Periodic Inflow Design Flood Control System Plan – Bottom Ash Basins

Belle River Power Plant
East China Township, Michigan
(PMP-22810)

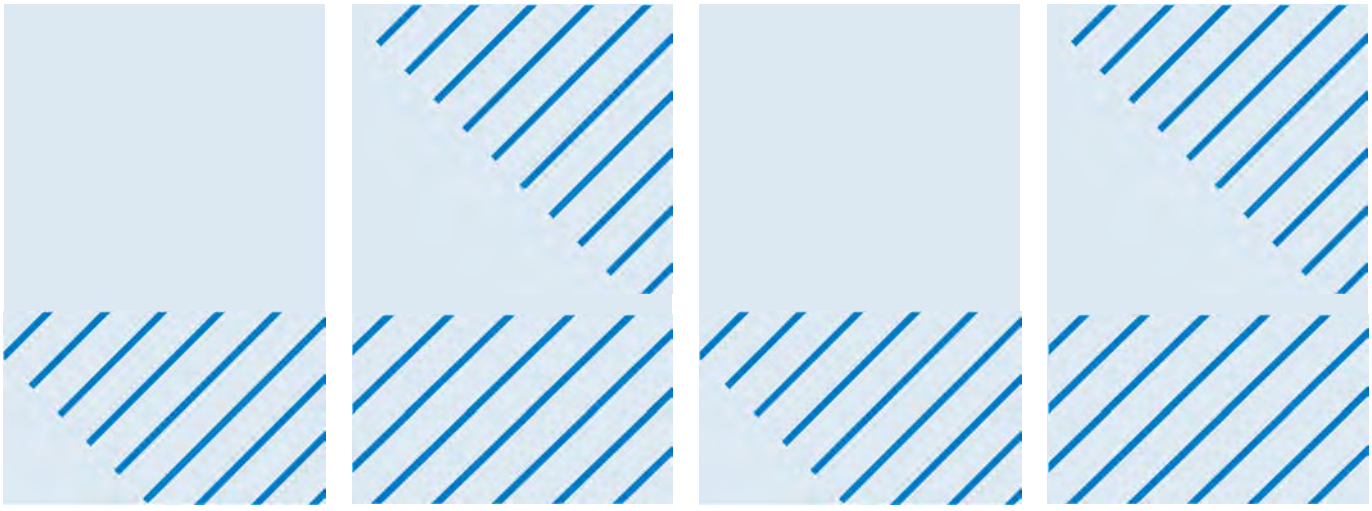
Prepared for
DTE Electric Company (DTE)

Prepared by
Barr Engineering Michigan LLC

October 2026

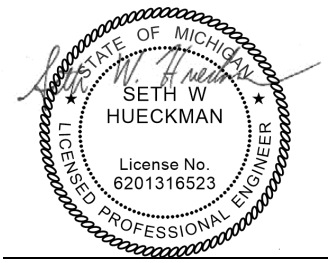
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Certification

I hereby certify that I, or my agent, have examined the facility and, being familiar with the provisions of 40 CFR Part § 257.82, attest that this Coal Combustion Residuals Periodic Inflow Flood Design Control System Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR Part § 257.82(c). I certify that the plan is adequate for this facility and that procedures for recordkeeping and reporting have been established.



Seth W. Hueckman
Michigan PE #: 6201316523

10/14/2026
Date

1 Introduction

DTE Electric Company (DTE) operates the Belle River Power Plant (BRPP), a coal fired power plant located in East China Township, Michigan. BRPP is currently being converted to natural gas fired boilers, which is to be completed in 2026. During operation as a coal fired power plant, bottom ash and other plant process effluents have been discharged in the North and South Bottom Ash Basin's (BAB's). The BAB's consist of two, approximately 0.8 acre sedimentation ponds. A system of weirs and ditches convey discharge water from the BAB's to the facility's stormwater management system where it is ultimately discharged in accordance with the National Pollutant Discharge Elimination System (NPDES) permit. Solids (bottom ash) accumulated in the BAB's are periodically dredged and disposed in the Range Road CCR Landfill. The BAB's must comply with the requirements of 40 CFR Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, herein referred to as the CCR Rule.

