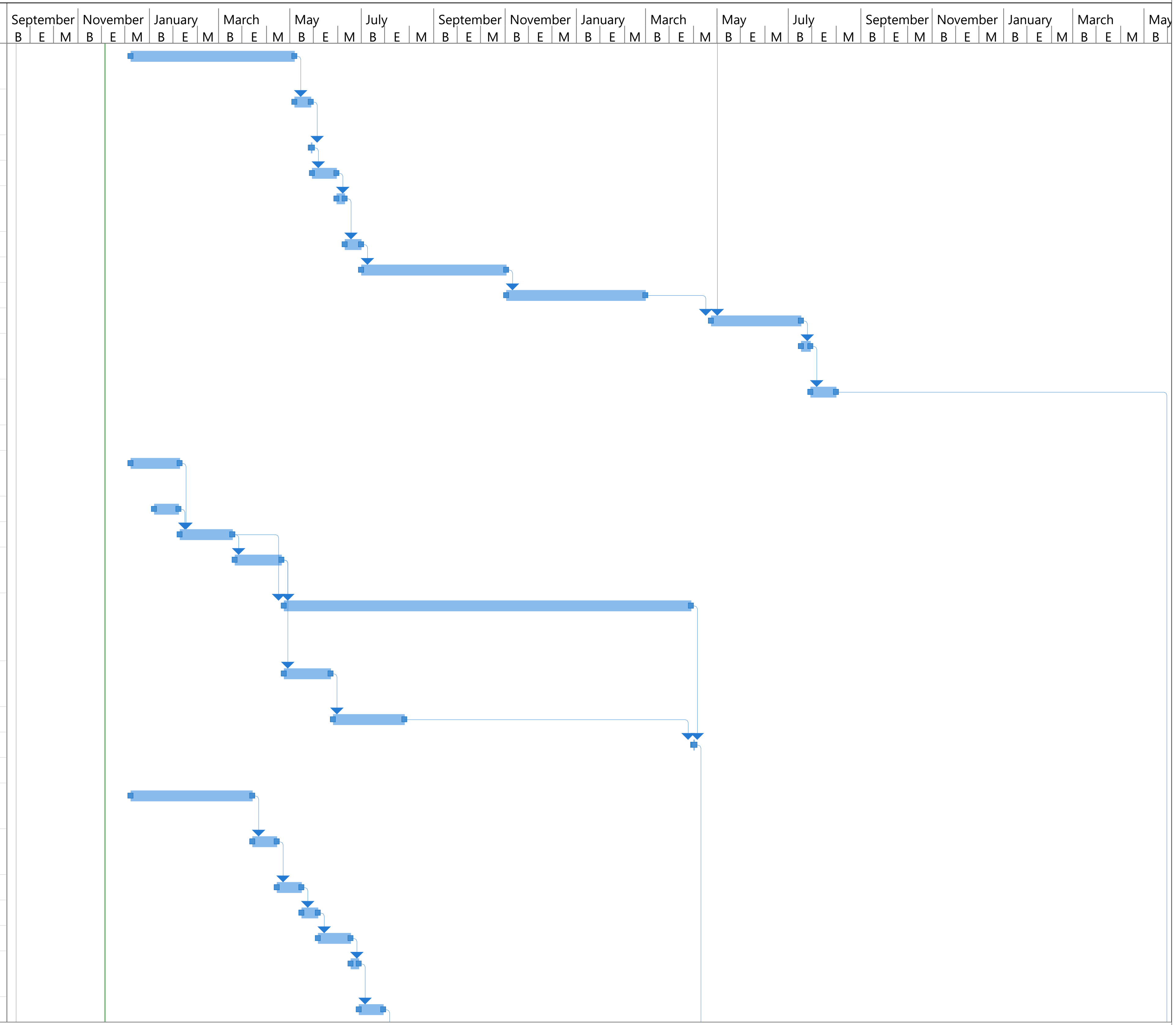
ID	Task Name	Duration	Start	Finish
1	**Surge and Settling Tanks**	**483 days**	**Wed 9/30/20**	**Fri 8/5/22**
2	Site Walk Down and Kickoff	1 day	Wed 9/30/20	Wed 9/30/20
3	Sampling Plan Development	4 days	Thu 10/1/20	Tue 10/6/20
4	On-Site Sampling	3 days	Wed 10/7/20	Fri 10/9/20
5	Ultrasonic Flow Meter Testing	11 days	Fri 10/9/20	Fri 10/23/20
6	Laboratory Analyses	16 days	Wed 10/7/20	Wed 10/28/20
7	Vendor Engagement for Quotes	11 days	Tue 10/6/20	Tue 10/20/20
8	Feasibility Study Report Preparation	9 days	Tue 10/20/20	Fri 10/30/20
9	Part A Demo Report Preparation	46 days	Mon 9/28/20	Mon 11/30/20
10	Procurement of Engineering Design Contract	35 days	Mon 11/2/20	Fri 12/18/20
11	Treatability Study	25 days	Mon 11/16/20	Fri 12/18/20
12	**Equipment Procurement**	**351 days**	**Mon 12/21/20**	**Mon 4/25/22**
13	HDR Development of Design Basis with Input from LBWL Stakeholders	21 days	Mon 12/21/20	Mon 1/18/21
14	HDR Develop CCR Draft Equipment Specification	12 days	Tue 1/19/21	Wed 2/3/21
15	LBWL Provide Input on CCR Equipment Specification	21 days	Thu 2/4/21	Thu 3/4/21
16	HDR Develop CCR Equipment Final Specification	15 days	Fri 3/5/21	Thu 3/25/21
17	BWL Board Review and Capital Fund Allocation	40 days	Fri 3/5/21	Thu 4/29/21
18	LBWL Prepare Bid Package for Issue	10 days	Fri 4/30/21	Thu 5/13/21
19	LBWL Issue Bid Package	1 day	Fri 5/14/21	Fri 5/14/21
20	Surge and Settling Tanks Vendor Bid Development	15 days	Mon 5/17/21	Fri 6/4/21
21	LBWL Surge and Settling Tanks Vendor Bid Submittal Review and HDR Recommendation	6 days	Mon 6/7/21	Mon 6/14/21
22	Negotiation and Contract Award	10 days	Tue 6/15/21	Mon 6/28/21
23	Surge and Settling Tanks Vendor Design and Submittals	25 days	Tue 6/29/21	Mon 8/2/21
24	LBWL Approve Surge and Settling Tanks Vendor Submittals	10 days	Tue 8/3/21	Mon 8/16/21
25	Surge and Settling Tank Vendor Raw Material Procurement	30 days	Tue 8/17/21	Mon 9/27/21
26	Vendor Equipment Fabrication After Raw Material Delivery, includes factory acceptance testing	120 days	Tue 9/28/21	Mon 3/14/22
27	Equipment Delivery	30 days	Tue 3/15/22	Mon 4/25/22
28	**Construction Procurement**	**431 days**	**Wed 12/16/20**	**Wed 8/10/22**



Task | Split | Milestone | Summary

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

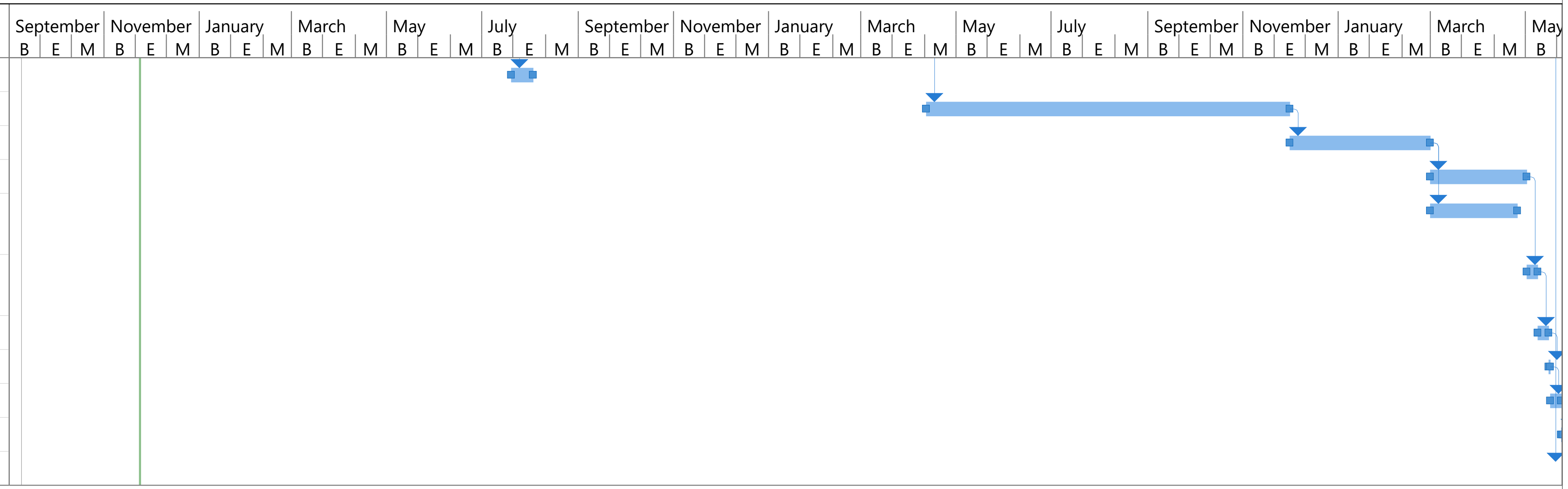
ID	Task Name	Duration	Start	Finish
29	HDR Design Development and Water Treatment Plant Construction Package	100 days	Wed 12/16/20	Tue 5/4/21
30	LBWL Prepare Water Treatment Plant Construction Bid Package for Issue	10 days	Wed 5/5/21	Tue 5/18/21
31	Issue for Bids	1 day	Wed 5/19/21	Wed 5/19/21
32	Contractor Bid Development	15 days	Thu 5/20/21	Wed 6/9/21
33	LBWL Contractor Bid Review and HDR Provide Recommdation for Award	5 days	Thu 6/10/21	Wed 6/16/21
34	Negotiation and Contract Award	10 days	Thu 6/17/21	Wed 6/30/21
35	Start Construction	88 days	Thu 7/1/21	Mon 11/1/21
36	Break for Winter	85 days	Tue 11/2/21	Mon 2/28/22
37	Resume Construction	55 days	Tue 4/26/22	Mon 7/11/22
38	Outage Tie-In (Pending LBWL Outage Schedule)	6 days	Tue 7/12/22	Tue 7/19/22
39	Startup and Commissioning (Pending LBWL Outage Schedule)	16 days	Wed 7/20/22	Wed 8/10/22
40	**Non-CCR Pond Development**	**635 days**	**Wed 12/16/20**	**Tue 5/23/23**
41	HDR Development of Design Basis with Input from LBWL Stakeholders	30 days	Wed 12/16/20	Tue 1/26/21
42	Non-CCR sampling event	15 days	Tue 1/5/21	Mon 1/25/21
43	Permit Documentation	33 days	Wed 1/27/21	Fri 3/12/21
44	BWL Board Review and Capital Fund Allocation	30 days	Mon 3/15/21	Fri 4/23/21
45	EGLE Permit(s) Modification Request for Part 22 Liner Characteristics and Installation Requirements	250 days	Mon 4/26/21	Fri 4/8/22
46	JPA Pond <5 Acres Administrative Completeness	30 days	Mon 4/26/21	Fri 6/4/21
47	JPA 45-Day Public Notice	45 days	Mon 6/7/21	Fri 8/6/21
48	State Approval	1 day	Mon 4/11/22	Mon 4/11/22
49	**Construction Procurement**	**164 days**	**Wed 12/16/20**	**Mon 8/2/21**
50	HDR Design Development and Construction Bid Package	74 days	Wed 12/16/20	Mon 3/29/21
51	LBWL Provide Input on Contractor Bid Package	15 days	Tue 3/30/21	Mon 4/19/21
52	HDR Develop Final Contractor Bid Package	15 days	Tue 4/20/21	Mon 5/10/21
53	LBWL Prepare Bid Package for Issue	10 days	Tue 5/11/21	Mon 5/24/21
54	Contractors Prepare Bids	20 days	Tue 5/25/21	Mon 6/21/21
55	LBWL Bid Review and HDR Provide Recommendation for Award	5 days	Tue 6/22/21	Mon 6/28/21
56	Negotiation and Contract Award	15 days	Tue 6/29/21	Mon 7/19/21



Task | Split | Milestone | Summary

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
57	Award and Complete Contract	10 days	Tue 7/20/21	Mon 8/2/21
58	Start Construction	167 days	Tue 4/12/22	Wed 11/30/22
59	Break for Winter	64 days	Thu 12/1/22	Tue 2/28/23
60	Resume Construction	44 days	Wed 3/1/23	Mon 5/1/23
61	Rerouting Non CCR Flows Including Construction for Pipeline to Pumphouse	40 days	Wed 3/1/23	Tue 4/25/23
62	Outage Tie-In (Pending LBWL Outage Schedule)	5 days	Tue 5/2/23	Mon 5/8/23
63	Startup and Commissioning	5 days	Tue 5/9/23	Mon 5/15/23
64	Construction Certification Report to State	1 day	Tue 5/16/23	Tue 5/16/23
65	Transition Operations to new Non-CCR Pond	5 days	Wed 5/17/23	Tue 5/23/23
66	Startup Pond in Service	1 day	Wed 5/24/23	Wed 5/24/23
67	**CCR and Non-CCR System Online**	**1 day**	**Thu 5/25/23**	**Thu 5/25/23**



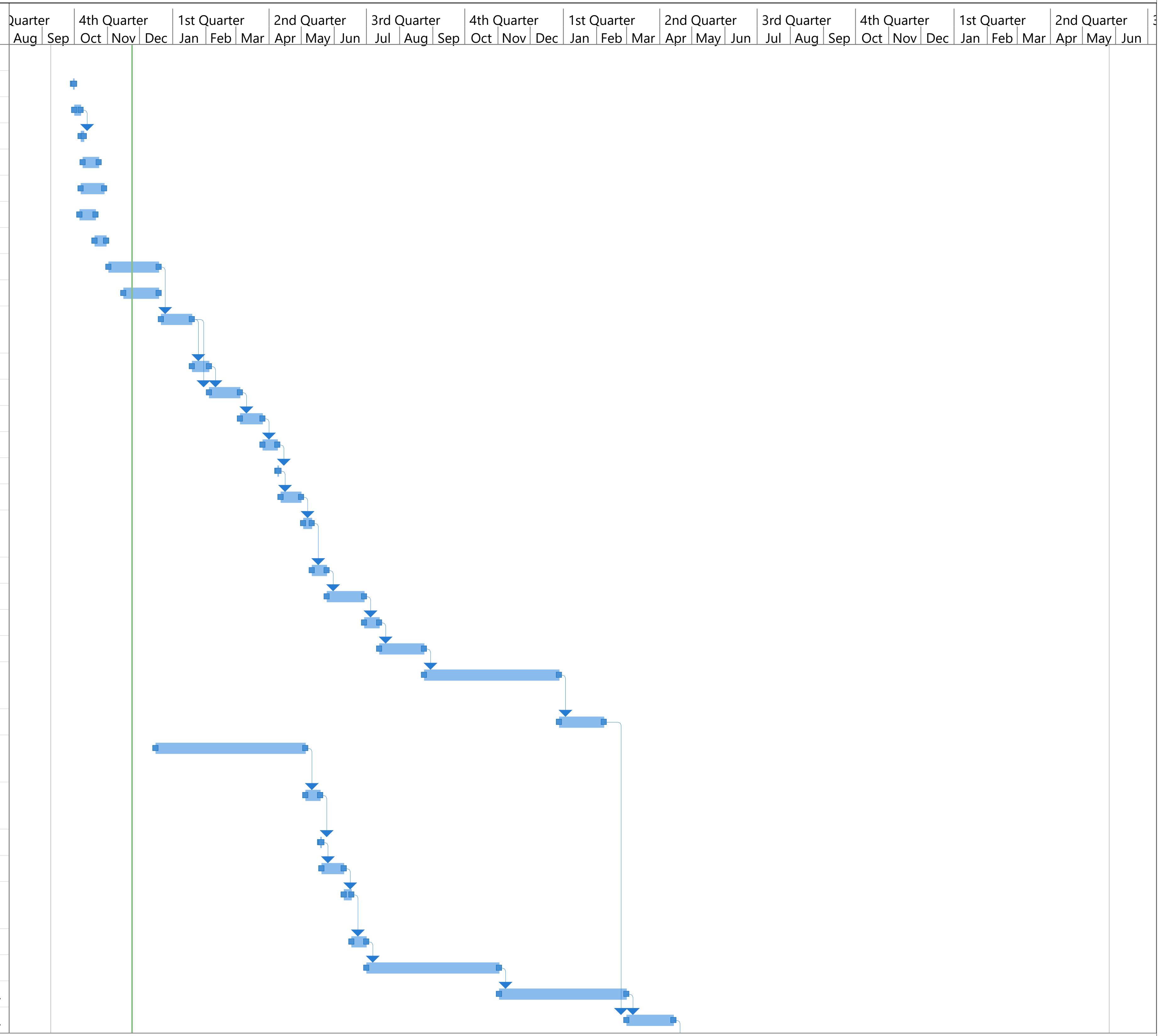
Task Split Milestone Summary

B

Alternatives Considered but not Selected Schedules

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
1	**Clarifier and Tanks**	**423 days**	**Wed 9/30/20**	**Fri 5/13/22**
2	Site Walk Down and Kickoff	1 day	Wed 9/30/20	Wed 9/30/20
3	Sampling Plan Development	4 days	Thu 10/1/20	Tue 10/6/20
4	On-Site Sampling	3 days	Wed 10/7/20	Fri 10/9/20
5	Ultrasonic Flow Meter Testing	11 days	Fri 10/9/20	Fri 10/23/20
6	Laboratory Analyses	16 days	Wed 10/7/20	Wed 10/28/20
7	Vendor Engagement for Quotes	11 days	Tue 10/6/20	Tue 10/20/20
8	Feasibility Study Report Preparation	9 days	Tue 10/20/20	Fri 10/30/20
9	Procurement of Engineering Design Contract	35 days	Mon 11/2/20	Fri 12/18/20
10	Treatability Study	25 days	Mon 11/16/20	Fri 12/18/20
11	HDR Development of Design Basis with Input from LBWL Stakeholders	21 days	Mon 12/21/20	Mon 1/18/21
12	HDR Develop CCR Draft Equipment Specification	12 days	Tue 1/19/21	Wed 2/3/21
13	LBWL Provide Input on CCR Equipment Specification	21 days	Thu 2/4/21	Thu 3/4/21
14	HDR Develop CCR Equipment Final Specification	15 days	Fri 3/5/21	Thu 3/25/21
15	LBWL Prepare Bid Package for Issue	10 days	Fri 3/26/21	Thu 4/8/21
16	LBWL Issue Bid Package	1 day	Fri 4/9/21	Fri 4/9/21
17	Clarifier and Tanks Vendor Bid Development	15 days	Mon 4/12/21	Fri 4/30/21
18	LBWL Clarifier and Tanks Vendor Bid Submittal Review and HDR Recommendation	6 days	Mon 5/3/21	Mon 5/10/21
19	Negotiation and Contract Award	10 days	Tue 5/11/21	Mon 5/24/21
20	Clarifier and Tanks Vendor Design and Submittals	25 days	Tue 5/25/21	Mon 6/28/21
21	LBWL Approve Clarifier and Tanks Vendor Submittals	10 days	Tue 6/29/21	Mon 7/12/21
22	Clarifier and Tanks Vendor Raw Material Procurement	30 days	Tue 7/13/21	Mon 8/23/21
23	Vendor Equipment Fabrication After Raw Material Delivery, includes factory acceptance testing	90 days	Tue 8/24/21	Mon 12/27/21
24	Equipment Delivery	30 days	Tue 12/28/21	Mon 2/7/22
25	HDR Design Development and Water Treatment Plant Construction Package	100 days	Wed 12/16/20	Tue 5/4/21
26	LBWL Prepare Water Treatment Plant Construction Bid Package for Issue	10 days	Wed 5/5/21	Tue 5/18/21
27	Issue for Bids	1 day	Wed 5/19/21	Wed 5/19/21
28	Contractor Bid Development	15 days	Thu 5/20/21	Wed 6/9/21
29	LBWL Contractor Bid Review and HDR Provide Recommdation for Award	5 days	Thu 6/10/21	Wed 6/16/21
30	Negotiation and Contract Award	10 days	Thu 6/17/21	Wed 6/30/21
31	Start Construction	88 days	Thu 7/1/21	Mon 11/1/21
32	Break for Winter	85 days	Tue 11/2/21	Mon 2/28/22
33	Resume Construction	32 days	Tue 3/1/22	Wed 4/13/22

