

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN PERIODIC 5-YEAR REVIEW

CFR 257.82(c)

Bottom Ash Pond Complex

Amos Power Plant
Winfield, West Virginia

October, 2021

Prepared for : Appalachian Power Company – Amos Plant

Winfield, West Virginia

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215



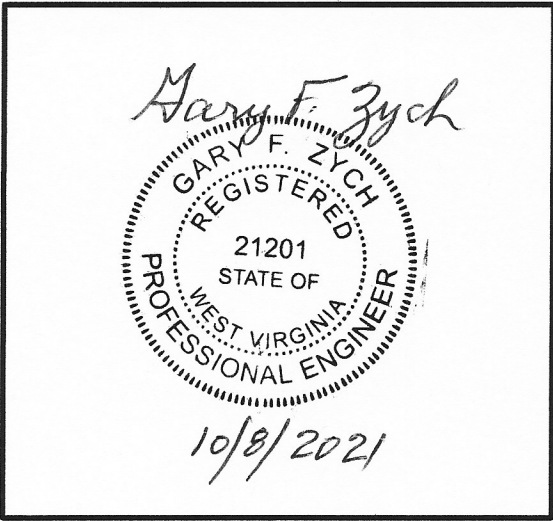
Document ID: GERS-21-057

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PERIODIC 5-YEAR REVIEW
CFR 257.82(c)
AMOS PLANT
BOTTOM ASH COMPLEX

PREPARED BY *Brian G. Palmer* DATE 10/08/2021
Brian G. Palmer, P.E.

REVIEWED BY *Brett A. Dreger* DATE 10/8/2021
Brett Dreger, P.E.

APPROVED BY *Gary F. Zych* DATE 10/8/2021
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering



I certify to the best of my knowledge, information, and belief that the information contained in this Inflow Design Flood Control System Plan meets the requirements of 40 CFR § 257.82.

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- Attachment A – Location Maps
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1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.82(c) for the Inflow Design Flood Control System Plan. This is the first periodic 5-year review of the inflow design flood control plan

2.0 DESCRIPTIONS OF CCR IMPOUNDMENT

The John E. Amos Plant is located in Putnam County, West Virginia. It is owned and operated by Appalachian Power Company (APCO). The facility operates a surface impoundment for storing CCR called the Bottom Ash Pond Complex.

The Bottom Ash Complex consists of Bottom Ash Pond 1A, Bottom Ash Pond 1B, Reclaim Water pond (RCWP) and the Treatment pond (TP). The Main Perimeter Dike is located on three sides of the impoundment and grades into native ground along the southern boundary. The BAP-1B pond is bounded on the west by the filled former sedimentation pond and on the east by the BAP-1A. A splitter dike separates the BAP-1A and BAP-1B and the Reclaim Water pond. Figure 1 (aerial image – plan view) illustrates the bottom ash pond complex (Attachment A).

3.0 DESCRIPTION OF DESIGN FLOOD 257.82(a)(3)

The Bottom Ash Pond Complex has been determined to be a Significant Hazard potential CCR impoundment. Based on this hazard classification, the design flood as determined by section 257.82(a)(3) is to be the 1,000-year storm which corresponds to 7 inches for this site. The State of West Virginia regulations for Class II dams requires the dam to be able to pass the ½ PMP (Probable Maximum Precipitation), 6 hour storm event which is equivalent to 14 inches of rain. This plan includes an analysis for the ½ PMP event which exceeds the requirements of section 257.82(a)(3).

4.0 DESCRIPTION OF INFLOW DESIGN FLOOD CONTROL SYSTEM 257.82(c)

The Amos Bottom Ash Complex is comprised of diked embankments on three sides which directs storm water away from the impoundment and limits runoff to that which falls directly on the pond surface. The watershed area to the south is approximately 50 acres and drains into the pond. Inflows into the pond complex are collected and discharged through outlet structures within each area. No changes to the watershed or operations since the last assessment.

Discharge water from either bottom ash pond flows into the reclaim water pond through a 36 inch diameter pipes. A portion of the flow into the reclaim water pond is pumped backed to the plant for reuse.

The remaining portion flows through a 36 inch diameter pipe into the treatment / clear water pond that decants into a concrete weir connected to a 24 in x 38 in elliptical reinforced concrete pipe. The 24 x 38 concrete elliptical pipe transitions to a 36 inch diameter steel pipe to a 36 inch diameter HDPE pipe that extends into the Kanawha River along the river bed allowing the flow to be discharged into a mixing zone.

The 24 x 38 concrete elliptical pipe discharge pipe was slip lined in 2013 due to leakage at the joints.

An overflow spillway pipe, 36 inch diameter, is located along the reclaim pond with an invert elevation set modeled at 583.2 ft. Bottom ash pond 1B also has a 36 in diameter overflow spillway pipe that discharges to Bill’s Creek that was modeled with an invert elevation of 583.7 feet.

The interior splitter dikes between the pond 1A, 1B, the Reclaim Water Pond and the Treatment Basin will be inundated during the ½ PMF event. The dike between the Reclaim Pond and the Treatment Pond will be inundated from a smaller storm event.

5.0 SUMMARY OF INFLOWS, OUTFLOWS AND FLOOD ELEVATIONS

The following table provides the maximum inflows, outflows and flood elevations for each portion of the pond complex. See the analysis included in Attachment B for detailed calculations.

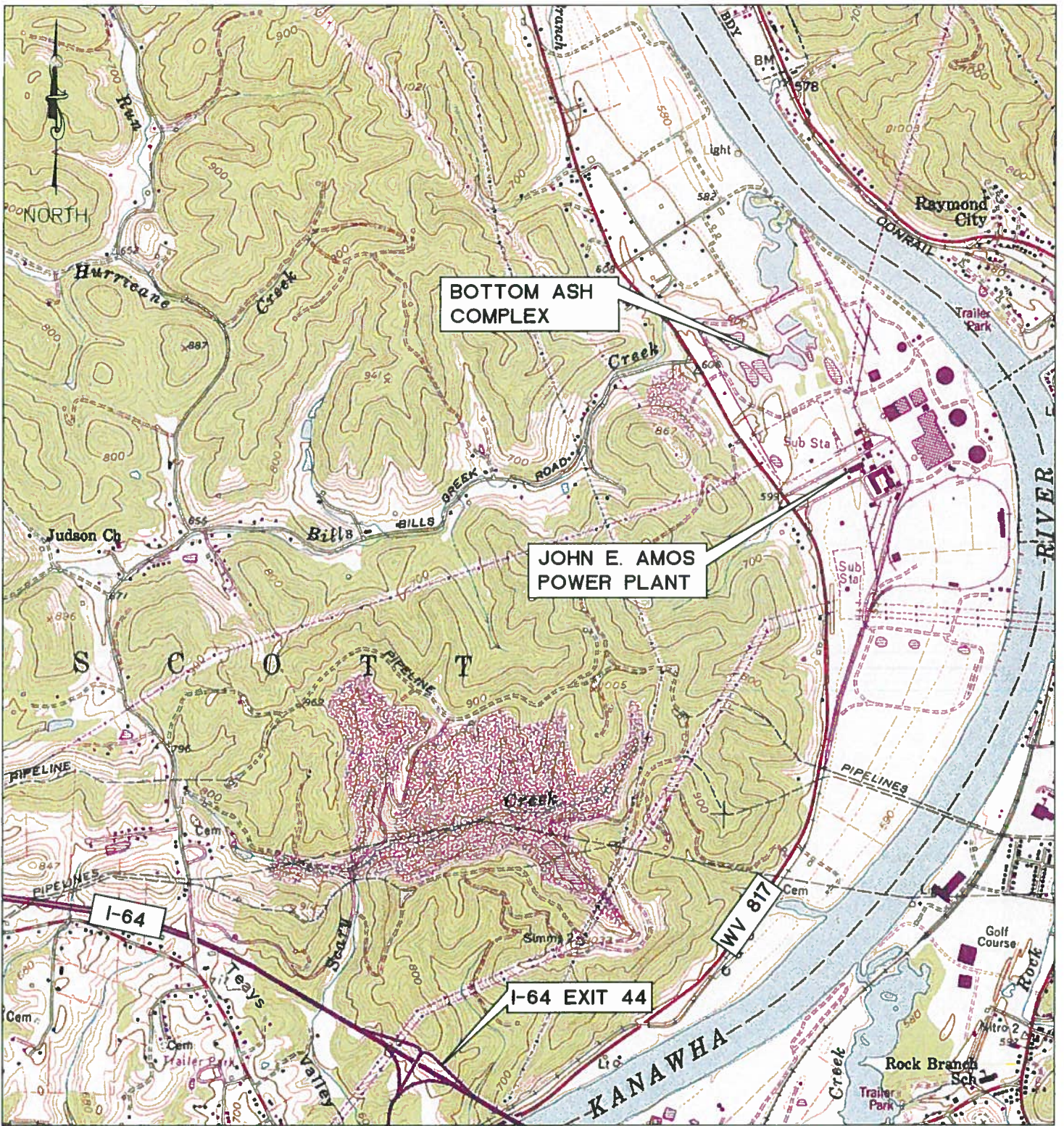
Bottom Ash Pond 1A & Reclaim Pond	
Storm Event	½ 6-hour PMP
Peak Inflow	243 cfs
Peak Outflow	19 cfs
Maximum Pool Elevation	585.4 ft.
Crest Elevation	588 ft.

Bottom Pond 1B & Reclaim Pond	
Storm Event	½ 6-hour PMP
Peak Inflow	225 cfs
Peak Outflow	14 cfs
Maximum Pool Elevation	585.5 ft.
Crest Elevation	588 ft.

Ref: Geo/Environmental Assc., Inc. December 2015, “CCR Rules Certification Report, John Amos Plant-Bottom Ash Complex, Putnam County West Virginia” GA Project No. 15055009, GA Assc. Knoxville TN.

ATTACHMENT A

LOCATION MAPS



SAINT ALBANS, WV
7.5 MINUTE SERIES
UPDATED 1976

**JOHN E. AMOS PLANT
BOTTOM ASH COMPLEX**

LOCATION MAP

PUTNAM COUNTY

REV NO.