The initial and first periodic update to the Hazard Potential Classification for the BAB's was developed by NTH Consultants, Ltd in October of 2016 and 2021. These reports classified the BAB's as low hazard. To complete the second periodic update to the report, Barr has reviewed these reports as well as changes implemented at the facility since the last periodic update in coordination with DTE staff. In 2023, the BAB's were retrofitted with a composite liner system. This work included dredging of the BAB's to remove accumulated bottom ash and other solids and installing a liner system consisting of 60-mil high-density polyethylene (HDPE) geomembrane over a geosynthetic clay liner. Protective sand and coarse aggregate were placed over the liner system to act as protective layers during future dredging operations.

DTE is in the process of converting the BRPP to natural gas fired boilers. During the conversion, the BAB's will receive small volumes of CCR from construction activities related to the conversion. After the conversion, the BAB's will continue to receive low volumes of wastewater generated from the converted BRPP. The existing infrastructure (inflow piping, outlet weirs, outlet piping, and discharge ditches) will remain in place after the conversion and the BAB's will continue to operate in the same manner as prior to the conversion, with lower anticipated inflows.

2 Objectives

Hydrologic and hydraulic capacity requirements for CCR surface impoundments, 40 CFR § 257.82, requires the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment (unit) to design, construct, operate, and maintain an inflow design flood control system. In addition, owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit.

In order to fulfill these objectives, the inflow design flood control system plan must:

- define the inflow design flood event for the CCR unit;
- provide documentation that the inflow design flood control system adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood;
- provide documentation that the inflow design flood control system adequately manages flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood;

- include a certification from a qualified professional engineer.

3 BAB's Location and Physical Description

The BAB's are rectangular shaped and located on the north side of the facility, approximately 500 feet from the main plant structures, see Figure 1. The BAB's have a depth of approximately 10-15 feet when sediments have been dredged out and were constructed with 2:1 H:V interior side slopes. The BAB's share an embankment on the south/north side of the BAB's and are surrounded by stormwater conveyance ditches to the north, south, and west, see Figure 2. Beyond the stormwater ditches lies undeveloped land to the north, storage yards and outbuildings to the west and south, and roads/rail tracks to the east. The BAB's generally have an embankment crest elevation of 592 feet, with varying embankment heights as the natural topography varies around the toe of the embankments. The lowest elevation at the toe of the North Basin is on the west side with an elevation of approximately 588 feet. The lowest elevation near the South Basin embankment is approximately 585 feet on the south side of the basin. Both BAB's discharge via box weirs on the west side that run the width of the basins (approximately 92 feet). The box weirs have a fixed elevation of 590 feet, limiting the pool elevation during normal operations.

4 Inflow Design Flood Event

The inflow design flood event for CCR surface impoundments is based on hazard potential classifications. Guidance for the hazard potential classification is provided in 40 CFR § 257.53 stating that "*Hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications include high hazard potential CCR surface impoundment, significant hazard potential CCR surface impoundment, and low hazard potential CCR surface impoundment.*"

The CCR Rule further goes on to define these terms:

> *"High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life"*
>
> *"Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns."*
>
> *"Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property."*

Failure or mis-operation of the BAB's is not likely to cause loss of human life, economic loss, environmental damage, or disruption of lifeline facilities. Therefore the BAB's are classified as a low hazard potential CCR surface impoundment. The inflow design flood for a low hazard potential CCR surface impoundment is the 100-year flood, 24 hour event (40 CFR § 257.82(a)(3)(iii)).

5 Flow into CCR Unit

During active operation, each BAB is fed by two, 24-inch pipes that discharge process water into each basin. As previously discussed, the BRPP is converting to natural gas fired boilers. After the conversion is completed, the BAB's will continue to receive low volume wastewater from the BRPP. To conservatively model the impacts from the 100-year storm event, the pool elevation within the basins was assumed to be full, at the elevation of the weir crest, 590 feet, during the storm event.

