# Periodic Inflow Design Flood Control System Plan

*Possum Point Power Station CCR Surface Impoundment: Pond D*

Submitted to:

**Possum Point Power Station**

19000 Possum Point Road

Dumfries, Virginia 22026

Submitted by:


**Golder Associates Inc.**

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Project No. 21466315

October 2021

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**APPENDICES**

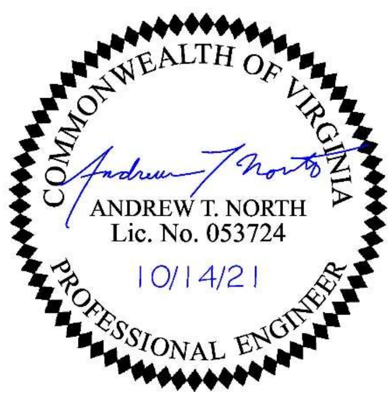
# 1.0 CERTIFICATION

This periodic Inflow Design Flood Control System Plan for the Possum Point Power Station's Pond D was prepared by Golder Associates Inc. (Golder). The document and Certification/Statement of Professional Opinion are based on and limited to information that Golder has relied on from Dominion and others, but not independently verified, as well as work products produced by Golder.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that this document has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, at the same time, and in the same locale. It is my professional opinion that the document was prepared consistent with the requirements in §257.82 of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015, with an effective date of October 19, 2015 (40 CFR §257.82).

The use of the word "Certification" in this document shall be interpreted and construed as a Statement of Professional Opinion and is not and shall not be interpreted or construed as a guarantee, warranty, or legal opinion.

| | |
|---|---|
| Andrew T. North, PE | Senior Civil Engineer |
| Print Name | Title |
| | 10/14/2021 |
| Signature | Date |



# 2.0 INTRODUCTION

This periodic Inflow Design Flood Control System (PIDFCS) Plan was prepared for the Possum Point Power Station's (Station) existing Coal Combustion Residuals (CCR) surface impoundment known as Pond D. This PIDFCS Plan was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.82.

The Station, owned and operated by Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion), is in Prince William County at 19000 Possum Point Road, east of Route 1 (Jefferson Davis Highway), and bounded to the south and east by Quantico Creek and the Potomac River. The Station includes an existing CCR surface impoundment, Pond D, as defined by the Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule (40 CFR §257; the CCR rule). Pond D is also regulated as an impounding structure by the Virginia Department of Conservation and Recreation (DCR), with Inventory Number 153020. Discharge from the Pond D is currently regulated by Virginia Department of Environmental Quality (DEQ) Virginia Pollutant Discharge Elimination System Permit No. VA0002071 (VPDES Permit).

# 3.0 PURPOSE

This PIDFCS Plan is prepared pursuant to § 257.82(c) of the CCR Rule [40 CFR § 257.82(c)]. The initial Inflow Design Flood Control System Plan was completed on October 17, 2016, and is required to be updated every five (5) years pursuant to 40 CFR §257.82(c)(4).

# 4.0 PERIODIC INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

As required by § 257.82(c)(1), this PIDFCS Plan includes:

- Documentation of how the inflow design flood control system has been designed, constructed, operated, and maintained to adequately manage flow into Pond D during and following the peak discharge of the inflow design flood [§ 257.82(a)(1)];
- Documentation of how the inflow design flood control system has been designed, constructed, operated, and maintained to adequately manage flow from Pond D to collect and control the peak discharge resulting from the inflow design flood [§ 257.82(a)(2)]; and
- Documentation of how the inflow design flood control system has been designed, constructed, operated, and maintained to adequately address the requirements of § 257.3-3 [§ 257.82(b)].

## 4.1 Hazard Potential Classification

As indicated in Golder's Periodic Hazard Potential Classification Assessment (Golder, 2021), Pond D is assigned a "Significant" hazard potential rating per 40 CFR §257.73.

## 4.2 Inflow Design Flood

In accordance with 40 CFR §257.82(a)(3)(ii), a CCR impoundment with a significant hazard potential must collect and control the peak discharge resulting from a 1,000-year flood. Based on the DCR criteria, Pond D is considered a high hazard potential dam. Per the DCR's Impounding Structure Regulations §4VAC50-20-50, the Spillway Design Flood (SDF) for an existing dam with a high hazard potential should be evaluated using 90% of the area's potential max precipitation (PMP). The 6-, 12-, and 24-hour PMP events were analyzed and found to have rainfall totals of 25.6, 30.3, and 30.3 inches, respectively, using 90% of the area's PMP. Per NOAA Atlas-14, the 1,000-year rainfall event totals for the 6-, 12-, and 24-hour durations are 8.04, 10.8, and 13.6 inches, respectively. Thus, the evaluation of Pond D’s hydraulic performance using the DCR’s requirements for a SDF in Appendix A has been used in-lieu of the 1,000-year flood which provides a more conservative approach to satisfy the requirements of 40 CFR §257.82(a)(3)(ii), therefore, demonstrating adequacy of the inflow design flood control system.

## 4.3 Inflow Control

As required by § 257.82(a)(1), a control system must be in place for Pond D that is designed, constructed, operated, and maintained to adequately manage flow into Pond D during, and following the peak discharge of the inflow design flood.

Pond D has a surface area of approximately 88 acres, and it receives surface water run-on from 27 acres of adjacent up-land areas. The adjacent areas are predominantly brush areas, gravel access roads, managed turf areas along the embankment, and areas of exposed CCR. Stormwater is conveyed into Pond D by sheet flow and through natural valleys, depressions, and channels within the surrounding topography. The natural conveyance systems adequately manage run-on into Pond D during the inflow design flood.

Pond D receives additional pumped inflows from the existing Pond D toe drain collection system and Pond ABC and E surface water runoff, which are considered negligible during the inflow design flood and are not included in this analysis.

## 4.4 Outflow Control

As required by § 257.82(a)(2), an inflow design flood control system must be in place for Pond D that is designed, constructed, operated, and maintained to adequately manage flow from Pond D to collect and control the peak discharge resulting from the inflow design flood.

Pond D’s principal spillway, a reinforced concrete riser and 30-inch diameter pipe, has been temporarily plugged, and is not included in this analysis.

The emergency spillway, located on the northwest side of the pond, is available for discharge should water accumulate to the crest of the spillway. The existing emergency spillway is a trapezoidal-shape, broad-crested vegetated spillway that is built into the road surface along the top of the Pond D embankment. It has a width of 70 feet, 10:1 side slopes, and a crest elevation of 144.5 feet above mean sea level (ft amsl). The embankment has an effective depth of 4.5 feet and is surfaced with well-compacted gravel confined by established vegetation.

Pond D’s stormwater system was modeled in the U.S. Army Corps of Engineers Hydrologic Engineering Center’s Hydraulic Modeling System (HEC HMS), and the analysis is included in Appendix A. Pond D’s inflow design flood control system is capable of adequately managing the inflow from the design flood event without overtopping the embankment and has adequate spillway capacity to manage resulting outflow.

## 4.5 Surface Water Requirements

As required by § 257.82(b), a control system must be in place for Pond D that is designed, constructed, operated, and maintained to meet the requirements of § 257.3-3.

Pond D is operated under VPDES No. VA0002071. The site is routinely inspected and monitored by Dominion personnel to minimize potential surface water impacts.

# 5.0 CONCLUSIONS

Based on known site conditions, information in this PIDFCS Plan, as well as work performed by Golder including field inspection and document review, it is Golder's opinion that the existing Pond D inflow design flood control system complies with the requirements of 40 CFR § 257.82 of the CCR Rule for a significant hazard potential impoundment.

# 6.0 REFERENCES

Code of Virginia, 4VAC50-20-50. Performance standards required for impounding structures; effective March 23, 2016.

GAI Consultants. Coal Combustion Residuals Inflow Design Flood Control System Plan, Surface Impoundment D. October 2016.

Golder Associates. Periodic Hazard Potential Classification Assessment, Possum Point Power Station CCR Surface Impoundment: Pond D. October 2021.

National Oceanic and Atmospheric Administration's National Weather Service. NOAA Atlas 14 Point Precipitation Frequency Estimates: VA. 2017. Available online: https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=va

Virginia Department of Environmental Quality (VDEQ), Northern Regional Office. Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0002071.

**APPENDIX A**

# Pond D Inflow Design Flood Analysis

| | | | |
|---|---|---|---|
| **Date:** | October 2021 | **Made by:** | JAF |
| **Project No.:** | 21-466315 | **Checked by:** | ATN |
| **Site Name:** | Possum Point Power Station | **Reviewed by:** | JRD |
| **Subject:** | **Pond D Inflow Design Flood Analysis** | | |

## 1.0 OBJECTIVE

The objective of this evaluation is to verify the design and hydraulic performance of the Pond D coal combustion residuals (CCR) surface impoundment during the design inflow flood. As required by 40 CFR §257.82, the owner or operator of a CCR impoundment must design, construct, operate, and maintain an inflow design flood control system that:

- Adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood; and,
- Adequately manages flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood.

This evaluation is in support of the Periodic Inflow Design Flood Control System Plan and is based on a "Significant" hazard potential classification as defined in §257.53 of the CCR Rule.

## 2.0 HYDRAULIC ANALYSIS

### 2.1 Hydrology

Drainage areas were delineated based on topography from an aerial survey completed by McKenzie Snyder, INC. on 4/28/2017. The direct contributing drainage area to Pond D is approximately 115 acres as shown in Attachment A. The water surface area of the pond at the spillway invert elevation is 58 acres. The remaining drainage acreage consists of brush areas, gravel access roads, managed turf areas along the embankment, and areas of exposed CCR. An overall composite curve number (CN) of 88 was computed for the total Pond D drainage area. Information on soil types and corresponding hydrologic soil groups (HSG) was obtained from the NRCS Web Soil Survey (WSS). The predominant soil types in the area are Hydrologic Soil Group (HSG) 'B' soils. Due to the prevalence of exposed CCR and placed CCR and soil materials within Pond D's footprint, soils were conservatively modeled as type 'C'. Landcover data was determined from Google Earth aerial imagery dated 10/8/2020 as well as field observations and records.

### 2.2 Pond Storage

Pond D storage volumes were computed based on various survey and design plans including the April 2017 McKenzie Snyder aerial survey, "Pond D Western Bench Grading and Fill Plan" prepared by Golder Associates dated 7/17/2018, and field surveys by D&M Survey completed in April of 2020, as complied together by Golder. Volumes were computed as available water storage from the bottom of Pond D at elevation 87 feet above mean sea level (ft amsl) to the top of the embankment at elevation 150 ft amsl and are included in Attachment B. The water surface elevation in Pond D is approximately 124 ft amsl as of 8/9/2021. The available remaining volume in Pond D is approximately 975 acre-feet (ac-ft) from the current water surface elevation to the crest of the emergency spillway.

### 2.3 Inflow and Outflow Control

The surface area of Pond D is approximately 88 acres and receives surface water run-on from 27 acres of adjacent upland areas. Stormwater inflow is conveyed into Pond D by sheet flow and through natural valleys, depressions, and channels within the surrounding topography. Pond D receives additional pumped inflows from the existing

Pond D toe drain collection system and Pond ABC and E surface water runoff, which are considered negligible durring the inflow design flood and are not included in this analysis.

Pond D's principal spillway, a reinforced concrete riser and 30-inch diameter pipe, has been temporarily plugged, and is not included in this analysis.

The existing emergency spillway is a trapezoidal-shape, broad-crested vegetated spillway that is built into the road surface along the top of the Pond D embankment. It has a width of 70 feet, 10:1 side slopes, and a crest elevation of 144.5 ft amsl. The embankment has an effective depth of 4.5 feet and is surfaced with well-compacted gravel confined by established vegetation. The spillway capacity and rating table is included in Attachment C.

## 2.4 Probable Maximum Precipitation

Per §257.82(a)(3)(ii), the impoundment is required to adequately manage flow resulting from the 24-hour, 1,000-year storm event. Per NOAA Atlas 14, the 1,000-year rainfall event totals for the 6-, 12-, and 24-hour durations are 8.04, 10.8, and 13.6 inches, respectively (Attachment D-1).

Based on the DCR criteria, Pond D is considered a high hazard potential dam. Per the DCR's Impounding Structure Regulations §4VAC50-20-50, the Spillway Design Flood (SDF) for an existing dam with a high hazard potential should be evaluated using 90% of the area's potential max precipitation (0.9 PMP).

GAI Consultants performed a probable maximum precipitation (PMP) evaluation of the Possum Point Power Station area using the November 2015 "Probable Maximum Precipitation Study for Virginia" PMP Calculation Worksheet included in Attachment D-2. The 6-hour event, based on "local" storm data, produced a controlling PMP value of 25.6 inches, using 90% of the area's PMP. The 12 and 24-hour events are based on the "tropical" storm data produced controlling PMP values of 30.3 and 30.3 inches, respectively, using 90% of the area's PMP. The August 2018 "VA 2018 PMP Temporal Distribution" Calculation Worksheet was used to compute temporal distribution curves for the 0.9 PMP events as shown in Attachment D-3.

Since the Virginia Impounding Structure Regulations require analysis of floods that are greater than the 24-hour, 1,000-year storm event, exceeding the requirements of 40 CFR §257.82, the design flood analyzed for Pond D is the 0.9 PMP events in accordance with the Virginia Impounding Structure Regulations §4VAC50-20-50. This provides a more conservative approach to satisfy the requirements of 40 CFR §257.82(a)(3)(ii), therefore, demonstrating adequacy of the inflow design flood control system.

