CCR RULE COMPLIANCE

NORTH ASH POND
INFLOW DESIGN FLOOD CONTROL SYSTEM
INITIAL PLAN

Prepared for:

NRG Power Midwest LP
New Castle Generating Station
West Pittsburg, Pennsylvania

Prepared by:

CB&I Environmental & Infrastructure, Inc.
Pittsburgh, Pennsylvania 15235

October 2016

Table of Contents

1.0 Introduction

On December 19, 2014, the Administrator of the United States Environmental Protection Agency signed the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities final rule (the Rule). The Rule was published in the Federal Register on April 17, 2015, became effective on October 19, 2015, and is contained within amended portions of Title 40, Part 257 of the Code of Federal Regulations (CFR). The Rule establishes a comprehensive set of requirements for the disposal/management of CCR in landfills and surface impoundments at coal-fired power plants under Subtitle D of the Resource Conservation and Recovery Act. These requirements include compliance with location restrictions, design criteria, operating criteria, groundwater monitoring and corrective action criteria, and closure and post-closure care aspects.

Included with the operating criteria under 40 CFR §257.82 are requirements to prepare an initial inflow design flood control system plan (Plan) and subsequent periodic Plans for all existing, new, or expanded CCR surface impoundments. Pursuant to the Rule, this Plan is to serve as documentation by a professional engineer that the CCR unit is designed, constructed, operated, and maintained with an inflow design flood control system that will adequately manage flow into and from the CCR unit under the peak discharge conditions of the design flood. The specific design flood under which each CCR unit must be evaluated is based on the hazard potential classification of the impoundment as determined pursuant to §257.73(a)(2). Further details regarding the required content and criteria for the Plan (pursuant to §257.82[c]) are provided in Section 2.0 of this document. The initial Plan must be prepared no later than October 17, 2016, and periodic Plans must be prepared every 5 years thereafter.

The New Castle Generating Station (Station) is a coal and natural gas-fired power plant operated by NRG Power Midwest LP (a subsidiary of NRG Energy, Inc. [NRG]) and located in West Pittsburg, Pennsylvania. The Station is not currently burning any coal and is fully utilizing natural gas fuel (since gas addition was completed in approximately June 2016), but retains the capability to use coal. The Station has one surface impoundment that is subject to this Rule, specifically identified as the North Ash Pond. When the pond is used for CCR handling, accumulated bottom ash is removed from the pond during periodic cleanout activities and is transported to the Station's CCR landfill (the New Castle Plant Ash Landfill) for disposal. The Station and the North Ash Pond are shown on Figure 1.

NRG engaged the services of CB&I Environmental & Infrastructure, Inc. (CB&I) to develop an initial Plan for the ash pond. This Plan development followed the review of available background and design information and a field visit conducted on May 25, 2016. Additionally, preparation of this Plan occurred in conjunction with development of a non-applicability determination by CB&I relative to the Hazard Potential Classification for this pond. The non-applicability determination is based on the categorization of the pond as incised, and is documented in a letter submitted to NRG under separate cover in October 2016.

Beyond this introductory section of the Plan, Section 2.0 outlines the regulatory requirements of §257.82, Section 3.0 describes the hydrologic and hydraulic evaluation performed for the subject impoundment, and Section 4.0 provides conclusions and recommendations regarding the adequacy of the impoundment to manage the specified flood conditions. Section 5.0 contains the professional engineer certification, and Section 6.0 lists the references that were consulted during development of this Plan.

As required, this Plan will be appropriately placed in the facility's operating record pursuant to §257.105(g)(4), noticed to the State Director per §257.106(g)(4), and posted to the publicly accessible internet site pursuant to §257.107(g)(4).

2.0 Hydrologic and Hydraulic Capacity Requirements of 40 CFR §257.82

The Rule requires owners or operators of any existing CCR surface impoundment to design, construct, operate, and maintain an inflow design flood control system (Federal Register, 2015). The ability of the system to meet these requirements must be demonstrated in the form of an inflow design flood control system Plan.

2.1 Demonstration of the Adequacy of the Inflow Design Flood Control System

Pursuant to §257.82(a)(1)-(2), the design flood control system must:

- *Adequately Manage Flow Into the CCR Unit* – 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.
- *Adequately Manage Flow From the CCR Unit* – 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.

Pursuant to §257.82(a)(3), the inflow design flood that must be managed is based on the type of impoundment (incised or non-incised) and hazard potential classification as determined in accordance with §257.73(a)(2). The impoundment types and classifications and the associated inflow design floods are as follows:

- *Incised CCR Surface Impoundment* – A 25-year design flood applies to an incised CCR surface impoundment.

- *Low Hazard Potential CCR Surface Impoundment* – A 100-year design flood applies to a (non-incised) Low Hazard CCR surface impoundment.

- *Significant Hazard Potential CCR Surface Impoundment* – A 1000-year design flood applies to a (non-incised) Significant Hazard CCR surface impoundment.

- *High Hazard Potential CCR Surface Impoundment* – The probable maximum flood applies to a (non-incised) Significant Hazard CCR surface impoundment.

Since the subject pond is incised (refer to Section 3.3), a 25-year design flood applies. Pursuant to §257.82(c), discharge from the CCR unit must be handled in accordance with the surface water requirements of §257.3-3 (i.e., the discharge must be authorized under the National Pollutant Discharge Elimination System [NPDES] program). Flow from the North Ash Pond is discharged in accordance with the Station's NPDES permit No. PA0005061 issued by the Pennsylvania Department of Environmental Protection (PADEP).

2.2 Inflow Design Flood Control System Plan

The Rule requires preparation of an initial Plan and periodic Plans to document the adequacy of the inflow design flood control system. The Plan must be supported by appropriate engineering calculations per §257.82(c)(1) and be certified by a qualified professional engineer in accordance with §257.82(c)(5).

3.0 Hydrologic and Hydraulic Evaluation

Confirmation of the adequacy of the inflow design flood control system was performed via a hydrologic and hydraulic evaluation conducted by CB&I. The overall effort consisted of four main activities, including: (1) review of background and design information, (2) a site visit, (3) determination of an incised impoundment configuration and the non-applicability of the Hazard Potential Classification (documented in a letter submitted under separate cover October 2016, but referenced herein), and (4) preparation of stormwater calculations. These activities are described in the sections below.

3.1 Review of Background and Design Information

Prior to the field visit, CB&I collected and reviewed available background and design information regarding the impoundment and surrounding area, including mapping, aerial images, and reports and other documents provided by NRG. Mapping and aerial images were utilized to prepare Figures 1 through 3 included with this Plan. Pertinent information identified during development of the figures included ground surface elevations and topography, surface water features, and pond design information (such as geometry, crest elevation, operating water level, and inflow and outflow features).

The impoundment is located on a south central portion of the Station property. It is situated in a wide, mildly sloped valley bound by the Beaver River to the west and McKee Run to the south. Immediately surrounding the entire perimeter of the pond is a gravel-surfaced access road. Beyond the perimeter access road and to the south is the South Low Volume Waste Pond and McKee Run, which is about 450 south of the impoundment. Across from McKee Run is the main Plant area. West of the pond is an undeveloped and predominantly wooded area that leads to the Beaver River. To the north of the impoundment is the New Castle Ash Plant Landfill and to the east is the former coal pile storage area and additional undeveloped Station property. To the southeast is the former Coal Pile Runoff (CPRO) Pond, which collects surface drainage from the former coal pile storage area.