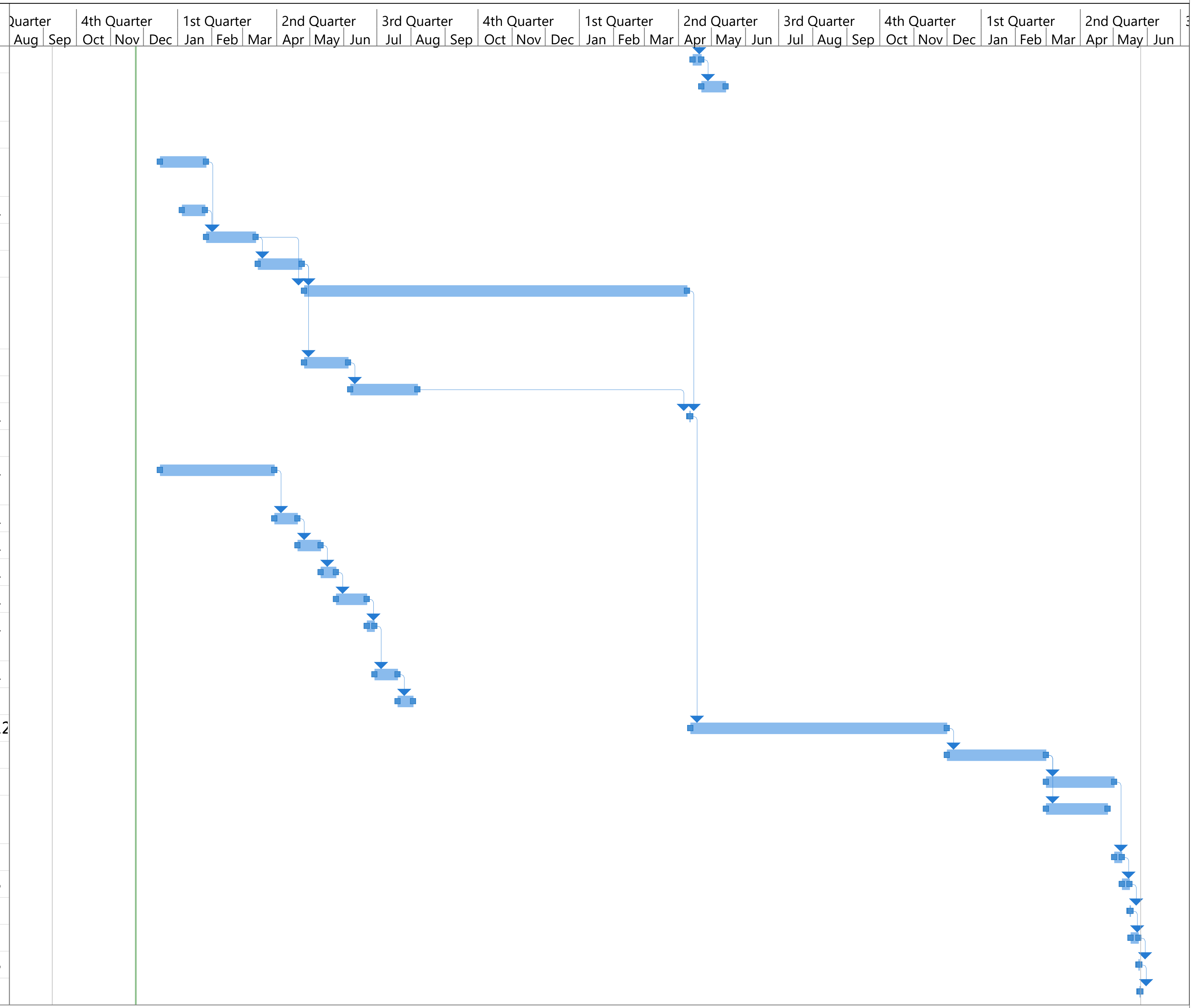


Task | Split | Milestone | Summary

CCR Alternative Capacity System Timeline
Tanks, Clarfier and Non-CCR Pond

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

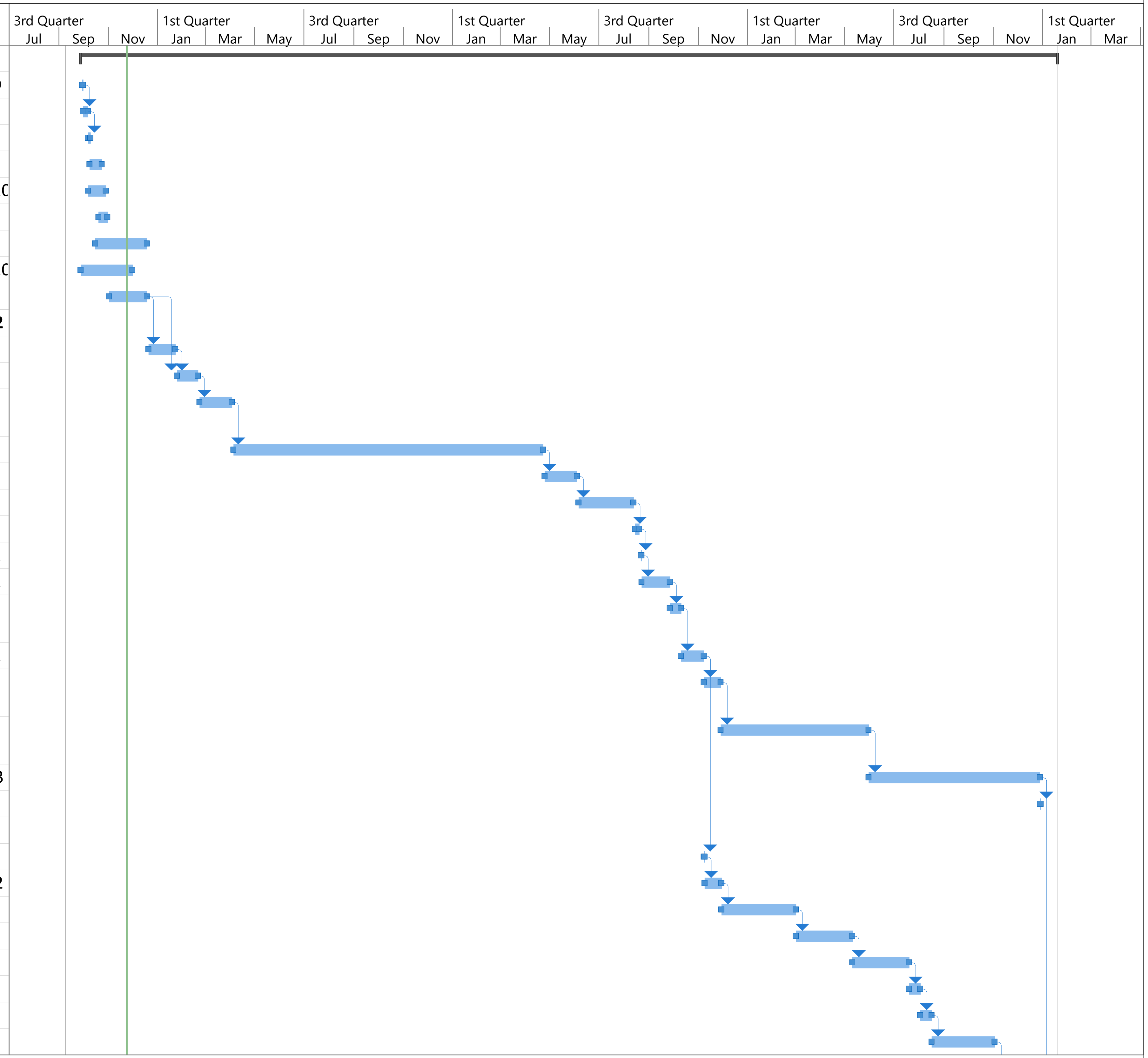
ID	Task Name	Duration	Start	Finish
34	Outage Tie-In (Pending LBWL Outage Schedule)	6 days	Thu 4/14/22	Thu 4/21/22
35	Startup and Commissioning (Pending LBWL Outage Schedule)	16 days	Fri 4/22/22	Fri 5/13/22
36	**Non-CCR Pond Development**	**635 days**	**Wed 12/16/20**	**Tue 5/23/23**
37	HDR Development of Design Basis with Input from LBWL Stakeholders	30 days	Wed 12/16/20	Tue 1/26/21
38	Non-CCR sampling event	15 days	Tue 1/5/21	Mon 1/25/21
39	Permit Documentation	33 days	Wed 1/27/21	Fri 3/12/21
40	BWL Board Review and Capital Fund Allocatio	30 days	Mon 3/15/21	Fri 4/23/21
41	EGLE Permit(s) Modification Request for Part 22 Liner Characteristics and Installation Requirements	250 days	Mon 4/26/21	Fri 4/8/22
42	JPA Pond <5 Acres Administrative Completene	30 days	Mon 4/26/21	Fri 6/4/21
43	JPA 45-Day Public Notice	45 days	Mon 6/7/21	Fri 8/6/21
44	State Approval	1 day	Mon 4/11/22	Mon 4/11/22
45	**Construction Procurement**	**164 days**	**Wed 12/16/20**	**Mon 8/2/21**
46	HDR Design Development and Construction Bid Package	74 days	Wed 12/16/20	Mon 3/29/21
47	LBWL Provide Input on Contractor Bid Packag	15 days	Tue 3/30/21	Mon 4/19/21
48	HDR Develop Final Contractor Bid Package	15 days	Tue 4/20/21	Mon 5/10/21
49	LBWL Prepare Bid Package for Issue	10 days	Tue 5/11/21	Mon 5/24/21
50	Contractors Prepare Bids	20 days	Tue 5/25/21	Mon 6/21/21
51	LBWL Bid Review and HDR Provide Recommendation for Award	5 days	Tue 6/22/21	Mon 6/28/21
52	Negotiation and Contract Award	15 days	Tue 6/29/21	Mon 7/19/21
53	Award and Complete Contract	10 days	Tue 7/20/21	Mon 8/2/21
54	Start Construction	167 days	Tue 4/12/22	Wed 11/30/22
55	Break for Winter	64 days	Thu 12/1/22	Tue 2/28/23
56	Resume Construction	44 days	Wed 3/1/23	Mon 5/1/23
57	Rerouting Non CCR Flows Including Construction for Pipeline to Pumphouse	40 days	Wed 3/1/23	Tue 4/25/23
58	Outage Tie-In (Pending LBWL Outage Schedul	5 days	Tue 5/2/23	Mon 5/8/23
59	Startup and Commissioning	5 days	Tue 5/9/23	Mon 5/15/23
60	Construction Certification Report to State	1 day	Tue 5/16/23	Tue 5/16/23
61	Transition Operations to new Non-CCR Pond	5 days	Wed 5/17/23	Tue 5/23/23
62	Startup Pond in Service	1 day	Wed 5/24/23	Wed 5/24/23
63	**CCR and Non-CCR System Online**	**1 day**	**Thu 5/25/23**	**Thu 5/25/23**



Task | Split | Milestone | Summary

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
1	**CCR Pond Development**	**865 days**	**Mon 9/28/20**	**Fri 1/19/24**
2	Site Walk Down and Kickoff	1 day	Wed 9/30/20	Wed 9/30/20
3	Sampling Plan Development	4 days	Thu 10/1/20	Tue 10/6/20
4	On-Site Sampling	3 days	Wed 10/7/20	Fri 10/9/20
5	Ultrasonic Flow Metering Testing	11 days	Fri 10/9/20	Fri 10/23/20
6	Laboratory Analyses	16 days	Wed 10/7/20	Wed 10/28/2(
7	Feasibility Study Report Preparation	9 days	Tue 10/20/20	Fri 10/30/20
8	Treatability Study	46 days	Fri 10/16/20	Fri 12/18/20
9	Part A Demo Report Preparation	46 days	Mon 9/28/20	Mon 11/30/2(
10	Procurement of Engineering Design Contract	35 days	Mon 11/2/20	Fri 12/18/20
11	**Construction Procurement**	**306 days**	**Mon 12/21/20**	**Mon 2/21/22**
12	Prepare Bottom Ash Pond Conceptual Design	25 days	Mon 12/21/20	Fri 1/22/21
13	HDR Development Impoundment Design Workplar	20 days	Mon 1/25/21	Fri 2/19/21
14	HDR Prepare Impoundment Engineering Report and Permit Documentation	30 days	Mon 2/22/21	Fri 4/2/21
15	State Permit Review and Approval	275 days	Mon 4/5/21	Fri 4/22/22
16	BWL Board Review and Capital Fund Allocation	30 days	Mon 4/25/22	Fri 6/3/22
17	HDR Prepare Construction Drawings and Bid Packa	50 days	Mon 6/6/22	Fri 8/12/22
18	LBWL Prepare Bid Package for Issue	5 days	Mon 8/15/22	Fri 8/19/22
19	LBWL Issue Package for Bid	1 day	Mon 8/22/22	Mon 8/22/22
20	Contractor Bid Development	25 days	Tue 8/23/22	Mon 9/26/22
21	LBWL Bid Review and HDR Provide Recommendation for Award	10 days	Tue 9/27/22	Mon 10/10/22
22	LBWL Negotiation and Complete Contract Award	20 days	Tue 10/11/22	Mon 11/7/22
23	CCR Rule Ground Water Monitoring Network Installation and Development	15 days	Tue 11/8/22	Mon 11/28/22
24	CCR Rule Ground Background Sampling (180 Days Before)	131 days	Tue 11/29/22	Tue 5/30/23
25	Prepare CCR documents Prior to Reciept of CCRs	152 days	Wed 5/31/23	Thu 12/28/23
26	Place all CCR Documents in Public Website	1 day	Fri 12/29/23	Fri 12/29/23
27	**Contruction of New Bottom Ash Pond**	**499 days**	**Tue 2/22/22**	**Fri 1/19/24**
28	Contractor Mobilization / Start Construction	1 day	Tue 11/8/22	Tue 11/8/22
29	Prepare Liner Subgrade	15 days	Wed 11/9/22	Tue 11/29/22
30	Break for Winter	66 days	Wed 11/30/22	Wed 3/1/23
31	Resume Construction	50 days	Thu 3/2/23	Wed 5/10/23
32	Install Composite Liner System	50 days	Thu 5/11/23	Wed 7/19/23
33	Place Cover Soils Above Liner	10 days	Thu 7/20/23	Wed 8/2/23
34	Pump Water from Liner Area	10 days	Thu 8/3/23	Wed 8/16/23
35	Constuction of Rerouted Piping and Pumps	56 days	Thu 8/17/23	Thu 11/2/23

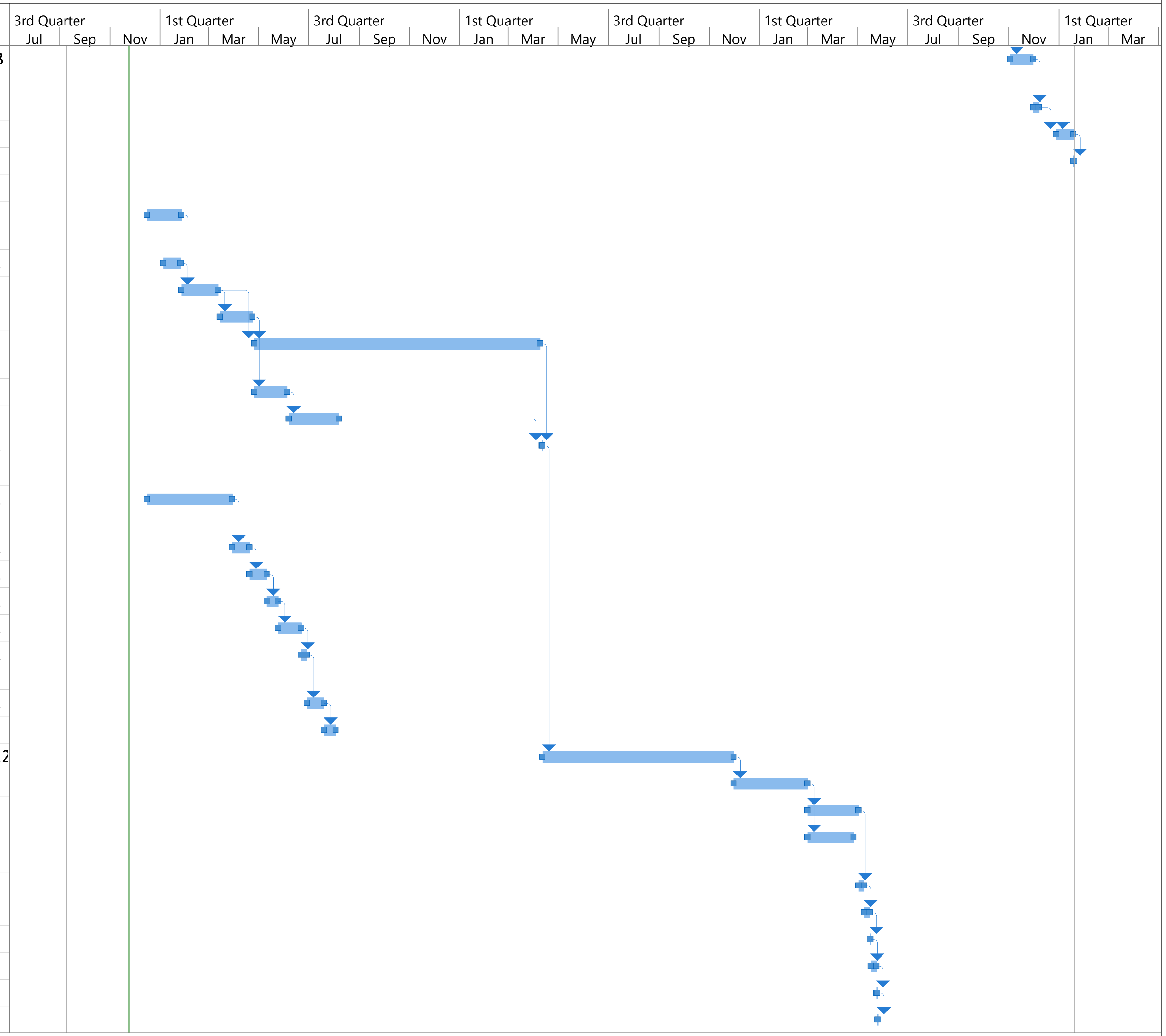


Task | Split | Milestone | Summary

CCR Alternative Capacity System Timeline
CCR Pond and non-CCR Pond

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
36	U1 Outage - Install Seal Trough and Bottom Ash Influent Piping	20 days	Fri 11/3/23	Thu 11/30/23
37	Startup and Commissioning	5 days	Fri 12/1/23	Thu 12/7/23
38	Prepare Construction Certification Report to Sta	15 days	Fri 12/29/23	Thu 1/18/24
39	Startup Pond in Service	1 day	Fri 1/19/24	Fri 1/19/24
40	**Non-CCR Pond Development**	**635 days**	**Wed 12/16/20**	**Tue 5/23/23**
41	HDR Development of Design Basis with Input from LBWL Stakeholders	30 days	Wed 12/16/20	Tue 1/26/21
42	Non-CCR sampling event	15 days	Tue 1/5/21	Mon 1/25/21
43	Permit Documentation	33 days	Wed 1/27/21	Fri 3/12/21
44	BWL Board Review and Capital Fund Allocation	30 days	Mon 3/15/21	Fri 4/23/21
45	EGLE Permit(s) Modification Request for Part 22 Liner Characteristics and Installation	250 days	Mon 4/26/21	Fri 4/8/22
46	JPA Pond <5 Acres Administrative Completeness	30 days	Mon 4/26/21	Fri 6/4/21
47	JPA 45-Day Public Notice	45 days	Mon 6/7/21	Fri 8/6/21
48	State Approval	1 day	Mon 4/11/22	Mon 4/11/22
49	**Construction Procurement**	**164 days**	**Wed 12/16/20**	**Mon 8/2/21**
50	HDR Design Development and Construction Bid Package	74 days	Wed 12/16/20	Mon 3/29/21
51	LBWL Provide Input on Contractor Bid Package	15 days	Tue 3/30/21	Mon 4/19/21
52	HDR Develop Final Contractor Bid Package	15 days	Tue 4/20/21	Mon 5/10/21
53	LBWL Prepare Bid Package for Issue	10 days	Tue 5/11/21	Mon 5/24/21
54	Contractors Prepare Bids	20 days	Tue 5/25/21	Mon 6/21/21
55	LBWL Bid Review and HDR Provide Recommendation for Award	5 days	Tue 6/22/21	Mon 6/28/21
56	Negotiation and Contract Award	15 days	Tue 6/29/21	Mon 7/19/21
57	Award and Complete Contract	10 days	Tue 7/20/21	Mon 8/2/21
58	Start Construction	167 days	Tue 4/12/22	Wed 11/30/22
59	Break for Winter	64 days	Thu 12/1/22	Tue 2/28/23
60	Resume Construction	44 days	Wed 3/1/23	Mon 5/1/23
61	Rerouting Non CCR Flows Including Construction for Pipeline to Pumphouse	40 days	Wed 3/1/23	Tue 4/25/23
62	Outage Tie-In (Pending LBWL Outage Schedule)	5 days	Tue 5/2/23	Mon 5/8/23
63	Startup and Commissioning	5 days	Tue 5/9/23	Mon 5/15/23
64	Construction Certification Report to State	1 day	Tue 5/16/23	Tue 5/16/23
65	Transition Operations to new Non-CCR Pond	5 days	Wed 5/17/23	Tue 5/23/23
66	Startup Pond in Service	1 day	Wed 5/24/23	Wed 5/24/23
67	**CCR and Non-CCR System Online**	**1 day**	**Thu 5/25/23**	**Thu 5/25/23**

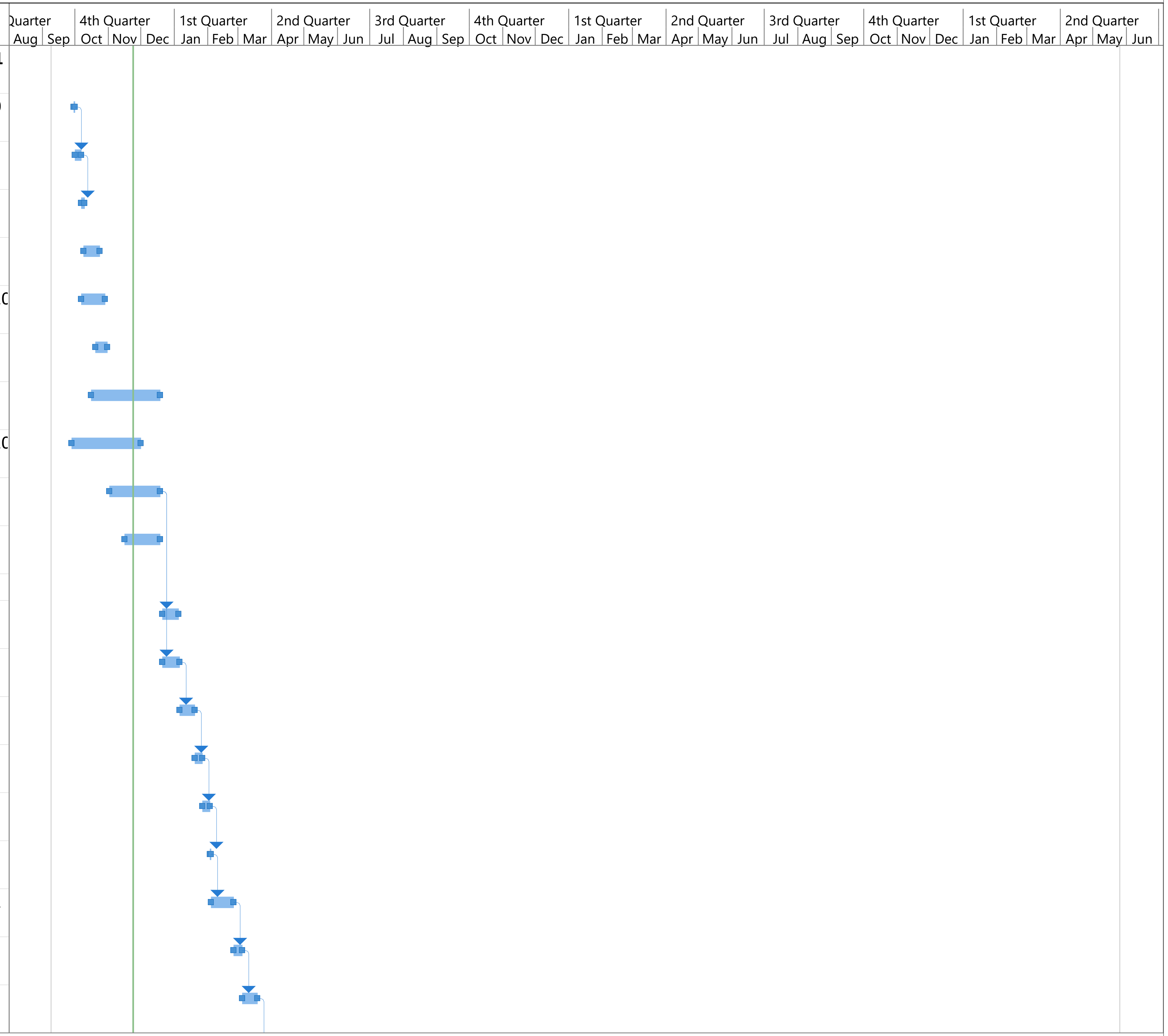


Task | Split | Milestone | Summary

CCR Alternative Capacity System Timeline
CCR Pond and non-CCR Pond

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

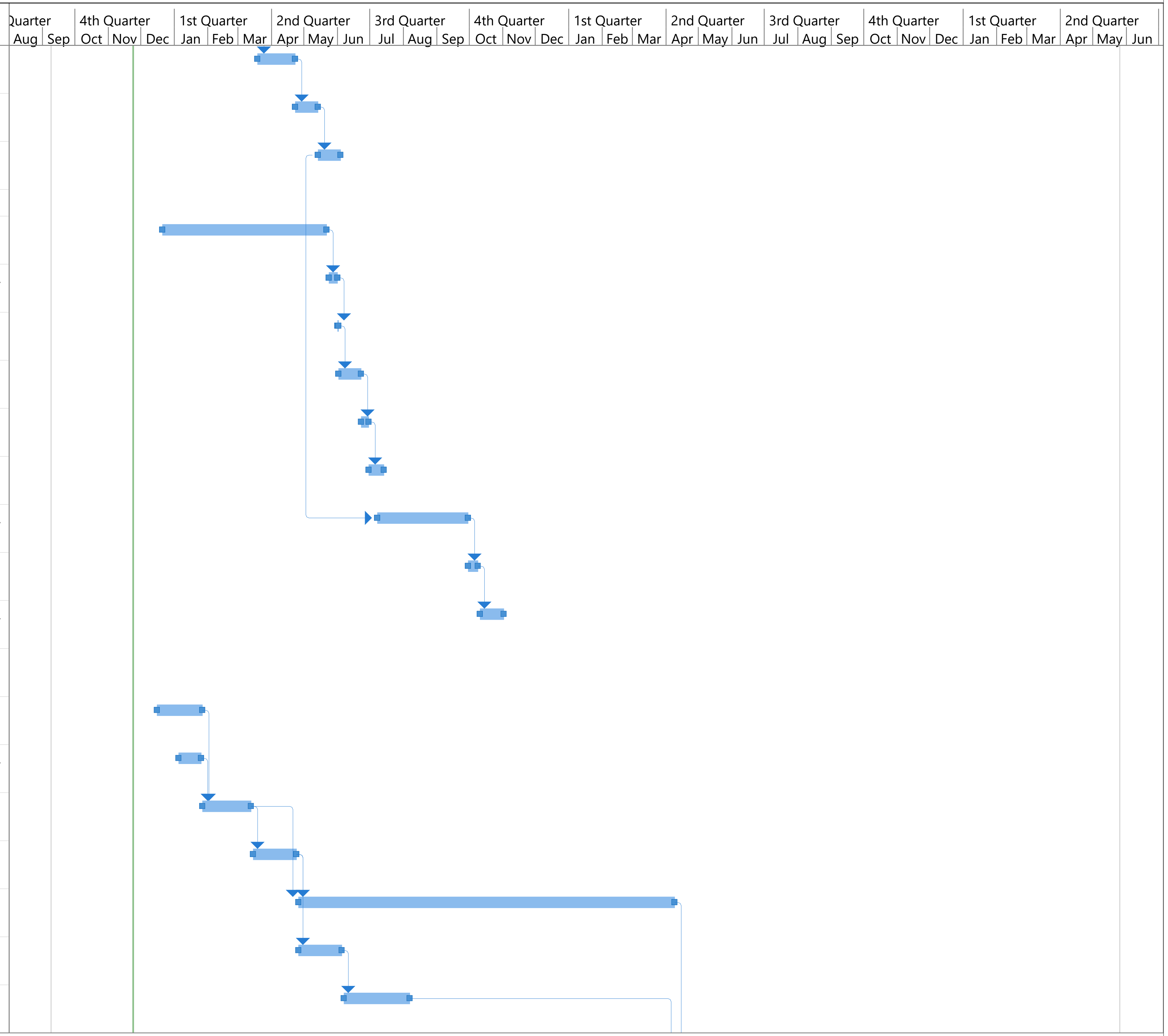
ID	Task Name	Duration	Start	Finish
1	**Rental Equipment Schedule**	**284 days**	**Wed 9/30/20**	**Mon 11/1/21**
2	Site Walk Down and Kickoff	1 day	Wed 9/30/20	Wed 9/30/20
3	Sampling Plan Development	4 days	Thu 10/1/20	Tue 10/6/20
4	On-Site Sampling	3 days	Wed 10/7/20	Fri 10/9/20
5	Ultrasonic Flow Metering Test	11 days	Fri 10/9/20	Fri 10/23/20
6	Laboratory Analyses	16 days	Wed 10/7/20	Wed 10/28/2(
7	Feasibility Study Report Preparation	9 days	Tue 10/20/20	Fri 10/30/20
8	Treatability Study	46 days	Fri 10/16/20	Fri 12/18/20
9	Part A Demo Report Preparation	46 days	Mon 9/28/20	Mon 11/30/2(
10	Procurement of Engineering Design Contract	35 days	Mon 11/2/20	Fri 12/18/20
11	Treatability Study	25 days	Mon 11/16/2(	Fri 12/18/20
12	**Equipment Procurement**	**119 days**	**Mon 12/21/2(**	**Thu 6/3/21**
13	Development of Rental Equipment Design Basis with Input from LBWL Stakeholders	11 days	Mon 12/21/20	Mon 1/4/21
14	HDR Develop Rental Equipment Draft Equipment Specification	12 days	Mon 12/21/20	Tue 1/5/21
15	LBWL Provide Input on Rental Equipment Specificatic	10 days	Wed 1/6/21	Tue 1/19/21
16	HDR Rental Equipment Specification Final	5 days	Wed 1/20/21	Tue 1/26/21
17	LBWL Prepare Bid Package for Issue	5 days	Wed 1/27/21	Tue 2/2/21
18	LBWL Issue Bid Package	1 day	Wed 2/3/21	Wed 2/3/21
19	Vendor Bid Development	15 days	Thu 2/4/21	Wed 2/24/21
20	LBWL Bid Review and HDR Recommendation for Awa	6 days	Thu 2/25/21	Thu 3/4/21
21	LBWL Negotiation and Contract Award	10 days	Fri 3/5/21	Thu 3/18/21



Task | Split | Milestone | Summary

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
22	Vendor Treatment Design and Submittal	25 days	Fri 3/19/21	Thu 4/22/21
23	Equipment Fabrication	15 days	Fri 4/23/21	Thu 5/13/21
24	Equipment Delivery	15 days	Fri 5/14/21	Thu 6/3/21
25	**Construction Procurement**	**147 days**	**Mon 12/21/2(**	**Tue 7/13/21**
26	HDR Design Development and Construction Package	110 days	Mon 12/21/2(	Fri 5/21/21
27	LBWL Prepare Bid Package for Issue	6 days	Mon 5/24/21	Mon 5/31/21
28	LBWL Issue for Bids	1 day	Tue 6/1/21	Tue 6/1/21
29	Contractor Bid Development	15 days	Wed 6/2/21	Tue 6/22/21
30	LBWL Bid Review and HDR Provide Recommdation for Award	5 days	Wed 6/23/21	Tue 6/29/21
31	BWL Negotiation and Contract Award	10 days	Wed 6/30/21	Tue 7/13/21
32	Construction	60 days	Thu 7/8/21	Wed 9/29/21
33	Outage Tie-In (Pending LBWL Outage Schedule)	7 days	Thu 9/30/21	Fri 10/8/21
34	Startup and Commissioning (Pending LBWL Outage Schedule)	16 days	Mon 10/11/21	Mon 11/1/21
35	**Non-CCR Pond Development**	**635 days**	**Wed 12/16/2(**	**Tue 5/23/23**
36	HDR Development of Design Basis with Input from LBWL Stakeholders	30 days	Wed 12/16/20	Tue 1/26/21
37	Non-CCR sampling event	15 days	Tue 1/5/21	Mon 1/25/21
38	Permit Documentation	33 days	Wed 1/27/21	Fri 3/12/21
39	BWL Board Review and Capital Fund Allocation	30 days	Mon 3/15/21	Fri 4/23/21
40	EGLE Permit(s) Modification Request for Part 22 Liner Characteristics and Installation	250 days	Mon 4/26/21	Fri 4/8/22
41	JPA Pond <5 Acres Administrative Completeness	30 days	Mon 4/26/21	Fri 6/4/21
42	JPA 45-Day Public Notice	45 days	Mon 6/7/21	Fri 8/6/21