## 2.5 Modeling

Software from the U.S. Army Corps of Engineers, Hydrology Engineering Center – Hydrologic Modeling System (HEC-HMS) release 4.7.1 was used to analyze Pond D hydraulic performance. Lag times for the HEC-HMS model were computed using methods outlined in the Natural Resource Conservation Service (NRCS) National Engineering Handbook, Part 630, Chapter 15. HEC-HMS input values including area, CN, and lag times are included in Attachment E.

## 2.6 Design Flood Inflows

The design flood was calculated for the 6-, 12-, and 24-hour 0.9 PMP events. The resulting inflow from each event was then routed into the hydrologic model. Table 1 outlines the magnitude of each event as modeled.

**Table 1: Calculated Design Flood Inflows**

| 0.9 PMP Event | Rainfall (in) | Peak Inflow Rate (cfs) | Volume (ac-ft) |
|---|---|---|---|
| 6-Hour | 25.6 | 851.1 | 237.8 |
| 12-Hour | 30.3 | 420.9 | 282.4 |
| 24-Hour | 30.3 | 420.9 | 282.4 |

### 2.7 Results

The design flood inflows from the 0.9 PMP events were modeled to determine the resulting high-water elevation and outflow rates. The initial water elevation was set to the invert of the emergency spillway at 144.5 ft amsl. The following table summarizes the results of the HEC-HMS analysis which are included in Attachment F.

**Table 2: HEC-HMS Results**

| 0.9 PMP Event | Rainfall (in) | Full Pond Start | | |
|---|---|---|---|---|
| | | Peak Water Elevation (ftamsl) | Outflow Rate (cfs) | Freeboard (ft) |
| 6-Hour | 25.6 | 146.3 | 647.1 | 3.7 |
| 12-Hour | 30.3 | 145.8 | 387.0 | 4.2 |
| 24-Hour | 30.3 | 145.8 | 387.0 | 4.2 |

At peak flow conditions, the approximate average flow velocity through the spillway is approximately 4.1 feet per second (ft/s). Table C-1 of the VA DEQ Stormwater Design Specifications, Appendix C, Vegetated Emergency Spillway lists a maximum permissible velocity of 4.0 to 6.0 ft/s for vegetated spillways. The lining of the emergency spillway should not experience significant erosion during the short-term flow event such as the design flood.

## 3.0 CONCLUSION

Based on the presented calculations, Pond D adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood and manages flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood. The size and capacity of the Pond D’s emergency spillway is adequate to discharge the runoff from the 6-, 12-, and 24-hour 0.9 PMP storm events without overtopping the embankment.

## 4.0 REFERENCES

Code of Virginia, 4VAC50-20-50. Performance standards required for impounding structures; effective March 23, 2016.

D&M Surveyors, P.C. Topographic Survey of Southwest Corner Pond “D”. May 2020.

Golder Associates. Pond D Western Bench Grading and Fill Plan. July 17, 2018

Landcover data was determined from Google Earth aerial imagery dated 10/8/2020.

McKenzie Snyder, Inc. Topography using Photogrammetric Methods from Aerial Photography. April 2017.

GAI Consultants, Inc. PMP Evaluation for Possum Point Pond D. October 7, 2020.

United States Department of Agriculture, National Resources Conservation Service. Part 630 Hydrology National Engineering Handbook. Chapter 15. May 2010. Available online: https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=27002.wba

United States Department of Agriculture, National Resources Conservation Service. Web Soils Survey. July 2019. Available online: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Virginia Department of Environmental Quality. VA DEQ Stormwater Design Specification, Appendix C Vegetated Emergency Spillway. Table C-1. Version 1.0. March 2011. Available online: https://swbmpvwrrc.wp.prod.es.cloud.vt.edu/wp-content/uploads/2017/11/Introduction_App-C_Vegetated-Emergency-Spillways_03012011.pdf

## Attachments

Attachment A Pond D Drainage Map

Attachment B Pond D Stage-Storage Table

Attachment C Emergency Spillway Rating Table

Attachment D PMP Calculation Worksheets

D-1 Atlas 14

D-2 PMP Flow Sheets

D-3 Temporal Distribution Worksheets

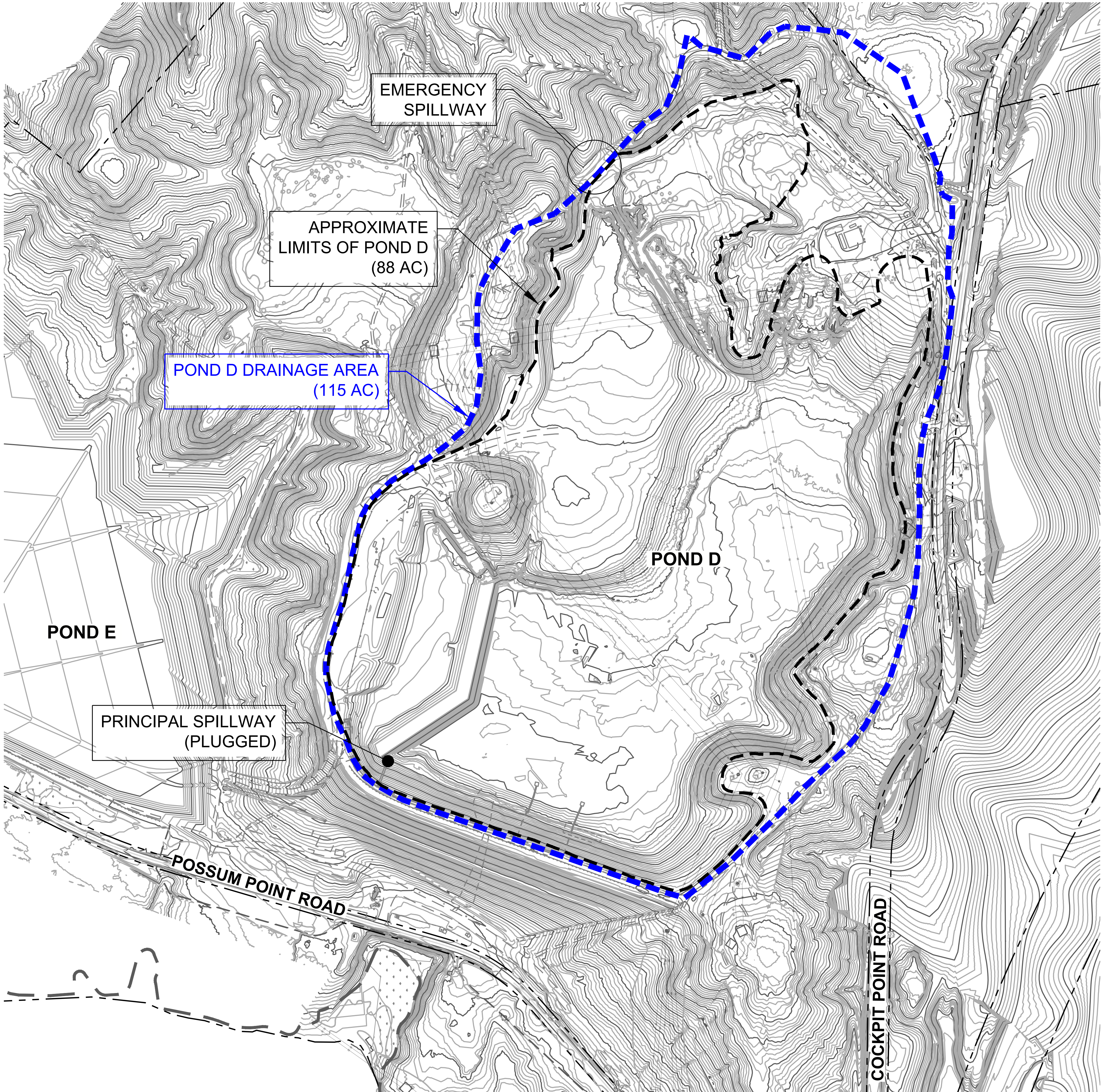
Attachment E HEC-HMS Model Inputs

Attachment F HEC-HMS Model Outputs

https://golderassociates.sharepoint.com/sites/146039/project files/5 technical work/possum/5-yr assessments/inflow design plan/final copies/pond d hydraulic analysis (10-14-21) final.docx

**ATTACHMENT A**

# Pond D Drainage Map




## LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING TOPOGRAPHIC CONTOURS (2' INTERVALS)
- APPROXIMATE LIMITS OF EXISTING ASH PONDS
- LIMITS OF 100-YR FLOOD PLAIN
- LIMITS OF DRAINAGE AREA

## NOTES

1. EXISTING CONDITIONS COMPILED BY MCKENZIE SNYDER, INC., USING PHOTOGRAMMETRIC METHODS, FROM AERIAL PHOTOGRAPHY DATED APRIL 28, 2017.

400 0 400
FEET
SCALE

CLIENT
DOMINION ENERGY
POSSUM POINT POWER STATION
PRINCE WILLIAM COUNTY, VIRGINIA

CONSULTANT
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2021-08-16 |
| DESIGNED | ATN |
| PREPARED | SIB |
| REVIEWED | JRD |
| APPROVED | ATN |

PROJECT
INFLOW DESIGN FLOOD ANALYSIS
POND D

TITLE
DRAINAGE AREA MAP

PROJECT NO. 21-466315

REV. 0

FIGURE 1

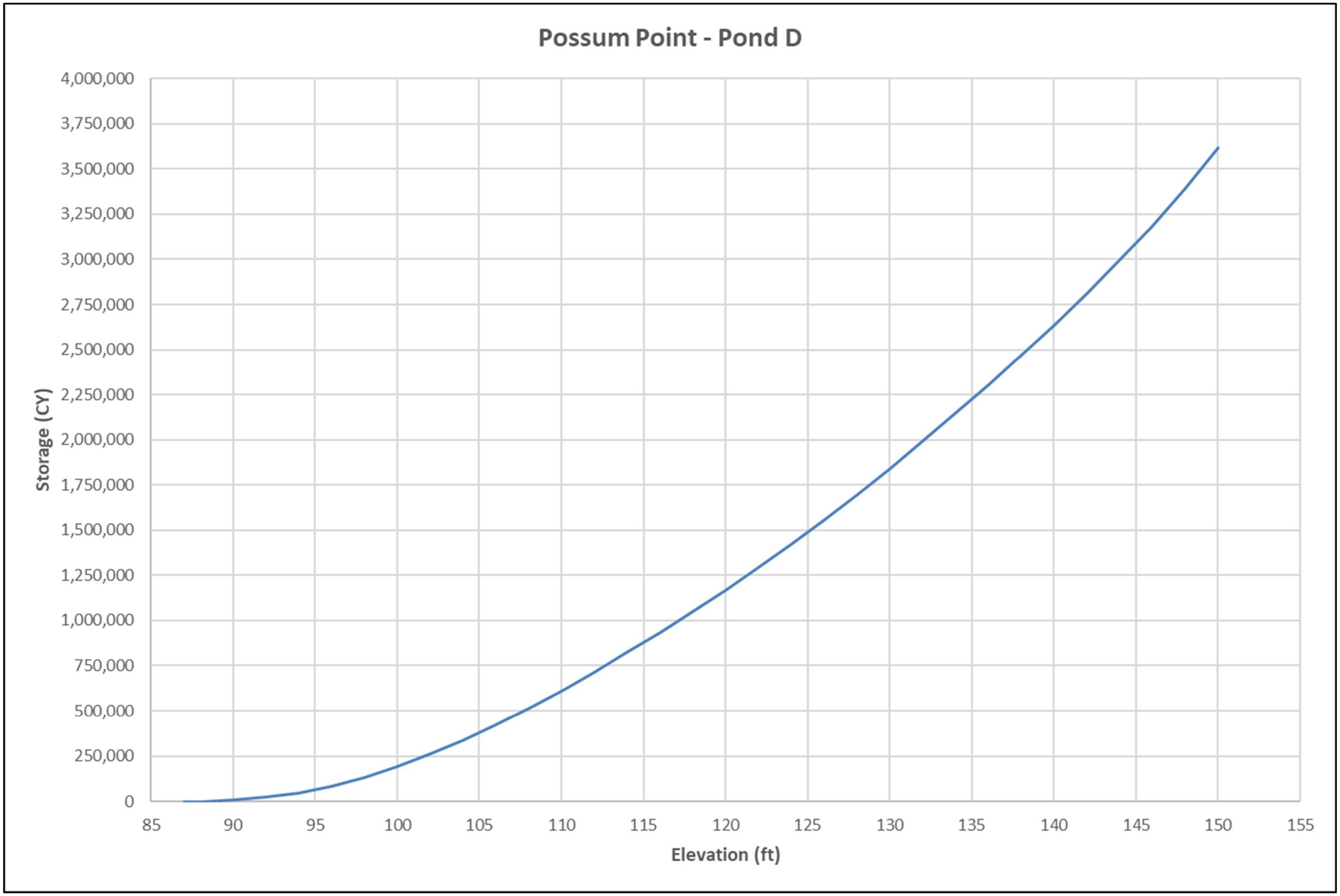
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Path: G:\Plan Production Data Files\Drawing Data Files\21-466315\040_Possum 5-yr Assessments\Active Drawings\21466315-040-01.dwg

