CCR RULE COMPLIANCE

ASH FILTER PONDS
INFLOW DESIGN FLOOD CONTROL SYSTEM
INITIAL PLAN

Prepared for:

GenOn Northeast Management Company
Conemaugh Generating Station
New Florence, Pennsylvania

Prepared by:

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

October 2016

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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 Conemaugh Generating Station (Station) is a coal-fired power plant operated by GenOn Northeast Management Company (a subsidiary of NRG Energy, Inc. [NRG]) and located in New Florence, Pennsylvania. The Station has four surface impoundments that are subject to this Rule, specifically identified as Ash Filter Ponds A, B, C, and D. The ponds are part of an ash water recycling system, and serve the multi-purpose function of receiving, storing, settling, and supplying water for bottom ash sluicing activities. Other components of the ash water recycling system include a distribution box (also known as the receiver box), ash dewatering bins (which receive sluice water from the bottom ash hoppers), an ash water recycle sump (AWRS), and recycling and level control pumps.

Water from the ponds drains via gravity to the AWRS, where it is subsequently pumped to the bottom ash hoppers during sluicing. Sluice water from the hoppers is sent to dewatering bins, and is decanted or drained from the bins and sent back to the ponds via the distribution box. Some water is introduced into the system via precipitation falling directly into and around the ponds, and from additional sources (such as sump pumps, drains, and plant processes) that are routed to the distribution box and AWRS locations. These sources help to replenish any losses, ensuring an adequate, ongoing supply of sluice water. Still, the majority of the water that flows through the system is recycled. In addition, there are overflow provisions for the ponds and the AWRS. Accumulated bottom ash is removed from the ponds during periodic cleanout activities and is transported to the Station's CCR landfill (the Ash/Refuse Disposal Site). The locations of the Station and the ponds are shown on Figure 1.

NRG engaged the services of CB&I Environmental & Infrastructure, Inc. (CB&I) to develop an initial Plan for all four Ash Filter Ponds. This Plan development followed the review of available background and design information and a field visit conducted on June 28, 2016. Additionally, development of this Plan occurred following an Initial Hazard Potential Classification completed by CB&I, and documented 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 impoundments, and Section 4.0 provides conclusions and recommendations regarding the adequacy of the impoundments 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 ponds are diked, Low Hazard (refer to Section 3.3) impoundments, the 100-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 these ponds is discharged in accordance with the Station's NPDES permit No. PA0005011 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) development of a hazard potential classification (provided under separate cover in a report by CB&I dated 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 impoundments 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 elevations, operating water levels, and inflow and outflow features).

The impoundments are situated toward the southern reaches of the Station property, just southwest of the primary operations area. The nearest Station property boundary is to the south, and abuts the Conemaugh River. The ponds are located together in a common impoundment area and share an overall perimeter dike. This diked area is bordered by a station haul road to the north and south, a haul road and limestone storage area to the west, and the flue gas desulfurization (FGD) system to the east. A rail corridor runs through the Station property between the impoundment area and the Conemaugh River. At its closest, the rail corridor is over 300 feet away from the toe of the basin impoundment area.

Topographic information for the subject area was obtained from a site survey by L. R. Kimball performed in 2010 (Kimball, 2010). The overall topography in the vicinity of the ponds slopes southward toward the Conemaugh River. The common diked area has a crest elevation of approximately 1092 to 1095 feet mean sea level (ft msl). The greatest exterior embankment heights occur on the western and southern sides, while relief on the northern and eastern sides is minimal. The western and southern embankments slope to the west and south, respectively, to perimeter channels at the toe, at an approximate elevation of 1080 ft msl. Toward the north and east, the ground surface generally slopes away from the ponds, toward a grassy area and perimeter road to the north, and toward the FGD system to the east.

Google Earth imagery (Google Earth, 2015) was consulted to confirm select elevations. Google Earth indicated a typical crest elevation of approximately 1,092 ft msl around the western, northern, and southern pond perimeters and a slightly higher crest elevation of approximately 1,095 ft msl on the eastern side, which is in agreement with the elevations identified in the design plans (Gilbert Associates, 1995) and topographic mapping (Kimball, 2010).

Pond design information was obtained from drawings and previous reports provided by NRG. Each pond has a storage capacity of 6.2 acre-feet (ac-ft), based on a combined operational capacity for three ponds of 18.6 ac-ft (Dewberry Consultants, 2014). Only three of the four ponds are in use at any one time, with the fourth out of service for maintenance and cleaning purposes. Two of the in-service ponds receive water overflowing from the dewatering bins, while the third is valved to receive and store the ash water that is discharged from the dewatering bin while the ash truck is loading (Raytheon, 1995). The ponds are operated so as to keep relatively constant water levels while in use. For all of the ponds, the normal water operating level while in service is 1,090 ft msl (Gilbert Associates, 1995).

