Prepared for


**Dominion**
5000 Dominion Boulevard
Glen Allen, Virginia 23060

# COAL COMBUSTION RESIDUALS INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

*for*

# VIRGINIA ELECTRIC AND POWER COMPANY CHESTERFIELD POWER STATION LOWER ASH POND CHESTERFIELD COUNTY, VIRGINIA

*Prepared by*


9211 Arboretum Parkway, Suite 200
Richmond, Virginia 23236

MV1373
October 2016

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## 1. CERTIFICATION/STATEMENT OF PROFESSIONAL OPINION

The Initial Inflow Design Flood Control System Plan (Plan) for the Chesterfield Power Station Lower Ash Pond was prepared by Geosyntec Consultants, Inc. (Geosyntec). The Plan was based on certain information that, other than for information Geosyntec originally prepared, Geosyntec has relied on but not independently verified. This Certification/Statement of Professional Opinion is therefore limited to the information available to Geosyntec at the time the Plan was written. 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 the Assessment 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 Plan was prepared consistent with the requirements of section 257.82 of the United States Environmental Protection Agency's "Disposal of Coal Combustion Residuals From Electric Utilities," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (40 CFR 257 Subpart D).

The use of the words "certification" and/or "certify" 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.

Geosyntec Consultants, Inc.


Scott Sheridan, P.E.
Principal

Date 10/14/2016

## 2. INTRODUCTION

The Chesterfield Power Station (Station) is owned by Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion) and is located in Chesterfield, VA. The station includes the Lower Ash Pond (LAP) impoundment, which is a component of the Station's wastewater treatment system utilized to manage and settle solids, including CCRs..

The LAP is located on Dominion property at the Chesterfield Power Station in Chesterfield County, Virginia (coordinates 37.3737° North and 77.3795° West) and is bounded by the Old Channel of the James River and the Upper Pond on the south, Henricus Park Road on the east, Coxendale Road on the north, and the thermal channel to the west. Zoning adjacent to the site includes a Heavy Industrial (I-3) district to the west, a Light Industrial (I-1) district to the south and an Agricultural District (A) to the east. Runoff consists of precipitation that falls directly on the LAP, runoff from the coal pile basin drainage area, and precipitation that falls on the Station and is pumped to the LAP. Runoff drains through the LAP outfall into Farrar Gut, a backwater of the James River within the watershed HUC 020802060106 (VA 6$^{th}$-order JL06).

The LAP is regulated as an existing surface impoundment under the Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" [40 CFR 257 Subpart D] published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (CCR Rule).

## 3. PURPOSE

This CCR Unit Inflow Design Flood Control System Plan (Plan) is prepared pursuant to the requirements in 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 (CCR Rule), § 257.82(c) of the CCR Rule [40 CFR § 257.82(c)].

## 4. INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

In accordance with § 257.73(a)(2), an initial Hazard Potential Classification was prepared for the LAP under current conditions. The LAP was determined to be a "significant hazard potential" CCR impoundment. The CCR Rule requires that owners and operators of a significant hazard potential unit must prepare a Plan that describes

how the unit will be designed, constructed operated, and maintained to manage a 1,000 year flood event.

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

1. Documentation of how the inflow design flood control system has been designed, constructed, operated and maintained to adequately manage flow into the LAP during and following the peak discharge of the inflow design flood [§ 257.82(a)(1)];
2. Documentation of how the inflow design flood control system has been designed, constructed, operated and maintained to adequately manage flow from the LAP so as to collect and control the peak discharge of the inflow design flood [§ 257.82(a)(2)]; and
3. 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 Site Configuration

The LAP is an existing CCR surface impoundment under the CCR rule constructed with earthen embankments that receives CCR sluice water, run-on from the coal pile drainage area, and other low volume wastewater streams. Water collected within the LAP, including precipitation that falls on the LAP, discharges through an outfall structure designated Outfall 004 under the Virginia Pollutant Discharge Elimination System (VPDES) permit number VA0004146.

## 4.2 Inflow to the Lower Ash Pond

As required by § 257.82(a)(1), a control system must be in place for the LAP that is designed, constructed, operated and maintained to flow into the LAP for the 1,000 year flood event. There are three general sources of inflow into the LAP that are affected by precipitation events, including the coal pile drainage area, low volume wastewater streams from the Station, and precipitation that falls on the LAP. CCR sluice water also discharges into the LAP; however, the CCR sluice water flow is not affected by precipitation events. The sources affected by precipitation are described in the following paragraphs.

The coal pile drainage area consists of 29.6 acres that surround the Station's coal pile located north of Coxendale Road between the Station and a railroad spur. Runoff within the drainage area is collected in a stormwater basin, which discharges through an outfall structure and a series of culverts and ditches into the LAP.

The Station's low volume wastewater streams discharge into the LAP via a series of pump stations. The pump stations within the Station collect the flow into two main pipe systems that discharge into the LAP: the FGD yard sump pipe and the master sump pipe. During precipitation events, runoff within drainage areas of the Station pump stations is collected and discharged through these pipes into the LAP.

Precipitation also falls on the LAP, and the precipitation is collected wholly within the LAP embankments. Precipitation falls over three general areas within the pond: active CCR sluice operations, stored CCR covered with soil cover or vegetation, and open water.

### 4.3 Outflow from the Lower Ash Pond

As required by § 257.82(a)(2), an inflow design flood control system must be in place for the LAP that is designed, constructed, operated, and maintained to flow from the LAP for the 1,000 year flood event. The outfall structure of the LAP consists of a cenosphere skirt that provides control of floating debris from entering the outfall structure. After flowing under the skirt, water discharges into a concrete box structure through a primary weir set at elevation 15.8 feet. The weir is 6.25 feet wide. In significant precipitation events water flows through a 5.4-foot by 5.9-foot opening in the top of the discharge structure. Once in the structure, water discharges through a 27-inch diameter concrete and steel pipe into Farrar Gut. A 40-foot wide emergency spillway is located above the discharge structure pipe to safely pass at least a 1,000 year flood event without overtopping the embankment. The emergency spillway has a bottom elevation of 18 feet and a top elevation of 18.5 feet.

In this Plan, management of the inflow design flood is defined as having the capacity to convey the peak discharge resulting from a 1,000-year flood event without overtopping the embankment. The hydraulics were modeled as described in the following paragraph.

According to the National Oceanic and Atmospheric Administration's (NOAA) estimates a 1,000 year flood event generates 13.1 inches of precipitation over a 24-hour

period for the area surrounding the Station. NOAA's estimate is provided in Appendix A. Inflow sources into the LAP as described in Section 4.2 were modeled as follows:

- The coal pile drainage area was modeled as a contributing subcatchment to the LAP using the 1,000 year, 24-hour event.
- Low volume wastewater streams were modeled as "base flow" into the LAP. The base flow from the low volume wastewater was estimated to be 89.4 cubic feet per second (cfs) based on a pump model generated by Dominion for the maximum potential discharge from the pump stations over a 24-hour period (Dominion, 2015). The total base flow was estimated to be 7.1 cfs during the subsequent 24-hour period for typical pump station discharge.
- To model the precipitation falling on the LAP, the pond's 102-acres was divided into three land cover areas: wetland, coal ash, and water. Precipitation falling on the 32 acres of wetland was modeled with a time of concentration of 26.9 minutes. Precipitation falling on the 33 acres of coal ash was modeled with a time of concentration of 46.9 minutes, and precipitation falling on the 37 acres of the LAP currently covered in water was modeled with a time of concentration of 0 minutes.
- While not affected by precipitation, the average CCR sluice water input of 4.3 cfs was also modeled as a base flow into the LAP.

The model indicates that the peak water surface elevation in the 1000-year event is at elevation 18.27 feet (below the minimum embankment elevation of 18.5 feet). The model results are included in Appendix B.

### 4.4 Surface Water Requirements

As required by § 257.82(b), a control system must in place for the LAP that is designed, constructed, operated, and maintained to meet the requirements of § 257.3-3. The LAP is operated under a VPDES discharge permit. Discharges from the LAP are monitored for compliance with the requirements in the VPDES permit.

## 5. CONCLUSION

Based on the information in this Report, it is Geosyntec's determination that the existing LAP inflow design flood control system is in compliance with the requirements of § 257.82 of the CCR Rule for a significant hazard potential impoundment.

## 6. REFERENCES

Virginia Electric & Power Co. Pump model entitled Existing NPDES Sump Pumps Pipeline Estimated Operation Capabilities. 2015.

