Inflow Design Flood Control System Plan
Tecumseh Energy Center
Bottom Ash Surface Impoundment

Prepared for:

Westar Energy

Jeffrey Energy Center

St. Marys, Kansas

Prepared by:

CB&I Environmental & Infrastructure, Inc.

October 2016

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LIST OF FIGURES AND APPENDICES

FIGURES

APPENDICES

Plan Review/Amendment Log §257.82(c)(2-4)

Date of Review	Reviewer Name	Sections Amended and Reason	Version

CCR Regulatory Requirements

USEPA CCR Rule Criteria 40 CFR 257.82	**Tecumseh Energy Center (TEC) Hydraulic and Hydrologic Capacity Plan**
§257.82(a)(1) stipulates: *(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.* *(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.*	Section 5.3.1
§257.82(a)(2) stipulates: *(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.*	Section 5.3.1

USEPA CCR Rule Criteria 40 CFR 257.82	Tecumseh Energy Center (TEC) Hydraulic and Hydrologic Capacity Plan
§257.82(a)(3) stipulates: *(3) The inflow design flood is:* *(i) For a high hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the probable maximum flood;* *(ii) For a significant hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the 1,000-year flood;* *(iii) For a low hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the 100-year flood; or* *(iv) For an incised CCR surface impoundment, the 25-year flood.*	Section 4.0
§257.82(b) stipulates: *(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.*	Section 3.3

USEPA CCR Rule Criteria **40 CFR 257.82**	**Tecumseh Energy Center (TEC)** **Hydraulic and Hydrologic Capacity Plan**
§257.82(c)(1) stipulates: *(c) Inflow design flood control system plan—* *(1) Content of the plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(4).*	Sections 1.0 - 7.0
§257.82(c)(2) stipulates: *(2) Amendment of the plan. The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.*	Section 6.3

USEPA CCR Rule Criteria 40 CFR 257.82	Tecumseh Energy Center (TEC) Hydraulic and Hydrologic Capacity Plan
§257.82(c)(3) stipulates: *(3) Timeframes for preparing the initial plan—* *(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must prepare the initial inflow design flood control system plan no later than October 17, 2016.* *(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator must prepare the initial inflow design flood control system plan no later than the date of initial receipt of CCR in the CCR unit.*	Section 1.0

USEPA CCR Rule Criteria 40 CFR 257.82	Tecumseh Energy Center (TEC) Hydraulic and Hydrologic Capacity Plan
§257.82(c)(4) stipulates: *(4) Frequency for revising the plan. The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed an inflow design flood control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(4).*	Section 6.3
§257.82(c)(5) stipulates: *(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of this section.*	Section 7.0

USEPA CCR Rule Criteria 40 CFR 257.82	Tecumseh Energy Center (TEC) Hydraulic and Hydrologic Capacity Plan
§257.82(d) stipulates: *(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(g), the notification requirements specified in §257.106(g), and the internet requirements specified in §257.107(g).*	Section 6.0

1.0 INTRODUCTION

CB&I Environmental and Infrastructure, Inc. (CB&I) has prepared the following Inflow Design Flood Control System Plan (Plan) at the request of Westar Energy (Westar) for the Bottom Ash Surface Impoundment (Surface Impoundment) located at the Tecumseh Energy Center (TEC) in Tecumseh, Kansas. TEC is a coal-fired power plant that has been in operation since 1925. The Surface Impoundment has been deemed to be a regulated coal combustion residue (CCR) unit by the United States Environmental Protection Agency (USEPA), through the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (CCR Rule) 40 CFR §257 and §261.

CCR regulations set forth within Title 40 Code of Federal Regulations (CFR) Part §257.82, provide guidelines for inflow design flood control systems to ensure that regulated CCR units are designed to safely manage stormwater flow during the inflow design flood. Specifically, §257.82 stipulates the following:

> §257.82:"*(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system… (1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood… and (2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood"*

As demonstrated in this Plan, the inflow design flood control system has been designed to safely manage the inflow design flood and is in compliance with 40 CFR Part §257.82. This document provides discussion of CB&I's professional judgement/opinion regarding specific aspects of the Rule as they pertain to the Surface Impoundment which has been deemed as a regulated CCR unit at Westar's TEC. This Plan will be placed within the Facility Operations Plan prior to October 17, 2016, in accordance with 40 CFR Part §257.82(c)(3).

2.0 REGULATORY OVERVIEW OF HYDROLOGIC AND HYDRAULIC CAPACITY REQUIREMENTS

On April 17, 2015, USEPA published the CCR Rule under Subtitle D of the Resource Conservation and Recovery Act (RCRA) as 40 CFR Parts §257 and §261. The purpose of the CCR Rule is to regulate the management of coal combustion residuals in regulated units for landfill and surface impoundments. The Surface Impoundment has been deemed to be a regulated CCR unit at TEC.

This Plan marks the initial analysis of the facility inflow design flood control system based on the current facility conditions. Construction activities may occur at the facility that will subsequently modify the current conditions as described within this Plan. This Plan will be amended in accordance with §257.82(2), which stipulates:

> §257.81(2): *"The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect."*

This Plan will be amended to accurately analyze the inflow design flood control system associated with the current facility conditions. Amendments to this Plan will be documented within the Plan Review/Amendment Log immediately following the Table of Contents.

This Plan also details Westar's compliance with the recordkeeping requirements specified in Section 6.0.

3.0 TEC SURFACE IMPOUNDMENT OVERVIEW

3.1 Site Location and Topography

Westar owns and operates a surface impoundment system at TEC in Tecumseh, Shawnee County, Kansas. TEC is located approximately 6.5 miles east of Topeka, Kansas and approximately 2 miles north of Highway 70 and resides in Sections 31, Township 11 South, and Range 17 East. The location of the surface impoundment is depicted as Area 1 in **Figure 1.**

The Area 1 is located due west of the TEC power plant. Area 1 is comprised of two ponds: the North Pond is the northernmost pond and the South Pond is the southernmost pond. The Area 1 is approximately 4.0 acres.

A perimeter berm surrounds the North and South Ponds. The top elevation of Area 1 varies between approximate 884 to 886 ft. mean sea level (MSL), as depicted in **Figure 2.**

The berm slopes down towards Tecumseh Creek and is stabilized along the north, west, and south. The perimeter berm prevents overland flow of stormwater into the Surface Impoundments. Existing site topography is depicted in **Figure 2.**

3.2 Existing Regulatory Permits and Consents

Westar has been granted an Industrial Landfill Permit at TEC by the Kansas Department of Health and Environment – Bureau of Waste Management (KDHE-BWM) Permit No. 0322, in accordance with Kansas Statutes Annotated (K.S.A.) 65-3407. The KDHE modified the solid waste permit, per K.A.R. 28-29-6a, in response to the CCR Rule to include CCR waste management units as disposal areas to be covered by the existing solid waste permit. This Permit enables the Site to continue safe disposal of the CCR generated on-site at TEC to be properly disposed of within the Area 1.

Westar has also been granted a Kansas Water Pollution Control Permit and Authorization to Discharge under the National Pollutant Discharge Elimination System (NPDES) Permit No. I-KS72-BO01 from the KDHE. The NPDES Permit covers outfall locations at TEC and allows the discharge of non-contact stormwater into the Kansas River and surrounding streams in accordance with effluent limitations and monitoring requirements.

3.3 Existing Flood Control System

Area 1 consists of two ponds separated by a stabilized berm. The two ponds are denoted North Pond and South Pond. Process water, bottom ash slurry, and stormwater are pumped to the ponds from the Cinder Pit and the process facility. A diversion structure is utilized so that one pond can be filled while the other is dewatered and dredged of CCR material. A weir structure is positioned between the two ponds, allowing water to flow openly from one pond to the other. As the ponds fill with water, a 12-inch plastic pipe

(PVC) conveys water from both ponds to the clear pond across Tecumseh Creek. Water discharges into Tecumseh Creek once it passes through the clear pond. The clear pond is currently permitted under the National Pollutant Discharge Elimination System (NPDES) Permit No. I-KS72-BO01 and 40 CFR Part §257.82(b). The inflow design flood control system is depicted in **Figure 3.**

4.0 HAZARD POTENTIAL DEFINITION (§257.82(a)(3))

In accordance with §257.82(a)(3), the inflow design flood event utilized to demonstrate compliance with the Rule is determined by the hazard potential classification. Hazard potential classifications are based on potential loss or damage to the following:

- Human life
- Economic loss
- Environmental damage
- Disruption of lifeline facilities

According to the United States Environmental Protection Agency (USEPA), the Surface Impoundment has been classified as a Significant Hazard Potential CCR surface impoundment. An Initial Hazard Potential Classification Assessment has also been undertaken in line with §257.73(a)(2) and has concurred the same judgement; in that, the site is judged to have a Significant Hazard Potential Classification. The Initial Hazard Potential Classification is provided in **Appendix B.**

As defined in §257.82(a)(3), the 1000-year flood event (1000-year, 24-hour storm event) is utilized for inflow design flood control system analysis for significant hazard potential surface impoundments. The inflow design control system will be evaluated to demonstrate the ability to adequately manage stormwater flow, per §257.82(a)(1), and collect and control the peak discharge, per §257.82(a)(2).