Topographic information for the subject area was obtained from LIDAR mapping (PA Department of Conservation and Natural Resources, 2006). The ground surface in the vicinity of the impoundment slopes toward McKee Run. The topography to the east and west of the pond generally varies between about 780 and 784 feet mean seal level (ft msl). To the north, the topography gradually increases from about 780 ft msl along the northern pond perimeter to approximately 786 ft msl at the toe of the landfill, which is approximately 100 feet away from the pond. Within the landfill footprint, the grade steepens to an engineered outslope greater than 15 percent. Runoff from the portion of the landfill closest to the North Ash Pond is collected in a perimeter channel located along the toe of the slope and conveyed to the west.

Google Earth imagery (Google Earth, 2016) was consulted to check select elevations. Google Earth indicated a typical elevation of 778 to 780 ft msl around the crest of the North Ash Pond, which is in agreement with the LIDAR topography and the design crest elevation of 778 ft msl. As observed from the Google Earth imagery, the pond water level at the time of the aerial photograph was approximately 771 feet, which is within the range of water levels shown by LIDAR mapping (770 ft msl) and indicated by NRG as the approximate operating water level (772 ft msl).

Limited design information is available for the North Ash Pond, which was constructed in 1955. As such, pertinent information was generally obtained from operator records as relayed to CB&I from NRG and from review of the 2014 Dam Safety Assessment of CCW Impoundments Report by O'Brien & Gere (OB&G). Based on this information, the North Ash Pond has an approximate capacity of 16 acre-ft, an estimated bottom elevation of 760 ft msl, inboard slopes of approximately 2:1 (horizontal to vertical), and a crest elevation of approximately 778 ft msl (OB&G, 2014). The OB&G Report further notes a range in water levels for the pond between 768 ft msl (identified as a typical elevation) and 771 ft msl (observed at the time of a 2012 inspection). These elevations are lower than the estimated current operating water level provided to CB&I by NRG of 772 ft msl. The higher elevation is utilized in the hydrologic and hydraulic assessment conducted in conjunction with this Plan.

When the pond was previously utilized for bottom ash management, ash transport water would gravity drain to the pond via piping from hydrobins located across McKee Run. The water would enter the impoundment via piping located along the western pond perimeter. Currently, the only appreciable amount of water that is introduced to the pond is precipitation that falls directly on the pond footprint and within the pond's contributory drainage area. The total pond drainage area is shown on Figure 3, and encompasses approximately 4.62 acres, of which approximately 2 acres consist of the pond footprint.

The North Ash Pond has two outlet structures located along its eastern internal bank. The northern outlet is the primary structure and consists of a concrete box riser with a horizontal top grate, a rectangular weir, stop logs to govern pond discharge elevations, and slide gate baffles. Flow from the primary riser is routed to the secondary outlet structure via a 24-inch diameter concrete pipe. The secondary outlet structure consists of double concrete box risers with horizontal top grates and two separate rectangular weirs having stop logs and slide gate baffles. The secondary outlet weir setting is maintained at a higher elevation, and according to NRG, there is generally no outflow from this device. No survey or as-built information was available for the top of weir elevations. The top elevation for the primary weir is estimated to be equal to the normal water operating level of 772 ft msl, based on information provided by NRG. This appeared in general agreement with CB&I's field observations. The top elevation for the secondary weir is estimated to be about 775.5 ft msl, based on field approximations. A 24-inch diameter high-density polyethylene (HDPE) pipe connects the secondary outlet structure to Manhole No. 1 (MH #1) located between the CPRO Pond and the South Low Volume Waste Pond. In the past, MH #1 also received flow from the South Low Volume Waste Pond, but the primary outlet structure for that pond has been deactivated by raising the weir to an elevation that precludes discharge. From MH #1, the outflow travels to MH #2 via a 24-inch diameter HDPE pipe, and then from MH #2 to NPDES-permitted Outfall 004 (again via a 24-inch diameter HDPE pipe), where the effluent is discharged to the Beaver River.

3.2 Field Visit

On May 25, 2016, Laurel Lopez (CB&I senior engineer) met with Steve Brown (NRG Environmental Specialist) to perform a site walk and visual reconnaissance of the pond and surrounding area. The visit was conducted to support CB&I's Hazard Potential Classification non-applicability determination (provided under separate cover) and the hydrologic and hydraulic evaluation performed herein. CB&I walked the perimeter of the pond and confirmed its incised configuration. Also observed were inlet/outlet piping and structures, which appeared to be in agreement with the previously reviewed reports and documents. At the time of the visit, the water level within the pond appeared to be approximately equal to the top of the weir elevation at the primary outlet structure.

As part of the hydrologic and hydraulic evaluation, CB&I visually assessed upstream conditions for run-on potential. Run-on from the landfill is prevented by an existing stormwater channel that runs along the landfill toe. Run-on from the undeveloped area to the east of the pond is prevented by the grading of the access road between the pond and this area. In the past, some of the eastern area was hydrologically connected to the North Ash Pond by catch basins and a culvert that entered the pond on its eastern side, but this has since been abandoned. In general, the majority of run-on entering the pond originates from the access roadway and gravel areas surrounding the pond, the lower portion of the landfill access road, and from small vegetated patches of grass and weeds to the west, north, and east of the pond.

3.3 Non-applicability of Hazard Potential Classification

Based on the review of background information and field observations, CB&I determined that the North Ash Pond is an incised CCR impoundment pursuant to the definition provided in §257.53 of the Rule. Pursuant to this definition, the pond was constructed by excavating entirely below the adjacent natural ground surface, holds an accumulation of CCR entirely below the adjacent natural ground surface, and does not consist of any diked portion. This determination is detailed in a letter by CB&I provided to NRG in October 2016. Due to the categorization of the pond as an incised CCR surface impoundment, the hazard potential classification assessments as specified in §257.73(a)(2) are not required. In addition, the incised configuration of this pond results in the assignment of a 25-year design flood for the purpose of the hydrologic and hydraulic evaluation performed in accordance with §257.82.

3.4 Hydrologic Calculations

The pond is operated so as to maintain a relatively constant operating water level. When the pond was utilized for bottom ash management activities, this was accomplished by application of a pumped pond inflow rate below the capacity of the pond outfall structure with very minimal increases in water levels, such that pond outflow would equal pond inflow. Currently, the water level is maintained through stormwater inflow that is generally held (other than losses by evaporation or infiltration) until the water level exceeds the weir elevation on the primary outlet structure. For modeling and calculation purposes, the normal operating water level for the pond has been set approximately equal to the weir crest elevation of the primary outlet structure.

These calculations consider the capacity of the pond to contain stormwater from the inflow design flood. It is assumed that the pond is filled to its normal water operating level when the design flood occurs. The design flood is assumed to be equivalent to the design storm, since hydrologic analyses are based upon storm events rather than floods. If the maximum water level that results from the design storm is less than the pond crest elevation, no overtopping of the pond will occur and the flood control system is deemed adequate to manage the flow into the pond during and following the inflow design storm.

Attachment A provides a hydrologic and hydraulic analysis of the North Ash Pond and related stormwater management features using HydroCAD® Version 10.0 software. HydroCAD® was utilized to analyze the 25-year, 24-hour duration storm event. The point precipitation associated with this return frequency was determined to be 3.93 inches (NOAA, 2016), and was directly input into HydroCAD® for the development of a rainfall distribution. Runoff from the pond drainage area (referred to as a "subcatchment" in HydroCAD®) was calculated using the Soil Conservation Service (SCS) TR-20 Method, which is integrated within the HydroCAD® model. This method utilizes a Curve Number (CN) and time of concentration (Tc) for the drainage area to determine the runoff over time for a particular rainfall event.