DATE

DESC.



gai consultants

CHARLESTON OFFICE
300 SUMMERS STREET,
SUITE 1100
CHARLESTON, WV 25301
304-926-8100

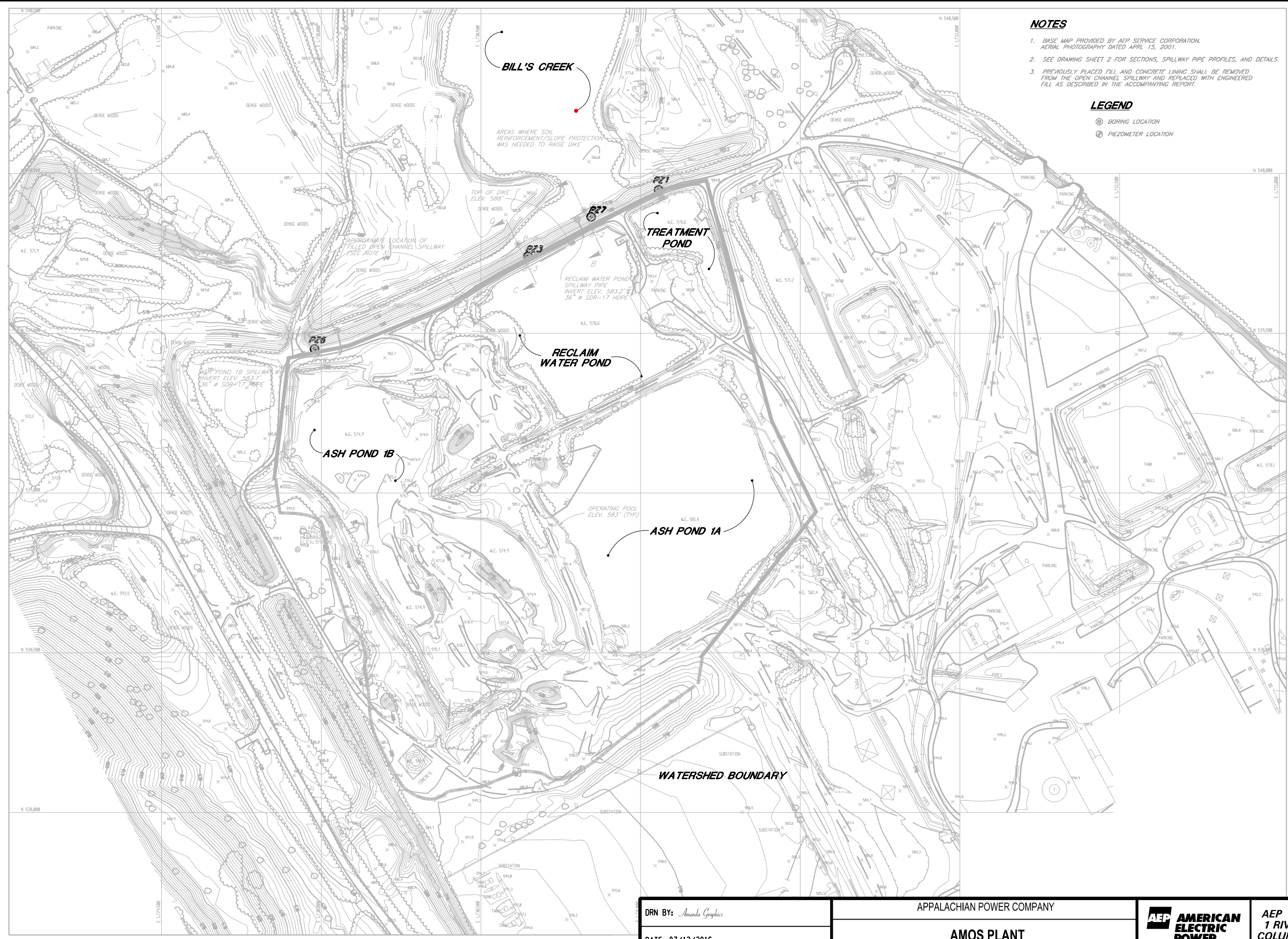
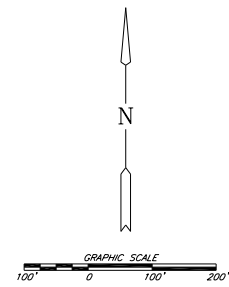
DATE	SCALE
7/8/13	1"=2000'

FIGURE NUMBER

1

SCALE 1" = 2000'





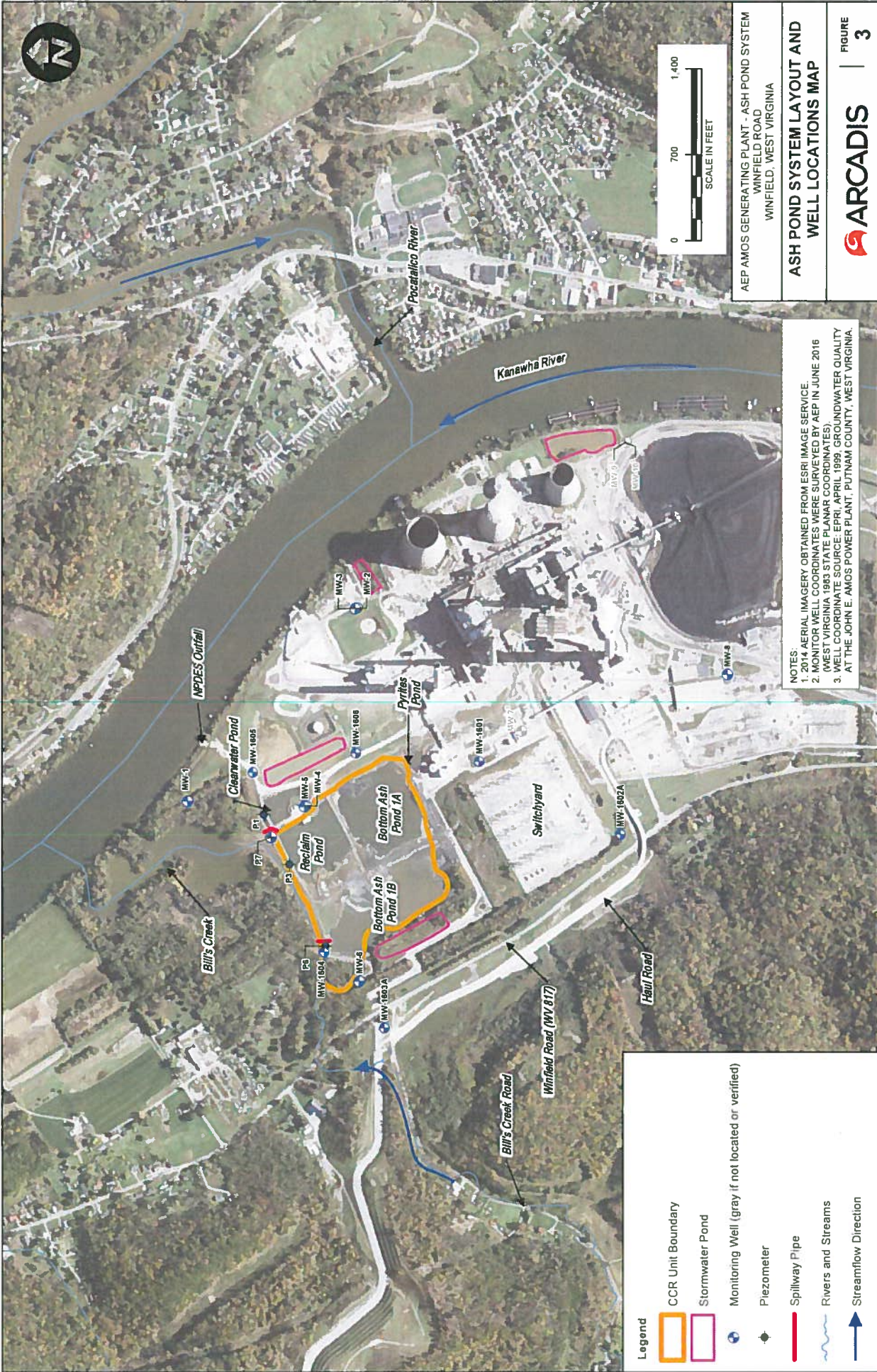
NOTES

1. BASE MAP PROVIDED BY AEP SERVICE CORPORATION. AERIAL PHOTOGRAPHY DATED APRIL 15, 2001.
2. SEE DRAWING SHEET 2 FOR SECTIONS, SPILLWAY PIPE PROFILES, AND DETAILS.
3. PREVIOUSLY PLACED FILL AND CONCRETE LINING SHALL BE REMOVED FROM THE OPEN CHANNEL SPILLWAY AND REPLACED WITH ENGINEERED FILL AS DESCRIBED IN THE ACCOMPANYING REPORT.

LEGEND

- BORING LOCATION
- ⊙ PIEZOMETER LOCATION

DRN BY: Amanda Graphics	APPALACHIAN POWER COMPANY			AEP SERVICE CORP. 1 RIVERSIDE PLAZA COLUMBUS, OH 43215
DATE: 07/12/2016	SCARY	AMOS PLANT WEST VIRGINIA		
SCALE: N. T. S	BOTTOM ASH POND COMPLEX		FIGURE 2	



AEP AMOS GENERATING PLANT - ASH POND SYSTEM
WINFIELD ROAD
WINFIELD, WEST VIRGINIA

ASH POND SYSTEM LAYOUT AND WELL LOCATIONS MAP

ARCADIS | **FIGURE 3**

NOTES:
 1. 2014 AERIAL IMAGERY OBTAINED FROM ESRI IMAGE SERVICE.
 2. MONITOR WELL COORDINATES WERE SURVEYED BY AEP IN JUNE 2016 (WEST VIRGINIA 1983 STATE PLANNAR COORDINATES).
 3. WELL COORDINATE SOURCE: EPRI, APRIL 1999, GROUNDWATER QUALITY AT THE JOHN E. AMOS POWER PLANT, PUTNAM COUNTY, WEST VIRGINIA.

Legend

- CCR Unit Boundary
- Stormwater Pond
- Monitoring Well (gray if not located or verified)
- ◆ Piezometer
- Spillway Pipe
- ~ Rivers and Streams
- ➔ Streamflow Direction

City: DTRIX On/Group: I/DCV Created By: K Ives Last Saved By: webb
 C:\01576\0009\00001\Map\Ash Pond Well Location Map_V3.mxd / 2/29/2016 10:08:45 AM
 Z:\01576\0009\00001\Map\Ash Pond Well Location Map_V3.mxd / 2/29/2016 10:08:45 AM

ATTACHMENT B

DESIGN REPORT

**CCR RULES CERTIFICATION REPORT
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
PUTNAM COUNTY, WEST VIRGINIA**

Prepared For:

**AEP Service Corporation
Geotechnical Engineering Group
1 Riverside Plaza
Columbus, OH 43215-2373**

Prepared By:

**Geo/Environmental Associates, Inc.
3502 Overlook Circle
Knoxville, TN 37909**

**GA Project No. 15055009
December 21, 2015**



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**CCR RULES ASSESSMENT AND CERTIFICATION
JOHN AMOS PLANT - BOTTOM ASH COMPLEX
POCA, PUTNAM COUNTY, WEST VIRGINIA
DECEMBER 21, 2015**

INTRODUCTION

Geo/Environmental Associates, Inc. (GA) has performed a site visit, conducted an engineering assessment, and prepared a certification statement for the John Amos Plant - Bottom Ash Complex. These services were performed to meet specific requirements set forth in the Environmental Protection Agency's CCR Rules (i.e., 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals From Electric Utilities, Final Rule," dated April 17, 2015). Provided in this report is a discussion of GA's findings and a certification statement pertaining to the facility. Photographs, supplemental field and laboratory data, engineering analyses, and a drawing are included in the appendices.

REVIEW OF PREVIOUS ANALYSES AND SITE DESCRIPTION

The Amos Power Plant is situated in Putnam County, West Virginia within the physiographic province of the Appalachian Plateau. A more detailed description of the site geology is included in Appendix II. The Amos Power Plant primary and ancillary facilities are located along the southern bank of the Kanawha River along S.R. 35 approximately two miles northwest of Interstate I-64 at Scary, WV. The Bottom Ash Complex consists of two dams #1A WVA ID #07918 and #1B WVA ID #07919. The dams share a common earthen embankment across Bill's Creek with a series of splitter dikes to create four distinct cells referred to as Bottom Ash Pond No. 1A, Bottom Ash Pond No. 1B, Reclaim Water Pond and the Treatment Basin.

The earliest record available of the Bottom Ash Complex is dated June 28, 1970. There was an open channel that acted as the emergency spillway of an earthen dike structure on the northwest corner of the Bottom Ash Pond No. 1B.

Modifications to the site include: the 1977 construction of a road embankment on the northwest corner of the Bottom Ash Pond No. 1B, a sedimentation pond, and a splitter dike constructed on the southeast corner of the Bottom Ash Pond No. 1A for the sedimentation of pyrites (referred to as the Pyrites Pond). The construction of the roadway embankment effectively eliminated the northwest corner of the Bottom Ash Pond No. 1B from collecting additional bottom ash and from ponding water. An open channel spillway, that was part of the original construction, was abandoned prior to 1977.