4.1 Emergency Action Plan

According to 40 CFR Part 257.74(a)(3), an Emergency Action Plan (EAP) is required for all CCR units that have been classified as either a high hazard potential or significant hazard potential CCR surface impoundment. The EAP is not required to be completed under the CCR Rule until April 17, 2017. Westar will establish an EAP for the Surface Impoundment at TEC prior to the deadline

5.0 INFLOW DESIGN FLOOD CONTROL SYSTEM ANALYSIS

5.1 Methodology Overview

In order to determine compliance with 40 CFR Part §257.82 regarding the inflow design flood control system within Area 1, existing site topography and existing inflow design flood control system features were modeled using the computer model software HydroCAD. This computer model is used to developed discharge rates and volumes associated with the subcatchments contributing to the flow into the Area 1. Inflow design flood features were modeled to ensure that these features are capable of managing peak discharge rates and volumes associated with the inflow design flood.

5.2 Model Input Parameters

To ensure that the inflow design flood control system complies with 40 CFR Part §257.82, all elements were computer modeled with numerous conservative assumptions. AutoCAD Civil3D 2014 (AutoCAD) was utilized to delineate key features and the computer model HydroCAD was used to develop discharge rates and volumes for the inflow design flood event. HydroCAD is a computer aided design program used to model hydrology and hydraulics of stormwater using either TR-20 or TR-55 procedures developed by the Soil Conservation Services (now the Natural Resource Conservation Service).

The stormwater modeling methodology used the following analysis methods, as further describe in subsequent text:

Runoff Calculation Method:	SCS TR-20
Pond Routing Method:	Storage Indication Method (Modified-Puls)
Storm Distribution:	Rainfall Intensity Table for Kansas Counties - 1997
Unit Hydrograph:	SCS
Antecedent Moisture Condition:	2

The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), developed methods TR-20 and TR-55 as standardized stormwater modeling. Both provide similar results; the main differentiation in methodology is based on the use of chart-based solutions vs. computer modeling. TR-55, frequently called the "tabular method" was developed prior to the widespread use or computer modeling. As such, it was developed to utilize chart based solutions to use the SCS runoff equation. TR-20 is a computer based modeling approach that is more complex and generally considered more accurate than TR-55.

5.2.1 Rainfall Totals and Distributions

Rainfall intensities for the inflow design flood system analysis were determined by using USEPA hazard potential classification. The USEPA has classified the Surface Impoundment at TEC to be a significant hazard potential CCR unit. The 1000-year flood event (1000-year, 24-hour storm event) will be utilized within the model, in accordance with 40 CFR Part §257.82(3) which states:

> §257.82(3) stipulates: *"(3) The inflow design flood is: … (ii) For a significant hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the 1,000-year flood;"*

The rainfall depth and distribution pattern for the inflow design flood system analysis was determined using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 point precipitation frequency tool for Kansas provided by the National Weather Service (NWS). The rainfall depth for the modeled scenario was selected from this report and entered into HydroCAD. TR-55 outlines that an NRCS Type II 24-hour storm distribution is appropriate within this region of Kansas. The distribution pattern may be selected from a drop-down list in HydroCAD. The rainfall total from the NOAA-NWS is can be found in **Appendix A.**

5.2.2 Subcatchment Boundaries

Subcatchment areas (also known as watersheds) were delineated using AutoCAD based on topographic breaks within the areas to be analyzed. For the inflow design flood system analysis, direct precipitation onto the Surface Impoundment was delineated and imported into HydroCAD. The subcatchment boundary is depicted in **Figure 4.**

5.2.3 Run-off Coefficient Variables

Curve numbers are used to identify the run-off characteristics of an area. Curve numbers consider both the land cover that will be encountered by surface water as well as the type of soil that underlies the land cover. The underlying soil is important because soil matrix has a large impact on whether water infiltrates the soil or is shed.

The SCS (NRCS) technical resource TR-55 provides lookup tables of curve numbers for combinations of various land covers and the underlying surficial soils. CB&I developed assumptions of surficial soil types and delineated various landcovers to develop a weighted average for each modeled subcatchment area using values specified in TR-55.

The subcatchment included in this analysis is the grassed area surrounding Area 1, which is conservatively assumed to be water surface. Direct precipitation falling within this area will be inundated with water, therefore, the run-off coefficient is conservatively assumed to be water surface. The normal water level within Area 1 is approximate elevation 882 ft. MSL.

5.2.4 Time of Concentration

The time of concentration, defined as the longest amount of time a waterdrop would take to travel from the headwater of a subcatchment area to its downstream edge (ie. prior to being managed downstream). Direct precipitation captured within Area 1 does not have a time of concentration. The time of concentration for this subcatchment was conservatively assumed to be zero.

5.2.5 Surface Impoundments

The Surface Impoundment was modeled by entering the area at major contour intervals between the normal water elevation and the top of perimeter berm elevation to determine incremental detention volumes. The North and South ponds were modeled together because the ponds are able to intermix. The normal water elevation was assumed to be at approximate elevation 882 ft. MSL. The top of perimeter berm elevation was assumed to be at approximate elevation 884 ft. MSL. The Surface Impoundment was modeled with a 12-inch plastic pipe as the solitary outlet structure. Site topography and outlet pipe parameters for Area 1 were provided by Professional Engineering Consultants (PEC).

5.2.6 Base Flow from TEC Operations

Process water, bottom ash slurry, and stormwater are pumped to the Surface Impoundment from the Cinder Pit and the Process Facility. Westar has provided an initial stormwater analysis for this area. The Cinder Pit will pump water to the Surface Impoundment until it reaches maximum capacity. The Cinder Pit pump flows at a maximum capacity of 1 cubic feet per second (cfs). This flow was modeled as a continuous flow throughout the model storm event. The Process Facility also pumps water to the Surface Impoundment until it reaches maximum capacity. This Process Facility pump flows at a maximum capacity of 0.5 cfs. This flow was modeled as a continuous flow throughout the model storm event. These base flows were manual entered into HydroCAD.

5.3 Model Findings

The HydroCAD results for the 1000-year flood event (1000-year, 24-hour storm event) were analyzed to evaluate the inflow design flood control system at Area 1. Results from the model indicate that the inflow design flood control system properly manages flow into and out of Area 1. The inflow design flood control system properly manages water from the inflow design flood event without overtopping the perimeter berm structures.

5.3.1 Inflow Design Flood Control System Analysis (§257.82(a))

The inflow design flood control system analysis was completed to demonstrate that the existing system complies with 40 CFR Part §257.82(a), which states:

> *"(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section. (2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section."*

Peak discharge rates for each subcatchment were determined using HydroCAD. A review of the peak discharge rates and flow velocities show that the Surface Impoundment has the available capacity to accept water volumes associated with the 1000-year flood event. A review of the flow velocities indicate that erosion or scour is not anticipated to occur.

The inflow design flood control system consisting of a 12-inch plastic pipe was modeled as the solitary outlet structure for Area 1 during the 1000-year flood event. A review of the model shows that during the 1000-year flood event, Area 1 drains, such that, the peak elevation during the flood event is approximately 882.56 ft. MSL. During the 1000-year flood event, the inflow design flood control system provides approximately 1.44 ft. of freeboard between the peak water elevation and the top of the perimeter berm at 884 ft. MSL.

Results from the inflow design flood control system analysis can be found in **Appendix C.**

5.4 Engineering Evaluation of Findings

5.4.1 Design Appropriateness Based on Model Findings

Based on the model findings, it has been demonstrated that the current inflow design flood control system complies with 40 CFR Part §257.82(a) of the Rule. The inflow design flood control system has been appropriately designed to manage direct precipitation and stormwater run-off associated with the 1000-year flood event.

5.4.2 Operations and Maintenance Considerations

The Surface Impoundment will continue operations as specified in the Industrial Landfill Permit No. 0322 Application.

Regular inspections of the inflow design flood control system and the perimeter berm are recommended in order to clear debris, repair erosion, and monitor and maintain vegetation.

6.0 RECORDS RETENTION AND MAINTENANCE (§257.82(d))

6.1 Incorporation of Plan into Operating Record

§257.105(g) of 40 CFR Part 257 provides record keeping requirements to ensure that the Plan must be placed in the facility's operating record. Specifically, §257.105(g) stipulates:

> §257.105(g) stipulates*: "(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information, as it becomes available, in the facility's operating record: (4) The initial and periodic inflow design flood control system plan as required by §257.82(c)."*

This Report will be placed within the Facility Operating Record upon Westar's review and approval.