The primary inflow to the ponds is recycled ash water that is pumped from a distribution box located just northeast of the pond area. Controls at the distribution box allow Station personnel to select the desired mode of operation for each pond. Ponds that are in active mode receive water through inflow piping on the eastern pond perimeters. A small amount of water also enters Ponds A and B via pumping as recirculation water (water is recirculated to prevent pump overheating). Some additional water is introduced to the ponds via precipitation, but this is generally limited to water falling directly within and in limited areas around the pond footprints due to the elevated construction of the ponds.

Outflow from each pond gravity drains through an outlet structure located on the western side of the pond. Each outlet structure consists of twin saw tooth weirs that drain to a concrete box structure. The concrete structure outlets to gravity drainage pipes that merge together into a single pipe to Manhole No. 4 (NPDES Internal Monitoring Point [IMP 707]). From Manhole 4, the water generally flows via gravity to the AWRS. An emergency overflow pipe is present in Manhole No. 4 to route overflow water to a surface swale via NPDES Outfall 007, if necessary. Water routed to the AWRS is pumped to the ash hoppers. Should water levels become sufficiently high in the AWRS, water is pumped to the on-site Desilting Basin.

3.2 Field Visit

On June 28, 2016, Laurel Lopez (CB&I senior engineer) met with James Brunson (NRG Environmental Specialist) to perform a site walk and visual reconnaissance of the ponds and surrounding area. The visit was conducted to support CB&I’s hazard assessment of the impoundments (provided under separate cover) and the hydrologic and hydraulic evaluation performed herein. CB&I walked the perimeter of the ponds and confirmed that the ash water recycling features appeared to be in overall agreement with the previously reviewed reports and documents.

As part of the hydrologic and hydraulic evaluation, CB&I visually assessed upstream conditions for run-on potential. Due to the diked construction of the impoundment area, potential run-on is minimal, limited to precipitation falling directly on and in the immediate vicinity of the ponds.

3.3 Hazard Potential Classification

Based on the review of background information and field observations, CB&I assigned a Low Hazard rating to each of the four subject ponds. A full discussion of the process and rationale for this assignment is provided in a report entitled, "Ash Filter Ponds Hazard Potential Classification Initial Assessment Report" (CB&I, 2016). The Low Hazard rating for each pond is based on the determination that a failure or mis-operation of these impoundments would be unlikely to cause a loss of human life and would cause minor economic or environmental losses principally limited to the surface impoundment owner's property. In addition, a failure or mis-operation would be unlikely to impact lifeline or critical facilities or cause other significant negative effects.

3.4 Hydrologic Calculations

As noted previously, the ponds are operated so as to maintain constant operating water levels in the ponds that are in service. Under normal operating conditions, this is accomplished by application of pond inflow rates that are below the capacity of the pond outfall structures with very minimal increases in water levels, such that pond outflow equals pond inflow. Accordingly, the water level rises to just slightly (less than a few inches) above the crest of the effluent saw tooth weirs, and discharge occurs until the water level drops and becomes approximately equal to the crest of the effluent weirs. For practical purposes, the normal operating water level for each pond is approximately equal to the crest of the effluent weir structure.

These calculations consider the capacity of each pond to contain stormwater from the inflow design flood. For the modeling of each pond, 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 available capacity of the pond between the operating water level and the crest is determined to be greater than the design storm inflow volume, the flood control system is deemed adequate to manage the flow into the pond during and following the inflow design storm. Under these conditions, the storm water inflow would temporarily raise the water level of the subject pond above the normal operating level, but would not overtop the basin crest. Conservatively, these calculations consider each pond's capacity to temporarily hold the entire storm event inflow volume. In actuality, pond discharge would occur during the storm event and the entire storm inflow volume would not need to be held at once.

Attachment A provides calculations showing the capability of each pond to hold the contents of a 24-hour, 100-year design storm within the volume between its operating water level and crest. The point precipitation associated with the specified storm event is 5.80 inches (NOAA, 2016). Since stormwater inflow into each pond is limited to the precipitation that falls directly on the pond footprint and upon a small area immediately surrounding the pond, a direct computation of inflow volume was performed as the precipitation depth for the inflow design storm times the approximate pond surface water drainage area. The drainage areas were obtained via CAD and are depicted on Figure 3. The available volume between the operating water level and crest elevation for each pond was computed using the areas at each elevation (determined via CAD and shown on Figure 3), freeboard height, and the average end area method. The inflow volume and available volume were computed and compared for each pond. These calculations show the available capacity for stormwater inflow to be adequate for all of the ponds. For the 100-year storm event, it is estimated that only between 34 to 37 percent of the pond volume above the operating water level would be utilized for the ponds.