**ATTACHMENT B**

# Pond D Stage-Storage Table

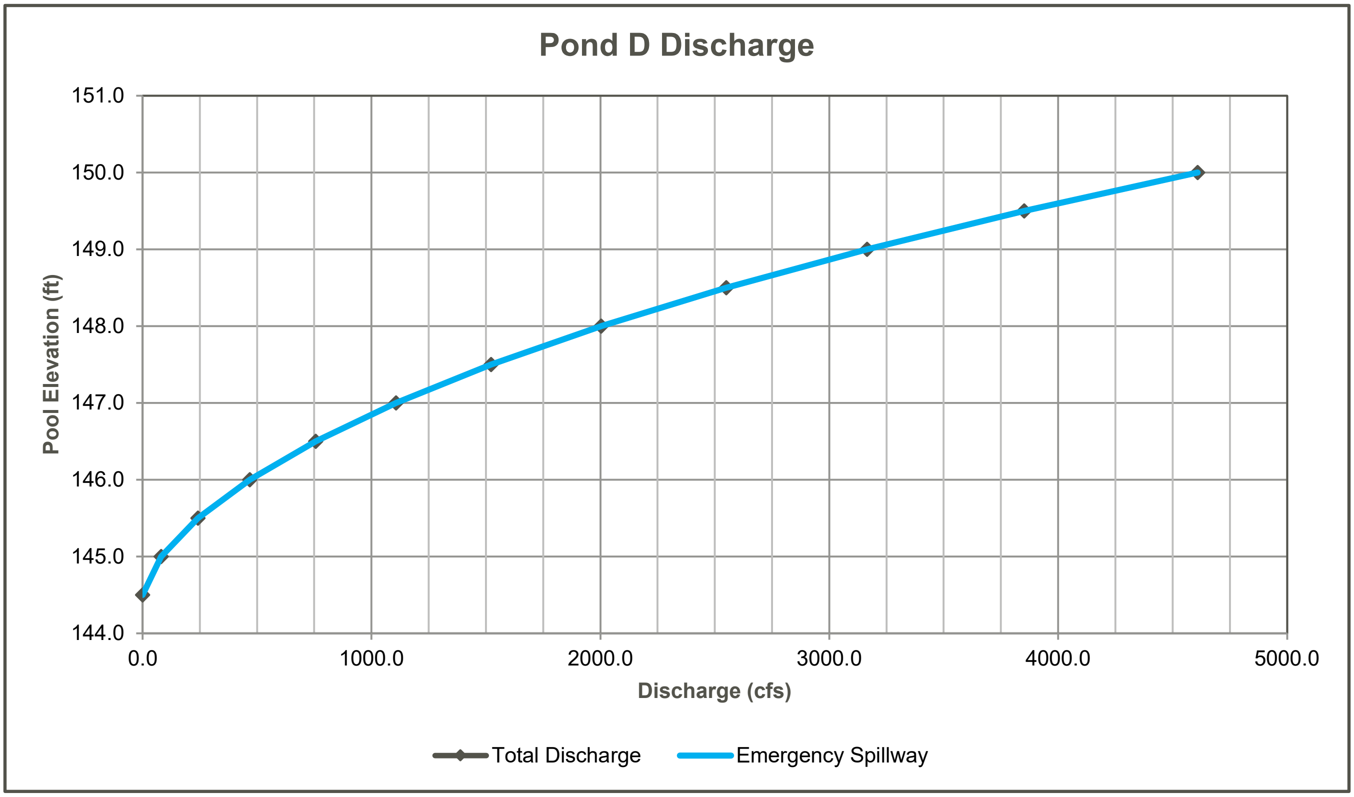
| Pond D Stage Storage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Elevation | Area | | Volume | | Cumulative Volume | | | | Notes |
| (ft) | (sqft) | (acres) | (cuft) | (CY) | (CY) | (cuft) | (ac-ft) | MG | |
| 150.00 | 3194594.0 | 73.338 | 6104936.37 | 226108.75 | 3617981.90 | 97685511 | 2242.55 | 730.74 | Top of Embankment |
| 148.00 | 2912515.0 | 66.862 | 5590046.14 | 207038.75 | 3391873.14 | 91580575 | 2102.40 | 685.07 | |
| 146.00 | 2679155.0 | 61.505 | 5198082.13 | 192521.56 | 3184834.40 | 85990529 | 1974.07 | 643.25 | |
| 144.00 | 2519742.0 | 57.845 | 4917638.93 | 182134.78 | 2992312.84 | 80792447 | 1854.74 | 604.37 | EL 144.5 - Emergency Spillway |
| 142.00 | 2398396.0 | 55.060 | 4709210.19 | 174415.19 | 2810178.06 | 75874808 | 1741.85 | 567.58 | |
| 140.00 | 2311084.0 | 53.055 | 4552698.22 | 168618.45 | 2635762.87 | 71165597 | 1633.74 | 532.35 | |
| 138.00 | 2241790.0 | 51.464 | 4419424.52 | 163682.39 | 2467144.42 | 66612899 | 1529.22 | 498.30 | |
| 136.00 | 2177789.0 | 49.995 | 4293095.16 | 159003.52 | 2303462.03 | 62193475 | 1427.77 | 465.24 | |
| 134.00 | 2115457.0 | 48.564 | 4166400.36 | 154311.12 | 2144458.50 | 57900380 | 1329.21 | 433.12 | |
| 132.00 | 2051109.0 | 47.087 | 4045053.99 | 149816.81 | 1990147.38 | 53733979 | 1233.56 | 401.96 | |
| 130.00 | 1994079.0 | 45.778 | 3928102.75 | 145485.29 | 1840330.56 | 49688925 | 1140.70 | 371.70 | |
| 128.00 | 1934176.0 | 44.403 | 3785046.63 | 140186.91 | 1694845.28 | 45760823 | 1050.52 | 342.31 | |
| 126.00 | 1851174.0 | 42.497 | 3620024.31 | 134074.97 | 1554658.37 | 41975776 | 963.63 | 314.00 | |
| 124.00 | 1769160.0 | 40.614 | 3456054.18 | 128002.01 | 1420583.39 | 38355752 | 880.53 | 286.92 | |
| 122.00 | 1687218.0 | 38.733 | 3318079.36 | 122891.83 | 1292581.38 | 34899697 | 801.19 | 261.07 | |
| 120.00 | 1631020.0 | 37.443 | 3217010.44 | 119148.53 | 1169689.56 | 31581618 | 725.01 | 236.25 | |
| 118.00 | 1586095.0 | 36.412 | 3124197.75 | 115711.03 | 1050541.02 | 28364608 | 651.16 | 212.18 | |
| 116.00 | 1538225.0 | 35.313 | 3027600.34 | 112133.35 | 934829.99 | 25240410 | 579.44 | 188.81 | |
| 114.00 | 1489506.0 | 34.194 | 2926189.02 | 108377.37 | 822696.65 | 22212809 | 509.94 | 166.16 | |
| 112.00 | 1436841.0 | 32.985 | 2783317.21 | 103085.82 | 714319.28 | 19286620 | 442.76 | 144.27 | |
| 110.00 | 1346960.0 | 30.922 | 2638564.78 | 97724.62 | 611233.45 | 16503303 | 378.86 | 123.45 | |
| 108.00 | 1291797.0 | 29.656 | 2464914.45 | 91293.13 | 513508.83 | 13864738 | 318.29 | 103.72 | |
| 106.00 | 1174055.0 | 26.953 | 2260542.76 | 83723.81 | 422215.70 | 11399824 | 261.70 | 85.28 | |
| 104.00 | 1087046.0 | 24.955 | 2092320.13 | 77493.34 | 338491.90 | 9139281 | 209.81 | 68.37 | |
| 102.00 | 1005800.0 | 23.090 | 1885732.61 | 69841.95 | 260998.56 | 7046961 | 161.78 | 52.71 | |
| 100.00 | 881303.0 | 20.232 | 1620773.40 | 60028.64 | 191156.61 | 5161229 | 118.49 | 38.61 | |
| 98.00 | 741482.0 | 17.022 | 1315292.07 | 48714.52 | 131127.97 | 3540455 | 81.28 | 26.48 | |
| 96.00 | 577233.0 | 13.251 | 958362.40 | 35494.90 | 82413.45 | 2225163 | 51.08 | 16.65 | |
| 94.00 | 387416.0 | 8.894 | 645406.29 | 23903.94 | 46918.54 | 1266801 | 29.08 | 9.48 | |
| 92.00 | 262061.0 | 6.016 | 419231.61 | 15527.10 | 23014.61 | 621394 | 14.27 | 4.65 | |
| 90.00 | 161232.0 | 3.701 | 188602.09 | 6985.26 | 7487.51 | 202163 | 4.64 | 1.51 | |
| 88.00 | 40682.0 | 0.934 | 13560.67 | 502.25 | 502.25 | 13561 | 0.31 | 0.10 | |
| 87.00 | 0.0 | 0.000 | - | - | - | - | 0.00 | 0.00 | |



Possum Point - Pond D
4,000,000
3,750,000
3,500,000
3,250,000
3,000,000
2,750,000
2,500,000
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
Storage (CY)
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
Elevation (ft)

**ATTACHMENT C**

# Emergency Spillway Rating Table




| Water Elevation | Head | Discharge Rate |
|---|---|---|
| *(ft-amsl)* | *(ft)* | *(cfs)* |
| 144.5 | 0 | 0.00 |
| 145.0 | 0.5 | 80.94 |
| 145.5 | 1.0 | 241.77 |
| 146.0 | 1.5 | 467.75 |
| 146.5 | 2.0 | 756.46 |
| 147.0 | 2.5 | 1,107.94 |
| 147.5 | 3.0 | 1,523.15 |
| 148.0 | 3.5 | 2,003.46 |
| 148.5 | 4.0 | 2,550.48 |
| 149.0 | 4.5 | 3,165.91 |
| 149.5 | 5.0 | 3,851.51 |
| 150.0 | 5.5 | 4,609.06 |

**ATTACHMENT D**

# PMP Calculation Worksheets

**NOAA Atlas 14, Volume 2, Version 3**
**Location name: Dumfries, Virginia, USA***
**Latitude: 38.5495°, Longitude: -77.285°**
**Elevation: 105.73 ft****
* source: ESRI Maps
** source: USGS

**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 | 0.356 (0.322-0.393) | 0.427 (0.387-0.470) | 0.508 (0.459-0.560) | 0.567 (0.511-0.625) | 0.642 (0.575-0.707) | 0.698 (0.622-0.769) | 0.754 (0.668-0.832) | 0.808 (0.711-0.894) | 0.877 (0.765-0.977) | 0.932 (0.806-1.04) |
| 10-min | 0.569 (0.514-0.627) | 0.683 (0.618-0.752) | 0.813 (0.735-0.896) | 0.906 (0.817-0.999) | 1.02 (0.916-1.13) | 1.11 (0.991-1.23) | 1.20 (1.06-1.32) | 1.28 (1.13-1.42) | 1.39 (1.21-1.55) | 1.47 (1.27-1.64) |
| 15-min | 0.711 (0.643-0.784) | 0.858 (0.777-0.946) | 1.03 (0.929-1.13) | 1.15 (1.03-1.26) | 1.30 (1.16-1.43) | 1.41 (1.25-1.55) | 1.51 (1.34-1.67) | 1.62 (1.42-1.79) | 1.75 (1.52-1.94) | 1.84 (1.59-2.06) |
| 30-min | 0.974 (0.881-1.08) | 1.19 (1.07-1.31) | 1.46 (1.32-1.61) | 1.66 (1.50-1.83) | 1.92 (1.72-2.12) | 2.12 (1.89-2.34) | 2.32 (2.06-2.56) | 2.52 (2.21-2.78) | 2.78 (2.42-3.09) | 2.98 (2.58-3.34) |
| 60-min | 1.22 (1.10-1.34) | 1.49 (1.35-1.64) | 1.87 (1.69-2.07) | 2.16 (1.95-2.38) | 2.56 (2.29-2.82) | 2.87 (2.56-3.17) | 3.19 (2.83-3.53) | 3.53 (3.10-3.91) | 3.99 (3.48-4.44) | 4.36 (3.77-4.87) |
| 2-hr | 1.42 (1.28-1.57) | 1.73 (1.56-1.91) | 2.19 (1.98-2.42) | 2.55 (2.29-2.82) | 3.06 (2.74-3.38) | 3.48 (3.09-3.84) | 3.91 (3.45-4.33) | 4.38 (3.83-4.85) | 5.03 (4.35-5.60) | 5.56 (4.76-6.22) |
| 3-hr | 1.53 (1.38-1.71) | 1.86 (1.67-2.08) | 2.36 (2.12-2.63) | 2.76 (2.46-3.07) | 3.32 (2.95-3.70) | 3.79 (3.34-4.21) | 4.28 (3.74-4.77) | 4.81 (4.17-5.37) | 5.56 (4.76-6.23) | 6.18 (5.23-6.95) |
| 6-hr | 1.88 (1.70-2.11) | 2.28 (2.05-2.55) | 2.88 (2.58-3.22) | 3.37 (3.01-3.77) | 4.10 (3.63-4.58) | 4.71 (4.14-5.26) | 5.37 (4.68-6.01) | 6.09 (5.24-6.82) | 7.15 (6.06-8.05) | 8.04 (6.72-9.08) |
| 12-hr | 2.28 (2.04-2.57) | 2.75 (2.46-3.10) | 3.50 (3.12-3.93) | 4.13 (3.67-4.64) | 5.09 (4.47-5.70) | 5.92 (5.15-6.63) | 6.84 (5.89-7.68) | 7.87 (6.69-8.85) | 9.43 (7.86-10.7) | 10.8 (8.83-12.2) |
| 24-hr | 2.57 (2.33-2.88) | 3.11 (2.82-3.49) | 4.03 (3.65-4.51) | 4.82 (4.35-5.39) | 6.04 (5.41-6.71) | 7.11 (6.32-7.88) | 8.32 (7.34-9.18) | 9.69 (8.46-10.7) | 11.8 (10.1-12.9) | 13.6 (11.6-14.9) |
| 2-day | 2.98 (2.70-3.32) | 3.62 (3.28-4.03) | 4.67 (4.22-5.20) | 5.57 (5.02-6.19) | 6.94 (6.22-7.68) | 8.13 (7.24-8.97) | 9.46 (8.35-10.4) | 10.9 (9.57-12.0) | 13.2 (11.4-14.5) | 15.1 (12.9-16.7) |
| 3-day | 3.16 (2.87-3.52) | 3.83 (3.48-4.27) | 4.93 (4.47-5.48) | 5.88 (5.31-6.52) | 7.30 (6.54-8.07) | 8.53 (7.60-9.41) | 9.90 (8.75-10.9) | 11.4 (10.0-12.6) | 13.7 (11.9-15.1) | 15.7 (13.4-17.3) |
| 4-day | 3.35 (3.04-3.72) | 4.05 (3.68-4.51) | 5.20 (4.71-5.77) | 6.19 (5.59-6.85) | 7.65 (6.87-8.45) | 8.93 (7.97-9.84) | 10.3 (9.16-11.4) | 11.9 (10.5-13.1) | 14.3 (12.4-15.6) | 16.3 (14.0-17.9) |
| 7-day | 3.89 (3.56-4.27) | 4.69 (4.29-5.16) | 5.93 (5.42-6.52) | 6.99 (6.37-7.67) | 8.56 (7.77-9.38) | 9.91 (8.94-10.8) | 11.4 (10.2-12.4) | 13.0 (11.6-14.2) | 15.5 (13.6-16.8) | 17.5 (15.2-19.1) |
| 10-day | 4.45 (4.09-4.86) | 5.35 (4.92-5.84) | 6.67 (6.13-7.28) | 7.77 (7.12-8.47) | 9.37 (8.55-10.2) | 10.7 (9.73-11.6) | 12.1 (11.0-13.2) | 13.7 (12.3-14.9) | 15.9 (14.2-17.3) | 17.8 (15.7-19.3) |
| 20-day | 6.00 (5.58-6.48) | 7.14 (6.63-7.71) | 8.63 (8.02-9.31) | 9.84 (9.13-10.6) | 11.5 (10.7-12.4) | 12.9 (11.9-13.9) | 14.3 (13.1-15.4) | 15.8 (14.4-17.0) | 17.8 (16.1-19.2) | 19.4 (17.5-21.0) |
| 30-day | 7.37 (6.87-7.90) | 8.72 (8.14-9.36) | 10.4 (9.68-11.1) | 11.7 (10.9-12.5) | 13.5 (12.6-14.5) | 15.0 (13.9-16.0) | 16.4 (15.2-17.6) | 17.9 (16.5-19.2) | 20.0 (18.3-21.4) | 21.6 (19.6-23.1) |
| 45-day | 9.26 (8.69-9.83) | 10.9 (10.3-11.6) | 12.8 (12.0-13.6) | 14.2 (13.3-15.1) | 16.1 (15.1-17.1) | 17.5 (16.4-18.6) | 18.9 (17.7-20.1) | 20.3 (18.9-21.5) | 22.1 (20.5-23.5) | 23.4 (21.6-24.9) |
| 60-day | 11.0 (10.4-11.6) | 12.9 (12.2-13.7) | 15.0 (14.1-15.8) | 16.5 (15.5-17.4) | 18.4 (17.3-19.5) | 19.9 (18.7-21.0) | 21.2 (19.9-22.4) | 22.5 (21.1-23.8) | 24.2 (22.5-25.6) | 25.4 (23.6-26.9) |

