CenterPoint Energy

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November 13, 2023

JFracett@idem.IN.gov

Ms. Juliana Fracetti, Permit Manager
Office of Land Quality
Indiana Department of Environmental Management
Solid Waste Permits

RE: Southern Indiana Gas and Electric Company (SIGECO) A.B. Brown Ash Pond Closure Plan Submittal
A.B. Brown Generating Station, Posey County, IN

Dear Ms. Fracetti,

Enclosed please find the Closure Plan for the Ash Pond at the A.B. Brown Generating Station. SIGECO (doing business as CenterPoint Energy Indiana South) together with our engineering consultant AECOM have prepared this closure plan to conform to the applicable rules and regulations for closing a Coal Combustion Residual (CCR) surface impoundment in the State of Indiana. While this closure plan is being submitted at this time, we also note that CCR material is being removed from the ash pond for the purpose of beneficial use, and 40 CFR 257.102 (e)(1)(ii) states that closure must commence no later than 30 days after the date on which the CCR unit removes the known final volume of CCR from the CCR unit for the purpose of beneficial use of CCR. A meeting was previously held at IDEM's office on where the overall closure strategy was discussed. We have incorporated into this Closure Plan much of IDEM's input received during that meeting, as well as information that has been gained through the process of receiving and responding to Requests for Additional Information for the F.B. Culley East Ash Pond Closure Plan approval that is pending at your office.

The closure method SIGECO proposes for the Ash Pond incorporates Closure by Removal (CbR) as described in 40 CFR § 257.102(c) including excavation and complete removal of existing CCR materials within the Ash Pond. An important aspect of this ash pond closure is the means by which post-excavation CCR removal verification will be conducted. As described in the enclosed Closure Plan, excavation activities are proposed to terminate once complete removal of CCR materials has been achieved based on visual confirmation (including photographic documentation and third-party survey), followed by over-excavation of up to 2-feet of underlying native soil previously in contact with the CCR materials and verification through polarized light microscopy (PLM) testing.

In Section 1.1.1 of this Plan, the regulatory basis for this ash pond closure and post-removal verification approach is discussed. Based on the EPA's stated expectations described in the preamble of the Final Rule, CCR removal and decontamination will be demonstrated through the excavation of CCR and underlying soil materials (previously described) and attainment of the established groundwater protection standards described in § 257.90-.98 of the CCR Rule. Accordingly, post-removal requirements including maintaining a groundwater monitoring program will be established. Further, following CCR removal, SIGECO will execute an Environmental Restrictive Covenant (ERC) and record a notation on the deed to the property.

Based on recent more discussions with IDEM, we understand that IDEM's CCR regulations are under development (pursuant to Senate Bill 271) and IDEM is working through legislation passed in 2023 regarding state regulations being no more stringent than the federal regulations. As an alternate to the approach proposed in this Closure Plan, SIGECO is open to IDEM providing approval of this Plan in a phased manner; whereas IDEM's initial approval addresses CCR being removed by excavation as described in the Plan, and a subsequent approval would address an agreed-upon method for post-excavation CCR removal verification pending development of IDEM's CCR regulations under Senate Bill 271.

In accordance with the Completeness Public Notice Process for CCR Closure Plans, adjacent landowners will be notified within 10 working days of this submittal. The affidavit is included in this application packet.

If you have any questions, please contact me via email (Angela.Casbon-Scheller@centerpointenergy.com) or at 812-491-4787.

Sincerely,

Angela Casbon-Scheller

Angela Casbon-Scheller
Director, Generation Compliance and Carbon Policy
CenterPoint Energy

AECOM

Submitted to
SIGECO d/b/a
CenterPoint Energy Indiana South
211 NW Riverside Dr.
Evansville, IN 47708

Submitted by
AECOM
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Suite 500
Cleveland, OH 44114

Closure Plan
A.B. Brown Ash Pond
Closure Permit Application
A.B. Brown Generating Station
Posey County, Indiana

Rev 0 November 13, 2023

Professional Engineer Certification

I, Jay D. Mokotoff, being a Professional Engineer in good standing in the State of Indiana (PE11400808), do hereby certify to the best of my knowledge, information, and belief that the information contained in this closure plan is prepared in accordance with the accepted practice of engineering. I certify pursuant to 40 CFR §257.102(b)(4) that the closure of the CCR surface impoundment under 40 CFR §257.102(c) and 40 CFR §257.102(d), as described herein, are technically feasible within the timeframe in 40 CFR §257.102(f)(ii).

Jay D. Mokotoff, PE, PMP

AECOM

1300 E 9th Street, Suite 500

Cleveland, Ohio 44114

(216)-622-2300

______________________	PE 11400808
Signature	Professional Engineer Registration Number
Jay D. Mokotoff, PE, PMP	*Senior Project Manager*
Name	Title
AECOM	*11/13/2023*
Company	Date

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Appendices

1.0 Introduction

1.1 Purpose and Scope of Plan

The A.B. Brown Generating Station (A.B. Brown Station) is located in Posey County, Indiana and is owned and operated by Southern Indiana Gas and Electric Company (SIGECO) dba CenterPoint Energy Indiana South (CenterPoint). The A.B. Brown Station operates an unlined coal combustion residual (CCR) surface impoundment, identified as the A.B. Brown Ash Pond (Ash Pond). The Ash Pond actively receives CCR materials. This Closure Plan has been developed for the Ash Pond. The closure method SIGECO proposes for the Ash Pond incorporates Closure by Removal (CbR) with excavation and removal of existing CCR materials.

Pursuant to 40 CFR §257.102(g) of the Environmental Protection Agency's (EPA's) Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule (hereinafter referred to as the Final Rule), a Notice of Intent (NOI) will be placed in the facility's operating record following the triggering of closure of this surface impoundment (based on last receipt of waste). Once closure is initiated, the Ash Pond will be closed by removal and beneficial reuse of the majority of CCR materials within the pond. Currently, bottom ash transport water, scrubber and truck bay wash water from the FGD system, Capital Pond discharge, treated sanitary wastewater, plant floor drains, coal pile runoff and stormwater are managed within the Ash Pond.

In accordance with the revision to the Federal CCR Rule § 257.103(f)(1)) titled "A Holistic Approach to Closure Part A: Deadline to Initiate Closure" (Part A), a document titled *Development of Alternative Capacity is Technically Infeasible Demonstration (Part A Demonstration)* was issued to the US EPA on November 24, 2020. As described in the Part A Demonstration document, alternate management of flows at A.B. Brown Station will require the extension of the cease flow date for CCR and non-CCR streams to the Ash Pond. SIGECO submitted this document to demonstrate that obtaining alternative capacity for the CCR and non-CCR flows at the A.B. Brown Ash Pond is infeasible before the April 11, 2021 deadline, and that additional time is needed to operate the Ash Pond until alternative capacity becomes available under the fastest technically feasible timeline. Consequently, as described in the Part A Demonstration document, SIGECO requested an extension of the April 11, 2021 "cease flow" deadline for operation of the Ash Pond until October 15, 2023 to complete the construction of a new lined CCR pond and the rerouting of certain CCR and non-CCR streams that currently discharge to the Ash Pond.

For continued operation of the Ash Pond beyond April 11, 2021, two extension mechanisms are available under the final Part A: (1) Development of Alternative Capacity is Technically Infeasible (40 CFR § 257.103(f)(1)) or (2) Permanent Cessation of a Coal-Fired Boiler(s) by a Date Certain (40 CFR § 257.103(f)(2)). SIGECO prepared the referenced document to demonstrate that obtaining alternative capacity for the CCR and non-CCR flows managed by the A.B. Brown Ash Pond is infeasible before the April 11, 2021 deadline. This extension mechanism has been selected in lieu of the "boiler cessation" alternative due to the regulatory criteria within the "boiler cessation" alternative that requires that closure also be completed by October 17, 2028 (for units greater than 40 acres). This closure completion date is not technically feasible due to the closure method selected (closure by removal for beneficial use), current contractual obligations, and production limitations by the end user. For this reason, the "Development of Alternative Capacity is Technically Infeasible" extension mechanism has been selected.

All flows ceased discharging to the Ash Pond on or before October 14, 2023 with the retirement of the coal-burning operations at the A.B. Brown Station. Although excavation for beneficial reuse is currently ongoing, closure of the Ash Pond is estimated to commence in October 2023. The preliminary schedule for closure of the impoundment indicates closure will take approximately 11 years, ending in the second half of 2034, and is described in Section 3.0 of this Closure Plan.

The following subsections regarding the EPA Final Rule and IDEM Requirements provide the regulatory basis used in the development of this Closure Plan which further serve as the basis for the scope of this document.

1.1.1 Regulatory Basis:

The EPA Final Rule requirements that are now applicable to the Ash Pond [§257.102(b) and (c)] are as follows:

- *Closure by removal of CCR.* An owner or operator may elect to close a CCR unit by removing and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to § 257.95(h) for constituents listed in appendix IV to this part.

As discussed in this Closure Plan, a visual basis for CCR removal is proposed for the A.B. Brown Ash Pond and this approach is consistent with the Final Rule and the approach being implemented by the majority of closure-by-removal sites throughout the country. The preamble of the Final Rule also sets forth EPA's expectations for "CCR removal and decontamination" wherein it is noted that "*In practice, EPA does not routinely require complete removal of all contamination (that is, cleanup to "background") from a closing unit even for hazardous waste units. Requiring CCR units to clean up soils to levels before the site was contaminated, would be more stringent than current hazardous waste policies. There is no basis in the current record to impose provisions for the remediation of CCR units that are more stringent than those imposed on hazardous wastes*" (Page 21412 Federal Register / Vol. 80, No. 74 / Friday, April 17, 2015 / Rules and Regulations). The preamble further states that *"Once a facility has removed the waste and any liner, the presumption is that the source of contamination has been removed as well".* (Page 21412 Federal Register / Vol. 80, No. 74 / Friday, April 17, 2015 / Rules and Regulations). Lastly, the Preamble states that "Typically, any metals in these ''*subsoils'' in excess of background levels are allowed to either naturally attenuate, or are removed by flushing*." (Preamble Page 21412).

It is noted that IDEM has previously indicated their interpretation of 40 CFR §257.702(c) is to require removal of all contaminated media and sediments (i.e., removal of CCR constituents to background levels within the subsoils). However, in consideration of EPA's stated expectations for "CCR removal and decontamination" that "*In practice, EPA does not routinely require complete removal of all contamination (that is, cleanup to "background") …",* it is believed that IDEM's interpretation would be establishing requirements for this closure project that are more stringent than the CCR Rule. Indiana House Bill 1623 (https://iga.in.gov/pdf-documents/123/2023/house/bills/HB1623/HB1623.05.ENRS.pdf) which passed on May 4, 2023, establishes in Section 68. IC 13-19-3-3 (as amended by P.L. 120-2022, Section 5), Sec. 3(c): that the board shall adopt rules concerning coal combustion residuals that do not impose a restriction or requirement that is more stringent than the corresponding restriction or requirement imposed under the federal CCR rule; and do not impose a restriction or requirement that is not imposed by the federal CCR rule.

Based on the EPA's stated expectations described in the preamble of the Final Rule, CCR removal and decontamination will be demonstrated through the groundwater protection standard established per the requirements in § 257.90-.98 of the Final Rule. Accordingly, post-closure requirements including maintaining a groundwater monitoring program and execution of an Environmental Restrictive Covenant (ERC) will be established. As such, following closure of the A.B. Brown Ash Pond, in the event that any remaining contamination exists following removal of the CCR, it will be addressed if the groundwater monitoring data demonstrates that further remedy may be needed.

The State of Indiana has incorporated the Final Rule by reference and is currently developing the State of Indiana's CCR program for submission to EPA (pursuant to Senate Bill 271). In addition, IDEM's Office of Land Quality developed existing guidance that addresses the closure of CCR surface impoundments: "Surface Impoundment IDEM Closure Guidance" (IDEM Closure Guidance). However, the IDEM Closure Guidance only addresses the "Closure-in-Place" and "Clean Closure" methodologies, neither of which is proposed as the closure method for the A.B. Brown Ash Pond. The proposed closure design's compliance with the aforementioned requirements and criteria is discussed and demonstrated throughout this document.

SIGECO understands that IDEM's CCR regulations have been issued for second notice and comment, and another notice and comment period is forthcoming in the near future. SIGECO is open to IDEM providing approval of this Closure Plan in a phased manner; whereas IDEM's initial approval would permit CCR to be removed by excavation as described in this Closure Plan, and a subsequent approval would address an agreed-upon method for post-excavation CCR removal verification pending issuance of IDEM's CCR regulations under Senate Bill 271.

1.2 Site Background and Description

1.2.1 Site Background and History

<u>Site Description</u>

The IDEM Closure Guidance states that for any design incorporating a surface impoundment closure, a complete Site Characterization must be prepared. The Site Characterization is a narrative description of the impoundment that includes the following items: impoundment design, volume of waste, discharges to the impoundment, site description, and site geology. These elements are discussed in this section as well as in Section 1.2.2 (Site Geology and Hydrology).

The A.B. Brown Generating Station is located in Marrs Township, Posey County, Indiana in Township 7 South, Range 12 West, Section 24. The closure for the A.B. Brown Ash Pond submitted herein is intended for an area covering approximately 161 acres. A narrative description of the solid waste boundary for the Ash Pond follows.

Description of A.B. Brown Ash Pond

The A.B. Brown Ash Pond (Ash Pond) is impounded by an earthen dam (the Lower Dam) placed across a natural valley created by an unnamed tributary to the Ohio River. This dam is regulated by IDNR based on its impoundment volume (greater than 100 ac-ft) and embankment height (greater than 25 ft). The Ash Pond was previously separated into two by a dam (the Upper Dam) which has been breached under authorization from IDNR, creating an Upper Pool and a Lower Pool. Currently, the Upper pool and the Lower Pool act as one CCR unit referred to as the Ash Pond. The surface impoundment covers approximately 161 acres, containing an estimated 5,370,800 cubic yards (CY) of CCR, and is not equipped with an engineered bottom liner system. The current elevation of the top surface of the CCR material within the impoundment is approximately 460 feet within the Upper Pool, behind the former Upper Dam. The normal pool level within the Lower Pool is maintained at approximately 440 feet. The Lower Dam embankment is approximately 1,540 feet long, 30 feet high, and has 3 to 1 (horizontal to vertical) side slopes covered with grassy vegetation. The embankment crest elevation is 450.9 feet and has a crest width of 20 feet. An earthen buttress was constructed against the outboard slope of the dam. The buttress crest extends the length of the dam, is up to 200 feet wide and varies in elevation from 442 feet to 432 feet. The Ash Pond is situated east of the A.B. Brown coal-fired electricity generating power plant.

A site map depicting the 7.5-minute topographic map of the site area is provided in Figure 1- Site Location. A second site map depicting the impoundment on an aerial photograph is provided in Figure 2- Aerial Site Map. A depiction of the impoundment and current site topography is provided in Figure 3- Site Topography. The closure limit for the Ash Pond is depicted on these maps. All figures are provided in **Appendix A**.

History of Construction

The Ash Pond is located east of the power plant as shown in the Existing Conditions Plan in the Engineering Plans. Original design plans indicate that the Ash Pond was constructed in 1978 by damming a natural valley with what is now referred to as the Lower Dam. The bottom elevation of the pond is approximately at 389 feet, following the natural topography which gradually increases in elevation as the pond extends northeast. In 2003, a second dam (referred to as the Upper Dam) was constructed east of the original dam and further up the valley to increase the storage capacity. This temporarily created an upper pond and a lower pond. The upper and lower ponds were operated separately until 2016 when the upper dam was decommissioned. A 10-foot-wide breach was installed in the upper embankment and the normal pool elevation was lowered. The original construction drawings are provided in **Appendix B**.

Discharges to Impoundment

A breakdown of the discharges to the Ash Pond prior to October 14, 2023 is as follows:

- Bottom and fly ash transport water
- Scrubber and truck bay wash water from the FGD system
- Capital Pond discharge
- Coal Pile runoff
- Treated sanitary wastewater
- Plant floor drains

Base flows into Ash Pond are approximately 8.8 million gallons per day (MGD), or 13.6 cubic feet per second (cfs). Discharge from the Ash Pond is monitored through NPDES (National Pollutant Discharge Elimination System) as Outfall 001 (discharge through the plant). The Ash Pond and plant operate as a closed-loop system, with water discharged to the Ash Pond withdrawn from the Lower Pool for use. The Lower Pool is maintained at an approximate elevation of 440 feet. The Ash Pond's emergency spillway is rarely used and only discharges flow when the Lower Pool elevation reaches 444 feet.

1.2.2 Site Geology and Hydrology

Geologic Conditions

Information regarding geologic conditions of the site is provided in the Ground Water Monitoring Program in **Appendix F.**

Surface Water Management

Hydrology and hydraulics (H&H) analyses were performed to design controls to manage stormwater upon closure of the Ash Pond. The size of all post-closure stormwater conveyance channels including the proposed outlet channel to the receiving stream (unnamed tributary to the Ohio River) are based on these analyses.