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 drainage to the AWRS and subsequent pumping to the ash hoppers). As extra precautionary measures, two overflow features are present in structures that receive outflow from the ponds. First, there is an emergency overflow pipe at Manhole No. 4, such that if the ponds discharge more than can be routed to the AWRS, the excess flow will discharge to Outfall 007. In addition, there are sensors and overflow pumps in the AWRS that will send water from the AWRS to the Desilting Basin (located northeast of the impoundment area) should the water levels rise too high. Even during the unlikely event that discharge occurs through emergency overflow structures at either Manhole No. 4 or from the AWRS, such discharges would be to NPDES-approved outfalls within Station property. Any such discharges would be temporary and limited, and would not result in adverse downstream impacts. Accordingly, the inflow design flood control system adequately manages flow from each 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 calculations contained in Attachment A), the subject ponds have flood control systems that are adequate to manage flow into and from the units under the applicable inflow design flood. Any outflow from the ponds 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 ponds in accordance with design documents and appropriate operating procedures. Any deviations from the crest elevations or operating conditions presented in this Plan would warrant a re-evaluation of the ponds 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 ponds 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 Conemaugh Generating Station Ash Filter Ponds, and have reviewed available design and operational information for the ponds as provided by NRG. Based my observations, review of information, and analyses, the subject ponds have flood control systems that are adequate to manage flow into and from the units 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.

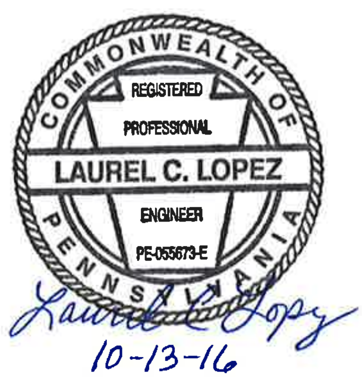
Signature: Laurel C Lopez

Date: 10-13-16

PE Registration State: Pennsylvania

PE Registration Number: PE-055673-E

Professional Engineer Seal:



6.0 References

CB&I. "Ash Filter Ponds Hazard Potential Classification Initial Assessment Report." October 2016.

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Federal Emergency Management Agency (FEMA). "National Flood Hazard Layer." Indiana County, Pennsylvania. January 27, 2015.

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Geosyntec. "Geotechnical and Hydraulic Assessment Report, Conemaugh Generating Station – Filter Ash Ponds and Desilting Basin." November 22, 2013.

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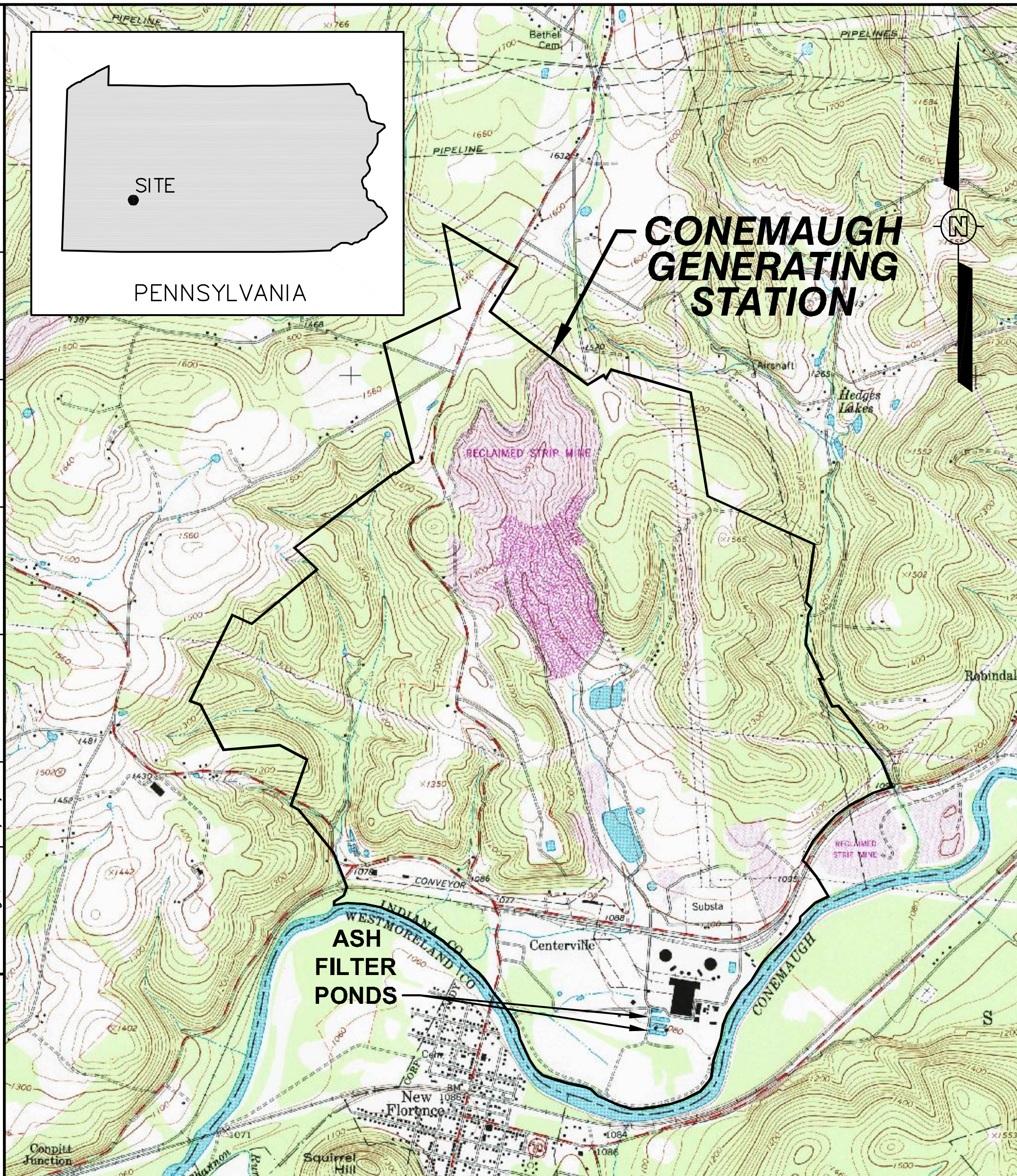
Kimball, L. R., "Conemaugh Station Base Mapping." Drawing No. E-744-3093-0. August 4, 2010.