Subsequent modifications, mostly associated with the operations of the ponds, have taken place since 1977. Perhaps the most relevant has been the elimination, from active use, of the sedimentation pond located along the west side of the Bottom Ash Pond No. 1B, illustrated on the 1977 drawing. In addition, higher than anticipated operating water levels could occur sporadically in the ponds during certain plant maintenance operations. Ash handling operations can also result in the localized accumulation of bottom ash at or above the operational water levels. The current configuration of the Bottom Ash Complex is shown on the drawings in Appendix VI.

Current operations of the ponds consist of sluicing bottom ash into ponds #1A or #1B, allowing the particles to settle and the overflow to circulate to the reclaim pond from where the majority of the water is pumped back to the plant and the remaining water is allowed to overflow into the treatment pond before it is released into the Kanawha River at outfall No. 003. During the course of the year, the Bottom Ash Ponds are alternately taken out of service to allow for the removal of the bottom ash for beneficial re-use. Thus, it is commonly expected that, at the same time bottom ash slurry is sluiced into one pond, the other pond is being excavated.

The Bottom Ash Pond Complex is inspected by Plant personnel on a monthly basis and, under the direct supervision of a professional engineer, it is inspected annually. Reports of the engineer's inspection are forwarded to the West Virginia DEP Dam Safety office with the frequency established in the regulations for Class II facilities.

The main dike of the facility is about 1350 feet long. We were provided with a copy of a report titled "Report on Dam Safety Inspection Amos Fly Ash Dam and Amos Bottom Ash Dikes" dated March 1981, prepared by Woodward-Clyde Consultants. According to that report, the maximum height of the main dike above natural ground is about 24 feet.

GA performed design and analysis services for the facility in 2005 and 2008. We provided two reports, "Responses to February 15, 2005 DEP Review Letter," dated December 5, 2005 and "Responses to May 12, 2008 DEP Review Letter," dated May 22, 2008. Our work involved addressing West Virginia DEP concerns and also raising the main dikes from a minimum crest elevation of about 584 feet with a minimum crest width of about 15 feet, to a minimum elevation of 588 feet. The increased dike elevation was needed to operate the pool levels in Ash Ponds 1A

and 1B and the Reclaim Pond as high as elevation 583 feet under certain operating conditions while providing adequate storm storage and routing and maintaining at least one foot of freeboard during the design storm. Our work at the time included hydrologic, hydraulic, and stability analyses. The facility previously had an open channel spillway with bottom elevation 581 feet through the main dike at the Reclaim Water Pond. In our design we proposed two 36-inch diameter polyethylene spillway pipes, both with inlet elevations of 583.5 feet.

In 2010, the main dikes were raised to the minimum proposed crest elevation of 588 feet. In addition to the main dike, the eastern side of the complex was raised to elevation 588 feet. In some areas the elevation 584 crest was wide enough such that it could be raised with 4 feet of soil fill and still maintain a minimum 10-foot-wide crest. In other areas that were too narrow to raise the crest with soil fill, a segmented retaining block system (Redi-rock) was used to achieve the elevation 588 feet crest. The drawings in Appendix VI show the areas where the block walls were constructed and a construction detail of the block wall system.

Field Investigation and Laboratory Testing

At the direction of AEPSC, eight borings were drilled through the main dike in August 2005 by H.C. Nutting Company of Charleston, West Virginia. The boring locations are shown on the drawings in Appendix VI. Boring logs are included in Appendix III. Standard Penetration Tests (SPT) were performed generally on 5-foot intervals. Relatively undisturbed samples were collected at selected locations using a thin walled sampler. Additionally, three standpipe piezometers were installed in the main dike during the drilling.

Borings B-1 through B-6 were drilled from the crest of the main dike. These borings generally encountered a stiff, lean clay, referred to as shale fill, from the ground surface to a depth of about 15 to 20 feet. Below the shale fill an interval of clayey gravel fill 8 to 10 feet thick was encountered. Below the clayey gravel, a 4 to 6-foot thick layer of soft clay and about a 20-foot thick layer of silty sand, both likely alluvial in origin, were encountered. Below the silty sand, residual weathered shale was encountered to the boring termination depths. Borings B-7 and B-8 were drilled on the downstream face of the main dike, near the water level of Bill's Creek. These two borings encountered strata consistent with borings B-1 through B-6.



Laboratory testing was performed by AEPSC on the SPT split-spoon samples and relatively undisturbed samples. Laboratory testing included moisture content, grain size analysis, classification, permeability, and strength testing. Laboratory test results are included in Appendix III. Laboratory test results are discussed in our comments regarding the stability of the dike.

SITE VISIT BY A PROFESSIONAL ENGINEER

At the request of AEPSC, GA personnel performed a site visit of the Bottom Ash Complex to observe and document the prevalent site conditions. Specifically, Seth W. Frank, P.E. (GA), performed a site inspection of the Bottom Ash Complex on August, 18, 2015. GA believes that the conditions observed, during the August 18, 2015, site visit, are representative of the conditions modeled in the assessment and analyses provided in this report. Pictures taken during the site visit are included in Appendix I.

HYDROLOGIC AND HYDRAULIC ANALYSES

GA's 2008 report included hydrologic and hydraulic analyses to meet WVDEP's design storm requirements for a Class II structure, which is one-half of the 6-hour Probable Maximum Precipitation (PMP) event (about 14 inches of rainfall in 6 hours). The spillway pipes, pool levels, and crest elevation were designed based on this event. GA used the U.S. Army Corps of Engineers HEC-1 computer program for the analyses. A summary of the results are shown in Table 1, and complete results are included in Appendix IV. As shown, the facility passes the design storm while maintaining adequate freeboard.

Table 1. Summary of Hydrologic Analyses

Pond	Crest Elev., ft	Normal Pool Elev., ft	Peak Pool Elev. During Storm, ft	Minimum Freeboard During Storm, ft
1A and Reclaim	588	583.2	585.43	2.57
1B	588	583.7	585.47	2.53



STABILITY ANALYSES AND ACTION VALUES

We have performed stability analyses in general accordance to EPA's CCR requirements.

The requirements specify the following stability assessments:

1. Static factor of safety under the long-term, maximum storage pool condition,
2. Static factor of safety under the maximum surcharge pool condition,
3. Seismic factor of safety,
4. Liquefaction factor of safety,
5. End-of-construction factor of safety,

Limit equilibrium stability analyses were performed on sections B-B and C-C to assess the stability of the embankment. The stability analyses were performed with *SLOPE/W*, a component of the *GeoStudio* software package. *SLOPE/W* is formulated in terms of moment and force equilibrium factor of safety equations. Specifically, the Morgenstern-Price method was used to calculate the factor of safety of each section.

Strength parameters for the various materials used in the analyses are listed in Table 2. The properties of the various materials that comprise the embankment were determined from laboratory tests where appropriate samples could be obtained for testing. The parameters for other materials are based on typical material properties and our experience with similar materials. The Redi-rock reinforced embankment was conservatively assumed to have the strength parameters of the shale fill.



Table 2. Summary of Strength Parameters

Material	EFFECTIVE STRENGTH PARAMETERS	
	c' (psf)	ϕ' (°)
Bottom Ash ⁽²⁾	0	28
Shale Fill ⁽¹⁾	370	27.2
Clayey Gravel Fill ⁽¹⁾	300	32
Clay (natural) ⁽¹⁾	150	35.2
Silty Sand (natural) ⁽¹⁾	0	36.8

(1) Estimated from laboratory tests (See Appendix III).

(2) Estimated based on material properties and experience with similar materials.

Stability analyses were performed with phreatic conditions at the maximum level measured in piezometers or during drilling. A summary of the safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Static Factor of Safety under the Long-Term Storage Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.5 when the pool is at the maximum, long-term level (i.e., normal pool) and a steady state seepage condition has developed. GA selected two critical sections, designated as B-B and C-C, for the analyses. The sections and their locations are shown on the drawings in Appendix VI. GA determined the embankment material types and stratigraphy from the aforementioned drilling and laboratory testing performed by AEPSC.

Static Factor of Safety under the Maximum Surcharge Pool Condition

The CCR regulations specify the factor of safety should meet or exceed 1.4 when the pool is at the maximum surcharge pool condition. We performed the stability analyses with the pool at the peak level during the one-half PMP design storm event, discussed previously. As shown in Table 1, the peak level in either pond was elevation 585.5 feet. We used this level for the stability analyses of both B-B and C-C.

A summary of the safety factors, from the maximum surcharge stability analyses, is shown in Table 4. Stability analysis results are included in Appendix V.



Seismic Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.0 under seismic conditions. Furthermore, the recommended design earthquake event should have a 2% exceedance in 50 years (an approximate return period of 2,475 years). GA performed pseudo-static stability analyses on sections B-B and C-C with the elevation 583.5 normal pool level and steady state seepage conditions based on maximum, measured piezometric levels.

Based on the *2008 Interactive Deaggregations* website, provided online through the USGS Geologic Hazards Science Center, the Amos Bottom Ash Complex facility has a peak ground acceleration of 0.065g for a seismic loading event with a mean return time of 2,475 years. Conservatively assuming soft soil ground conditions above rock, translates to a peak horizontal ground surface acceleration of approximately 0.15g. Using a commonly applied factor of 0.5 times the peak horizontal acceleration yields the conservative horizontal seismic coefficient of 0.075 that was applied in the slope stability analyses.

A summary of the pseudo-static safety factors is shown in Table 4. Stability analysis results are included in Appendix V.

Liquefaction Assessment

The CCR regulations specify the liquefaction factor of safety should meet or exceed 1.2. This requirement applies to facilities with embankment materials that have been determined to contain soils susceptible to liquefaction.

We used the Standard Penetration Testing (SPT) results from the exploratory drilling program and laboratory testing results to determine the embankment soils' susceptibility to liquefaction. We used methods from Mine Safety and Health Administration's *Engineering and Design Manual for Coal Refuse Disposal Facilities* (2010) to make the determination. First, the SPT blow counts were corrected to $N_{1,60}$ values for each soil layer and a median value was calculated. Calculation spreadsheets are included in Appendix V, and the median values for embankment materials are in shown in Table 3.



Table 3. Corrected SPT Data and Soil Type

Soil	Median Corrected SPT Blow Count	Sand-like or Clay-like
Shale Fill	19.6	clay-like
Clayey Gravel	15.2	clay-like

MSHA manual guidelines state a clay-like soil can be susceptible to liquefaction if the corrected SPT value is less than 6. As shown in Table 3, using these guidelines, the shale fill and clayey gravel should not be susceptible to liquefaction. Because the embankment materials are not susceptible to liquefaction, no additional analyses were performed for this assessment. Note that this assessment does not extend to foundation materials, below the embankment.

End-of-construction Factor of Safety

The CCR regulations specify the factor of safety should meet or exceed 1.3 for the end-of-construction loading condition. End of construction factors of safety are typically calculated for new construction. Given that the facility has been in service for more than 40 years and is considered to be in its long-term condition, no additional analyses were performed.

Summary of Results

A summary of results from the slope stability analyses is provided in Table 4. *SLOPE/W* computer output, showing the modeled profiles, loading conditions, and critical failure surfaces are provided in Appendix V. As shown in the slope stability analysis results in Table 4, the factors of safety satisfy the requirements set forth in the CCR Rules.