To assess the capability of the design to convey the storm flows, a hydraulic model was created in HydroCAD 10.00-12. HydroCAD has the capability to evaluate each subcatchment within the network, to respond to variable tailwater, permit flow loops, and reversing flows. HydroCAD routing calculations reevaluate the outfall system's discharge capability at each time increment, making the program an efficient and dynamic tool for this evaluation. This model was developed based upon existing contour data provided by SIGECO, field data collected by surveyors, site walks conducted by both AECOM and SIGECO, and engineering drawings prepared by AECOM. Noncontact stormwater from the closed Ash Pond footprint will enter a network of grass-lined discharge channels, which will ultimately discharge through the proposed breach in the Lower Dam into an unnamed tributary to the Ohio River. All flow channel or perimeter ditches constructed will be earthen channels lined with erosion control matting. The H&H computations utilize the 10-year, 24-hour design storm event (4.74 inches). Further discussion of the H&H design aspects of the design is provided in the Basis of Design Report in **Appendix C** and the Stormwater Management Plan is provided as part of the Engineering Plan set in **Appendix D**.

Wetlands

No wetlands are anticipated to be impacted by the breach of the Lower Dam. A reassessment of the potential wetland impacts to breaching the Lower Dam will be conducted in the future.

Floodplains

The closure of the Ash Pond is not anticipated to require floodplain permitting.

1.2.3 Geotechnical Considerations

Geotechnical analyses were conducted to inform the dewatering requirements of the excavation for beneficial reuse (e.g. ditch spacing and separation distance between equipment and the piezometric surface). Additional information regarding these analyses is contained in the Basis of Design Report in **Appendix C**.

1.2.4 Waste Characterization

As previously discussed, the majority of the CCR material removed from the Ash Pond will be beneficially reused; however, materials not meeting the recycler's criteria for beneficial reuse (non-conforming material) are anticipated to be consolidated within the onsite Type III RWS landfill (FGD Landfill), or other regulated disposal location. While the onsite FGD Landfill is not currently authorized to accept the CCR materials from the Ash Pond, a request was submitted to IDEM dated December 18, 2019 (VFC # 82895271) to modify the landfill's operating permit to allow acceptance of these CCR materials. In order to evaluate the regulatory acceptability of this approach, a range of samples believed representative of the various Ash Pond contents were collected and subjected to the Waste Characterization profiling of 329 IAC 10-9-4. The representative CCR samples were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and Natural Leaching Method Test (NLP). Results of these analyses are contained with the aforementioned request submitted to IDEM as well as the follow-up information submitted on October 12, 2023 within the *A.B. Brown Ash Pond Characterization Summary Report*. Based on the TCLP and NLP testing performed on a range of representative samples, the results confirm the potential acceptability of placement of these materials within the FGD Landfill consistent with the regulatory requirements and the provisions of the landfill's operating permit.

2.0 Closure Methodology

2.1 Closure Overview and Criteria

The design proposed for the closure of the Ash Pond incorporates Closure by Removal (CbR) with excavation and removal of CCR materials. In general, the existing CCR materials will be excavated and hauled to the conveyor loading point at the northwestern perimeter of the Ash Pond. The conveyor transports the CCR materials to a barge-loading facility on the Ohio River and the materials will be beneficially reused by a third-party for cement manufacturing. Materials not meeting the criteria for beneficial reuse are anticipated to be disposed in the onsite FGD Landfill or other regulated disposal location. Once all CCR materials have been removed, the underlying valley topography will be regraded within minimum and maximum grades to promote drainage as well as limit erosion. Stormwater channels will then be constructed to promote drainage from the final grades. The site will be stabilized with native vegetation and final erosion control measures will be installed. Once the site has been stabilized, clean stormwater will be routed via the stormwater channels through a breach in the Lower Dam to a new stormwater outfall discharging to an unnamed tributary to the Ohio River in accordance with the design.

A Final Grading and Layout Plan is included in the Engineering Drawings (**Appendix D**) identifying final contours at two (2) ft. intervals.

2.1.1 Closure Design

The Ash Pond will be excavated to historical grades, and steep areas (slopes greater than 3:1 H:V) will be regraded to a maximum slope of 3:1 H:V to promote establishment of vegetation and reduce the potential for erosion. Once CCR materials have been excavated from the areas immediately upstream of the dam (within the footprint of the Lower Pool), these areas will be backfilled with compacted soils, and the Lower Dam and buttress will be breached. The Lower Dam will be breached in coordination with and upon approval by the IDNR Dam Safety Office. The soils excavated from the Lower Dam and buttress will be used to establish positive drainage within the excavated footprint of the Ash Pond. Topsoil will be placed to a depth of 3” to sustain vegetative cover. The final grades and stormwater ditches will be sloped to promote drainage through the restored valley to the breach in the Lower Dam and buttress.

The closure of the Ash Pond will consist of removal of surface water and any water remaining in the pond; dewatering of the CCR materials to reduce pore water; removal of CCR materials for beneficial reuse; and stabilization of the site. Stormwater/pore water accumulating in the Lower Pool during removal of CCR materials will be conveyed to a downgradient contact stormwater pond in the vicinity of the coal pile (currently undergoing construction) for treatment prior to discharge to a permitted NPDES outfall. CCR material removal and excavation of underlying native soil will be complete when the materials previously in contact with the CCR materials have been removed based on visual confirmation. Polarized light microscopy (PLM) analysis is also proposed to provide additional verification of complete CCR removal. CCR excavation will follow the requirements of the Dewatering Plan included in the Engineering Drawings (**Appendix D**). This is further discussed in Section 2.2.

The closure design was executed based on the information SIGECO provided on existing site features, utility location, topographic mapping, and survey information. The existing survey information is based on the aerial survey and north dam survey performed by Three i Design in 2016. It was further supplemented by the as-built buttress survey and as-built stream relocation survey performed by Blankenberger Brothers, Inc., dated October 3, 2016. The site topography was updated with additional information provided by Three i Design dated February 2, 2020, which also included bathymetric survey data of the Lower Pool.

2.2 Description of Closure Activities

2.2.1 Dewatering

Before excavation occurs within a specific area of the Ash Pond, all localized free water (above the CCR surface) and most of the pore water must be removed . Free water will be removed from the pond via the pond’s existing pumping station. Pore water will be removed using a combination of gravity and positive dewatering methods to achieve a stable subgrade on which the construction contractor can work. Gravity dewatering methods include excavated ditches and sumps in conjunction with pumping. Positive dewatering methods include deep wells, well points or a combination of both.

Treatment of free water and pore water in accordance with existing NPDES permit effluent limitations will be achieved using sedimentation. The water will be managed using the existing ash pond’s pumping station and/or other pumps as necessary and will be pumped to a Contact Stormwater Pond (CSP) to be located downgradient in the vicinity of the coal pile (currently under construction) for treatment prior to discharge to a permitted NPDES outfall. The design of the CSP includes a robust composite liner system (compacted clay overlaid by 60 mil HDPE geomembrane liner) and protected by a concrete mat above the liner system.

2.2.2 Abandonment of Existing Structures

Abandonment of existing outlet structures/piping includes the demolition of in-place or bulk-heading and grouting of existing pipes and inlets/outlet structures. The Ash Pond’s principal/overflow spillway system was abandoned in-place in May 2020. The spillway system consisted of a 36-inch RCP vertical drop inlet connected to a 36-inch RCP horizontal pipeline passing through the Lower Dam and earthen buttress. The principal/overflow spillway was abandoned by completely filling the existing spillway pipeline with grout to minimize the likelihood of future seepage through the pipeline and potential dam safety concerns. Currently there are no other known outlet pipes that extend from within the limits of the Ash Pond to any point beyond the limits of CCR materials; therefore, removal and/or grouting of outlet pipes is not anticipated. The existing pumping station on the southern perimeter of the pond will require abandonment upon completion of closure activities.

2.2.3 Excavation and Loading

CCR materials will be excavated and decanted within the pond. Analytical testing will be conducted to determine suitability of CCR materials for beneficial reuse. If materials are found to be suitable, they will be worked (formed in windrows and periodically moved) to facilitate drying prior to loading onto the conveyor system. Material that does not meet beneficial reuse specifications are anticipated to be hauled and disposed in the onsite FGD Landfill or other regulated disposal location under a future permit modification. It is anticipated that sufficient structural fill material will be obtained onsite to establish the final grades shown in the design drawings. Estimated quantities of fill, topsoil, and CCR materials for the closure are provided below.

Structural Fill	304,000 CY
Topsoil	66,000 CY
Total CCR Removed	5,370,800 CY

2.2.4 Transportation of Materials

As previously described, any structural fill materials required are anticipated to be obtained from the onsite features or the breach in the Lower Dam and the buttress.

2.2.5 Establishment of Background

The Ash Pond is anticipated to be required to continue post-closure groundwater monitoring due to some constituent levels exceeding site-specific groundwater protection standards established in the Final Rule. Establishment of background is referenced in the IDEM Closure Guidance for certification of *Clean Closure* which eliminates the need for further post-closure groundwater monitoring. However, since a post-closure groundwater monitoring program is already necessary for the Ash Pond, SIGECO is not pursuing a *Clean Closure* certification. Therefore, establishment of background procedures are not proposed.

SIGECO proposes to use a visual and PLM-based approach to removal confirmation and is thereby accepting ongoing groundwater monitoring and execution of an Environmental Restrictive Covenant following CCR excavation, as further described in Section 5.0 (Post Closure Care). A legal description for the Ash Pond solid waste boundary will be provided with the Environmental Restrictive Covenant. The Ash Pond closure will conform to Qualified Professional Engineer (QPE) discretion and the Closure by Removal standards referenced in the Final Rule as described in the following subsection.

2.2.6 Removal Verification

The excavation activities are anticipated to terminate once complete removal of CCR materials has been achieved based on visual confirmation and as much as 2-feet of underlying native soil previously in contact with the CCR materials have been removed. It is not anticipated that 2-feet of over-excavation will occur consistently across the footprint of the ash pond. Once native soils are encountered within the excavation, the bottom of the excavation will be visually inspected by the Engineer or the CQA Inspector to verify that all CCR materials have been removed without any residue and/or visible contamination. Once this visual inspection is complete, a third-party topographic survey of the excavated surface will be performed. Surveying will be conducted using a grid system with a maximum spacing of 100-ft. x 100-ft. Photographic documentation of the bottom of excavation will also be collected. Refer to Section 1.1.1 where the regulatory basis is provided to support use of visual removal verification.

In addition to collecting photographic documentation of the bottom of excavation, collection of samples for analysis using PLM is proposed to provide additional verification of complete CCR removal. Once excavation of CCR materials is completed as described above, soil samples will be collected from the bottom and side slopes of the pond on an established sampling grid for purposes of performing PLM analysis. PLM is a method whereby a soil sample is viewed under a high magnification microscope coupled with reflected-light illumination which allows for the positive identification of particles of coal combustion products in the soil sample. By examining the internal variation in optical indices within a sample and comparing shape, size, color, transparency, opacity, and other optical properties of the sample, the presence or absence of coal combustion products can be discerned. This common method has been successfully used on similar ash pond closures to verify CCR removal.

Based on the surface area of the pond bottom and side slopes, a proposed sampling grid of 200-ft. X 200-ft. would yield approximately 161 samples for PLM analysis by a qualified laboratory (or approximately one sample per acre). The results of the PLM analysis provide the percent of CCR materials by area within each sample. The percent by area can be directly compared to an equivalent percent by weight (based on a sample being placed on a standard 22mm x 22mm coverslip slide). The proposed pass/fail criteria for PLM analysis is less than or equal to 5% by weight of CCR[1]. Therefore, results indicating less than or equal to 5% by weight of CCR would be considered a passing result and further soil removal would not be required. PLM results indicating greater than 5% by weight of CCR would require additional soil removal up to a maximum of 2-feet below the interface between the originally removed CCR materials and native soils. Upon completion of excavation activities, AECOM will photograph and identify the coordinates of each sample location (based on GPS methodology). This documentation will be included in the construction certification report to be submitted to IDEM upon completion of the closure project. All documentation (photographic documentation and PLM sampling data) associated with the verification of CCR removal will be submitted to IDEM with the Closure Construction Certification Report.

As stated in Section 1.1.1, it is recognized that IDEM's CCR regulations are still being drafted. As an alternate to the approach proposed in this Closure Plan, SIGECO is open to IDEM providing approval of this Closure Plan in a phased manner; whereas IDEM's initial approval would permit CCR to be removed by excavation as described in this Closure Plan, and a subsequent approval would address an agreed-upon method for post-excavation CCR removal verification pending issuance of IDEM's CCR regulations under Senate Bill 271.

2.2.7 Waste Residue/Contaminated Media Disposal

All excavated CCR materials will be stockpiled within the limits of the impoundment to be decanted. After decanting, the CCR materials will be worked to dry them sufficiently, and materials conforming to beneficial use specifications will be loaded on the conveyor located on site. The loaded material will be subsequently conveyed to a barge loading point for transport to a third-party for beneficial reuse. Material that does not meet beneficial reuse specifications are anticipated to be hauled and disposed in the onsite FGD Landfill or other regulated disposal location. While the onsite FGD Landfill is not currently authorized to accept the CCR materials from the Ash Pond, a request has been submitted to IDEM to modify the landfill's operating permit to allow acceptance of these CCR materials.

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1 The proposed pass/fail criteria for PLM analysis being less than or equal to 5% by weight of CCR is based on results of sampling of background soils and subsequent PLM analysis in September 2022 which yielded laboratory PLM results ranging from 2% to 4% by weight of CCR. The background samples were obtained from locations on SIGECO's F.B. Culley Station property that are unaffected by power plant operations.

2.2.8 Phases of Closure

The tentative schedule for closure activities includes:

- Prior to Plant Closure (Prior to October 14, 2023)
  - Equipment mobilization and installation of erosion and sediment controls
  - Construction of temporary access roads
  - Excavation of ponded CCR materials and offsite transport for beneficial reuse by third-party or disposal in onsite FGD Landfill or other regulated disposal location.

- Post Plant Closure (October 15, 2023 through 2033)
  - Ash dewatering
  - Continued excavation of ponded CCR materials and offsite transport for beneficial reuse by third-party or disposal in onsite FGD Landfill or other regulated disposal location.

- 2034 - 2035
  - Complete excavation of ponded CCR materials.
  - Conduct removal verification procedures.
  - Final grading
  - Existing pump station demolition
  - Lower Dam breach and construction of proposed outlet channel
  - Preparation of offsite borrow area for topsoil and restoration of offsite borrow area
  - Site restoration and stabilization
  - Demobilization of equipment

2.2.9 Groundwater Monitoring

The Ground Water Monitoring Program is included in **Appendix F**.

3.0 Closure Schedule

All flows ceased discharging to the Ash Pond on October 14, 2023 and the A.B. Brown facility has ceased operation of its coal fired boilers. Excavation of CCR for beneficial reuse is currently ongoing and is estimated to continue through 2034. In accordance with 40 CFR § 257.102(e)(1)(ii), formal closure of the Ash Pond will commence upon removing the known final volume of CCR from the Ash Pond for the purposed of beneficial use of the CCR.

A schedule for completing all activities necessary to satisfy the closure criteria in 40 CFR §257.102, including an estimate of the year in which all closure activities for the CCR unit will be completed is tabulated below. The schedule provides sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering phase of CCR surface impoundment closure, final regrading of the site, and the estimated timeframes to complete each step or phase of CCR unit closure.

The milestones and the associated timeframes are initial estimates. Some of the activities associated with the milestones will overlap. Adjustments to the milestones and timeframes will be made as more information becomes available.

A.B. Brown Ash Pond Closure Schedule	
Milestone / Activity	**Milestone Date**
Placement of Written Closure Plan (Rev 1) in Operating Record per CCR Rule	November 24, 2020
Final Receipt of Waste	October 14, 2023 (plant retirement)
Submittal of Permit Application and Closure Plan to IDEM	November 13, 2023
Agency Coordination	following submittal of Closure Plan to IDEM
Obtaining Closure Plan Approval from IDEM	TBD
Complete Dewatering	2033
Complete Excavation and Beneficial Reuse / Disposal of CCR Materials	2033 - 2034
Initiate Closure	2034
Breach Lower Dam and Construct Outlet Channel	2033 - 2034
Complete Regrading and Final Stabilization	2035
Completion of Closure Activities	2035

4.0 Amendment of Closure Plan

This Closure Plan may be amended at any time and shall be amended whenever the following occurs:

A. There is a change in the operation of the CCR unit that would substantially affect this written Closure Plan.
B. An unanticipated event before or after closure activities have commenced necessitates a revision of this Closure Plan.

5.0 Post-Closure Care

5.1 Closure Construction Certification

Upon completion of the Ash Pond closure activities described in this Closure Plan, SIGECO will submit a Closure Construction Certification Report, certified by a qualified professional engineer. The Closure Construction Certification Report will be prepared in accordance and in compliance with the post-closure requirements listed under the Final Rule §257.102(f)(3) and 329 IAC 10-30-7.