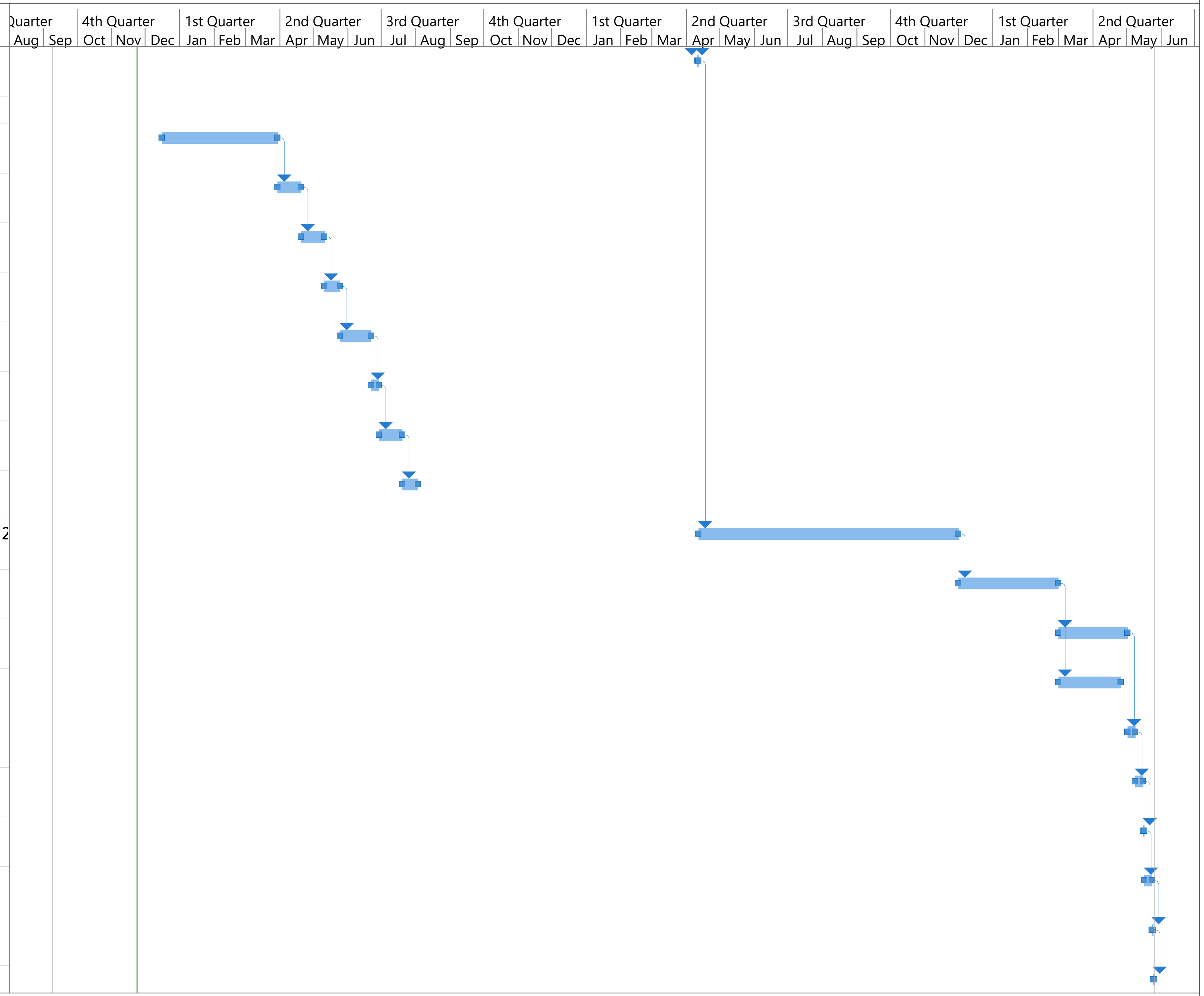


Task | Split | Milestone | Summary

Tue 11/24/20

Lansing Board of Water & Light
CCR Alternative Capacity System Timeline

ID	Task Name	Duration	Start	Finish
43	State Approval	1 day	Mon 4/11/22	Mon 4/11/22
44	**Construction Procurement**	**164 days**	**Wed 12/16/2(**	**Mon 8/2/21**
45	HDR Design Development and Construction Bid Package	74 days	Wed 12/16/20	Mon 3/29/21
46	LBWL Provide Input on Contractor Bid Package	15 days	Tue 3/30/21	Mon 4/19/21
47	HDR Develop Final Contractor Bid Package	15 days	Tue 4/20/21	Mon 5/10/21
48	LBWL Prepare Bid Package for Issue	10 days	Tue 5/11/21	Mon 5/24/21
49	Contractors Prepare Bids	20 days	Tue 5/25/21	Mon 6/21/21
50	LBWL Bid Review and HDR Provide Recommendation for Award	5 days	Tue 6/22/21	Mon 6/28/21
51	Negotiation and Contract Award	15 days	Tue 6/29/21	Mon 7/19/21
52	Award and Complete Contract	10 days	Tue 7/20/21	Mon 8/2/21
53	Start Construction	167 days	Tue 4/12/22	Wed 11/30/22
54	Break for Winter	64 days	Thu 12/1/22	Tue 2/28/23
55	Resume Construction	44 days	Wed 3/1/23	Mon 5/1/23
56	Rerouting Non CCR Flows Including Construction for Pipeline to Pumphouse	40 days	Wed 3/1/23	Tue 4/25/23
57	Outage Tie-In (Pending LBWL Outage Schedule)	5 days	Tue 5/2/23	Mon 5/8/23
58	Startup and Commissioning	5 days	Tue 5/9/23	Mon 5/15/23
59	Construction Certification Report to State	1 day	Tue 5/16/23	Tue 5/16/23
60	Transition Operations to new Non-CCR Pond	5 days	Wed 5/17/23	Tue 5/23/23
61	Startup Pond in Service	1 day	Wed 5/24/23	Wed 5/24/23
62	**CCR and Non-CCR System Online**	**1 day**	**Thu 5/25/23**	**Thu 5/25/23**



Task | Split | Milestone | Summary

C

Well Boring Logs

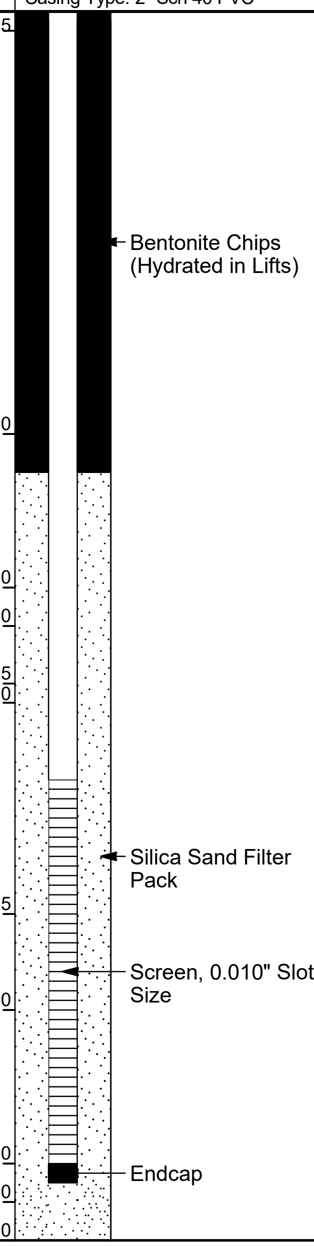
CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, MI
DATE STARTED 10/15/19 11:00 **COMPLETED** 10/15/19 12:30
GROUND ELEVATION 885.97 ft MSL **HOLE DIAMETER** 7"
DRILLING CONTRACTOR SME **DRILLER** Rudy Musulin
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Track-Mounted CME 55
▽ **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	MATERIAL DESCRIPTION	Elev.
0.5		SANDY LEAN CLAY WITH GRAVEL, (CL) brown (10YR 5/3), dry, stiff, low plasticity	885.5
11.0		SANDY LEAN CLAY WITH GRAVEL, (CL) yellowish brown (10YR 5/4), dry, medium stiff, mottled, low plasticity	875.0
15.0		▼ SANDY LEAN CLAY WITH GRAVEL, (CL) yellowish brown (10YR 5/4), moist, medium stiff, mottled, low plasticity	871.0
16.0		SANDY LEAN CLAY, (CL) very dark gray (2.5Y 3/1), moist, stiff, low plasticity	870.0
17.5		CLAYEY SAND, (SC) dark greenish gray (10GY 4/1), poorly graded, fine grained, moist, medium dense, iron oxide staining	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
23.5	SS 20-22	POORLY GRADED SAND WITH CLAY, (SP) gray (5Y 5/1), fine to medium grained, wet, medium dense	862.5
26.0		CLAYEY SAND, (SC) gray (5Y 5/1), poorly graded, fine grained, wet, medium dense	860.0
30.0	SS 26-28	LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine grained, wet, soft, low plasticity	856.0
31.0		FAT CLAY, (CH) gray (5Y 5/1), wet, stiff, medium plasticity	855.0
32.0		LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine to medium grained, wet, soft, low plasticity	854.0

Bottom of borehole at 32.0 feet.

WELL DIAGRAM

Casing Top Elev: 888.74 (ft)
Casing Type: 2" Sch 40 PVC



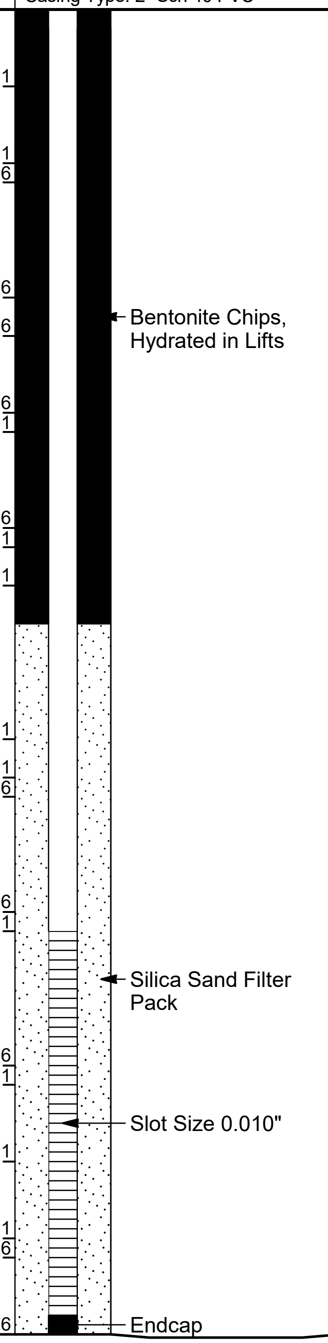
MW-2

CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, 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** Derek Blackburn
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Truck-Mounted CME 55
∇ **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	MATERIAL DESCRIPTION	Elev.
0.0–2.0		LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand	884.1
2.0–4.0		LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand, fine gravel	882.1
4.0–4.5		LEAN CLAY, SILTY, (CL) dark gray (10YR 4/1), dry, stiff, low plasticity, fine sand	881.6
4.5–7.5		LEAN CLAY, SILTY, (CL) brown (10YR 5/3), dry, stiff, low plasticity, fine sand	878.6
7.5–8.5		LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, stiff, medium plasticity	877.6
8.5–10.5		LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand	875.6
10.5–11.0		LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, medium stiff, medium plasticity	875.1
11.0–13.5		LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand	872.6
13.5–14.0		LEAN CLAY, (CL) dark greenish gray (5GY 4/1), moist, medium stiff, medium plasticity	872.1
14.0–15.0		LEAN CLAY, SILTY, (CL) brown (10YR 5/4), moist, medium stiff, low plasticity, fine sand	871.1
15.0–19.0		LEAN CLAY, SILTY, (CL) dark grayish brown (2.5Y 4/2), moist, soft to medium stiff, low plasticity, fine sand, fine gravel	867.1
19.0–20.0		CLAYEY SAND WITH GRAVEL, (SC) brown (10YR 5/4), poorly graded, fine grained, moist, dense	866.1
20.0–20.5		POORLY GRADED SAND, (SP) brown (10YR 5/4), fine to medium grained, wet, loose	865.6
20.5–23.5		LEAN CLAY, SILTY, (CL) brown to olive (10YR 5/4), wet, medium stiff, low plasticity, lenses of fine sand	862.6
23.5–24.0		POORLY GRADED SAND, (SP) brown (10YR 5/4), fine to medium grained, wet, loose	862.1
24.0–27.5	SS 24-26	POORLY GRADED SAND, (SP) light olive (2.5YR 5/3), fine to medium grained, wet, loose	858.6
27.5–28.0		LEAN CLAY, SILTY, (CL) gray (2.5Y 5/1), moist, soft, low plasticity, fine sand	858.1
28.0–30.0	SS 28-30	POORLY GRADED SAND, CLAYEY, (SP) grayish brown (2.5Y 5/2), fine to medium grained, wet, loose	856.1
30.0–32.0		CLAYEY SAND, (SC) grayish brown (2.5Y 5/2), fine grained, wet, loose, grades into sandy clay over depth	854.1
32.0–32.5	SS 32-34	WELL GRADED SAND WITH GRAVEL, (SW) grayish brown (2.5Y 5/2), fine to coarse grained, wet, loose	853.6
32.5–34.5		LEAN CLAY, SILTY, (CL) grayish brown (2.5Y 5/2), wet, stiff, low plasticity, fine sand	851.6

WELL DIAGRAM

Casing Top Elev: 885.97 (ft)
Casing Type: 2" Sch 40 PVC



Bottom of borehole at 34.5 feet.

MW-3

HDR

CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, 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** Derek Blackburn
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Truck-Mounted CME 55
▽ **AT TIME OF DRILLING** 15.00 ft / Elev 870.12 ft
LOGGED BY Emily Munoz **CHECKED BY**
▼ **72 HRS AFTER DRILLING** 15.21 ft / Elev 869.91 ft
NOTES Sample ID prefix LBWL-MW3-. Driller recorded blow counts on SME logs.

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			

MATERIAL DESCRIPTION

- CLAYEY SAND, (SC) brown (10YR 4/3), poorly graded, fine grained, moist, dense
- LEAN CLAY, (CL) grayish brown (10YR 5/2), moist, medium stiff, low plasticity, sand
- POORLY GRADED SAND, (SP) brown (10YR 4/3), fine to medium grained, moist, dense, clay
- LEAN CLAY, SILTY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity, sand
- LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, medium stiff, mottled, low plasticity
- LEAN CLAY, (CL) very dark grayish brown (2.5Y 3/2), moist, medium stiff, low plasticity, sand
- LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, stiff, mottled, low plasticity, gravel
- LEAN CLAY, SANDY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity
- LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, soft, mottled, low plasticity, sand
- LEAN CLAY, SANDY, (CL) very dark grayish brown (2.5Y 3/2), moist, soft, low plasticity
- LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, soft, low plasticity, fine gravel
- LEAN CLAY, (CL) yellowish brown (10YR 5/4), moist, medium stiff, low plasticity, sand, gravel
- CLAYEY SAND, (SC) yellowish brown (10YR 5/4), poorly graded, fine grained, wet, loose
- 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
- POORLY GRADED SAND WITH CLAY, (SP) very dark grayish brown (10YR 3/2), fine to medium grained, wet, loose
- LEAN CLAY, SILTY, (CL) very dark grayish brown (10YR 3/2), moist, soft, low plasticity, fine sand, Stiff, plastic fat clay (CH) in shoe.

Bottom of borehole at 36.0 feet.

Layer boundaries

Depth (ft)	Elevation
1.5	883.6
2.0	883.1
4.0	881.1
4.5	880.6
6.0	879.1
7.0	878.1
8.0	877.1
8.5	876.6
10.0	875.1
10.8	874.4
12.0	873.1
15.0 ▽▼	870.1
16.0	869.1
19.5	865.6
34.5	850.6
35.5	849.6
36.0	849.1

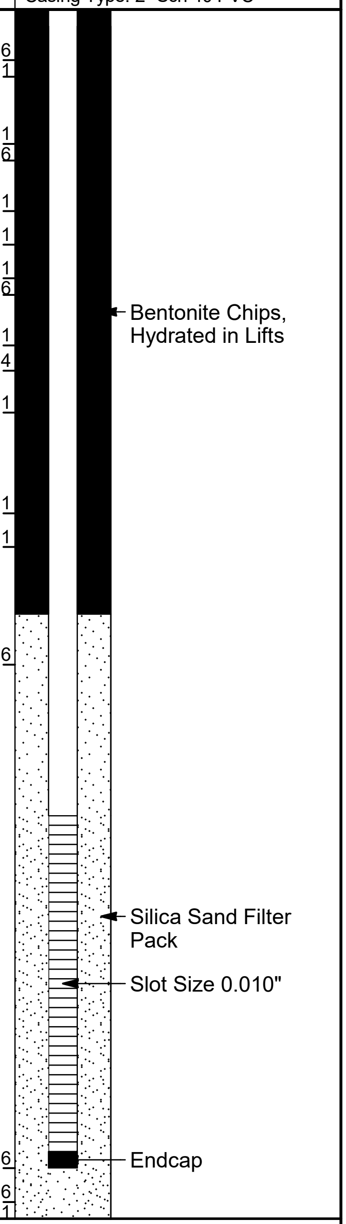
Samples

Sample Type	Number
SS	26-28
SS	28-30

Depth scale (ft): 5, 10, 15, 20, 25, 30, 35

WELL DIAGRAM

Casing Top Elev: 884.81 (ft)
Casing Type: 2" Sch 40 PVC



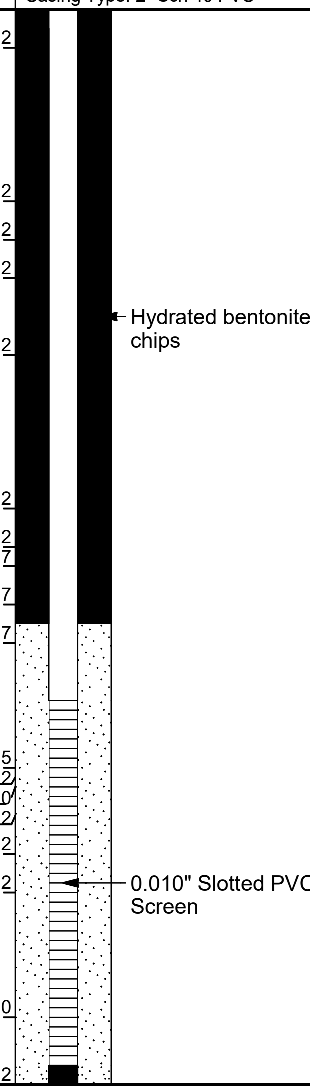
MW-4

CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, 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** Derek Blackburn
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Truck-Mounted CME 55
▽ **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	MATERIAL DESCRIPTION	Elev.
0–1.0		LEAN CLAY, SILTY, (CL) very dark brown (7.5YR 2.5/2), moist, soft, low plasticity, fine sand	884.2
1.0–5.0		LEAN CLAY, SILTY, (CL) brown (10YR 4/3), moist, soft, low plasticity	880.2
5.0–6.0		LEAN CLAY, SILTY, (CL) dark brown (7.5YR 3/2), moist, soft, low plasticity, fine sand	879.2
6.0–7.0		LEAN CLAY, SILTY, (CL) brown with dark brown (10YR 5/3), moist, medium stiff, mottled, low plasticity, fine sand, fine gravel	878.2
7.0–9.0		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
9.0–13.0		LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), moist, soft, medium plasticity, fine sand, fine gravel ▼ ▽	872.2
13.0–14.0		LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), wet, soft, medium plasticity, fine sand, fine gravel	871.2
14.0–14.5			870.7
14.5–15.5		WELL GRADED SAND WITH GRAVEL, (SW) brown (10YR 4/3), fine to coarse grained, wet, loose	869.7
15.5–16.5		LEAN CLAY, SILTY, (CL) yellowish brown (10YR 5/4), wet, stiff, medium plasticity, fine sand, fine gravel	868.7
16.5–		CLAYEY SAND, (SP) yellowish brown (10YR 5/4), fine grained, wet, loose, fine gravel	
–19.8		LEAN CLAY, (CL) brown (7.5YR 4/2), wet, medium stiff, low plasticity, fine sand, fine gravel	865.5
19.8–20.0		CLAYEY SAND, (SP) brown (7.5YR 5/2), fine to coarse grained, wet, loose, fine gravel	865.2
20.0–20.3			865.0
20.3–21.0			864.2
21.0–22.0	GB	CLAYEY SAND, (SP) brown (7.5YR 5/2), fine grained, wet, loose	863.2
22.0–23.0		LEAN CLAY, (CL) brown (7.5YR 5/2), wet, soft, low plasticity, fine sand	862.2
23.0–		POORLY GRADED SAND, (SP) dark gray (7.5YR 4/1), coarse grained, wet, loose, fine gravel	
		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
26.3–28.0		LEAN CLAY, SANDY, (CL) dark gray to black (7.5YR 4/1), wet, medium stiff, low plasticity	857.2

WELL DIAGRAM

Casing Top Elev: 889.15 (ft)
Casing Type: 2" Sch 40 PVC



Bottom of borehole at 28.0 feet.

MW-5

HDR

CLIENT Lansing Board of Water and Light

PROJECT NAME LBWL Confidential

PROJECT NUMBER 10173187

PROJECT LOCATION Erickson Power Station, Lansing, 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** Derek Blackburn

GROUND WATER LEVELS:

DRILLING METHOD HSA **EQUIPMENT** Truck-Mounted CME 55

▽ **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

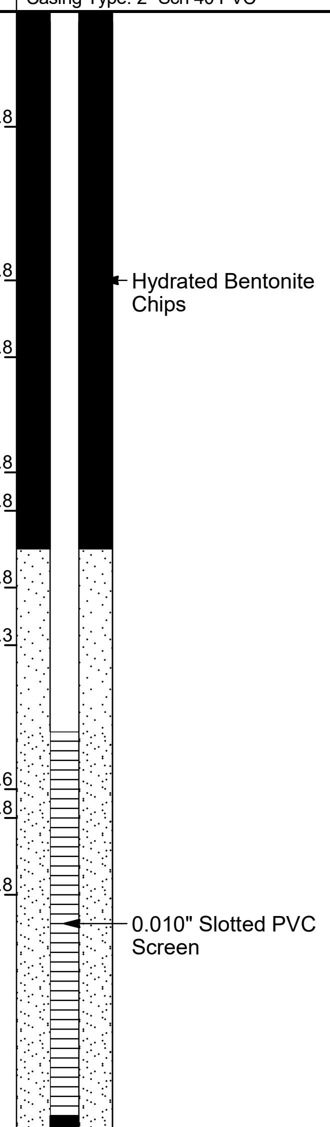
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION	Elev.
0 – 3.0		CLAYEY SAND, (SP) dark yellowish brown (10YR 4/4), poorly graded, fine grained, moist, dense	882.8
3.0 – 7.0		LEAN CLAY, SANDY, (CL) brown to very dark grayish brown (10YR 5/3), dry to moist, stiff, low plasticity, gravel	878.8
7.0 – 9.0		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, stiff, low plasticity, gravel	876.8
9.0 – 12.0		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, soft, low plasticity, gravel	873.8
12.0 – 13.0		▽ LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), wet, soft, low plasticity, gravel	872.8
13.0 – 15.0		CLAYEY SAND, (SC) yellowish brown (10YR 5/4), poorly graded, fine to coarse grained, wet, loose, lenses of sandy clay	870.8
15.0 – 16.5		WELL GRADED SAND, (SW) yellowish brown (10YR 5/4), well graded, fine to coarse grained, wet, loose	869.3
16.5 – 20.3		▼ FAT CLAY, (CH) dark gray (10YR 4/1), wet, soft, high plasticity, trace fine sand and gravel	865.6
20.3 – 21.0	GB	LEAN CLAY, SANDY, (CL) dark gray (10YR 4/1), moist, stiff, low plasticity, fine gravel	864.8
21.0 – 23.0	GB	LEAN CLAY, SANDY, (CL) grayish brown (10YR 5/2), wet, stiff, low plasticity, fine gravel	862.8
23.0 – 29.5	GB	LEAN CLAY, SANDY, (CL) grayish brown (10YR 5/2), wet, soft, low plasticity	856.3

Bottom of borehole at 29.5 feet.

WELL DIAGRAM

Casing Top Elev: 885.5 (ft)
Casing Type: 2" Sch 40 PVC

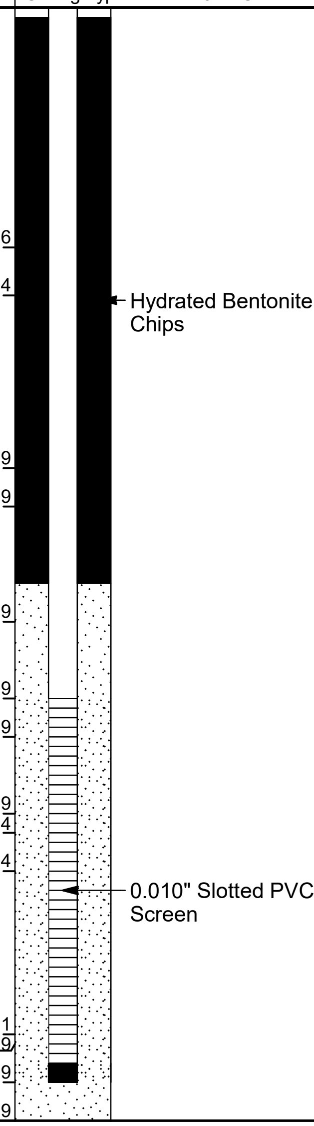


CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, MI
DATE STARTED 01/07/20 11:40 **COMPLETED** 01/07/20 13:00
GROUND ELEVATION 885.86 ft MSL **HOLE DIAMETER** 8"
DRILLING CONTRACTOR SME **DRILLER** Derek Blackburn
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Truck-Mounted CME 55
▽ **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	MATERIAL DESCRIPTION	Elev.
0		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), dry to moist, stiff, low plasticity, gravel	
6.3		LEAN CLAY, SANDY, (CL) dark gray (10YR 4/1), moist, stiff, low plasticity, gravel, iron oxide staining	879.6
7.5		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), moist, stiff, low plasticity, gravel	878.4
12.0		LEAN CLAY, SANDY, (CL) dark gray to black (10YR 4/1), moist, medium stiff, low plasticity, gravel	873.9
13.0		LEAN CLAY, SANDY, (CL) dark gray to yellowish brown (10YR 4/1), moist, medium stiff, mottled, low plasticity, gravel	872.9
16.0		POORLY GRADED SAND, (SP) yellowish brown to brown (10YR 5/6), fine grained, moist, loose to medium dense	869.9
18.0 ▽	GB	POORLY GRADED SAND, (SP) yellowish brown to brown (10YR 5/6), fine grained, wet, loose to medium dense, mottled, iron oxide staining	867.9
19.0 ▼		POORLY GRADED SAND, (SP) yellowish brown to dark yellowish brown (10YR 5/4), fine grained, wet, loose to medium dense, mottled, iron oxide staining	866.9
21.0		WELL GRADED SAND, (SW) dark yellowish brown (10YR 4/4), fine to coarse grained, wet, loose	864.9
21.5		LEAN CLAY, SANDY, (CL) yellowish brown (10YR 5/4), wet, soft, low plasticity	864.4
22.5		POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), fine to medium grained, wet, medium dense	863.4
26.8		LEAN CLAY, (CL) yellowish brown to grayish brown (10YR 5/4), wet, medium stiff, low plasticity, fine sand	859.1
27.0		POORLY GRADED SAND, (SP) yellowish brown (10YR 5/4), fine to medium grained, wet, medium dense	858.9
28.0		LEAN CLAY, (CL) dark grayish brown (10YR 4/2), moist, stiff, medium plasticity, some silt and fine sand	857.9
29.0			856.9

Bottom of borehole at 29.0 feet.