6.2 Notification Requirements

§257.106(g) of 40 CFR Part 257 provides guidelines for the notification of the availability of the initial and periodic plan. Specifically, §257.106(g) stipulates:

> §257.106(g) stipulates: "*(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must notify the State Director and/or appropriate Tribal authority when information has been placed in the operating record and on the owner or operator's publicly accessible internet site. The owner or operator must: ((4) Provide notification of the availability of the initial and periodic inflow design flood control system plans specified under §257.105(g)(4)"*

The State Director and appropriate Tribal Authority will be notified upon placement of this Report in the Facility Operating Record.

§257.107(g) of 40 CFR Part 257 provides publicly accessible Internet site requirements to ensure that the Plan is accessible through the Westar Energy webpage. Specifically, §257.107(g) stipulates:

> §257.107(g) stipulates: *"(g) Operating criteria. The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site: (4) The initial and periodic inflow design flood control system plans specified under §257.105(g)(4)."*

This Plan will be uploaded to Westar Energy's CCR compliance reporting website upon Westar's review and approval.

6.3 Plan Amendments (§257.82(c)(3))

This Plan has been completed in accordance with §257.82(c)(3) to provide an initial analysis of the inflow design flood control system. This Plan will continue to undergo review as Area 1 continues operation. Westar Energy is required to prepare inflow design flood control system plans every five (5) years, as required by §257.82(c)(4) of the Rule. The amended Plan will be reviewed and recertified by a registered professional engineer and will be placed in TEC's facility operating record as required per §257.105(g)(4). The amended Plan will supersede and replace any prior versions. Availability of the amended Plan will be noticed to the State Director per §257.106(g)(4) and posted to the publicly accessible internet site per §257.107(g)(4).

A record of Plan reviews/assessments is provided on the first page of this document, immediately following the Table of Contents.

7.0 PROFESSIONAL ENGINEER CERTIFICATION (§257.82(c)(5))

The undersigned registered professional engineer is familiar with the requirements of the CCR Rule and has visited and examined the Tecumseh Energy Center or has supervised examination of the Tecumseh Energy Center by appropriately qualified personnel. The undersigned registered professional engineer attests that this Inflow Design Flood Control Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and meets the requirements of §257.82, and that this Plan is adequate for the TEC facility. This certification was prepared as required by §257.82(c)(5)

Name of Professional Engineer: Richard Southorn

Company: CB&I

Signature: [signature]

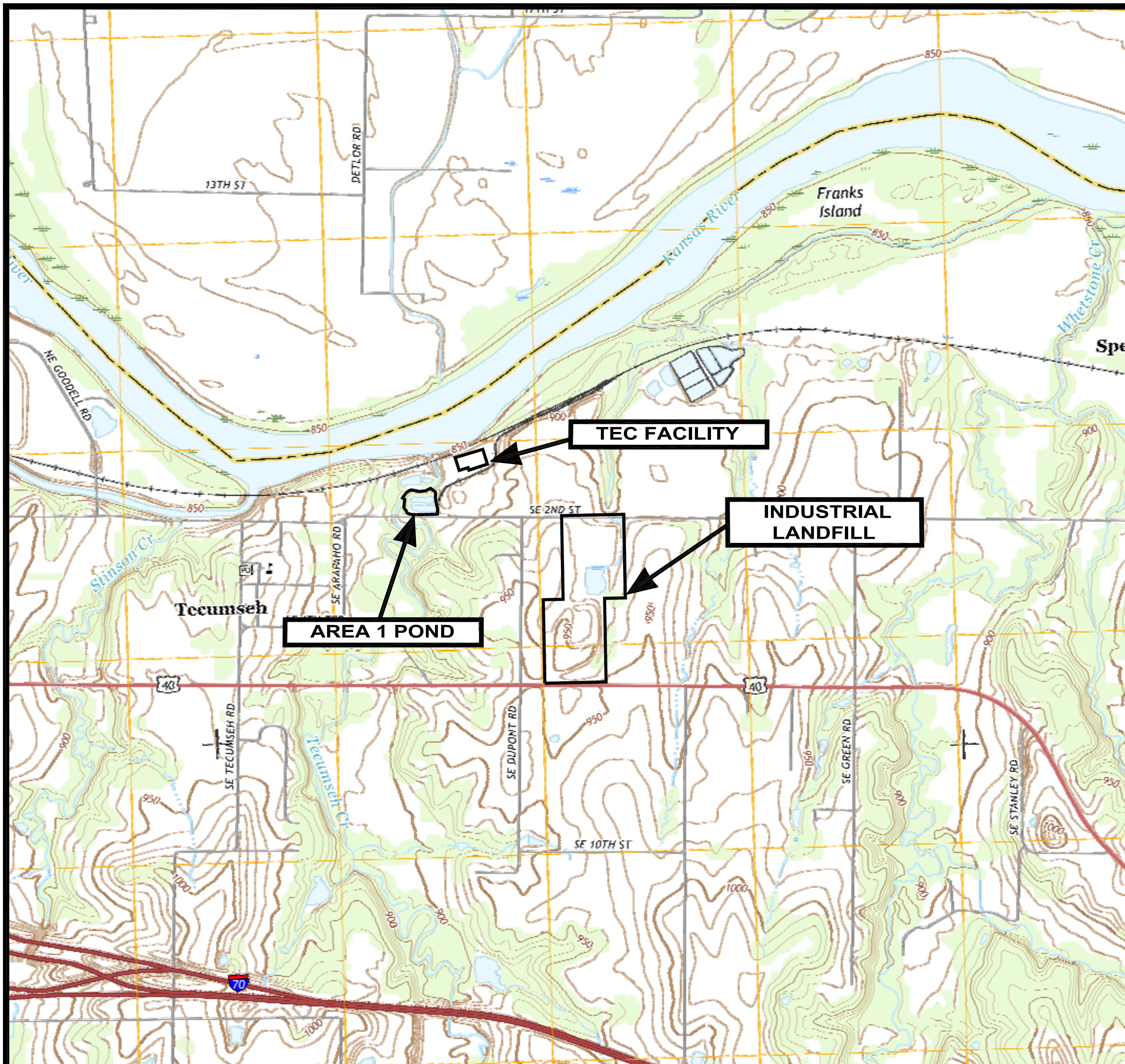
Date: 10/4/16

PE Registration State: Kansas

PE Registration Number: PE25201

Professional Engineer Seal: RICHARD DAVID SOUTHORN LICENSED 25201 KANSAS PROFESSIONAL ENGINEER

FIGURES



LEGEND

APPROXIMATE CCR UNIT BOUNDARY

N

0 2500'