The 100-year, 24-hour storm event at BRPP produces 5.08 inches of rainfall (reference: Atlas 14). The BAB's have a contributing drainage area of approximately 1.3 acres each, which is comprised of approximately 0.8 acres of each basin's pool area and approximately 0.5 acres of adjacent embankments and roads. Hydrologic modeling of the BAB's for the 100-year event produces a runoff volume of approximately 0.5 acre-feet for each basin, resulting in a peak pond elevation of approximately 590.1 feet and minimum freeboard of 1.9 feet from the embankment crests.

6 Flow from CCR Unit

Flow from the BAB's is controlled by box weirs on the west side of each basin. The weir is approximately 92 feet in width, the full width of the basin, and feeds a 24-in RCP pipe. The RCP outlet pipe in each basin is approximately 85 feet long, graded at a 0.7% slope. The outlet pipes discharge into open ditches, which route water into the facilities' stormwater management system through a series of open ditches, culverts, and an additional sedimentation basin. Ultimately, water from the BAB's is discharged off site under the facilities' National Pollutant Discharge Elimination System (NPDES) permit.

The peak inflow to the pond during the 100-year storm event is approximately 9.75 cfs. This inflow is capable of being passed by the 24-inch outlet pipe, with minimal backup of water within the BAB's. The 24-in outlet pipes have a maximum capacity of approximately 20 cfs before surcharging.

7 Conclusion

The North and South Bottom Ash Basins can safely manage the 100-year, 24-hour inflow design flood, with modeled peak water levels of approximately 590.1 feet and a minimum freeboard of 1.9 feet. The existing 24-inch outlet pipes have sufficient capacity to convey the estimated 9.75 cfs peak inflow without surcharging, demonstrating that the inflow flood control system meets the requirements of 40 CFR § 257.82.

8 References

NOAA Atlas 14 Point Precipitation Frequency Estimates: Michigan. National Weather Service. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=nd. Accessed September 24, 2026.

NTH, 2021. Inflow Design Flood Control System Plan 5-Year Periodic Assessment, Belle River Power Plant Bottom Ash Basins, October 2021.

NTH, 2016. Inflow Design Flood Control System Plan, Belle River Power Plant, October 2016.

Figures

Barr Footer: ArcGISPro 3.7.1, 2026-09-25 08:57 File: I:\Projects\22\74\1143\Maps\BRPP Site Features\Site Features.aprx Layout: Figure 1 Site Location User: AMB5