NOAA. "Point Precipitation Frequency (PF) Estimates, New Florence, PA." NOAA Atlas 14, Vol. 2, Version 3.

Raytheon Engineers & Constructors, Inc., "System Description, Ash Water Recycle, Conemaugh Station." May 5, 1995.

Reliant Energy. "Water Balance Diagram, for Conemaugh Station Units 1 & 2." Drawing No. 1942-SK-M-113 SH 2 Rev. 9. February 3, 2006.

Figures



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SCALE

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REFERENCE:

U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, NEW FLORENCE, PENNSYLVANIA QUADRANGLE, DATED 1964.

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500 Penn Center Boulevard, Suite 1000
Pittsburgh, Pennsylvania

nrg.

FIGURE 1

SITE LOCATION MAP

CONEMAUGH GENERATING STATION
INDIANA COUNTY, PENNSYLVANIA

N

LEGEND:

APPROXIMATE STATION PROPERTY BOUNDARY

EXISTING DRAINAGE CHANNEL OR SWALE

REFERENCE:

GOOGLE EARTH AERIAL PHOTOGRAPH DATED 10/11/2015.

SCALE

0 200 400 FEET

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FIGURE 2
PHOTOGRAPHIC MAP

CONEMAUGH GENERATING STATION
INDIANA COUNTY, PENNSYLVANIA

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Pittsburgh, PA	10/6/16	LCL	ELS	DJS	LCL	1009144003-B1