# APPENDIX A

# NOAA PRECIPITATION ESTIMATE

**NOAA Atlas 14, Volume 2, Version 3**
**Location name: Chester, Virginia, USA***
**Latitude: 37.3819°, Longitude: -77.3844°**
**Elevation: 46.78 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 | 0.379 (0.342-0.419) | 0.448 (0.406-0.496) | 0.525 (0.475-0.580) | 0.588 (0.530-0.650) | 0.660 (0.593-0.729) | 0.715 (0.640-0.789) | 0.767 (0.683-0.846) | 0.814 (0.721-0.898) | 0.871 (0.765-0.963) | 0.916 (0.799-1.01) |
| 10-min | 0.605 (0.547-0.670) | 0.717 (0.650-0.794) | 0.840 (0.760-0.930) | 0.940 (0.848-1.04) | 1.05 (0.945-1.16) | 1.14 (1.02-1.26) | 1.22 (1.09-1.34) | 1.29 (1.14-1.42) | 1.38 (1.21-1.52) | 1.44 (1.26-1.60) |
| 15-min | 0.756 (0.683-0.837) | 0.901 (0.817-0.998) | 1.06 (0.962-1.18) | 1.19 (1.07-1.32) | 1.33 (1.20-1.47) | 1.44 (1.29-1.59) | 1.54 (1.37-1.70) | 1.63 (1.44-1.80) | 1.73 (1.52-1.92) | 1.81 (1.58-2.00) |
| 30-min | 1.04 (0.937-1.15) | 1.25 (1.13-1.38) | 1.51 (1.37-1.67) | 1.72 (1.55-1.91) | 1.98 (1.77-2.18) | 2.17 (1.94-2.40) | 2.36 (2.10-2.60) | 2.53 (2.25-2.80) | 2.76 (2.43-3.05) | 2.93 (2.56-3.24) |
| 60-min | 1.29 (1.17-1.43) | 1.56 (1.42-1.73) | 1.94 (1.75-2.14) | 2.24 (2.02-2.48) | 2.63 (2.36-2.90) | 2.94 (2.63-3.25) | 3.25 (2.89-3.58) | 3.55 (3.15-3.92) | 3.96 (3.48-4.38) | 4.28 (3.74-4.74) |
| 2-hr | 1.54 (1.39-1.72) | 1.86 (1.68-2.07) | 2.33 (2.10-2.59) | 2.73 (2.46-3.03) | 3.26 (2.91-3.61) | 3.70 (3.28-4.09) | 4.15 (3.65-4.58) | 4.61 (4.04-5.09) | 5.25 (4.55-5.79) | 5.77 (4.96-6.37) |
| 3-hr | 1.66 (1.49-1.86) | 2.01 (1.81-2.24) | 2.52 (2.26-2.81) | 2.96 (2.65-3.30) | 3.54 (3.15-3.93) | 4.02 (3.55-4.47) | 4.52 (3.97-5.01) | 5.04 (4.39-5.59) | 5.76 (4.97-6.39) | 6.36 (5.43-7.04) |
| 6-hr | 2.01 (1.80-2.26) | 2.42 (2.16-2.72) | 3.03 (2.70-3.41) | 3.57 (3.17-4.01) | 4.31 (3.81-4.83) | 4.95 (4.34-5.52) | 5.62 (4.88-6.27) | 6.33 (5.46-7.06) | 7.35 (6.25-8.18) | 8.21 (6.90-9.13) |
| 12-hr | 2.40 (2.15-2.71) | 2.89 (2.59-3.27) | 3.64 (3.26-4.12) | 4.33 (3.85-4.88) | 5.29 (4.66-5.93) | 6.13 (5.35-6.86) | 7.04 (6.08-7.85) | 8.03 (6.85-8.93) | 9.47 (7.95-10.5) | 10.7 (8.88-11.9) |
| 24-hr | 2.77 (2.53-3.06) | 3.36 (3.07-3.71) | 4.30 (3.93-4.76) | 5.11 (4.64-5.64) | 6.30 (5.68-6.93) | 7.32 (6.56-8.05) | 8.45 (7.51-9.27) | 9.69 (8.54-10.6) | 11.5 (10.0-12.6) | 13.1 (11.3-14.4) |
| 2-day | 3.24 (2.96-3.56) | 3.92 (3.59-4.31) | 5.00 (4.57-5.50) | 5.89 (5.37-6.48) | 7.20 (6.52-7.90) | 8.31 (7.47-9.11) | 9.50 (8.49-10.4) | 10.8 (9.58-11.9) | 12.7 (11.1-14.0) | 14.3 (12.4-15.8) |
| 3-day | 3.42 (3.14-3.76) | 4.14 (3.80-4.55) | 5.27 (4.83-5.79) | 6.21 (5.68-6.81) | 7.58 (6.88-8.30) | 8.73 (7.88-9.56) | 9.98 (8.94-10.9) | 11.3 (10.1-12.4) | 13.3 (11.7-14.6) | 15.0 (13.0-16.5) |
| 4-day | 3.61 (3.31-3.95) | 4.37 (4.01-4.79) | 5.55 (5.10-6.09) | 6.53 (5.98-7.15) | 7.96 (7.24-8.71) | 9.16 (8.29-10.0) | 10.5 (9.39-11.4) | 11.9 (10.6-13.0) | 13.9 (12.3-15.2) | 15.6 (13.6-17.2) |
| 7-day | 4.17 (3.84-4.56) | 5.01 (4.61-5.48) | 6.27 (5.78-6.86) | 7.32 (6.72-8.00) | 8.82 (8.07-9.63) | 10.1 (9.16-11.0) | 11.4 (10.3-12.5) | 12.9 (11.5-14.1) | 15.0 (13.3-16.4) | 16.7 (14.6-18.3) |
| 10-day | 4.75 (4.39-5.16) | 5.70 (5.27-6.19) | 7.05 (6.52-7.65) | 8.14 (7.51-8.84) | 9.70 (8.91-10.5) | 11.0 (10.0-11.9) | 12.3 (11.2-13.4) | 13.7 (12.4-15.0) | 15.8 (14.1-17.2) | 17.4 (15.4-19.0) |
| 20-day | 6.40 (5.96-6.88) | 7.63 (7.11-8.21) | 9.23 (8.58-9.92) | 10.5 (9.74-11.3) | 12.2 (11.3-13.1) | 13.6 (12.5-14.6) | 15.0 (13.7-16.1) | 16.4 (15.0-17.7) | 18.3 (16.6-19.8) | 19.8 (17.9-21.5) |
| 30-day | 7.94 (7.44-8.48) | 9.41 (8.82-10.0) | 11.2 (10.4-11.9) | 12.5 (11.7-13.3) | 14.3 (13.3-15.2) | 15.6 (14.5-16.7) | 16.9 (15.7-18.1) | 18.3 (16.9-19.5) | 20.0 (18.4-21.4) | 21.3 (19.5-22.9) |
| 45-day | 9.97 (9.37-10.6) | 11.8 (11.1-12.5) | 13.8 (12.9-14.6) | 15.3 (14.3-16.2) | 17.2 (16.1-18.3) | 18.7 (17.5-19.9) | 20.1 (18.8-21.4) | 21.5 (20.0-22.9) | 23.3 (21.5-24.8) | 24.6 (22.7-26.3) |
| 60-day | 11.9 (11.2-12.6) | 13.9 (13.1-14.8) | 16.1 (15.2-17.0) | 17.8 (16.7-18.8) | 19.9 (18.7-21.0) | 21.4 (20.1-22.6) | 22.9 (21.4-24.2) | 24.3 (22.7-25.7) | 26.1 (24.3-27.7) | 27.4 (25.4-29.1) |

[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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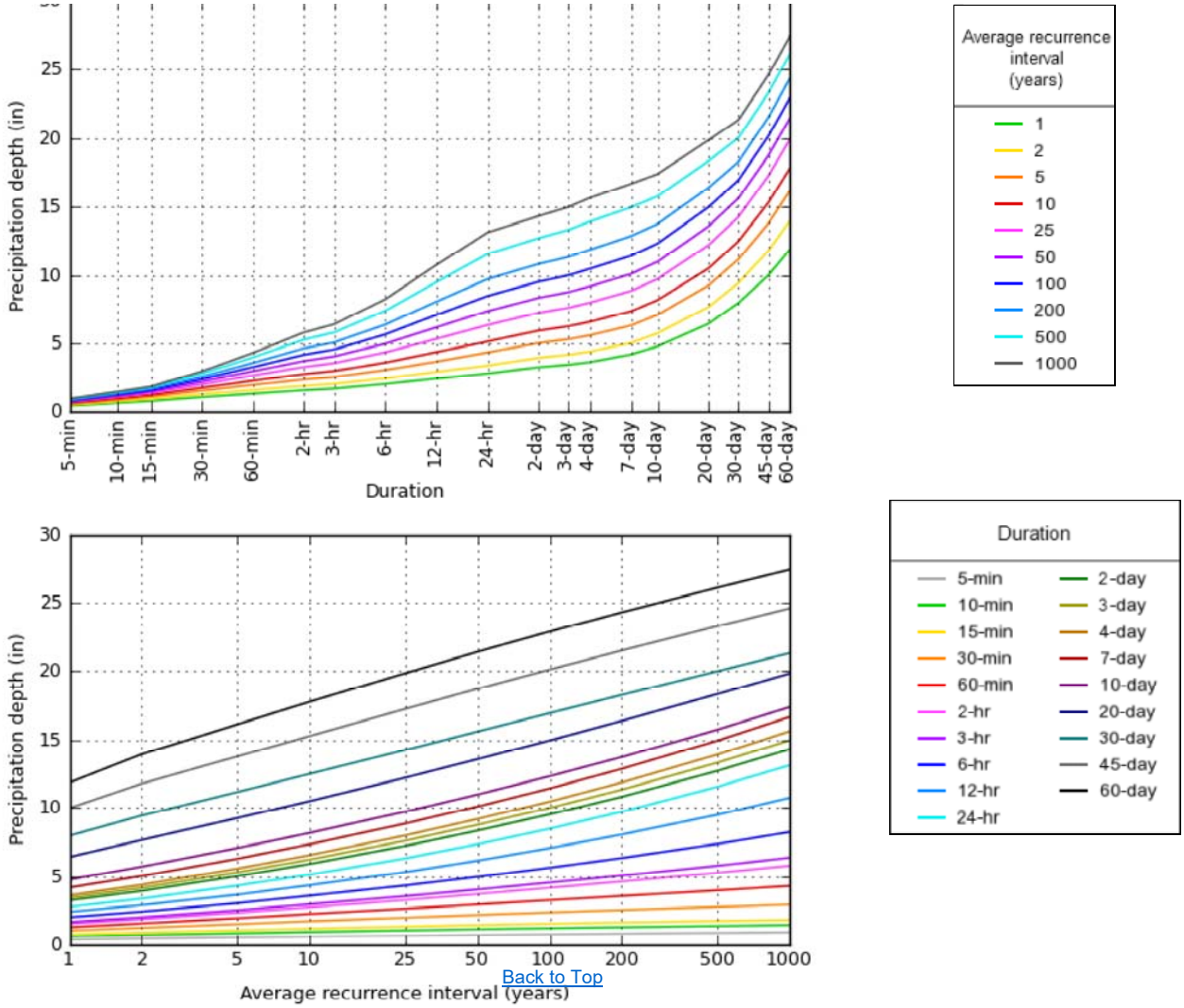
## PF graphical

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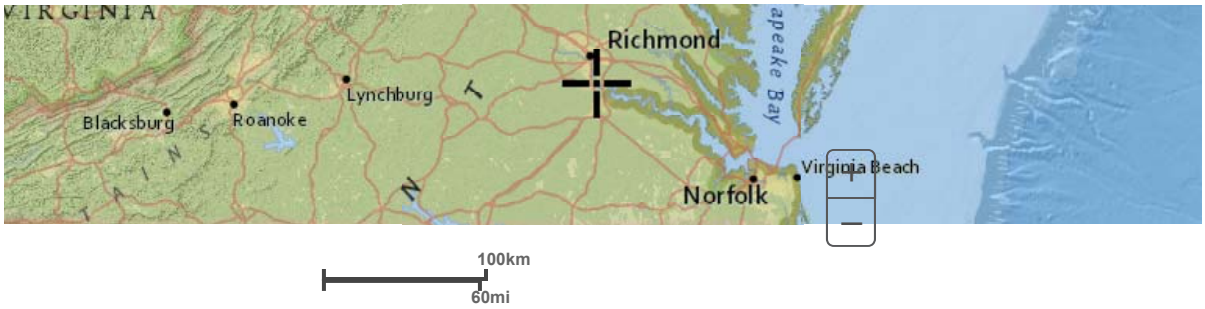
## Maps & aerials