[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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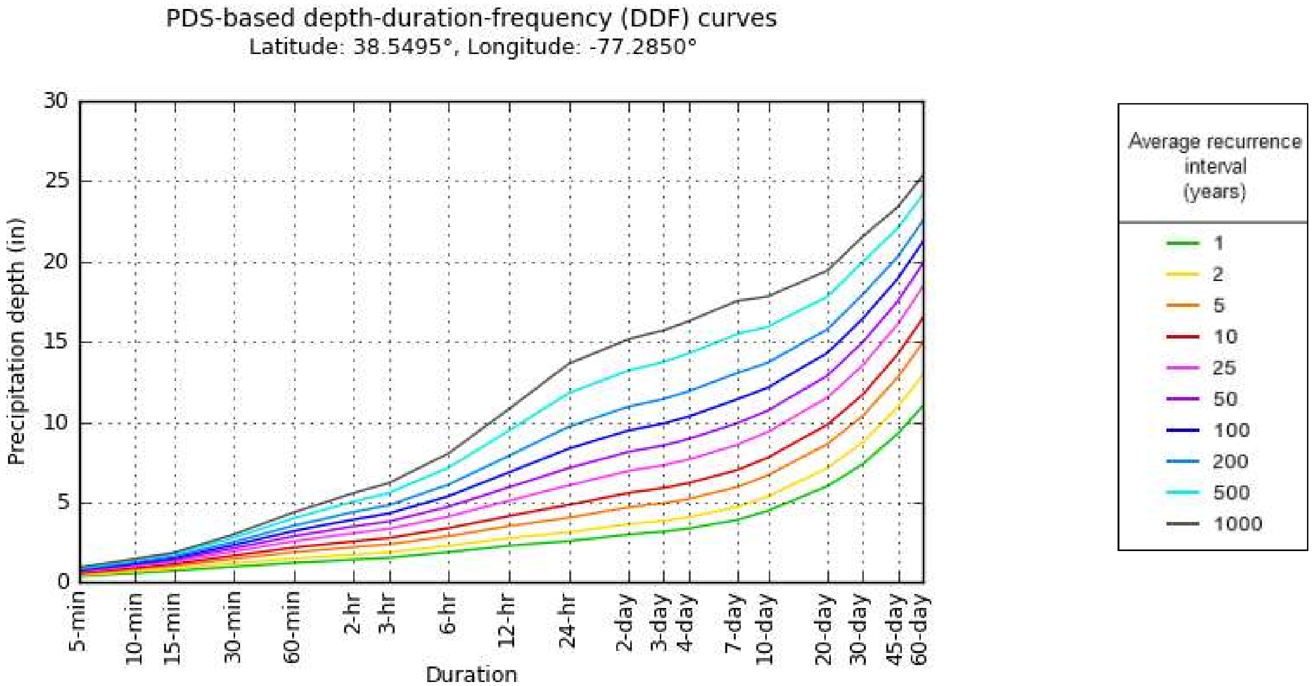
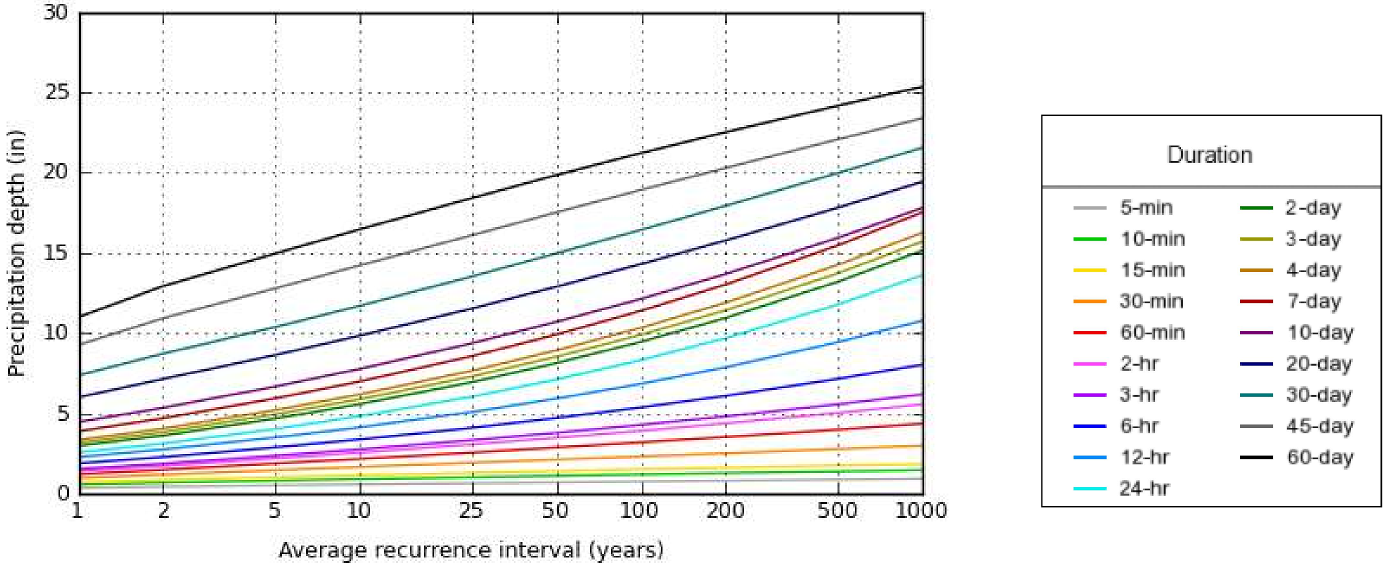
## PF graphical




NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Thu Aug 12 19:54:15 2021

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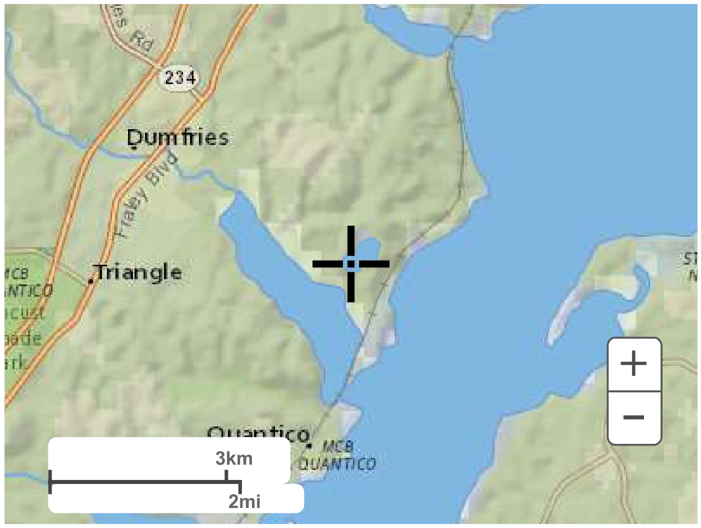
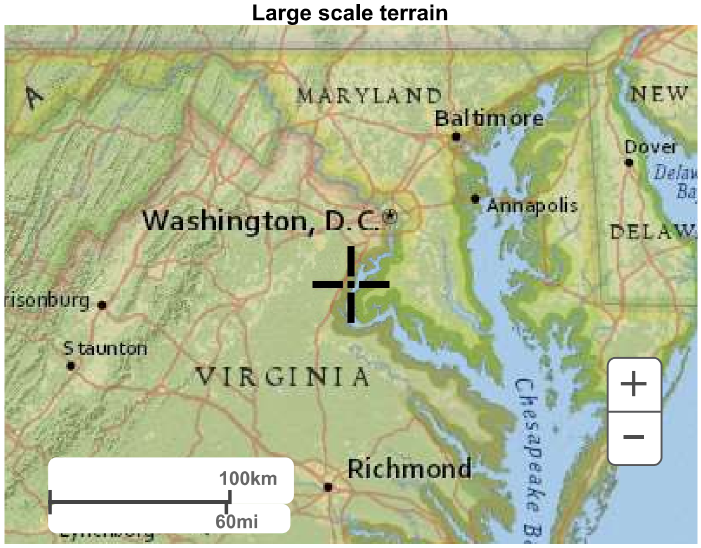
## Maps & aerials

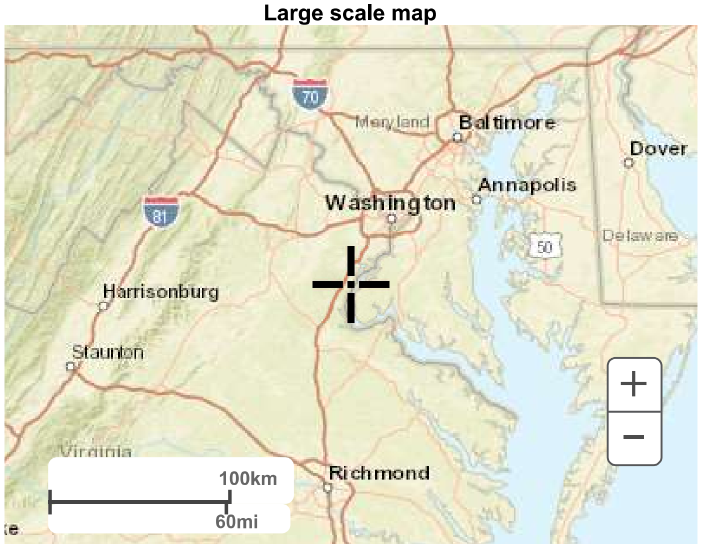
**Small scale terrain**



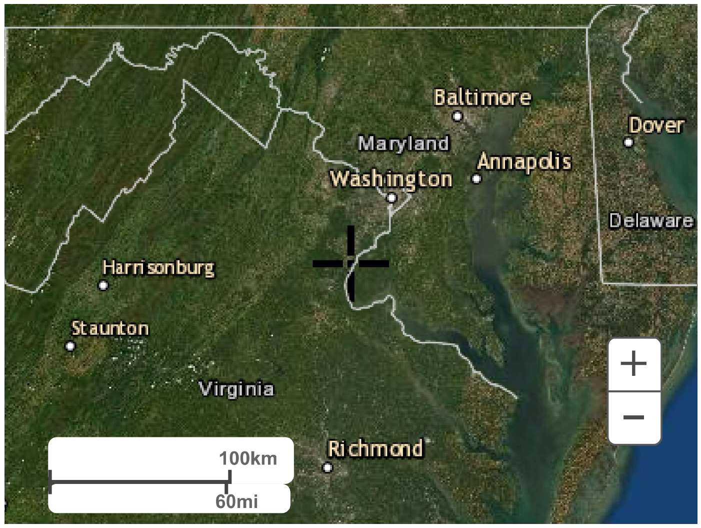

**Large scale terrain**




**Large scale map**




**Large scale aerial**

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

DCR
Virginia Department of Conservation & Recreation

# Certification Form: Review of New Probable Maximum Precipitation Values (Effective March 23, 2016) Using the PMP Evaluation Tool

Name of Dam (Print): Possum Point Ash Pond D; Inventory Number for Dam: 153020 ; Dam in County or City: Prince William

## CERTIFICATION BY OWNER'S ENGINEER

I certify that I have evaluated the new probable maximum precipitation (PMP) values, and have found that one of the following conditions has occurred: (1) each of the governing PMP values for the 6-, 12-, and 24-hour durations have decreased from previously utilized HMR PMP values or (2) the PMP value for the controlling storm has decreased from previously utilized HMR values and still results in the largest outflow from the dam when compared to the other two durations. I therefore find that the original dam break inundation zone map and the emergency action plan/ emergency preparedness plan on file remain protective of public safety. I have attached a completed copy of the *Virginia PMP 2015 Watershed Calculation Spreadsheet* and my supporting calculations to serve as the confirmation record. Further, I have notified the impounding structure owner of my findings.