The CN is based on ground surface conditions and is an indication of the fraction of precipitation that translates into surface water runoff. Three types of ground cover conditions were identified in the subject drainage area: gravel roadways; water surface; and a combination of brush, weeds and grass. CN's for these surface conditions were obtained using tabulated values in HydroCAD®, with consideration to the Hydrologic Soil Group (HSG) at this project location. According to National Resource Conservation Service mapping (NRCS, 2015), soil in the subject area is predominantly Holly Silt Loam, which is assigned an HSG of B/D. This dual group is associated with soils having a moderate infiltration rate (Group B) when thoroughly wetted and drained, and a very slow infiltration rate (Group D) when thoroughly wetted and undrained. Subsequently, CN's for HSG C, which falls between HSG's B and D, were selected for the analyses. The cover types, CN's, and applicable areas are shown in tabular form on Figure 3. The resulting composite CN (weighted based on relative area) for the pond drainage area is 91.

Tc is defined as the time for a drop of water to travel from the most hydrologically remote point in the subcatchment to the point of collection. The Tc calculation finds the travel time based on the travel distances, surface conditions, and types of flow (sheet/overland flow, shallow concentrated flow, and channel or pipe flow). The path utilized for the subject drainage area is shown on Figure 3. The flow path was modeled as two segments of shallow concentrated flow. The Tc for the drainage area was determined to be 2.6 minutes.

Using the CN and Tc values for the drainage area, stormwater inflow to the pond was computed. The amount of inflow that is stored or discharged by a pond depends on the outlet structure configuration and storage capacity of the pond. Design information for the North Ash Pond was obtained from a combination of LIDAR topography, field observations, and information contained in the OB&G Report. The pond storage was developed using the LDAR topographic contours. For the current study, available storage was assumed to begin at the typical water surface elevation of 772 ft msl and extend to the pond crest elevation of 778 ft msl.

Using HydroCAD®, the maximum water level elevation, resulting freeboard, and maximum discharge rate for the North Ash Pond for the 25-year design storm were computed. These values are summarized in the table below.

North Ash Pond Stormwater Analysis Results For a 25-year Storm Recurrence Frequency		
North Ash Pond (Crest Elev. ~ 778 ft msl)	Max. Water Elevation (ft msl)	772.4
	Freeboard (feet)	5.6
	Max. Discharge Rate (cfs)	2.54

These results indicate that the North Ash Pond has ample capacity to manage the design storm. The storm inflow will raise the normal water operating level only 0.4 feet (from 772 to 772.4 ft msl), leaving 5.6 feet of available freeboard.

3.5 Pond Outflow Considerations

Following the design storm event, the pond water level would gradually return to its normal operating water level via the regular discharge process (gravity flow to the Beaver River). The maximum discharge predicted for this storm event is only 2.54 cfs, which is readily managed by the downstream piping. This is evidenced by equivalent flow entering and exiting MH #1 and MH #2 located along the discharge pipe. There would be no discharge from the pond other than via NPDES-permitted Outfall 004. The discharge would not result in any adverse downstream impacts. As a result, the inflow design flood control system adequately manages flow from the CCR unit that results from the inflow design storm.

4.0 Conclusions and Recommendations

Based upon observations, review of information, and the hydrologic and hydraulic analyses described herein (and associated HydroCAD® calculations contained in Attachment A), the subject pond has a flood control system that is adequate to manage flow into and from the unit under the applicable inflow design flood. All outflow from the pond will be via an approved NPDES outfall.

These conclusions are based upon the background information provided to CB&I by NRG and field observations made around the time of the Plan preparation. The applicability of these results is dependent upon the ongoing operation and maintenance of the pond in accordance with design documents and appropriate operating procedures. Any deviations from the crest elevation or operating conditions presented in this Plan would warrant a re-evaluation of the pond to ensure adequate available capacity for stormwater inflow. Such a re-evaluation would fall under the provisions of §257.82(c)(2), which stipulate that the Plan must be amended whenever significant changes in CCR unit configuration/operation affect the validity of the Plan that is currently in effect. Once completed, the amended Plan must be appropriately placed into the facility's operating record. As a matter of routine maintenance/inspection, any areas of settlement, depressions, ruts, or similar features along the crest shall be regraded and filled as needed. In addition, the integrity of the grading and diversion channels around the pond should be periodically inspected to ensure their continued functionality.

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5.0 Professional Engineer Certification

I attest to being familiar with the hydrologic and hydraulic capacity requirements of 40 CFR §257.82. I have personally visited and examined the New Castle Generating Station North Ash Pond, and have reviewed available design and operational information for the pond as provided by NRG. Based my observations, review of information, and analyses, the subject pond has a flood control system that is adequate to manage flow into and from the unit under the applicable inflow design flood. Further, this document serves as the Inflow Design Flood Control System Initial Plan and meets the applicable requirements of §257.82(c). I hereby certify that the information contained in this Plan is true and accurate to the best of my belief.

Name of Professional Engineer: Laurel C. Lopez

Company: CB&I Environmental & Infrastructure, Inc.

Signature: Laurel C. Lopez

Date: 10-13-16

PE Registration State: Pennsylvania

PE Registration Number: PE-055673-E

Professional Engineer Seal:

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
LAUREL C. LOPEZ
ENGINEER
PE-055673-E

Laurel C. Lopez
10-13-16

6.0 References

CB&I. “Hazard Potential Classification Non-Applicability Determination” Letter. October 2016.

Federal Register, Vol. 80, No. 74. Section 257.82 (Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments). April 17, 2015.

Google Earth. Imagery for New Castle, Pennsylvania. Dated April 15, 2016.

HydroCAD® Software Solutions, LLC. HydroCAD® Version 10.

National Resource Conservation Service (NRCS). Web Soil Survey for Lawrence County, PA. Version 2. November 16, 2015.

NOAA. “Point Precipitation Frequency (PF) Estimates, New Castle, PA.” NOAA Atlas 14, Vol. 2, Version 3. Accessed July 26, 2016.

O’Brien & Gere Engineers, Inc. “Dam Safety Assessment of CCW Impoundments—New Castle Generating Station.” Prepared for the United States Environmental Protection Agency. January 17, 2014.

Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. LIDAR Mapping. PA Map Program. 2006.