WELL DIAGRAM
Casing Top Elev: 885.53 (ft)
Casing Type: 2" Sch 40 PVC



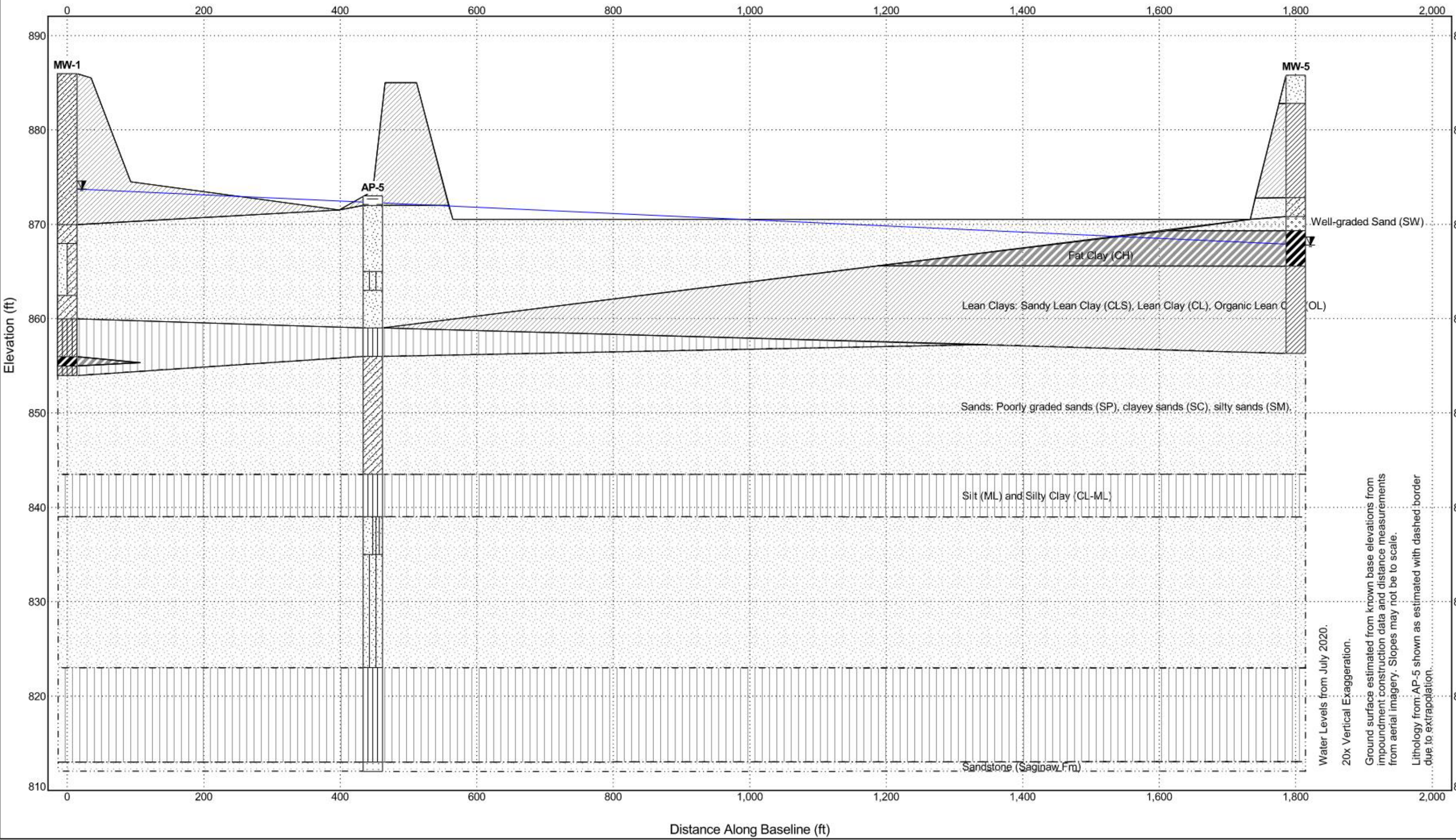
D

Geologic Cross Section

SUBSURFACE DIAGRAM
MW-1 to AP-5 to MW-5

CLIENT Lansing Board of Water and Light
PROJECT NUMBER 10173187
PROJECT NAME LBWL Confidential
PROJECT LOCATION Erickson Power Station, Lansing, MI

- USCS Low Plasticity Organic silt or clay
- USCS Silt
- Sandstone (Saginaw Fm)
- USCS Poorly-graded Sand with Clay
- USCS Poorly-graded Sand
- USCS Clayey Sand
- Fill
- USCS Low Plasticity Silty Clay
- USCS Silty Sand
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Sandy Clay
- USCS High Plasticity Clay



SUBSURFACE DIAGRAM
MW-4 to MW-6

Fill (made ground) | USCS Low Plasticity Clay | USCS Well-graded Sand | USCS Poorly-graded Sand

Water Levels from July 2020

40x Vertical Exaggeration

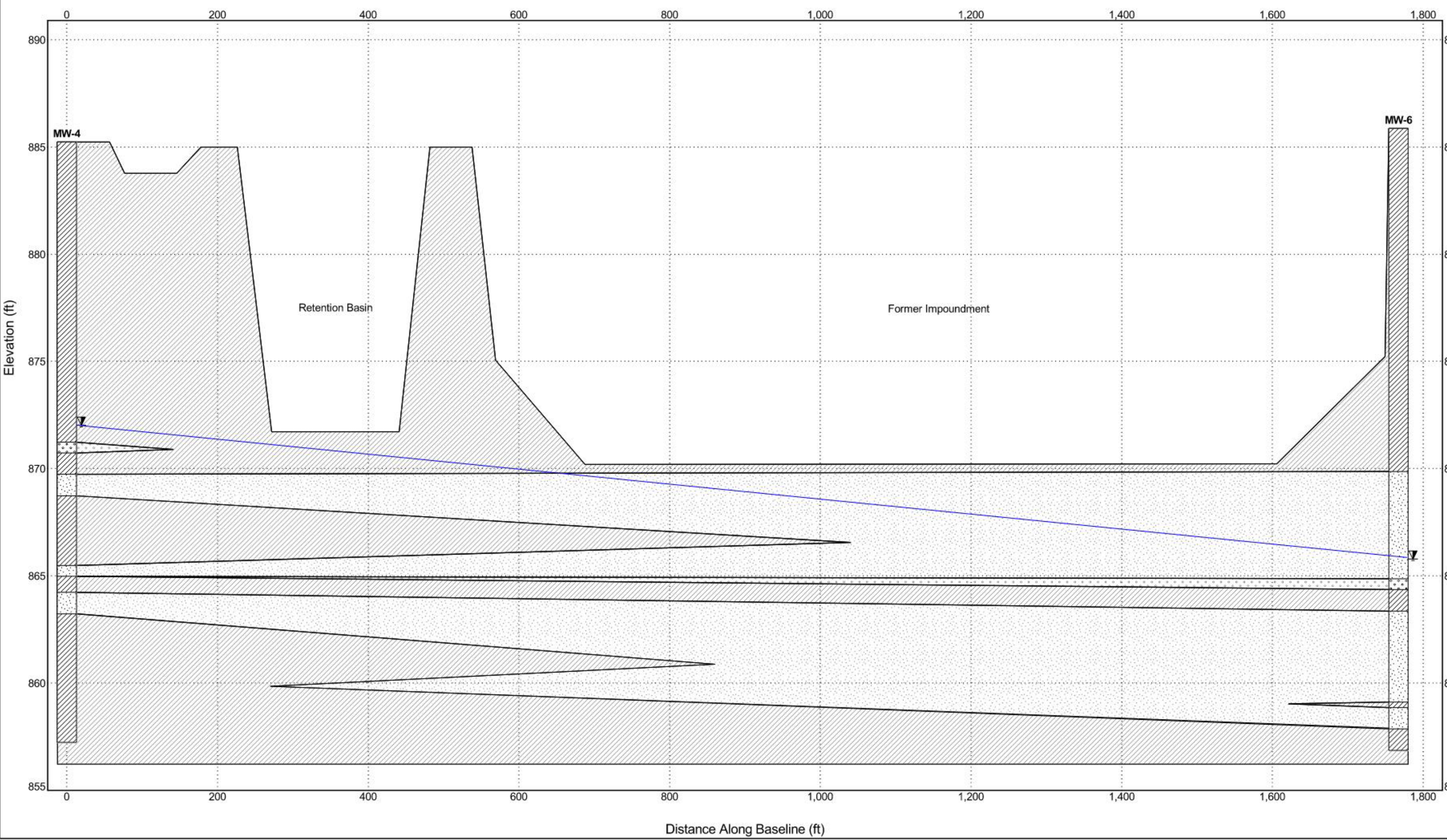
Ground surface estimated from known base elevations from impoundment construction data and distance measurements from aerial imagery. Slopes may not be to scale.

CLIENT Lansing Board of Water and Light

PROJECT NUMBER 10173187

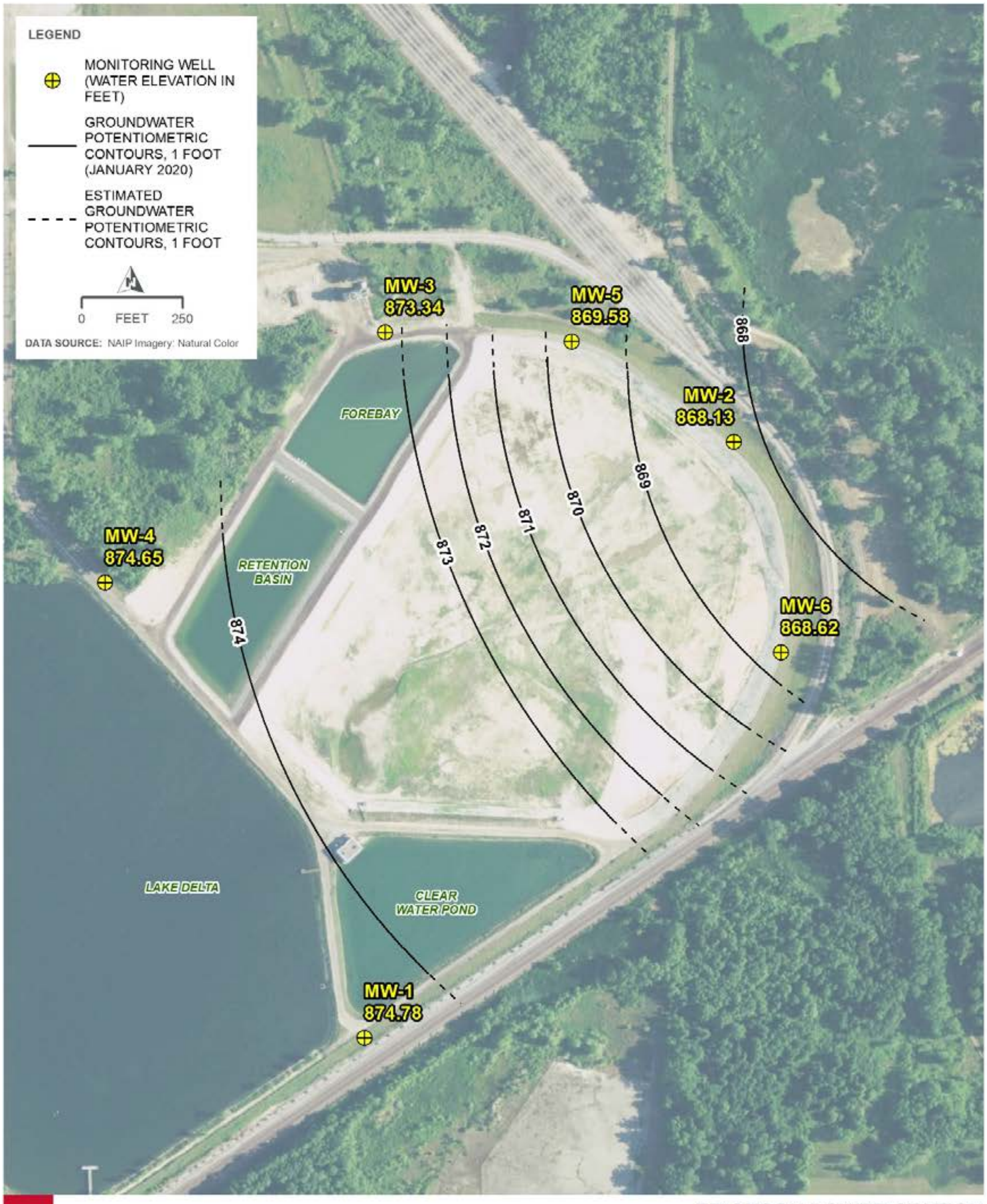
PROJECT NAME LBWL Confidential

PROJECT LOCATION Erickson Power Station, Lansing, MI



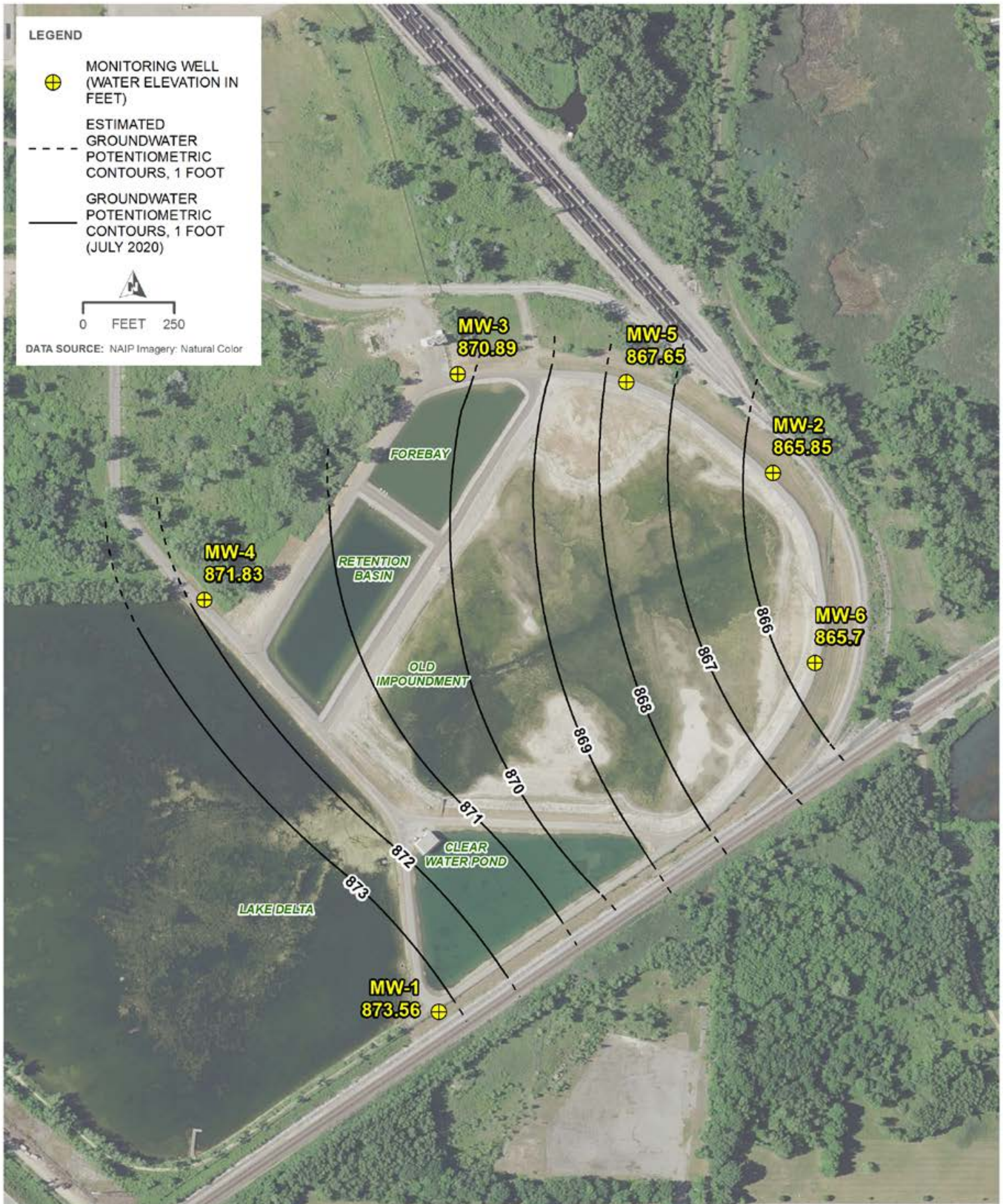
E

Groundwater Contour Maps



ERICKSON POWER STATION

EATON COUNTY, MICHIGAN



ERICKSON POWER STATION

EATON COUNTY, MICHIGAN

PATH: J:\RESOURCECENTER\USER_WORKSPACES\AKAPLE\CONFIDENTIAL_WELL_DATABASE\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\ERICKSONSTATION_PORTRAIT_GWCONTOURS_JULY2020.MXD - USER: AKAPLE - DATE: 11/6/2020

F

Groundwater Quality Data

Sample Location:		MW-1										
Sample Date:		4/28/2020	5/26/2020	6/23/2020	7/21/2020	8/18/2020	9/15/2020	9/28/2020	10/12/2020	10/19/2020	10/19/2020	11/6/2020
Constituent	Unit	Background										
Field Parameters											Field Dup	
pH	su	6.81	6.62	6.75	6.85	6.89	6.90	6.77	6.78	7.15	7.15	6.87
Conductivity	mS/cm	1.175	1.199	1.218	1.209	1.220	1.215	1.177	1.185	1.210	1.210	1.205
Turbidity	NTU	28.20	40.21	17.10	32.30	21.45	15.61	7.32	7.05	8.64	8.64	8.02
Dissolved Oxygen	mg/L	0.00	0.01	0.08	0.05	0.52	0.01	0.05	0.30	0.09	0.09	0.21
Temperature	°C	11.3	15.2	13.5	16.5	15.6	15.5	13.8	15.1	13.9	13.9	15.9
Oxidation Reduction Potential	mV	-43.2	-28.5	-87.2	-53.0	-34.7	-109.8	-62.7	-59.4	-79.2	-79.2	-78.8
Appendix III												
Boron	mg/L	0.48	0.27	0.39	0.38	0.41	0.44	0.45	0.37	0.41	0.39	--
Calcium	mg/L	162	180	165	156	161	170	153	167	156	150	--
Chloride	mg/L	74	52	70	64	65	59	61	59	52	53	--
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--
Sulfate	mg/L	38	69	59	75	75	77	80	81	84	85	--
Total Dissolved Solids	mg/L	728	794	774	782	776	768	796	774	806	784	--
pH, Field	su	6.81	6.62	6.75	6.85	6.89	6.90	6.77	6.78	7.15	7.15	--
Appendix IV												
Antimony	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	mg/L	0.004	0.005	0.007	0.004	0.006	0.006	0.006	0.006	0.005	0.006	0.007
Barium	mg/L	0.149	0.150	0.168	0.128	0.152	0.148	0.145	0.129	0.136	0.135	0.133
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Lithium	mg/L	0.036	0.023	0.032	0.033	0.034	0.039	0.041	0.037	0.036	0.036	0.034
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	pCi/L	1.100	0.340	0.518	0.299	0.400	0.618	-0.063	0.717	0.812	0.600	--
Radium-228	pCi/L	0.518	0.457	-0.166	0.254	1.470	0.217	-0.778	0.031	0.005	-0.262	--
Radium-226/228	pCi/L	1.610	0.796	0.518	0.553	1.870	0.889	0.000	0.748	0.816	0.600	--
Selenium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Suspended Solids	mg/L	31	45	43	37	48	55	19	20	31	32	19

Sample Location:		MW-2									
Sample Date:		4/28/2020	5/26/2020	6/23/2020	7/21/2020	8/18/2020	9/15/2020	9/28/2020	10/12/2020	10/19/2020	11/6/2020
Constituent	Unit	Downgradient									
Field Parameters											
pH	su	6.77	6.54	6.69	6.75	6.80	6.83	6.70	6.72	7.08	6.83
Conductivity	mS/cm	1.602	1.556	1.699	1.744	1.762	1.794	1.761	1.762	1.798	1.792
Turbidity	NTU	72.31	8.27	8.95	9.42	5.95	4.15	7.11	9.56	6.28	11.27
Dissolved Oxygen	mg/L	0.02	0.02	0.07	0.19	0.15	0.12	0.03	0.34	0.03	0.19
Temperature	°C	11.6	14.2	12.9	15.0	13.9	13.7	12.7	14.5	12.3	14.3
Oxidation Reduction Potential	mV	-42.5	36.0	-40.2	32.5	38.2	-75.8	56.1	35.3	22.1	-29.0
Appendix III											
Boron	mg/L	3.56	3.38	4.05	4.61	5.19	5.97	5.94	5.97	5.97	--
Calcium	mg/L	251	256	268	271	272	270	265	270	270	--
Chloride	mg/L	67	68	75	81	85	88	84	88	88	--
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--
Sulfate	mg/L	386	386	484	549	580	560	586	560	560	--
Total Dissolved Solids	mg/L	1170	1180	1300	1390	1430	1390	1420	1390	1390	--
pH, Field	su	6.77	6.54	6.69	6.75	38.2	-75.8	56.1	6.72	7.08	--
Appendix IV											
Antimony	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
Barium	mg/L	0.039	0.043	0.045	0.036	0.045	0.039	0.041	0.041	0.041	0.042
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Lithium	mg/L	0.055	0.047	0.055	0.053	0.057	0.066	0.066	0.065	0.070	0.063
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	mg/L	0.010	0.008	0.010	0.007	0.011	0.011	0.012	0.012	0.012	0.012
Radium-226	pCi/L	0.813	0.055	0.754	0.329	0.171	0.183	0.263	0.151	0.405	--
Radium-228	pCi/L	1.050	0.083	-0.139	0.033	0.573	-0.015	0.060	1.300	0.090	--
Radium-226/228	pCi/L	1.860	0.138	0.754	0.362	0.745	0.183	0.323	1.450	0.495	--
Selenium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Suspended Solids	mg/L	<3	1	<3	<3	14	<3	2	6	3	10

Sample Location:		MW-4																		
Sample Date:		4/28/2020	4/28/2020	5/26/2020	5/26/2020	6/23/2020	6/23/2020	7/21/2020	7/21/2020	8/18/2020	8/18/2020	9/15/2020	9/15/2020	9/28/2020	9/28/2020	10/12/2020	10/12/2020	10/19/2020	11/6/2020	11/6/2020
Constituent	Unit	Background																		
Field Parameters			Field Dup		Field Dup		Field Dup		Field Dup		Field Dup		Field Dup		Field Dup		Field Dup			Field Dup
pH	su	7.18	7.18	7.13	7.13	7.11	7.11	7.23	7.23	7.24	7.24	7.28	7.28	7.14	7.14	7.13	7.13	7.87	7.22	7.22
Conductivity	mS/cm	0.902	0.902	0.894	0.894	0.911	0.911	0.890	0.890	0.880	0.880	0.888	0.888	0.859	0.859	0.866	0.866	0.875	0.876	0.876
Turbidity	NTU	2.57	2.57	0.26	0.26	3.01	3.01	1.70	1.70	1.56	1.56	1.64	1.64	1.08	1.08	1.39	1.39	1.25	1.21	1.21
Dissolved Oxygen	mg/L	0.31	0.31	0.29	0.29	0.02	0.02	0.03	0.03	0.01	0.01	0.02	0.02	0.02	0.02	0.35	0.35	0.04	0.18	0.18
Temperature	°C	10.2	10.2	14.1	14.1	13.5	13.5	14.7	14.7	14.2	14.2	13.7	13.7	13.4	13.4	14.0	14.0	12.9	14.4	14.4
Oxidation Reduction Potential	mV	-76.7	-76.7	-45.2	-45.2	-174.8	-174.8	-68.4	-68.4	-75.0	-75.0	-153.2	-153.2	-77.3	-77.3	-63.8	-63.8	-78.1	-119.1	-119.1
Appendix III																				
Boron	mg/L	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.06	0.05	0.06	--	--
Calcium	mg/L	113	111	115	114	108	108	105	102	111	107	108	110	102	105	111	110	99.7	--	--
Chloride	mg/L	70	70	72	72	72	73	72	72	70	71	68	70	69	70	71	71	68	--	--
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--
Sulfate	mg/L	59	60	57	56	57	57	56	56	58	59	58	58	58	58	60	59	57	--	--
Total Dissolved Solids	mg/L	548	546	566	562	558	582	540	534	582	552	572	542	538	544	538	534	554	--	--
pH, Field	su	7.18	7.18	7.13	7.13	7.11	7.11	7.23	7.23	7.24	7.24	7.28	7.28	7.14	7.14	7.13	7.13	7.87	--	--
Appendix IV																				
Antimony	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	mg/L	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.007	0.008	0.007	0.009	0.007	0.008	0.009	0.009	0.009	0.009	0.009	0.009
Barium	mg/L	0.157	0.155	0.165	0.168	0.165	0.170	0.146	0.147	0.166	0.167	0.163	0.163	0.163	0.168	0.151	0.155	0.160	0.16	0.159
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Lithium	mg/L	<0.010	<0.010	0.009	0.009	0.008	0.008	0.009	0.008	<0.010	<0.010	0.010	0.010	0.010	0.011	0.010	<0.010	0.010	0.011	0.011
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	mg/L	<0.005	<0.005	<0.005	0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	pCi/L	0.839	0.953	0.599	1.080	0.368	0.223	0.339	0.811	0.527	0.300	0.583	0.773	0.797	0.759	0.350	0.709	0.357	--	--
Radium-228	pCi/L	1.080	1.380	-0.093	0.280	-0.141	0.302	0.863	0.721	2.460	0.253	0.113	-0.641	0.839	1.470	1.650	1.380	0.232	--	--
Radium-226/228	pCi/L	1.920	2.330	0.599	1.360	0.368	0.524	1.200	1.530	2.990	0.552	0.696	0.773	1.640	2.230	2.000	2.090	0.589	--	--
Selenium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Suspended Solids	mg/L	<3	<3	1	1	<3	<3	<3	<3	<3	<3	<3	<3	2	2	<3	1	3	1	1