GRAPHIC SCALE

NOTES

1. AERIAL TOPO OBTAINED FROM USGS 7.5-MINUTE SERIES, GRANTVILLE QUADRANGLE, KANSAS, 2014.

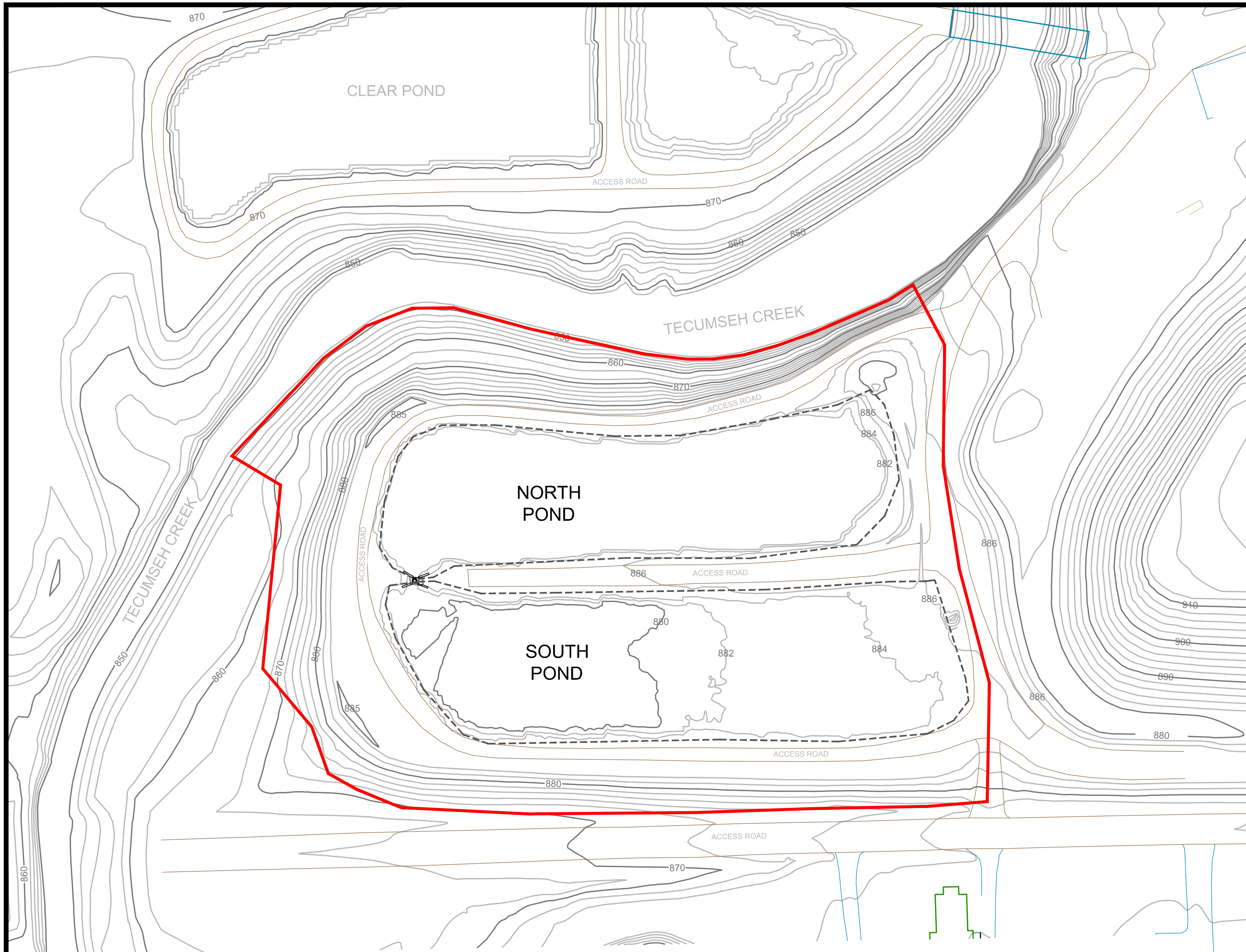
2. ALL BOUNDARIES ARE APPROXIMATE

CB&I Environmental & Infrastructure, Inc.

TECUMSEH ENERGY CENTER
5636 SE 2nd ST., TECUMSEH, KS

FIGURE 1
AREA 1 SURFACE IMPOUNDMENT
SITE LOCATION PLAN

APPROVED BY: MMS	PROJ. NO.: 631214397	DATE: OCTOBER 2016



0 80'
GRAPHIC SCALE

LEGEND

APPROXIMATE CCR UNIT BOUNDARY (AREA 1)

APPROXIMATE POND BOUNDARY

NOTES

1. EXISTING CONTOURS DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CCR BOUNDARY IS APPROX. 4.0 ACRES.

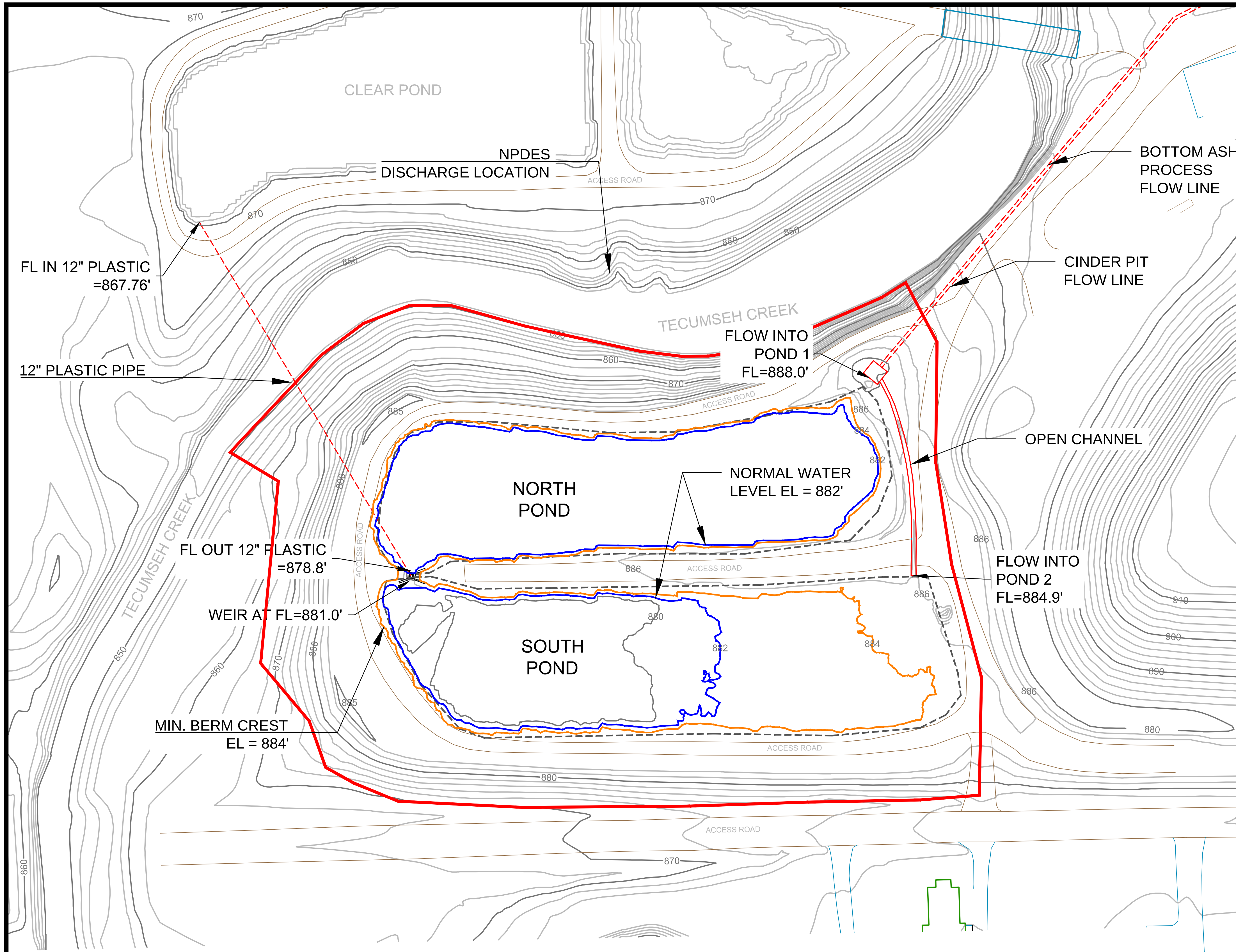
REV. NO.	DATE	DESCRIPTION

CB&I Environmental & Infrastructure, Inc.

TECUMSEH ENERGY CENTER
5636 SE 2nd ST., TECUMSEH, KANSAS

FIGURE 2
AREA 1 SURFACE IMPOUNDMENT
EXISTING SITE TOPOGRAPHY

DRAWN BY: SJL | APPROVED BY: MMS | PROJ. NO.: 631214397 | DATE: OCTOBER 2016



N

0 80'

GRAPHIC SCALE

LEGEND

- APPROXIMATE CCR UNIT BOUNDARY
- APPROXIMATEPOND BOUNDARY
- MINIMUM CREST OF PERIMETER BERM
- NORMAL WATER LEVEL
- STORMWATER CONVEYANCE FEATURES