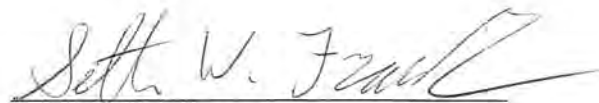
Table 4. Summary of Slope Stability Analyses Results

Analysis Condition	Section B-B	Section C-C
Maximum Long Term Pool	2.1	2.2
Maximum Surcharge Pool	2.0	2.2
Pseudo Static (Downstream)	1.6	1.8
Pseudo Static (Upstream)	3.1	3.2

CERTIFICATION STATEMENT

Based on the site visit, the results of the field and laboratory testing of the materials used in the embankment construction, and our review of the as-built embankment geometry; it is our opinion that the Amos Plant Bottom Ash Complex has slope stability factors of safety that meet or exceed the requirements in the CCR Rules. Furthermore, based on our review of the as-built embankment geometry, current operating pool levels, and the spillway system; we believe that the facility is capable of storing/routing the runoff from one-half of the 6-hour PMP design storm event.

Accordingly, I hereby certify that the John Amos Plant – Bottom Ash Complex meets the applicable requirements in the CCR Rules. It should be clearly noted that this certification is not a legal guarantee. This certification is merely a statement by a registered professional engineer that, to the best of his knowledge, the facility meets the applicable requirements set forth in the CCR Rules. No warranties, expressed or implied, are provided.



Seth W. Frank, P.E.
 West Virginia R.P.E. No. 20574

12-21-2015

Date



**APPENDIX IV
HYDROLOGIC AND HYDRAULIC ANALYSES**



**COMPUTATION OF INFLOW HYDROGRAPH (1/2 6-Hour PMP)
AND FLOOD ROUTING THROUGH THE
PROPOSED PIPE SPILLWAY**

Pond 1A

Crest Elevation	=	588 ft
Pipe Spillway Invert Elevation	=	583.2 ft
Normal Pool Elevation used for Routing	=	583.2 ft
Peak Inflow During Design Storm	=	242.86 cfs
Peak Outflow During Design Storm	=	18.91 cfs
Maximum Pool Elevation During Design Storm	=	585.43 ft
Minimum Freeboard During Design Storm	=	2.57 ft
Peak Storage Volume	=	24.43 ac-ft
Days to Decant 90% of Peak Storage Volume	=	1.44 days

POND 1A SPILLWAY PIPE

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
31.51	50.00	26.00	0.0100	583.20	0.90	0.00

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
581.00	0.000	0.000
581.50	0.000	0.000
582.00	0.000	0.000
582.50	0.000	0.000
583.00	0.000	0.000
583.20	0.000	0.000
583.50	(3)>0.929	0.929
584.00	(3)>3.997	3.997
584.50	(3)>8.280	8.280
585.00	(3)>13.485	13.485
585.50	(3)>19.484	19.484
586.00	(3)>26.165	26.165
586.50	(5)>32.642	32.642
587.00	(5)>38.091	38.091

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 12/10/2015 TIME 11:22:48 *
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*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
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X X XXXXXXXX XXXXX X
X X X X X XX
X X X X X X
XXXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

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1 ID *****
2 ID *
3 ID * AEP Amos Plant Hydraulic Assessment File: 6HRPMPA1.inp *
4 ID * Flood Routing for Ash Pond 1A and Reclaim Pond *
5 ID * 1/2 6 Hour PMP 36" Pipe Invert Elev. 583.2' *
6 ID * GA Project No. 05-361 *
7 ID *
8 ID * Analyses by: Geo/Environmental Associates *
9 ID * Knoxville, TN *
10 ID * December 12, 2015 *
11 ID *
12 ID *****
13 IT 15 0 0 300
14 IO 3
15 JR FLOW 0.5
16 VS BASIN IMP IMP IMP
17 VV 2.11 2.11 6.11 7.11
18 IN 15

19 KK BASIN
20 KM PRECIPITATION
21 PB 0
22 PI 0.287 0.373 0.445 0.502 0.545 0.573 0.653 0.834 0.825 0.980
23 PI 2.322 4.564 4.922 3.344 1.264 0.834 0.864 0.763 0.581 0.560
24 PI 0.525 0.475 0.411 0.332
25 BA 0.040
26 LU 0 0.05 60
27 UD 0.0

28 KK IMP
29 KM ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT
30 RS 1 ELEV 583.2
31 SA 6.01 6.25 17.65 19.97 22.28
32 SQ 0 4.00 13.48 26.16 38.09
33 SE 583.2 584 585 586 587
34 ZZ

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 12/10/2015 TIME 11:22:48 *
*
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*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
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* AEP Amos Plant Hydraulic Assessment File: 6HRPMPA1.inp *
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* Analyses by: Geo/Environmental Associates *
* Knoxville, TN *
* December 12, 2015 *
*
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14 IO OUTPUT CONTROL VARIABLES
      IPRNT      3 PRINT CONTROL
      IPLOT      0 PLOT CONTROL
      QSCAL      0. HYDROGRAPH PLOT SCALE

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IT HYDROGRAPH TIME DATA
      NMIN      15 MINUTES IN COMPUTATION INTERVAL
      IDATE      1 0 STARTING DATE
      ITIME      0000 STARTING TIME
      NQ         300 NUMBER OF HYDROGRAPH ORDINATES
      NDDATE     4 0 ENDING DATE
      NDTIME     0245 ENDING TIME
      ICENT      19 CENTURY MARK

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      COMPUTATION INTERVAL .25 HOURS
      TOTAL TIME BASE 74.75 HOURS

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ENGLISH UNITS
      DRAINAGE AREA SQUARE MILES
      PRECIPITATION DEPTH INCHES
      LENGTH, ELEVATION FEET
      FLOW CUBIC FEET PER SECOND
      STORAGE VOLUME ACRE-FEET
      SURFACE AREA ACRES
      TEMPERATURE DEGREES FAHRENHEIT

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USER-DEFINED OUTPUT SPECIFICATIONS

TABLE 1

VS STATION	BASIN	IMP	IMP	IMP						
VV VARIABLE CODE	2.11	2.11	6.11	7.11	.00	.00	.00	.00	.00	.00

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JP MULTI-PLAN OPTION
      NPLAN      1 NUMBER OF PLANS

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JR MULTI-RATIO OPTION
      RATIOS OF RUNOFF
      .50

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*****
*
19 KK * BASIN *
*
*****
      PRECIPITATION

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18 IN TIME DATA FOR INPUT TIME SERIES
      JXMIN      15 TIME INTERVAL IN MINUTES
      JXDATE     1 0 STARTING DATE

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JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

25 BA SUBBASIN CHARACTERISTICS
TAREA .04 SUBBASIN AREA

PRECIPITATION DATA

21 PB STORM 27.78 BASIN TOTAL PRECIPITATION

22 PI INCREMENTAL PRECIPITATION PATTERN
.29 .37 .45 .50 .54 .57 .65 .83 .82 .98
2.32 4.56 4.92 3.34 1.26 .83 .86 .76 .58 .56
.52 .48 .41 .33

26 LU UNIFORM LOSS RATE
STRTL .00 INITIAL LOSS
CNSTL .05 UNIFORM LOSS RATE
RTIMP 60.00 PERCENT IMPERVIOUS AREA

27 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .00 LAG

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

77. 21. 4. 1. 0.

*** *** *** *** ***

HYDROGRAPH AT STATION BASIN
FOR PLAN 1, RATIO = .50

TOTAL RAINFALL = 27.78, TOTAL LOSS = .12, TOTAL EXCESS = 27.66

PEAK FLOW TIME MAXIMUM AVERAGE FLOW
+ (CFS) (HR) 6-HR 24-HR 72-HR 74.75-HR
+ 486. 3.25 (CFS) 118. 30. 10. 10.
(INCHES) 27.490 27.658 27.658 27.658
(AC-FT) 59. 59. 59. 59.

CUMULATIVE AREA = .04 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION BASIN
FOR PLAN 1, RATIO = .50

PEAK FLOW TIME MAXIMUM AVERAGE FLOW
+ (CFS) (HR) 6-HR 24-HR 72-HR 74.75-HR
+ 243. 3.25 (CFS) 59. 15. 5. 5.
(INCHES) 13.745 13.829 13.829 13.829
(AC-FT) 29. 30. 30. 30.

CUMULATIVE AREA = .04 SQ MI

*** **

* *
28 KK * IMP *
* *

ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT

HYDROGRAPH ROUTING DATA

30 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP ELEV TYPE OF INITIAL CONDITION

RSVRIC 583.20 INITIAL CONDITION
 X .00 WORKING R AND D COEFFICIENT

31 SA	AREA	6.0	6.3	17.6	20.0	22.3
32 SQ	DISCHARGE	0.	4.	13.	26.	38.
33 SE	ELEVATION	583.20	584.00	585.00	586.00	587.00

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	4.90	16.37	35.17	56.28
ELEVATION	583.20	584.00	585.00	586.00	587.00

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HYDROGRAPH AT STATION IMP
 FOR PLAN 1, RATIO = .50

PEAK FLOW + (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.75-HR
19.	6.00	(CFS)	18.	12.	5.	5.
		(INCHES)	4.099	10.751	13.695	13.716
		(AC-FT)	9.	23.	29.	29.
PEAK STORAGE + (AC-FT)	TIME (HR)		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	74.75-HR
24.	6.00		23.	14.	6.	6.
PEAK STAGE + (FEET)	TIME (HR)		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	74.75-HR
585.43	6.00		585.33	584.77	583.93	583.91

CUMULATIVE AREA = .04 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS	
				RATIO 1	
				.50	
HYDROGRAPH AT					
+	BASIN	.04	1	FLOW	243.
				TIME	3.25
ROUTED TO					
+	IMP	.04	1	FLOW	19.
				TIME	6.00
				** PEAK STAGES IN FEET **	
			1	STAGE	585.43
				TIME	6.00

STATION	BASIN	IMP	IMP	IMP
PLAN	FLOW	FLOW	STORAGE	STAGE
RATIO	1	1	1	1
.50	.50	.50	.50	.50

PER DAY MON HRMN

1	1	0000	.00	.00	.00	583.20
2	1	0015	10.82	.09	.11	583.22
3	1	0030	17.14	.32	.40	583.26
4	1	0045	21.42	.64	.78	583.33
5	1	0100	24.68	1.01	1.24	583.40
6	1	0115	27.13	1.43	1.75	583.49
7	1	0130	28.82	1.87	2.30	583.57
8	1	0145	32.30	2.35	2.88	583.67
9	1	0200	40.18	2.92	3.58	583.78
10	1	0215	41.96	3.56	4.36	583.91
11	1	0230	48.23	4.25	5.21	584.03
12	1	0245	101.42	5.45	6.66	584.15
13	1	0300	202.15	7.93	9.66	584.41
14	1	0315	242.86	11.56	14.05	584.80
15	1	0330	191.47	14.76	18.27	585.10
16	1	0345	96.45	16.55	20.92	585.24
17	1	0400	54.44	17.36	22.13	585.31
18	1	0415	45.92	17.82	22.80	585.34
19	1	0430	40.58	18.17	23.32	585.37
20	1	0445	32.40	18.42	23.70	585.39
21	1	0500	29.43	18.59	23.95	585.40
22	1	0515	27.44	18.73	24.15	585.41
23	1	0530	25.03	18.83	24.31	585.42
24	1	0545	21.95	18.90	24.40	585.43
25	1	0600	18.11	18.91	24.43	585.43
26	1	0615	4.57	18.81	24.27	585.42
27	1	0630	.86	18.59	23.94	585.40
28	1	0645	.14	18.34	23.57	585.38
29	1	0700	.00	18.08	23.20	585.36
30	1	0715	.00	17.83	22.82	585.34
31	1	0730	.00	17.59	22.46	585.32
32	1	0745	.00	17.34	22.10	585.30
33	1	0800	.00	17.10	21.74	585.29
34	1	0815	.00	16.87	21.39	585.27
35	1	0830	.00	16.63	21.05	585.25
36	1	0845	.00	16.40	20.70	585.23
37	1	0900	.00	16.18	20.37	585.21
38	1	0915	.00	15.95	20.04	585.19
39	1	0930	.00	15.73	19.71	585.18
40	1	0945	.00	15.51	19.39	585.16
41	1	1000	.00	15.30	19.07	585.14
42	1	1015	.00	15.09	18.75	585.13
43	1	1030	.00	14.88	18.44	585.11
44	1	1045	.00	14.67	18.14	585.09
45	1	1100	.00	14.47	17.84	585.08
46	1	1115	.00	14.27	17.54	585.06
47	1	1130	.00	14.07	17.25	585.05
48	1	1145	.00	13.88	16.96	585.03
49	1	1200	.00	13.68	16.67	585.02
50	1	1215	.00	13.50	16.39	585.00