Sample Location:		MW-5									
Sample Date:		4/28/2020	5/26/2020	6/23/2020	7/21/2020	8/18/2020	9/15/2020	9/28/2020	10/12/2020	10/19/2020	11/6/2020
Constituent	Unit	Downgradient									
Field Parameters											
pH	su	7.27	7.24	7.31	7.34	7.30	7.17	6.71	7.34	7.45	7.16
Conductivity	mS/cm	1.576	1.882	1.970	1.869	1.750	1.893	1.945	2.493	1.425	2.234
Turbidity	NTU	179.57	69.71	17.91	15.10	20.25	19.02	15.75	12.35	9.58	18.49
Dissolved Oxygen	mg/L	0.55	0.65	2.61	3.85	2.50	0.64	1.27	3.49	4.25	1.02
Temperature	°C	11.6	13.9	15.2	17.5	12.7	12.3	12.5	15.5	11.6	12.5
Oxidation Reduction Potential	mV	-33.0	28.7	-34.8	58.4	69.5	-24.8	180.1	-31.2	130.2	17.5
Appendix III											
Boron	mg/L	4.99	5.19	4.59	4.57	4.48	5.00	5.09	5.00	5.75	--
Calcium	mg/L	245	320	289	251	266	266	283	372	319	--
Chloride	mg/L	68	82	75	80	76	77	78	81	83	--
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--
Sulfate	mg/L	591	930	931	877	714	791	873	1,080	1,170	--
Total Dissolved Solids	mg/L	1280	1770	1720	1640	1520	1540	1660	1960	2020	--
pH, Field	su	7.27	7.24	7.31	7.34	7.30	7.17	6.71	7.34	7.45	--
Appendix IV											
Antimony	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	mg/L	0.005	0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002
Barium	mg/L	0.064	0.056	0.049	0.041	0.056	0.043	0.043	0.048	0.042	0.033
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	mg/L	0.005	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Lithium	mg/L	0.091	0.051	0.061	0.074	0.085	0.091	0.070	0.054	0.046	0.057
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	mg/L	0.096	0.051	0.050	0.052	0.067	0.053	0.044	0.038	0.035	0.032
Radium-226	pCi/L	1.100	-0.042	0.379	-0.045	0.415	0.458	0.533	0.461	0.537	--
Radium-228	pCi/L	0.187	-0.481	-0.299	0.460	1.060	-0.005	0.225	0.176	-0.866	--
Radium-226/228	pCi/L	1.290	0.000	0.379	0.460	1.480	0.458	0.758	0.637	0.537	--
Selenium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Suspended Solids	mg/L	161	21	23	37	20	61	6	14	7	4

Sample Location:		MW-6									
Sample Date:		4/28/2020	5/26/2020	6/23/2020	7/21/2020	8/18/2020	9/15/2020	9/28/2020	10/12/2020	10/19/2020	11/6/2020
Constituent	Unit	Downgradient									
Field Parameters											
pH	su	6.64	6.35	6.68	6.76	6.80	6.85	6.69	6.71	7.11	6.76
Conductivity	mS/cm	0.954	0.902	1.044	1.075	1.130	1.251	1.149	1.205	1.275	1.169
Turbidity	NTU	16.71	17.80	33.60	6.61	8.99	6.95	5.42	8.45	8.35	9.69
Dissolved Oxygen	mg/L	0.05	0.01	0.09	0.09	0.05	0.04	0.02	0.24	0.04	0.18
Temperature	°C	10.5	14.2	11.7	13.4	13.0	13.6	12.6	14.3	12.8	15.2
Oxidation Reduction Potential	mV	-26.9	102.4	-45.9	139.7	91.1	-66.5	59.5	88.9	91.2	12.0
Appendix III											
Boron	mg/L	0.56	0.49	0.65	0.75	0.86	1.05	0.97	0.99	1.09	--
Calcium	mg/L	142	143	154	161	170	192	175	189	173	--
Chloride	mg/L	26	24	29	33	37	43	39	41	42	--
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--
Sulfate	mg/L	135	123	154	183	222	264	214	242	263	--
Total Dissolved Solids	mg/L	642	598	706	738	820	880	822	868	898	--
pH, Field	su	6.64	6.35	6.68	6.76	6.80	6.85	6.69	6.71	7.11	--
Appendix IV											
Antimony	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Barium	mg/L	0.042	0.050	0.042	0.044	0.053	0.054	0.055	0.054	0.057	0.052
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Lithium	mg/L	0.037	0.038	0.037	0.041	0.044	0.055	0.053	0.052	0.059	0.058
Mercury	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	mg/L	0.021	0.021	0.026	0.025	0.030	0.031	0.028	0.029	0.034	0.028
Radium-226	pCi/L	0.212	0.265	0.568	1.060	0.340	1.010	0.175	0.310	0.464	--
Radium-228	pCi/L	0.384	0.357	0.771	-0.042	1.220	0.641	0.270	0.237	1.140	--
Radium-226/228	pCi/L	0.596	0.622	1.340	1.060	1.560	1.650	0.445	0.547	1.610	--
Selenium	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Suspended Solids	mg/L	<3	6	<3	<3	<3	<3	<3	<3	1	<3

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Structural Stability & Safety Factor Assessment

Initial Structural Stability and Safety Factor Assessment

For Compliance with the EPA Coal Combustion Residuals (CCR) Rule 40 CFR 257.73(d) 40 CFR 257.73(e)

Erickson Power Station – Clear Water Pond

June 12, 2020

Prepared for:
Lansing Board of Water and Light
Erickson Power Station
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Contents

Tables

Figures

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1 Introduction and Purpose

HDR MICHIGAN, Inc. (HDR) has prepared this Structural Stability and Safety Factor Assessment Report for the Clear Water Pond at Erickson Power Station following the requirements of the Federal Coal Combustion Residuals (CCR) Rule to demonstrate compliance of the existing Erickson Power Station in Lansing, Michigan.

On April 17, 2015, the United States Environmental Protection Agency (EPA) issued the final rule (Ref. [2]) for disposal of Coal Combustion Residuals (CCR) under Subtitle D of the Resource Conservation and Recovery Act (RCRA). CCR Rule 40 CFR 257.73(b) requires that owners or operators of an existing CCR surface impoundment that either 1) has a height of five feet or more and a storage volume of 20 acre-feet or more; or 2) has a height of 20 feet or more perform periodic structural stability assessments (40 CFR 257.73(d)) and periodic safety factor assessments (40 CFR 257.73(e)). It was determined that the existing Clear Water Pond at the Erickson Power Station meets the first criteria with a height of five feet or more and a storage volume greater than 20 acre-feet.

The CCR Final Rule requires that initial and periodic structural stability assessments be conducted in accordance with Section 257.73(d). Section 257.73(e) requires that initial and periodic safety factor assessments be conducted to verify that the stability of the most critical section of the embankment complies with the required minimum factors of safety for the long-term maximum storage pool, maximum surcharge pool, and seismic load cases. This report presents the initial periodic structural stability assessment and initial periodic safety factor assessment for the Clear Water Pond.

The Structural Stability and Safety Factor Assessment Report presented herein addresses the specific requirements of 40 CFR 257.73(d) and 40 CFR 257.73(e). This Structural Stability and Safety Factor Assessment Report was prepared by Mr. Bryce Burkett, P.E., and was reviewed in accordance with HDR's internal review policy by Mr. Adam N. Jones, P.E., both of HDR. Mr. Burkett is a registered Professional Engineer in the State of Michigan.

1.1 Site Location

Erickson Power Station is an electrical power generation facility located at 3725 South Canal Road, Lansing, Michigan which is owned and operated by Lansing Board of Water & Light (BWL). The latitude and longitude of the Erickson Power Station are approximately 42.692422 N and 84.657764 W. The site is located southwest of Lansing Michigan, near the intersection of Interstates 69 and 96, as shown in the vicinity map, Figure 1.

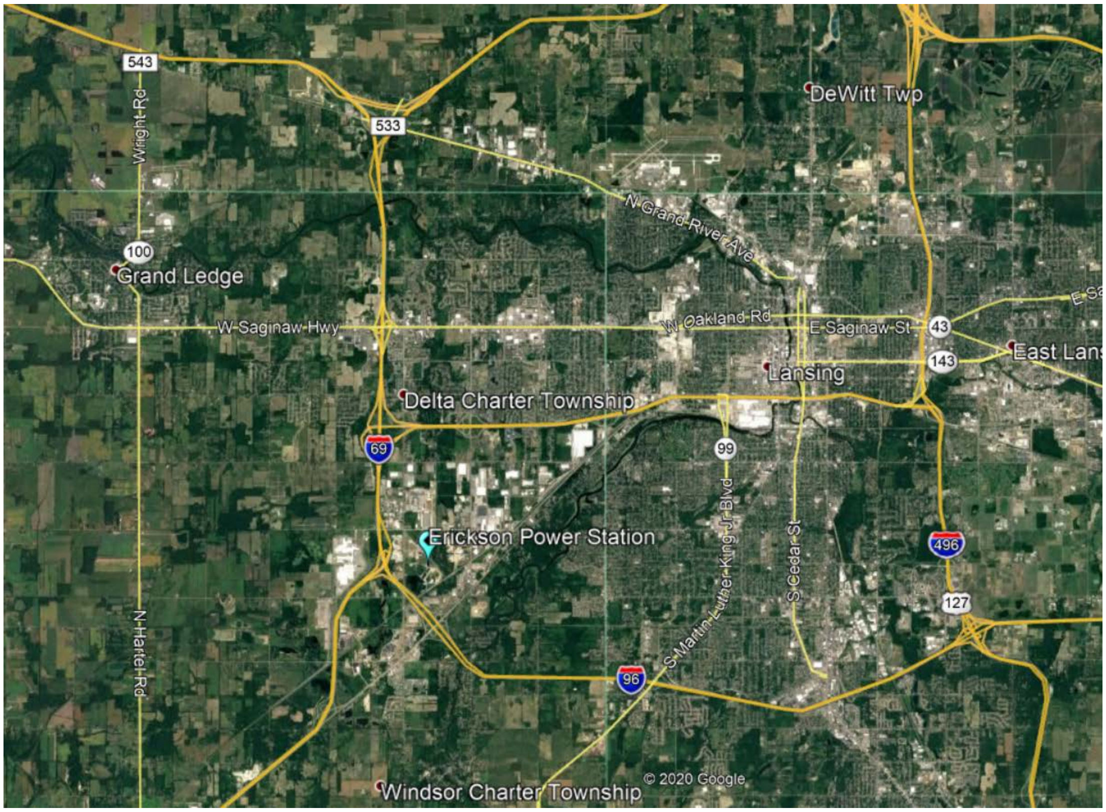


Figure 1. Site Vicinity Map

1.2 Site Description

Erickson Power Station was constructed starting in 1970, was completed in 1973, and is scheduled to close in 2025 as part of the BWL's move to cleaner energy sources. Erickson Power Station contains a single coal-fired steam turbine/generator capable of producing 165 megawatts of electricity.

Historically, fly ash and bottom ash resulting from the coal combustion process were mixed with water to form a slurry and pumped from the plant to the 33-acre impoundment system (physically closed in 2014). From the 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.

From 2009 through 2014, the ash was removed from the 33-acre impoundment, and a new system (including the construction of the Forebay and Retention Basin) (Ref. [9]) was installed. The Forebay and Retention Basin were installed within the footprint of the excavated 33-acre Former Impoundment and cover approximately 5-acres, leaving the Former Impoundment with a surface area of 28-acres.

Currently, bottom ash from the coal-fired boiler is sluiced from the plant to dewatering tanks (hydro-bins). The dewatered bottom ash is trucked to a sanitary landfill and the decant water is hydraulically fed through the current impoundment system, which consists of a series of three impoundments: the Forebay, Retention Basin, and Clear Water Pond.

The Clear Water Pond was constructed to provide a storage basin for water prior to recycling it back to Erickson Power Station via the Pump House located on the northwest corner of Clear Water Pond. The Clear Water Pond has a surface area (including top of dike) of approximately 4.7 acres. During normal operating conditions, the water flows between the station, the impoundments, the Clear Water Pond, and back to the station. The Clear Water Pond has a normal operating pool level of approximately El. 881.7 to El. 882.0 feet (NAVD 88[1]).

There is one overflow associated with the impoundment system, which is the Emergency Overflow Structure located in the Clear Water Pond. The overflow structure consists of a 36-inch ductile iron pipe set at El. 883.0 feet NAVD 88. In the event of an emergency overflow, water would enter the overflow structure which discharges to a swale that directs flow north to Carrier Creek, then north to Holly Drain, then to Clements Underhill Drain, and ultimately to the Grand River.

Figure 2 displays the Erickson Power Station site configuration, including the current impoundment system.

Figure 2. Erickson Power Station Site Configuration

Figure 3 presents a Google Earth view looking NNE, identifying the Clear Water Pond in relation to the impoundment system. Also viewable in Figure 3 is the Forebay, Retention Basin, Lake Delta, Former Impoundment, coal pile, and Erickson Power Station.

[1] North American Vertical Datum of 1988

Figure 3. Google Earth Image of Impoundment System

The Clear Water Pond has five hydraulic structures that extend through the embankment:

- Lake Delta Drainage Structure
- Lake Delta Transfer Structure
- Old Ash Impoundment Transfer Structure
- Old Ash Impoundment Drainage Structure
- Emergency Overflow Structure

Figure 4 (Ref. [11]) displays a plan view of the Clear Water Pond with the locations of the associated hydraulic structures and pipes extending through the embankment. Note that the elevations presented in Figure 4 (Ref. [11]) presents survey information referenced to NGVD 29[2] and NAVD 88.

[2] National Geodetic Vertical Datum of 1929

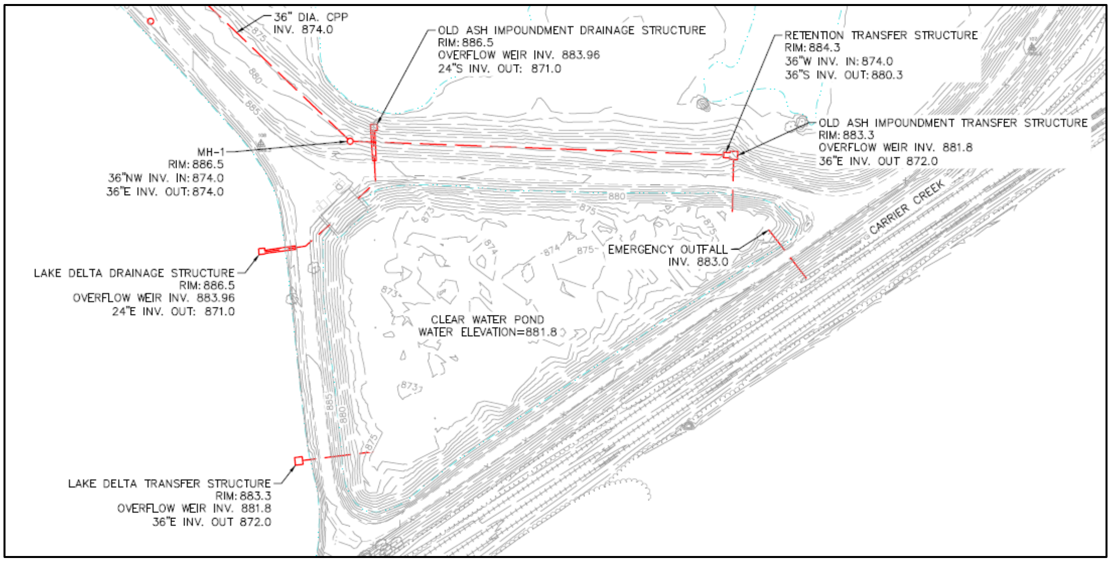


Figure 4. Location of Clear Water Pond Hydraulic Structures

The following provides details of each hydraulic structure located at the Clear Water Pond. It should be noted that elevations presented in this report were provided by a survey performed by BWL on May 7, 2020, along with a review of the existing elevations presented in reports provided by BWL.

Lake Delta Drainage Structure

The Lake Delta Drainage Structure is located between the Clear Water Pond and Lake Delta. Water from Lake Delta flows through the drainage structure (extending through the Clear Water Pond embankment) to the Pump House where it is sent to Erickson Power Station to use. The discharge pipe consists of 24-inch ductile iron pipe, equipped with square, (6-feet x 6-feet) concrete, anti-seep collars. HDR understands that this drainage structure is active and commonly in use.

The invert of the overflow weir is at approximately El. 883.6 feet NAVD 88 and the invert of the outlet is at approximately El. 870.4 feet NAVD 88.

Lake Delta Transfer Structure

The Lake Delta Transfer Structure is located between the Clear Water Pond and Lake Delta. Water from Lake Delta flows over the overflow weir through the discharge pipe extending through the Clear Water Pond embankment and into the Clear Water Pond. The discharge pipe consists of 36-inch ductile iron pipe, equipped with square, (8-feet x 8-feet) concrete, anti-seep collars. Stop logs are in place to the top of the overflow weir, preventing hydraulic connection between Lake Delta and the Clear Water Pond.

The invert of the overflow weir is at approximately El. 881.9 feet NAVD 88 and the invert of the outlet is at approximately El. 871.4 feet NAVD 88.

Old Ash Impoundment Transfer Structure

The Old Ash Impoundment Transfer Structure is located between the Clear Water Pond and the Former Impoundment. Water from the Retention Basin flows through piping to the Retention Transfer Structure, which is then transferred to the Old Ash Impoundment Transfer Structure which then flows through the pipe extending through the Clear Water

Pond embankment and in to the Clear Water Pond. The piping extending through the Clear Water Pond embankment consists of 36-inch ductile iron pipe, equipped with square, (8-feet x 8-feet) concrete, anti-seep collars. This structure is the only intake water source to the Clear Water Pond.

The invert of the overflow weir is at approximately El. 880.3 feet NAVD 88 and the invert of the outlet is at approximately El. 871.4 feet NAVD 88.

Old Ash Impoundment Drainage Structure

The Old Ash Impoundment Drainage Structure is located between the Clear Water Pond and the Former Impoundment. The Old Ash Impoundment Drainage Structure was designed to transfer water from the Former Impoundment to the Pump House but is now inactive and not in use. The piping extending through the Clear Water Pond embankment consists of 24-inch ductile iron pipe, equipped with square, (8-feet x 8-feet) concrete, anti-seep collars. According to BWL, the valve of the pipe is currently closed.

Emergency Overflow Structure

The Emergency Overflow Structure is located between the Clear Water Pond and the swale adjacent to the railroad. The Emergency Overflow Structure was designed in an overflow event of the Clear Water Pond to allow water to discharge through the pipe extending through the Clear Water Pond embankment and exit into the swale adjacent to the railroad. The pipe consists of 36-inch ductile iron pipe, equipped with square, (8-feet x 8-feet) concrete, anti-seep collars.

The top of the inlet of the Emergency Overflow Structure was repaired by BWL in approximately May 2017 due to corrosion/deterioration of the pipe. The invert of the overflow pipe is at approximately El. 883.0 feet NAVD 88 and the invert of the outlet pipe is at approximately EL. 873.1 feet NAVD 88. The outlet pipe is equipped with fencing to prevent animals from entering and vegetation was maintained around the outlet.

According to BWL, an overflow event has not occurred in the Clear Water Pond and the Emergency Overflow Structure has yet to be used for discharge.

1.3 Previous Assessments and Inspections

A previous assessment was performed by was performed by GZA GeoEnvironmental, Inc. (GZA) for the Erickson Power Station Ash Pond in 2011 and a report, referred to as a Round 10 Dam Assessment, was issued detailing the findings from the assessment in 2012 (Ref. [3]). The GZA 2012 report was performed for the Ash Pond which was undergoing closure at the time of the assessment. The Ash Pond has since been closed and is referred to herein as the Former Impoundment. A site visit was conducted for GZA 2012 on May 19, 2011. The GZA 2012 report includes discussion and details of the Clear Water Pond. An additional inspection of the Former Impoundment was performed in 2009 by Inspecsol Engineering, Inc. as noted in GZA 2012, however, that report was not available for review.

BWL performs weekly inspections for the entire CCR impoundment system. The weekly inspections are completed by qualified individuals to check for potentially hazardous conditions or structural weakness and the results of the inspections are documented internally on Weekly Inspection Reports.

There have been no reports of structural instability at the Clear Water Pond during previous inspections.

There are no records of previous structural stability assessments or safety factor assessments that have been performed for the Clear Water Pond embankment.

2 Structural Stability Assessment - 40 CFR 257.73(d)

The requirements to be documented in the Structural Stability Assessment for existing CCR surface impoundments are detailed in 40 CFR 257.73: *Structural integrity criteria for existing CCR surface impoundments*. CCR Rule 40 CFR 257.73(d) states that the assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with the items specified in 40 CFR 257.73(d)(1)(i) through (vii). Table 2-1 summarizes the information from paragraphs 40 CFR 257.73(d)(1)(i) through (vii), as well as the location of the information presented in this document.

Table 2-1. List of Structural Stability Assessment Items

40 CFR Rule	Rule Information	Document Section
257.73 (d)(1)(i)	Foundations and Abutments	Section 2.1
257.73 (d)(1)(ii)	Slope Protection	Section 2.2
257.73 (d)(1)(iii)	Embankment Compaction	Section 2.3
257.73 (d)(1)(iv)	Embankment Vegetation	Section 2.4
257.73 (d)(1)(v)	Spillway	Section 2.5
257.73 (d)(1)(vi)	Hydraulic Structures	Section 2.6
257.73 (d)(1)(vii)	Downstream Slope Drawdown	Section 2.7
257.73 (d)(2)	Structural Stability Deficiencies	Section 2.8

2.1 257.73 (d)(1)(i) - Foundations and Abutments

§257.73 (d)(1)(i): Stable foundations and abutments.

Prior to the construction of the Erickson Power Station impoundment system, a subsurface investigation program was performed in 1969 by Dames & Moore. The soil boring logs performed for that study are presented in the Location Restrictions Report prepared by Mayotte Design & Engineering (MD&E) (Ref. [10]). In addition to the 1969 soil borings, geoprobe borings and test pits were performed at the site by MD&E in 2018. In 2019 and 2020, HDR installed six monitoring wells across the site, with one monitoring well (MW-1) being installed through the south embankment of the Clear Water Pond. As part of the previous subsurface investigations, three borings (AP-4 through AP-6), three geoprobe borings (CW-SB-1 through CW-SB-3), and one monitoring well (MW-1) were performed/installed in the vicinity of the Clear Water Pond.

The historical boring logs prepared by Dames & Moore (1969) prior to the construction of the Clear Water Pond indicate that the embankment foundation is comprised primarily by alternating layers of sands and silts (i.e. sand, silty sand, clayey sand, clayey silt) from the surface to depths of approximately 60 feet below existing grade at the time of the investigation. The installation log of MW-1, installed in 2019, indicates the presence of cohesive layers (Lean and Fat Clay) within the granular layers. Gravel, traces of clay, and organic matter were observed in the alternating sand and silt layers. In the deepest boring performed (AP-5), a sandstone layer was encountered at approximately 60 feet below grade, which is the depth that the boring was terminated.

The previous subsurface investigation documentation indicates that the foundation is competent and stable. The assessment of abutment stability required by the CCR Final Rule is not applicable, as the embankment impounding the Clear Water Pond is continuous.

2.2 257.73 (d)(1)(ii) - Slope Protection

§257.73 (d)(1)(ii): Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.

The interior slopes of the Clear Water Pond are protected by vegetation above the water line and riprap below the water line. Some areas along the North Embankment interior slope were observed to have sparse rip rap and some shallow sloughing has occurred. The exterior slopes of the Clear Water Pond Southeast Embankment (adjacent to the railroad) are protected from erosion and deterioration by vegetative cover. The exterior slopes of the Clear Water Pond North Embankment (adjacent to the Former Impoundment) are protected from erosion and deterioration by a combination of vegetative cover and/or riprap. The exterior slopes of the Clear Water Pond West Embankment (adjacent to Lake Delta) are protected by vegetation above the water line and riprap below the water line.

The crest of the Clear Water Pond consists of a gravelly/soil surface around the perimeter of the entire pond. According to BWL, the road on the crest of the embankment is graded and maintained periodically.

Weekly inspections performed by BWL monitor the existing slopes for erosion, depressions, cracks, animal burrows, ruts, holes, and seepage. Erosion and sloughing along the interior slope of the North Embankment was observed, though, it is anticipated that this can be addressed through normal maintenance on an as needed basis without creating a risk to the facility. Except for the sparse riprap and shallow sloughing observed along the interior slope of the North Embankment, the existing slope protection measures for the Clear Water Pond are generally considered adequate to provide protection against surface erosion, wave action, and adverse effects of sudden drawdown. The March 2020 inspection performed by HDR (Ref. [6]) did not identify any other concerns relating to slope protection that required investigation or repair.

2.3 257.73 (d)(1)(iii) - Embankment Compaction

§257.73 (d)(1)(iii): Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

Construction drawings and specifications, including compaction records for the Clear Water Pond, were unavailable for review, however, GZA 2012 (Ref. [3]), referenced the original specifications for the embankment, and noted that "*It was reportedly constructed on clays and silts underlain by silts and sands underlain by bedrock (sandstone). According to the specifications construction for the Ash Pond, the natural ground surface, which also forms the liner, was stripped and scarified to provide a bond with the first layer of the dike fill. The construction specifications indicate that the embankment was constructed primarily with selected on-site clay borrow material from locations shown in Figure 4. The fill was specified to be placed in layers of 8-inch loose thickness and compacted to 95% of the maximum dry density determined by ASTM standard D-1557.*"

2.4 257.73 (d)(1)(iv) - Embankment Vegetation

§257.73 (d)(1)(iv): Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.

The interior and exterior slopes of the Clear Water Pond embankment contained vegetation (with the addition of riprap in some areas). The vegetation has been maintained by BWL, and reportedly is cut to maintain a height of 6 inches or less. The embankment vegetation did not exceed a height of six inches at the time of the site inspection in March 2020 (Ref. [6]).

2.5 257.73 (d)(1)(v) – Spillway

§257.73 (d)(1)(v): A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section.

(A) All spillways must be either:

(1) Of non-erodible construction and designed to carry sustained flows; or

(2) Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The Clear Water Pond is impounded by an above ground ring-shaped embankment, and there is no run off from adjacent areas. Inflow to the Clear Water Pond is limited to rainfall and water that is hydraulically flowing under controlled conditions. There are no spillways at the Clear Water Pond. The Clear Water Pond is equipped with an Emergency Overflow Structure located between the Clear Water Pond and the swale adjacent to the Canadian National Railroad right-of way, described in Section 1.2. Overflow from the Clear Water Pond would flow through the pipe and exit into the swale. According to BWL, the Emergency Overflow Structure has never been used for discharge.

The Clear Water Pond is considered to be a low hazard potential embankment, as stated in GZA 2012 (Ref. [3]) in which HDR concurs. Therefore, the combined capacity of all spillways must adequately manage flow during and following the peak discharge from the Inflow Design Flood (IDF), defined as the 100-year flood. No capacity calculations were available for the Emergency Overflow Structure. Discharge from the Clear Water Pond is normally maintained by the Pump House located at the northwest corner of the Clear Water Pond for reuse at Erickson Power Station.

The Emergency Overflow Structure can adequately manage flow resulting from the IDF, including wave action, without overtopping of the embankment, provided that the conduit and overflow is maintained without obstructions or debris. The methodology, assumptions, results, and conclusions of the spillway adequacy evaluation are described in the Inflow Design Flood Control System Plan (Ref. [5]).

2.6 257.73 (d)(1)(vi) - Hydraulic Structures

§257.73 (d)(1)(v): Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

The hydraulic structures underlying the base of the Clear Water Pond or passing through the Clear Water Pond embankment consist of the following:

- Lake Delta Drainage Structure
- Lake Delta Transfer Structure
- Old Ash Impoundment Transfer Structure
- Old Ash Impoundment Drainage Structure
- Emergency Overflow Structure

Details of each hydraulic structure are discussed in Section 1.2. Each hydraulic structure observed during the March 2020 inspection (Ref. [6]) appeared to maintain structural integrity. Additionally, the structures appeared free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris and HDR was not aware of deficiencies being observed in the past by BWL, with exception to the repair made to the intake of the Emergency Overflow Structure. It should be noted that the interior of the pipes and submerged pipes were not observed and should be inspected internally via remotely operated vehicle (ROV).