NOTES

1. EXISTING CONTOURS DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CCR BOUNDARY IS APPROX. 4.0 ACRES.

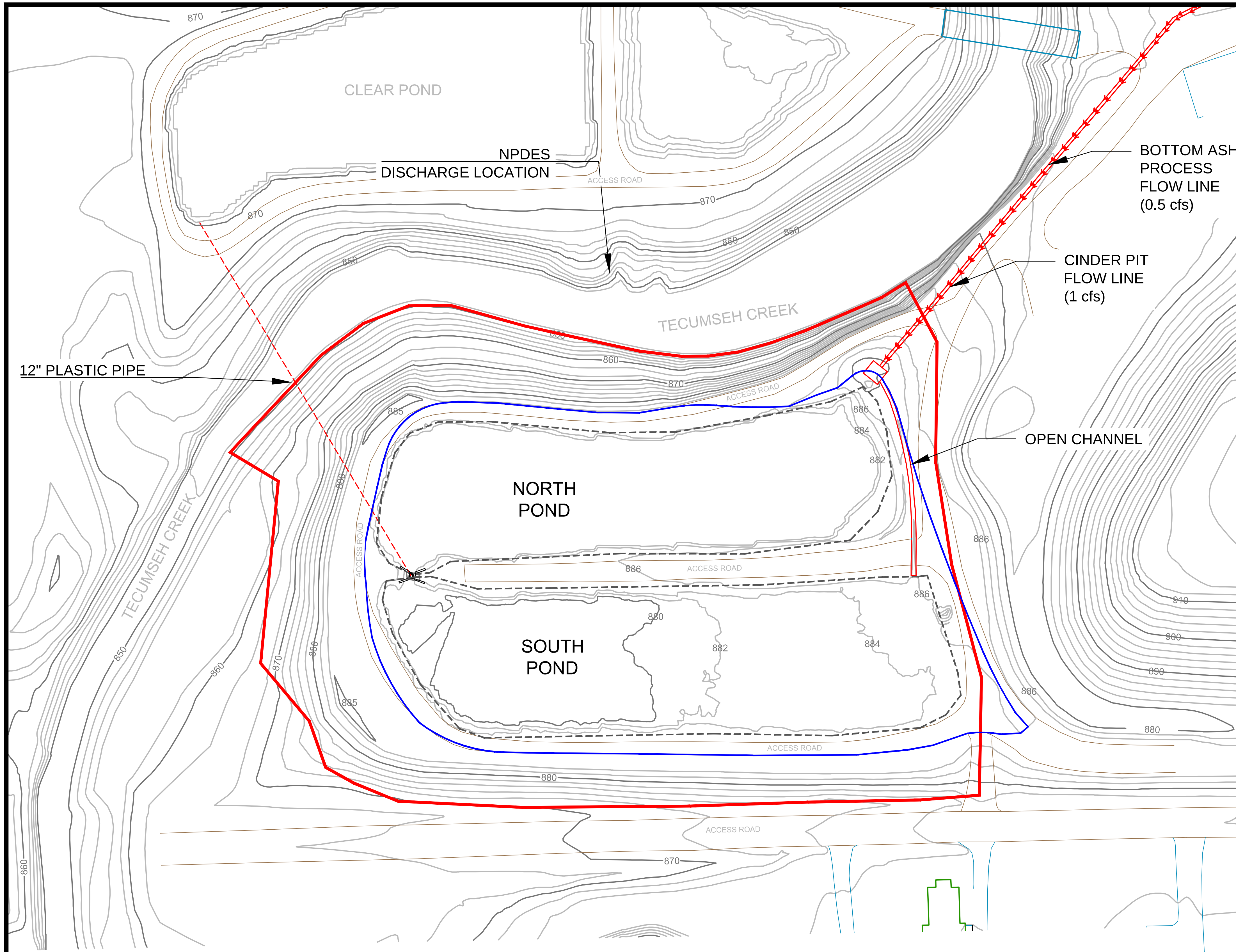
REV. NO.	DATE	DESCRIPTION

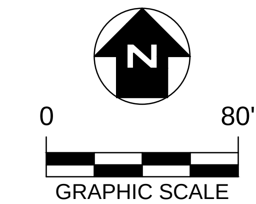
CB&I Environmental & Infrastructure, Inc.

TECUMSEH ENERGY CENTER
5636 SE 2nd ST., TECUMSEH, KANSAS

FIGURE 3
AREA 1 SURFACE IMPOUNDMENT
INFLOW DESIGN FLOOD CONTROL SYSTEM

DRAWN BY: SJL	APPROVED BY: MMS	PROJ. NO.: 631214397	DATE: OCTOBER 2016





LEGEND

(red line)	CCR UNIT BOUNDARY (AREA 1)
(dashed line)	POND BOUNDARY
(blue outlined area)	SUBCATCHMENT AREA
(red arrows)	FLOW INTO SURFACE IMPOUNDMENT

NOTES

1. EXISTING CONTOURS DEVELOPED BY PROFESSIONAL ENGINEERING CONSULTANTS IN JUNE 2016.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CCR BOUNDARY IS APPROX. 4.0 ACRES.

REV. NO.	DATE	DESCRIPTION

CB&I Environmental & Infrastructure, Inc.

TECUMSEH ENERGY CENTER
5636 SE 2nd ST., TECUMSEH, KANSAS

FIGURE 4
AREA 1 SURFACE IMPOUNDMENT SUBCATCHMENT AREAS

DRAWN BY:	APPROVED BY:	PROJ. NO.:	DATE:
SJL	MMS	631214397	OCTOBER 2016

APPENDICES

APPENDIX A

Rainfall Totals at Bottom Ash Surface Impoundment (NOAA-NWS)