← Maximum Stage/Storage 6.0 Hours after onset of event

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN				
51	1		1230	.00	13.27	16.12	584.98
52	1		1245	.00	13.05	15.85	584.95
53	1		1300	.00	12.82	15.58	584.93
54	1		1315	.00	12.61	15.32	584.91
55	1		1330	.00	12.39	15.06	584.89
56	1		1345	.00	12.18	14.80	584.86
57	1		1400	.00	11.98	14.55	584.84
58	1		1415	.00	11.77	14.31	584.82
59	1		1430	.00	11.58	14.07	584.80
60	1		1445	.00	11.38	13.83	584.78
61	1		1500	.00	11.19	13.60	584.76
62	1		1515	.00	11.00	13.37	584.74
63	1		1530	.00	10.81	13.14	584.72
64	1		1545	.00	10.63	12.92	584.70
65	1		1600	.00	10.45	12.70	584.68
66	1		1615	.00	10.27	12.49	584.66
67	1		1630	.00	10.10	12.28	584.64
68	1		1645	.00	9.93	12.07	584.63
69	1		1700	.00	9.76	11.87	584.61
70	1		1715	.00	9.59	11.67	584.59
71	1		1730	.00	9.43	11.47	584.57
72	1		1745	.00	9.27	11.28	584.56
73	1		1800	.00	9.11	11.09	584.54
74	1		1815	.00	8.96	10.90	584.52
75	1		1830	.00	8.81	10.72	584.51
76	1		1845	.00	8.66	10.54	584.49
77	1		1900	.00	8.51	10.36	584.48
78	1		1915	.00	8.37	10.19	584.46
79	1		1930	.00	8.23	10.02	584.45
80	1		1945	.00	8.09	9.85	584.43
81	1		2000	.00	7.95	9.68	584.42
82	1		2015	.00	7.81	9.52	584.40
83	1		2030	.00	7.68	9.36	584.39
84	1		2045	.00	7.55	9.20	584.37
85	1		2100	.00	7.42	9.05	584.36
86	1		2115	.00	7.30	8.89	584.35
87	1		2130	.00	7.17	8.74	584.33
88	1		2145	.00	7.05	8.60	584.32
89	1		2200	.00	6.93	8.45	584.31
90	1		2215	.00	6.82	8.31	584.30
91	1		2230	.00	6.70	8.17	584.28
92	1		2245	.00	6.59	8.03	584.27
93	1		2300	.00	6.48	7.90	584.26
94	1		2315	.00	6.37	7.77	584.25
95	1		2330	.00	6.26	7.64	584.24
96	1		2345	.00	6.15	7.51	584.23
97	2		0000	.00	6.05	7.38	584.22
98	2		0015	.00	5.95	7.26	584.21
99	2		0030	.00	5.85	7.14	584.19
100	2		0045	.00	5.75	7.02	584.18

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN			
101	2		0100	.00	5.65	6.90
102	2		0115	.00	5.55	6.78
103	2		0130	.00	5.46	6.67
104	2		0145	.00	5.37	6.56
105	2		0200	.00	5.28	6.45
106	2		0215	.00	5.19	6.34
107	2		0230	.00	5.10	6.23
108	2		0245	.00	5.01	6.13
109	2		0300	.00	4.93	6.03
110	2		0315	.00	4.84	5.92
111	2		0330	.00	4.76	5.83
112	2		0345	.00	4.68	5.73
113	2		0400	.00	4.60	5.63
114	2		0415	.00	4.52	5.54
115	2		0430	.00	4.45	5.44
116	2		0445	.00	4.37	5.35
117	2		0500	.00	4.30	5.26
118	2		0515	.00	4.23	5.18
119	2		0530	.00	4.15	5.09
120	2		0545	.00	4.08	5.00
121	2		0600	.00	4.01	4.92
122	2		0615	.00	3.95	4.84
123	2		0630	.00	3.88	4.76
124	2		0645	.00	3.82	4.68
125	2		0700	.00	3.75	4.60
126	2		0715	.00	3.69	4.52
127	2		0730	.00	3.63	4.45
128	2		0745	.00	3.57	4.37
129	2		0800	.00	3.51	4.30
130	2		0815	.00	3.45	4.23
131	2		0830	.00	3.39	4.16
132	2		0845	.00	3.33	4.09
133	2		0900	.00	3.28	4.02
134	2		0915	.00	3.22	3.95
135	2		0930	.00	3.17	3.89
136	2		0945	.00	3.12	3.82
137	2		1000	.00	3.07	3.76
138	2		1015	.00	3.01	3.69
139	2		1030	.00	2.96	3.63
140	2		1045	.00	2.91	3.57
141	2		1100	.00	2.87	3.51
142	2		1115	.00	2.82	3.45
143	2		1130	.00	2.77	3.40
144	2		1145	.00	2.72	3.34
145	2		1200	.00	2.68	3.28
146	2		1215	.00	2.63	3.23
147	2		1230	.00	2.59	3.17
148	2		1245	.00	2.55	3.12
149	2		1300	.00	2.50	3.07
150	2		1315	.00	2.46	3.02

TABLE 1 (CONT.)		STATION	BASIN	IMP	IMP	IMP	
		PLAN	FLOW	FLOW	STORAGE	STAGE	
		RATIO	1	1	1	1	
			.50	.50	.50	.50	
PER	DAY	MON	HRMN				
151	2		1330	.00	2.42	2.97	583.68
152	2		1345	.00	2.38	2.92	583.68
153	2		1400	.00	2.34	2.87	583.67
154	2		1415	.00	2.30	2.82	583.66
155	2		1430	.00	2.26	2.77	583.65
156	2		1445	.00	2.23	2.73	583.65
157	2		1500	.00	2.19	2.68	583.64
158	2		1515	.00	2.15	2.64	583.63
159	2		1530	.00	2.12	2.59	583.62
160	2		1545	.00	2.08	2.55	583.62
161	2		1600	.00	2.05	2.51	583.61
162	2		1615	.00	2.01	2.47	583.60
163	2		1630	.00	1.98	2.42	583.60
← Time to decant 90% maximum storage = 34.5 hours (1.44 days)							
164	2		1645	.00	1.94	2.38	583.59
165	2		1700	.00	1.91	2.34	583.58
166	2		1715	.00	1.88	2.30	583.58
167	2		1730	.00	1.85	2.27	583.57
168	2		1745	.00	1.82	2.23	583.56
169	2		1800	.00	1.79	2.19	583.56
170	2		1815	.00	1.76	2.15	583.55
171	2		1830	.00	1.73	2.12	583.55
172	2		1845	.00	1.70	2.08	583.54
173	2		1900	.00	1.67	2.05	583.53
174	2		1915	.00	1.64	2.01	583.53
175	2		1930	.00	1.62	1.98	583.52
176	2		1945	.00	1.59	1.95	583.52
177	2		2000	.00	1.56	1.91	583.51
178	2		2015	.00	1.54	1.88	583.51
179	2		2030	.00	1.51	1.85	583.50
180	2		2045	.00	1.49	1.82	583.50
181	2		2100	.00	1.46	1.79	583.49
182	2		2115	.00	1.44	1.76	583.49
183	2		2130	.00	1.41	1.73	583.48
184	2		2145	.00	1.39	1.70	583.48
185	2		2200	.00	1.36	1.67	583.47
186	2		2215	.00	1.34	1.65	583.47
187	2		2230	.00	1.32	1.62	583.46
188	2		2245	.00	1.30	1.59	583.46
189	2		2300	.00	1.28	1.56	583.46
190	2		2315	.00	1.25	1.54	583.45
191	2		2330	.00	1.23	1.51	583.45
192	2		2345	.00	1.21	1.49	583.44
193	3		0000	.00	1.19	1.46	583.44
194	3		0015	.00	1.17	1.44	583.43
195	3		0030	.00	1.15	1.41	583.43
196	3		0045	.00	1.13	1.39	583.43
197	3		0100	.00	1.12	1.37	583.42
198	3		0115	.00	1.10	1.34	583.42
199	3		0130	.00	1.08	1.32	583.42
200	3		0145	.00	1.06	1.30	583.41

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN				
201	3		0200	.00	1.04	1.28	583.41
202	3		0215	.00	1.02	1.26	583.40
203	3		0230	.00	1.01	1.24	583.40
204	3		0245	.00	.99	1.21	583.40
205	3		0300	.00	.97	1.19	583.39
206	3		0315	.00	.96	1.17	583.39
207	3		0330	.00	.94	1.15	583.39
208	3		0345	.00	.93	1.14	583.39
209	3		0400	.00	.91	1.12	583.38
210	3		0415	.00	.90	1.10	583.38
211	3		0430	.00	.88	1.08	583.38
212	3		0445	.00	.87	1.06	583.37
213	3		0500	.00	.85	1.04	583.37
214	3		0515	.00	.84	1.03	583.37
215	3		0530	.00	.82	1.01	583.36
216	3		0545	.00	.81	.99	583.36
217	3		0600	.00	.80	.98	583.36
218	3		0615	.00	.78	.96	583.36
219	3		0630	.00	.77	.94	583.35
220	3		0645	.00	.76	.93	583.35
221	3		0700	.00	.74	.91	583.35
222	3		0715	.00	.73	.90	583.35
223	3		0730	.00	.72	.88	583.34
224	3		0745	.00	.71	.87	583.34
225	3		0800	.00	.70	.85	583.34
226	3		0815	.00	.68	.84	583.34
227	3		0830	.00	.67	.82	583.33
228	3		0845	.00	.66	.81	583.33
229	3		0900	.00	.65	.80	583.33
230	3		0915	.00	.64	.78	583.33
231	3		0930	.00	.63	.77	583.33
232	3		0945	.00	.62	.76	583.32
233	3		1000	.00	.61	.75	583.32
234	3		1015	.00	.60	.73	583.32
235	3		1030	.00	.59	.72	583.32
236	3		1045	.00	.58	.71	583.32
237	3		1100	.00	.57	.70	583.31
238	3		1115	.00	.56	.68	583.31
239	3		1130	.00	.55	.67	583.31
240	3		1145	.00	.54	.66	583.31
241	3		1200	.00	.53	.65	583.31
242	3		1215	.00	.52	.64	583.30
243	3		1230	.00	.51	.63	583.30
244	3		1245	.00	.50	.62	583.30
245	3		1300	.00	.50	.61	583.30
246	3		1315	.00	.49	.60	583.30
247	3		1330	.00	.48	.59	583.30
248	3		1345	.00	.47	.58	583.29
249	3		1400	.00	.46	.57	583.29
250	3		1415	.00	.46	.56	583.29