Signed: ______________________ John R. Klamut Virginia Number: 048859
Professional Engineer's Signature Print Name

This 7th day of October , 20 20 .

Engineer's Virginia Seal: COMMONWEALTH OF VIRGINIA JOHN R. KLAMUT Lic. No. 048859 PROFESSIONAL ENGINEER

## CERTIFICATION BY OWNER

I, as the Owner of the impounding structure, certify that my engineer has evaluated the new probable maximum precipitation (PMP) values and advised me of the findings. I recognize that one of the following conditions has occurred: (1) each of the governing PMP values for the 6-, 12-, and 24-hour durations have decreased from previously utilized HMR PMP values or (2) the PMP value for the controlling storm has decreased from previously utilized HMR values and still results in the largest outflow from the dam when compared to the other two durations. In addition, I also certify that the original dam break inundation zone map and the emergency action plan/ emergency preparedness plan on file remain protective of public safety. I agree that should an evaluation be required in accordance with § 10.1-606.3 of the *Code of Virginia* to assess any development proposed within the boundaries of the dam break inundation zone below this impounding structure, that I shall upon notification from the Department of Conservation and Recreation immediately initiate efforts to update the dam break inundation zone map for my impounding structure so that a refined impact of the development may be assessed.

Signed: ______________________ Shaikh Z. Rahman
Owner's Signature Print Name

This 8th day of October , 20 20 .

**Mail the executed form to the appropriate**
**Department of Conservation and Recreation**
**Division of Dam Safety and Floodplain Management**
**Regional Engineer**

gai consultants

Richmond Office
120 Eastshore Drive
Suite 120
Glen Allen, Virginia 23060

T 804.729.8493
F 804.270.9358

October 7, 2020

Project No. (C150132.14)

Mr. Shaikh Rahman, PE
Engineer III
Dominion Energy
600 East Canal Street
Richmond, VA 23219

**PMP Evaluation for Possum Point Pond D**
**Possum Point Power Station**
**Prince William County, Virginia**

Dear Mr. Rahman:

The Virginia Department of Conservation and Recreation (VDCR) released revised Probable Maximum Precipitation (PMP) values in November 2015. The Virginia Soil and Water Conservation Board adopted the PMP Study for Virginia and the associated PMP Evaluation Tool and Database on December 9, 2015.

VDCR requires dam owners to certify that they have reviewed the revised PMP values and that they have addressed any required changes to the spillway designs or inundation mapping for the facility, if required.

This letter supports GAI Consultants certification that the revised PMP values do not increase the estimated controlling hydraulic conditions analyzed for The Possum Point Power Station Pond D, as developed in the 2012 Inundation Study and that revisions to the inundation mapping and/or design of the facility spillways are not required.

## Calculations

Per Section “D” of the VDCR 2015 PMP Watershed Calculations Worksheet, Option “C” applies when one or two of the 2015 PMP values increased when compared to the previously computed HMR 51 values. Option “C” requires that Calculation Sections “E” and “F” of the worksheet to be completed. For Pond D, two of the 2015 PMP values increased. The increase in the 6-Hr PMP event is 0.60 inches as governed by the Local Storm Event. The increase in the 12-Hr PMP is 1.00 inches as governed by the Tropical Storm Event.

To evaluate the revised PMP values, the HEC-HMS program was executed. The table below presents the calculated values from the original design for the 24-hour PMF, as well as with the revised PMP Values.

| PMP Source | Storm Duration (hr) | Rainfall (in) | Peak Inflow (cfs) | Peak Outflow (cfs) | Max Water Surface (ft) | Inflow Volume (ac-ft) |
|---|---|---|---|---|---|---|
| *HMR-51* | *24* | *37* | *971* | *449.1* | *145* | *321.7* |
| | | | | | | |
| VA Local | 6 | 28.4 | 976.5 | 208.5 | 144.5 | 211.1 |
| | 12 | 32.4 | 993.7 | 259.9 | 144.6 | 248.8 |
| | 24 | 32.4 | 994.2 | 261.5 | 144.6 | 250.2 |
| | | | | | | |
| VA Tropical | 6 | 22.2 | 1139.9 | 57.3 | 144.0 | 156.4 |
| | 12 | 33.8 | 1205.5 | 196.4 | 144.5 | 261.5 |
| | 24 | 33.8 | 1206.1 | 197.1 | 144.5 | 262.9 |

## Findings

As previously stated, the new PMP rainfall values for the 6-Hr and the 12-Hr storm events increased compared to the rainfall values of HMR 51. However, from the HEC-HMS analysis, the estimated peak discharge of the new PMP 6-Hr and 12-Hr storm events remains below those of the peak discharge rate estimated for the 24-hour controlling PMP under HMR-51.

## Conclusion

GAI's analysis indicates that the flow rates and volumes estimated in the 2012 Inundation Study using the HMR 51 methodology for the 24-hour event are larger than those produced when using the estimated VDCR PMP values for the 6-hour, 12-hour, and 24-hour events. As such, the previous design for the existing principal and emergency spillway at the site remains adequate for the new VDCR PMP values and the inundation mapping provides a conservative estimate of breach and non-breach conditions for Pond D.

If you have any questions regarding this information, please feel free to contact Mr. John Klamut at 412.399.5425.

Sincerely,

**GAI Consultants, Inc.**

Adam B. Scheller

Digitally signed by Adam B. Scheller
DN: E=a.scheller@gaiconsultants.com, CN=Adam B. Scheller
Date: 2020.10.07 17:57:35-04'00'

Adam B. Scheller, PE
Assistant Engineering Manager

Digitally signed by John R. Klamut
DN: E=J.Klamut@gaiconsultants.com, CN=John R. Klamut
Date: 2020.10.07 18:00:11-04'00'

John R. Klamut, PE
Senior Project Manager

Note : This sheet should be used in consultation with the *Guidance Document on New Probable Maximum Precipitation (PMP) Implementation* (March 23, 2016) and the *Certification Form: Review of New Probable Maximum Precipitation Values (Effective March 23, 2016) Using the PMP Evaluation Tool* .

# Virginia 2015 PMP Watershed Calculation Worksheet (SEPTEMBER 2016 version)

Dam: Possum Point Power Station Ash Pond D (Inventory No. 153020)

Date: 10/7/2020

Company: Dominion Generation

Engineer: John Klamut

**NOTES**

A. PLEASE ENSURE ALL RELEVANT SECTIONS ARE FILLED OUT (PLEASE SCROLL DOWN THROUGH ENTIRE WORKSHEET)

B. PLEASE ENSURE CELLS WITH EMBEDDED CALCULATIONS (CELLS WITH NO BLUE COLOR) ARE REFERENCING THE CORRECT NUMBERS. WHEN ADDING OR DELETING ROWS FOR GRID POINTS, CELLS WITH EMBEDDED CALCULATIONS MAY BE REFERENCING THE WRONG INFORMATION. PLEASE CHECK CALCULATION CELLS!

C. PLEASE ENSURE THAT ALL SUPPORTING DOCUMENTATION AND CALCULATIONS REQUIRED FOR THIS SUMMARY SHEET ARE INCLUDED IN SUBMITTAL (ESPECIALLY INFORMATION FOR SDF CALCULATIONS IN SECTIONS E AND F).

| Example Cell | **Cells Requiring User Input are Highlighted in Blue** |
|---|---|
| | |

## Calculation Section A - Drainage Area to Dam

Information obtained from GIS shapefile / watershed boundary analysis or previously completed Dam Failure Analysis

| | | |
|---|---|---|
| Drainage Area | 117.30 | 0.183 |
| | Acres | Sq. Miles |

## Calculation Section B - Original HMR 51/52 Values

Information obtained from previously computed HMR 51/52 program (previously completed Dam Failure Analysis)

| | | |
|---|---|---|
| 6-hr HMR 51/52 PMP Value | 28 | in / 6-hr |
| 12-hr HMR 51/52 PMP Value | 33 | in / 12-hr |
| 24-hr HMR 51/52 PMP Value | 37 | in / 24-hr |

## Calculation Section C - New 2015 PMP Values

Information obtained from new 2015 PMP GIS Evaluation Tool (see the PMP section of the DCR Dam Safety website for more details)

**General Storm Events**

| Grid Pts | Point X | Point Y | Zone | 6 Hr. PMP | 12 Hr. PMP | 24 Hr. PMP | Controlling 6 Hr. Storm | Controlling 12 Hr. Storm | Controlling 24 Hr. Storm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -77.3 | 38.55 | 6 | 16 | 18.6 | 22.8 | SPAS_1339_1 | SPAS_1339_1 | SPAS_1201_1 |
| 2 | -77.275 | 38.55 | 6 | 16 | 18.6 | 23 | SPAS_1339_1 | SPAS_1339_1 | SPAS_1201_1 |
| | | Average PMP Values: | | 16.0 | 18.6 | 22.9 | | | |

**Local Storm Events**

| Grid Pts | Point X | Point Y | Zone | 6 Hr. PMP | 12 Hr. PMP | 24 Hr. PMP | Controlling 6 Hr. Storm | Controlling 12 Hr. Storm | Controlling 24 Hr. Storm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -77.3 | 38.55 | 6 | 28.3 | 32.3 | 32.3 | SPAS_1534_1 | SPAS_1534_1 | SPAS_1534_1 |
| 2 | -77.275 | 38.55 | 6 | 28.4 | 32.4 | 32.4 | SPAS_1534_1 | SPAS_1534_1 | SPAS_1534_1 |

| | | | |
|---|---|---|---|
| Average PMP Values: | 28.4 | 32.4 | 32.4 |

**Tropical Storm Events**

| Grid Pts | Point X | Point Y | Zone | 6 Hr. PMP | 12 Hr. PMP | 24 Hr. PMP | Controlling 6 Hr. Storm | Controlling 12 Hr. Storm | Controlling 24 Hr. Storm |
|---|---|---|---|---|---|---|---|---|---|
| 1 | -77.3 | 38.55 | 6 | 22.1 | 33.6 | 33.6 | SPAS_1491_1 | SPAS_1491_1 | SPAS_1491_1 |
| 2 | -77.275 | 38.55 | 6 | 22.2 | 33.8 | 33.8 | SPAS_1491_1 | SPAS_1491_1 | SPAS_1491_1 |

| | | | |
|---|---|---|---|
| Average PMP Values: | 22.2 | 33.7 | 33.7 |

**Governing PMP Values from Storm Events**

| | 6 Hr. PMP | 12 Hr. PMP | 24 Hr. PMP |
|---|---|---|---|
| Governing PMP Values for Watershed | **28.4** | **33.7** | **33.7** |

## Calculation Section D - Comparison Calculations - Original HMR 51/52 Values vs. New 2015 PMP Values

Information for these calculations obtained from data provided in this spreadsheet. Section provides comparison between HMR 51/52 rainfall values and new 2015 PMP rainfall values. Please review options presented below and DCR Dam Safety PMP Guidance Documentation to determine if SDF calculations are required (next section).

| Storm Duration, hrs. | HMR 51/52 Value, in/hr | Governing 2015 PMP Value, in/hr | Comparison | Percent Difference, % |
|---|---|---|---|---|
| 6 | 28 | 28.4 | **0.35** | 1.25% |
| 12 | 33 | 33.7 | **0.70** | 2.12% |
| 24 | 37 | 33.7 | **-3.30** | -8.92% |

**Section Completion Options**

**Option A** - The Dam in question has no previously completed (or approved) Inundation Study and will only be utilizing the Governing 2015 PMP values for the new Dam Failure Analysis. Calculation Section E and Calculation Section F are not required as the SDF for the Dam in question will be calculated from the new Dam Failure Analysis. This option only applies to Dams with no previously completed (or approved) Inundation Study on file with DCR Dam Safety.

**Option B** - All three of the new Governing 2015 PMP values decreased when compared to the previously completed HMR 51/52 values (negative values for all three storm durations in the comparison column above). At this time, revisions to the existing Inundation Maps / EAPs for the Dam in question are optional and not generally required [Please refer to the *Guidance Document on New Probable Maximum Precipitation (PMP) Implementation* for further details, restrictions, and exceptions]. Please fill out information below in Calculation Section E Only. Calculation Section F is not required for this option.