Bottom Ash Basins
Diversion Pond

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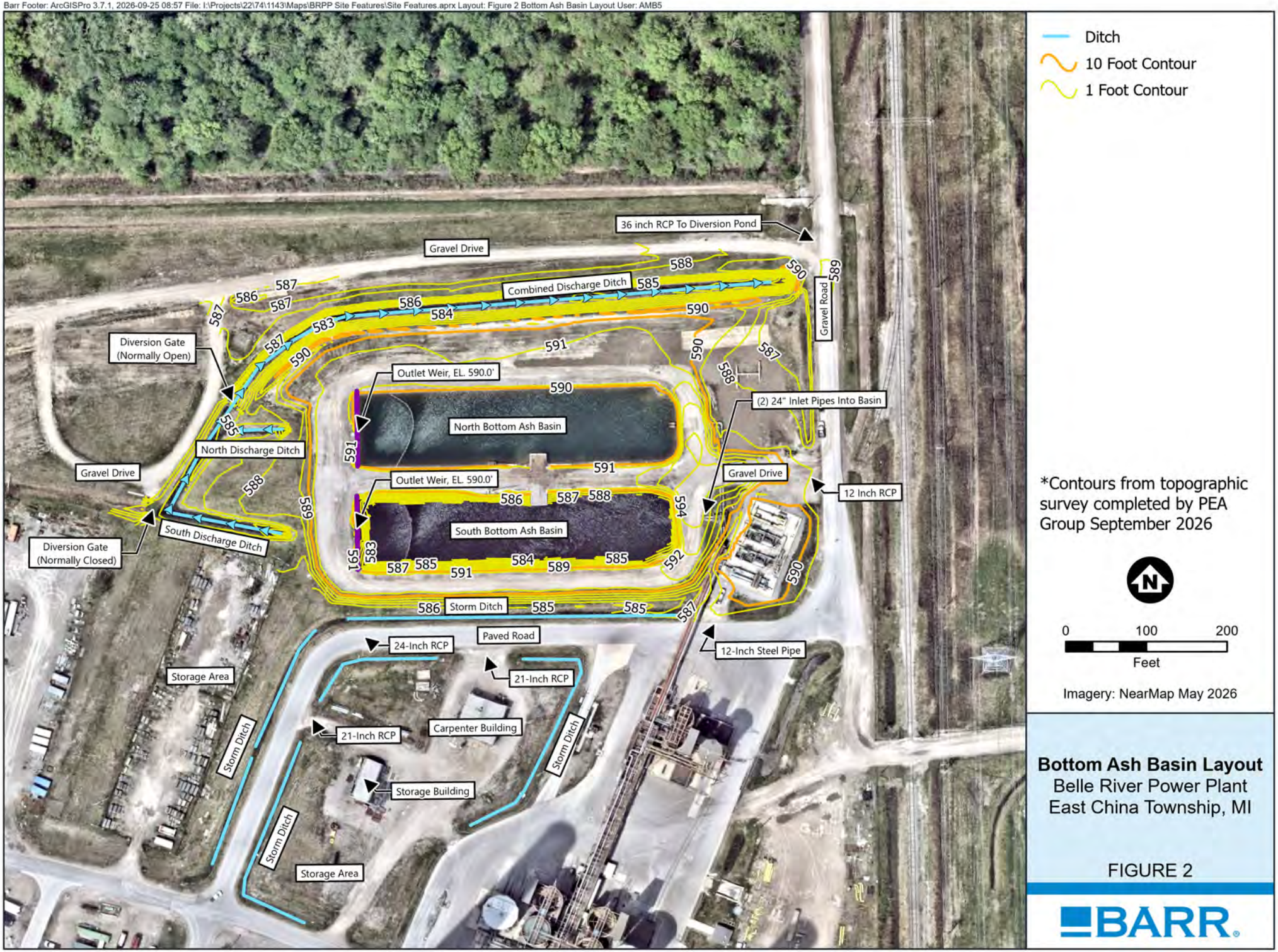
0 150 300
Feet