Figures

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
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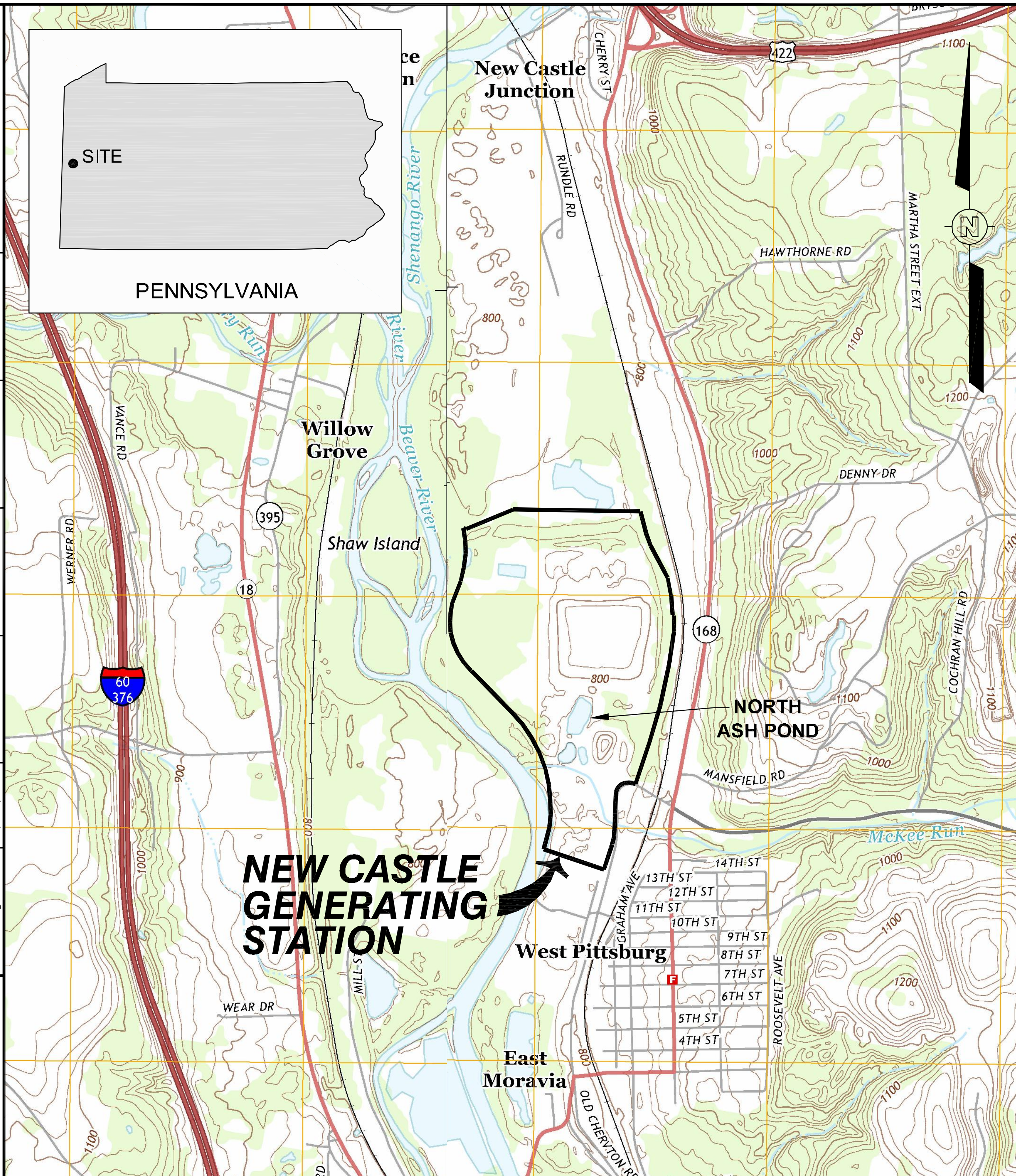

SCALE

0 2000 4000 FEET

CB&I
500 Penn Center Boulevard, Suite 1000
Pittsburgh, Pennsylvania

nrg.

FIGURE 1

SITE LOCATION MAP

NEW CASTLE GENERATING STATION
WEST PITTSBURG, PENNSYLVANIA

REFERENCE:

U.S.G.S. 7.5–MINUTE TOPOGRAPHIC MAP BESSEMER AND NEW CASTLE SOUTH, PENNSYLVANIA QUADRANGLES, DATED 2013.

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Plotted By: Evan.Schlegel

OFFICE Pittsburgh, PA

DRAWING NUMBER 1009194003-B1

LEGEND:

APPROXIMATE STATION BOUNDARY

EXISTING DRAINAGE CHANNEL OR SWALE

SCALE

0 400 800 FEET

REFERENCES:

1. GOOGLE AERIAL PHOTOGRAPH, DATED 4/15/2016.

REV	DESCRIPTION / ISSUE	DATE	APPROVED

CB&I
500 Penn Center Boulevard, Suite 1000
Pittsburgh, Pennsylvania 15235

nrg

DESIGNED BY: LCL

DRAWN BY: ELS

CHECKED BY: DJS

APPROVED BY: LCL

FIGURE 2
PHOTOGRAPHIC MAP
NEW CASTLE GENERATING STATION
WEST PITTSBURG, LAWRENCE COUNTY, PENNSYLVANIA

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10/10/16	AS SHOWN	1009194003-B1	--

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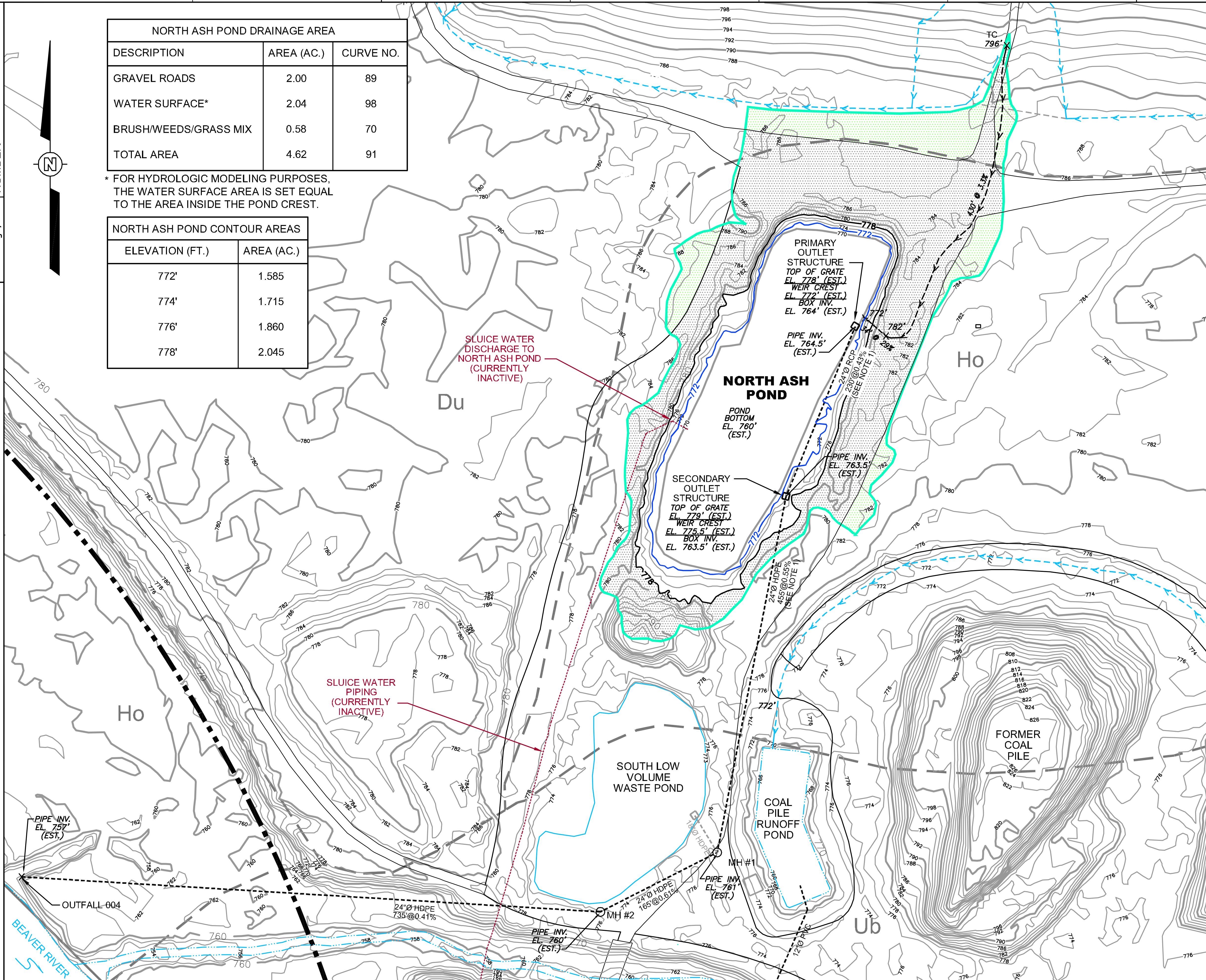
Plotted By: Evan.Schlegel

NORTH ASH POND DRAINAGE AREA		
DESCRIPTION	AREA (AC.)	CURVE NO.
GRAVEL ROADS	2.00	89
WATER SURFACE*	2.04	98
BRUSH/WEEDS/GRASS MIX	0.58	70
TOTAL AREA	4.62	91

* FOR HYDROLOGIC MODELING PURPOSES, THE WATER SURFACE AREA IS SET EQUAL TO THE AREA INSIDE THE POND CREST.