**<u>Option C</u>** - One or two of the new Governing 2015 PMP values <u>increased</u> when compared to the previously completed HMR 51/52 values (positive values for one or two storm durations in the comparison column above). At this time, revisions to the existing Inundation Maps / EAPs for the Dam in question may be required depending on further analysis of the Dam in question [Please refer to the *Guidance Document on New Probable Maximum Precipitation (PMP) Implementation* for further details, restrictions, and exceptions]. Please fill out information below in Calculation Section E and Calculation Section F as both are required. It must be determined if either of these new increased PMP values have become the controlling storm for the basin in question.

**<u>Option D</u>** - All of the new Governing 2015 PMP values <u>increased</u> when compared to the previously completed HMR 51/52 values (positive values for all three storm durations in the comparison column above). At this time revisions to the existing Inundation Maps / EAP's for the Dam in question will be required for the Dam in question [Please refer to the *Guidance Document on New Probable Maximum Precipitation (PMP) Implementation* for further details, restrictions, and exceptions]. Please fill out information below in Calculation Section E and Calculation Section F as both are required.

---

## Calculation Section E - Current Flow and SDF for Dam in Question

Information for this calculation section obtained from previously completed Dam Failure Analysis hydrology calculations (HEC-1 or HEC-HMS). Section provides existing controlling storm for Dam in question, existing controlling flow (flow to Dam) from controlling storm for Dam in question, flow existing Dam in question can pass without overtopping, storm event (SDF) existing Dam in question can pass without overtopping, and storm event (SDF) existing Dam in question must pass per Regulations.

| | | |
|---|---|---|
| Current controlling storm duration for Dam (6, 12, or 24): | 24 | hour |
| PMF Flow TO existing Dam during controlling storm duration | 971 | cfs |
| Flow existing Dam can pass without overtopping | 3124 | cfs |
| Storm event (SDF) existing Dam can pass without overtopping (calc) | 3.22 | PMF storm |
| Storm event (SDF) existing Dam <u>must</u> pass per State DS Regulations | 0.5 PMF | storm |

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## Calculation Section F - Revised Flow and SDF Calculations for Dam in Question

Information for this calculation section obtained from Calculation Section E and revised Dam Failure Analysis hydrology calculations (HEC-1 or HEC-HMS) (Please see DCR Dam Safety PMP Guidance Document). Section provides information on the revised controlling 6-hr, 12-hr, or 24-hr storm duration (if revisions needed), revised controlling storm for Dam in question (or previous controlling storm if no changes found), revised controlling flow (flow to Dam) from controlling storm for Dam in question, flow existing Dam in question can pass without overtopping (information from Calculation Section E), revised storm event (SDF) existing Dam in question can pass without overtopping, and storm event (SDF) existing Dam in question must pass per Regulations (information from Calculation Section E).

| | | |
|---|---|---|
| Did controlling storm duration for the Dam change based on revised flow / SDF data? | no | yes or no |
| Controlling storm duration for Dam based on Revised Data (6, 12, or 24): | 24 | hour |
| Revised PMF Flow TO existing Dam during revised controlling storm duration | 971 | cfs |
| Flow existing Dam can pass without overtopping (From Calculation Section E) | 3124 | cfs |
| Revised Storm event (SDF) existing Dam can pass without overtopping (calc) | 3.22 | PMF storm |
| Storm event (SDF) existing Dam <u>must</u> pass per State DS Regulations | 0.5 PMF | storm |
| Based on the revised flow / SDF values, can the Dam in question now pass the required SDF per State DS Regulations without overtopping? | yes | yes or no |

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This sheet should be used in consultation with VA PMP Temporal Distribution Training Document, Guidance Doc. on Dam Break Inundation Zone Modeling & Mapping Procedures (current version), 2018 VA PMP Temporal Distribution Analysis (Effective June 28, 2018), and VA 2015 PMP Watershed Calculations Worksheet (current version) in conjunction with the PMP Evaluation Tool.

# VA 2018 PMP Temporal Distribution Calculation Worksheet (Aug. 2018 Ver.)

| | |
|---|---|
| Date: | 08/06/21 |
| Dam: | Bremo North Ash Pond (#15320) |
| Dam Location: | Prince William County/Possum Point |
| Company: | Golder Associates |
| Engineer: | Jeremy Frantz, EIT |

**Cells Requiring User Input / Selection are Highlighted in Blue**
Example Cell

## Calculation Section A - PMP Values from VA 2015 PMP Watershed Calculation Worksheet

Data for this section should be obtained from Section C of the VA 2015 PMP Watershed Calculations Worksheet (current version)

### Average PMP Values by Storm Duration as Calculated through Virginia PMP Worksheet

| | | 0.9 6-Hour PMP | 0.9 12-Hour PMP | 0.9 24-Hour PMP |
|---|---|---|---|---|
| **GENERAL STORM EVENTS:** | Average PMP Values | 14.4 | 16.7 | 20.6 |
| **LOCAL STORM EVENTS:** | Average PMP Values | 25.6 | 29.2 | 29.2 |
| **TROPICAL STORM EVENTS:** | Average PMP Values | 20.0 | 30.3 | 30.3 |

### Governing PMP Values as Calculated through Virginia PMP Worksheet

| | Governing 0.9 6 Hr. PMP | Governing 0.9 12 Hr. PMP | Governing 0.9 24 Hr. PMP |
|---|---|---|---|
| Governing PMP Values for Watershed | **25.6** | **30.3** | **30.3** |
| Governing Storm Type (General, Local, or Tropical) | Local | Tropical | Tropical |

## Calculation Section B - Required PMP Input for Temporal Distribution Curve Calculations

This section is for internal calculation purposes only & will be auto-filled with information from Calculation Section A of this worksheet.

| Duration (hr.) | General 0.9 PMP (in) | Local 0.9 PMP (in) | Tropical 0.9 PMP (in) |
|---|---|---|---|
| 6 | **14.40** | **25.56** | **19.98** |
| 12 | **16.74** | **29.16** | **30.33** |
| 24 | **20.61** | **29.16** | **30.30** |

## Calculation Section C - Required OUTPUT Information for Temporal Distribution Curve

Data for this section should be obtained from Dam's physical location (East / West of drainage divide per Map Tab) & curve tabs located within worksheet. User shall evaluate PMP values to determine which value is controlling in order to choose correct temporal distribution curve. User shall provide controlling curves utilized in dropdown cells below. Not all temporal distribution curves provided in this worksheet will be utilized. It is up to the user to determine which curves are applicable for their Dam.

| | |
|---|---|
| Dam Location (State Drainage Perspective): | **East** |
| 6-Hour Temporal Distribution Curve Utilized: | **6-Hour EAST Local Curve** |

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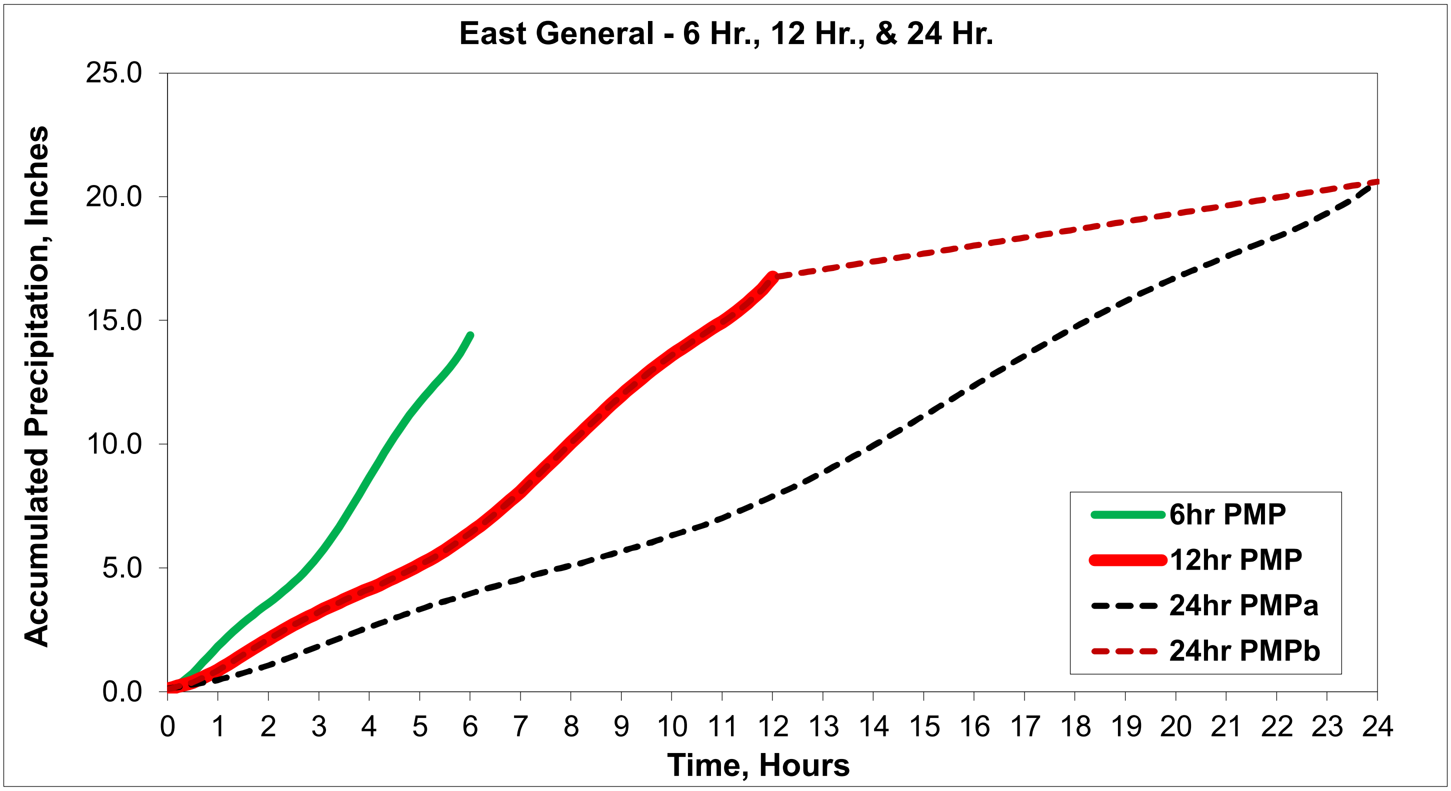
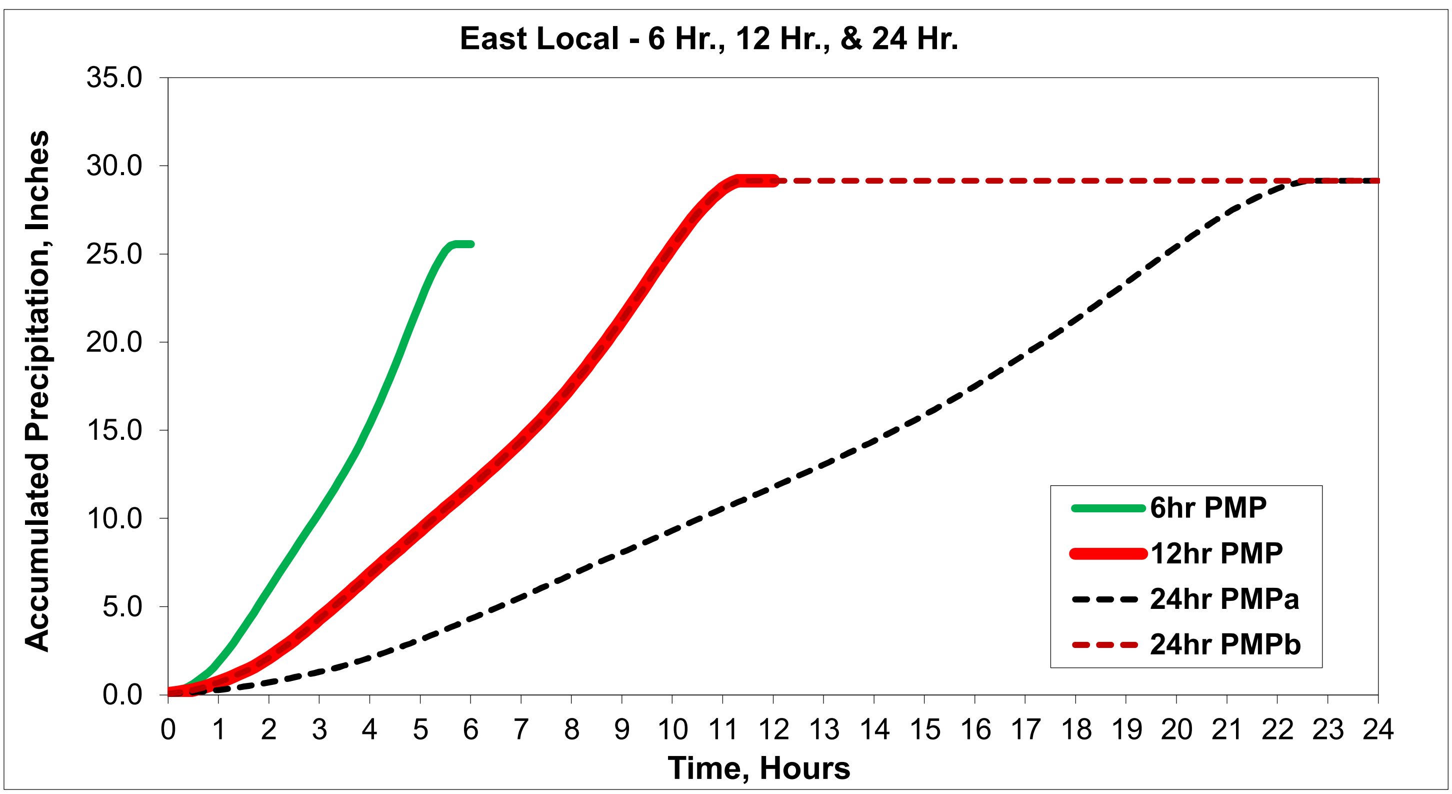
| | |
|---|---|
| 12-Hour Temporal Distribution Curve Utilized: | **12-Hour EAST Tropical Curve** |
| 24-Hour Temporal Distribution Curve Utilized: | **24-Hour EAST Tropical Curve (B Distribution)** |