NOAA Atlas 14, Volume 8, Version 2
Location name: Tecumseh, Kansas, US*
Latitude: 39.0522°, Longitude: -95.5715°
Elevation: 873 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.402 (0.340-0.477)	0.476 (0.402-0.565)	0.597 (0.503-0.712)	0.699 (0.585-0.836)	0.840 (0.674-1.04)	0.949 (0.742-1.19)	1.06 (0.795-1.36)	1.17 (0.838-1.55)	1.32 (0.903-1.79)	1.44 (0.953-1.98)
10-min	0.588 (0.498-0.699)	0.696 (0.589-0.828)	0.874 (0.737-1.04)	1.02 (0.856-1.23)	1.23 (0.987-1.52)	1.39 (1.09-1.74)	1.55 (1.17-1.99)	1.72 (1.23-2.26)	1.93 (1.32-2.63)	2.10 (1.40-2.90)
15-min	0.717 (0.607-0.852)	0.849 (0.718-1.01)	1.07 (0.898-1.27)	1.25 (1.04-1.49)	1.50 (1.20-1.85)	1.69 (1.32-2.12)	1.89 (1.42-2.43)	2.09 (1.50-2.76)	2.36 (1.61-3.20)	2.56 (1.70-3.54)
30-min	1.03 (0.870-1.22)	1.22 (1.03-1.45)	1.54 (1.29-1.83)	1.80 (1.51-2.15)	2.17 (1.74-2.68)	2.45 (1.92-3.07)	2.73 (2.05-3.51)	3.03 (2.16-3.99)	3.41 (2.33-4.63)	3.71 (2.46-5.12)
60-min	1.34 (1.14-1.59)	1.60 (1.36-1.91)	2.04 (1.71-2.42)	2.39 (2.00-2.86)	2.89 (2.31-3.56)	3.27 (2.55-4.09)	3.65 (2.74-4.68)	4.04 (2.89-5.33)	4.55 (3.11-6.18)	4.94 (3.28-6.82)
2-hr	1.66 (1.41-1.96)	1.99 (1.69-2.35)	2.53 (2.15-3.00)	2.98 (2.51-3.55)	3.60 (2.91-4.42)	4.08 (3.21-5.08)	4.56 (3.44-5.82)	5.05 (3.63-6.62)	5.69 (3.92-7.67)	6.18 (4.13-8.47)
3-hr	1.85 (1.58-2.18)	2.23 (1.90-2.62)	2.85 (2.42-3.35)	3.36 (2.83-3.97)	4.06 (3.29-4.96)	4.61 (3.63-5.71)	5.15 (3.90-6.54)	5.71 (4.12-7.45)	6.44 (4.45-8.65)	7.00 (4.70-9.56)
6-hr	2.20 (1.89-2.56)	2.64 (2.27-3.08)	3.37 (2.88-3.94)	3.98 (3.38-4.67)	4.82 (3.93-5.86)	5.49 (4.36-6.76)	6.15 (4.70-7.77)	6.83 (4.97-8.87)	7.75 (5.39-10.3)	8.44 (5.71-11.5)
12-hr	2.57 (2.22-2.97)	3.05 (2.63-3.54)	3.86 (3.32-4.49)	4.55 (3.89-5.31)	5.53 (4.54-6.68)	6.30 (5.04-7.72)	7.09 (5.45-8.91)	7.91 (5.80-10.2)	9.02 (6.33-12.0)	9.89 (6.73-13.3)
24-hr	2.98 (2.59-3.43)	3.49 (3.02-4.01)	4.34 (3.75-5.01)	5.08 (4.37-5.89)	6.15 (5.09-7.40)	7.00 (5.65-8.54)	7.89 (6.12-9.87)	8.82 (6.52-11.3)	10.1 (7.14-13.4)	11.1 (7.61-14.9)
2-day	3.46 (3.02-3.94)	3.98 (3.47-4.54)	4.86 (4.23-5.57)	5.63 (4.86-6.48)	6.74 (5.63-8.06)	7.64 (6.20-9.26)	8.58 (6.70-10.7)	9.57 (7.12-12.2)	10.9 (7.78-14.4)	12.0 (8.28-16.0)
3-day	3.77 (3.31-4.29)	4.32 (3.78-4.91)	5.25 (4.58-5.99)	6.06 (5.25-6.94)	7.21 (6.03-8.57)	8.14 (6.63-9.80)	9.10 (7.13-11.2)	10.1 (7.55-12.8)	11.5 (8.21-15.0)	12.6 (8.71-16.7)
4-day	4.05 (3.56-4.58)	4.62 (4.06-5.24)	5.60 (4.89-6.36)	6.43 (5.59-7.34)	7.63 (6.39-9.03)	8.58 (7.00-10.3)	9.56 (7.51-11.8)	10.6 (7.93-13.4)	12.0 (8.60-15.6)	13.1 (9.10-17.3)
7-day	4.80 (4.24-5.40)	5.44 (4.79-6.13)	6.51 (5.72-7.36)	7.43 (6.49-8.43)	8.74 (7.36-10.3)	9.78 (8.02-11.7)	10.8 (8.56-13.3)	12.0 (9.00-15.1)	13.5 (9.71-17.5)	14.7 (10.3-19.3)
10-day	5.45 (4.83-6.11)	6.16 (5.45-6.92)	7.36 (6.49-8.28)	8.38 (7.34-9.47)	9.82 (8.30-11.5)	11.0 (9.02-13.0)	12.1 (9.61-14.8)	13.4 (10.1-16.7)	15.0 (10.8-19.3)	16.3 (11.4-21.3)
20-day	7.22 (6.44-8.04)	8.23 (7.32-9.17)	9.87 (8.75-11.0)	11.2 (9.90-12.6)	13.1 (11.1-15.2)	14.6 (12.1-17.1)	16.1 (12.8-19.4)	17.5 (13.3-21.8)	19.5 (14.2-24.9)	21.0 (14.9-27.3)
30-day	8.76 (7.83-9.70)	9.98 (8.91-11.1)	12.0 (10.6-13.3)	13.6 (12.0-15.2)	15.7 (13.4-18.1)	17.4 (14.4-20.3)	19.0 (15.2-22.8)	20.6 (15.7-25.4)	22.7 (16.5-28.8)	24.2 (17.2-31.4)
45-day	10.8 (9.68-11.9)	12.3 (11.0-13.5)	14.6 (13.0-16.1)	16.4 (14.5-18.2)	18.8 (16.0-21.4)	20.6 (17.1-23.8)	22.2 (17.8-26.4)	23.9 (18.2-29.2)	25.9 (18.9-32.6)	27.3 (19.5-35.2)
60-day	12.6 (11.3-13.9)	14.2 (12.8-15.7)	16.7 (15.0-18.5)	18.7 (16.6-20.7)	21.2 (18.0-24.0)	23.0 (19.1-26.5)	24.6 (19.7-29.1)	26.1 (20.0-31.8)	28.0 (20.5-35.1)	29.2 (20.9-37.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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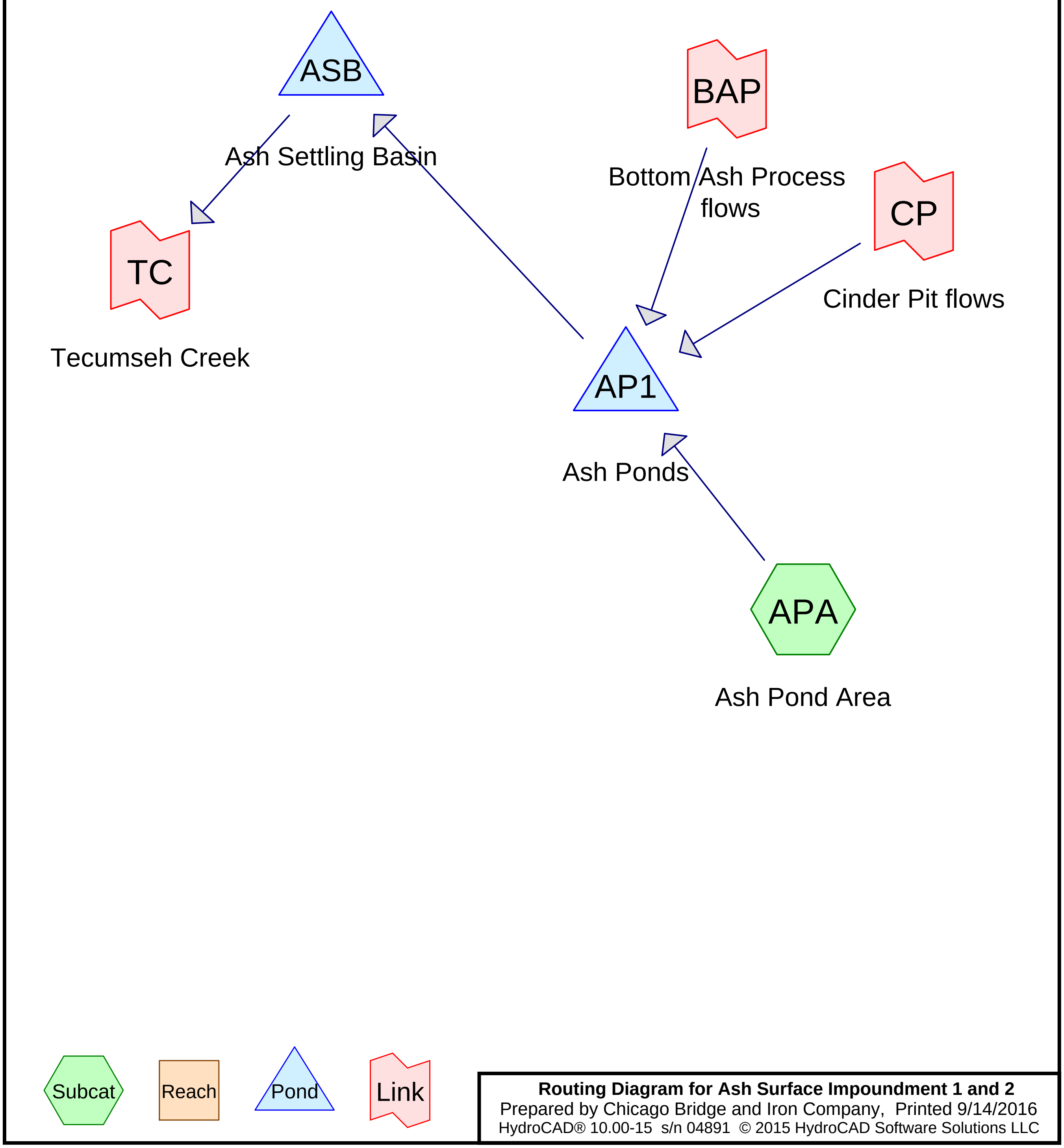
APPENDIX B

Area 1 Surface Impoundment Hazard Potential Classification Assessment

"Initial Hazard Potential Classification Assessment: Area 1 Pond CCR Surface Impoundment" is available on Westar's public CCR website - https://www.westarenergy.com/content/about-us/rates-regulations/ccr-rule/tec

APPENDIX C

Inflow Design Flood Control System HydroCAD Output Files



Routing Diagram for Ash Surface Impoundment 1 and 2
Prepared by Chicago Bridge and Iron Company, Printed 9/14/2016
HydroCAD® 10.00-15 s/n 04891 © 2015 HydroCAD Software Solutions LLC

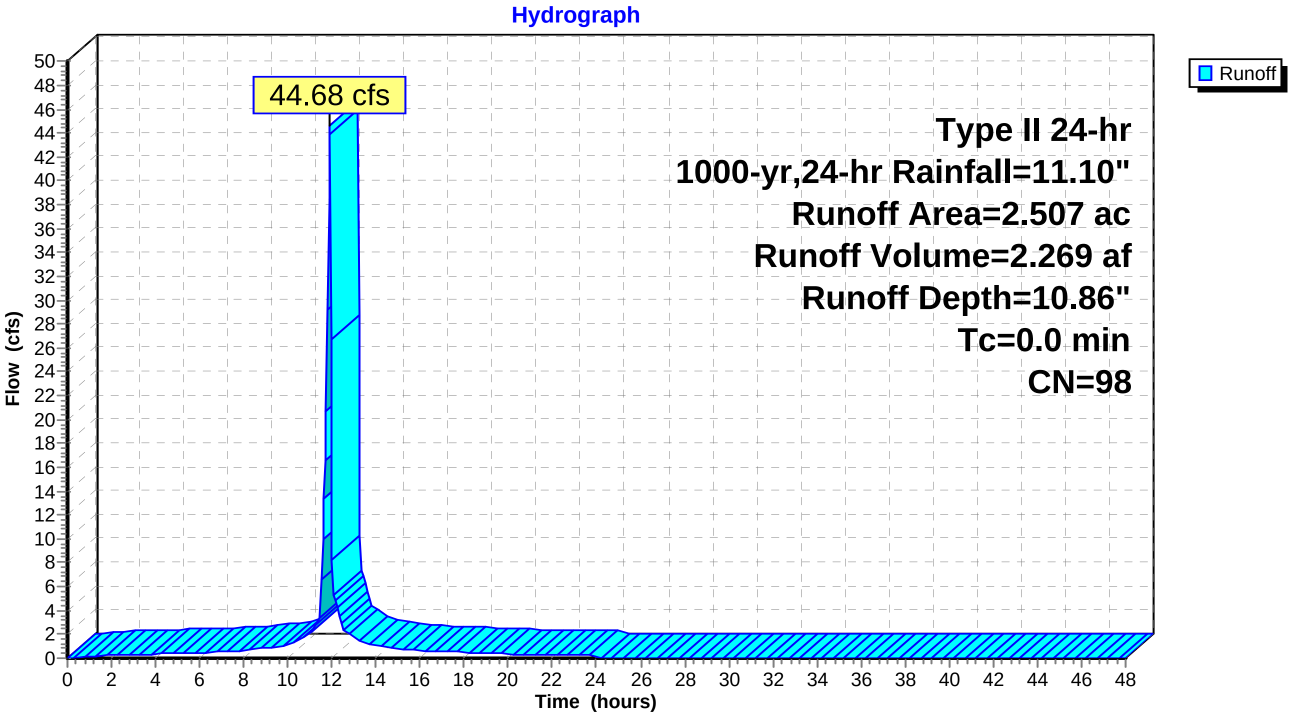
Summary for Subcatchment APA: Ash Pond Area