NORTH ASH POND CONTOUR AREAS	
ELEVATION (FT.)	AREA (AC.)
772'	1.585
774'	1.715
776'	1.860
778'	2.045



LEGEND:

- APPROXIMATE STATION BOUNDARY
- 800 — 10-FOOT SURFACE CONTOUR
- 788 — 2-FOOT SURFACE CONTOUR
- APPROXIMATE POND SURFACE DRAINAGE AREA LIMITS
- EXISTING DRAINAGE CHANNEL OR SWALE
- 778 — APPROXIMATE POND CREST ELEVATION
- 772 — APPROXIMATE POND NORMAL WATER OPERATING LEVEL ELEVATION
- GRAVEL ROADWAY
- BRUSH / WEEDS / GRASS
- TC — FLOW PATH USED FOR TIME OF CONCENTRATION CALCULATION
- STORMWATER PIPE (FROM REFERENCE 2)
- Ho — NRCS SOIL TYPE (SEE TABLE 1 BELOW)

TABLE 1 - NRCS SOIL TYPES AND DESCRIPTIONS

Soil Series	Type of Soils	Depth of Soils (in.)	Slope of Soils (%)	Limitations of Soils	Hydric
Ho	Holly Silt Loam	0-80 inches	0 - 3	1.) Depth to restrictive feature: More than 80 inches 2.) Capacity of most limiting layer to transmit water: Moderately High to High (0.2 to 2.0 in/hr)	Yes
Du	Dumps	NA	NA	NA	No
Ub	Urban Land - Arents Complex	NA	NA	1.) Depth to restrictive feature: More than 80 inches	No

* FROM REFERENCE 3

NOTE:

1. PIPE SIZES WERE ADJUSTED FROM THOSE INDICATED IN REFERENCED REPORTS BASED ON FIELD OBSERVATIONS DURING JULY 2014 AND MAY 2016 SITE VISITS.

REFERENCES:

1. TOPOGRAPHIC MAPPING WAS OBTAINED FROM PAMAP PROGRAM LIDAR MAPPING, DATED 2006.

2. SITE FEATURES WERE OBTAINED FROM O'BRIEN AND GERE ENGINEERS, INC. DRAWING ENTITLED "SITE AERIAL PHOTOGRAPH AND PHOTOGRAPH LOCATION MAP", DATED JANUARY 2014, AND A "HYDROLOGY AND HYDRAULIC STUDY" OF THE COAL PILE RUNOFF POND BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. OF PITTSBURGH, PA AND REVISED JUNE 10, 2011. INFORMATION NOT AVAILABLE IN THESE DOCUMENTS AND REQUIRED FOR THE PURPOSE OF STORMWATER MODELING WAS ESTIMATED.

3. SOILS MAP INFORMATION IS FROM NATIONAL RESOURCE CONSERVATION SERVICE, WEB SOIL SURVEY, LAWRENCE COUNTY, PA, VERSION 2, NOVEMBER 16, 2015.

SCALE 0 60 120 180 FEET

REV	DESCRIPTION / ISSUE	DATE	APPROVED

CB&I
500 Penn Center Boulevard, Suite 1000
Pittsburgh, Pennsylvania 15235

DESIGNED BY: LCL
DRAWN BY: ELS
CHECKED BY: DJS
APPROVED BY: LCL

nrg

FIGURE 3
HYDROLOGIC MAP
NEW CASTLE GENERATING STATION
WEST PITTSBURG, LAWRENCE COUNTY, PENNSYLVANIA

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10/10/16	AS SHOWN	1009194003–B2	--

OFFICE Pittsburgh, PA
DRAWING NUMBER 1009194003-B2

VERIFY SCALE 0 1"

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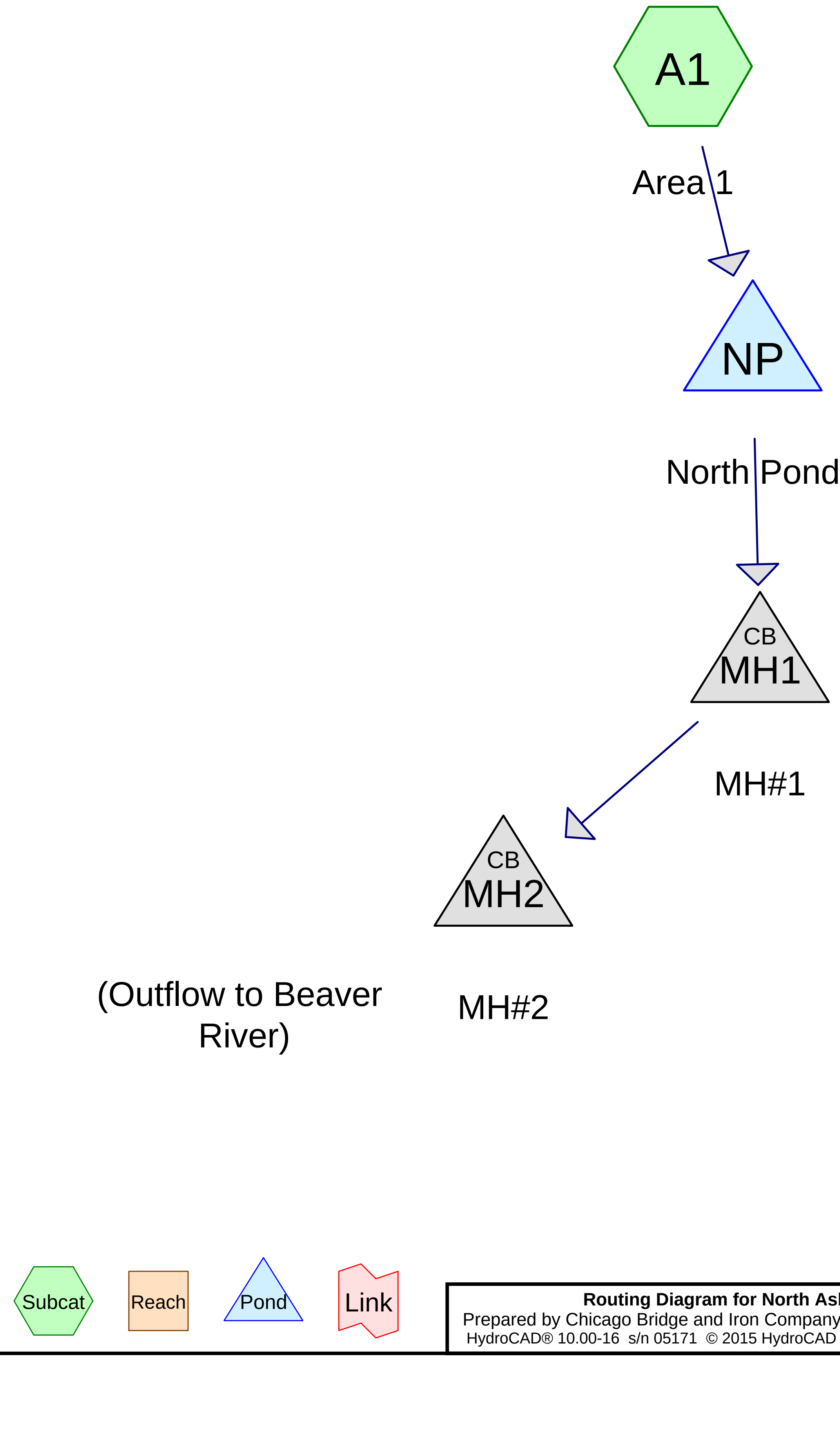
Attachment A

Hydrologic Calculations



Routing Diagram for North Ash Pond
Prepared by Chicago Bridge and Iron Company, Printed 10/12/2016