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN				
251	3		1430	.00	.45	.55	583.29
252	3		1445	.00	.44	.54	583.29
253	3		1500	.00	.43	.53	583.29
254	3		1515	.00	.43	.52	583.29
255	3		1530	.00	.42	.51	583.28
256	3		1545	.00	.41	.51	583.28
257	3		1600	.00	.41	.50	583.28
258	3		1615	.00	.40	.49	583.28
259	3		1630	.00	.39	.48	583.28
260	3		1645	.00	.39	.47	583.28
261	3		1700	.00	.38	.46	583.28
262	3		1715	.00	.37	.46	583.27
263	3		1730	.00	.37	.45	583.27
264	3		1745	.00	.36	.44	583.27
265	3		1800	.00	.35	.43	583.27
266	3		1815	.00	.35	.43	583.27
267	3		1830	.00	.34	.42	583.27
268	3		1845	.00	.34	.41	583.27
269	3		1900	.00	.33	.41	583.27
270	3		1915	.00	.33	.40	583.27
271	3		1930	.00	.32	.39	583.26
272	3		1945	.00	.32	.39	583.26
273	3		2000	.00	.31	.38	583.26
274	3		2015	.00	.30	.37	583.26
275	3		2030	.00	.30	.37	583.26
276	3		2045	.00	.29	.36	583.26
277	3		2100	.00	.29	.35	583.26
278	3		2115	.00	.28	.35	583.26
279	3		2130	.00	.28	.34	583.26
280	3		2145	.00	.28	.34	583.26
281	3		2200	.00	.27	.33	583.25
282	3		2215	.00	.27	.33	583.25
283	3		2230	.00	.26	.32	583.25
284	3		2245	.00	.26	.32	583.25
285	3		2300	.00	.25	.31	583.25
286	3		2315	.00	.25	.30	583.25
287	3		2330	.00	.24	.30	583.25
288	3		2345	.00	.24	.29	583.25
289	4		0000	.00	.24	.29	583.25
290	4		0015	.00	.23	.29	583.25
291	4		0030	.00	.23	.28	583.25
292	4		0045	.00	.22	.28	583.24
293	4		0100	.00	.22	.27	583.24
294	4		0115	.00	.22	.27	583.24
295	4		0130	.00	.21	.26	583.24
296	4		0145	.00	.21	.26	583.24
297	4		0200	.00	.21	.25	583.24
298	4		0215	.00	.20	.25	583.24
299	4		0230	.00	.20	.24	583.24
300	4		0245	.00	.20	.24	583.24
			MAX	242.86	18.91	24.43	585.43
			MIN	.00	.00	.00	583.20
			AVE	4.76	4.72	5.85	583.90

*** NORMAL END OF HEC-1 ***

**COMPUTATION OF INFLOW HYDROGRAPH (1/2 6-Hour PMP)
AND FLOOD ROUTING THROUGH THE
PROPOSED PIPE SPILLWAY**

POND 1B

Crest Elevation	=	588 ft
Pipe Spillway Invert Elevation	=	583.7 ft
Normal Pool Elevation used for Routing	=	583.7 ft
Peak Inflow During Design Storm	=	224.68 cfs
Peak Outflow During Design Storm	=	13.51 cfs
Maximum Pool Elevation During Design Storm	=	585.47 ft
Minimum Freeboard During Design Storm	=	2.53 ft
Peak Storage Volume	=	25.05 ac-ft
Days to Decant 90% of Peak Storage Volume	=	3.25 days

POND 1B SPILLWAY PIPE

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
31.51	55.00	18.00	0.0100	583.70	0.90	0.00

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
581.00	0.000	0.000
581.50	0.000	0.000
582.00	0.000	0.000
582.50	0.000	0.000
583.00	0.000	0.000
583.50	0.000	0.000
583.70	0.000	0.000
584.00	(3)>0.929	0.929
584.50	(3)>3.997	3.997
585.00	(3)>8.280	8.280
585.50	(3)>13.485	13.485
586.00	(3)>19.484	19.484
586.50	(3)>26.165	26.165
587.00	(5)>32.642	32.642


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 12/10/2015 TIME 11:52:36 *
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
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X X XXXXXXXX XXXXX X
X X X X X XX
X X X X X X
XXXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

```

1 ID *****
2 ID *
3 ID * AEP Amos Plant Hydraulic Assessment File: 6HRPMPB1.inp *
4 ID * Flood Routing for Ash Pond 1A and Reclaim Pond *
5 ID * 1/2 6 Hour PMP 36" Pipe Invert Elev. 583.7' *
6 ID * GA Project No. 05-361 *
7 ID *
8 ID * Analyses by: Geo/Environmental Associates *
9 ID * Knoxville, TN *
10 ID * December 12, 2015 *
11 ID *
12 ID *****
13 IT 15 0 0 300
14 IO 3
15 JR FLOW 0.5
16 VS BASIN IMP IMP IMP
17 VV 2.11 2.11 6.11 7.11
18 IN 15

19 KK BASIN
20 KM PRECIPITATION
21 PB 0
22 PI 0.287 0.373 0.445 0.502 0.545 0.573 0.653 0.834 0.825 0.980
23 PI 2.322 4.564 4.922 3.344 1.264 0.834 0.864 0.763 0.581 0.560
24 PI 0.525 0.475 0.411 0.332
25 BA 0.037
26 LU 0 0.05 66
27 UD 0.0

28 KK IMP
29 KM ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT
30 RS 1 ELEV 583.7
31 SA 12.75 13.00 13.93 14.87 15.80
32 SQ 0 0.93 8.28 19.48 32.64
33 SE 583.7 584 585 586 587
34 ZZ

```

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
* RUN DATE 12/10/2015 TIME 11:52:36 *
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

```

```

*****
*
* AEP Amos Plant Hydraulic Assessment File: 6HRPMPB1.inp *
* Flood Routing for Ash Pond 1A and Reclaim Pond *
* 1/2 6 Hour PMP 36" Pipe Invert Elev. 583.7' *
* GA Project No. 05-361 *
*
* Analyses by: Geo/Environmental Associates *
* Knoxville, TN *
* December 12, 2015 *
*
*****

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14 IO OUTPUT CONTROL VARIABLES
      IPRNT      3 PRINT CONTROL
      IPLOT      0 PLOT CONTROL
      QSCAL      0. HYDROGRAPH PLOT SCALE

```

```

IT HYDROGRAPH TIME DATA
      NMIN      15 MINUTES IN COMPUTATION INTERVAL
      IDATE      1 0 STARTING DATE
      ITIME      0000 STARTING TIME
      NQ         300 NUMBER OF HYDROGRAPH ORDINATES
      NDDATE     4 0 ENDING DATE
      NDTIME     0245 ENDING TIME
      ICENT      19 CENTURY MARK

```

```

      COMPUTATION INTERVAL .25 HOURS
      TOTAL TIME BASE 74.75 HOURS

```

```

ENGLISH UNITS
      DRAINAGE AREA SQUARE MILES
      PRECIPITATION DEPTH INCHES
      LENGTH, ELEVATION FEET
      FLOW CUBIC FEET PER SECOND
      STORAGE VOLUME ACRE-FEET
      SURFACE AREA ACRES
      TEMPERATURE DEGREES FAHRENHEIT

```

USER-DEFINED OUTPUT SPECIFICATIONS

TABLE 1

VS STATION	BASIN	IMP	IMP	IMP						
VV VARIABLE CODE	2.11	2.11	6.11	7.11	.00	.00	.00	.00	.00	.00