Imagery: NearMap May 2026

Site Location
Belle River Power Plant
East China Township, MI

FIGURE 1

BARR

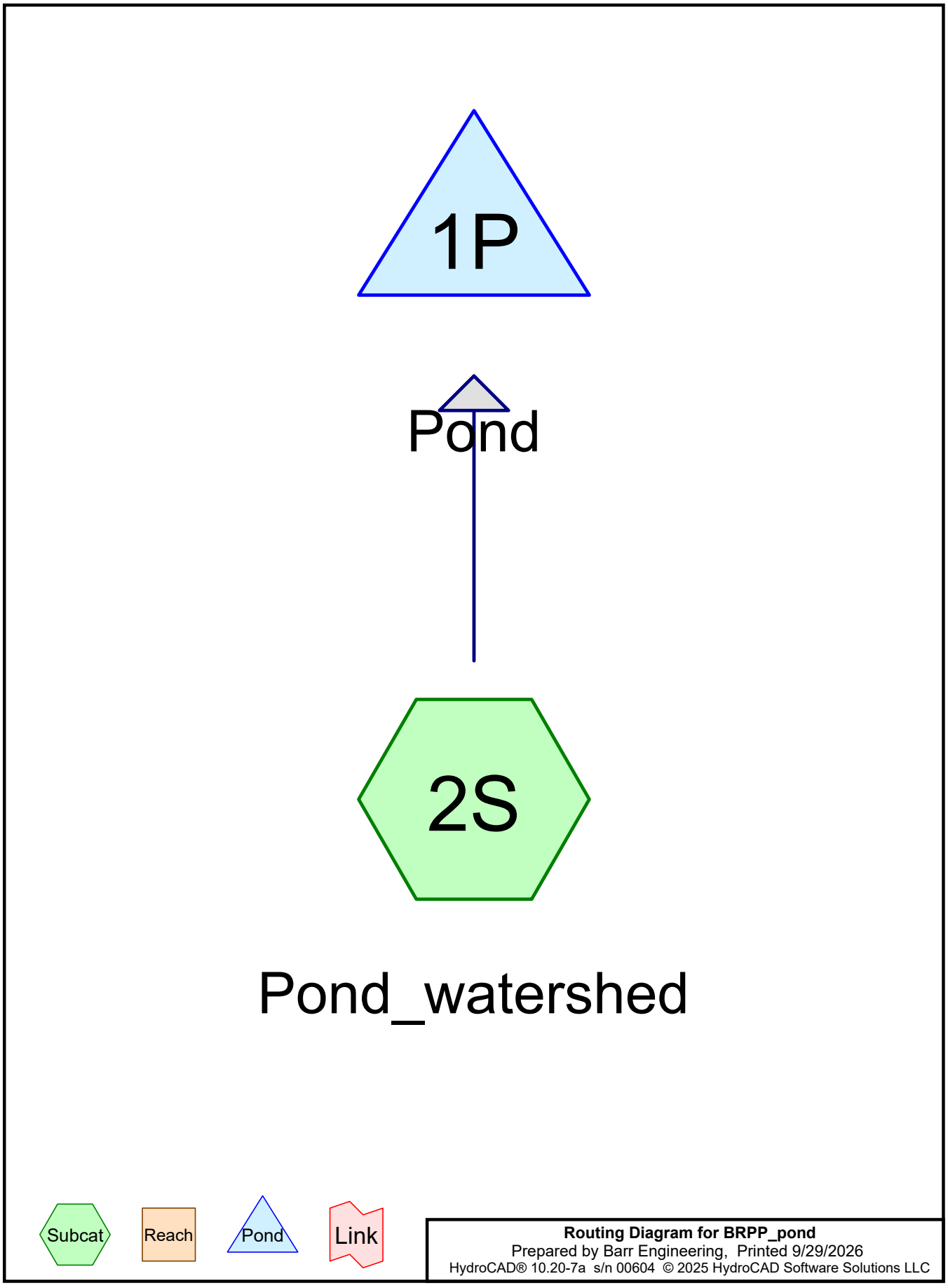


Bottom Ash Basin Layout
Belle River Power Plant
East China Township, MI

FIGURE 2

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Appendix A – HydroCAD Model



Routing Diagram for BRPP_pond
Prepared by Barr Engineering, Printed 9/29/2026
HydroCAD® 10.20-7a s/n 00604 © 2025 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.500	96	Gravel surface, HSG C (without ROW) (2S)
0.800	98	pool surface - impervious (2S)
1.300	**97**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.500	HSG C	2S
0.000	HSG D	
0.800	Other	2S
1.300		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.500	0.000	0.000	0.500	Gravel surface	2S
0.000	0.000	0.000	0.000	0.800	0.800	pool surface - impervious	2S
0.000	**0.000**	**0.500**	**0.000**	**0.800**	**1.300**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	1P	584.06	578.11	85.0	0.0700	0.013	0.0	24.0	0.0	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: Pond_watershed Runoff Area=1.300 ac 61.54% Impervious Runoff Depth>4.73"
Tc=5.0 min CN=97 Runoff=9.75 cfs 0.512 af

Pond 1P: Pond Peak Elev=590.09' Storage=6.207 af Inflow=9.75 cfs 0.512 af
Outflow=7.28 cfs 0.512 af

Total Runoff Area = 1.300 ac Runoff Volume = 0.512 af Average Runoff Depth = 4.73"
38.46% Pervious = 0.500 ac 61.54% Impervious = 0.800 ac