Runoff = 44.68 cfs @ 11.89 hrs, Volume= 2.269 af, Depth=10.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000-yr,24-hr Rainfall=11.10"

Area (ac)	CN	Description
2.507	98	Water Surface, 0% imp, HSG A
2.507		100.00% Pervious Area

Subcatchment APA: Ash Pond Area



Summary for Pond AP1: Ash Ponds

Inflow Area = 2.507 ac, 0.00% Impervious, Inflow Depth > 39.37" for 1000-yr,24-hr event
Inflow = 46.18 cfs @ 11.89 hrs, Volume= 8.225 af
Outflow = 6.88 cfs @ 12.07 hrs, Volume= 8.220 af, Atten= 85%, Lag= 10.9 min
Primary = 6.88 cfs @ 12.07 hrs, Volume= 8.220 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 882.56' @ 12.07 hrs Surf.Area= 64,391 sf Storage= 30,113 cf

Plug-Flow detention time= 11.0 min calculated for 8.218 af (100% of inflow)
Center-of-Mass det. time= 9.3 min (1,252.9 - 1,243.5)

Volume	Invert	Avail.Storage	Storage Description
#1	882.00'	89,690 cf	**Pond 1 (Prismatic)** Listed below (Recalc)
#2	882.00'	31,864 cf	**Pond 2 (Prismatic)** Listed below (Recalc)
		121,554 cf	Total Available Storage

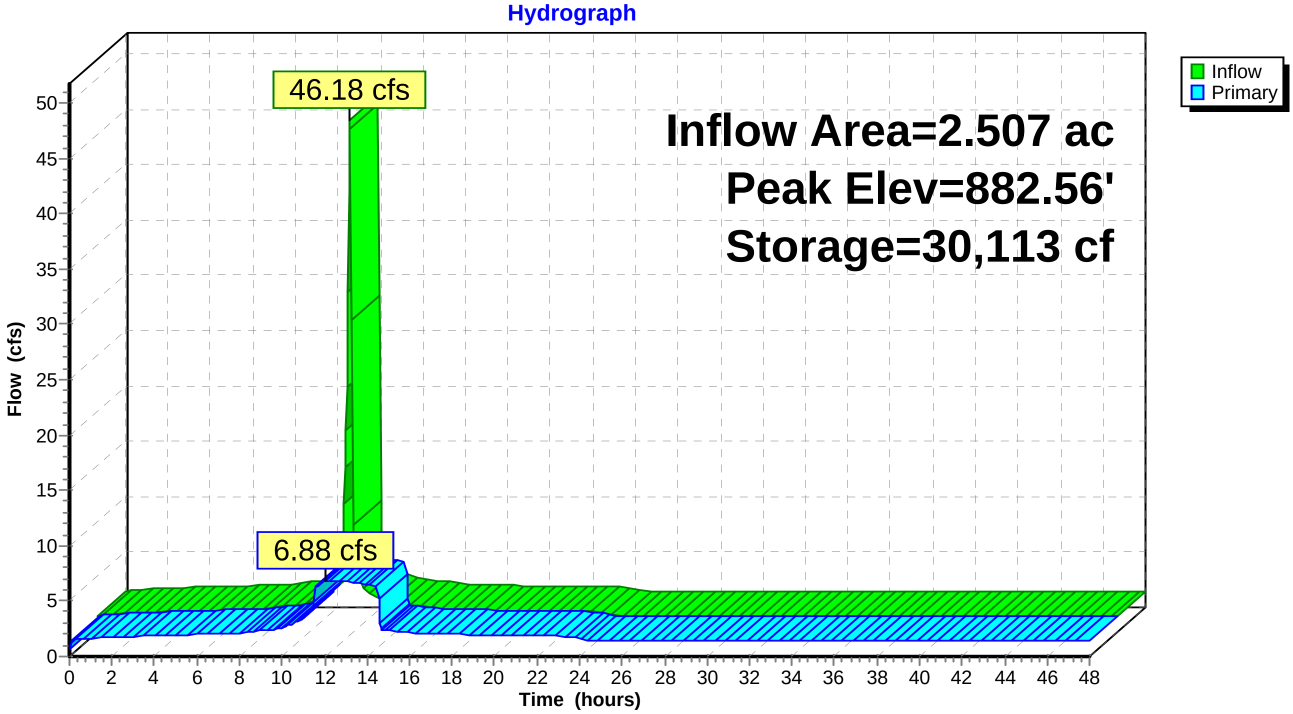
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
882.00	24,481	0	0
883.00	36,416	30,449	30,449
884.00	82,067	59,242	89,690

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
882.00	19,384	0	0
883.00	44,344	31,864	31,864

Device	Routing	Invert	Outlet Devices
#1	Primary	878.75'	**12.0" Round 12" Plastic** L= 305.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 878.75' / 867.76' S= 0.0360 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#2	Primary	878.75'	**16.0" Round 16" CMP X 0.00** L= 305.5' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 878.75' / 867.76' S= 0.0360 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf

Primary OutFlow Max=6.88 cfs @ 12.07 hrs HW=882.56' (Free Discharge)
↑—**1=12" Plastic** (Inlet Controls 6.88 cfs @ 8.75 fps)
└—**2=16" CMP** (Controls 0.00 cfs)

Pond AP1: Ash Ponds



Summary for Pond ASB: Ash Settling Basin

Inflow Area = 2.507 ac, 0.00% Impervious, Inflow Depth > 39.35" for 1000-yr,24-hr event
Inflow = 6.88 cfs @ 12.07 hrs, Volume= 8.220 af
Outflow = 2.57 cfs @ 14.66 hrs, Volume= 4.773 af, Atten= 63%, Lag= 155.6 min
Primary = 2.57 cfs @ 14.66 hrs, Volume= 4.773 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 869.62' @ 14.66 hrs Surf.Area= 40,606 sf Storage= 156,373 cf

Plug-Flow detention time= 1,097.6 min calculated for 4.767 af (58% of inflow)
Center-of-Mass det. time= 522.0 min (1,774.9 - 1,252.9)

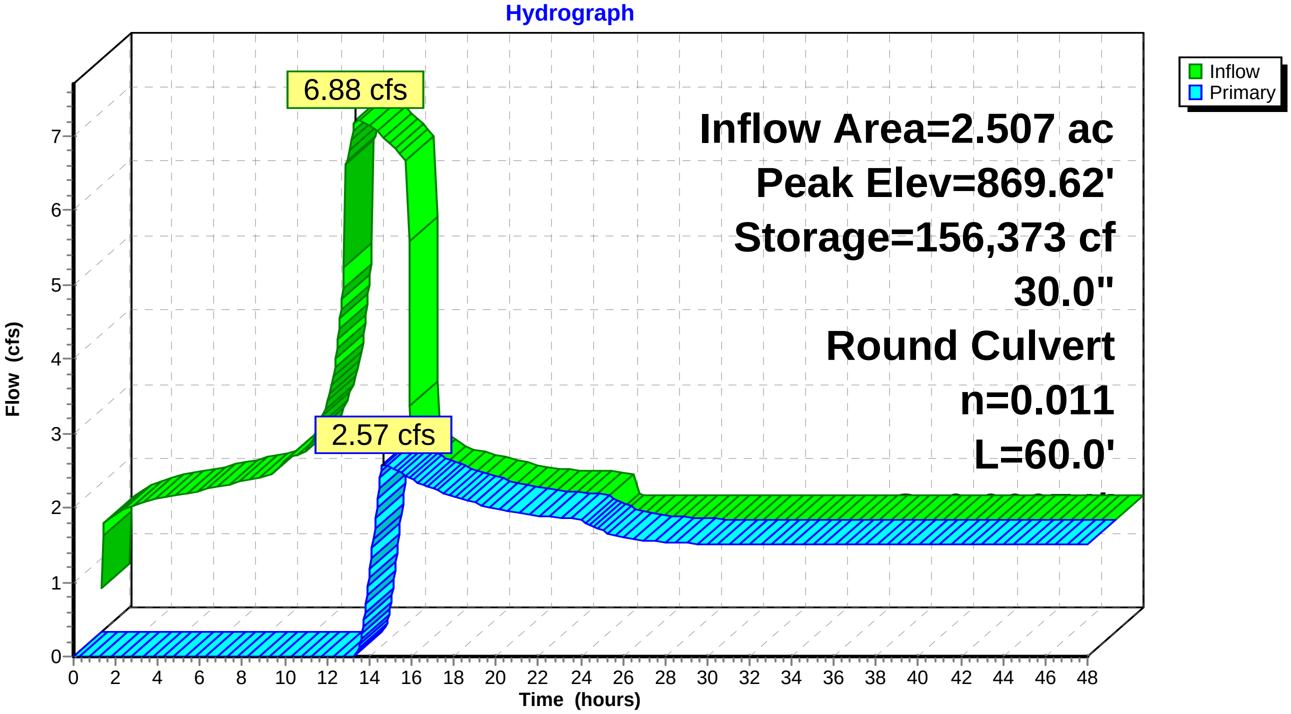
Volume	Invert	Avail.Storage	Storage Description
#1	865.00'	216,134 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
865.00	0	0	0
866.00	35,678	17,839	17,839
868.00	38,576	74,254	92,093
870.00	41,077	79,653	171,746
871.00	47,698	44,388	216,134