## Calculation Section D - OUTPUT Information for Temporal Distribution Curve



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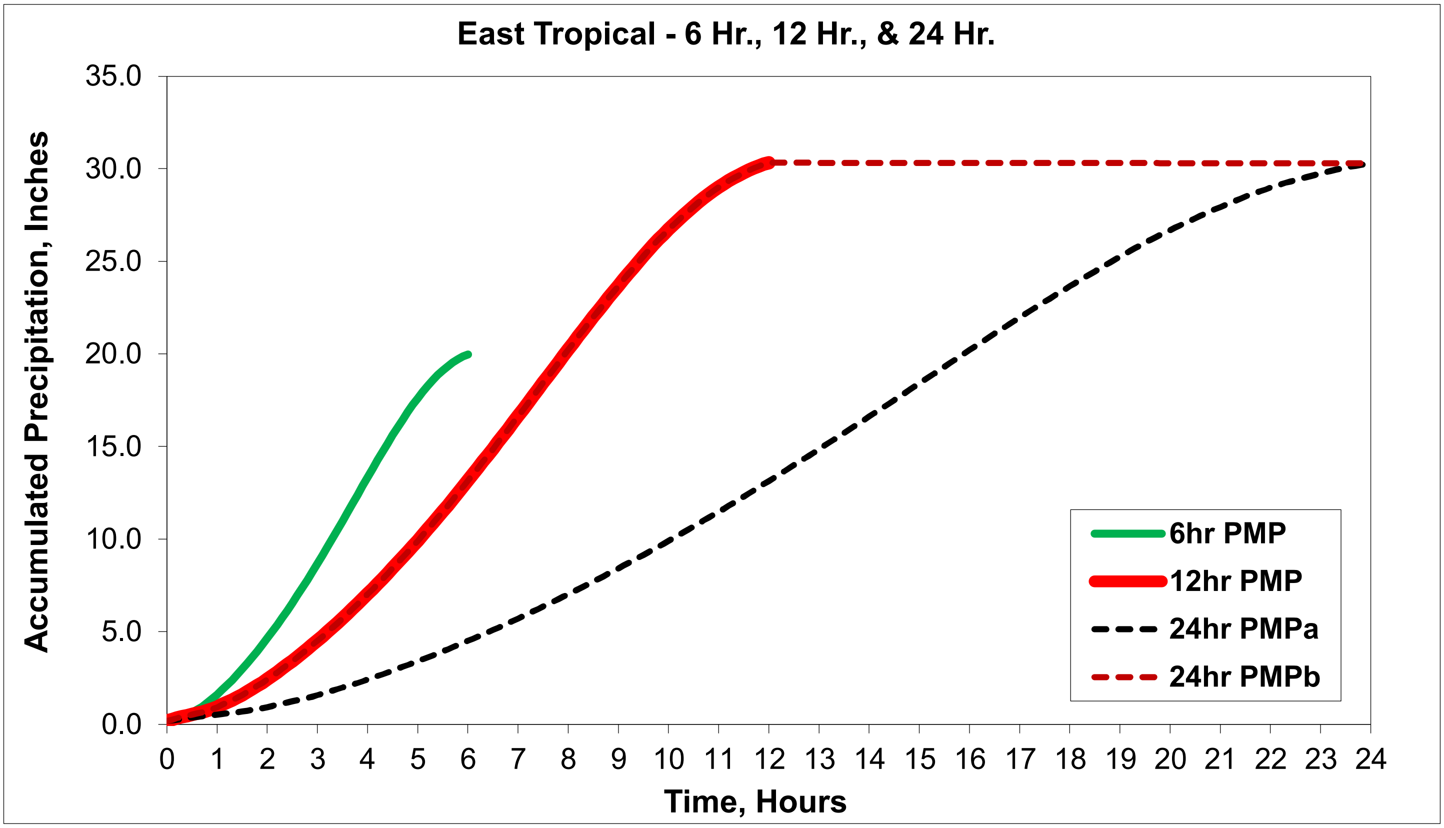
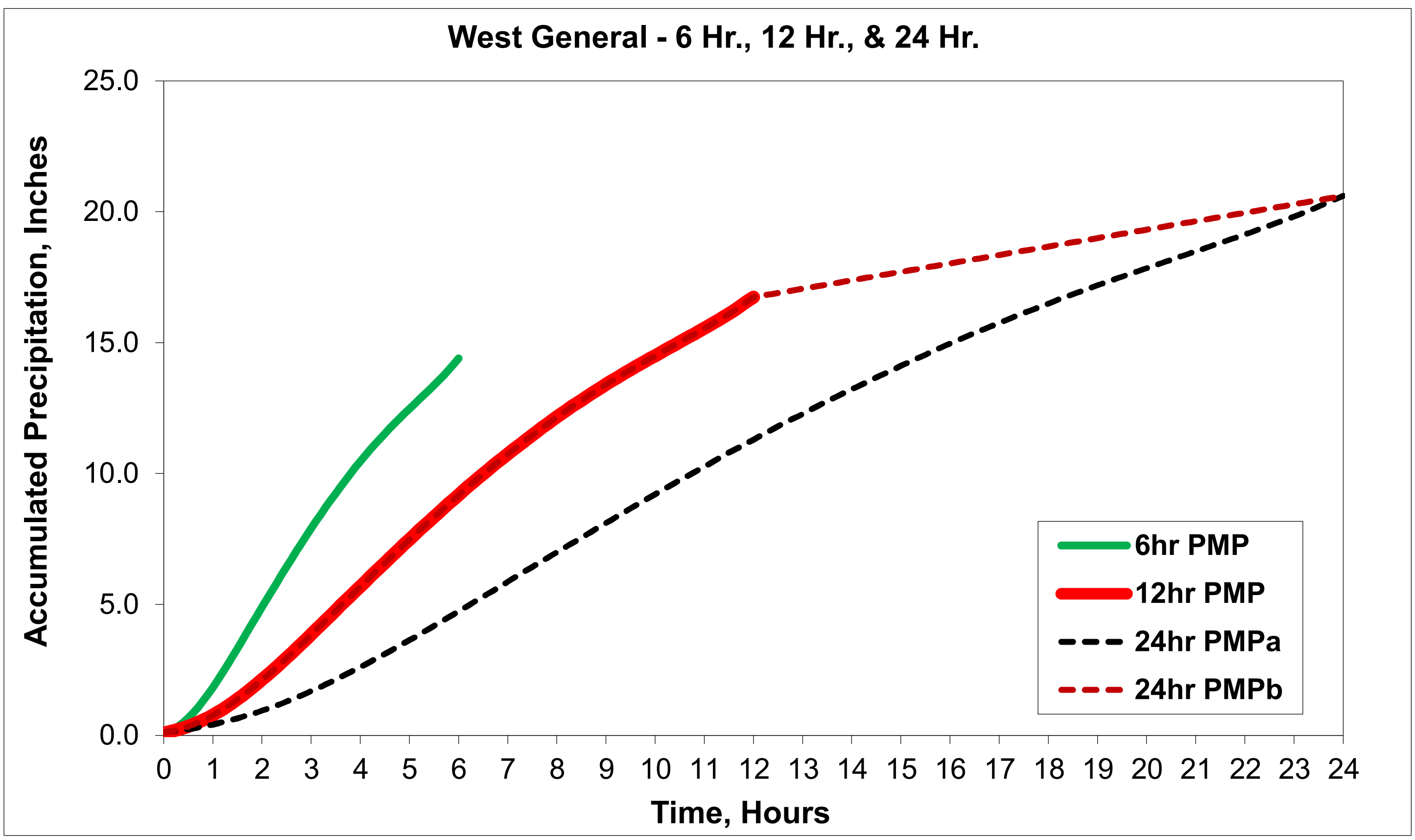
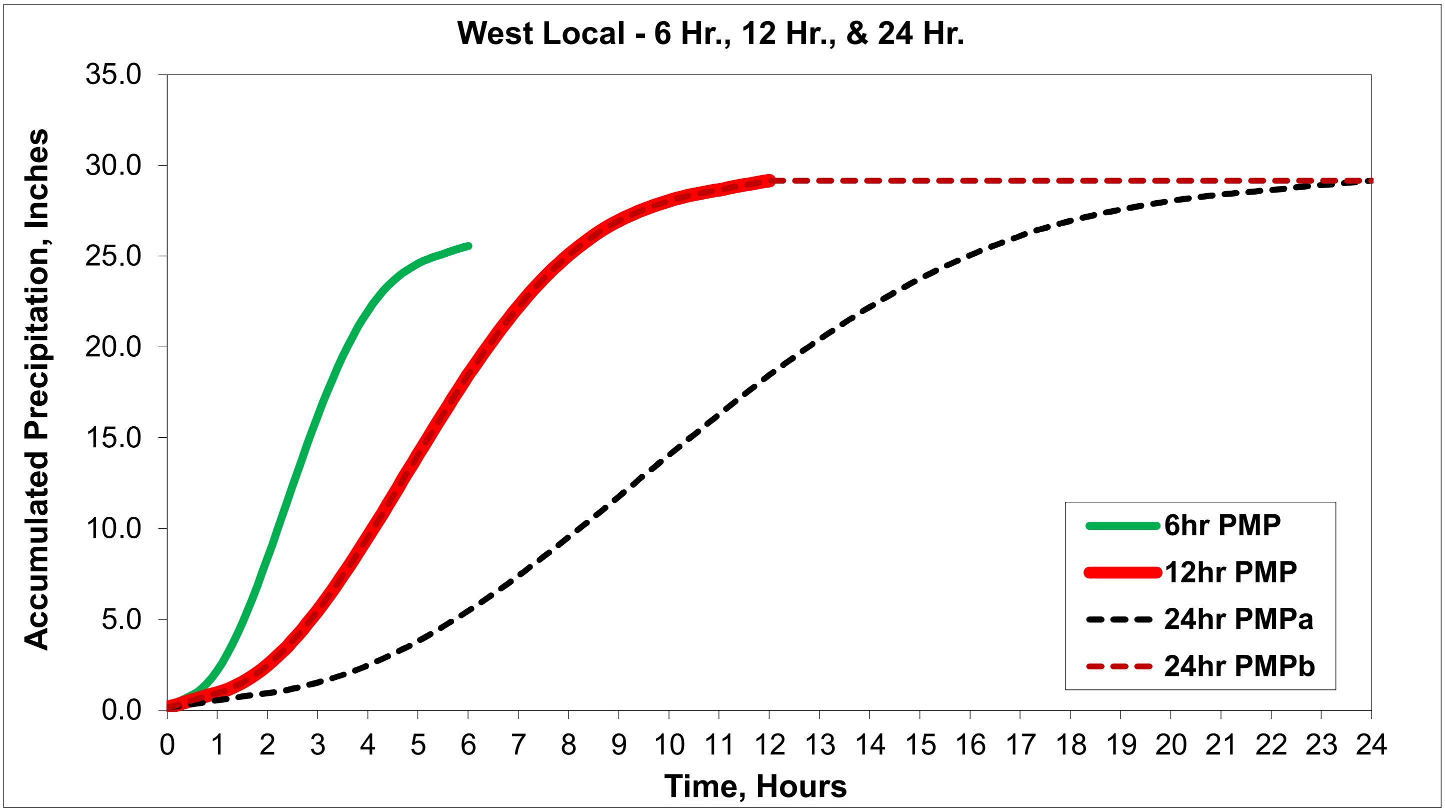
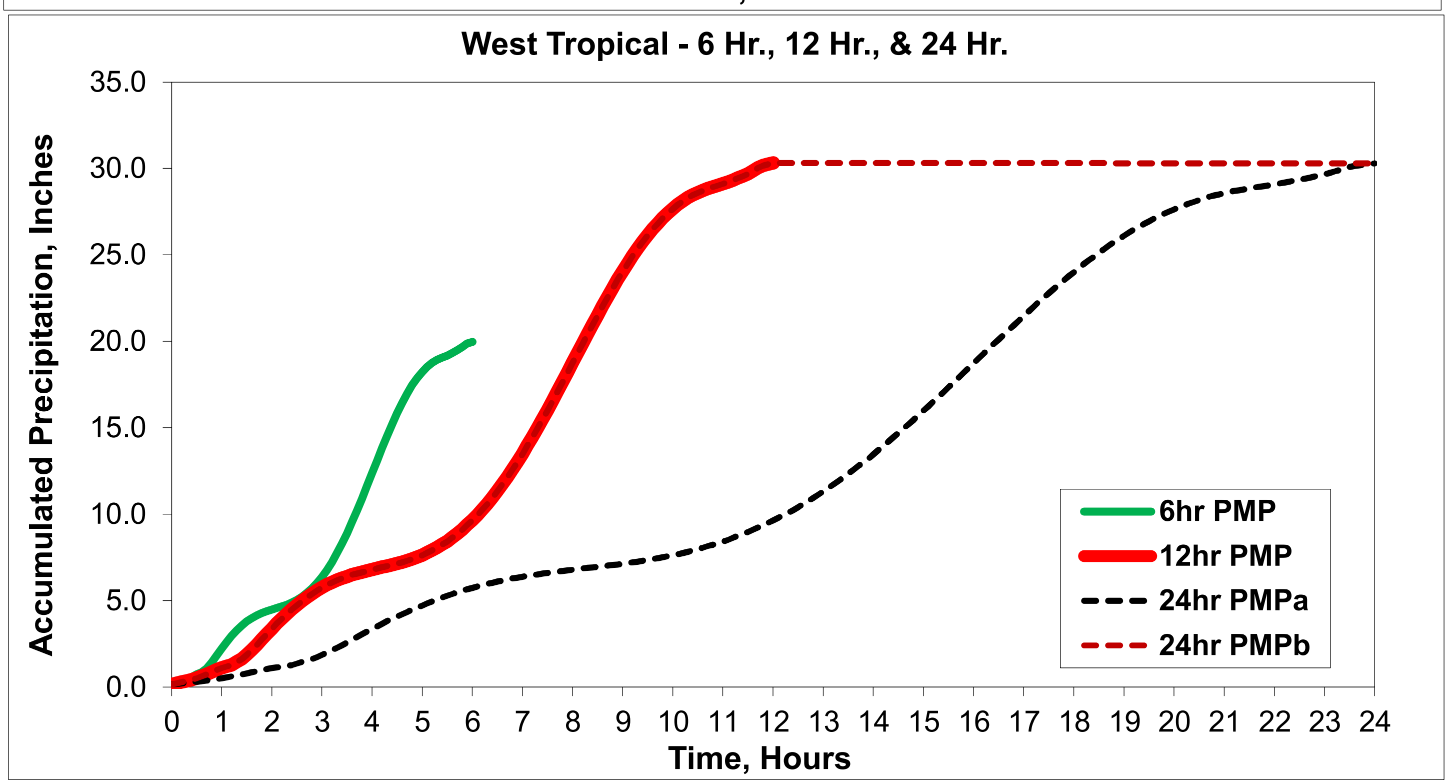
## Calculation Section C - OUTPUT Information for Temporal Distribution Curve