5.2 Post-Closure Use

Following closure, no additional planned uses of the Ash Pond area are envisioned. Once closure has been achieved, the restored valley (former CCR Unit area) will be maintained as an inactive property. No maintenance or monitoring activities shall disturb the integrity of the final vegetated surface and associated restored areas.

5.3 Post-Closure Plan

Per the Final Rule §257.104(a) an owner or operator of a CCR unit that elects to close a CCR unit by removing CCR as provided by §257.102(c) is not subject to the post-closure care criteria under that section. As such, a post-closure plan is not required. However, groundwater monitoring will be performed during the post-closure care period as described in the following subsection.

5.4 Groundwater Monitoring

In accordance with the groundwater protection standard established pursuant to §257.95(h) for constituents listed in Appendix IV of the Final Rule, post-closure requirements will include establishing, operating, and maintaining a groundwater monitoring program. It is anticipated that compliance with the groundwater protection standard will be attained approximately 0-5 years after complete removal of CCR materials in the Ash Pond is accomplished. A description of the groundwater monitoring program is included in **Appendix F**.

5.5 Environmental Restrictive Covenant

Following closure of the Ash Pond, SIGECO will execute an Environmental Restrictive Covenant (ERC) and record a notation on the deed to the property in accordance with §257.102(i). The notation on the deed will in perpetuity notify any potential purchaser of the property that the land has been used as a CCR unit and that its use is restricted under the post-closure care requirements as provided by §257.104(d)(1)(iii).

6.0 Cost-Estimate for Closure

The cost estimate for closure of the Ash Pond is provided per 329 IAC 10-30-4 (b) in **Appendix G** and was estimated using the engineering design and associated quantities developed. The total estimated closure cost is $56,470,000 and takes into consideration the following items as part of the scope of work, including but not limited to:

- Removal of free water and dewatering of CCR material in the Ash Pond
- Excavation of CCR materials to re-establish native grades
- Transport of CCR materials for beneficial use by a third-party or disposal in the onsite FGD Landfill or other regulated disposal location.
- Regrading of the site within minimum and maximum grades to promote drainage and limit erosion.
- Construction of stormwater channels to promote drainage from the final grades and to route clean stormwater through the breach in the Lower Dam.
- Breaching of Lower Dam and construction of outlet channel
- Establish vegetative cover over the site and install erosion control measures

The total area being closed is 161 acres, hence the cost per acre for performing closure activities described herein is approximately $350,745.

7.0 References

1. Federal Register, Vol. 80, No. 74, April 17, 2015. 40 CFR Part 257 and 261, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residual from Electric Utilities; Final Rule.
2. Indiana Department of Environmental Management, Title 329 Solid Waste Management Division, Article 10: Solid Waste Land Disposal Facilities.
3. National Pollutant Discharge Elimination System (NPDES) Individual Permit No. IN0052191 for SIGECO A.B. Brown Generating Station, modified July 23, 2021.
4. United States Environmental Protection Agency, August 11. 2015. Frequent Questions on the Implementation of the Disposal of Coal Combustion Residual (CCR) from Electric Utilities Final Rule.
5. United States Geological Survey, 7.5-Minute Topographic Map, 1991. *Evansville, Indiana.*
6. Vectren, Financial Assurance Documentation for Post-Closure Care, 2016.
7. A.B. Brown Ash Pond Characterization Summary Report (AECOM, October 2023).

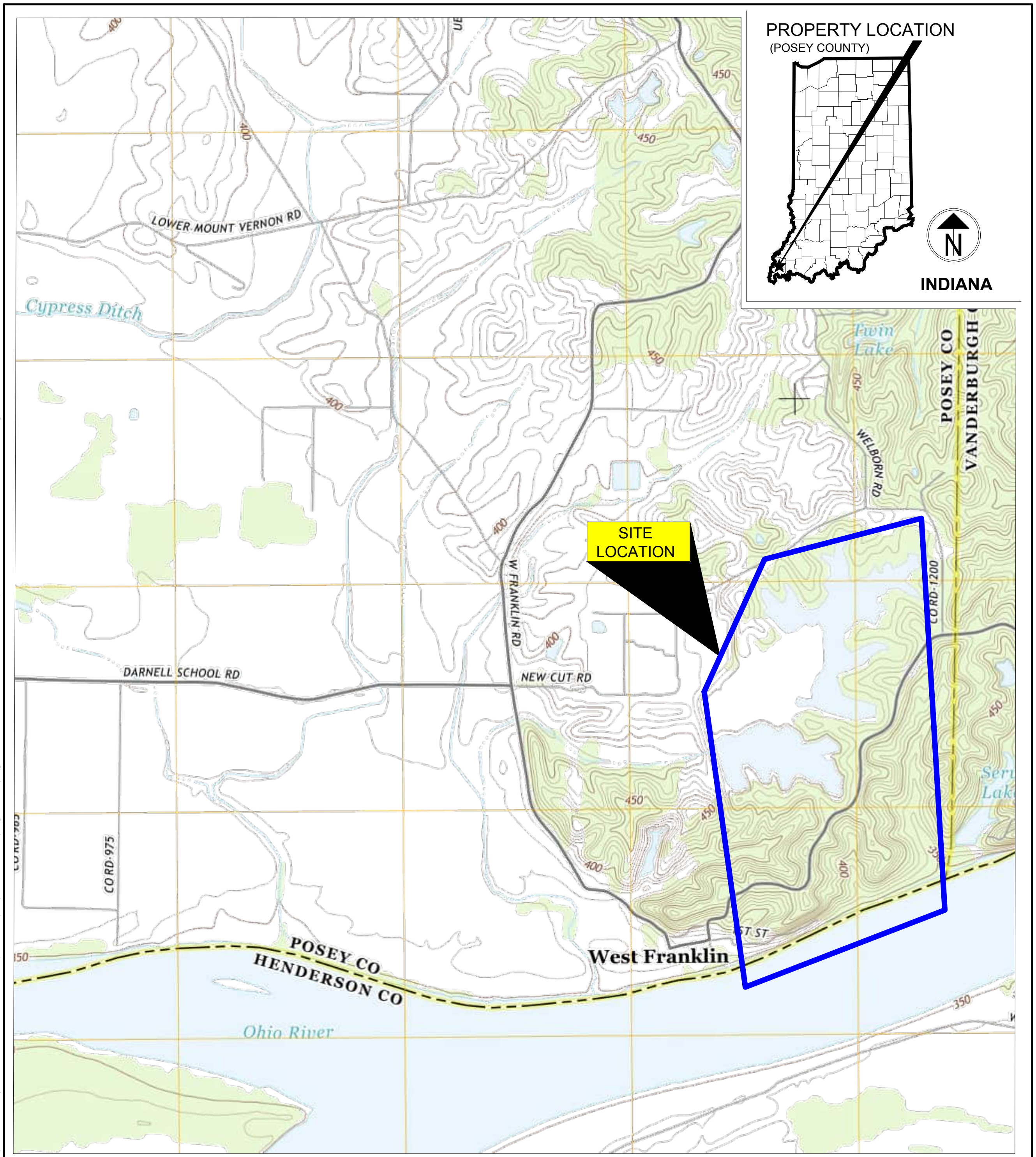
8.0 Limitations

Background information, design basis, and other data have been furnished to AECOM by third parties, which AECOM has used in preparing this report. AECOM has relied on this information as furnished. Our recommendations are based on available information from previous and current investigations. These recommendations may be updated as future investigations are performed.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility.

APPENDIX A

Figures



0 1000 2000

SCALE: 1"=2000'

N

AECOM

AB BROWN GENERATING STATION

POSEY COUNTY, IN

FIGURE 1 - SITE LOCATION MAP

DRAWN BY:	CHECKED BY:	PROJECT No:	DATE:	FIGURE No:
ACI	MJ	60442676	12/21/18	1

G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBrown\DWGs\C\GEOTECH\Figures\Figure 1 - Site Location Map_CLOSURE -12-21-18.dwg User: aileen.ivic Dec 21, 2018 - 11:46am

LEGEND

POND BOUNDARY

REFERENCES

THE EXISTING SURVEY INFORMATION (TOPOGRAPHY, PLANIMETRICS, ETC.) IS BASED ON THE AERIAL TOPOGRAPHIC SURVEY AND NORTH DAM SURVEY PERFORMED BY THREE-I ENGINEERING IN 2016. IT WAS FURTHER SUPPLEMENTED BY THE AS-BUILT BUTTRESS SURVEY AND AS-BUILT STREAM RELOCATION SURVEY PERFORMED BY BLANKENBERGER BROTHERS, INC., DATED OCTOBER 3, 2016. THE BASEMAP WAS UPDATED WITH ADDITIONAL INFORMATION PROVIDED BY THREE-I ENGINEERING DATED FEBRUARY 2, 2020.

N

0 200 400 600

GRAPHIC SCALE (IN FEET)

AECOM

PROJECT

Ash Pond
IDEM Closure Plan
FIGURE 2

A.B. BROWN GENERATING STATION
8511 Welborn Rd
Mount Vernon, IN 47620

CenterPoint® Energy

CLIENT

SIGECO
DBA CENTER POINT ENERGY SOUTH
P.O. Box 209
Evansville, IN 47702
800.227.1376 tel
http://www.vectren.com

CONSULTANT

AECOM Process Technologies
9400 Amberglen Boulevard
Austin, Tx 78729
512.454.4797 tel 512.419.6004 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

FIGURE 2

SHEET NUMBER

2

ARCH D 24" x 36"

Approved: ___ Checked: ___ Designer: ___ Project Management Initials: ___

Last saved by: RACHEL.SUTOR(2021-09-22) Last Plotted: 2021-09-22
Filename: Z:\CLEVELAND-USCLV01\DCS\PROJECTS\VECTREN CORPORATION\60442676_ABBCLOSURE\400-TECHNICAL\451-REPORTS AND DOCUMENTS\CLOSURE_POSTCLOSURE PLAN\IDEM VERSION -- PENDING START\APPENDIX A - FIGURES\FIGURE 2_ABB CLOSURE_IDEM.DWG

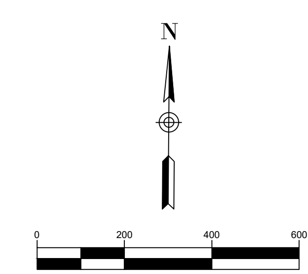
Printed on ___% Post-Consumer Recycled Content Paper

LEGEND

POND BOUNDARY

REFERENCES

THE EXISTING SURVEY INFORMATION (TOPOGRAPHY, PLANIMETRICS, ETC.) IS BASED ON THE AERIAL TOPOGRAPHIC SURVEY AND NORTH DAM SURVEY PERFORMED BY THREE-I ENGINEERING IN 2016. IT WAS FURTHER SUPPLEMENTED BY THE AS-BUILT BUTTRESS SURVEY AND AS-BUILT STREAM RELOCATION SURVEY PERFORMED BY BLANKENBERGER BROTHERS, INC., DATED OCTOBER 3, 2016. THE BASEMAP WAS UPDATED WITH ADDITIONAL INFORMATION PROVIDED BY THREE-I ENGINEERING DATED FEBRUARY 2, 2020.



AECOM

PROJECT

Ash Pond
IDEM Closure Plan
FIGURE 3

A.B. BROWN GENERATING STATION
8511 Welborn Rd
Mount Vernon, IN 47620

CenterPoint® Energy

CLIENT

SIGECO
DBA CENTER POINT ENERGY SOUTH
P.O. Box 209
Evansville, IN 47702
800.227.1376 tel
http:///www.vectren.com

CONSULTANT

AECOM Process Technologies
9400 Amberglen Boulevard
Austin, Tx 78729
512.454.4797 tel 512.419.6004 fax
www.aecom.com

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

FIGURE 3

SHEET NUMBER

3

ARCH D 24" x 36"
Project Management Initials: Designer: Checked: Approved:
Last saved by: RACHEL SUTOR(2021-09-22) Last Plotted: 2021-09-22
Filename: Z:\CLEVELAND-USCLV01\DCS\PROJECTS\VECTREN CORPORATION\60442676_ABBCLOSURE\400-TECHNICAL\451-REPORTS AND DOCUMENTS\CLOSURE_POSTCLOSURE PLAN\IDEM VERSION -- PENDING START\APPENDIX A - FIGURES\FIGURE 3_ABB CLOSURE_IDEM.DWG

APPENDIX B

Original Construction Drawings

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF INDIANA
INDIANA DEPARTMENT OF CONSERVATION
INDIANAPOLIS, INDIANA

STATE OF KENTUCKY
DEPARTMENT OF ECONOMIC DEVELOPMENT

WEST FRANKLIN QUADRANGLE
INDIANA–KENTUCKY
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 HENDERSON 15' QUADRANGLE

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Culture and drainage in part compiled from aerial photographs taken 1950 (Kentucky) and 1956 (Indiana). Indiana topography by photogrammetric methods and planetable surveys 1957. Kentucky topography by planetable surveys 1952. Revised 1957

Polyconic projection. 1927 North American datum
10,000-foot grids based on Indiana coordinate system, west zone, and Kentucky coordinate system, south zone 1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

The state boundary as shown represents the approximate position of the low waterline as determined from U. S. Department of the Army, Corps of Engineers, Ohio River charts, surveyed 1912, and supplementary information

Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked

All wells shown are oil wells

UTM GRID AND 1957 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

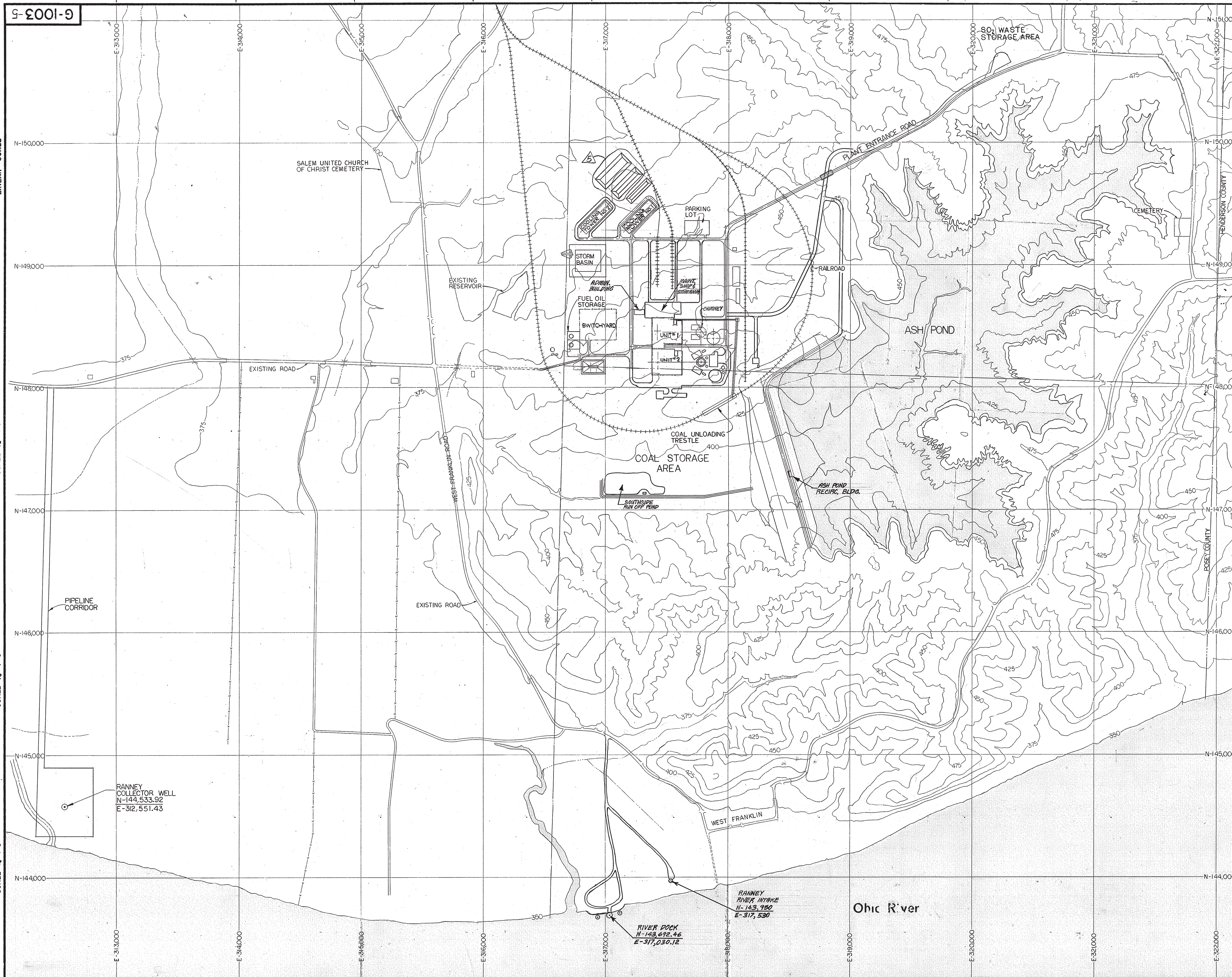
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242,
INDIANA DEPARTMENT OF CONSERVATION, INDIANAPOLIS, INDIANA,
KENTUCKY GEOLOGICAL SURVEY, LEXINGTON, KENTUCKY,
AND KENTUCKY DEPARTMENT OF COMMERCE, FRANKFORT, KENTUCKY
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
State Route

WEST FRANKLIN, IND.–KY.
NW/4 HENDERSON 15' QUADRANGLE
N3752.5—W8737.5/7.5
1957

AMS 3459 I NW--SERIES V851



NO.	DATE	REVISION	BY	CHK.	APP.
6	06-08-89	ADDED RIVER INTAKE & RIVER DOCK ET. AL.	MW/RES		
5	2-28-86	REVISED BASINS	GJ		
4	10-21-83	REVISED AS NOTED FOR UNIT NO. 2	RFS		
3	3-20-81	ISS. FOR CONSTRUCTION PER MV LTR GISELR	WN	RJ	
2	5-23-80	ADDED UNIT #2 & ISSUED FOR BLD'G PERMIT	RJ	mimi	KN
1	5-2-80	REV. AS BUILT-UNIT #1	mimi	RJ	K.N.
0	5-2-77	ISSUED FOR CONSTRUCTION	WTB	RAD	TLP

DRAWN J. Brockheimer
CHECKED RA DIRKSEN
APPROVED TLPettikas 5-2-77
CUSTOMER APP.