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
25,265	70	Brush, Fair, HSG C (A1)
87,120	89	Gravel roads, HSG C (A1)
88,862	98	Water Surface, HSG C (A1)
201,247	**91**	**TOTAL AREA**

Summary for Subcatchment A1: Area 1

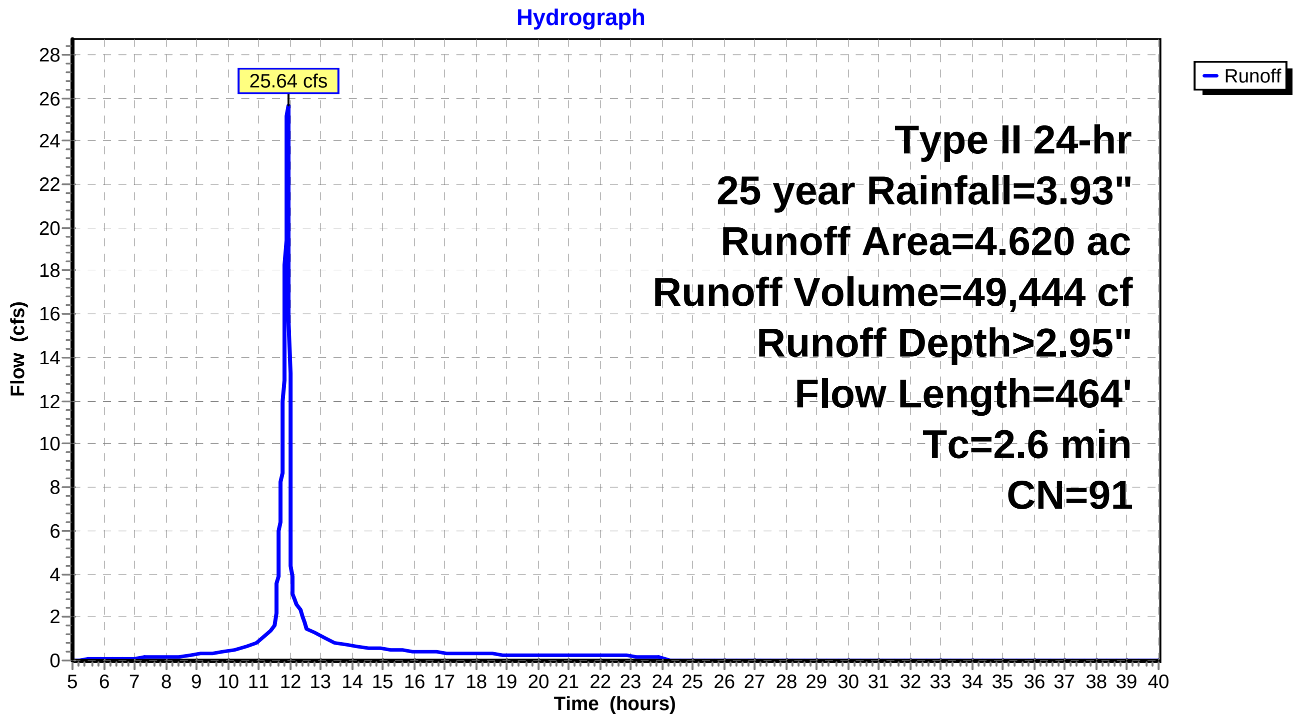
Runoff = 25.64 cfs @ 11.93 hrs, Volume= 49,444 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-40.00 hrs, dt= 0.01 hrs
Type II 24-hr 25 year Rainfall=3.93"

Area (ac)	CN	Description
2.000	89	Gravel roads, HSG C
2.040	98	Water Surface, HSG C
0.580	70	Brush, Fair, HSG C
4.620	91	Weighted Average
2.580		55.84% Pervious Area
2.040		44.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	430	0.0330	2.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.1	34	0.2900	8.67		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.6	464	Total			

Subcatchment A1: Area 1



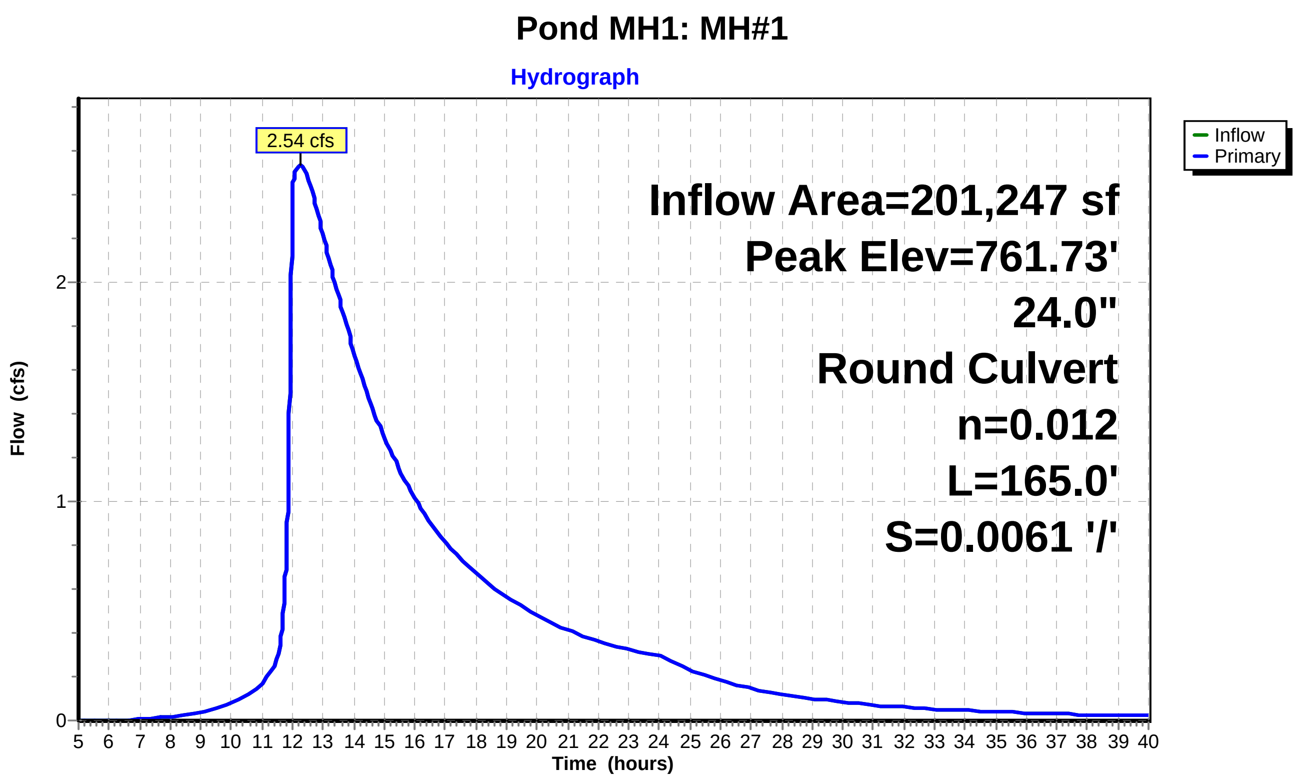
Summary for Pond MH1: MH#1

Inflow Area =	201,247 sf,	44.16% Impervious,	Inflow Depth > 2.89"	for 25 year event
Inflow =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf	
Outflow =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf, Atten= 0%, Lag= 0.0 min	
Primary =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf	

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 761.73' @ 12.26 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	761.00'	**24.0" Round Culvert** L= 165.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 761.00' / 760.00' S= 0.0061 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.54 cfs @ 12.26 hrs HW=761.73' TW=760.73' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.54 cfs @ 3.67 fps)