Device	Routing	Invert	Outlet Devices
#1	Primary	869.00'	**30.0" Round Culvert** L= 60.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 869.00' / 865.00' S= 0.0667 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 4.91 sf

Primary OutFlow Max=2.57 cfs @ 14.66 hrs HW=869.62' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.57 cfs @ 2.69 fps)

Pond ASB: Ash Settling Basin



Summary for Link BAP: Bottom Ash Process flows

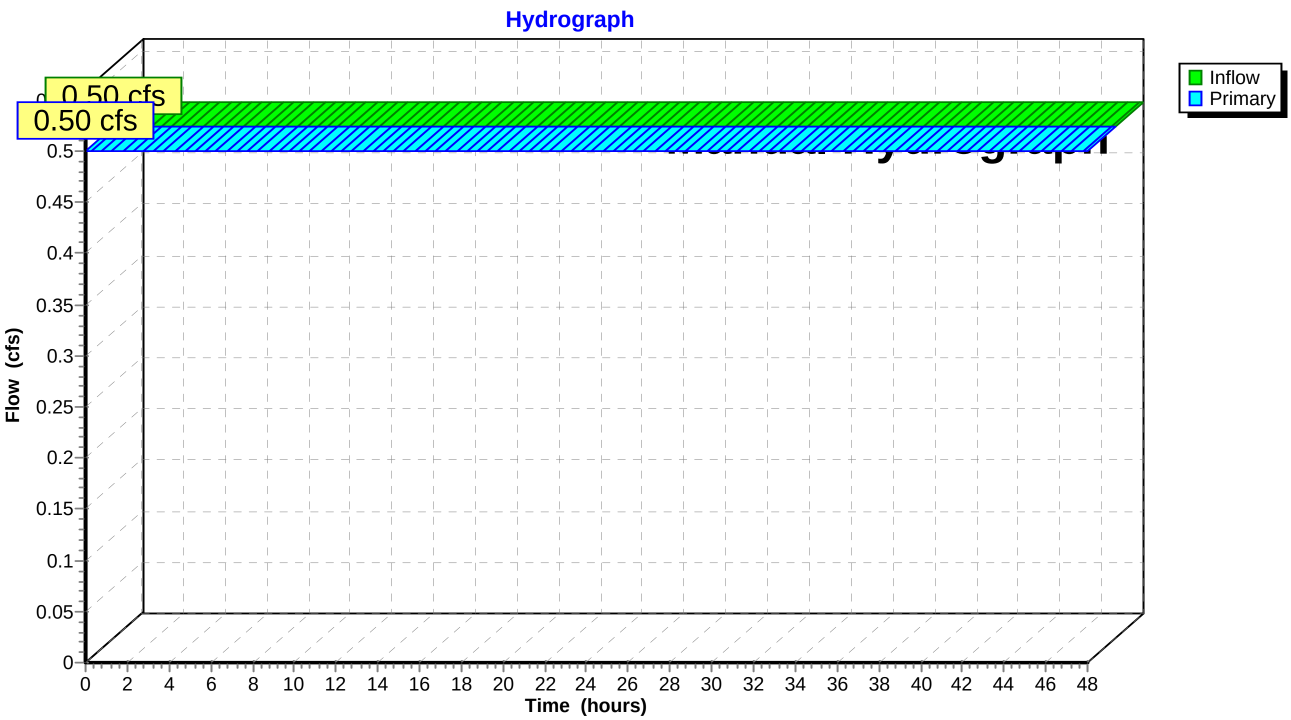
Inflow	=	0.50 cfs @	0.00 hrs, Volume=	1.986 af
Primary	=	0.50 cfs @	0.00 hrs, Volume=	1.986 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

49 Point manual hydrograph, To= 0.00 hrs, dt= 1.00 hrs, cfs =

0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	

Link BAP: Bottom Ash Process flows



Summary for Link CP: Cinder Pit flows

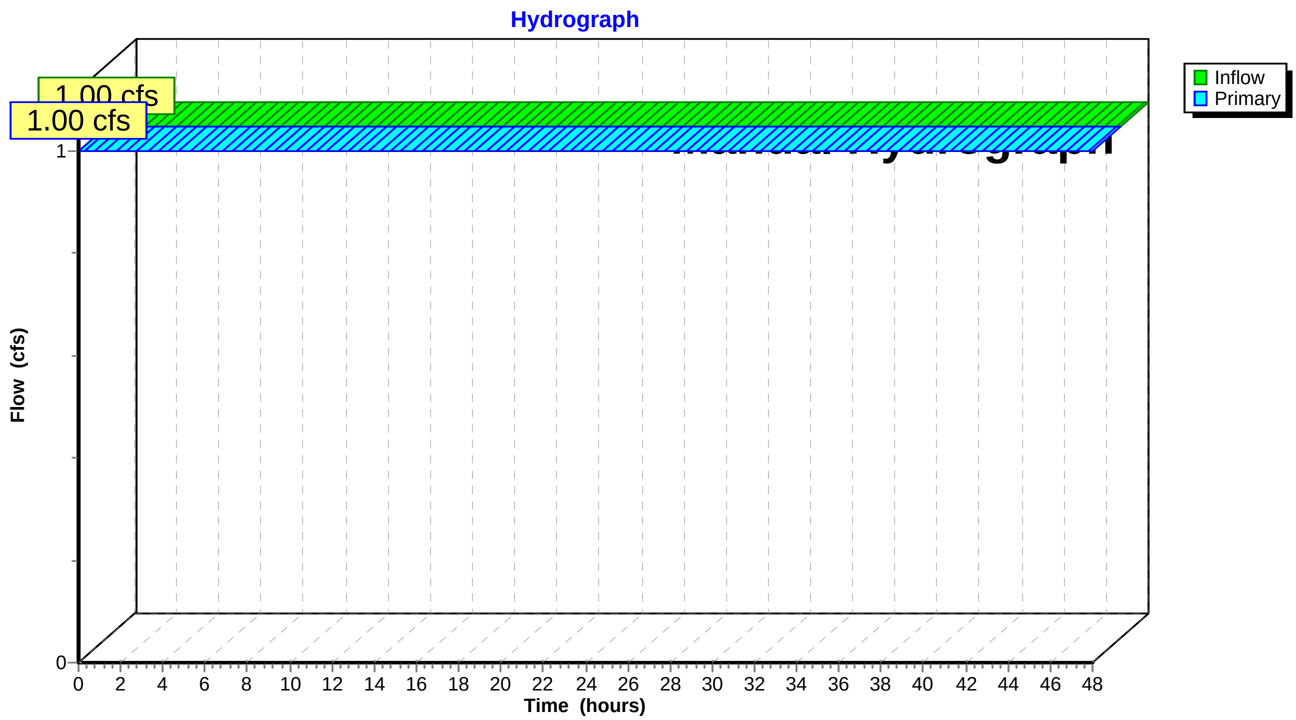
Inflow	=	1.00 cfs @	0.00 hrs, Volume=	3.971 af
Primary	=	1.00 cfs @	0.00 hrs, Volume=	3.971 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

49 Point manual hydrograph, To= 0.00 hrs, dt= 1.00 hrs, cfs =

1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

Link CP: Cinder Pit flows



Summary for Link TC: Tecumseh Creek

Inflow Area =	2.507 ac,	0.00% Impervious,	Inflow Depth > 22.85"	for 1000-yr,24-hr event	
Inflow =	2.57 cfs @	14.66 hrs,	Volume=	4.773 af	
Primary =	2.57 cfs @	14.66 hrs,	Volume=	4.773 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link TC: Tecumseh Creek