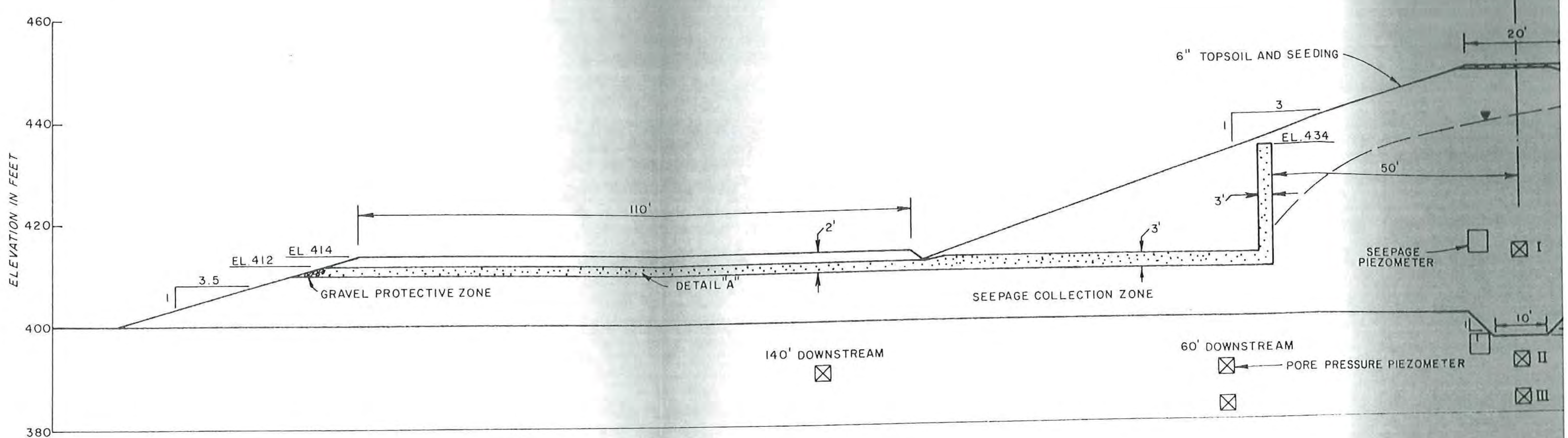
TOM L. PETTIKAS REGISTERED No. 13359 STATE OF INDIANA PROFESSIONAL ENGINEER

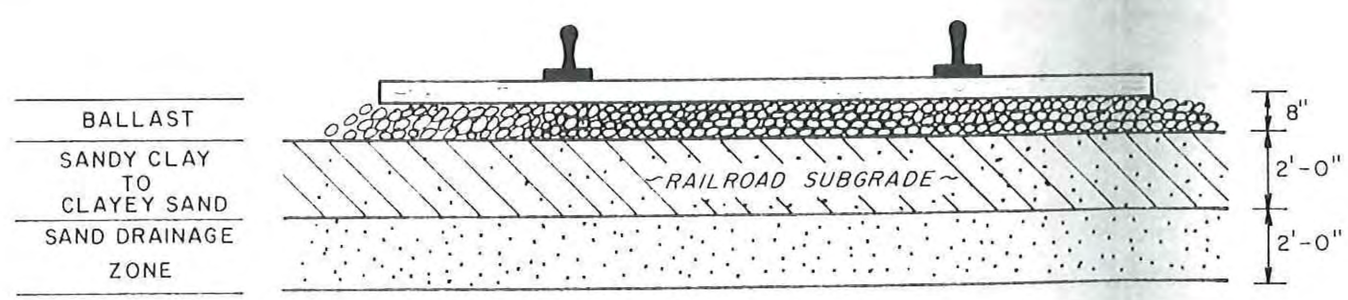
MID-VALLEY, INC.
ENGINEERS - CONSTRUCTORS
OAK BROOK, ILLINOIS

SOUTHERN INDIANA GAS & ELECTRIC CO.
EVANSVILLE, INDIANA
A.B. BROWN STATION
UNIT NO. 1&2

DRAWING TITLE
CIVIL
SITE PLAN

CONTRACT NO. CP-0013
DATE: MAY 1, 1976
SCALE: 1" = 300'
DRAWING NO. G-1003-6





DETAIL "A"

NOTES:

1. Compact embankment fill to at least 92
of maximum standard density

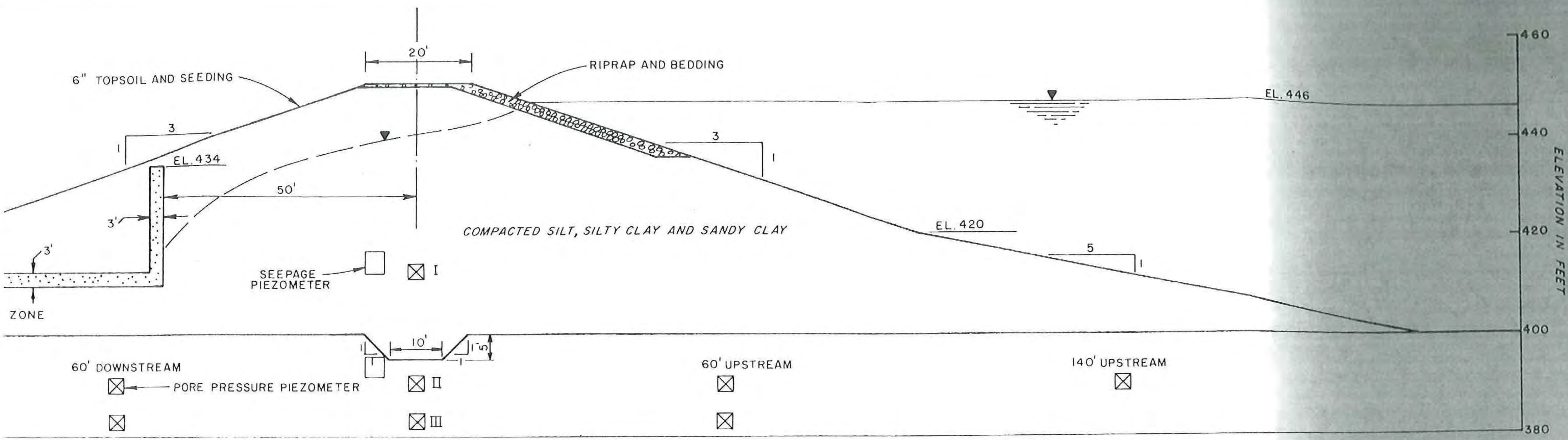
2. Compact railroad subgrade above sand
drainage zone to 95% modified maximu
density

3. Compact horizontal sand drainage zone
6 passes of 25 ton rubber tired roller ap
to each 12 inch lift. Compact vertical
zone with hand tampers

4. Sand drainage zone should be nonplasti
graded and have less than 10% passing
sieve

5. Slope sand drainage zone to daylight a
slope in areas where berm is not require
downstream surface grade is above El.

6. Sand drainage zone not required for em
sections where downstream surface grad
above El. 430.



NOTES:

1. Compact embankment fill to at least 92% of maximum standard density
2. Compact railroad subgrade above sand drainage zone to 95% modified maximum density
3. Compact horizontal sand drainage zone with 6 passes of 25 ton rubber tired roller applied to each 12 inch lift. Compact vertical sand zone with hand tampers
4. Sand drainage zone should be nonplastic, well graded and have less than 10% passing No. 200 sieve
5. Slope sand drainage zone to daylight at toe of slope in areas where berm is not required or downstream surface grade is above El. 414
6. Sand drainage zone not required for embankment sections where downstream surface grade is at or above El. 430.

Pore Pressure Piezometers

Type	Tip Elevation
I	400
II	380
III	10' below top of shale

Locate three systems or nine piezometers in valley area with surface grade at or below El. 410.

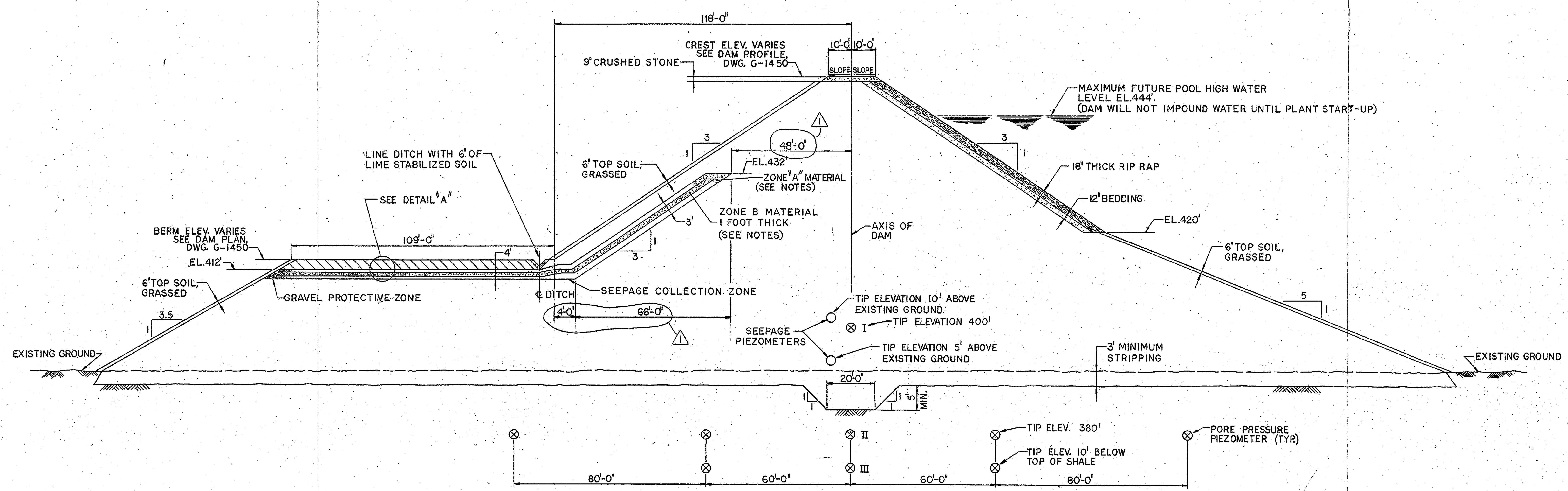
Seepage Piezometers

Type	Tip Elevation
I	5' above natural grade
II	10' below natural grade

Locate three system of two piezometers in valley area with surface grade at or below El. 410.

TYPICAL EMBANKMENT SECTION

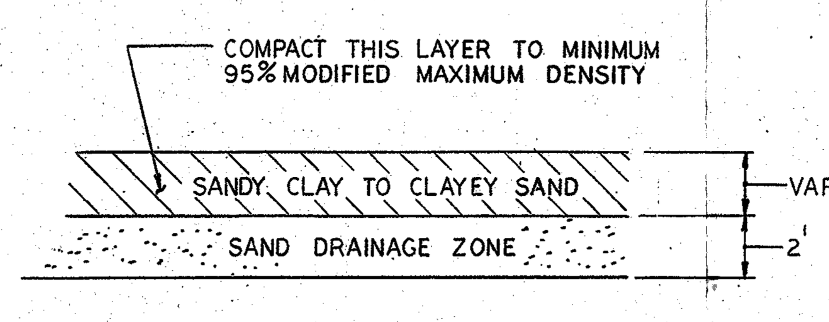
G-1452-1



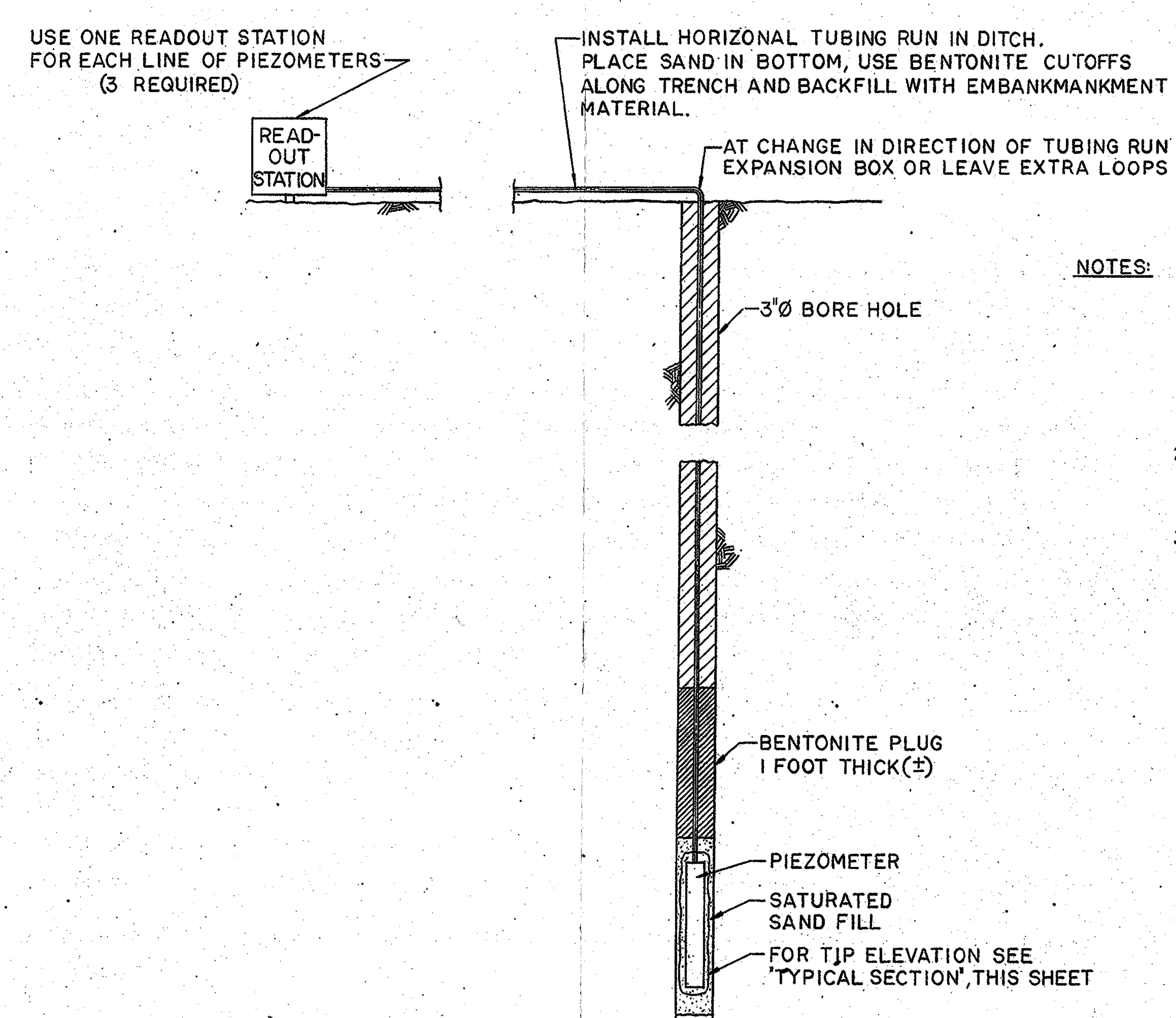
TYPICAL CROSS SECTION

SCALE
HORIZONTAL: 1" = 20'-0"
VERTICAL: 1" = 10'-0"

NOTE:
FOR LOCATION OF PIEZOMETERS ALONG ℄ OF DAM, SEE DWG. G-1050



DETAIL "A"



NOTES:

1. PIEZOMETERS SHALL BE HYDRAULICALLY FLUSHABLE, THREE TUBE PNEUMATIC MODEL P-1020 AS MANUFACTURED BY TERRA TECHNOLOGY OF SEATTLE, WASHINGTON OR ENGINEER APPROVED EQUAL.
2. PLACE PIEZOMETER IN POROUS BAG FILL WITH MOIST SAND AND PLACE ASSEMBLY IN BORE HOLE.
3. ALL TUBING RUNS SHALL HAVE 10% SLACK TO ALLOW FOR DAM SETTLEMENT AND TO PREVENT TUBES FROM STRETCHING.