2.7 257.73 (d)(1)(vii) - Downstream Slope Drawdown

§257.73 (d)(1)(v): For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The only water body present on the downstream slope of the Clear Water Pond is Lake Delta. Lake Delta is a shore and dock fishing lake located at Delta Township Park which is leased to and maintained by Delta Township. Water from Grand River is fed to the lake by the Erickson's River Pump House located on the Grand River to maintain lake levels for recreation at a design elevation of 882.5 feet. The water in Lake Delta is not subject to drawdown, thus a rapid drawdown condition was not considered a potential mechanism for structural instability of the exterior slope of the Clear Water Pond.

2.8 257.73 (d)(2) - Structural Stability Deficiencies

§257.73 (d)(1)(v): The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

Based on the previous GZA 2012 (Ref. [3]) report, weekly inspections performed by BWL, and the inspection performed in March 2020 by HDR (Ref. [6]), no structural stability deficiencies were identified for the embankment of the Clear Water Pond.

3 Safety Factor Assessment - 40 CFR 257.73(e)

3.1 Stability Analysis Criteria

The CCR Final Rule does not stipulate the stability analysis methodology directly, although the minimum required factor of safety criteria were adopted from the U.S. Army Corp of Engineers (USACE) guidance manuals, and USACE Engineering Manual EM 1110-2-1902 (Ref. [13]) is referred to by the CCR Rule as a benchmark in the dam engineering community for slope stability analyses. The methodologies in EM 1110-2-1902 were used in this assessment of the static load cases.

Safety Factor Assessment documentation requirements for existing CCR surface impoundments are detailed in 40 CFR 257.73: *Structural integrity criteria for existing CCR surface impoundments*. CCR Rule 40 CFR 257.73(e) states that:

§257.73 (d)(1)(v): The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (iv) of this section for the critical cross section of the

embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(e)(1)(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(e)(1)(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(e)(1)(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(e)(1)(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

3.2 Methodology

The slope stability analysis was conducted using the GeoStudio computer program Slope/W, which uses limit equilibrium methodologies to evaluate potential rotational and sliding block failure surfaces. For a given geometry and soil profile, the program evaluates potential failure surfaces and identifies the surface exhibiting the minimum factor of safety. The Spencer Method was used in the evaluation because it satisfies both force and moment equilibrium. The factors of safety against sliding for both shallow and deep failure surfaces were determined. The shallow failure surfaces typically have lower factors of safety but are not typically a dam safety concern since they are surficial in nature and failure of a shallow surface is not likely to result in the release of the impoundment. The "deep" failure surfaces were defined for this study as failure surfaces that penetrate the phreatic surface or penetrate at least ¼ of the crest width (approximately 5 feet) and, therefore, represent the most critical failure surfaces for the embankment stability.

3.3 Critical Cross Section Geometry

The critical section of the embankment was determined using the existing topography provided by BWL and acquired from the topographic survey performed in 2018 by Droneview and prepared by NTH Consultants, Ltd. (Ref. [11]), the interpreted subsurface profile from the available boring (MW-1) at the Clear Water Pond, and the interpreted phreatic surface based on observations at the site and from the monitoring well installed on the south embankment of the Clear Water Pond.

One section of the embankment was considered as potentially being critical based on geometry, described below, and located as shown on Figure 5, and can be seen in Figure 6.

- Section 1, located at the northeast of the Clear Water Pond, is adjacent to the Former Impoundment. Section 1 was selected due to the geometry of the slopes, the height of the embankment, the differential head acting on the section, and the lack of a downstream berm, which is in place over the majority of the north embankment and as formed by the railroad tracks on the southeast embankment. Due to the geometry that is present for this portion of the Clear Water Pond embankment, it was deemed more critical than the other portions of the embankment alignment. Although this section is anticipated to have the most critical factor of safety, discharge from a breach, were it to occur, would be contained within the Former Impoundment.

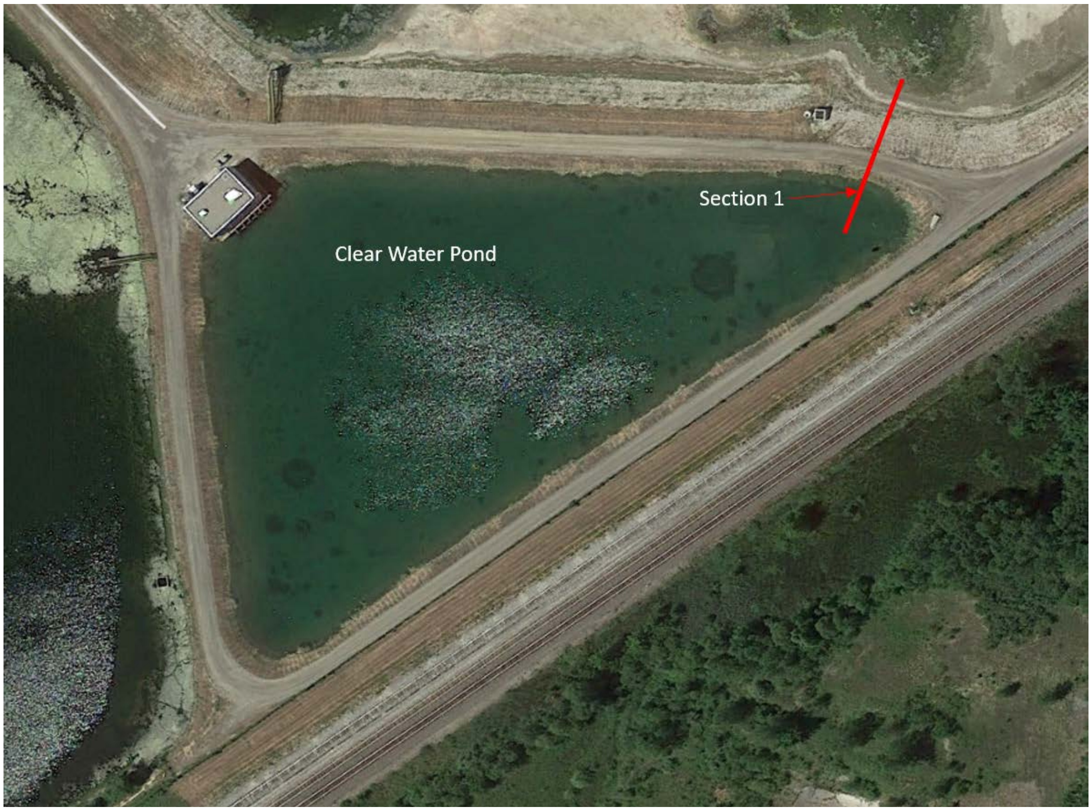


Figure 5. Location of Section 1

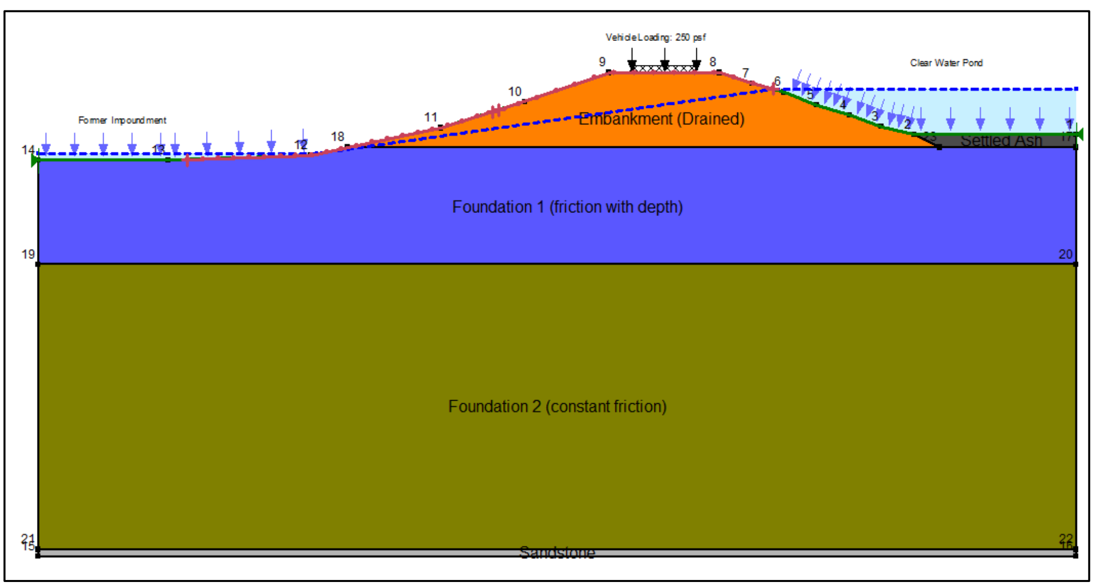


Figure 6. Section 1 Cross Section

3.4 Credible Load Cases

The loading conditions that were analyzed and the USEPA required minimum factors of safety are summarized in Table 3-1 below.

Table 3-1. Loading Conditions and Minimum Required Factors of Safety

Loading Condition	Headwater El.	Minimum Required Factor of Safety
Maximum Storage Pool (Normal)	882.0[1]	1.5
Maximum Surcharge	884.0[2]	1.4
Seismic[3]	882.0	1.0
Post-earthquake - Liquefaction	882.0	1.2

[1]Assumed to be normal operating pool level of the Clear Water Pond.
[2] Assumed to be approximately at lowest Top of Dike elevation of Clear Water Pond according to 2018 Droneview survey (Ref. [11]).
[3] Using a Peak Ground Acceleration (PGA) = 0.076g with 2 percent probability of exceedance in 50 years (2,475 recurrence interval) (USGS 2018).

3.5 Pond Elevation and Phreatic Conditions

The phreatic surface for the stability models was developed based on current water level conditions within the Clear Water Pond and Former Impoundment as well as from historical pond levels provided by BWL. Two upstream water boundary conditions were considered in the analyses; the maximum pool storage and the maximum pool surcharge conditions. The maximum pool storage (i.e. normal operating condition) of the Clear Water Pond is 882.0 feet NAVD 88. The maximum pool surcharge scenario considers the temporary rise of the pond water elevation due to rainfall and collection of site storm water runoff. For the maximum pool surcharge scenario, HDR assumed that the pool level would rise to the lowest surveyed elevation of Top of Dike along the perimeter of the Clear Water Pond: 884.0 feet NAVD 88.

The downstream water boundary condition was set at the current pond elevation of the Former Impoundment: 872.0 feet NAVD 88. The Former Impoundment is no longer in service therefore the water boundary condition should be relatively stable.

The phreatic surface was estimated inside the embankment from the assumed water levels discussed above. Consideration was given to the monitoring well installed at the Clear Water Pond (MW-1), however, a more conservative phreatic surface condition was chosen using a straight line connecting the water level conditions of the Clear Water Pond to the Former Impoundment.

3.6 Material Properties

Prior to the construction of the Erickson Power Station impoundment system, a subsurface investigation program was performed in 1969 by Dames & Moore. The soil boring logs performed for that study are presented in the Location Restrictions Report prepared by Mayotte Design & Engineering (MD&E) (Ref. [10]). In addition to the 1969 soil borings, geoprobe borings and test pits were performed at the site by MD&E in 2018. In 2019 and

2020, HDR installed six monitoring wells across the site, with one monitoring well (MW-1) being installed through the south embankment of the Clear Water Pond (Ref. [4]).

The embankment stratigraphy is shown in Figure 6 and the material properties used for the slope stability analysis are presented in Table 3-2. The estimated material engineering properties were based on correlations with Standard Penetration Testing (SPT) performed in 1969 and HDR's experience with similar conditions. The boring logs are provided in Attachment 1. HDR used undrained and drained shear strengths related to effective stresses, as recommended by the USACE.

Table 3-2. Summary of Material Properties Used in Analysis

Material Types	Elevation (feet)	Unit Weight, γ (pcf)	Short-term (Undrained)		Long-term (Drained	
			Cohesion, c (psf)	Friction Angle, φ (degrees)	Cohesion, c' (psf)	Friction Angle, φ' (degrees)
Embankment	884.5 to 873	130	1,000	0	200	28
Foundation 1*	873 to 855	120	0	26 to 35	0	26 to 35
Foundation 2	855 to 811	120	0	35	0	35
Sandstone	811 to 810	160	2,000	45	2,000	45
Settled Ash	875 to 873	90	0	30	0	30

* - Friction angle of foundation was modeled to increase linearly (from 26 to 35 degrees) with depth from El. 873 to 855 feet and is constant (35 degrees) thereafter with depth. Friction angle interpretation was taken from a review of the N values provided on boring logs in Attachment 1.

The embankment stratigraphy and elevations were interpreted from the 1969 boring logs and MW-1 (Attachment 1), the 2018 Droneview topography (Ref. [11]), and measurements taken during the HDR 2020 site inspection (Ref. [6]).

3.7 Vehicle Loading

The crest of the embankment is intermittently used as access roads around the Clear Water Pond, therefore, a vehicle load was used on the crest of the embankment in the stability analyses. The vehicle loading was applied to the loading conditions for the maximum pool storage and maximum pool surcharge cases. The vehicle load used in the analysis is based on American Association of State Highway and Transportation Officials (AASHTO) recommended loading for *Equivalent Height of Soil for Vehicular Loading on Abutments* (Ref. [1]).

3.8 Assessment of Liquefaction Potential

The embankment is an engineered compacted fill that is classified as sandy lean clay (CL) and founded on foundation soils generally consisting of clayey and silty sand, and silt that becomes denser with depth. A "triggering analysis" was used to assess the potential for liquefaction of the foundation soils using correlations with the SPT data from Borings AP-4, AP-5, and AP-6. These borings were drilled in 1969 before construction of the embankment in the vicinity of the foot print of the embankment as shown in Figure 7. The borings logs are provided in Attachment 1.

Figure 7. Approximate Boring/Monitoring Well Locations at Clear Water Pond

The foundation soils were screened for seismically-induced liquefaction susceptibility using methods recommended by the National Center for Earthquake Research (NCEER), which uses SPT data (Ref. [5]). For liquefaction triggering analysis, the fine contents of SM and SC material is conservatively taken based on the lower bound of USCS fine contents (12%). Two one-dimensional sections were analyzed: 1) a section at the toe of the embankment (i.e. the natural ground) and 2) a section that includes the embankment (i.e. the embankment crest elevation). It was conservatively assumed that the original borings were dry, and, following the start of plant operations, the phreatic surface increased, such that all of the considered layers below the assumed phreatic surface were saturated. Based on these assumptions, the corrected SPT blow counts and soil stresses were calculated for evaluation of cyclic shear strength and stress.

Using the USGS online Unified Hazard Tool (Ref. [15]), the Peak Ground Acceleration (PGA) and earthquake magnitude, assuming a Site Class B/C boundary were selected as 0.0466g and 5.5, respectively. Pages 1 through 3 of Attachment 2 present a summary of the Unified Hazard Tool data. The USGS Unified Hazard Tool has not been developed for 2020, however grid data is available in the form of tables and map. Based on the site location and the interpolated 2018 data that are available for 0.05 degrees grids, the PGA was estimated at 0.0544g, slightly higher than 0.0466g and, as such, the higher value was used for analysis. According to most recent geotechnical report performed in the vicinity of the site (Ref. [12]), the site is classified as Seismic Site Class C and in accordance with ASCE-7 2016, so a factor of 1.3/0.9 was applied to obtain the site PGA of 0.076g used for the analysis.

As discussed above, the triggering analysis requires that the raw SPT "N" values be corrected to a confining pressure of 1 ton per square foot and a drive energy of 60% efficiency (referred to as a $(N_1)_{60}$ value). Hammer efficiency testing was likely not performed. A hammer efficiency of 60% was assumed corresponding to standard rope and cat head SPT method. Due to water level measurements (after ground water stabilization) not being available from the historical data, it is assumed that the boreholes were dry in order to be conservative for including the effect of overburden pressure. The methods used to calculate $(N_1)_{60}$ were those that have been proposed by Idriss and Boulanger (Ref. [5]). The raw SPT "N" values (N_{raw}) presented on the boring logs were converted to $(N_1)_{60}$ values using the following equation:

$$\boldsymbol{(N1)_{60}} = N_{RAW}C_N C_E C_B C_R C_S$$

Where:

C_N = Overburden Correction Factor = (P_a/σ'_{vo})^(0.784-0.0768[$(N_1)_{60}$^$^{0.5}$]

C_E = Hammer Energy Correction factor = 60% efficient safety hammer = 1.0

C_B = Borehole Diameter Correction Factor = 1.0

C_R = Rod Length Correction Factor

= 0.75 (0-9.75 ft.)

= 0.8 (9.75 to 13 ft.)

= 0.85 (13 to 19.5 ft.)

= 0.95 (19.5 to 32 ft.)

= 1 (>32 ft.)

C_S = Spoon Liner Correction

= 1.0 No liner was used

Additional corrections were then made to correct the $(N_1)_{60}$ value to an equivalent "clean sand" value for use in determining cyclic stress resistance (CRR), which was used for assessing triggering of liquefaction. The clean sand value, $(N_1)_{60cs}$, was determined based on the lowest possible fine contents from soil classification noted on the boring logs and using the method proposed by Idriss and Boulanger (Ref. [5]) and the following equation:

$$\boldsymbol{\Delta(N_1)_{60cs}} = e^{(1.63+9.7/(PF+0.01)-(15.7/(PF+0.01))\wedge 2)}$$

Where:

PF = Percent fines passing No. 200 sieve

Using Idriss and Boulanger (Ref. [5]), CRR was then calculated using the following equation:

$$\mathbf{CRR} = e^{[(N_1)_{60cs}/14.1 + ((N_1)_{60cs}/126)\wedge 2 - ((N_1)_{60cs}/23.6)\wedge 3 + ((N_1)_{60cs}/25.4)\wedge 4 - 2.8]}$$

The Cyclic Stress Ratio (CSR) was then calculated using the design earthquake. The CSR is defined as the ratio of the cyclic shear stress acting on a horizontal plane to the initial (pre-earthquake) effective or overburden stress. The PGA of 0.076g was assumed in the analysis and the distribution of CSR through the foundation cross-section was determined. The CSR was then calculated using the following equation:

$$\mathbf{CSR} = 0.65*(a_{max}/g)*(\sigma_v/\sigma'_v)*r_d$$

Where:

$\mathbf{a_{max}/g}$ = 0.076

$\boldsymbol{\sigma_v}$ = Total Overburden Stress

$\boldsymbol{\sigma'_v}$ = Effective Overburden Stress

$\mathbf{r_d} = e^{(a(z) + B(z)M)}$

Where:

a(z) = -1.012-1.126*sin((z/11.73)+5.133)

b(z) = 0.106+0.118*sin((z/11.28)+5.142)

M = 5.5

z = depth in meters

Once the CSR and CRR values were calculated, the factor of safety against triggering liquefaction was calculated as:

$$\mathbf{FS} = CRR/CSR \times MSF \times K_\sigma \times K_\alpha$$

Where:

MSF = magnitude scaling factor = $6.9*e^{(-M/4)} - 0.058$, ≤1.8

$\mathbf{K_\alpha}$ = correction factor for the effects of an initial static shear stress ratio = 1

$\mathbf{K_\sigma}$ = overburden correction factor = 1

Where:

$\mathbf{C_\sigma} = 1/\{18.9-2.55*SQRT((N_1)_{60cs}\} \le 0.3$

$\mathbf{P_a}$ = Pressure at 1 atmosphere

The static shear strength in the liquefaction-susceptible material is small. Therefore, K_α was taken equal to one for the purpose of this analysis. If the FS is greater than 1.2, soil is not susceptible to liquefaction. The calculated factor of safety against seismically-induced liquefaction is presented in on Page 4 of Attachment 2 and was calculated to be greater than 1.20 throughout the foundation depth. Considering that the embankment is classified as CL (USCS standard) and compacted material, the screening-level results indicate that the embankment and foundation soils are not susceptible to seismically-induced liquefaction for the seismic loading considered. In summary, the foundation was determined to be stable with respect to liquefaction for earthquakes up to the considered 2475-year return interval, which would have a PGA of 0.076g.

The corrected blow counts were also used for evaluation of foundation shear strength for stability analysis. Page 5 of Attachment 2 shows the calculated value and the assumed bilinear variation of friction angle in foundation soil for slope stability analysis.

Because neither the embankment nor foundation soil were considered to be liquefiable, a pseudo static seismic stability analysis was conducted assuming no strength loss for the embankment materials, and the embankment yield acceleration was evaluated. In order to include the amplification factor that accounts for the quasi-elastic response of the embankment, the peak transverse crest acceleration was evaluated to be 0.25g, using a peak transverse base acceleration of 0.076g from the figure presented on Page 6 of

Attachment 2 (Ref. [14]). The average embankment acceleration for a deep failure surface was then obtained from the figure on Page 7 of Attachment 2 (Ref. [8]), using y/h=1, the maximum ratio of 0.47, and an effective seismic coefficient of 0.25*0.47=0.1175 was used for the calculation of the factor of safety during an earthquake based on a conservative undrained shear strength of 1,000 psf. The results indicate that the factor of safety during earthquake is 1.48 which is greater than 1 and suggests that the deformation of the embankment during and after the earthquake would be very small. The yield acceleration of the embankment was calculated as 0.23g. The ratio of the effective acceleration to the yield acceleration, as shown on the figure on Page 8 of Attachment 2 (Ref. [8]), indicates that the deformation during an earthquake is anticipated to be negligible.

3.9 Stability Analysis Results and Conclusions

Analysis summary diagrams for each loading case are provided in Attachment 3. Table 3-3 below also summarizes the results of the analyses conducted for each loading case.

As presented in Table 3-3, the factors of safety against slope instability for deep failure surfaces that are capable of breaching the embankment satisfy the requirements of the CCR Final Rule under all loading conditions.

Table 3-3. Summary of Stability Analyses Results

Loading Condition	Required Minimum Factor of Safety	Computed Factor of Safety	Figure Location
Maximum Storage Pool (Normal)	1.5	1.6	Attachment 3, Page 1
Maximum Surcharge	1.4	1.4	Attachment 3, Page 2
Seismic[2]	1.0	1.5	Attachment 3, Page 3
Post-earthquake - Liquefaction	1.2	>1.2	Attachment 2, Page 4

4 Closure

Based on the information provided to HDR by BWL, information available on BWL's CCR website, and HDR's visual observations and analyses, this Initial Structural Stability Assessment and Safety Factor Assessment was conducted in accordance with the requirements of the USEPA 40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, April 17, 2015 (CCR Final Rule). Based on the information currently available, I certify to the best of my knowledge, information and belief that this Initial Structural Stability Assessment and Safety Factor Assessment meets the requirements of CCR Rule §257.73(d,e) in accordance with professional standards of care for similar work. HDR appreciates the opportunity to assist BWL with this project. Please contact us if you have any questions or comments.

STATE OF MICHIGAN
TERRY BRYCE BURKETT ENGINEER No. 6201066757
LICENSED PROFESSIONAL ENGINEER

12 June 2020

Bryce Burkett, P.E.
Senior Geotechnical Project Manager

Adam Jones, P.E.
Engineering Manager

5 References

Ref. [1] American Association of State Highway and Transportation Officials (AASHTO), Load Resistant Factor Design (LFRD) Bridge Design Specifications, 2012.

Ref. [2] Environmental Protection Agency, 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, Washington D.C., April 2015.

Ref. [3] GZA GeoEnvironmental, Inc. Draft Round 10 Dam Assessment Report, Lansing Board of Water & Light, Erickson Station, Ash Pond. April 30, 2012.

Ref. [4] HDR Engineering, Inc. Groundwater Monitoring 2019 Annual Report, Lansing Board of Water & Light Erickson Station, Lansing, Michigan, January 30, 2020.

Ref. [5] HDR Engineering, Inc. Inflow Design Flood Control System Plan, Erickson Power Station – CCR Surface Impoundments, Lansing Board of Water & Light, Lansing, Michigan, June 9, 2020.

Ref. [6] HDR Engineering, Inc. Initial Inspection Report, Erickson Station – Clear Water Pond, Lansing Board of Water & Light Erickson Station, Lansing, Michigan, June 12, 2020.

Ref. [7] Idriss, I.M. and Boulanger, R.W., SPT-Based Liquefaction Triggering Procedures, Report No. UCD/CGM-10/02, Department of Civil and Environmental Engineering, University of California at Davis, December 2010

Ref. [8] Makdisi, F.I. and Seed, H.B., Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations, Journal of Geotechnical Engineering, 1978.

Ref. [9] Mayotte Design & Engineering, P.C. Construction Documentation Report Ash Impoundment System Reconfiguration, Lansing Board of Water & Light Erickson Station, Lansing, Michigan, May 2015.

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

Ref. [11] NTH Consultants, Ltd. Closure Plan, CCR Surface Impoundment System, Erickson Power Station. August 16, 2019.

Ref. [12] SME. Geotechnical Data Report, Lansing Board of Water and Light, New Gas Combined Cycle Plant, Delta Township, Michigan. SME Project No. 079295.00, August 16, 2018.

Ref. [13] USACE. EM 1110-2-1902, Slope Stability, October 31, 2003.

Ref. [14] US Army Corps of Engineers for the Nuclear Regulatory Commission, Technical Bases for Regulatory Guide for Soil Liquefaction, Figure 40, March 2000.