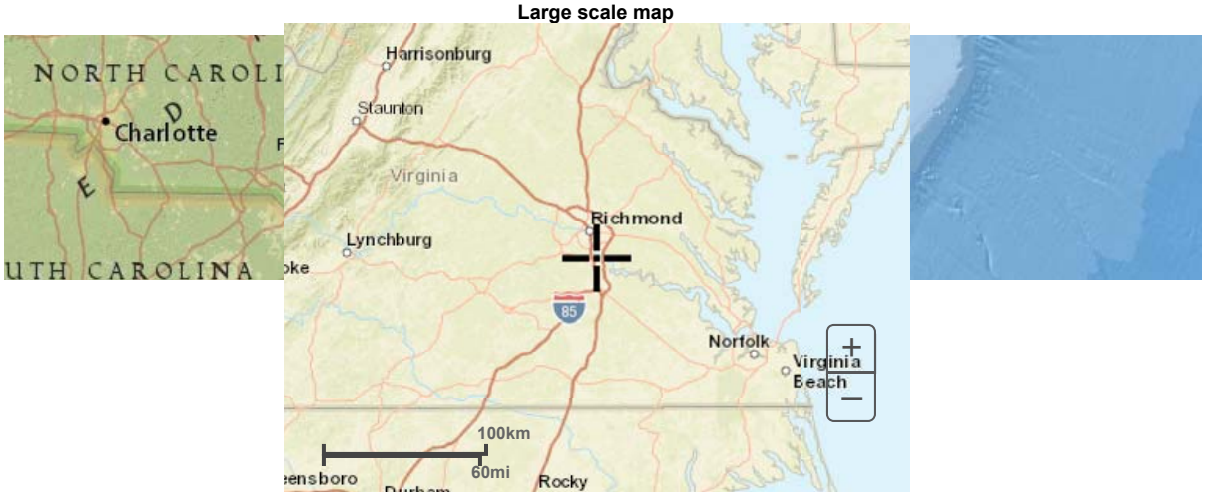
NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Sep 28 13:48:59 2016

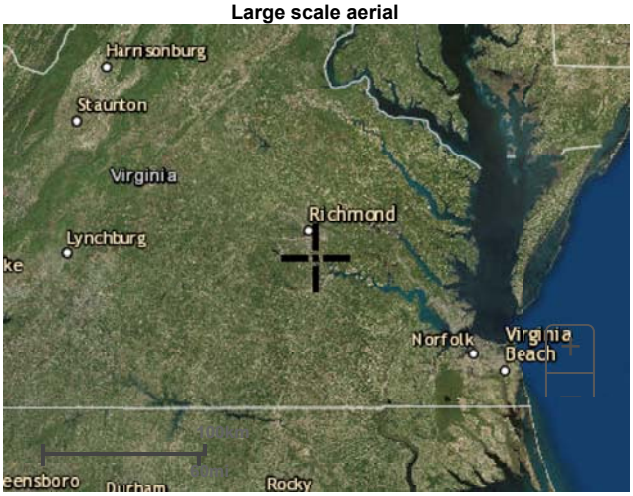
**Small scale terrain**


**Large scale map**




**Large scale aerial**

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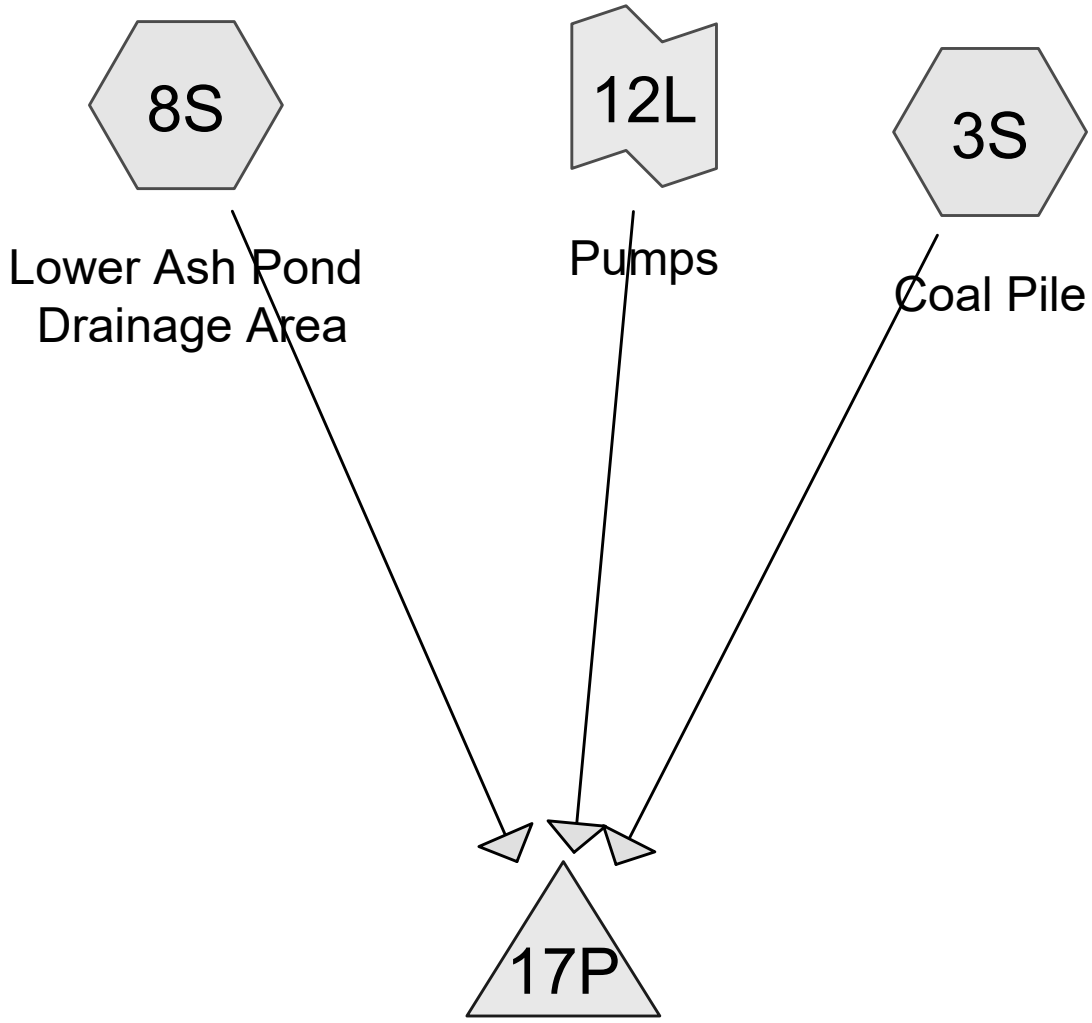
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

# APPENDIX B

# HYDROCAD MODEL RESULTS




Subcat Reach Pond Link

**Routing Diagram for LAP_Pre_Dev**
Prepared by SCCM-01, Printed 10/7/2016

## Summary for Subcatchment 3S: Coal Pile

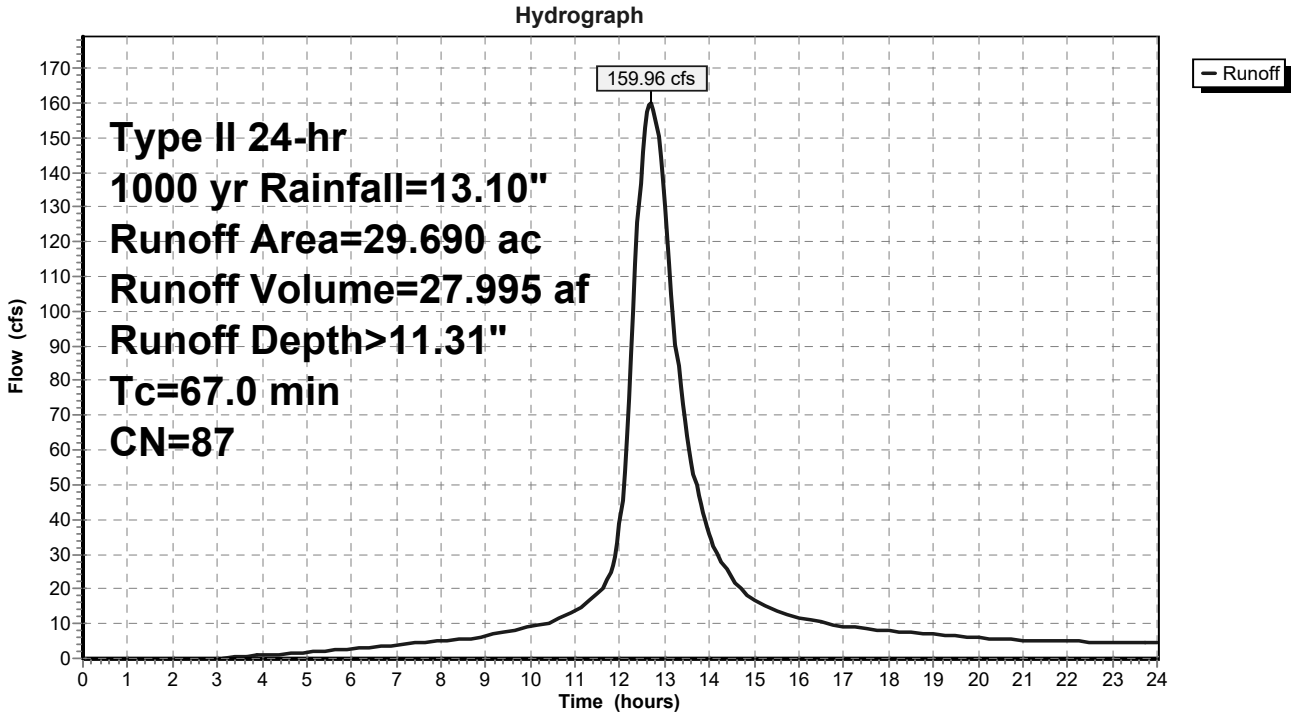
Runoff = 159.96 cfs @ 12.69 hrs, Volume= 27.995 af, Depth>11.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000 yr Rainfall=13.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 5.970 | 82 | |
| * | 17.640 | 88 | |
| * | 6.080 | 91 | |
| | 29.690 | 87 | Weighted Average |
| | 29.690 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 41.1 | | | | | **Direct Entry, DA4** |
| 18.6 | | | | | **Direct Entry, DA4A** |
| 7.3 | | | | | **Direct Entry, DA5** |
| 67.0 | 0 | Total | | | |