TYPICAL PIEZOMETER INSTALLATION

SCALE: $1\frac{1}{2}$" = 1'-0"

NOTES

1. EMBANKMENT MATERIAL SHALL CONSIST OF CLAY, SILTY CLAY, AND SANDY CLAY UNLESS OTHERWISE NOTED.
2. COMPACT EMBANKMENT TO MINIMUM OF 95% MAXIMUM STANDARD DENSITY AS DETERMINED BY ASTM DESIGNATION D698 UNLESS OTHERWISE NOTED.
3. RIP RAP SHALL CONFORM TO MID-VALLEY, INC. SPECIFICATION C-127
4. SEEDING SHALL CONFORM TO MID-VALLEY, INC. SPECIFICATION C-127.1
5. CRUSHED STONE ON CREST SHALL CONFORM TO GRADING NO.53 OF THE INDIANA STATE HIGHWAY STANDARD SPECIFICATION COMPACTED TO 95% MAXIMUM STANDARD DENSITY
6. WHERE EXISTING GROUND CONTOUR HAS LESS SLOPE THAN THOSE SHOWN, LEAVE THE EXISTING SLOPE.
7. SAND OR CRUSHED STONE FOR USE IN THE SEEPAGE COLLECTION ZONE SHALL BE CLEAN, WELL GRADED, & NON PLASTIC.
8. ZONE "A" MATERIAL SHALL BE ASPHALT SAND CONFORMING TO ASTM DESIGNATION D1073, GRADING #1:

SIEVE SIZE	% PASS (AMOUNT FINER BY WEIGHT)
3/8	100
NO.4	95-100
8	70-100
16	40-80
30	20-65
50	7-40
100	2-20
200	0-10

9. ZONE "B" MATERIAL SHALL HAVE A UNIFORM GRADING MEETING THE FOLLOWING GRAIN SIZE REQUIREMENTS:
   D_{15} = 1.75 MM ± 1MM
   D_{50} = 6 MM ± 2MM
   D_{85} = 15 MM ± 2MM
   100% PASS 3/4" SIEVE
   MAX 2% PASS #100 SIEVE
10. A SIEVE ANALYSIS OF THE AGGREGATES PROPOSED FOR USE IN THE SEEPAGE COLLECTION ZONE SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO THIER USE. THE SIEVE ANALYSIS SHALL CONFORM TO THE REQUIREMENTS OF ASTM DESIGNATION C-136 AND SHALL BE REPORTED ON THE BASIS OF TOTAL PERCENTAGE OF MATERIAL PASSING EACH SIEVE.
11. COMPACT THE HORIZONTAL SEEPAGE COLLECTION ZONE WITH 6 PASSES OF A 25 TON RUBBER TIRED ROLLER FOR EACH LIFT. COMPACT VERTICAL COLLECTION ZONE WITH HAND TAMPERS.
12. EXTREME CARE SHALL BE TAKEN TO PREVENT MIXING EMBANKMENT MATERIAL WITH THE DRAINAGE ZONE. THE COLLECTION ZONE SHALL BE COMPLETELY FREE OF FOREIGN MATERIALS.
13. SLOPE SEEPAGE COLLECTION ZONE TO DAYLIGHT AT THE TOE OF THE SLOPE IN AREAS WHERE THE RAILROAD BERM IS NOT REQUIRED OR WHERE THE DOWNSTREAM SURFACE GRADE IS ABOVE ELEVATION 414.0'
14. THE SEEPAGE COLLECTION ZONE IS NOT REQUIRED FOR DAM SECTIONS WHERE THE DOWNSTREAM SURFACE GRADE IS AT OR ABOVE ELEVATION 430.0'
15. STRIP UNSUITABLE MATERIAL AND COMPACT FOUNDATION BEFORE PLACING EMBANKMENT.
16. ELEVATIONS OF PIEZOMETERS ARE NOT SHOWN TO SCALE
17. CLEARING AND GRUBBING HAS BEEN COMPLETED BY OTHERS.
18. PLACE CLAYEY MATERIAL IN CORE AREA AND UPSTREAM FACE AS DIRECTED BY THE GENERAL CONTRACTOR'S REPRESENTATIVE.
19. CRUSHED STONE ON CREST TO HAVE 1/4" PER FOOT CROWN.
20. LIME STABILIZED SOIL TO HAVE 4% LIME BY WEIGHT.

REFERENCE DRAWINGS

1. G-1450 DAM PLAN AND PROFILE
2. G-1451 DAM SPILLWAY SECTIONS & DETAILS
3. G-1453 DAM DETAILS

DRAWING NUMBER WAS G-1052-1

NO.	DATE	REVISION	BY	CHK.	APP.
1	12-20-82	REVISED DIMEN. PER AS BUILT	RRR		
	2-19-75	ISSUED TO INDIANA DEPT. OF NATURAL RESOURCES FOR APPROVAL	W.T.B.		

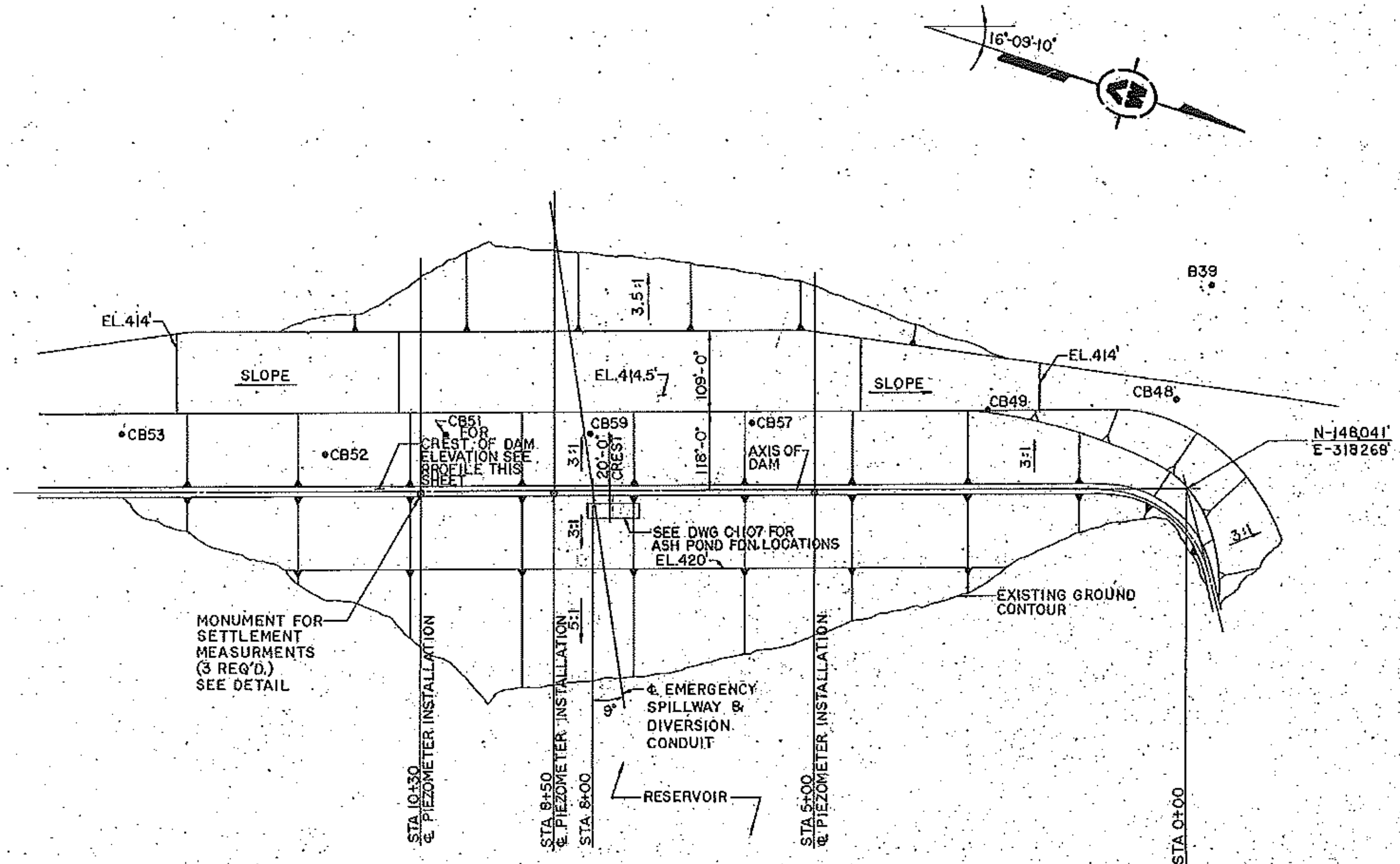
DRAWN: BARABAS, WALTER T.
CHECKED: M. Garlich
APPROVED
CUSTOMER APP.

MID-VALLEY, INC.
ENGINEERS - CONSTRUCTORS
OAK BROOK, ILLINOIS

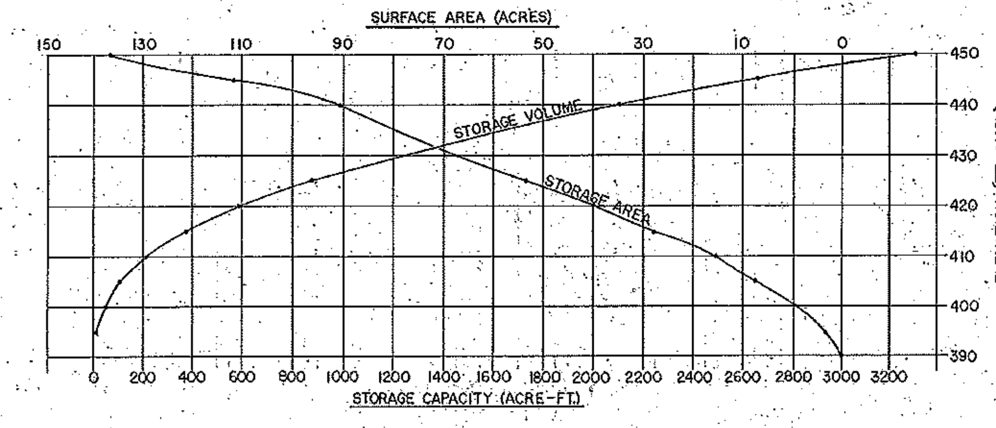
SOUTHERN INDIANA GAS & ELECTRIC CO.
EVANSVILLE, INDIANA
A.B. BROWN STATION
UNIT NO. 1&2

DRAWING TITLE: CIVIL / DAM / SECTIONS & DETAILS

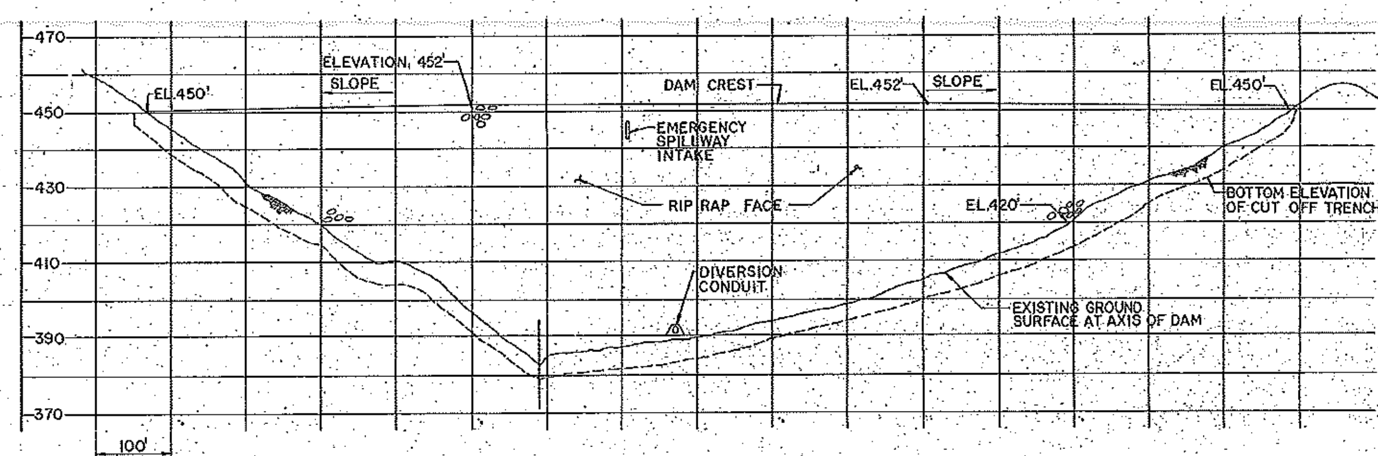
CONTRACT NO. CP-0013
DATE: JAN.24,1975
SCALE: AS SHOWN
DRAWING NO. G-1452-1



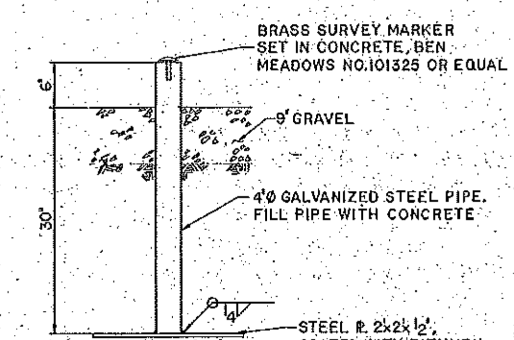
DAM PLAN
SCALE 1"=100'-0"



STORAGE DEPTH CURVES



DAM PROFILE
SCALE
HORIZONTAL 1"=100'-0"
VERTICAL 1"=20'-0"



SETTLEMENT MONUMENT DETAIL
SCALE: 1"=1'-0"

LEGEND
1 ▫ SETTLEMENT MONUMENT
2 • BORING LOCATION

NOTES

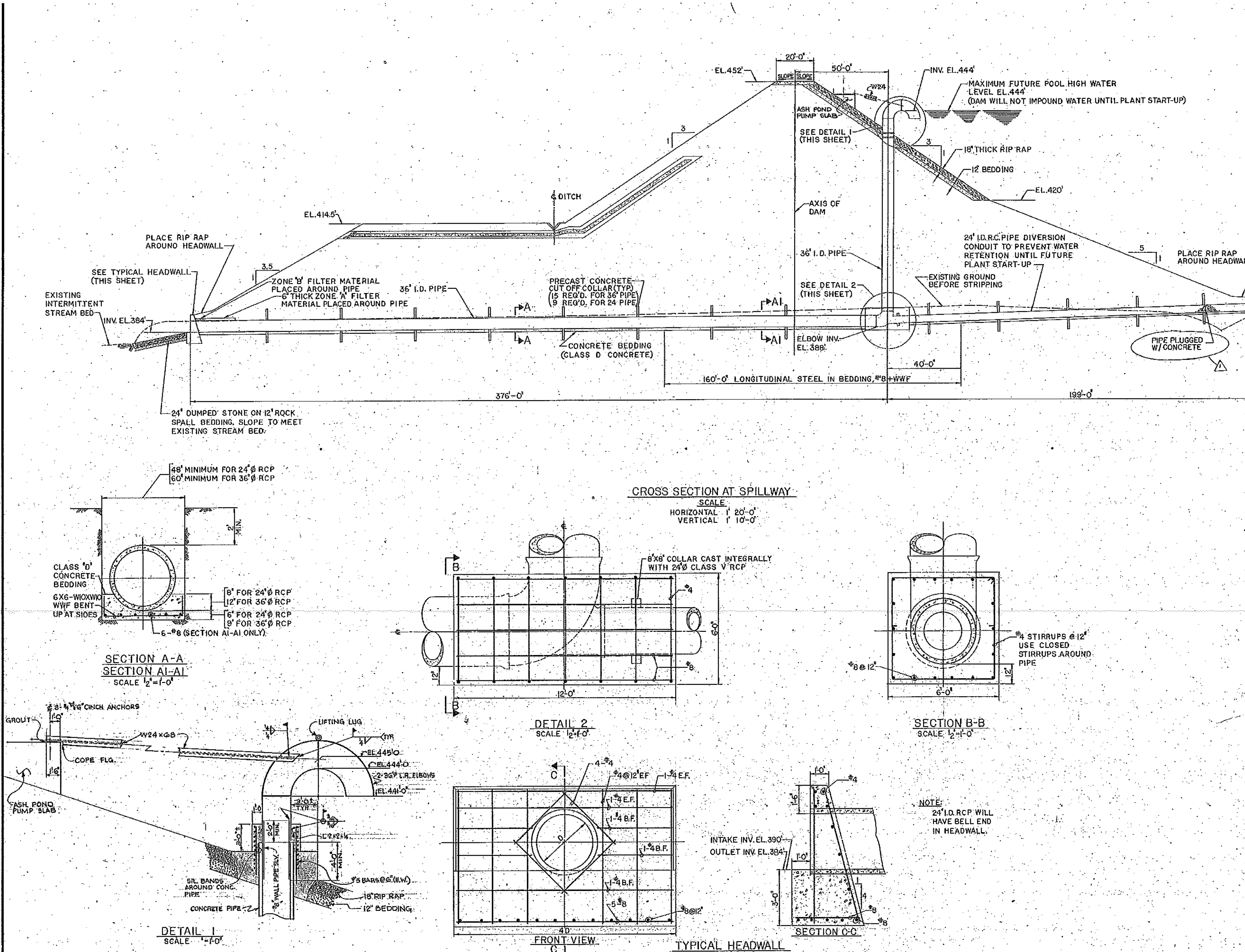
1. ELEVATIONS SHOWN ARE BASED ON MEAN SEA LEVEL DATUM AS ESTABLISHED BY THE UNITED STATES COAST AND GEODETIC SURVEY.
2. GRID COORDINATES ARE BASED ON THE INDIANA COORDINATE SYSTEM, WEST ZONE.
3. NORTH ARROW IS GRID NORTH.
4. CONTOUR LINES, ELEVATIONS, AND THE EXTENT OF SLOPES ARE APPROXIMATE.
5. PLACE ALIGNMENT STAKES AT TOE OF SLOPES FOR OBSERVATION OF POSSIBLE MOVEMENT.
6. FOR BORING LOCATIONS AND BORING LOG SEE DRAWING G-1002.