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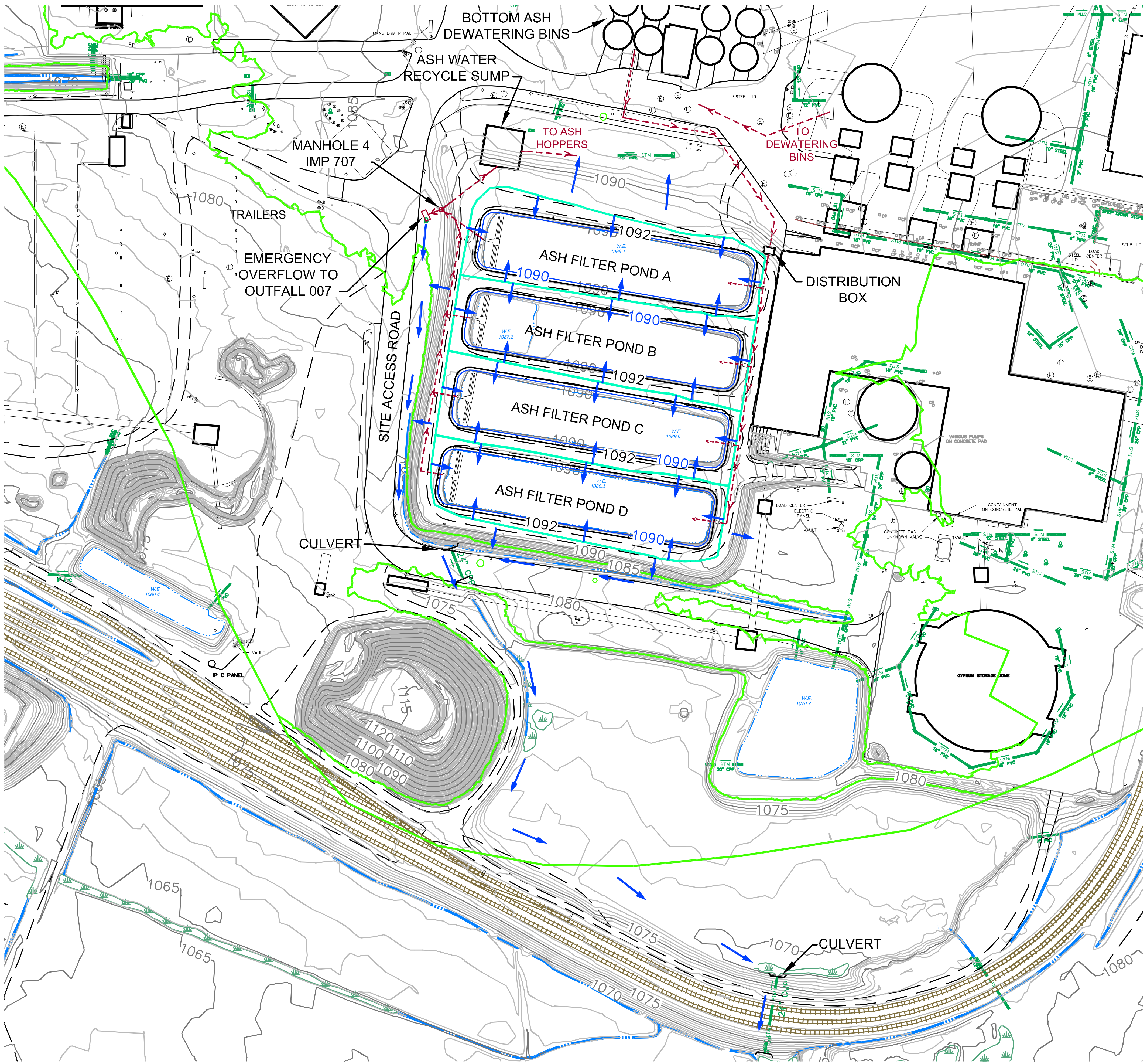

LEGEND:

- 1070 — 1-FOOT TOPOGRAPHIC CONTOUR (SEE REFERENCE 1)
- EXISTING DRAINAGE CHANNEL OR SWALE
- SURFACE WATER FLOW DIRECTION
- EXISTING STRUCTURE (SEE REFERENCE 1)
- FEMA SPECIAL FLOOD HAZARD AREA (SFHA) LIMITS (REFERENCE 2)
- STM — STORMWATER CULVERT
- APPROXIMATE POND SURFACE DRAINAGE AREA LIMITS
- 1092 — APPROXIMATE POND CREST ELEVATION (REFERENCE 3)
- 1090 — APPROXIMATE POND NORMAL WATER OPERATING LEVEL ELEVATION (REFERENCE 3)
- APPROXIMATE ASH PROCESS WATER FLOW DIRECTION

ASH FILTER POND ID	CREST*		OPERATING WATER LEVEL*		APPROXIMATE POND SURFACE DRAINAGE AREA (SQ. FT.)
	ELEV. (FT.)	AREA (SQ. FT.)	ELEV. (FT.)	AREA (SQ. FT.)	
A	1092	36,051	1090	32,280	51,161
B	1092	36,051	1090	32,280	52,199
C	1092	36,051	1090	32,280	50,626
D	1092	35,819	1090	32,054	48,212

* ELEVATIONS AND AREAS WERE OBTAINED FROM REFERENCE 3.

REFERENCES:

1. GROUND SURFACE CONTOURS, EXISTING STRUCTURES, AND SITE FEATURES WERE OBTAINED FROM SITE SURVEY DRAWING NO. E-744-3093-0, "CONEMAUGH STATION BASE MAPPING", BY L.R. KIMBALL, DATED 8/4/2010.
2. SFHA LIMITS WERE OBTAINED FROM FEMA, NATIONAL FLOOD HAZARD LAYER, INDIANA COUNTY, PA, 01/27/2015.
3. APPROXIMATE CREST AND NORMAL WATER OPERATING LEVEL ELEVATIONS AND AREAS WERE OBTAINED FROM "CONEMAUGH POWER STATION ADDITION OF 4TH ASH FILTER POND, AS-BUILT DRAWING NO. D-782-008", BY GILBERT ASSOCIATES, INC., LAST REVISED 10/10/1995.