Summary for Subcatchment 2S: Pond_watershed

[49] Hint: Tc<2dt may require smaller dt

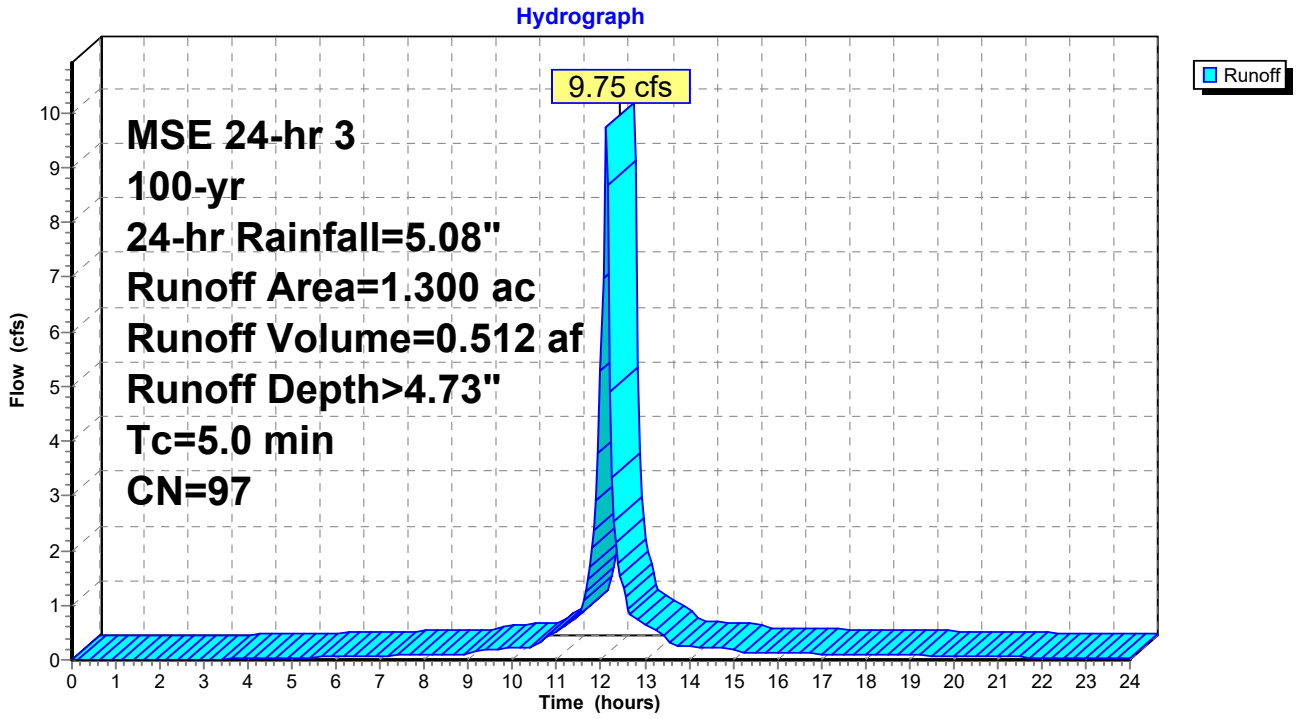
Runoff = 9.75 cfs @ 12.11 hrs, Volume= 0.512 af, Depth> 4.73"
Routed to Pond 1P : Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-yr, 24-hr Rainfall=5.08"

	Area (ac)	CN	Description
*	0.800	98	pool surface - impervious
*	0.500	96	Gravel surface, HSG C (without ROW)
	1.300	97	Weighted Average
	0.500		38.46% Pervious Area
	0.800		61.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, assumed minimum TOC due to small drainage area**

Subcatchment 2S: Pond_watershed



Summary for Pond 1P: Pond

Inflow Area = 1.300 ac, 61.54% Impervious, Inflow Depth > 4.73" for 100-yr, 24-hr event
Inflow = 9.75 cfs @ 12.11 hrs, Volume= 0.512 af
Outflow = 7.28 cfs @ 12.17 hrs, Volume= 0.512 af, Atten= 25%, Lag= 3.5 min
Primary = 7.28 cfs @ 12.17 hrs, Volume= 0.512 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Starting Elev= 590.00' Surf.Area= 0.800 ac Storage= 6.133 af
Peak Elev= 590.09' @ 12.17 hrs Surf.Area= 0.805 ac Storage= 6.207 af (0.074 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 7.9 min (758.0 - 750.1)