REFERENCE DRAWINGS

1. G-1002 SOIL BORING LOCATION PLAN AND SOIL PROFILES
2. G-1451 DAM SPILLWAY SECTIONS & DETAILS
3. G-1452 DAM SECTIONS & DETAILS
4. G-1453 DAM DETAILS

DRAWING NUMBER WAS G1050

DRAWN BARABAS, WALTER T. CHECKED M. Lul APPROVED	MID-VALLEY, INC. ENGINEERS - CONSTRUCTORS	SOUTHERN INDIANA GAS & ELECTRIC CO. EVANSVILLE, INDIANA A.B. BROWN STATION	DRAWING TITLE CIVIL DAM	CONTRACT NO. CP-0013	DATE: JAN 16 1975 SCALE: AS SHOWN



NOTES

1. ALL CONCRETE SHALL BE CLASS 'C' UNLESS OTHERWISE NOTED.
2. CLASS 'C' CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS.
3. ALL REINFORCING BARS SHALL CONFORM TO ASTM DESIGNATION A615 GRADE 60.
4. ALL PIPE SHALL BE REINFORCED CONCRETE CONFORMING TO ASTM DESIGNATION C-76, CLASS V, WALL 'B'.
5. REINFORCED CONCRETE PIPE SHALL HAVE CONFINED O-RING RUBBER JOINTS CONFORMING TO ASTM DESIGNATION C-443.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE 3/4" CHAMFER UNLESS OTHERWISE NOTED.
7. CUTOFF COLLARS ON 36" I.D. RCP TO BE 8'x8' AND ON 24" I.D. RCP TO BE 6'x6' MINIMUM SIZE.
8. CUTOFF COLLARS TO BE EVENLY SPACED ALONG PIPE.
9. COMPACT BACKFILL AROUND PIPE TO A MINIMUM OF 95% MAXIMUM STANDARD DENSITY.
10. CLASS 'D' CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2000 PSI AT 28 DAYS.
11. ALL REINFORCING STEEL TO HAVE 3" MINIMUM COVER.
12. ON OUTLET HEADWALL INSTALL 4 PIECES OF 1/2" I.D. GALVANIZED STEEL OR PLASTIC PIPE TO ALLOW SEEPAGE FROM FILTER BEHIND HEADWALL. SPACE PIPES EVENLY AROUND 36" I.D. OUTLET.
13. PLACE 1/2" PREMOLDED BITIMINOUS FILLERS OR GRAPHITE-COATED PAPER TO SEPARATE THE PIPE FROM THE CUTOFF COLLARS. THIS JOINT SHALL BE WATER TIGHT.
14. DUMPED STONE AT 36"Ø PIPE OUTLET TO HAVE MINIMUM 18" TOP STONES.

REFERENCE DRAWINGS

1. G-1450 DAM PLAN AND PROFILE
2. G-1452 DAM SECTIONS & DETAILS
3. G-1453 DAM DETAILS

2. 0-21-85 REVISED DET. '1'	RJ	KN	DRAWN BARABAS, WALTER T.	
1. REVISED PER AS BUILT			CHECKED	
			APPROVED	

MID-VALLEY, INC.
ENGINEERS - CONSTRUCTORS

SOUTHERN INDIANA GAS & ELECTRIC CO.
EVANSVILLE, INDIANA
A.B. BROWN STATION

DRAWING TITLE
CIVIL
DAM

CONTRACT NO. CP-0013
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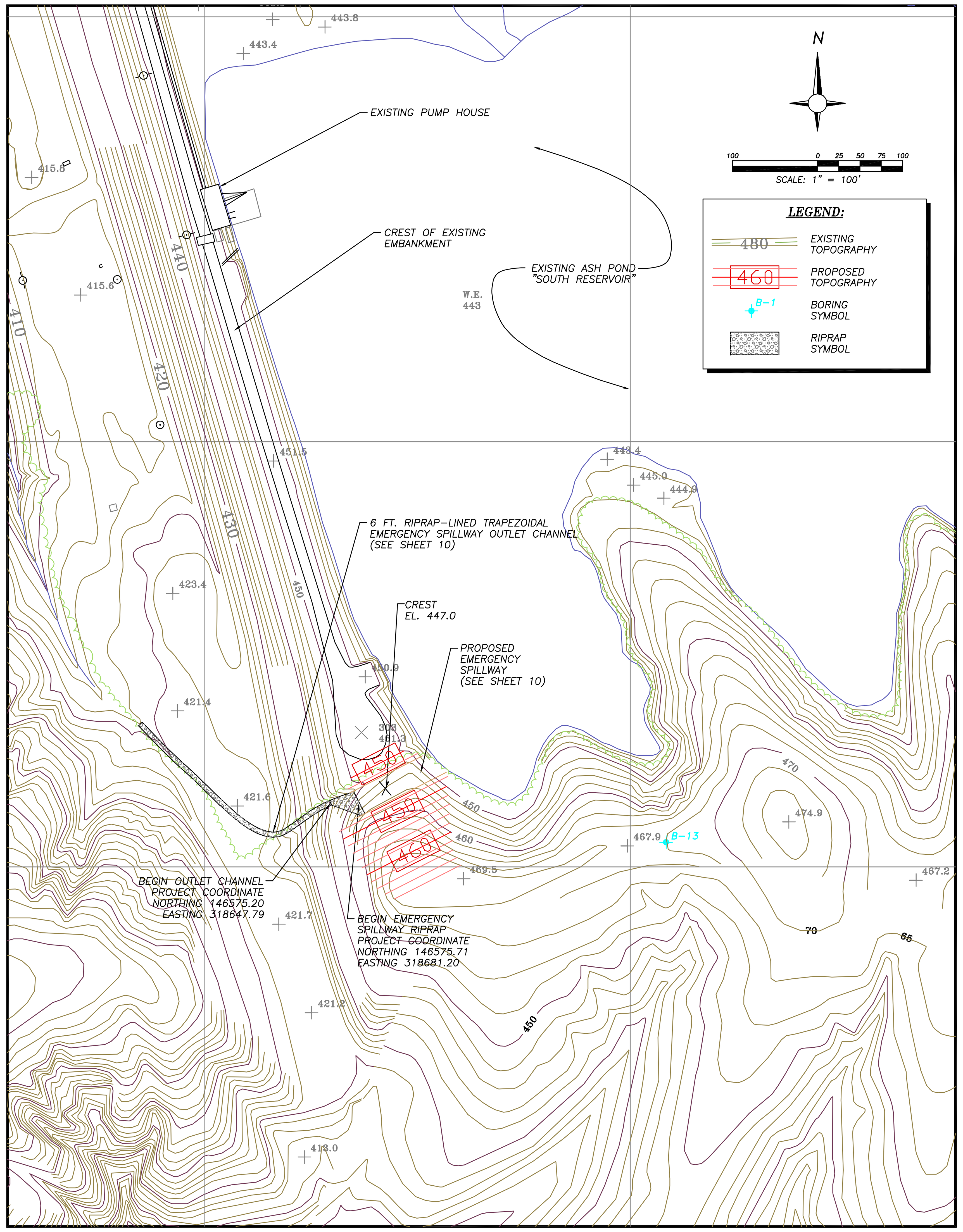
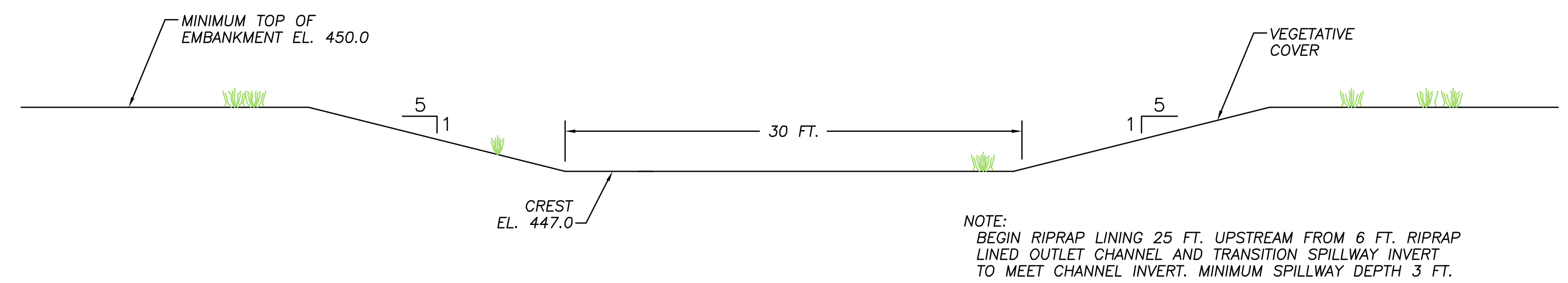
SCALE: AS SHOWN
DRAWING NO.



LOCATION OF NEW EMERGENCY SPILLWAY FOR EXISTING EMBANKMENT



SOUTH IMPOUNDMENT EMERGENCY SPILLWAY

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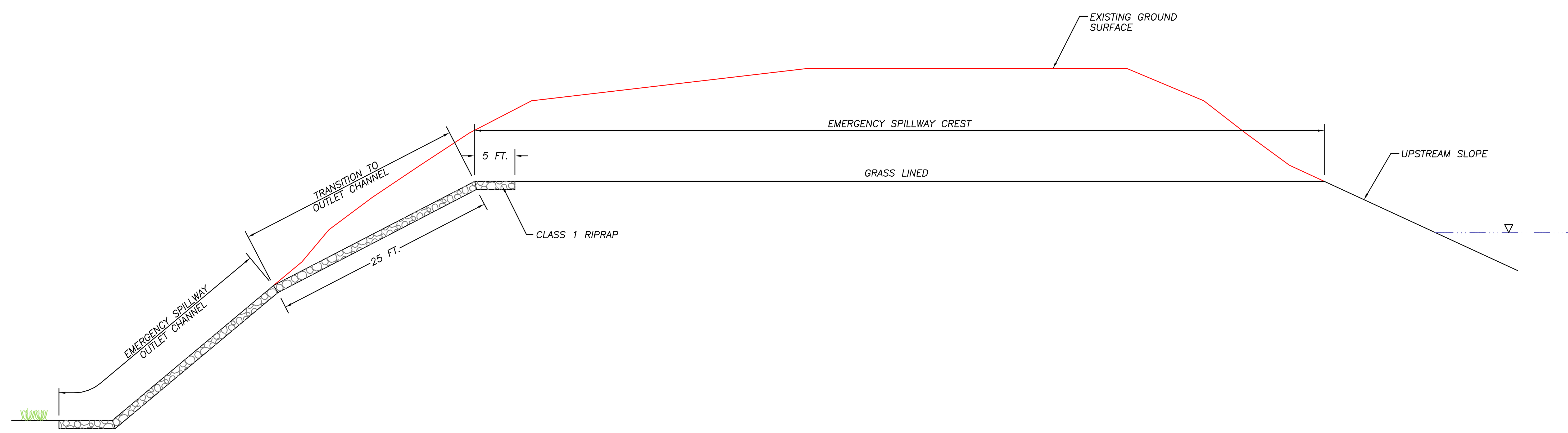
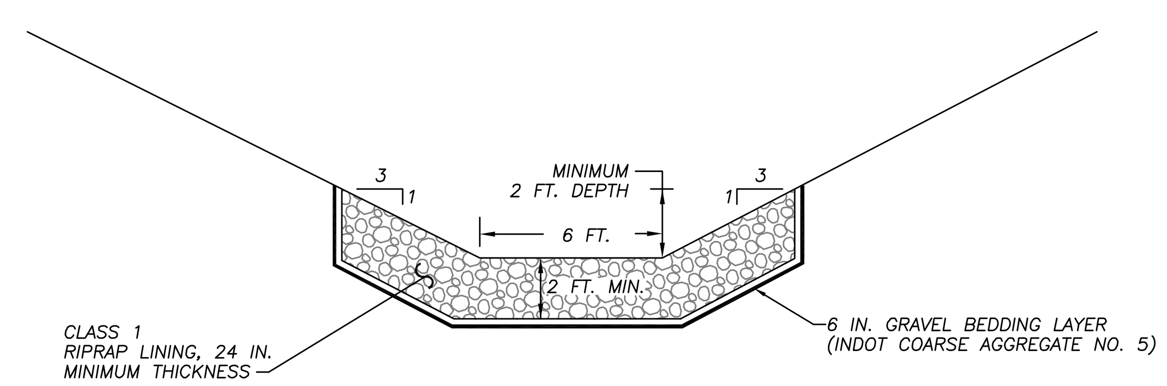


TYPICAL EMERGENCY SPILLWAY PROFILE

(NOT TO SCALE)



EMERGENCY SPILLWAY OUTLET CHANNEL FOR NORTH AND SOUTH IMPOUNDMENTS AND DOWNSTREAM OF PRINCIPAL SPILLWAY OUTLET

(NOT TO SCALE)

NOTES:

TRANSITION 30 FT. CREST WIDTH THROUGH EMBANKMENTS INTO 6 FT. WIDE RIPRAP-LINED TRAPEZOIDAL DITCH ALONG DOWNSTREAM EMBANKMENT SLOPE. AS NOTED ON TYPICAL EMERGENCY PROFILE.

FOR SOUTH IMPOUNDMENT, EXTEND RIPRAP-LINED DITCH SECTION TO TRANSITION INTO EXISTING VEGETATED DITCH AS SHOWN ON THE DESIGN DRAWINGS.