```

JP MULTI-PLAN OPTION
  NPLAN 1 NUMBER OF PLANS

```

```

JR MULTI-RATIO OPTION
  RATIOS OF RUNOFF
  .50

```

*** **

```

*****
*
19 KK * BASIN *
*
*****
      PRECIPITATION

```

```

18 IN TIME DATA FOR INPUT TIME SERIES
      JXMIN      15 TIME INTERVAL IN MINUTES
      JXDATE     1 0 STARTING DATE

```

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

25 BA SUBBASIN CHARACTERISTICS
TAREA .04 SUBBASIN AREA

PRECIPITATION DATA

21 PB STORM 27.78 BASIN TOTAL PRECIPITATION

22 PI INCREMENTAL PRECIPITATION PATTERN
.29 .37 .45 .50 .54 .57 .65 .83 .82 .98
2.32 4.56 4.92 3.34 1.26 .83 .86 .76 .58 .56
.52 .48 .41 .33

26 LU UNIFORM LOSS RATE
STRTL .00 INITIAL LOSS
CNSTL .05 UNIFORM LOSS RATE
RTIMP 66.00 PERCENT IMPERVIOUS AREA

27 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .00 LAG

UNIT HYDROGRAPH
5 END-OF-PERIOD ORDINATES

71. 20. 4. 1. 0.

*** **

HYDROGRAPH AT STATION BASIN
FOR PLAN 1, RATIO = .50

TOTAL RAINFALL = 27.78, TOTAL LOSS = .10, TOTAL EXCESS = 27.68

PEAK FLOW TIME MAXIMUM AVERAGE FLOW
+ (CFS) (HR) 6-HR 24-HR 72-HR 74.75-HR
+ 449. 3.25 (CFS) 109. 28. 9. 9.
(INCHES) 27.507 27.676 27.676 27.676
(AC-FT) 54. 55. 55. 55.

CUMULATIVE AREA = .04 SQ MI

*** **

HYDROGRAPH AT STATION BASIN
FOR PLAN 1, RATIO = .50

PEAK FLOW TIME MAXIMUM AVERAGE FLOW
+ (CFS) (HR) 6-HR 24-HR 72-HR 74.75-HR
+ 225. 3.25 (CFS) 55. 14. 5. 4.
(INCHES) 13.754 13.838 13.838 13.838
(AC-FT) 27. 27. 27. 27.

CUMULATIVE AREA = .04 SQ MI

*** **

* *
28 KK * IMP *
* *

ROUTE COMPUTED HYDROGRAPH THROUGH IMPOUNDMENT

HYDROGRAPH ROUTING DATA

30 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP ELEV TYPE OF INITIAL CONDITION

RSVRIC 583.70 INITIAL CONDITION
 X .00 WORKING R AND D COEFFICIENT

31 SA	AREA	12.8	13.0	13.9	14.9	15.8
32 SQ	DISCHARGE	0.	1.	8.	19.	33.
33 SE	ELEVATION	583.70	584.00	585.00	586.00	587.00

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	3.86	17.32	31.72	47.05
ELEVATION	583.70	584.00	585.00	586.00	587.00

*** *** *** *** ***

HYDROGRAPH AT STATION IMP
 FOR PLAN 1, RATIO = .50

PEAK FLOW + (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.75-HR
14.	6.00	(CFS)	12.	8.	4.	4.
		(INCHES)	3.095	8.391	12.260	12.310
		(AC-FT)	6.	17.	24.	24.
PEAK STORAGE + (AC-FT)	TIME (HR)		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	74.75-HR
24.	6.00		23.	17.	9.	9.
PEAK STAGE + (FEET)	TIME (HR)		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	74.75-HR
585.47	6.00		585.36	584.95	584.40	584.38

CUMULATIVE AREA = .04 SQ MI

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS	
				RATIO 1	.50
HYDROGRAPH AT					
+	BASIN	.04	1	FLOW	225.
				TIME	3.25
ROUTED TO					
+	IMP	.04	1	FLOW	14.
				TIME	6.00
				** PEAK STAGES IN FEET **	
			1	STAGE	585.47
				TIME	6.00

TABLE 1		STATION	BASIN	IMP	IMP	IMP	
		PLAN	FLOW	FLOW	STORAGE	STAGE	
		RATIO	1	1	1	1	
			.50	.50	.50	.50	
PER	DAY	MON	HRMN				
1	1		0000	.00	.00	.00	583.70
2	1		0015	10.03	.02	.10	583.71
3	1		0030	15.89	.09	.37	583.73
4	1		0045	19.85	.18	.74	583.76
5	1		0100	22.87	.28	1.17	583.79
6	1		0115	25.13	.40	1.66	583.83
7	1		0130	26.69	.53	2.19	583.87
8	1		0145	29.92	.66	2.76	583.91
9	1		0200	37.20	.83	3.44	583.97
10	1		0215	38.85	1.12	4.20	584.03
11	1		0230	44.64	1.57	5.04	584.09
12	1		0245	93.85	2.33	6.43	584.19
13	1		0300	187.02	3.88	9.27	584.40
14	1		0315	224.68	6.15	13.42	584.71
15	1		0330	177.15	8.35	17.42	585.01
16	1		0345	89.25	10.34	19.98	585.18
17	1		0400	50.39	11.29	21.20	585.27
18	1		0415	42.51	11.85	21.92	585.32
19	1		0430	37.57	12.30	22.49	585.36
20	1		0445	30.00	12.64	22.93	585.39
21	1		0500	27.26	12.90	23.26	585.41
22	1		0515	25.42	13.11	23.54	585.43
23	1		0530	23.18	13.29	23.77	585.45
24	1		0545	20.34	13.43	23.94	585.46
25	1		0600	16.79	13.51	24.05	585.47 ← Maximum Stage/Storage 6 hours after onset of event
26	1		0615	4.23	13.46	23.98	585.46
27	1		0630	.80	13.29	23.76	585.45
28	1		0645	.13	13.08	23.50	585.43
29	1		0700	.00	12.87	23.23	585.41
30	1		0715	.00	12.67	22.97	585.39
31	1		0730	.00	12.47	22.71	585.37
32	1		0745	.00	12.27	22.45	585.36
33	1		0800	.00	12.07	22.20	585.34
34	1		0815	.00	11.88	21.95	585.32
35	1		0830	.00	11.69	21.71	585.30
36	1		0845	.00	11.50	21.47	585.29
37	1		0900	.00	11.32	21.23	585.27
38	1		0915	.00	11.14	21.00	585.26
39	1		0930	.00	10.96	20.77	585.24
40	1		0945	.00	10.79	20.55	585.22
41	1		1000	.00	10.62	20.33	585.21
42	1		1015	.00	10.45	20.11	585.19
43	1		1030	.00	10.28	19.90	585.18
44	1		1045	.00	10.12	19.68	585.16
45	1		1100	.00	9.95	19.48	585.15
46	1		1115	.00	9.80	19.27	585.14
47	1		1130	.00	9.64	19.07	585.12
48	1		1145	.00	9.49	18.87	585.11
49	1		1200	.00	9.33	18.68	585.09
50	1		1215	.00	9.19	18.49	585.08

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN			
51	1		1230	.00	9.04	18.30
52	1		1245	.00	8.90	18.12
53	1		1300	.00	8.75	17.93
54	1		1315	.00	8.61	17.75
55	1		1330	.00	8.48	17.58
56	1		1345	.00	8.34	17.40
57	1		1400	.00	8.23	17.23
58	1		1415	.00	8.14	17.06
59	1		1430	.00	8.05	16.90
60	1		1445	.00	7.96	16.73
61	1		1500	.00	7.87	16.57
62	1		1515	.00	7.78	16.41
63	1		1530	.00	7.69	16.25
64	1		1545	.00	7.60	16.09
65	1		1600	.00	7.52	15.93
66	1		1615	.00	7.44	15.78
67	1		1630	.00	7.35	15.62
68	1		1645	.00	7.27	15.47
69	1		1700	.00	7.19	15.32
70	1		1715	.00	7.11	15.18
71	1		1730	.00	7.03	15.03
72	1		1745	.00	6.95	14.89
73	1		1800	.00	6.87	14.74
74	1		1815	.00	6.79	14.60
75	1		1830	.00	6.72	14.46
76	1		1845	.00	6.64	14.32
77	1		1900	.00	6.57	14.19
78	1		1915	.00	6.49	14.05
79	1		1930	.00	6.42	13.92
80	1		1945	.00	6.35	13.79
81	1		2000	.00	6.28	13.66
82	1		2015	.00	6.21	13.53
83	1		2030	.00	6.14	13.40
84	1		2045	.00	6.07	13.27
85	1		2100	.00	6.00	13.15
86	1		2115	.00	5.93	13.03
87	1		2130	.00	5.87	12.90
88	1		2145	.00	5.80	12.78
89	1		2200	.00	5.74	12.67
90	1		2215	.00	5.67	12.55
91	1		2230	.00	5.61	12.43
92	1		2245	.00	5.55	12.32
93	1		2300	.00	5.48	12.20
94	1		2315	.00	5.42	12.09
95	1		2330	.00	5.36	11.98
96	1		2345	.00	5.30	11.87
97	2		0000	.00	5.24	11.76
98	2		0015	.00	5.18	11.65
99	2		0030	.00	5.12	11.54
100	2		0045	.00	5.07	11.44

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN			
101	2		0100	.00	5.01	11.33
102	2		0115	.00	4.95	11.23
103	2		0130	.00	4.90	11.13
104	2		0145	.00	4.84	11.03
105	2		0200	.00	4.79	10.93
106	2		0215	.00	4.74	10.83
107	2		0230	.00	4.68	10.73
108	2		0245	.00	4.63	10.64
109	2		0300	.00	4.58	10.54
110	2		0315	.00	4.53	10.45
111	2		0330	.00	4.48	10.36
112	2		0345	.00	4.43	10.26
113	2		0400	.00	4.38	10.17
114	2		0415	.00	4.33	10.08
115	2		0430	.00	4.28	9.99
116	2		0445	.00	4.23	9.91
117	2		0500	.00	4.18	9.82
118	2		0515	.00	4.14	9.73
119	2		0530	.00	4.09	9.65
120	2		0545	.00	4.04	9.56
121	2		0600	.00	4.00	9.48
122	2		0615	.00	3.95	9.40
123	2		0630	.00	3.91	9.32
124	2		0645	.00	3.86	9.24
125	2		0700	.00	3.82	9.16
126	2		0715	.00	3.78	9.08
127	2		0730	.00	3.74	9.00
128	2		0745	.00	3.69	8.93
129	2		0800	.00	3.65	8.85
130	2		0815	.00	3.61	8.77
131	2		0830	.00	3.57	8.70
132	2		0845	.00	3.53	8.63
133	2		0900	.00	3.49	8.55
134	2		0915	.00	3.45	8.48
135	2		0930	.00	3.41	8.41
136	2		0945	.00	3.38	8.34
137	2		1000	.00	3.34	8.27
138	2		1015	.00	3.30	8.20
139	2		1030	.00	3.26	8.14
140	2		1045	.00	3.23	8.07
141	2		1100	.00	3.19	8.00
142	2		1115	.00	3.15	7.94
143	2		1130	.00	3.12	7.87
144	2		1145	.00	3.08	7.81
145	2		1200	.00	3.05	7.74
146	2		1215	.00	3.02	7.68
147	2		1230	.00	2.98	7.62
148	2		1245	.00	2.95	7.56
149	2		1300	.00	2.92	7.50
150	2		1315	.00	2.88	7.44

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN				
151	2		1330	.00	2.85	7.38	584.26
152	2		1345	.00	2.82	7.32	584.26
153	2		1400	.00	2.79	7.26	584.25
154	2		1415	.00	2.76	7.21	584.25
155	2		1430	.00	2.72	7.15	584.24
156	2		1445	.00	2.69	7.09	584.24
157	2		1500	.00	2.66	7.04	584.24
158	2		1515	.00	2.63	6.98	584.23
159	2		1530	.00	2.60	6.93	584.23
160	2		1545	.00	2.58	6.88	584.22
161	2		1600	.00	2.55	6.82	584.22
162	2		1615	.00	2.52	6.77	584.22
163	2		1630	.00	2.49	6.72	584.21
164	2		1645	.00	2.46	6.67	584.21
165	2		1700	.00	2.43	6.62	584.20
166	2		1715	.00	2.41	6.57	584.20
167	2		1730	.00	2.38	6.52	584.20
168	2		1745	.00	2.35	6.47	584.19
169	2		1800	.00	2.33	6.42	584.19
170	2		1815	.00	2.30	6.37	584.19
171	2		1830	.00	2.27	6.32	584.18
172	2		1845	.00	2.25	6.28	584.18
173	2		1900	.00	2.22	6.23	584.18
174	2		1915	.00	2.20	6.19	584.17
175	2		1930	.00	2.17	6.14	584.17
176	2		1945	.00	2.15	6.10	584.17
177	2		2000	.00	2.13	6.05	584.16
178	2		2015	.00	2.10	6.01	584.16
179	2		2030	.00	2.08	5.97	584.16
180	2		2045	.00	2.05	5.92	584.15
181	2		2100	.00	2.03	5.88	584.15
182	2		2115	.00	2.01	5.84	584.15
183	2		2130	.00	1.99	5.80	584.14
184	2		2145	.00	1.96	5.76	584.14
185	2		2200	.00	1.94	5.72	584.14
186	2		2215	.00	1.92	5.68	584.13
187	2		2230	.00	1.90	5.64	584.13
188	2		2245	.00	1.88	5.60	584.13
189	2		2300	.00	1.86	5.56	584.13
190	2		2315	.00	1.84	5.52	584.12
191	2		2330	.00	1.82	5.48	584.12
192	2		2345	.00	1.79	5.45	584.12
193	3		0000	.00	1.77	5.41	584.11
194	3		0015	.00	1.75	5.37	584.11
195	3		0030	.00	1.74	5.34	584.11
196	3		0045	.00	1.72	5.30	584.11
197	3		0100	.00	1.70	5.27	584.10
198	3		0115	.00	1.68	5.23	584.10
199	3		0130	.00	1.66	5.20	584.10
200	3		0145	.00	1.64	5.16	584.10

TABLE 1	STATION	BASIN	IMP	IMP	IMP
(CONT.)		FLOW	FLOW	STORAGE	STAGE
	PLAN	1	1	1	1
	RATIO	.50	.50	.50	.50

PER	DAY	MON	HRMN			
201	3		0200	.00	1.62	5.13
202	3		0215	.00	1.60	5.10
203	3		0230	.00	1.59	5.06
204	3		0245	.00	1.57	5.03
205	3		0300	.00	1.55	5.00
206	3		0315	.00	1.53	4.97
207	3		0330	.00	1.52	4.93
208	3		0345	.00	1.50	4.90
209	3		0400	.00	1.48	4.87
210	3		0415	.00	1.46	4.84
211	3		0430	.00	1.45	4.81
212	3		0445	.00	1.43	4.78
213	3		0500	.00	1.42	4.75
214	3		0515	.00	1.40	4.72
215	3		0530	.00	1.38	4.69
216	3		0545	.00	1.37	4.67
217	3		0600	.00	1.35	4.64
218	3		0615	.00	1.34	4.61
219	3		0630	.00	1.32	4.58
220	3		0645	.00	1.31	4.56
221	3		0700	.00	1.29	4.53
222	3		0715	.00	1.28	4.50
223	3		0730	.00	1.27	4.48
224	3		0745	.00	1.25	4.45
225	3		0800	.00	1.24	4.42
226	3		0815	.00	1.22	4.40
227	3		0830	.00	1.21	4.37
228	3		0845	.00	1.20	4.35
229	3		0900	.00	1.18	4.32
230	3		0915	.00	1.17	4.30
231	3		0930	.00	1.16	4.28
232	3		0945	.00	1.14	4.25
233	3		1000	.00	1.13	4.23
234	3		1015	.00	1.12	4.21
235	3		1030	.00	1.10	4.18
236	3		1045	.00	1.09	4.16
237	3		1100	.00	1.08	4.14
238	3		1115	.00	1.07	4.12
239	3		1130	.00	1.06	4.09
240	3		1145	.00	1.04	4.07
241	3		1200	.00	1.03	4.05
242	3		1215	.00	1.02	4.03
243	3		1230	.00	1.01	4.01
244	3		1245	.00	1.00	3.99
245	3		1300	.00	.99	3.97
246	3		1315	.00	.98	3.95
247	3		1330	.00	.97	3.93
248	3		1345	.00	.95	3.91
249	3		1400	.00	.94	3.89
250	3		1415	.00	.93	3.87

STATION	BASIN	IMP	IMP	IMP
(CONT.)	FLOW	FLOW	STORAGE	STAGE
PLAN	1	1	1	1
RATIO	.50	.50	.50	.50

PER DAY MON HRMN

251	3	1430	.00	.93	3.85	584.00
252	3	1445	.00	.92	3.83	584.00
253	3	1500	.00	.92	3.81	584.00
254	3	1515	.00	.91	3.79	583.99
255	3	1530	.00	.91	3.77	583.99
256	3	1545	.00	.90	3.75	583.99
257	3	1600	.00	.90	3.74	583.99
258	3	1615	.00	.89	3.72	583.99
259	3	1630	.00	.89	3.70	583.99
260	3	1645	.00	.89	3.68	583.99
261	3	1700	.00	.88	3.66	583.98
262	3	1715	.00	.88	3.64	583.98
263	3	1730	.00	.87	3.63	583.98
264	3	1745	.00	.87	3.61	583.98
265	3	1800	.00	.86	3.59	583.98
266	3	1815	.00	.86	3.57	583.98
267	3	1830	.00	.86	3.55	583.98
268	3	1845	.00	.85	3.54	583.97
269	3	1900	.00	.85	3.52	583.97
270	3	1915	.00	.84	3.50	583.97
271	3	1930	.00	.84	3.48	583.97
272	3	1945	.00	.83	3.47	583.97
273	3	2000	.00	.83	3.45	583.97
274	3	2015	.00	.83	3.43	583.97
275	3	2030	.00	.82	3.42	583.97
276	3	2045	.00	.82	3.40	583.96
277	3	2100	.00	.81	3.38	583.96
278	3	2115	.00	.81	3.36	583.96
279	3	2130	.00	.81	3.35	583.96
280	3	2145	.00	.80	3.33	583.96
281	3	2200	.00	.80	3.31	583.96
282	3	2215	.00	.79	3.30	583.96
283	3	2230	.00	.79	3.28	583.95
284	3	2245	.00	.79	3.27	583.95
285	3	2300	.00	.78	3.25	583.95
286	3	2315	.00	.78	3.23	583.95
287	3	2330	.00	.77	3.22	583.95
288	3	2345	.00	.77	3.20	583.95
289	4	0000	.00	.77	3.19	583.95
290	4	0015	.00	.76	3.17	583.95
291	4	0030	.00	.76	3.15	583.95
292	4	0045	.00	.76	3.14	583.94
293	4	0100	.00	.75	3.12	583.94
294	4	0115	.00	.75	3.11	583.94
295	4	0130	.00	.74	3.09	583.94
296	4	0145	.00	.74	3.08	583.94
297	4	0200	.00	.74	3.06	583.94
298	4	0215	.00	.73	3.05	583.94
299	4	0230	.00	.73	3.03	583.94
300	4	0245	.00	.73	<u>3.02</u>	<u>583.93</u> ← Stage/Storage 68.75 Hours after maximum stage/storage

MAX	224.68	13.51	24.05	585.47
MIN	.00	.00	.00	583.70
AVE	4.41	3.92	9.04	584.38

*** NORMAL END OF HEC-1 ***


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 12/10/2015 TIME 12:41:06 *
*
*****

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*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

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X X XXXXXXXX XXXXX X
X X X X X XX
X X X X X X
XXXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXXX XXXXX XXX

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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