Ref. [15] United States Geologic Survey, Unified Hazard Tool, accessed April 2020, https://earthquake.usgs.gov/hazards/interactive/

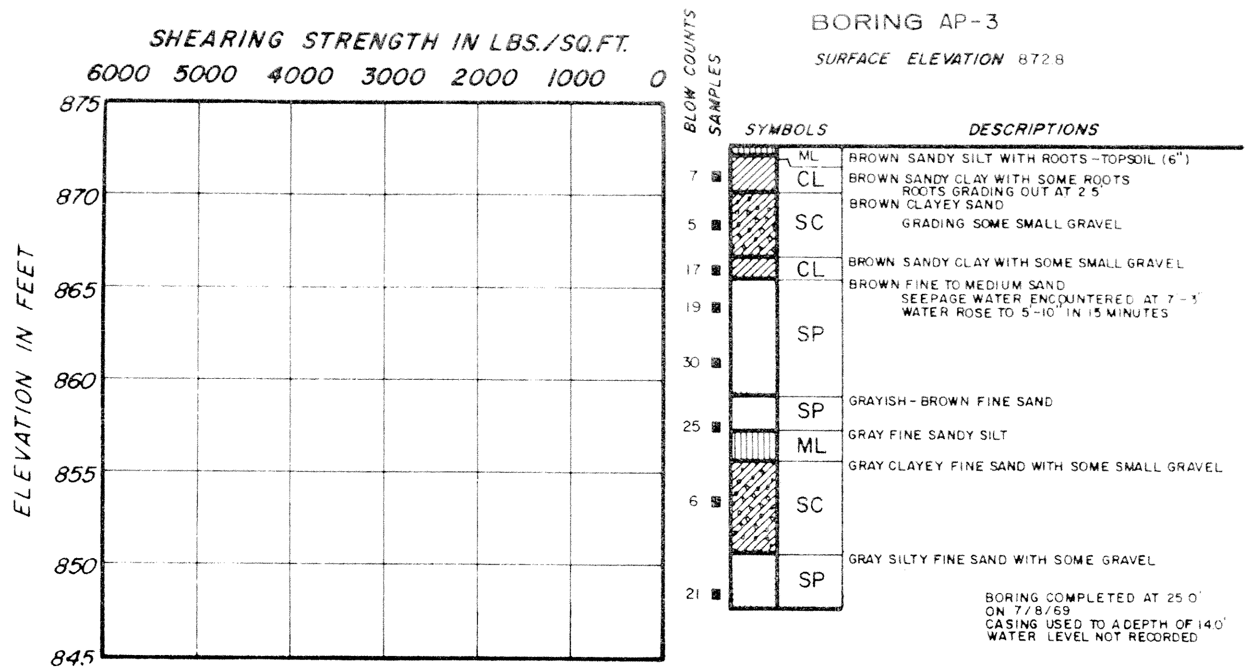
6 Attachments

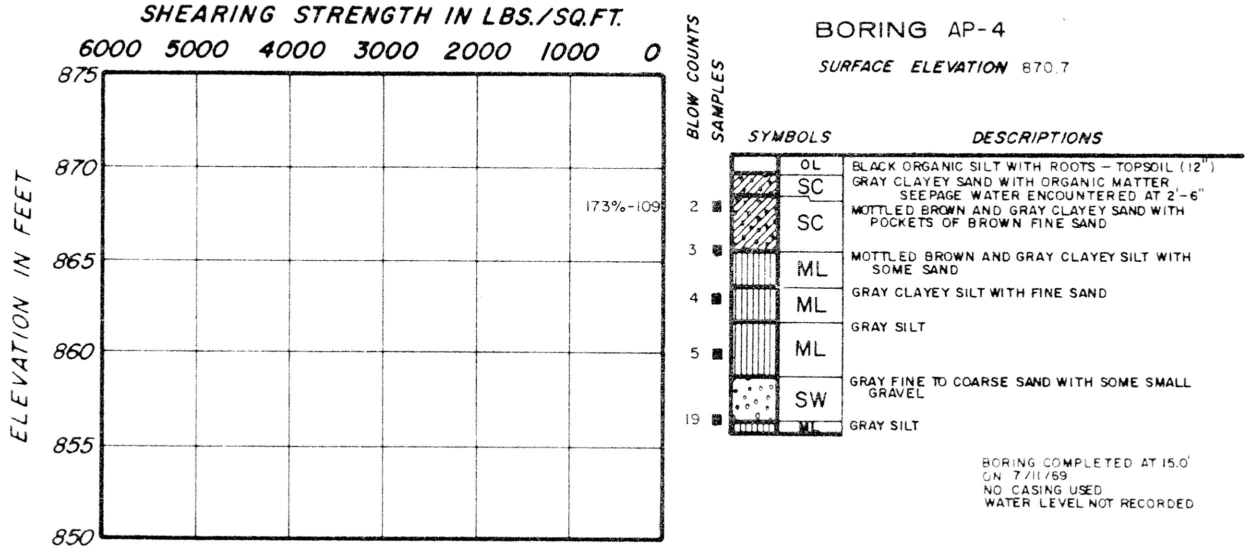
Attachment 1 Boring Logs and Monitoring Well Logs at Clear Water Pond

Attachment 2 Liquefaction Analysis Figures and Results

Attachment 3 Stability Analyses Results

ATTACHMENT 1
BORING LOGS AND MONITORING WELL LOGS AT CLEAR WATER POND



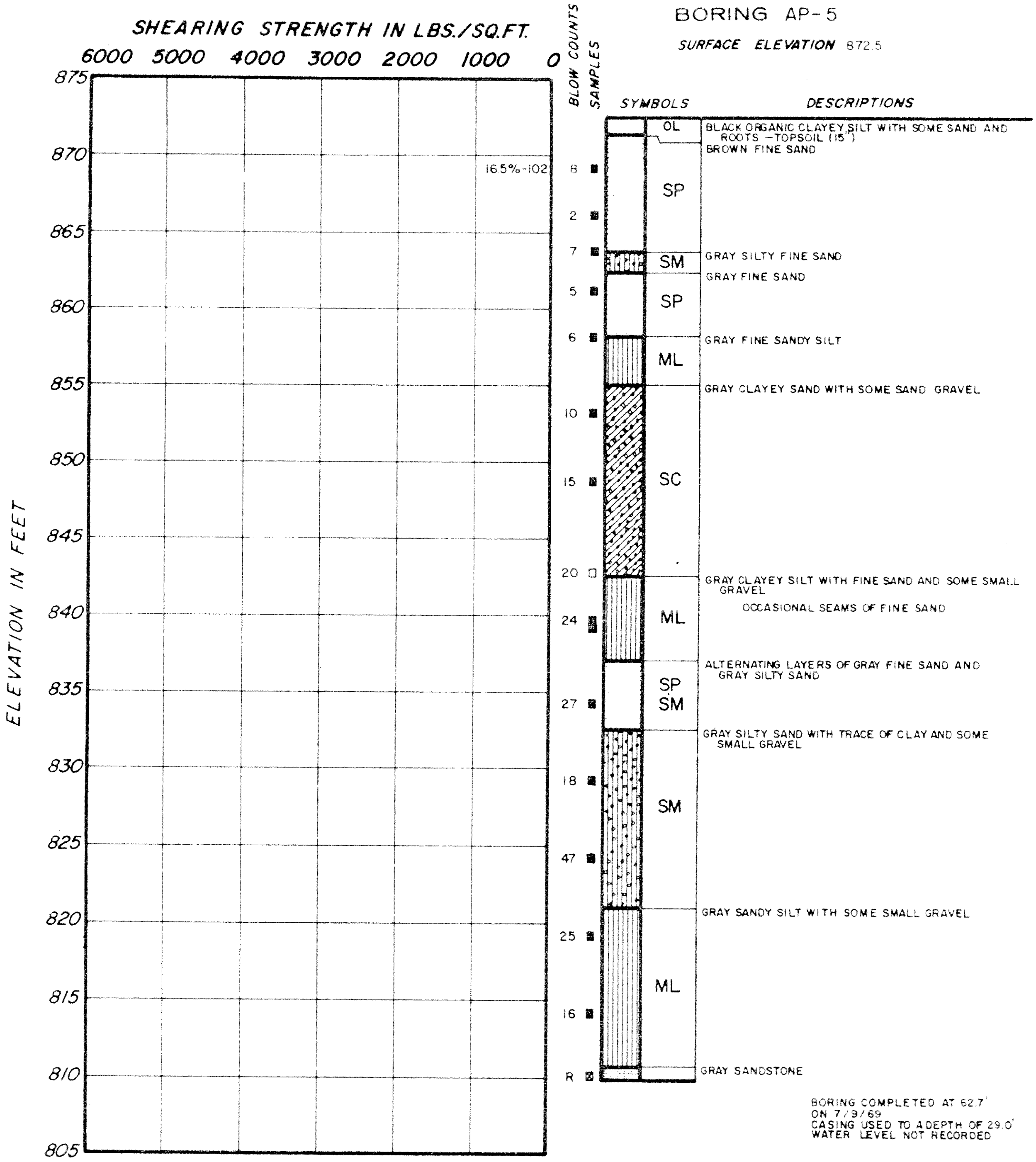


LOG OF BORINGS

Attachment 1, Page 1

DAMES & MOORE

PLATE A-10

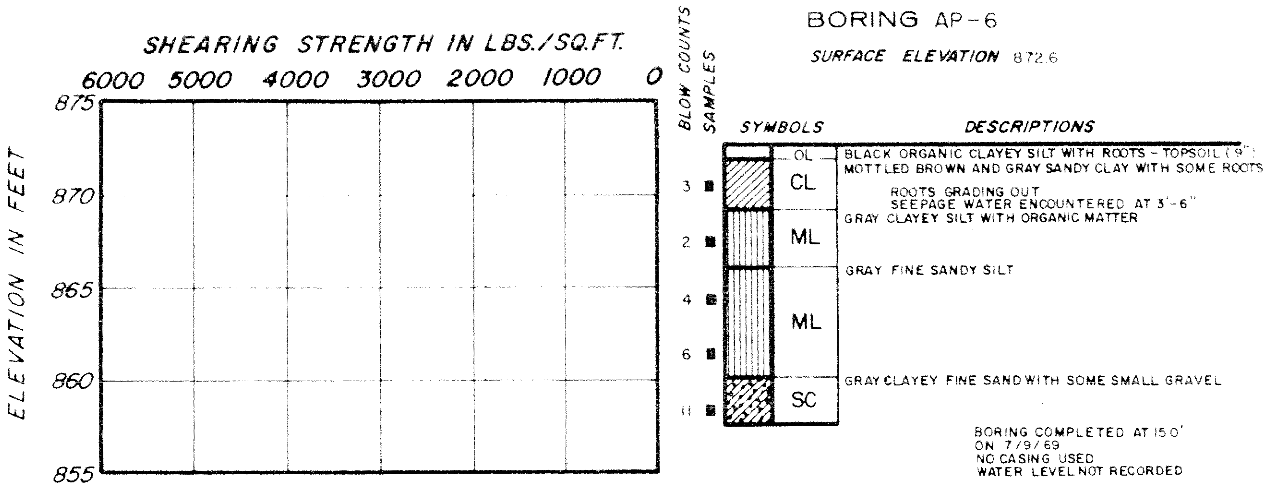


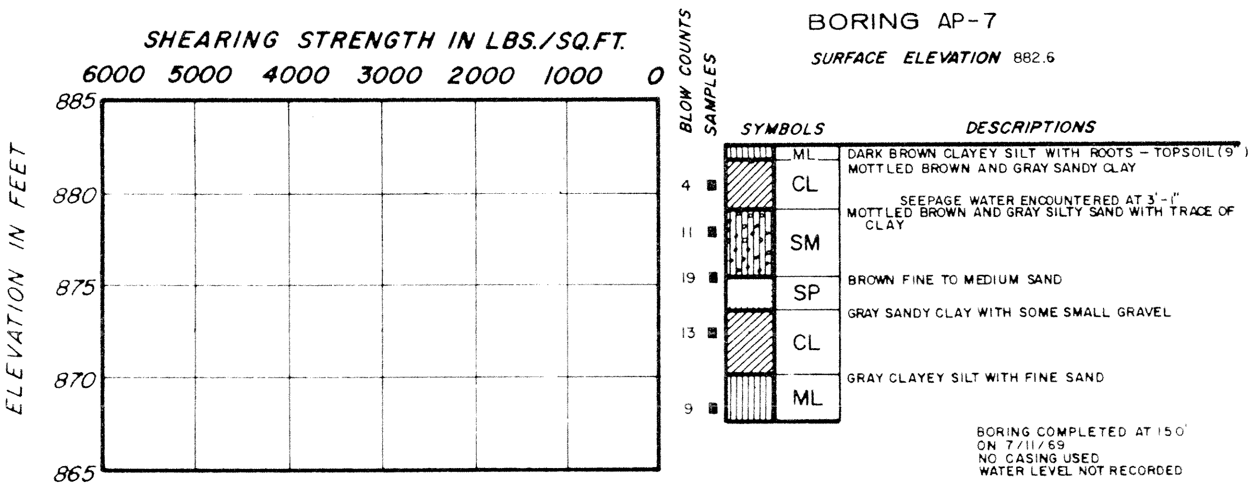
LOG OF BORINGS

Attachment 1, Page 2

DAMES & MOORE

PLATE A-IV





LOG OF BORINGS

DAMES & MOORE

PLATE A-1W

MW-1

HDR

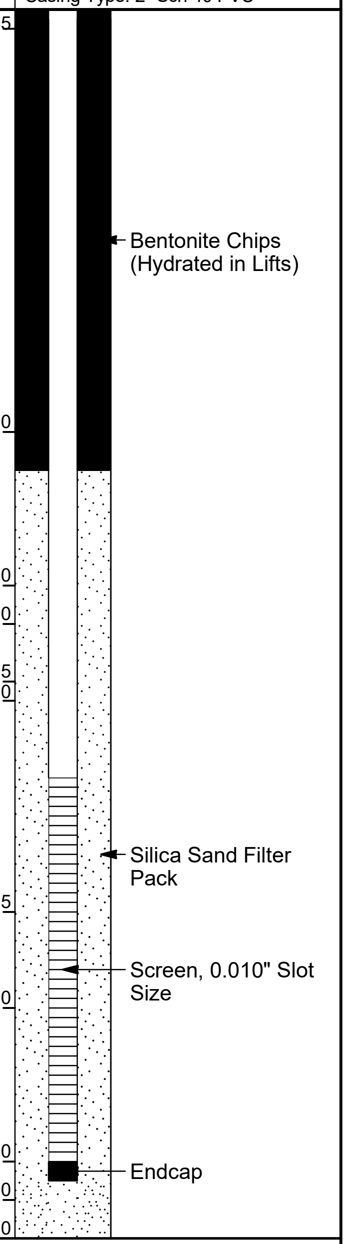
CLIENT Lansing Board of Water and Light
PROJECT NAME LBWL Confidential
PROJECT NUMBER 10173187
PROJECT LOCATION Erickson Power Station, Lansing, MI
DATE STARTED 10/15/19 11:00 **COMPLETED** 10/15/19 12:30
GROUND ELEVATION 885.97 ft MSL **HOLE DIAMETER** 7"
DRILLING CONTRACTOR SME **DRILLER** Rudy Musulin
GROUND WATER LEVELS:
DRILLING METHOD HSA **EQUIPMENT** Track-Mounted CME 55
▽ **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	MATERIAL DESCRIPTION	Elev.
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	
11.0		▼ SANDY LEAN CLAY WITH GRAVEL, (CL) yellowish brown (10YR 5/4), moist, medium stiff, mottled, low plasticity	875.0
15.0		SANDY LEAN CLAY, (CL) very dark gray (2.5Y 3/1), moist, stiff, low plasticity	871.0
16.0		CLAYEY SAND, (SC) dark greenish gray (10GY 4/1), poorly graded, fine grained, moist, medium dense, iron oxide staining	870.0
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
	SS 20-22	POORLY GRADED SAND WITH CLAY, (SP) gray (5Y 5/1), fine to medium grained, wet, medium dense	
23.5		CLAYEY SAND, (SC) gray (5Y 5/1), poorly graded, fine grained, wet, medium dense	862.5
26.0	SS 26-28	LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine grained, wet, soft, low plasticity	860.0
30.0		FAT CLAY, (CH) gray (5Y 5/1), wet, stiff, medium plasticity	856.0
31.0		LEAN CLAY WITH SAND, SILTY, (CL) gray (5Y 5/1), fine to medium grained, wet, soft, low plasticity	855.0
32.0			854.0

Bottom of borehole at 32.0 feet.

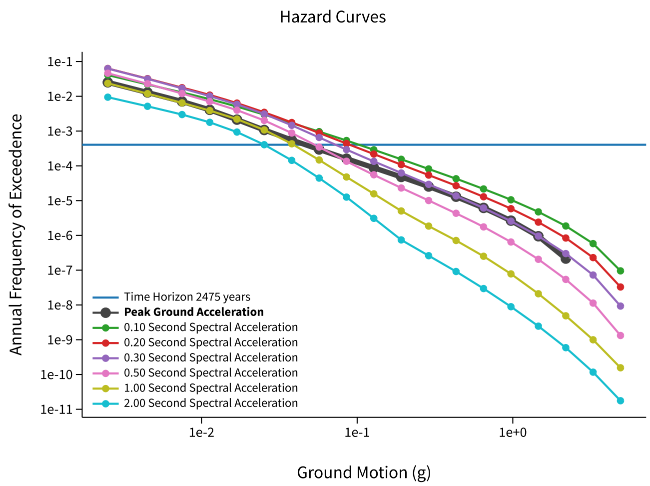
WELL DIAGRAM

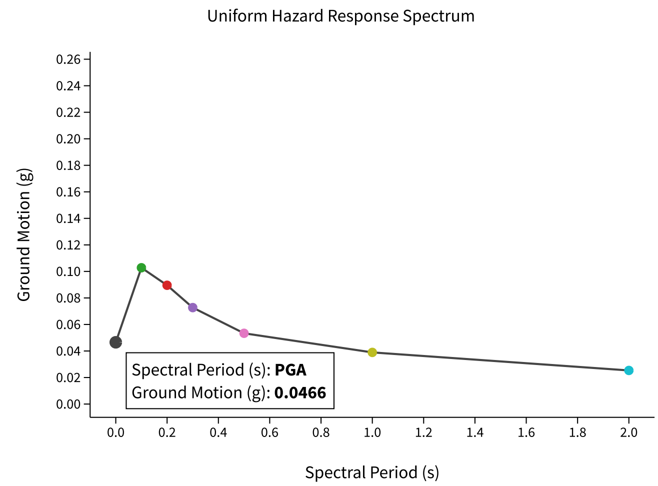
Casing Top Elev: 888.74 (ft)
Casing Type: 2" Sch 40 PVC