Revision: 1/02

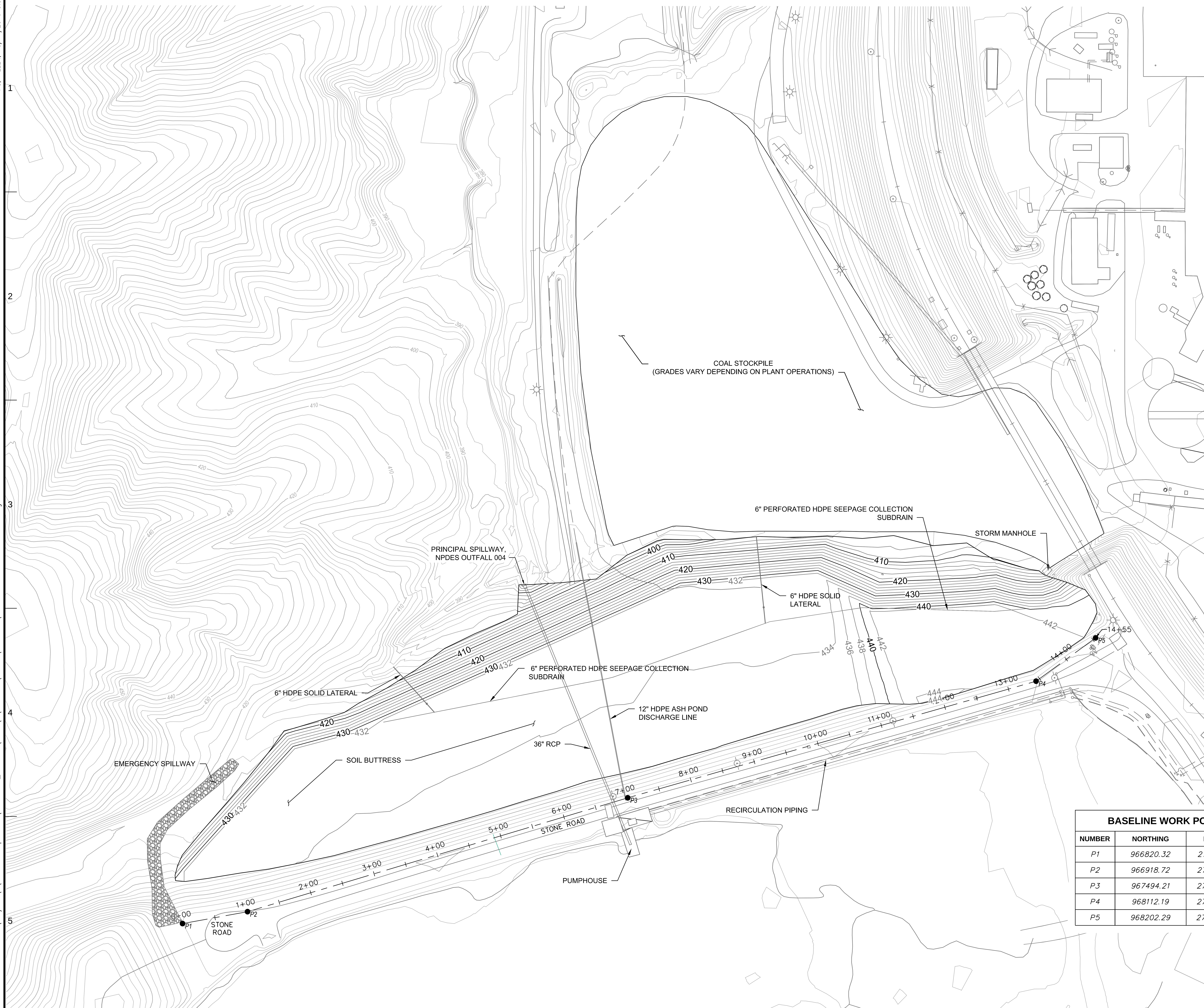
Project Number: 86.33159.0030
Drawing File: DETAIL2
Date: 1/03
Scale:
Drn. By: CR
Ckd. By: TC
App'd By:

Company Name: SOUTHERN INDIANA GAS AND ELECTRIC COMPANY

ATC ASSOCIATES INC.
7988 Centerpoint Drive, Suite 100
Indianapolis, Indiana 46256-3345
317.849.4990, Fax 317.849.4278, www.atc-enviro.com

Drawing Title: NEW EMERGENCY SPILLWAY OF EXISTING EMBANKMENT
A.B. BROWN GENERATING STATION
WEST FRANKLIN, INDIANA

Sheet: 10



0 75 150 Feet

NOTES

1. NORMAL OPERATING POOL IS 441.5 FT; MAX POOL PER INFLOW DESIGN FLOOD IS 446.8 FT.

BASELINE WORK POINT COORDINATES

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P1	966820.32	2771411.20	0+00.00
P2	966918.72	2771393.15	1+00.00
P3	967494.21	2771220.89	7+00.76
P4	968112.19	2771044.44	13+43.44
P5	968202.29	2770978.94	14+54.83

RECORD DRAWING

AECOM
1300 E. 9TH STREET
SUITE 500
CLEVELAND, OH
216-622-2300 (PHONE)

VECTREN
Live Smart
P.O.BOX 209
EVANSVILLE, IN 47702
1-800-227-1376

A.B. BROWN
GENERATING STATION
POSEY COUNTY, IN

LOWER DAM
STABILIZING
BUTTRESS

VIKRAM K. GAUTAM REGISTERED No. PE11600291 STATE OF INDIANA PROFESSIONAL ENGINEER
10/11/16

ISSUED FOR BIDDING - 3/28/16 VKG DATE BY

ISSUED FOR CONSTRUCTION 5/12/16 VKG DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
0	ISSUED FOR CONSTRUCTION	5/12/16
1	REVISION 1	7/11/16
2	AS-BUILT DRAWINGS	10/11/16

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DRAWN BY:	ACI
DESIGNED BY:	ACI
CHECKED BY:	VKG
DATE CREATED:	10/05/2016
PLOT DATE:	10/05/2016
SCALE:	AS SHOWN
ACAD VER:	AUTOCAD CIVIL 3D 2014

SHEET TITLE

BUTTRESS PLAN

C-200

SHEET 07 OF 25

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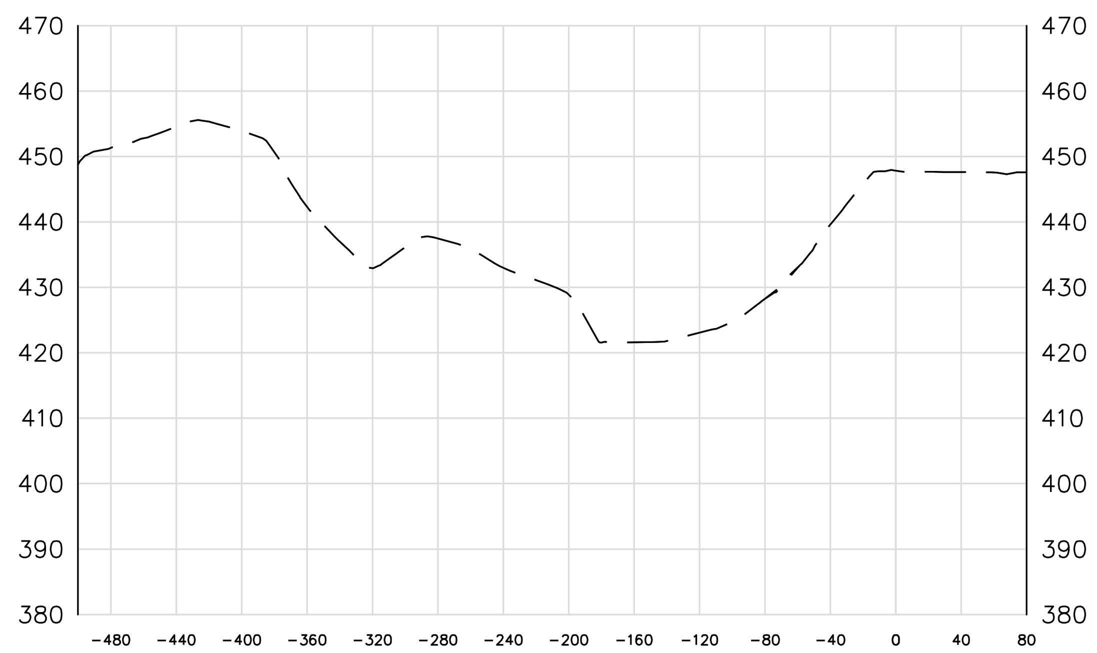

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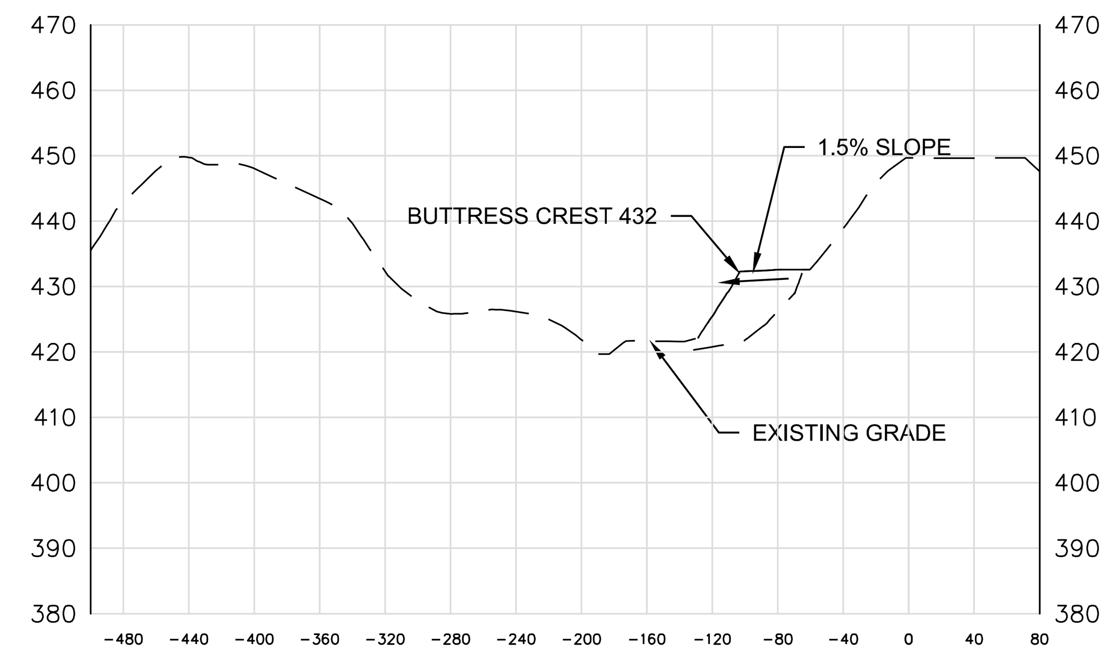

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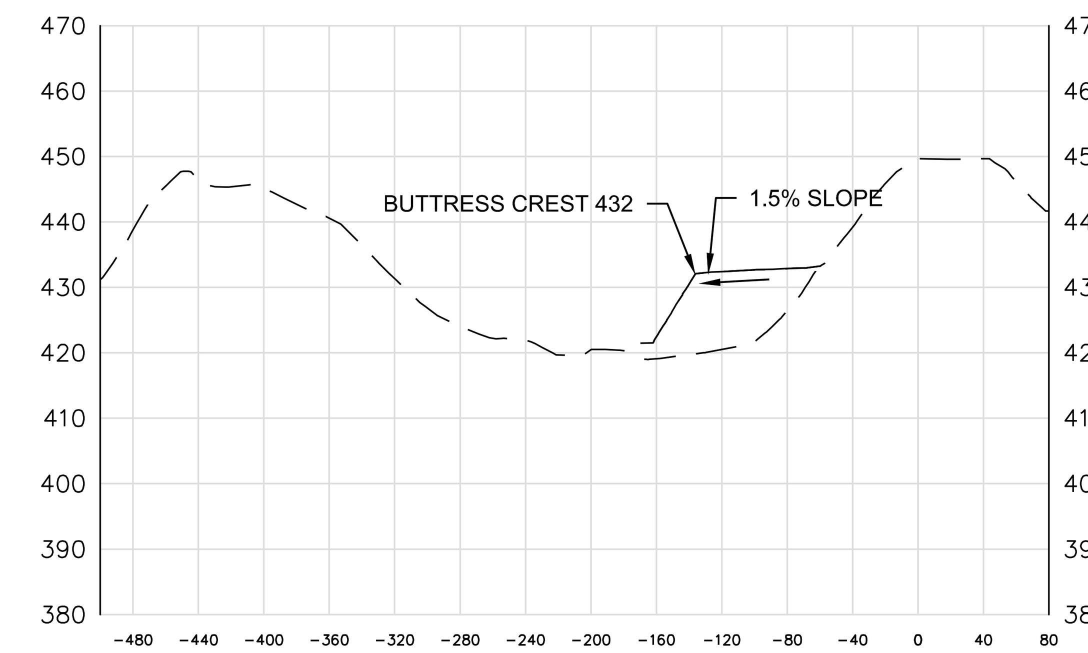

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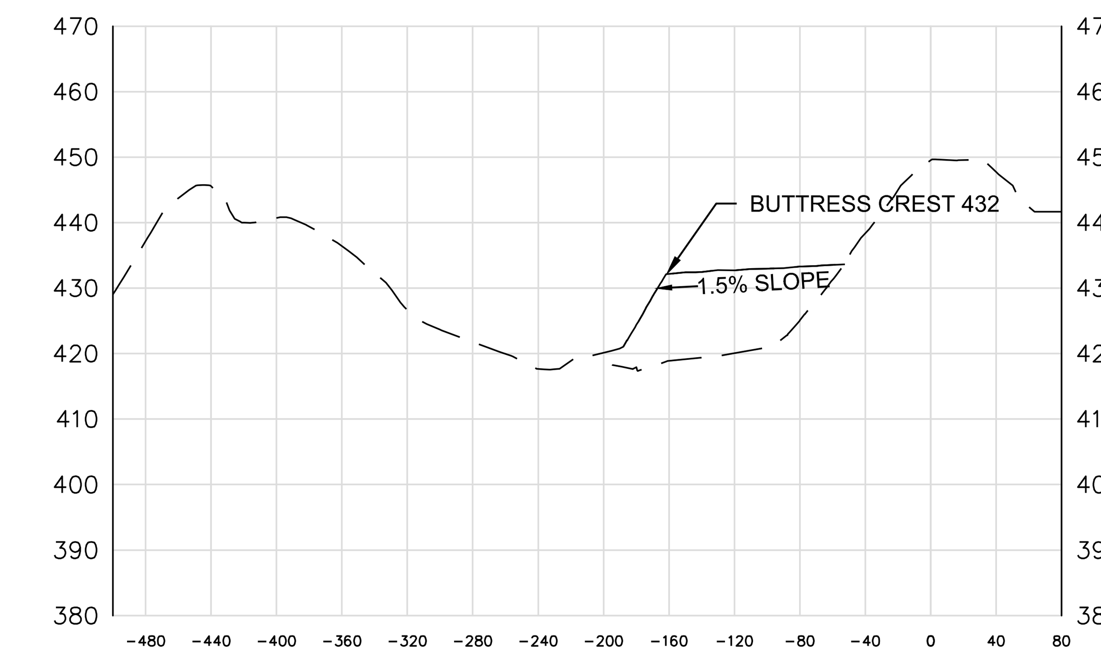

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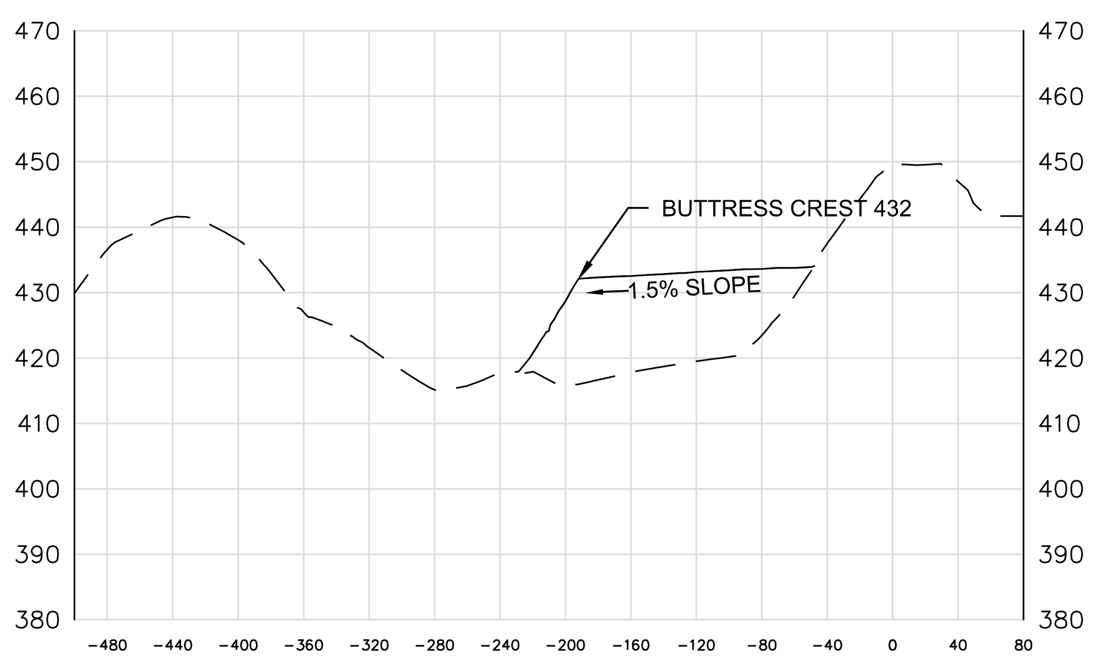

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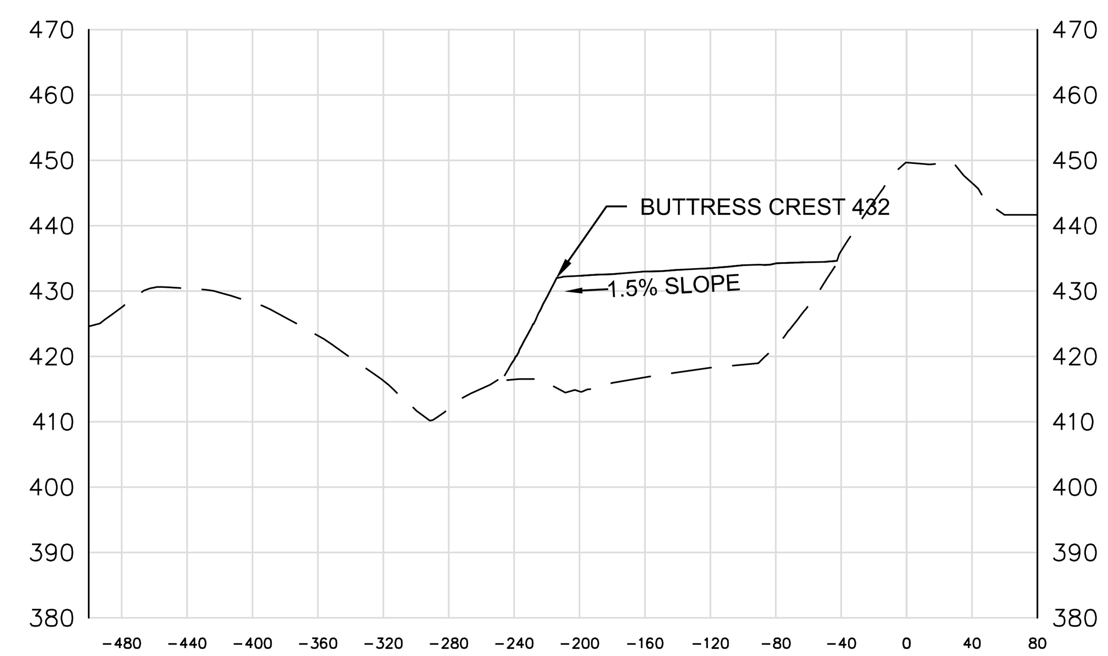