SCALE
0 150 300 FEET

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nrg.

FIGURE 3
HYDROLOGIC MAP

CONEMAUGH GENERATING STATION
INDIANA COUNTY, PENNSYLVANIA

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Attachment A

Hydrologic Calculations

I. Purpose

To evaluate the stormwater inflow volume that will result from the design flood (storm) as specified by 40 CFR §257.82(a)(3), and to compare this volume with the available storage capacity for each subject pond.

II. Given

Four CCR impoundments located in New Florence, PA, each having a Low Hazard Rating and the following design information (From Fig. 3 by CB&I, 2016):

Ash Filter Pond A

Crest Elevation, E_c:	1092.0	ft msl
Pond Area at Crest, A_c:	36,051	sq ft
Operating Water Level, E_w:	1090.0	ft msl
Area at Operating Water Level, A_w:	32,280	sq ft
Approximate Inflow Area, A_{IN}:	51,161	sq ft
Freeboard, FB = E_c - E_w =	2.0	ft

Ash Filter Pond B

Crest Elevation, E_c:	1092.0	ft msl
Pond Area at Crest, A_c:	36,051	sq ft
Operating Water Level, E_w:	1090.0	ft msl
Area at Operating Water Level, A_w:	32,280	sq ft
Approximate Inflow Area, A_{IN}:	52,199	sq ft
Freeboard, FB = E_c - E_w =	2.0	ft

Ash Filter Pond C

Crest Elevation, E_c:	1092.0	ft msl
Pond Area at Crest, A_c:	36,051	sq ft
Operating Water Level, E_w:	1090.0	ft msl
Area at Operating Water Level, A_w:	32,280	sq ft
Approximate Inflow Area, A_{IN}:	50,626	sq ft
Freeboard, FB = E_c - E_w =	2.0	ft

Ash Filter Pond D

Crest Elevation, E_c:	1092.0	ft msl
Pond Area at Crest, A_c:	35,819	sq ft
Operating Water Level, E_w:	1090.0	ft msl
Area at Operating Water Level, A_w:	32,054	sq ft
Approximate Inflow Area, A_{IN}:	48,212	sq ft
Freeboard, FB = E_c - E_w =	2.0	ft

III. Methodology

Step 1: Determine the appropriate Rainfall Depth (D_R) for the stormwater inflow calculations.

From 40 CFR §257.82(a)(3), the CCR units must adequately manage flow resulting from the following design floods:

* For an incised impoundment, the 25-year flood
* For a non-incised, Low Hazard impoundment, a 100-year design flood
* For a non-incised, Significant Hazard impoundment, a 1000-year design flood
* For a non-incised, High Hazard impoundment, the probable maximum flood

Step 2: Determine the Inflow Volume (V_{IN}). For a pond with a limited inflow area (i.e., with inflow limited to rainfall directly on top of the pond footprint and on berm areas right around the pond perimeter), compute the volume directly as the Rainfall Depth (D_R) times the Inflow Area (A_{IN}). For ponds with run-on from additional upstream areas, compute V_{IN} using HydroCAD.

Step 3: Compute the Available Capacity (V_{AVAIL}) of each pond to contain stormwater runoff as the volume between the pond operating water level and the pond crest elevation. Use the Average End Area method.

Step 4: Compare the volume of inflow (V_{IN}) for the specified design flood (storm) to the pond's available capacity (V_{AVAIL}) for stormwater runoff to determine if the pond will manage the specified stormwater inflow without overtopping.

IV. Calculations

Step 1: Determine the appropriate Rainfall Depth (D_R).

None of the ponds are completely incised, and all are assigned Low Hazard classifications. Pursuant to 40 CFR §257.82(a)(3), the ponds must manage flow from the 100-year flood (storm).

From NOAA (NOAA, 2016), the rainfall depth (D_R) associated with the 24-hour, 100-year storm is:

D_R = 5.80 " = 0.4833 ft

Step 2: Determine the Inflow Volume (V_{IN}).

Inflow is limited to rainfall directly on top of each pond footprint and upon a limited area around each pond. Therefore, directly compute V_{IN} as follows:

Inflow , V_{IN} (cu ft) = Rainfall depth, D_R (ft) x Inflow Area, A_{IN} (sq ft)

For Ash Filter Pond A:

V_{IN} = 0.4833 ft x 51,161 sq ft
= 24,728 cu ft

For Ash Filter Pond B:

V_{IN} = 0.4833 ft x 52,199 sq ft
= 25,230 cu ft

For Ash Filter Pond C:

V_{IN} = 0.4833 ft x 50,626 sq ft
= 24,469 cu ft

For Ash Filter Pond D:

V_{IN} = 0.4833 ft x 48,212 sq ft
= 23,302 cu ft

Step 3: Compute the Available Capacity (V_{AVAIL}) of each pond to contain stormwater runoff as the volume between the pond operating water level and the pond crest elevation. Use the Average End Area method.