```

1 ID *****
2 ID *
3 ID * AEP Amos Plant Bottom Ash Complex File: PMPB1DD.inp *
4 ID * Flood Routing for Ash Pond 1A and Reclaim Pond *
5 ID * 1/2 6 Hour PMP Storm Drawdown 36" Pipe Invert Elev 583.2' *
6 ID * GA Project No. 15055009.01 *
7 ID *
8 ID * Analyses by: Geo/Environmental Associates *
9 ID * Knoxville, TN *
10 ID * October 2015 *
11 ID *
12 ID *****
13 IT 15 0 0 50
14 IO 3
15 VS IMP IMP IMP
16 VV 2.11 6.11 7.11

17 KK IMP
18 KM continue drawdown 68.75 hours after peak
19 RS 1 ELEV 583.93
20 SA 6.01 6.25 17.65 19.97 22.28
21 SQ 0 4.00 13.48 26.16 38.09
22 SE 583.2 584 585 586 587
23 ZZ

```

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 12/10/2015 TIME 12:41:06 *
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

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*****
*
* AEP Amos Plant Bottom Ash Complex File: PMPB1DD.inp *
* Flood Routing for Ash Pond 1A and Reclaim Pond *
* 1/2 6 Hour PMP Storm Drawdown 36" Pipe Invert Elev 583.2' *
* GA Project No. 15055009.01 *
*
* Analyses by: Geo/Environmental Associates *
* Knoxville, TN *
* October 2015 *
*
*****

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14 IO OUTPUT CONTROL VARIABLES
      IPRNT      3 PRINT CONTROL
      IPLOT      0 PLOT CONTROL
      QSCAL      0. HYDROGRAPH PLOT SCALE

```

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IT HYDROGRAPH TIME DATA
      NMIN      15 MINUTES IN COMPUTATION INTERVAL
      IDATE      1 0 STARTING DATE
      ITIME      0000 STARTING TIME
      NQ         50 NUMBER OF HYDROGRAPH ORDINATES
      NDDATE     1 0 ENDING DATE
      NDTIME     1215 ENDING TIME
      ICENT      19 CENTURY MARK

```

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      COMPUTATION INTERVAL .25 HOURS
      TOTAL TIME BASE 12.25 HOURS

```

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ENGLISH UNITS
      DRAINAGE AREA SQUARE MILES
      PRECIPITATION DEPTH INCHES
      LENGTH, ELEVATION FEET
      FLOW CUBIC FEET PER SECOND
      STORAGE VOLUME ACRE-FEET
      SURFACE AREA ACRES
      TEMPERATURE DEGREES FAHRENHEIT

```

USER-DEFINED OUTPUT SPECIFICATIONS

TABLE 1

VS	STATION	IMP	IMP	IMP								
VV	VARIABLE CODE	2.11	6.11	7.11	.00	.00	.00	.00	.00	.00	.00	.00

*** **

```

*****
*
* IMP *
*
*****
      continue drawdown 68.75 hours after peak

```

HYDROGRAPH ROUTING DATA

```

19 RS STORAGE ROUTING
      NSTPS      1 NUMBER OF SUBREACHES
      ITYP      ELEV TYPE OF INITIAL CONDITION
      RSVRIC     583.93 INITIAL CONDITION
      X          .00 WORKING R AND D COEFFICIENT

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20 SA AREA 6.0 6.3 17.6 20.0 22.3

```

21 SQ	DISCHARGE	0.	4.	13.	26.	38.
22 SE	ELEVATION	583.20	584.00	585.00	586.00	587.00

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	4.90	16.37	35.17	56.28
ELEVATION	583.20	584.00	585.00	586.00	587.00

*** *** *** *** ***

HYDROGRAPH AT STATION IMP

PEAK FLOW	TIME			MAXIMUM	AVERAGE FLOW	
			6-HR	24-HR	72-HR	12.25-HR
+ (CFS)	(HR)	(CFS)				
+ 4.	.25	3.	2.	2.	2.	
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	1.	3.	3.	3.
PEAK STORAGE	TIME			MAXIMUM	AVERAGE STORAGE	
			6-HR	24-HR	72-HR	12.25-HR
+ (AC-FT)	(HR)					
+ 4.	.25	4.	3.	3.	3.	
PEAK STAGE	TIME			MAXIMUM	AVERAGE STAGE	
			6-HR	24-HR	72-HR	12.25-HR
+ (FEET)	(HR)					
+ 583.93	.00	583.80	583.70	583.70	583.70	583.70

CUMULATIVE AREA = .00 SQ MI

RUNOFF SUMMARY
 FLOW IN CUBIC FEET PER SECOND
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
ROUTED TO	IMP	4.	.25	3.	2.	2.	.00	583.93	.00

TABLE 1				IMP	IMP	IMP
STATION				FLOW	STORAGE	STAGE
PER	DAY	MON	HRMN			
1	1		0000	3.65	4.47	583.93
2	1		0015	3.58	4.39	583.92
3	1		0030	3.52	4.32	583.90
4	1		0045	3.46	4.25	583.89
5	1		0100	3.41	4.18	583.88
6	1		0115	3.35	4.11	583.87
7	1		0130	3.29	4.04	583.86
8	1		0145	3.24	3.97	583.85
9	1		0200	3.18	3.90	583.84
10	1		0215	3.13	3.84	583.83
11	1		0230	3.08	3.77	583.82
12	1		0245	3.03	3.71	583.81
13	1		0300	2.98	3.65	583.80
14	1		0315	2.93	3.59	583.79
15	1		0330	2.88	3.53	583.78
16	1		0345	2.83	3.47	583.77
17	1		0400	2.78	3.41	583.76
18	1		0415	2.74	3.35	583.75
19	1		0430	2.69	3.30	583.74
20	1		0445	2.65	3.24	583.73
21	1		0500	2.60	3.19	583.72
22	1		0515	2.56	3.14	583.71
23	1		0530	2.51	3.08	583.70
24	1		0545	2.47	3.03	583.69
25	1		0600	2.43	2.98	583.69
26	1		0615	2.39	2.93	583.68
27	1		0630	2.35	2.88	583.67
28	1		0645	2.31	2.83	583.66
29	1		0700	2.27	2.79	583.65
30	1		0715	2.23	2.74	583.65
31	1		0730	2.20	2.69	583.64
32	1		0745	2.16	2.65	583.63
33	1		0800	2.12	2.60	583.62
34	1		0815	2.09	2.56	583.62
35	1		0830	2.05	2.52	583.61
36	1		0845	2.02	2.48	583.60
37	1		0900	1.99	2.43	583.60
38	1		0915	1.95	2.39	583.59
39	1		0930	1.92	2.35	583.58
40	1		0945	1.89	2.31	583.58
41	1		1000	1.86	2.28	583.57
42	1		1015	1.83	2.24	583.57
43	1		1030	1.80	2.20	583.56
44	1		1045	1.77	2.16	583.55
45	1		1100	1.74	2.13	583.55
46	1		1115	1.71	2.09	583.54
47	1		1130	1.68	2.06	583.54
48	1		1145	1.65	2.02	583.53
49	1		1200	1.62	1.99	583.52
50	1		1215	1.60	1.96	583.52
			MAX	3.65	4.47	583.93
			MIN	1.60	1.96	583.52
			AVE	2.48	3.04	583.70

← Time to decant 90% maximum storage = 78.0 hours (3.25 days)

*** NORMAL END OF HEC-1 ***