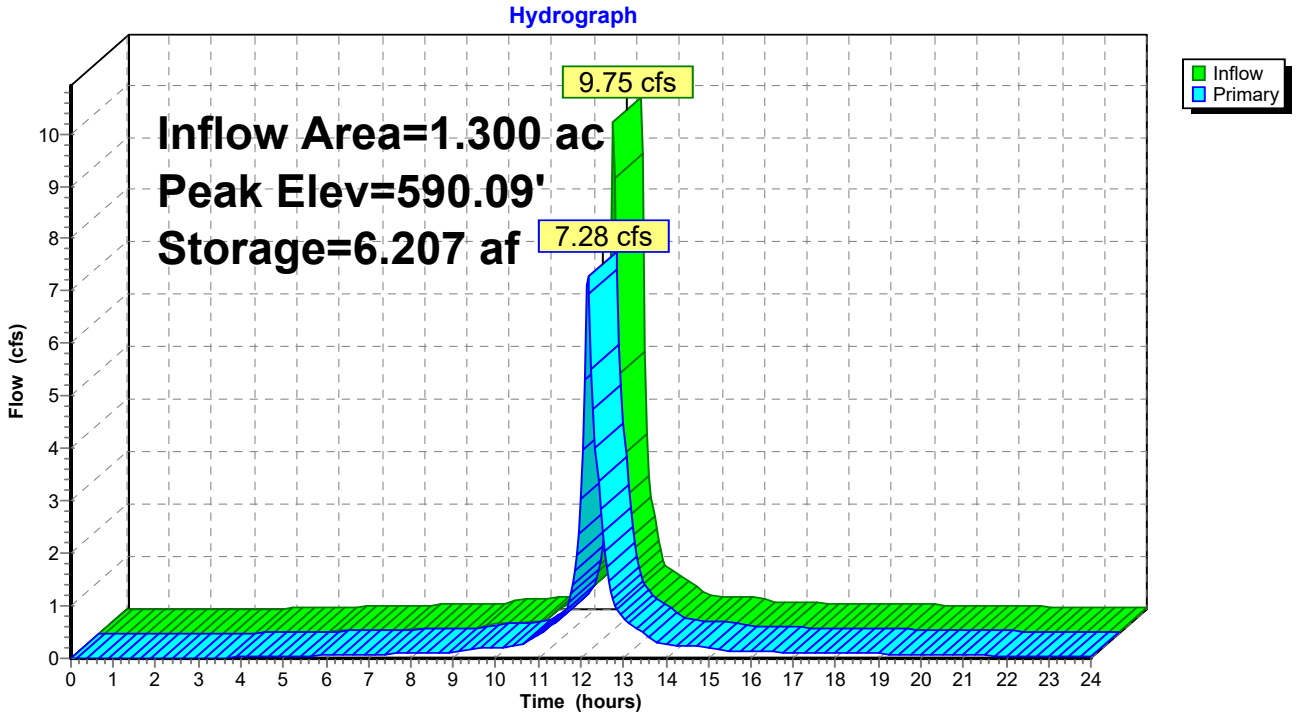
Volume	Invert	Avail.Storage	Storage Description
#1	580.00'	7.830 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
580.00	0.402	0.000	0.000
581.00	0.439	0.420	0.420
582.00	0.515	0.477	0.898
583.00	0.555	0.535	1.433
584.00	0.595	0.575	2.008
585.00	0.635	0.615	2.623
586.00	0.635	0.635	3.258
587.00	0.677	0.656	3.913
588.00	0.719	0.698	4.611
589.00	0.762	0.740	5.352
590.00	0.800	0.781	6.133
591.00	0.850	0.825	6.958
592.00	0.895	0.872	7.830

Device	Routing	Invert	Outlet Devices
#1	Device 2	590.00'	**92.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	584.06'	**24.0" Round RCP_Round 24"** L= 85.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 584.06' / 578.11' S= 0.0700 '/' Cc= 0.900 n= 0.013, Flow Area= 3.14 sf

Primary OutFlow Max=6.74 cfs @ 12.17 hrs HW=590.09' (Free Discharge)
↑—**2=RCP_Round 24"** (Passes 6.74 cfs of 33.93 cfs potential flow)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 6.74 cfs @ 0.81 fps)

Pond 1P: Pond


Hydrograph
Inflow Area=1.300 ac
Peak Elev=590.09'
Storage=6.207 af
9.75 cfs
7.28 cfs
Inflow
Primary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24