Summary for Pond MH2: MH#2

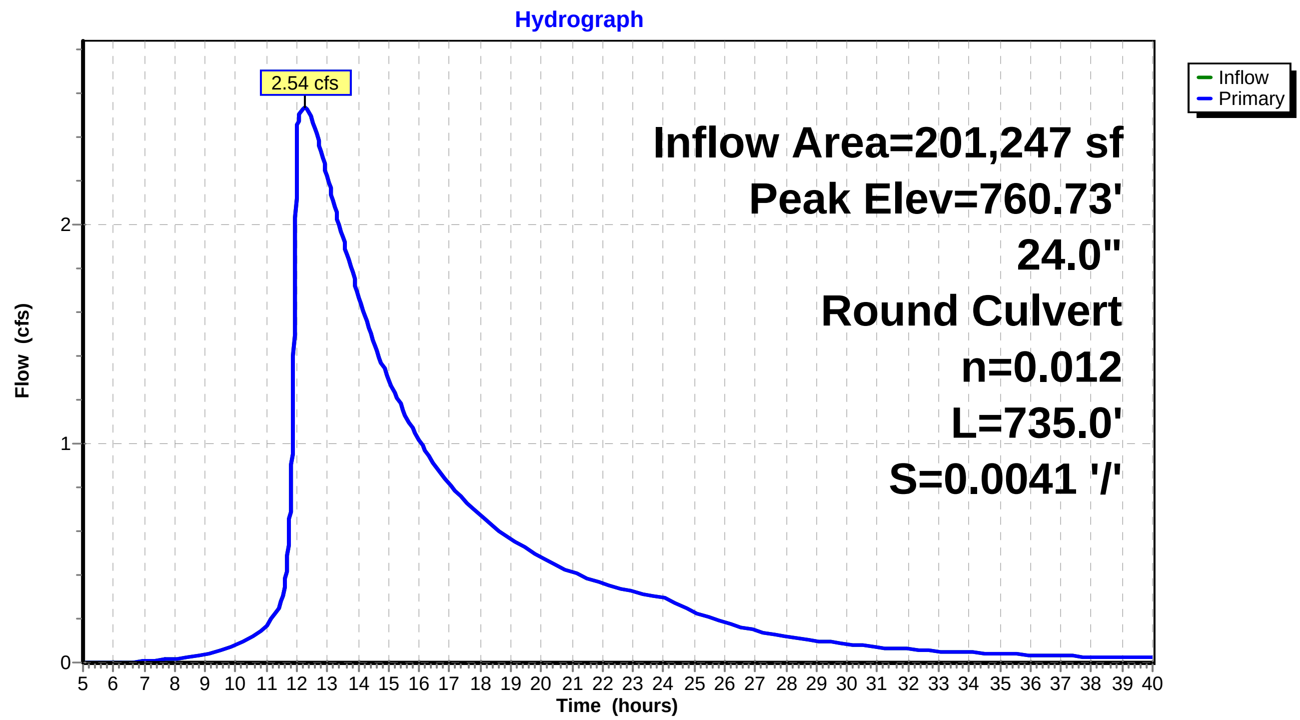
Inflow Area =	201,247 sf,	44.16% Impervious,	Inflow Depth > 2.89"	for 25 year event
Inflow =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf	
Outflow =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf, Atten= 0%, Lag= 0.0 min	
Primary =	2.54 cfs @	12.26 hrs, Volume=	48,398 cf	

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 760.73' @ 12.26 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	760.00'	**24.0" Round Culvert** L= 735.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 760.00' / 757.00' S= 0.0041 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=2.54 cfs @ 12.26 hrs HW=760.73' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 2.54 cfs @ 3.61 fps)

Pond MH2: MH#2



Summary for Pond NP: North Pond

Inflow Area = 201,247 sf, 44.16% Impervious, Inflow Depth > 2.95" for 25 year event
Inflow = 25.64 cfs @ 11.93 hrs, Volume= 49,444 cf
Outflow = 2.54 cfs @ 12.26 hrs, Volume= 48,398 cf, Atten= 90%, Lag= 19.9 min
Primary = 2.54 cfs @ 12.26 hrs, Volume= 48,398 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.01 hrs
Peak Elev= 772.37' @ 12.26 hrs Surf.Area= 1.609 ac Storage= 0.594 af

Plug-Flow detention time= 235.2 min calculated for 48,398 cf (98% of inflow)
Center-of-Mass det. time= 222.0 min (1,011.1 - 789.1)

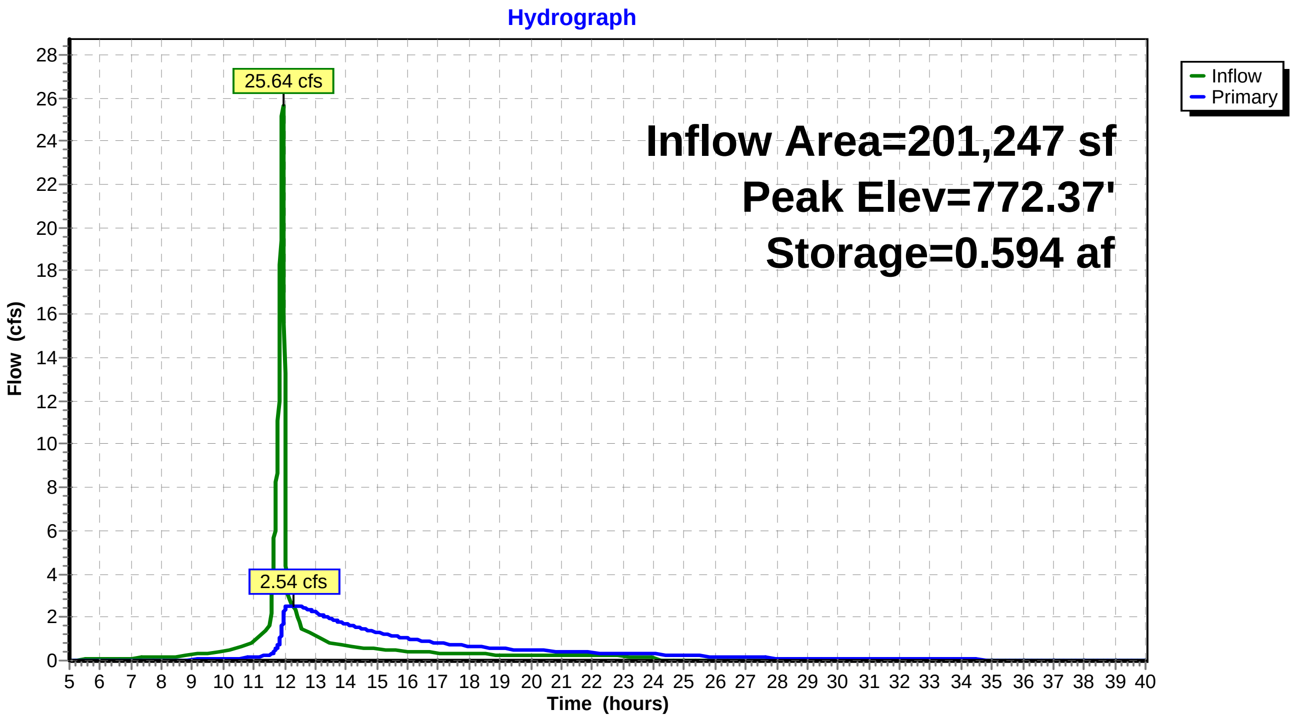
Volume	Invert	Avail.Storage	Storage Description
#1	772.00'	10.780 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
772.00	1.585	0.000	0.000
774.00	1.715	3.300	3.300
776.00	1.860	3.575	6.875
778.00	2.045	3.905	10.780