Available Capacity, V_{AVAIL} (cu ft) = [(A_c + A_w)/2] x FB

For Ash Filter Pond A:

V_{AVAIL} = [(36,051 + 32,280) / 2] x 2.0
= (68,331 / 2) x 2.0
= 68,331 cu ft

For Ash Filter Pond B:

V_{AVAIL} = [(36,051 + 32,280) / 2] x 2.0
= (68,331 / 2) x 2.0
= 68,331 cu ft

For Ash Filter Pond C:

$$V_{AVAIL} = [(36{,}051 + 32{,}280) / 2] \times 2.0$$
$$= (68{,}331 / 2) \times 2.0$$
$$= 68{,}331 \text{ cu ft}$$

For Ash Filter Pond D:

$$V_{AVAIL} = [(35{,}819 + 32{,}054) / 2] \times 2.0$$
$$= (67{,}873 / 2) \times 2.0$$
$$= 67{,}873 \text{ cu ft}$$

V. Results

Step 4: For each pond, compare the Inflow Volume (V_{IN}) for the specified design flood (storm) to the Available Capacity (V_{AVAIL}) for stormwater runoff to determine if it will manage the specified inflow without overtopping.

Percent of Freeboard Capacity Utilized, $\%V_{FB} = \frac{V_{IN}}{V_{AVAIL}}$

For Ash Filter Pond A:

$$\%V_{FB} = 24{,}728 / 68{,}331$$
$$= 36\%$$

For Ash Filter Pond B:

$$\%V_{FB} = 25{,}230 / 68{,}331$$
$$= 37\%$$

For Ash Filter Pond C:

$$\%V_{FB} = 24{,}469 / 68{,}331$$
$$= 36\%$$

For Ash Filter Pond D:

$$\%V_{FB} = 23{,}302 / 67{,}873$$
$$= 34\%$$

VI. Conclusions

All four ash filter ponds have adequate capacity to meet the temporary storage requirements for a 100-year design flood (storm).

VII. References

CB&I. "Figure 3 Hydrologic Map, Conemaugh Generating Station." Drawing No. 1009144003-B2. Dated October 6, 2016.