## Subcatchment 3S: Coal Pile



## Hydrograph for Subcatchment 3S: Coal Pile

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.25 | 0.03 | 0.00 | 0.00 |
| 0.50 | 0.07 | 0.00 | 0.00 |
| 0.75 | 0.10 | 0.00 | 0.00 |
| 1.00 | 0.14 | 0.00 | 0.00 |
| 1.25 | 0.17 | 0.00 | 0.00 |
| 1.50 | 0.21 | 0.00 | 0.00 |
| 1.75 | 0.25 | 0.00 | 0.00 |
| 2.00 | 0.29 | 0.00 | 0.00 |
| 2.25 | 0.33 | 0.00 | 0.00 |
| 2.50 | 0.37 | 0.00 | 0.01 |
| 2.75 | 0.41 | 0.01 | 0.04 |
| 3.00 | 0.45 | 0.01 | 0.13 |
| 3.25 | 0.49 | 0.02 | 0.28 |
| 3.50 | 0.54 | 0.03 | 0.46 |
| 3.75 | 0.58 | 0.05 | 0.67 |
| 4.00 | 0.63 | 0.06 | 0.89 |
| 4.25 | 0.68 | 0.08 | 1.11 |
| 4.50 | 0.72 | 0.09 | 1.33 |
| 4.75 | 0.77 | 0.11 | 1.56 |
| 5.00 | 0.83 | 0.14 | 1.80 |
| 5.25 | 0.88 | 0.16 | 2.04 |
| 5.50 | 0.93 | 0.19 | 2.29 |
| 5.75 | 0.99 | 0.22 | 2.55 |
| 6.00 | 1.05 | 0.25 | 2.81 |
| 6.25 | 1.11 | 0.28 | 3.08 |
| 6.50 | 1.17 | 0.32 | 3.35 |
| 6.75 | 1.23 | 0.36 | 3.62 |
| 7.00 | 1.30 | 0.40 | 3.89 |
| 7.25 | 1.36 | 0.44 | 4.16 |
| 7.50 | 1.43 | 0.49 | 4.44 |
| 7.75 | 1.50 | 0.54 | 4.71 |
| 8.00 | 1.57 | 0.59 | 4.99 |
| 8.25 | 1.65 | 0.64 | 5.26 |
| 8.50 | 1.73 | 0.70 | 5.55 |
| 8.75 | 1.82 | 0.77 | 5.94 |
| 9.00 | 1.93 | 0.85 | 6.47 |
| 9.25 | 2.03 | 0.93 | 7.12 |
| 9.50 | 2.14 | 1.01 | 7.86 |
| 9.75 | 2.25 | 1.10 | 8.56 |
| 10.00 | 2.37 | 1.20 | 9.16 |
| 10.25 | 2.51 | 1.32 | 9.81 |
| 10.50 | 2.67 | 1.46 | 10.71 |
| 10.75 | 2.86 | 1.62 | 11.93 |
| 11.00 | 3.08 | 1.81 | 13.56 |
| 11.25 | 3.35 | 2.05 | 15.69 |
| 11.50 | 3.71 | 2.37 | 18.54 |
| 11.75 | 5.07 | 3.63 | 23.07 |
| 12.00 | 8.69 | 7.12 | 38.75 |
| 12.25 | 9.25 | 7.67 | 87.07 |
| 12.50 | 9.63 | 8.04 | **145.83** |
| 12.75 | 9.89 | 8.30 | **158.48** |
| 13.00 | 10.11 | 8.52 | 130.00 |
| 13.25 | 10.30 | 8.70 | 90.57 |
| 13.50 | 10.47 | 8.87 | 64.28 |
| 13.75 | 10.61 | 9.01 | 47.17 |
| 14.00 | 10.74 | 9.14 | 35.85 |
| 14.25 | 10.86 | 9.25 | 28.31 |
| 14.50 | 10.97 | 9.36 | 23.14 |
| 14.75 | 11.08 | 9.47 | 19.46 |
| 15.00 | 11.18 | 9.57 | 16.96 |
| 15.25 | 11.28 | 9.66 | 15.19 |
| 15.50 | 11.37 | 9.75 | 13.74 |
| 15.75 | 11.45 | 9.83 | 12.64 |
| 16.00 | 11.53 | 9.91 | 11.83 |
| 16.25 | 11.60 | 9.98 | 11.08 |
| 16.50 | 11.67 | 10.05 | 10.39 |
| 16.75 | 11.74 | 10.12 | 9.79 |
| 17.00 | 11.81 | 10.19 | 9.29 |
| 17.25 | 11.88 | 10.26 | 8.89 |
| 17.50 | 11.94 | 10.32 | 8.57 |
| 17.75 | 12.01 | 10.38 | 8.27 |
| 18.00 | 12.07 | 10.44 | 8.00 |
| 18.25 | 12.12 | 10.50 | 7.75 |
| 18.50 | 12.18 | 10.55 | 7.50 |
| 18.75 | 12.23 | 10.61 | 7.25 |
| 19.00 | 12.28 | 10.66 | 7.01 |
| 19.25 | 12.33 | 10.71 | 6.76 |
| 19.50 | 12.38 | 10.75 | 6.52 |
| 19.75 | 12.43 | 10.80 | 6.28 |
| 20.00 | 12.47 | 10.84 | 6.04 |
| 20.25 | 12.51 | 10.88 | 5.79 |
| 20.50 | 12.56 | 10.92 | 5.57 |
| 20.75 | 12.60 | 10.97 | 5.36 |
| 21.00 | 12.64 | 11.01 | 5.20 |
| 21.25 | 12.68 | 11.05 | 5.09 |
| 21.50 | 12.72 | 11.09 | 5.00 |
| 21.75 | 12.76 | 11.13 | 4.93 |
| 22.00 | 12.80 | 11.17 | 4.87 |
| 22.25 | 12.84 | 11.20 | 4.81 |
| 22.50 | 12.88 | 11.24 | 4.76 |
| 22.75 | 12.91 | 11.28 | 4.71 |
| 23.00 | 12.95 | 11.32 | 4.66 |
| 23.25 | 12.99 | 11.35 | 4.61 |
| 23.50 | 13.03 | 11.39 | 4.56 |
| 23.75 | 13.06 | 11.43 | 4.52 |
| 24.00 | **13.10** | **11.46** | 4.47 |

## Summary for Subcatchment 8S: Lower Ash Pond Drainage Area

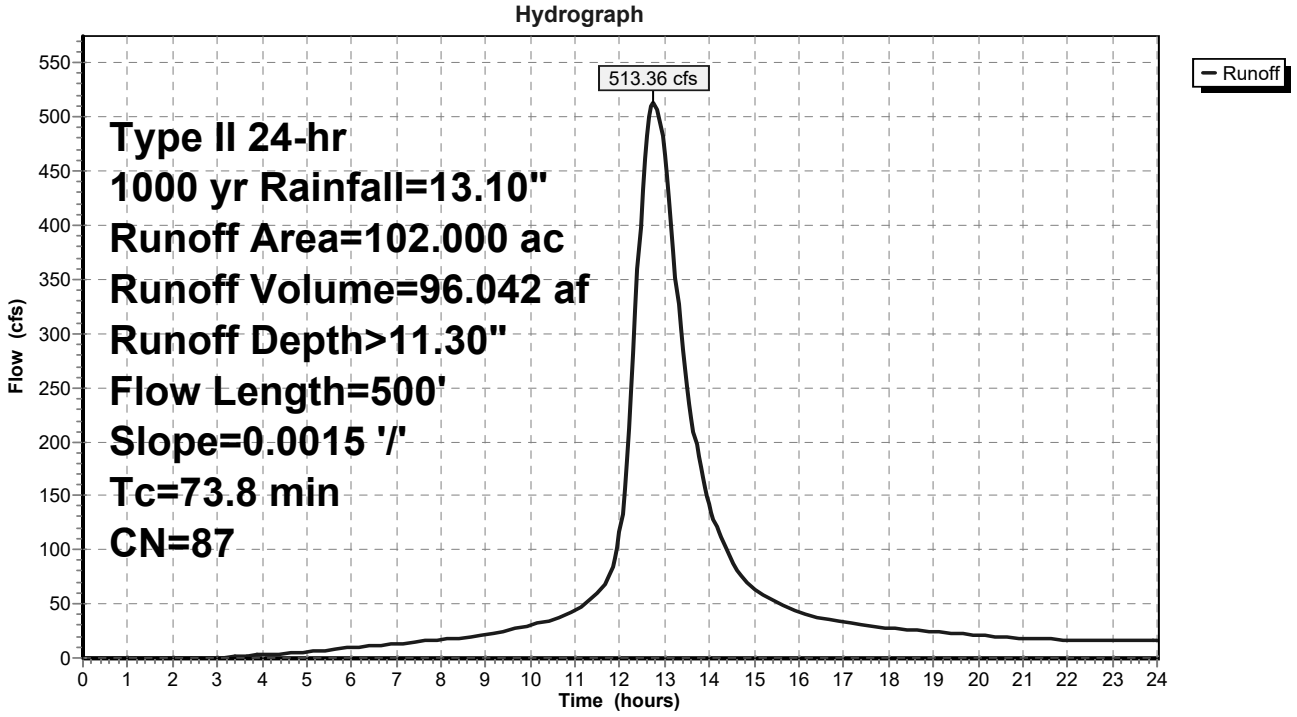
Runoff = 513.36 cfs @ 12.76 hrs, Volume= 96.042 af, Depth>11.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 1000 yr Rainfall=13.10"

| | Area (ac) | CN | Description |
|---|---|---|---|
| * | 37.000 | 98 | Water |
| * | 33.000 | 77 | Coal Ash |
| * | 32.000 | 83 | Wetland |
| | 102.000 | 87 | Weighted Average |
| | 65.000 | | 63.73% Pervious Area |
| | 37.000 | | 36.27% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.0 | | | | | **Direct Entry,** |
| 26.9 | 300 | 0.0015 | 0.19 | | **Sheet Flow,** Fallow n= 0.050 P2= 3.36" |
| 46.9 | 200 | 0.0015 | 0.07 | | **Sheet Flow,** Grass: Short n= 0.150 P2= 3.36" |
| 73.8 | 500 | Total | | | |