Device	Routing	Invert	Outlet Devices
#1	Primary	763.50'	**24.0" Round Culvert** L= 455.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 763.50' / 761.00' S= 0.0055 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	775.50'	**8.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	764.50'	**24.0" Round Culvert** L= 230.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 764.50' / 763.50' S= 0.0043 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#4	Device 3	772.00'	**3.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.54 cfs @ 12.26 hrs HW=772.37' TW=761.73' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.54 cfs of 30.67 cfs potential flow)
  ├─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Culvert** (Passes 2.54 cfs of 33.28 cfs potential flow)
    └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 2.54 cfs @ 1.99 fps)

Pond NP: North Pond



Attachment A-1

NOAA Point Precipitation Frequency (PF) Estimates

NOAA Atlas 14, Volume 2, Version 3
Location name: New Castle, Pennsylvania, US*
Latitude: 40.9418°, Longitude: -80.3681°
Elevation: 770 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

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	0.317 (0.286–0.352)	0.378 (0.342–0.420)	0.457 (0.412–0.507)	0.519 (0.466–0.574)	0.597 (0.535–0.659)	0.656 (0.586–0.724)	0.714 (0.635–0.786)	0.772 (0.685–0.850)	0.851 (0.750–0.936)	0.909 (0.798–0.999)
10-min	0.492 (0.445–0.546)	0.591 (0.533–0.656)	0.711 (0.641–0.788)	0.801 (0.719–0.886)	0.913 (0.818–1.01)	0.995 (0.888–1.10)	1.07 (0.956–1.18)	1.15 (1.02–1.27)	1.25 (1.10–1.38)	1.32 (1.16–1.45)
15-min	0.604 (0.545–0.670)	0.722 (0.652–0.802)	0.872 (0.787–0.967)	0.985 (0.885–1.09)	1.13 (1.01–1.25)	1.23 (1.10–1.36)	1.33 (1.19–1.47)	1.43 (1.27–1.58)	1.56 (1.38–1.72)	1.66 (1.45–1.82)
30-min	0.799 (0.722–0.886)	0.967 (0.873–1.07)	1.20 (1.08–1.33)	1.37 (1.23–1.51)	1.59 (1.43–1.76)	1.76 (1.57–1.94)	1.93 (1.72–2.12)	2.09 (1.86–2.30)	2.31 (2.04–2.54)	2.48 (2.18–2.72)
60-min	0.975 (0.881–1.08)	1.19 (1.07–1.32)	1.50 (1.35–1.66)	1.74 (1.56–1.93)	2.07 (1.85–2.28)	2.32 (2.07–2.56)	2.58 (2.29–2.84)	2.84 (2.52–3.12)	3.20 (2.82–3.52)	3.48 (3.06–3.83)
2-hr	1.12 (1.01–1.23)	1.36 (1.23–1.50)	1.71 (1.55–1.89)	1.99 (1.79–2.18)	2.37 (2.12–2.59)	2.66 (2.38–2.91)	2.97 (2.64–3.24)	3.29 (2.91–3.58)	3.72 (3.27–4.04)	4.05 (3.54–4.39)
3-hr	1.18 (1.08–1.31)	1.43 (1.30–1.58)	1.80 (1.64–1.99)	2.09 (1.90–2.30)	2.50 (2.26–2.74)	2.82 (2.54–3.09)	3.16 (2.83–3.44)	3.50 (3.12–3.81)	3.98 (3.52–4.33)	4.36 (3.82–4.73)
6-hr	1.41 (1.29–1.55)	1.70 (1.56–1.87)	2.12 (1.94–2.32)	2.46 (2.24–2.69)	2.94 (2.67–3.20)	3.33 (3.01–3.61)	3.73 (3.35–4.04)	4.16 (3.72–4.48)	4.75 (4.21–5.11)	5.23 (4.60–5.61)
12-hr	1.66 (1.52–1.83)	1.99 (1.82–2.19)	2.46 (2.25–2.70)	2.84 (2.59–3.11)	3.39 (3.08–3.70)	3.84 (3.47–4.18)	4.32 (3.88–4.67)	4.82 (4.30–5.20)	5.53 (4.88–5.95)	6.10 (5.34–6.55)
24-hr	1.98 (1.85–2.13)	2.37 (2.21–2.54)	2.89 (2.70–3.10)	3.32 (3.10–3.56)	3.93 (3.66–4.19)	4.42 (4.10–4.71)	4.94 (4.56–5.25)	5.48 (5.04–5.81)	6.23 (5.69–6.60)	6.83 (6.20–7.23)
2-day	2.30 (2.16–2.46)	2.75 (2.58–2.93)	3.33 (3.12–3.55)	3.80 (3.56–4.05)	4.45 (4.15–4.73)	4.97 (4.63–5.28)	5.51 (5.11–5.85)	6.07 (5.60–6.43)	6.83 (6.27–7.24)	7.43 (6.78–7.87)
3-day	2.47 (2.33–2.63)	2.94 (2.77–3.13)	3.53 (3.33–3.76)	4.02 (3.78–4.28)	4.69 (4.39–4.97)	5.22 (4.88–5.54)	5.77 (5.37–6.11)	6.33 (5.87–6.70)	7.10 (6.54–7.51)	7.70 (7.06–8.15)
4-day	2.64 (2.49–2.80)	3.13 (2.95–3.33)	3.74 (3.53–3.98)	4.24 (4.00–4.51)	4.93 (4.63–5.22)	5.47 (5.13–5.80)	6.03 (5.63–6.38)	6.60 (6.14–6.98)	7.36 (6.82–7.79)	7.97 (7.34–8.42)
7-day	3.15 (2.98–3.33)	3.72 (3.52–3.94)	4.40 (4.16–4.65)	4.95 (4.67–5.23)	5.68 (5.36–6.00)	6.26 (5.89–6.60)	6.84 (6.42–7.21)	7.43 (6.95–7.83)	8.20 (7.63–8.65)	8.80 (8.15–9.28)
10-day	3.63 (3.45–3.83)	4.29 (4.07–4.52)	5.03 (4.77–5.30)	5.61 (5.32–5.91)	6.39 (6.04–6.73)	7.00 (6.61–7.37)	7.61 (7.16–8.00)	8.21 (7.70–8.64)	8.99 (8.40–9.46)	9.58 (8.92–10.1)
20-day	5.08 (4.83–5.35)	5.97 (5.67–6.29)	6.91 (6.56–7.27)	7.63 (7.25–8.03)	8.60 (8.15–9.03)	9.33 (8.83–9.80)	10.0 (9.48–10.5)	10.7 (10.1–11.3)	11.6 (10.9–12.2)	12.3 (11.5–12.9)
30-day	6.38 (6.06–6.71)	7.47 (7.09–7.86)	8.56 (8.13–9.00)	9.41 (8.93–9.89)	10.5 (9.97–11.1)	11.4 (10.8–11.9)	12.2 (11.5–12.8)	13.0 (12.2–13.6)	14.0 (13.1–14.7)	14.7 (13.7–15.4)
45-day	8.15 (7.78–8.55)	9.51 (9.07–9.97)	10.8 (10.3–11.3)	11.7 (11.2–12.3)	13.0 (12.3–13.6)	13.9 (13.2–14.5)	14.7 (14.0–15.4)	15.5 (14.7–16.3)	16.5 (15.6–17.3)	17.2 (16.3–18.1)
60-day	9.85 (9.41–10.3)	11.5 (10.9–12.0)	12.9 (12.3–13.5)	13.9 (13.3–14.6)	15.3 (14.6–16.0)	16.2 (15.5–17.0)	17.1 (16.3–17.9)	18.0 (17.1–18.8)	19.0 (18.0–19.9)	19.7 (18.6–20.6)

[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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PF graphical