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

Attachment A-1

NOAA Point Precipitation Frequency (PF) Estimates

NOAA Atlas 14, Volume 2, Version 3
Location name: New Florence, Pennsylvania, US*
Latitude: 40.3833°, Longitude: -79.0626°
Elevation: 1091 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	0.319 (0.289–0.353)	0.381 (0.346–0.422)	0.461 (0.418–0.510)	0.525 (0.474–0.579)	0.608 (0.546–0.670)	0.674 (0.603–0.741)	0.741 (0.659–0.814)	0.812 (0.718–0.891)	0.911 (0.799–0.998)	0.988 (0.861–1.08)
10-min	0.496 (0.449–0.548)	0.595 (0.540–0.658)	0.717 (0.649–0.793)	0.810 (0.731–0.894)	0.930 (0.835–1.03)	1.02 (0.914–1.12)	1.12 (0.992–1.23)	1.21 (1.07–1.33)	1.34 (1.18–1.47)	1.44 (1.25–1.57)
15-min	0.608 (0.551–0.672)	0.728 (0.660–0.805)	0.880 (0.797–0.974)	0.997 (0.899–1.10)	1.15 (1.03–1.27)	1.27 (1.13–1.39)	1.39 (1.23–1.52)	1.51 (1.33–1.65)	1.67 (1.47–1.83)	1.80 (1.57–1.97)
30-min	0.804 (0.729–0.889)	0.974 (0.883–1.08)	1.21 (1.09–1.33)	1.38 (1.25–1.53)	1.62 (1.46–1.79)	1.81 (1.62–1.99)	2.00 (1.78–2.20)	2.20 (1.95–2.41)	2.48 (2.17–2.71)	2.70 (2.35–2.95)
60-min	0.982 (0.890–1.09)	1.20 (1.08–1.32)	1.51 (1.37–1.67)	1.76 (1.59–1.94)	2.11 (1.89–2.32)	2.38 (2.13–2.62)	2.68 (2.38–2.94)	2.99 (2.64–3.28)	3.43 (3.00–3.75)	3.79 (3.30–4.14)
2-hr	1.16 (1.05–1.28)	1.40 (1.27–1.55)	1.78 (1.61–1.96)	2.08 (1.88–2.29)	2.52 (2.26–2.76)	2.87 (2.57–3.15)	3.26 (2.90–3.57)	3.68 (3.25–4.02)	4.29 (3.75–4.68)	4.80 (4.16–5.24)
3-hr	1.25 (1.13–1.38)	1.51 (1.37–1.67)	1.91 (1.73–2.10)	2.23 (2.01–2.46)	2.70 (2.42–2.96)	3.09 (2.75–3.38)	3.51 (3.11–3.84)	3.97 (3.49–4.33)	4.65 (4.05–5.07)	5.22 (4.50–5.69)
6-hr	1.51 (1.38–1.68)	1.83 (1.66–2.03)	2.28 (2.07–2.53)	2.66 (2.40–2.95)	3.21 (2.88–3.54)	3.67 (3.28–4.05)	4.17 (3.70–4.59)	4.73 (4.15–5.19)	5.54 (4.81–6.07)	6.24 (5.37–6.82)
12-hr	1.84 (1.67–2.05)	2.20 (2.01–2.45)	2.73 (2.48–3.04)	3.18 (2.88–3.52)	3.84 (3.46–4.24)	4.40 (3.94–4.85)	5.02 (4.45–5.52)	5.70 (5.01–6.26)	6.73 (5.83–7.37)	7.60 (6.52–8.31)
24-hr	2.17 (2.00–2.36)	2.59 (2.40–2.82)	3.19 (2.95–3.48)	3.71 (3.41–4.03)	4.46 (4.08–4.84)	5.10 (4.63–5.52)	5.80 (5.23–6.27)	6.57 (5.86–7.10)	7.70 (6.77–8.34)	8.67 (7.53–9.40)
2-day	2.50 (2.31–2.72)	2.98 (2.76–3.25)	3.65 (3.38–3.98)	4.22 (3.89–4.58)	5.03 (4.61–5.45)	5.72 (5.21–6.20)	6.46 (5.84–6.99)	7.26 (6.51–7.87)	8.44 (7.46–9.16)	9.43 (8.22–10.3)
3-day	2.68 (2.49–2.91)	3.19 (2.97–3.47)	3.88 (3.60–4.21)	4.46 (4.12–4.82)	5.28 (4.86–5.70)	5.95 (5.45–6.43)	6.68 (6.07–7.22)	7.45 (6.72–8.07)	8.57 (7.62–9.29)	9.49 (8.34–10.3)
4-day	2.87 (2.67–3.10)	3.41 (3.18–3.68)	4.11 (3.83–4.44)	4.70 (4.36–5.06)	5.52 (5.10–5.95)	6.19 (5.69–6.67)	6.90 (6.30–7.44)	7.65 (6.92–8.26)	8.70 (7.78–9.43)	9.55 (8.46–10.4)
7-day	3.47 (3.26–3.71)	4.10 (3.85–4.39)	4.89 (4.58–5.23)	5.53 (5.17–5.91)	6.40 (5.97–6.85)	7.11 (6.61–7.60)	7.83 (7.23–8.37)	8.57 (7.87–9.18)	9.59 (8.72–10.3)	10.4 (9.37–11.2)
10-day	4.06 (3.84–4.32)	4.79 (4.53–5.09)	5.64 (5.32–5.99)	6.31 (5.95–6.70)	7.23 (6.78–7.67)	7.94 (7.43–8.43)	8.66 (8.07–9.20)	9.39 (8.71–9.99)	10.4 (9.53–11.1)	11.1 (10.2–11.9)
20-day	5.78 (5.49–6.08)	6.76 (6.44–7.14)	7.81 (7.42–8.24)	8.63 (8.19–9.10)	9.71 (9.20–10.2)	10.5 (9.97–11.1)	11.4 (10.7–12.0)	12.2 (11.4–12.9)	13.2 (12.3–14.0)	14.0 (13.0–14.8)
30-day	7.33 (7.02–7.69)	8.56 (8.19–8.99)	9.78 (9.35–10.3)	10.8 (10.3–11.3)	12.0 (11.4–12.6)	13.0 (12.3–13.6)	13.9 (13.2–14.6)	14.8 (14.0–15.5)	15.9 (15.0–16.8)	16.8 (15.7–17.7)
45-day	9.46 (9.07–9.90)	11.0 (10.6–11.6)	12.5 (11.9–13.0)	13.6 (13.0–14.2)	15.0 (14.3–15.7)	16.0 (15.3–16.8)	17.0 (16.2–17.8)	18.0 (17.0–18.9)	19.1 (18.1–20.1)	20.0 (18.8–21.1)
60-day	11.5 (11.0–11.9)	13.3 (12.8–13.9)	14.9 (14.3–15.6)	16.2 (15.5–16.9)	17.7 (17.0–18.5)	18.8 (18.0–19.7)	19.9 (19.0–20.8)	20.9 (19.9–21.8)	22.1 (21.0–23.1)	22.9 (21.8–24.1)

[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