## Subcatchment 8S: Lower Ash Pond Drainage Area



## Hydrograph for Subcatchment 8S: Lower Ash Pond Drainage Area

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.25 | 0.03 | 0.00 | 0.00 |
| 0.50 | 0.07 | 0.00 | 0.00 |
| 0.75 | 0.10 | 0.00 | 0.00 |
| 1.00 | 0.14 | 0.00 | 0.00 |
| 1.25 | 0.17 | 0.00 | 0.00 |
| 1.50 | 0.21 | 0.00 | 0.00 |
| 1.75 | 0.25 | 0.00 | 0.00 |
| 2.00 | 0.29 | 0.00 | 0.00 |
| 2.25 | 0.33 | 0.00 | 0.00 |
| 2.50 | 0.37 | 0.00 | 0.02 |
| 2.75 | 0.41 | 0.01 | 0.11 |
| 3.00 | 0.45 | 0.01 | 0.35 |
| 3.25 | 0.49 | 0.02 | 0.78 |
| 3.50 | 0.54 | 0.03 | 1.36 |
| 3.75 | 0.58 | 0.05 | 2.03 |
| 4.00 | 0.63 | 0.06 | 2.76 |
| 4.25 | 0.68 | 0.08 | 3.50 |
| 4.50 | 0.72 | 0.09 | 4.26 |
| 4.75 | 0.77 | 0.11 | 5.03 |
| 5.00 | 0.83 | 0.14 | 5.84 |
| 5.25 | 0.88 | 0.16 | 6.66 |
| 5.50 | 0.93 | 0.19 | 7.53 |
| 5.75 | 0.99 | 0.22 | 8.40 |
| 6.00 | 1.05 | 0.25 | 9.30 |
| 6.25 | 1.11 | 0.28 | 10.20 |
| 6.50 | 1.17 | 0.32 | 11.12 |
| 6.75 | 1.23 | 0.36 | 12.04 |
| 7.00 | 1.30 | 0.40 | 12.98 |
| 7.25 | 1.36 | 0.44 | 13.91 |
| 7.50 | 1.43 | 0.49 | 14.85 |
| 7.75 | 1.50 | 0.54 | 15.79 |
| 8.00 | 1.57 | 0.59 | 16.73 |
| 8.25 | 1.65 | 0.64 | 17.68 |
| 8.50 | 1.73 | 0.70 | 18.67 |
| 8.75 | 1.82 | 0.77 | 19.90 |
| 9.00 | 1.93 | 0.85 | 21.53 |
| 9.25 | 2.03 | 0.93 | 23.64 |
| 9.50 | 2.14 | 1.01 | 26.03 |
| 9.75 | 2.25 | 1.10 | 28.45 |
| 10.00 | 2.37 | 1.20 | 30.58 |
| 10.25 | 2.51 | 1.32 | 32.82 |
| 10.50 | 2.67 | 1.46 | 35.58 |
| 10.75 | 2.86 | 1.62 | 39.44 |
| 11.00 | 3.08 | 1.81 | 44.51 |
| 11.25 | 3.35 | 2.05 | 51.22 |
| 11.50 | 3.71 | 2.37 | 60.10 |
| 11.75 | 5.07 | 3.63 | 73.98 |
| 12.00 | 8.69 | 7.12 | 115.84 |
| 12.25 | 9.25 | 7.67 | 246.44 |
| 12.50 | 9.63 | 8.04 | 432.41 |
| 12.75 | 9.89 | 8.30 | **513.32** |
| 13.00 | 10.11 | 8.52 | 464.48 |
| 13.25 | 10.30 | 8.70 | 351.05 |
| 13.50 | 10.47 | 8.87 | 250.74 |
| 13.75 | 10.61 | 9.01 | 186.35 |
| 14.00 | 10.74 | 9.14 | 141.81 |
| 14.25 | 10.86 | 9.25 | 111.09 |
| 14.50 | 10.97 | 9.36 | 89.71 |
| 14.75 | 11.08 | 9.47 | 74.53 |
| 15.00 | 11.18 | 9.57 | 63.94 |
| 15.25 | 11.28 | 9.66 | 56.26 |
| 15.50 | 11.37 | 9.75 | 50.81 |
| 15.75 | 11.45 | 9.83 | 46.20 |
| 16.00 | 11.53 | 9.91 | 42.32 |
| 16.25 | 11.60 | 9.98 | 39.29 |
| 16.50 | 11.67 | 10.05 | 36.82 |
| 16.75 | 11.74 | 10.12 | 34.57 |
| 17.00 | 11.81 | 10.19 | 32.73 |
| 17.25 | 11.88 | 10.26 | 31.21 |
| 17.50 | 11.94 | 10.32 | 29.98 |
| 17.75 | 12.01 | 10.38 | 28.90 |
| 18.00 | 12.07 | 10.44 | 27.93 |
| 18.25 | 12.12 | 10.50 | 27.02 |
| 18.50 | 12.18 | 10.55 | 26.13 |
| 18.75 | 12.23 | 10.61 | 25.28 |
| 19.00 | 12.28 | 10.66 | 24.42 |
| 19.25 | 12.33 | 10.71 | 23.60 |
| 19.50 | 12.38 | 10.75 | 22.74 |
| 19.75 | 12.43 | 10.80 | 21.94 |
| 20.00 | 12.47 | 10.84 | 21.08 |
| 20.25 | 12.51 | 10.88 | 20.28 |
| 20.50 | 12.56 | 10.92 | 19.44 |
| 20.75 | 12.60 | 10.97 | 18.73 |
| 21.00 | 12.64 | 11.01 | 18.12 |
| 21.25 | 12.68 | 11.05 | 17.68 |
| 21.50 | 12.72 | 11.09 | 17.32 |
| 21.75 | 12.76 | 11.13 | 17.07 |
| 22.00 | 12.80 | 11.17 | 16.83 |
| 22.25 | 12.84 | 11.20 | 16.63 |
| 22.50 | 12.88 | 11.24 | 16.44 |
| 22.75 | 12.91 | 11.28 | 16.26 |
| 23.00 | 12.95 | 11.32 | 16.09 |
| 23.25 | 12.99 | 11.35 | 15.91 |
| 23.50 | 13.03 | 11.39 | 15.75 |
| 23.75 | 13.06 | 11.43 | 15.58 |
| 24.00 | **13.10** | **11.46** | 15.42 |

## Summary for Pond 17P: Lower Ash Pond

Inflow Area = 131.690 ac, 28.10% Impervious, Inflow Depth > 28.64" for 1000 yr event
Inflow = 767.84 cfs @ 12.73 hrs, Volume= 314.311 af
Outflow = 67.57 cfs @ 24.00 hrs, Volume= 61.309 af, Atten= 91%, Lag= 675.9 min
Primary = 53.27 cfs @ 24.00 hrs, Volume= 58.436 af
Secondary = 14.30 cfs @ 24.00 hrs, Volume= 2.873 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Starting Elev= 15.80' Surf.Area= 102.080 ac Storage= 81.632 af
Peak Elev= 18.27' @ 24.00 hrs Surf.Area= 103.007 ac Storage= 334.535 af (252.903 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 270.2 min ( 1,029.2 - 759.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 15.00' | 410.150 af | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

| Elevation (feet) | Surf.Area (acres) | Inc.Store (acre-feet) | Cum.Store (acre-feet) |
|---|---|---|---|
| 15.00 | 102.000 | 0.000 | 0.000 |
| 16.00 | 102.100 | 102.050 | 102.050 |
| 16.50 | 102.300 | 51.100 | 153.150 |
| 17.00 | 102.500 | 51.200 | 204.350 |
| 17.50 | 102.700 | 51.300 | 255.650 |
| 18.00 | 102.900 | 51.400 | 307.050 |
| 18.50 | 103.100 | 51.500 | 358.550 |
| 19.00 | 103.300 | 51.600 | 410.150 |

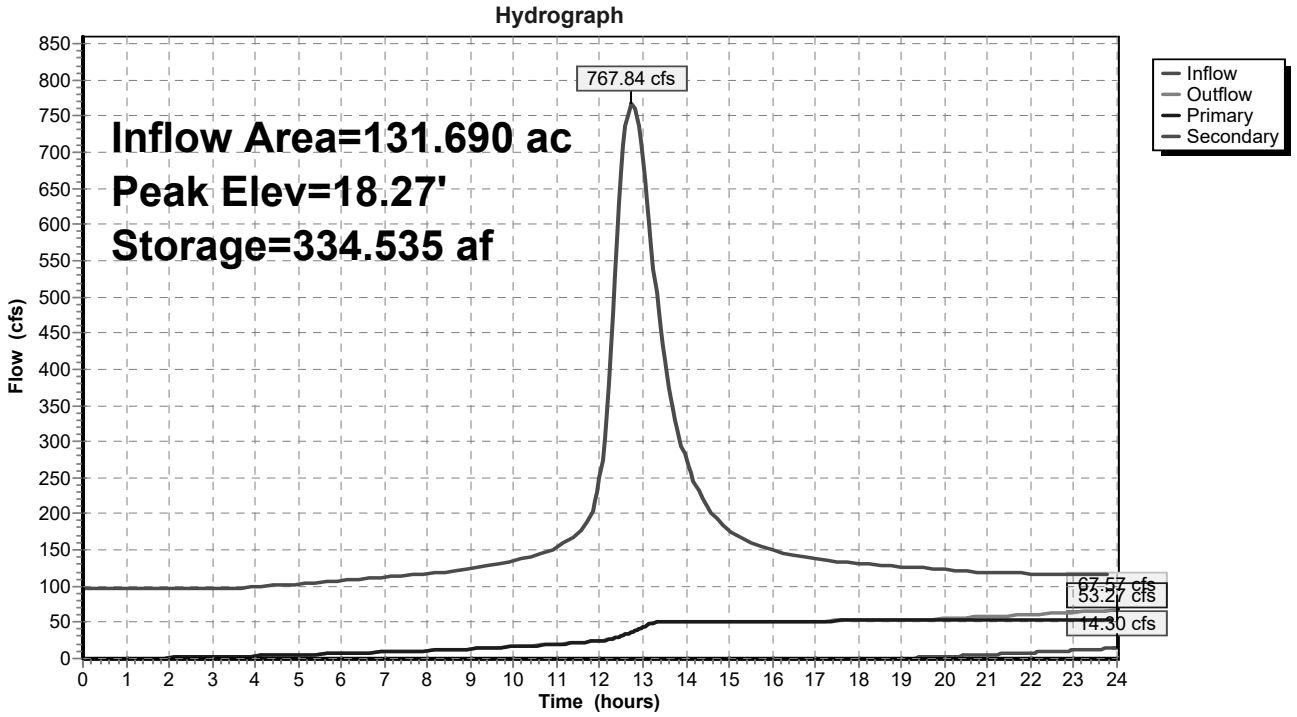
**NOTE:** The LAP storage was modeled to 19.00' to allow HydroCAD to accurately evaluate peak WSE. The true minimum height of the LAP top elevation is 18.00'.