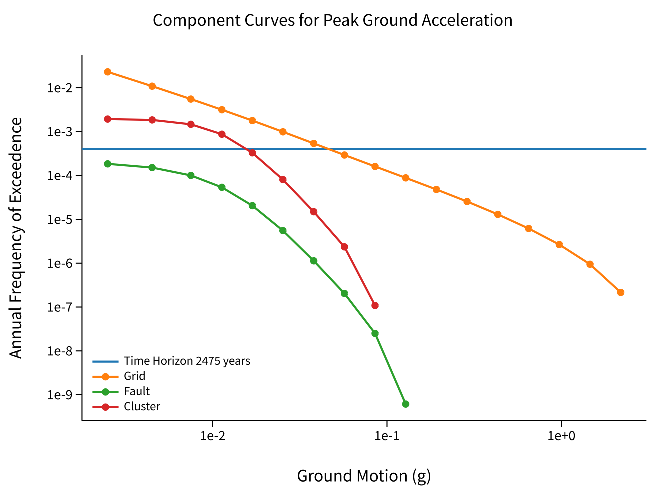


ATTACHMENT 2
LIQUEFACTION ANALYSIS FIGURES AND RESULTS

Hazard Curve





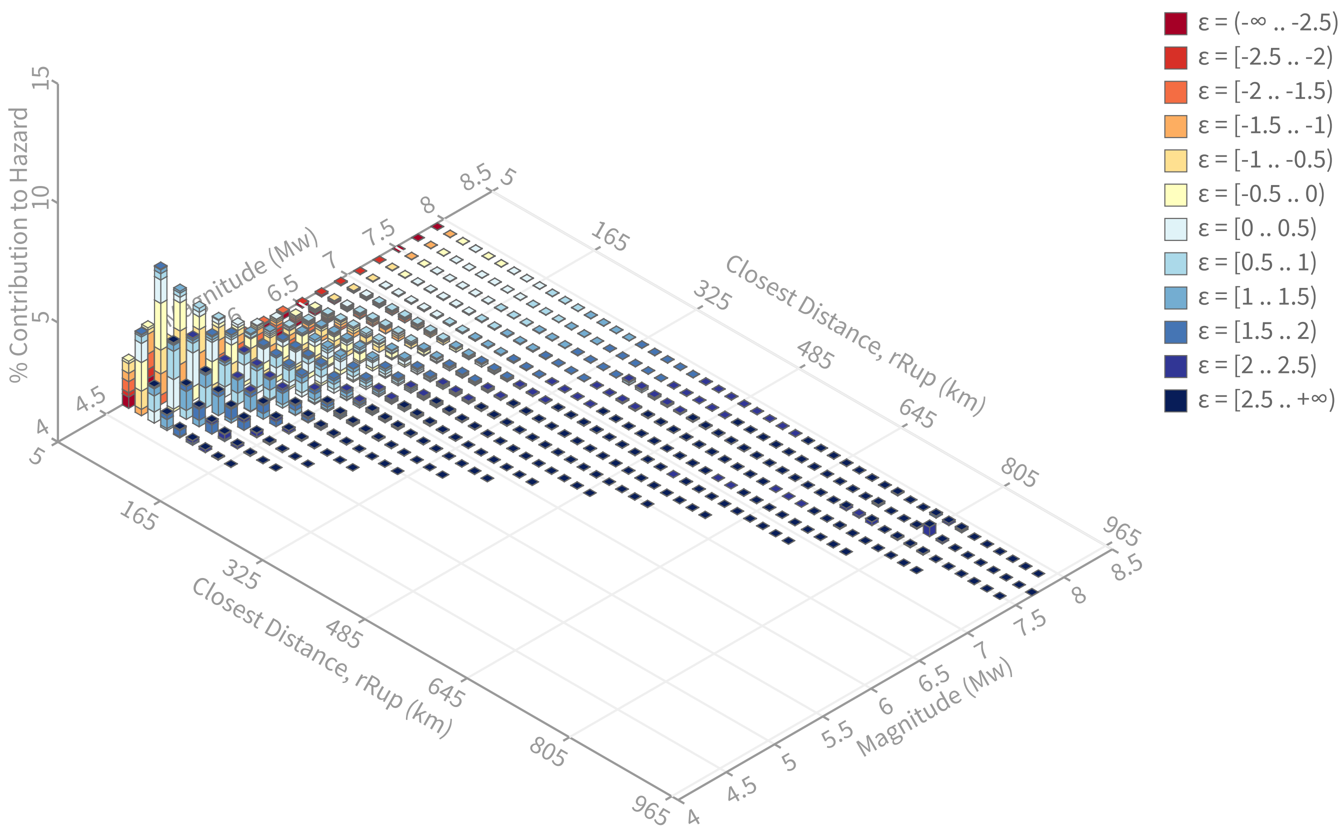


View Raw Data

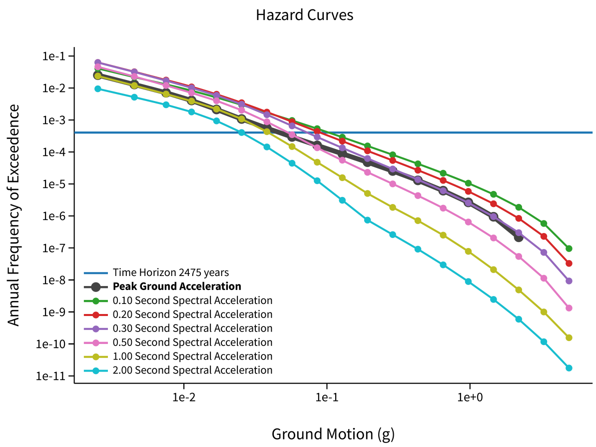
Deaggregation

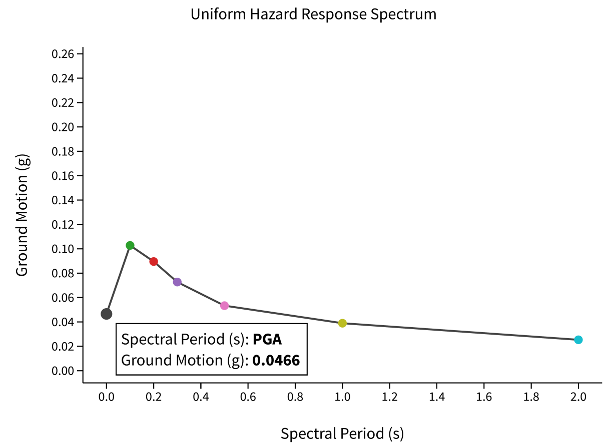
Component

Total



Hazard Curve

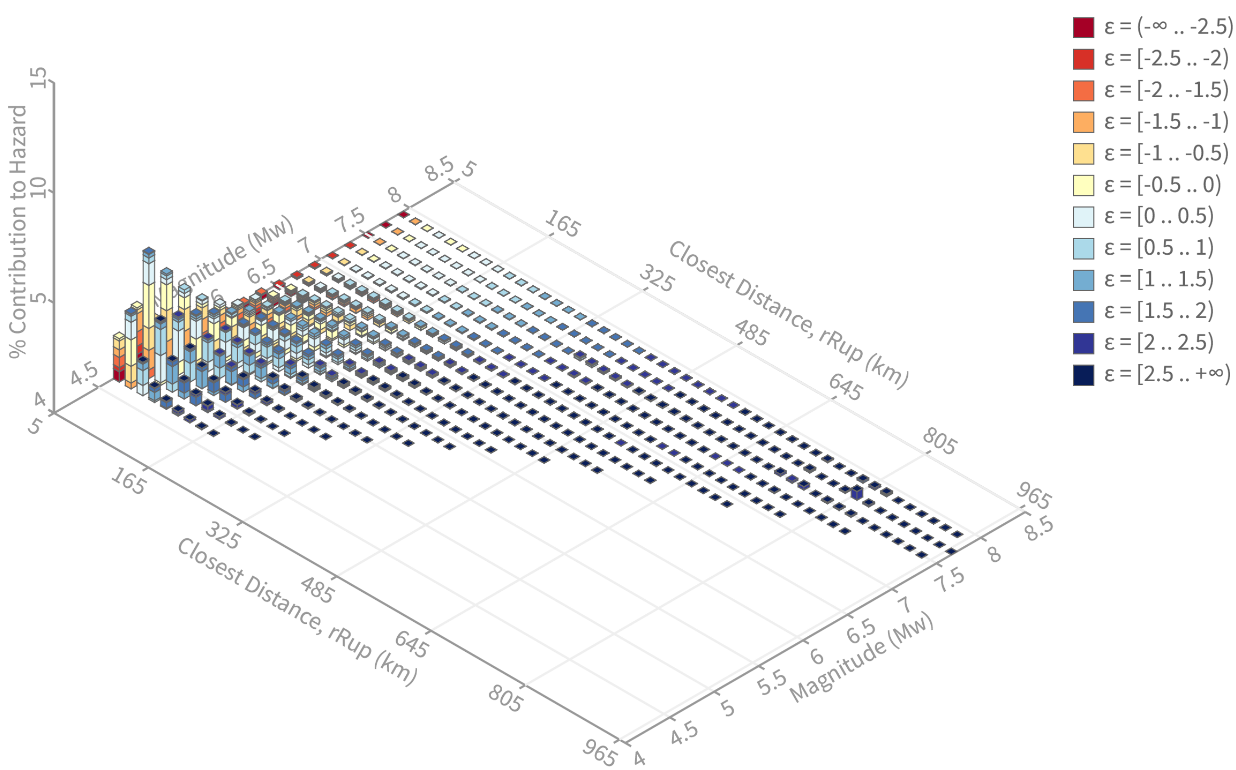


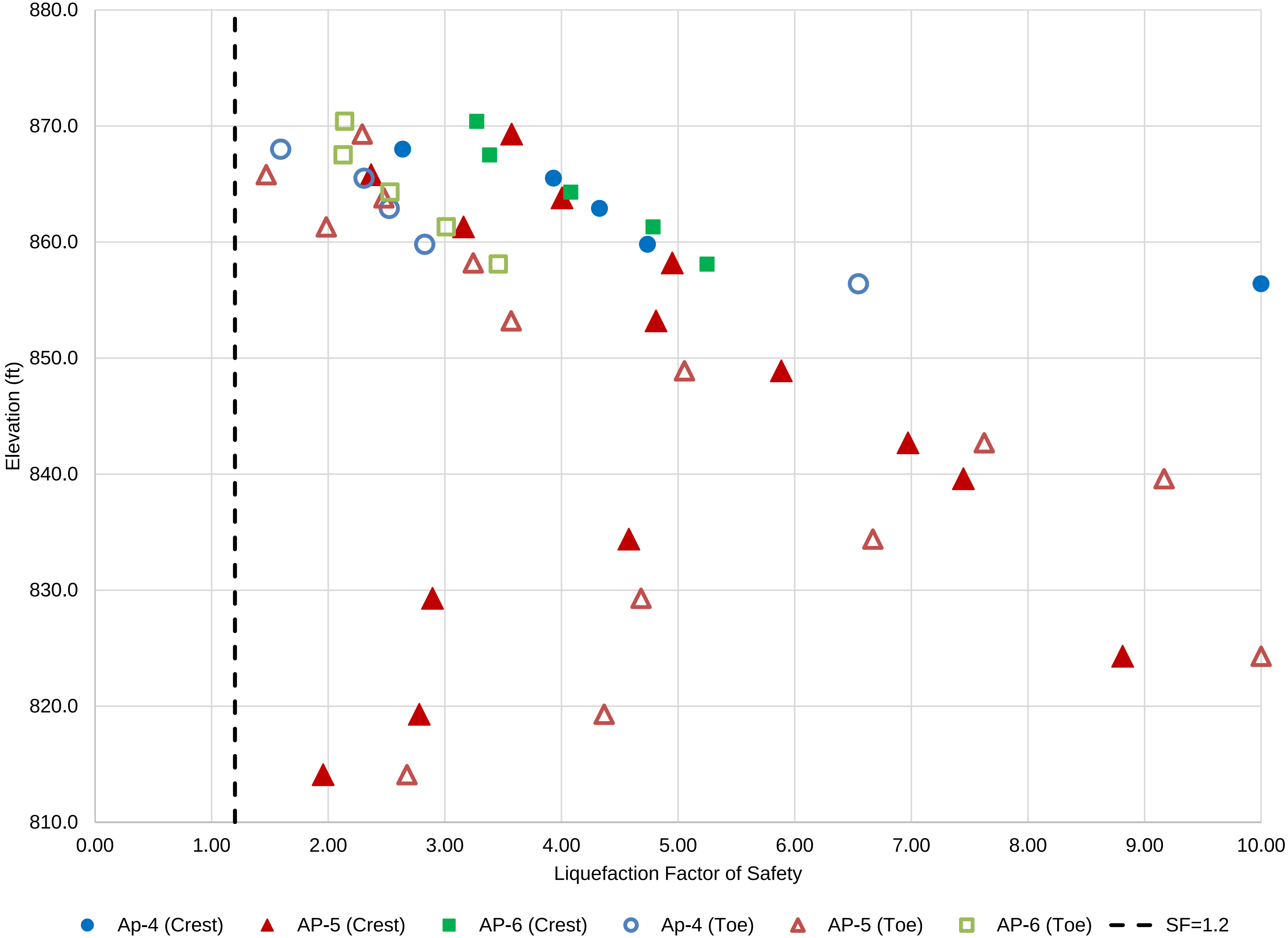


Deaggregation

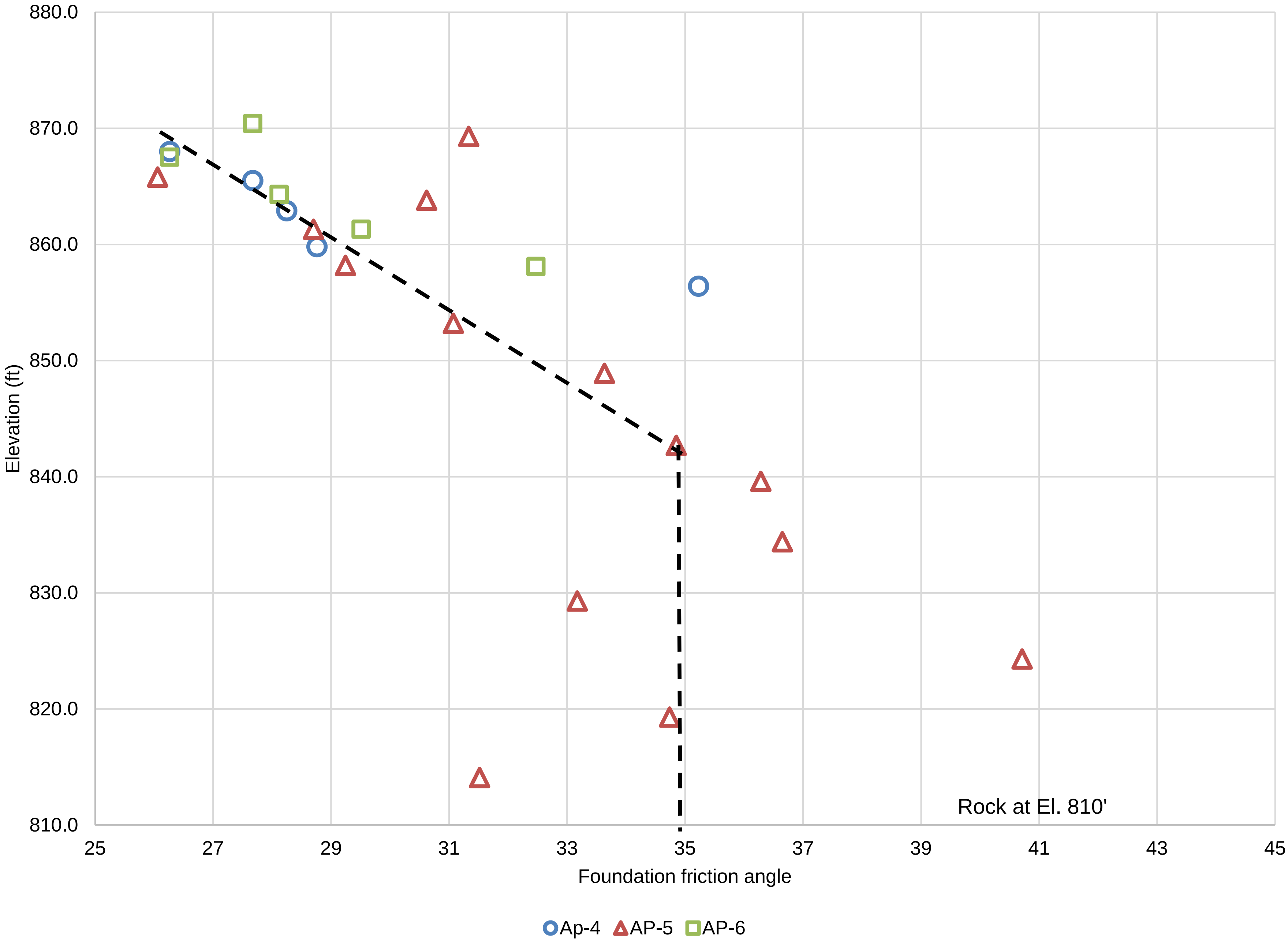
Component

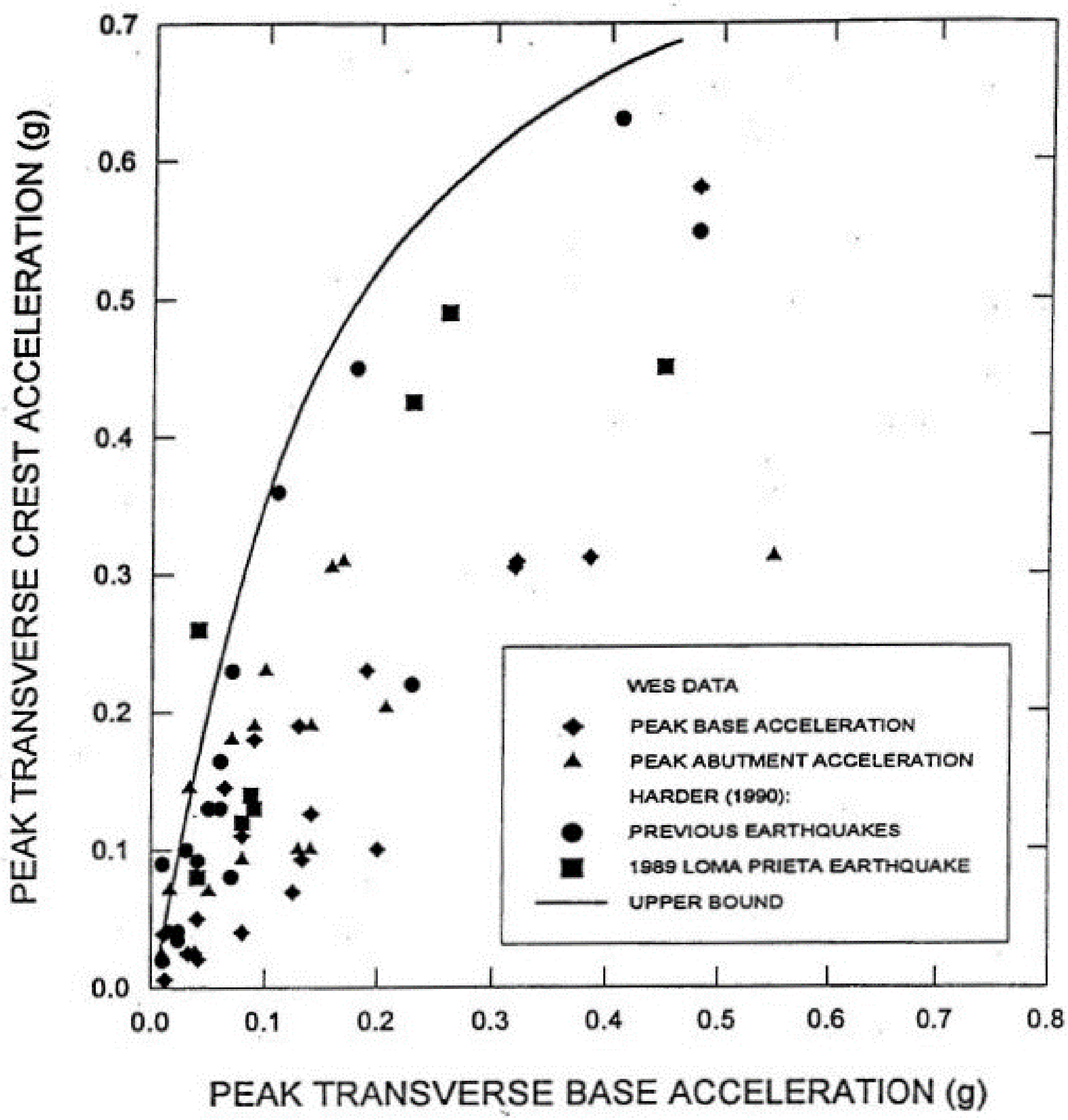
Total



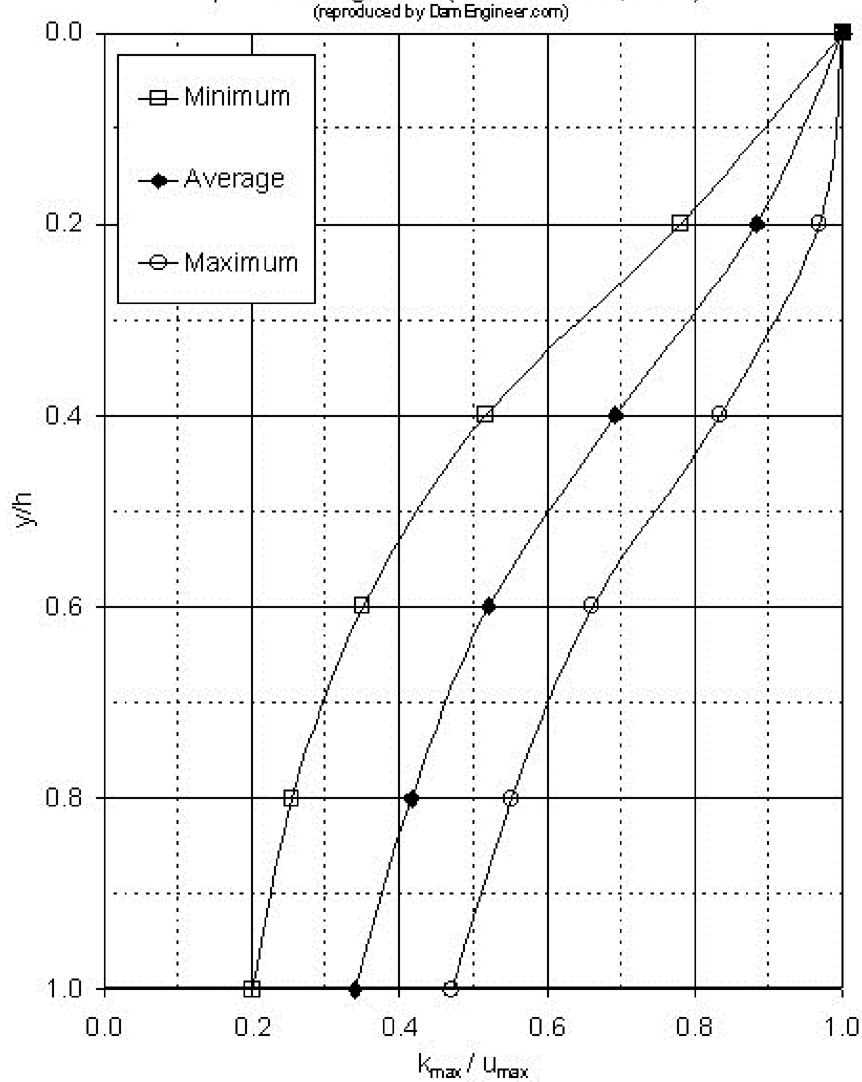


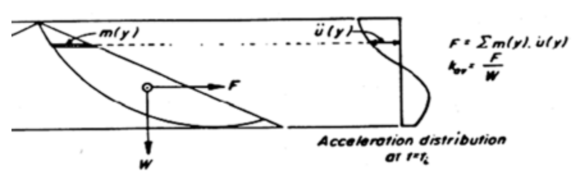
880.0
870.0
860.0
850.0
840.0
830.0
820.0
810.0
Elevation (ft)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
Liquefaction Factor of Safety
Ap-4 (Crest)
AP-5 (Crest)
AP-6 (Crest)
Ap-4 (Toe)
AP-5 (Toe)
AP-6 (Toe)
SF=1.2

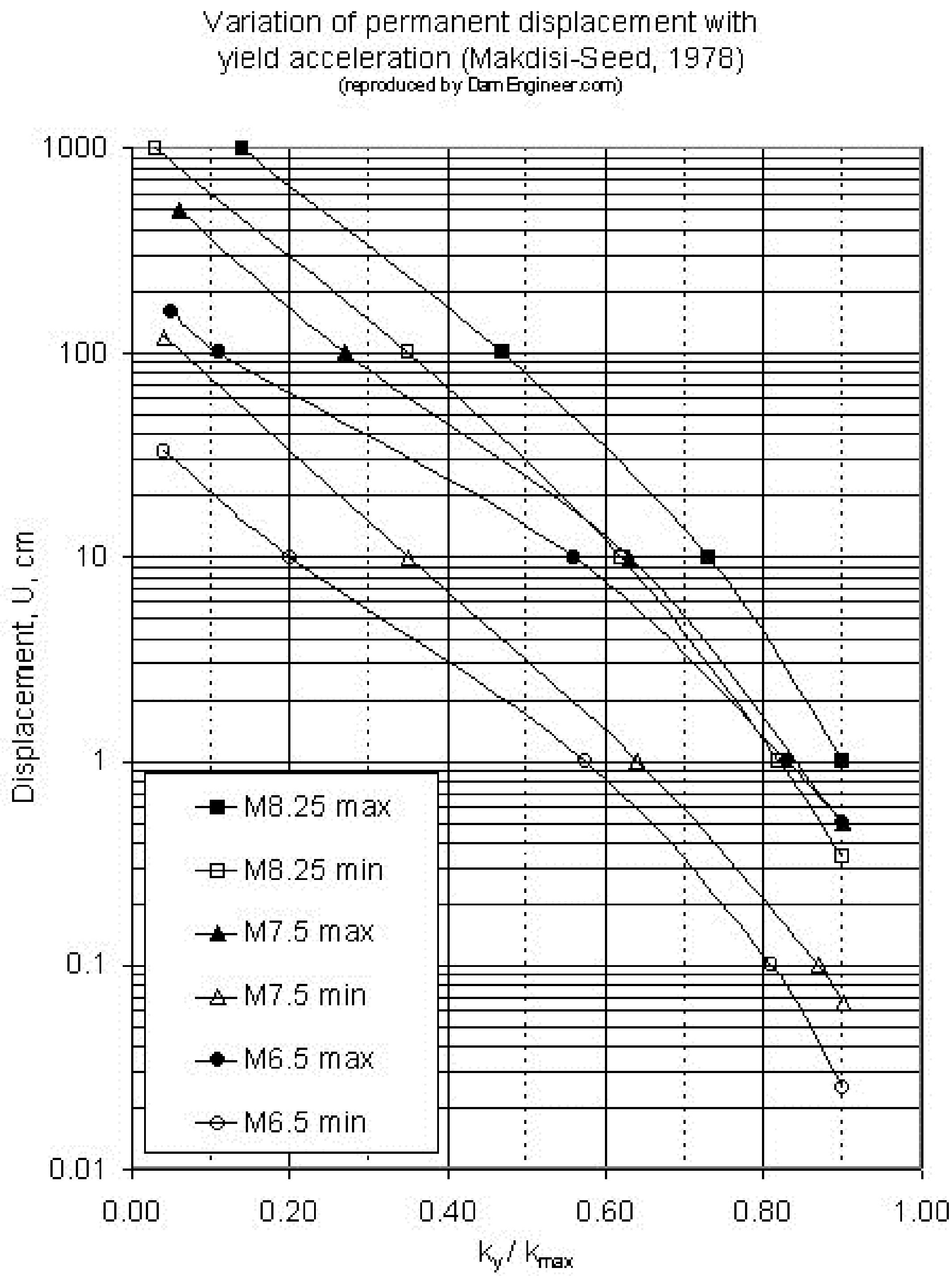

880.0
870.0
860.0
850.0
840.0
830.0
820.0
810.0
Elevation (ft)
25
27
29
31
33
35
37
39
41
43
45
Foundation friction angle
Rock at El. 810'
Ap-4
AP-5
AP-6


PEAK TRANSVERSE CREST ACCELERATION (g)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
PEAK TRANSVERSE BASE ACCELERATION (g)
WES DATA
PEAK BASE ACCELERATION
PEAK ABUTMENT ACCELERATION
HARDER (1990):
PREVIOUS EARTHQUAKES
1989 LOMA PRIETA EARTHQUAKE
UPPER BOUND

Variation of maximum acceleration ratio with depth of sliding mass (Makdisi-Seed, 1978)
(reproduced by DamEngineer.com)





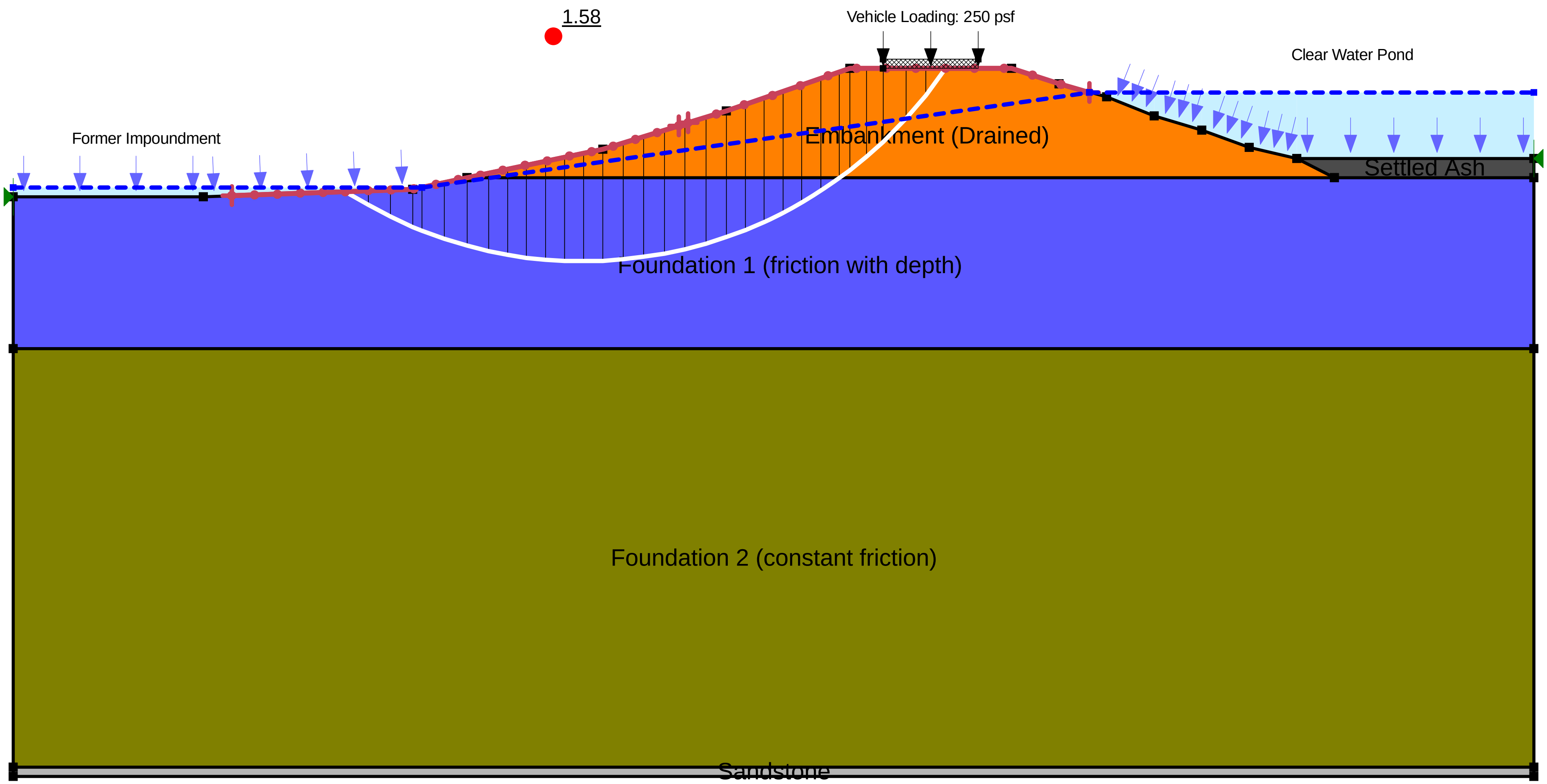


Variation of permanent displacement with
yield acceleration (Makdisi-Seed, 1978)
(reproduced by DamEngineer.com)
1000
100
10
1
0.1
0.01
Displacement, U, cm
0.00
0.20
0.40
0.60
0.80
1.00
ky / kmax
M8.25 max
M8.25 min
M7.5 max
M7.5 min
M6.5 max
M6.5 min

ATTACHMENT 3
STABILITY ANALYSES RESULTS

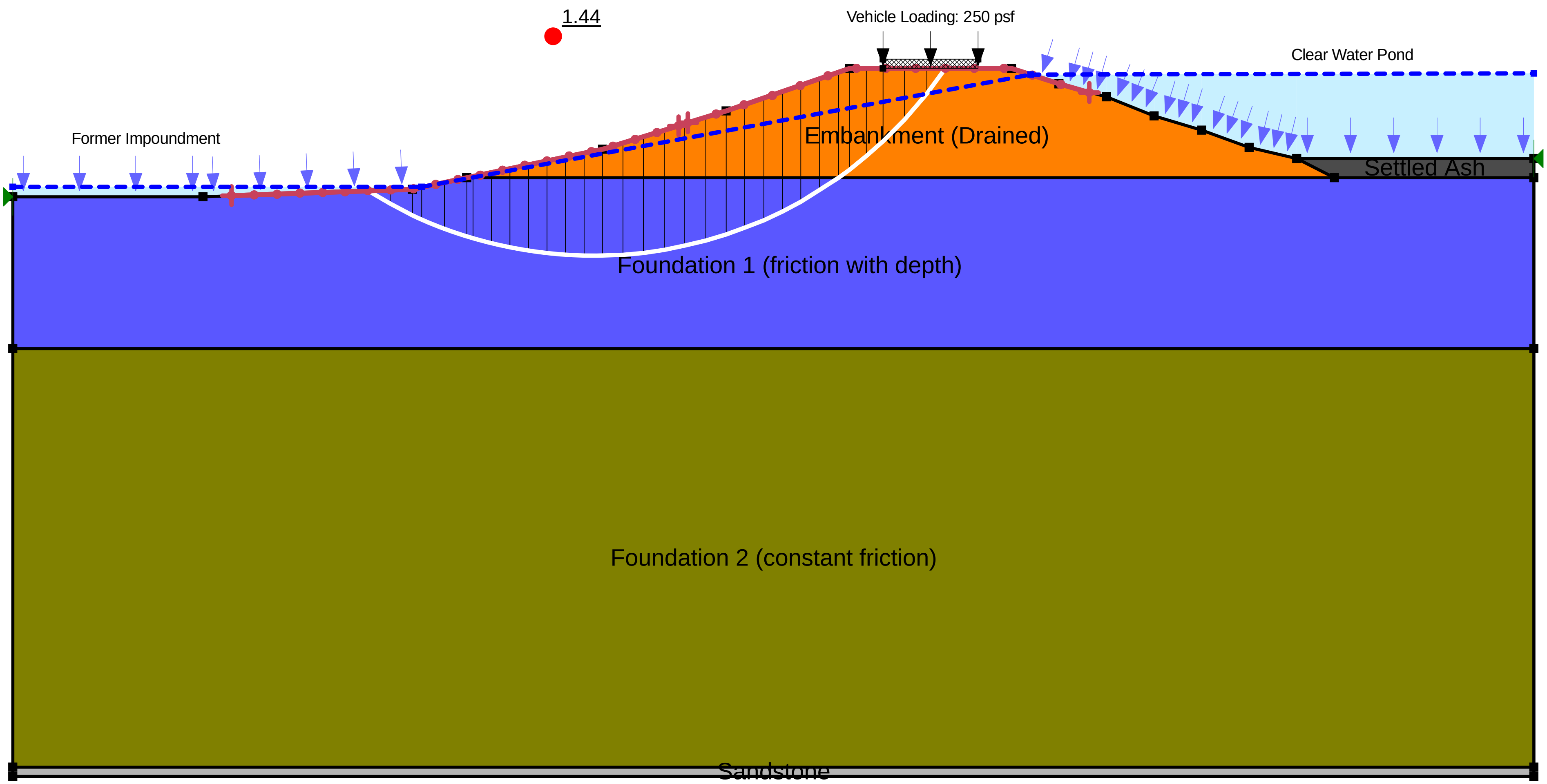
Name: Clear Water Pond - El. 882 feet
Description: Normal Pool, Drained Conditions
Method: Spencer
FS: 1.58

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi Fn	Phi' (°)
	Embankment (Drained)	120	200		28
	Foundation 1 (friction with depth)	115	0	loose silt/sand foundation	
	Foundation 2 (constant friction)	120	0		35
	Sandstone	160	2,000		45
	Settled Ash	90	0		30



Name: Clear Water Pond - El. 884 feet
Description: Surcharge Pool, Drained Conditions
Method: Spencer
FS: 1.44

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi Fn	Phi' (°)
Orange	Embankment (Drained)	120	200		28
Blue	Foundation 1 (friction with depth)	115	0	loose silt/sand foundation	
Olive	Foundation 2 (constant friction)	120	0		35
Light gray	Sandstone	160	2,000		45
Dark gray	Settled Ash	90	0		30



Name: Earthquake
Description: Normal Pool, Undrained Conditions
Method: Spencer
FS: 1.48

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi Fn	Phi (°)
	Embankment (Undrained)	120	1,000		0
	Foundation 1 (friction with depth)	115	0	loose silt/sand foundation	
	Foundation 2 (constant friction)	120	0		35
	Sandstone	160	2,000		45
	Settled Ash	90	0		30