## Calculation Section C - OUTPUT Information for Temporal Distribution Curve



**ATTACHMENT E**

# HEC-HMS Model Inputs

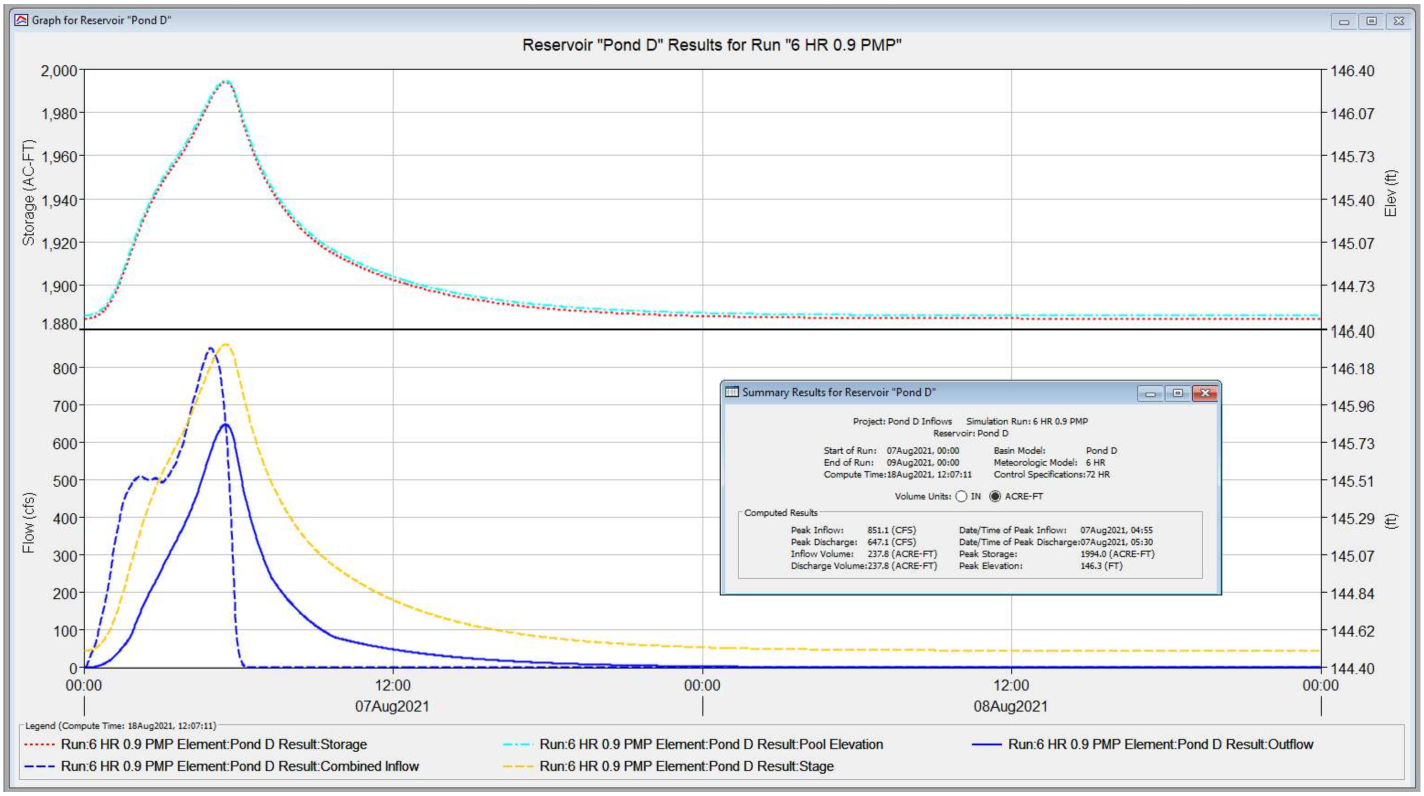
# HEC-HMS Model Inputs

| HEC-HMS Inputs (Drainage Areas) | | | | | |
|---|---|---|---|---|---|
| DA | Area | | CN | % Imp. | Lag |
| | ac | mi2 | | | min |
| Pond D DA - @ EL 144 | 115.38 | 0.180273 | 88.1 | 50.1% | 10.07 |

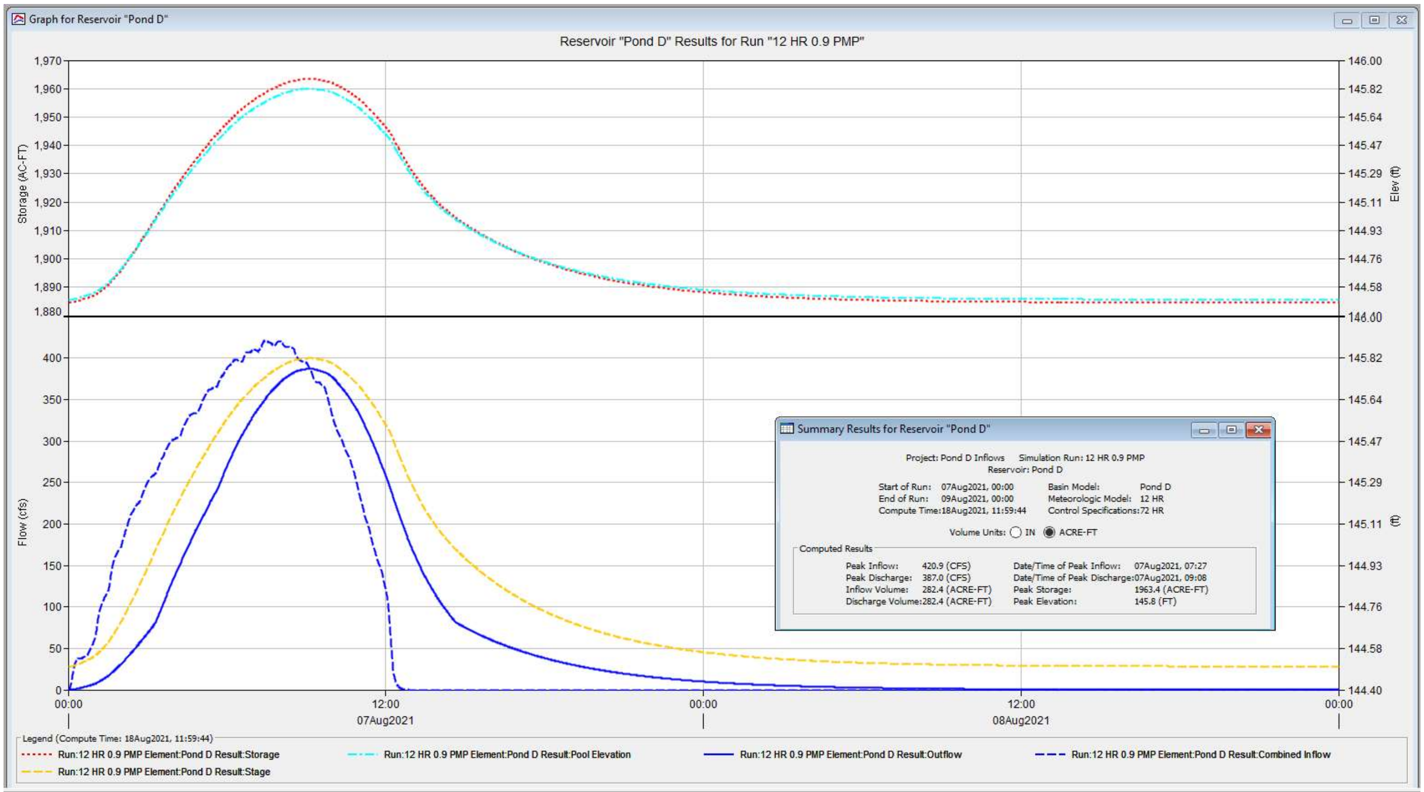
**ATTACHMENT F**

# HEC-HMS Model Outputs

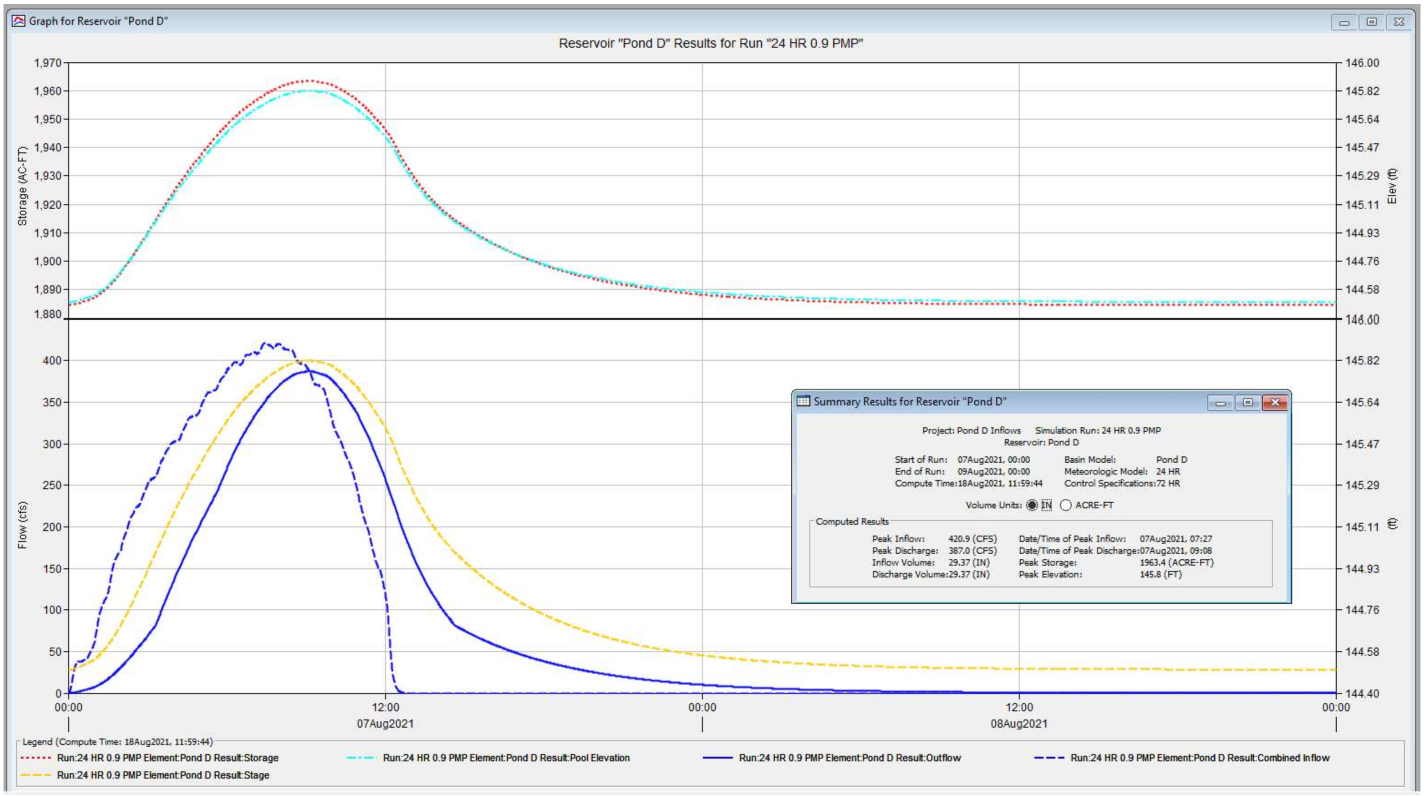
## Full Pond: 0.9 6 HR PMP




## Full Pond: 0.9 12 HR PMP



# Full Pond: 0.9 24 HR PMP



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