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 9.40' | **27.0" Round Culvert**<br>L= 90.0' RCP, sq.cut end projecting, Ke= 0.500<br>Inlet / Outlet Invert= 9.40' / 6.80' S= 0.0289 '/' Cc= 0.900<br>n= 0.012 Concrete pipe, finished, Flow Area= 3.98 sf |
| #2 | Device 1 | 15.80' | **6.2' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)<br>0.8' Crest Height |
| #3 | Device 1 | 17.20' | **5.9" x 5.4" Horiz. Orifice/Grate**<br>C= 0.600 in 5.9" x 5.4" Grate (100% open area)<br>Limited to weir flow at low heads |
| #4 | Secondary | 18.00' | **40.0' long x 12.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64 |

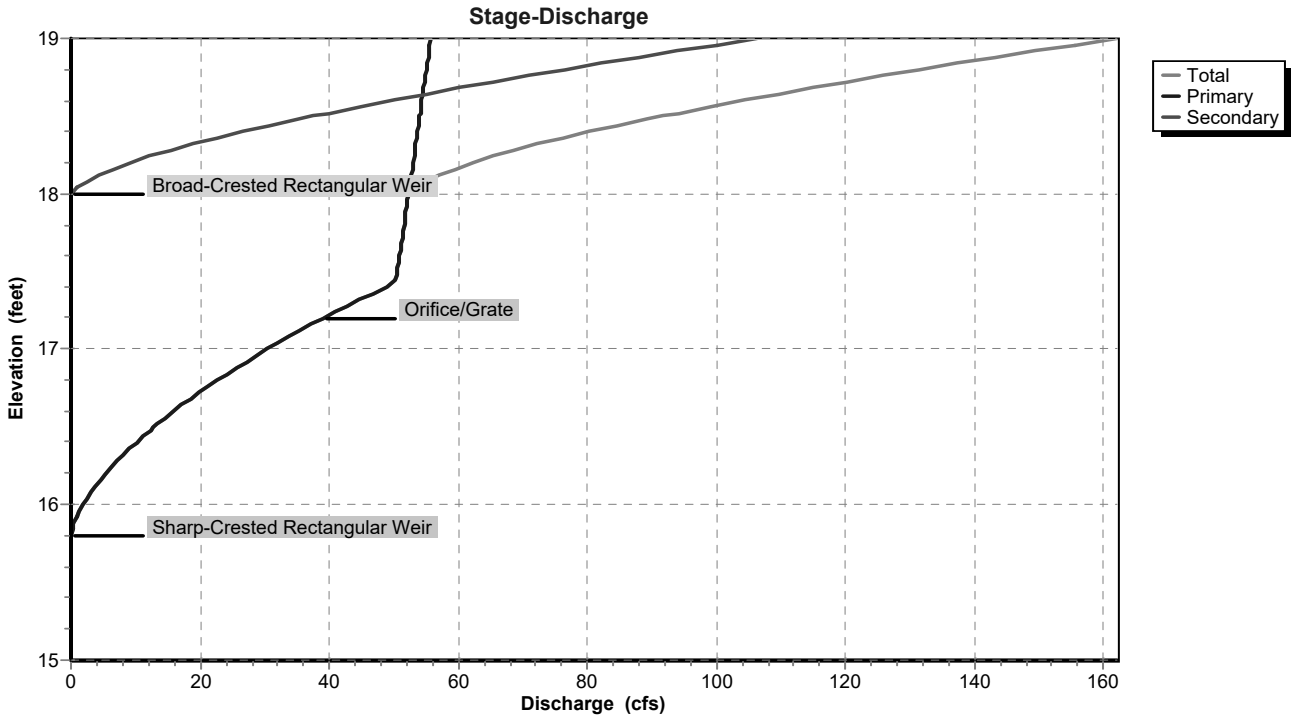
**Primary OutFlow** Max=53.27 cfs @ 24.00 hrs HW=18.27' (Free Discharge)
└**1=Culvert** (Inlet Controls 53.27 cfs @ 13.40 fps)
└**2=Sharp-Crested Rectangular Weir** (Passes < 99.58 cfs potential flow)
└**3=Orifice/Grate** (Passes < 1.10 cfs potential flow)

**Secondary OutFlow** Max=14.27 cfs @ 24.00 hrs HW=18.27' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Weir Controls 14.27 cfs @ 1.34 fps)

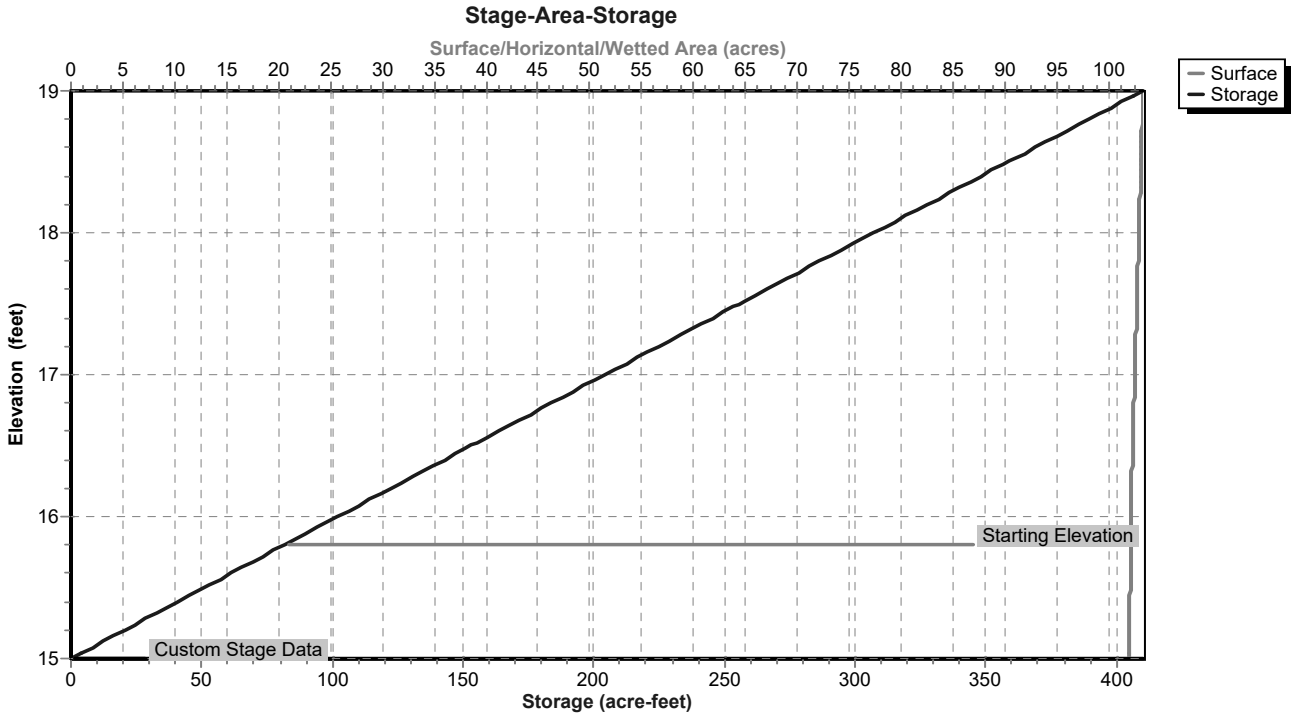
## Pond 17P: Lower Ash Pond




## Pond 17P: Lower Ash Pond



## Pond 17P: Lower Ash Pond



## Hydrograph for Pond 17P: Lower Ash Pond

| Time (hours) | Inflow (cfs) | Storage (acre-feet) | Elevation (feet) | Outflow (cfs) | Primary (cfs) | Secondary (cfs) |
|---|---|---|---|---|---|---|
| 0.00 | 95.73 | 81.830 | 15.80 | 0.01 | 0.01 | 0.00 |
| 0.50 | 95.73 | 85.782 | 15.84 | 0.17 | 0.17 | 0.00 |
| 1.00 | 95.73 | 89.725 | 15.88 | 0.46 | 0.46 | 0.00 |
| 1.50 | 95.73 | 93.654 | 15.92 | 0.83 | 0.83 | 0.00 |
| 2.00 | 95.73 | 97.566 | 15.96 | 1.28 | 1.28 | 0.00 |
| 2.50 | 95.75 | 101.459 | 15.99 | 1.78 | 1.78 | 0.00 |
| 3.00 | 96.21 | 105.338 | 16.03 | 2.34 | 2.34 | 0.00 |
| 3.50 | 97.55 | 109.229 | 16.07 | 2.95 | 2.95 | 0.00 |
| 4.00 | 99.37 | 113.162 | 16.11 | 3.61 | 3.61 | 0.00 |
| 4.50 | 101.33 | 117.145 | 16.15 | 4.34 | 4.34 | 0.00 |
| 5.00 | 103.37 | 121.178 | 16.19 | 5.12 | 5.12 | 0.00 |
| 5.50 | 105.55 | 125.265 | 16.23 | 5.95 | 5.95 | 0.00 |
| 6.00 | 107.84 | 129.410 | 16.27 | 6.85 | 6.85 | 0.00 |
| 6.50 | 110.20 | 133.612 | 16.31 | 7.81 | 7.81 | 0.00 |
| 7.00 | 112.60 | 137.871 | 16.35 | 8.82 | 8.82 | 0.00 |
| 7.50 | 115.02 | 142.187 | 16.39 | 9.90 | 9.90 | 0.00 |
| 8.00 | 117.44 | 146.558 | 16.44 | 11.04 | 11.04 | 0.00 |
| 8.50 | 119.95 | 150.981 | 16.48 | 12.24 | 12.24 | 0.00 |
| 9.00 | 123.72 | 155.476 | 16.52 | 13.51 | 13.51 | 0.00 |
| 9.50 | 129.62 | 160.120 | 16.57 | 14.88 | 14.88 | 0.00 |
| 10.00 | 135.47 | 164.957 | 16.62 | 16.35 | 16.35 | 0.00 |
| 10.50 | 142.02 | 169.972 | 16.66 | 17.94 | 17.94 | 0.00 |
| 11.00 | 153.80 | 175.285 | 16.72 | 19.68 | 19.68 | 0.00 |
| 11.50 | 174.36 | 181.172 | 16.77 | 21.68 | 21.68 | 0.00 |
| 12.00 | 250.32 | 188.444 | 16.84 | 24.27 | 24.27 | 0.00 |
| 12.50 | **673.97** | 205.588 | 17.01 | 30.82 | 30.82 | 0.00 |
| 13.00 | **690.20** | 234.581 | 17.29 | 43.51 | 43.51 | 0.00 |
| 13.50 | 410.75 | 254.995 | 17.49 | 50.54 | 50.54 | 0.00 |
| 14.00 | 273.40 | 266.674 | 17.61 | 50.95 | 50.95 | 0.00 |
| 14.50 | 208.57 | 274.363 | 17.68 | 51.22 | 51.22 | 0.00 |
| 15.00 | 176.64 | 280.124 | 17.74 | 51.42 | 51.42 | 0.00 |
| 15.50 | 160.28 | 284.922 | 17.78 | 51.58 | 51.58 | 0.00 |
| 16.00 | 149.88 | 289.182 | 17.83 | 51.73 | 51.73 | 0.00 |
| 16.50 | 142.94 | 293.083 | 17.86 | 51.86 | 51.86 | 0.00 |
| 17.00 | 137.75 | 296.729 | 17.90 | 51.99 | 51.99 | 0.00 |
| 17.50 | 134.28 | 300.194 | 17.93 | 52.11 | 52.11 | 0.00 |
| 18.00 | 131.66 | 303.531 | 17.97 | 52.22 | 52.22 | 0.00 |
| 18.50 | 129.36 | 306.763 | 18.00 | 52.33 | 52.33 | 0.00 |
| 19.00 | 127.16 | 309.888 | 18.03 | 53.01 | 52.44 | 0.57 |
| 19.50 | 124.99 | 312.889 | 18.06 | 53.99 | 52.54 | 1.45 |
| 20.00 | 122.85 | 315.755 | 18.08 | 55.19 | 52.64 | 2.55 |
| 20.50 | 120.74 | 318.479 | 18.11 | 56.57 | 52.73 | 3.84 |
| 21.00 | 119.04 | 321.065 | 18.14 | 58.02 | 52.82 | 5.20 |
| 21.50 | 118.05 | 323.534 | 18.16 | 59.49 | 52.90 | 6.59 |
| 22.00 | 117.42 | 325.907 | 18.18 | 61.08 | 52.98 | 8.10 |
| 22.50 | 116.92 | 328.193 | 18.21 | 62.65 | 53.06 | 9.59 |
| 23.00 | 116.48 | 330.393 | 18.23 | 64.29 | 53.13 | 11.16 |
| 23.50 | 116.04 | 332.507 | 18.25 | 65.92 | 53.20 | 12.72 |
| 24.00 | 115.62 | **334.535** | **18.27** | **67.57** | **53.27** | **14.30** |

## Stage-Discharge for Pond 17P: Lower Ash Pond

| Elevation (feet) | Discharge (cfs) | Primary (cfs) | Secondary (cfs) |
|---|---|---|---|
| 15.00 | 0.00 | 0.00 | 0.00 |
| 15.05 | 0.00 | 0.00 | 0.00 |
| 15.10 | 0.00 | 0.00 | 0.00 |
| 15.15 | 0.00 | 0.00 | 0.00 |
| 15.20 | 0.00 | 0.00 | 0.00 |
| 15.25 | 0.00 | 0.00 | 0.00 |
| 15.30 | 0.00 | 0.00 | 0.00 |
| 15.35 | 0.00 | 0.00 | 0.00 |
| 15.40 | 0.00 | 0.00 | 0.00 |
| 15.45 | 0.00 | 0.00 | 0.00 |
| 15.50 | 0.00 | 0.00 | 0.00 |
| 15.55 | 0.00 | 0.00 | 0.00 |
| 15.60 | 0.00 | 0.00 | 0.00 |
| 15.65 | 0.00 | 0.00 | 0.00 |
| 15.70 | 0.00 | 0.00 | 0.00 |
| 15.75 | 0.00 | 0.00 | 0.00 |
| 15.80 | 0.00 | 0.00 | 0.00 |
| 15.85 | 0.23 | 0.23 | 0.00 |
| 15.90 | 0.65 | 0.65 | 0.00 |
| 15.95 | 1.20 | 1.20 | 0.00 |
| 16.00 | 1.86 | 1.86 | 0.00 |
| 16.05 | 2.61 | 2.61 | 0.00 |
| 16.10 | 3.45 | 3.45 | 0.00 |
| 16.15 | 4.37 | 4.37 | 0.00 |
| 16.20 | 5.37 | 5.37 | 0.00 |
| 16.25 | 6.45 | 6.45 | 0.00 |
| 16.30 | 7.59 | 7.59 | 0.00 |
| 16.35 | 8.81 | 8.81 | 0.00 |
| 16.40 | 10.09 | 10.09 | 0.00 |
| 16.45 | 11.44 | 11.44 | 0.00 |
| 16.50 | 12.85 | 12.85 | 0.00 |
| 16.55 | 14.32 | 14.32 | 0.00 |
| 16.60 | 15.86 | 15.86 | 0.00 |
| 16.65 | 17.46 | 17.46 | 0.00 |
| 16.70 | 19.12 | 19.12 | 0.00 |
| 16.75 | 20.84 | 20.84 | 0.00 |
| 16.80 | 22.62 | 22.62 | 0.00 |
| 16.85 | 24.46 | 24.46 | 0.00 |
| 16.90 | 26.35 | 26.35 | 0.00 |
| 16.95 | 28.31 | 28.31 | 0.00 |
| 17.00 | 30.32 | 30.32 | 0.00 |
| 17.05 | 32.39 | 32.39 | 0.00 |
| 17.10 | 34.51 | 34.51 | 0.00 |
| 17.15 | 36.69 | 36.69 | 0.00 |
| 17.20 | 38.93 | 38.93 | 0.00 |
| 17.25 | 41.29 | 41.29 | 0.00 |
| 17.30 | 43.77 | 43.77 | 0.00 |
| 17.35 | 46.33 | 46.33 | 0.00 |
| 17.40 | 48.91 | 48.91 | 0.00 |
| 17.45 | 50.38 | 50.38 | 0.00 |
| 17.50 | 50.56 | 50.56 | 0.00 |
| 17.55 | 50.74 | 50.74 | 0.00 |
| 17.60 | 50.92 | 50.92 | 0.00 |
| 17.65 | 51.10 | 51.10 | 0.00 |
| 17.70 | 51.28 | 51.28 | 0.00 |
| 17.75 | 51.46 | 51.46 | 0.00 |
| 17.80 | 51.64 | 51.64 | 0.00 |
| 17.85 | 51.81 | 51.81 | 0.00 |
| 17.90 | 51.99 | 51.99 | 0.00 |
| 17.95 | 52.17 | 52.17 | 0.00 |
| 18.00 | 52.34 | 52.34 | 0.00 |
| 18.05 | 53.67 | 52.52 | 1.15 |
| 18.10 | 55.94 | 52.69 | 3.25 |
| 18.15 | 58.84 | 52.87 | 5.97 |
| 18.20 | 62.23 | 53.04 | 9.19 |
| 18.25 | 66.12 | 53.21 | 12.91 |
| 18.30 | 70.44 | 53.38 | 17.06 |
| 18.35 | 75.15 | 53.55 | 21.60 |
| 18.40 | 80.24 | 53.72 | 26.51 |
| 18.45 | 85.77 | 53.90 | 31.88 |
| 18.50 | 91.68 | 54.06 | 37.62 |
| 18.55 | 97.96 | 54.23 | 43.73 |
| 18.60 | 104.60 | 54.40 | 50.19 |
| 18.65 | 111.01 | 54.57 | 56.44 |
| 18.70 | 117.64 | 54.74 | 62.90 |
| 18.75 | 124.47 | 54.91 | 69.56 |
| 18.80 | 131.49 | 55.07 | 76.42 |
| 18.85 | 138.86 | 55.24 | 83.62 |
| 18.90 | 146.42 | 55.40 | 91.02 |
| 18.95 | 154.18 | 55.57 | 98.61 |
| 19.00 | **162.13** | **55.73** | **106.40** |

## Stage-Area-Storage for Pond 17P: Lower Ash Pond

| Elevation (feet) | Surface (acres) | Storage (acre-feet) |
|---|---|---|
| 15.00 | 102.000 | 0.000 |
| 15.05 | 102.005 | 5.100 |
| 15.10 | 102.010 | 10.200 |
| 15.15 | 102.015 | 15.301 |
| 15.20 | 102.020 | 20.402 |
| 15.25 | 102.025 | 25.503 |
| 15.30 | 102.030 | 30.605 |
| 15.35 | 102.035 | 35.706 |
| 15.40 | 102.040 | 40.808 |
| 15.45 | 102.045 | 45.910 |
| 15.50 | 102.050 | 51.012 |
| 15.55 | 102.055 | 56.115 |
| 15.60 | 102.060 | 61.218 |
| 15.65 | 102.065 | 66.321 |
| 15.70 | 102.070 | 71.424 |
| 15.75 | 102.075 | 76.528 |
| 15.80 | 102.080 | 81.632 |
| 15.85 | 102.085 | 86.736 |
| 15.90 | 102.090 | 91.841 |
| 15.95 | 102.095 | 96.945 |
| 16.00 | 102.100 | 102.050 |
| 16.05 | 102.120 | 107.156 |
| 16.10 | 102.140 | 112.262 |
| 16.15 | 102.160 | 117.369 |
| 16.20 | 102.180 | 122.478 |
| 16.25 | 102.200 | 127.587 |
| 16.30 | 102.220 | 132.698 |
| 16.35 | 102.240 | 137.810 |
| 16.40 | 102.260 | 142.922 |
| 16.45 | 102.280 | 148.035 |
| 16.50 | 102.300 | 153.150 |
| 16.55 | 102.320 | 158.266 |
| 16.60 | 102.340 | 163.382 |
| 16.65 | 102.360 | 168.499 |
| 16.70 | 102.380 | 173.618 |
| 16.75 | 102.400 | 178.737 |
| 16.80 | 102.420 | 183.858 |
| 16.85 | 102.440 | 188.980 |
| 16.90 | 102.460 | 194.102 |
| 16.95 | 102.480 | 199.225 |
| 17.00 | 102.500 | 204.350 |
| 17.05 | 102.520 | 209.476 |
| 17.10 | 102.540 | 214.602 |
| 17.15 | 102.560 | 219.729 |
| 17.20 | 102.580 | 224.858 |
| 17.25 | 102.600 | 229.987 |
| 17.30 | 102.620 | 235.118 |
| 17.35 | 102.640 | 240.250 |
| 17.40 | 102.660 | 245.382 |
| 17.45 | 102.680 | 250.515 |
| 17.50 | 102.700 | 255.650 |
| 17.55 | 102.720 | 260.786 |
| 17.60 | 102.740 | 265.922 |
| 17.65 | 102.760 | 271.059 |
| 17.70 | 102.780 | 276.198 |
| 17.75 | 102.800 | 281.337 |
| 17.80 | 102.820 | 286.478 |
| 17.85 | 102.840 | 291.620 |
| 17.90 | 102.860 | 296.762 |
| 17.95 | 102.880 | 301.905 |
| 18.00 | 102.900 | 307.050 |
| 18.05 | 102.920 | 312.196 |
| 18.10 | 102.940 | 317.342 |
| 18.15 | 102.960 | 322.489 |
| 18.20 | 102.980 | 327.638 |
| 18.25 | 103.000 | 332.787 |
| 18.30 | 103.020 | 337.938 |
| 18.35 | 103.040 | 343.090 |
| 18.40 | 103.060 | 348.242 |
| 18.45 | 103.080 | 353.395 |
| 18.50 | 103.100 | 358.550 |
| 18.55 | 103.120 | 363.706 |
| 18.60 | 103.140 | 368.862 |
| 18.65 | 103.160 | 374.019 |
| 18.70 | 103.180 | 379.178 |
| 18.75 | 103.200 | 384.337 |
| 18.80 | 103.220 | 389.498 |
| 18.85 | 103.240 | 394.660 |
| 18.90 | 103.260 | 399.822 |
| 18.95 | 103.280 | 404.985 |
| 19.00 | **103.300** | **410.150** |

## Summary for Link 12L: Pumps

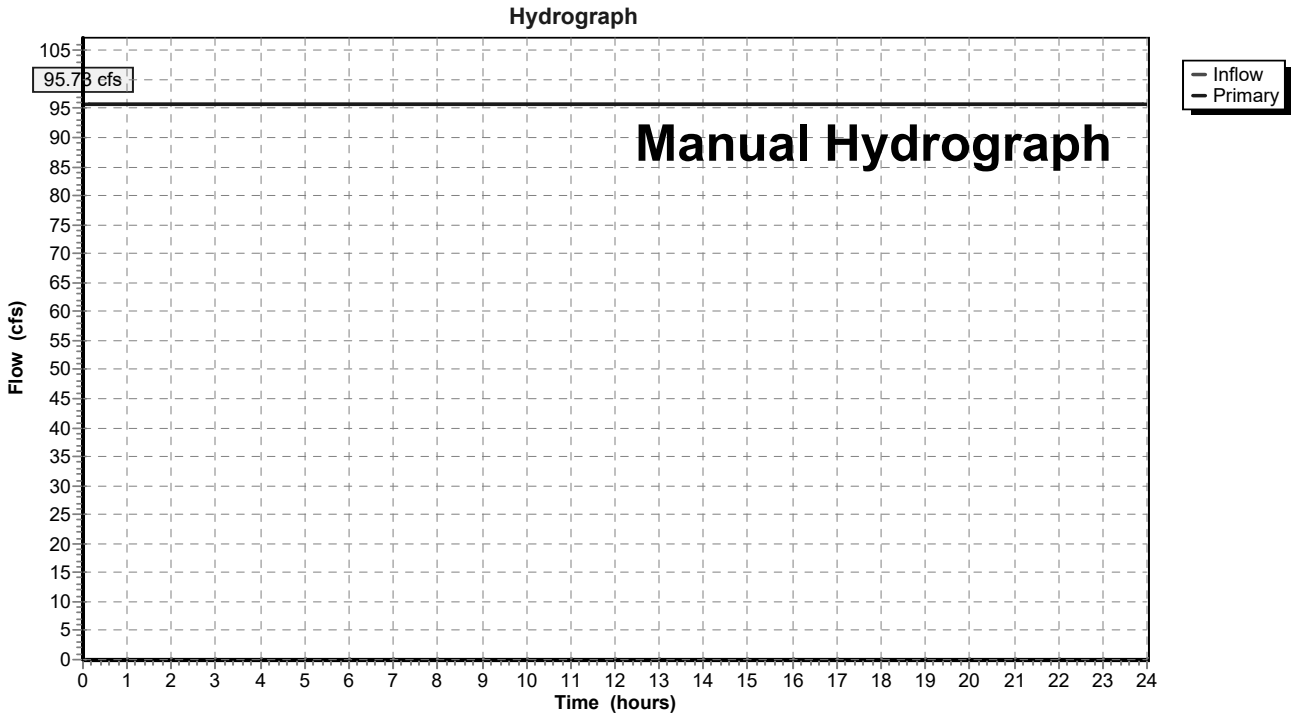
Inflow = 95.73 cfs @ 0.00 hrs, Volume= 190.273 af
Primary = 95.73 cfs @ 0.00 hrs, Volume= 190.273 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 |
| 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 95.73 |
| 95.73 | 95.73 | 95.73 | 95.73 | 95.73 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 |
| 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 |
| 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | 7.12 | |

## Link 12L: Pumps



## Hydrograph for Link 12L: Pumps

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | **95.73** | **0.00** | **95.73** | 13.25 | 95.73 | 0.00 | 95.73 |
| 0.25 | 95.73 | 0.00 | 95.73 | 13.50 | 95.73 | 0.00 | 95.73 |
| 0.50 | 95.73 | 0.00 | 95.73 | 13.75 | 95.73 | 0.00 | 95.73 |
| 0.75 | 95.73 | 0.00 | 95.73 | 14.00 | 95.73 | 0.00 | 95.73 |
| 1.00 | 95.73 | 0.00 | 95.73 | 14.25 | 95.73 | 0.00 | 95.73 |
| 1.25 | 95.73 | 0.00 | 95.73 | 14.50 | 95.73 | 0.00 | 95.73 |
| 1.50 | 95.73 | 0.00 | 95.73 | 14.75 | 95.73 | 0.00 | 95.73 |
| 1.75 | 95.73 | 0.00 | 95.73 | 15.00 | 95.73 | 0.00 | 95.73 |
| 2.00 | 95.73 | 0.00 | 95.73 | 15.25 | 95.73 | 0.00 | 95.73 |
| 2.25 | 95.73 | 0.00 | 95.73 | 15.50 | 95.73 | 0.00 | 95.73 |
| 2.50 | 95.73 | 0.00 | 95.73 | 15.75 | 95.73 | 0.00 | 95.73 |
| 2.75 | 95.73 | 0.00 | 95.73 | 16.00 | 95.73 | 0.00 | 95.73 |
| 3.00 | 95.73 | 0.00 | 95.73 | 16.25 | 95.73 | 0.00 | 95.73 |
| 3.25 | 95.73 | 0.00 | 95.73 | 16.50 | 95.73 | 0.00 | 95.73 |
| 3.50 | 95.73 | 0.00 | 95.73 | 16.75 | 95.73 | 0.00 | 95.73 |
| 3.75 | 95.73 | 0.00 | 95.73 | 17.00 | 95.73 | 0.00 | 95.73 |
| 4.00 | 95.73 | 0.00 | 95.73 | 17.25 | 95.73 | 0.00 | 95.73 |
| 4.25 | 95.73 | 0.00 | 95.73 | 17.50 | 95.73 | 0.00 | 95.73 |
| 4.50 | 95.73 | 0.00 | 95.73 | 17.75 | 95.73 | 0.00 | 95.73 |
| 4.75 | 95.73 | 0.00 | 95.73 | 18.00 | 95.73 | 0.00 | 95.73 |
| 5.00 | 95.73 | 0.00 | 95.73 | 18.25 | 95.73 | 0.00 | 95.73 |
| 5.25 | 95.73 | 0.00 | 95.73 | 18.50 | 95.73 | 0.00 | 95.73 |
| 5.50 | 95.73 | 0.00 | 95.73 | 18.75 | 95.73 | 0.00 | 95.73 |
| 5.75 | 95.73 | 0.00 | 95.73 | 19.00 | 95.73 | 0.00 | 95.73 |
| 6.00 | 95.73 | 0.00 | 95.73 | 19.25 | 95.73 | 0.00 | 95.73 |
| 6.25 | 95.73 | 0.00 | 95.73 | 19.50 | 95.73 | 0.00 | 95.73 |
| 6.50 | 95.73 | 0.00 | 95.73 | 19.75 | 95.73 | 0.00 | 95.73 |
| 6.75 | 95.73 | 0.00 | 95.73 | 20.00 | 95.73 | 0.00 | 95.73 |
| 7.00 | 95.73 | 0.00 | 95.73 | 20.25 | 95.73 | 0.00 | 95.73 |
| 7.25 | 95.73 | 0.00 | 95.73 | 20.50 | 95.73 | 0.00 | 95.73 |
| 7.50 | 95.73 | 0.00 | 95.73 | 20.75 | 95.73 | 0.00 | 95.73 |
| 7.75 | 95.73 | 0.00 | 95.73 | 21.00 | 95.73 | 0.00 | 95.73 |
| 8.00 | 95.73 | 0.00 | 95.73 | 21.25 | 95.73 | 0.00 | 95.73 |
| 8.25 | 95.73 | 0.00 | 95.73 | 21.50 | 95.73 | 0.00 | 95.73 |
| 8.50 | 95.73 | 0.00 | 95.73 | 21.75 | 95.73 | 0.00 | 95.73 |
| 8.75 | 95.73 | 0.00 | 95.73 | 22.00 | 95.73 | 0.00 | 95.73 |
| 9.00 | 95.73 | 0.00 | 95.73 | 22.25 | 95.73 | 0.00 | 95.73 |
| 9.25 | 95.73 | 0.00 | 95.73 | 22.50 | 95.73 | 0.00 | 95.73 |
| 9.50 | 95.73 | 0.00 | 95.73 | 22.75 | 95.73 | 0.00 | 95.73 |
| 9.75 | 95.73 | 0.00 | 95.73 | 23.00 | 95.73 | 0.00 | 95.73 |
| 10.00 | 95.73 | 0.00 | 95.73 | 23.25 | 95.73 | 0.00 | 95.73 |
| 10.25 | 95.73 | 0.00 | 95.73 | 23.50 | 95.73 | 0.00 | 95.73 |
| 10.50 | 95.73 | 0.00 | 95.73 | 23.75 | 95.73 | 0.00 | 95.73 |
| 10.75 | 95.73 | 0.00 | 95.73 | 24.00 | 95.73 | 0.00 | 95.73 |
| 11.00 | 95.73 | 0.00 | 95.73 | | | | |
| 11.25 | 95.73 | 0.00 | 95.73 | | | | |
| 11.50 | 95.73 | 0.00 | 95.73 | | | | |
| 11.75 | 95.73 | 0.00 | 95.73 | | | | |
| 12.00 | 95.73 | 0.00 | 95.73 | | | | |
| 12.25 | 95.73 | 0.00 | 95.73 | | | | |
| 12.50 | 95.73 | 0.00 | 95.73 | | | | |
| 12.75 | 95.73 | 0.00 | 95.73 | | | | |
| 13.00 | 95.73 | 0.00 | 95.73 | | | | |