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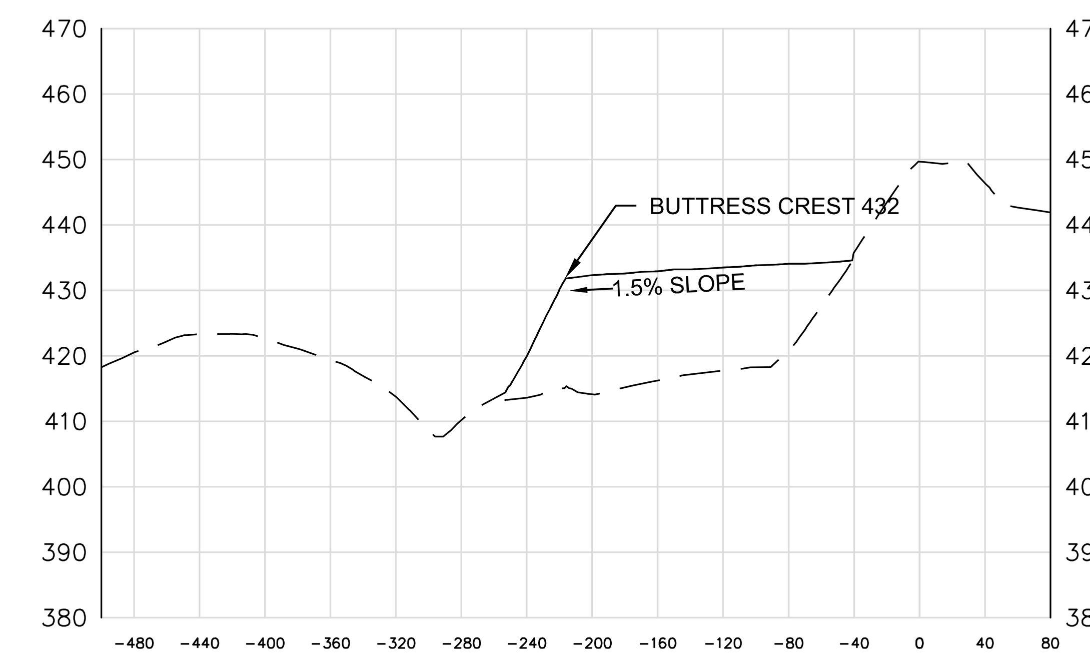

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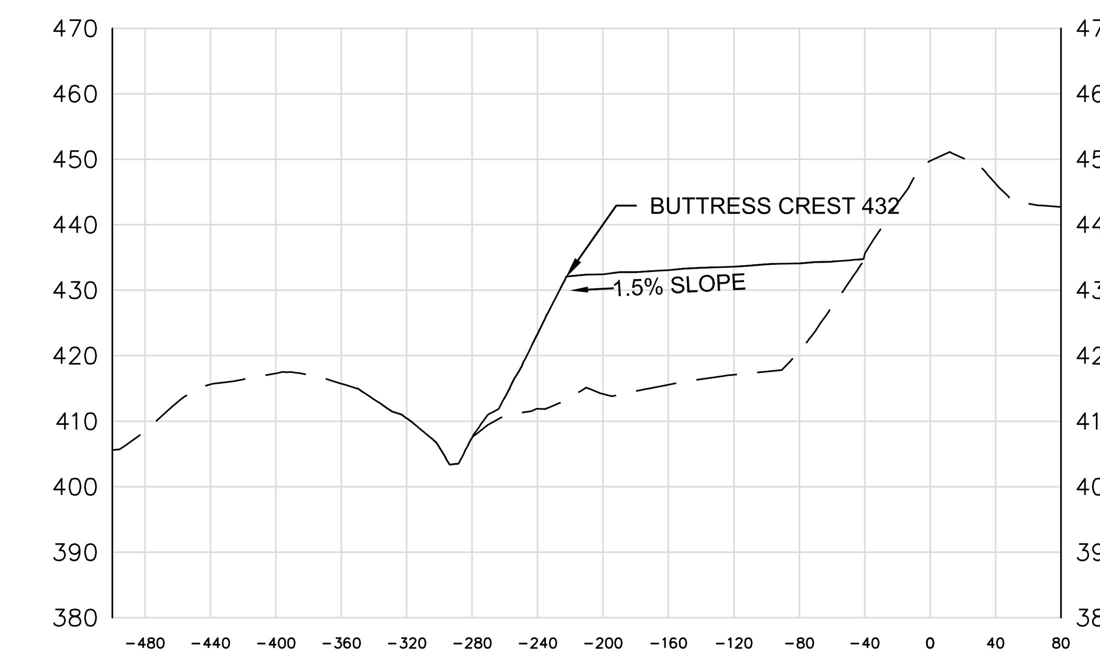

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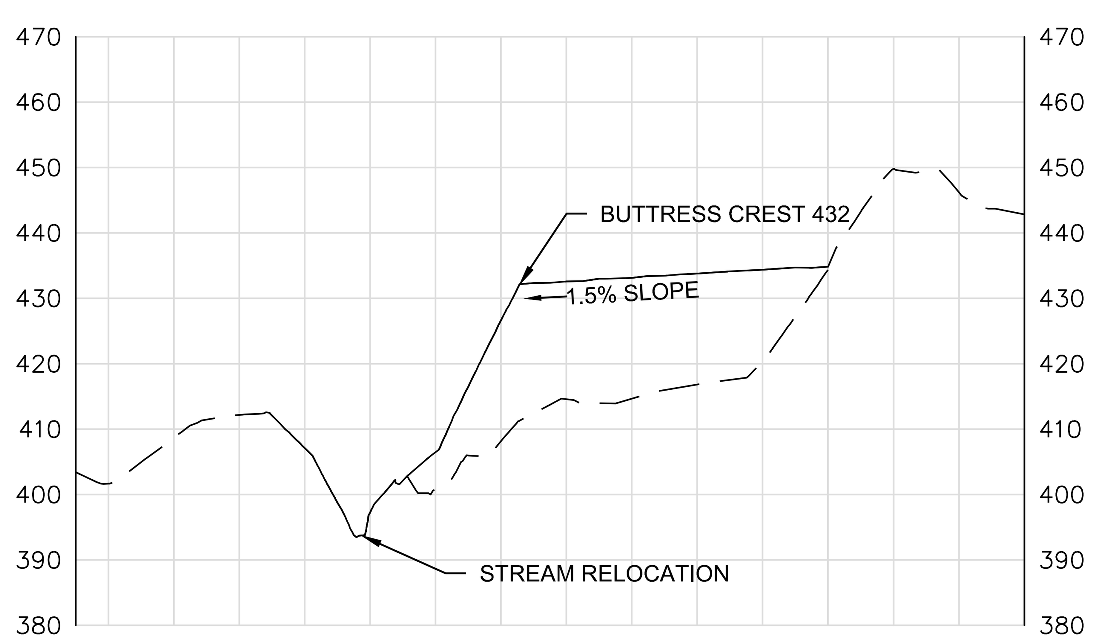

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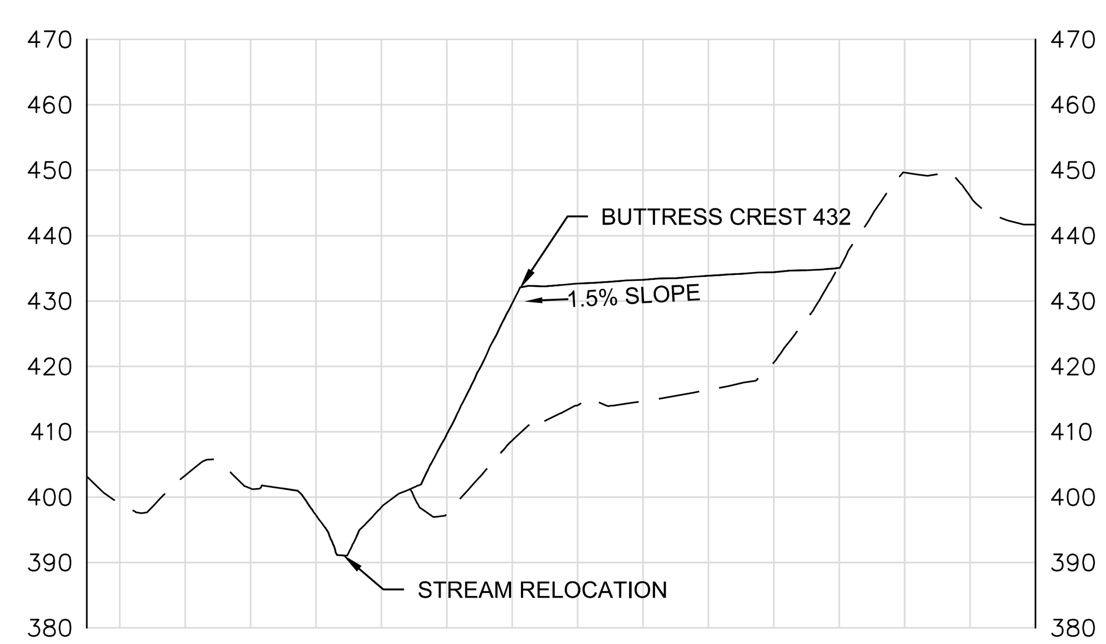

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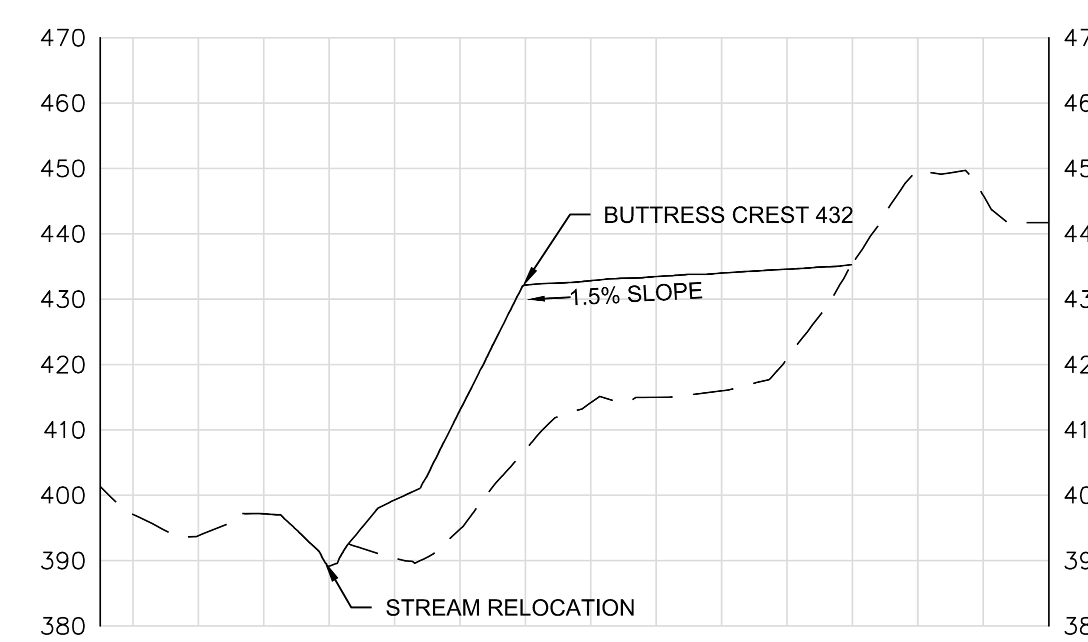

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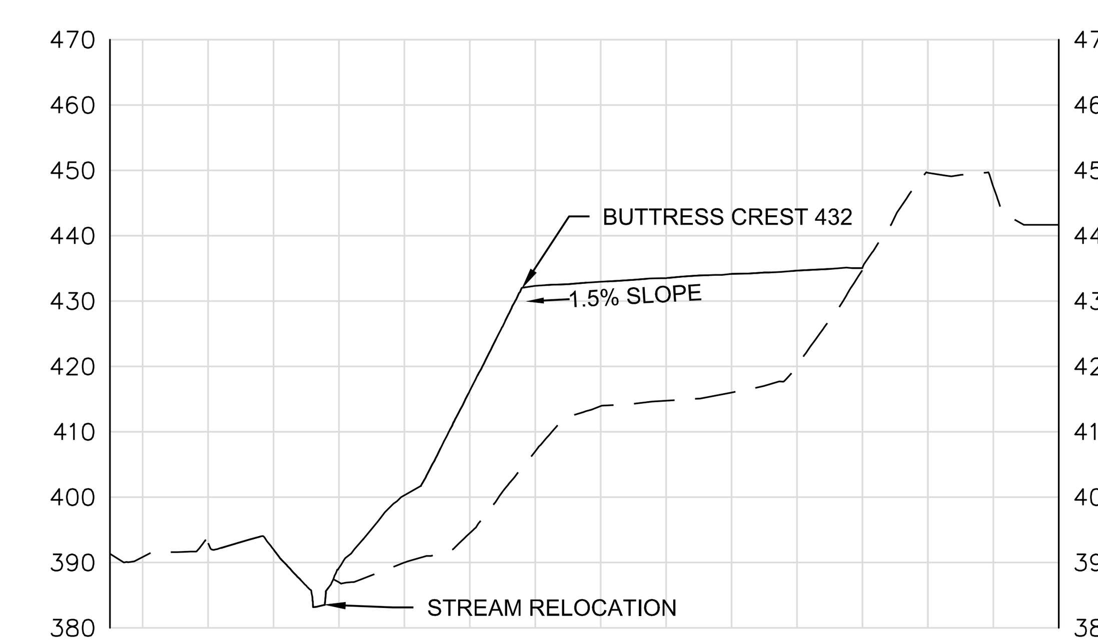

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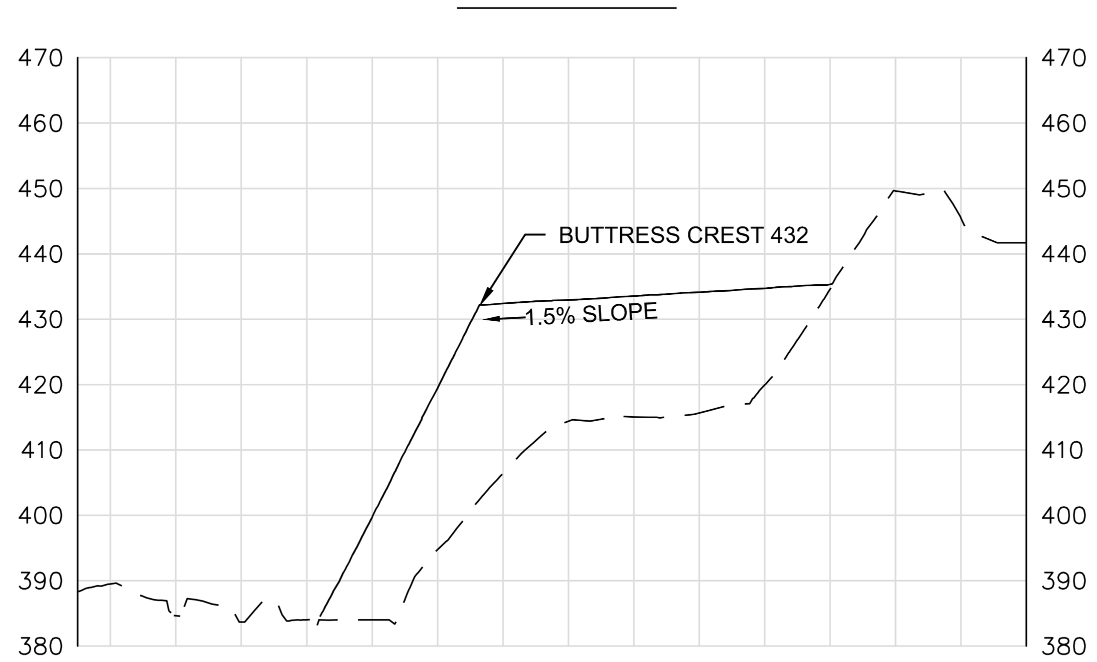

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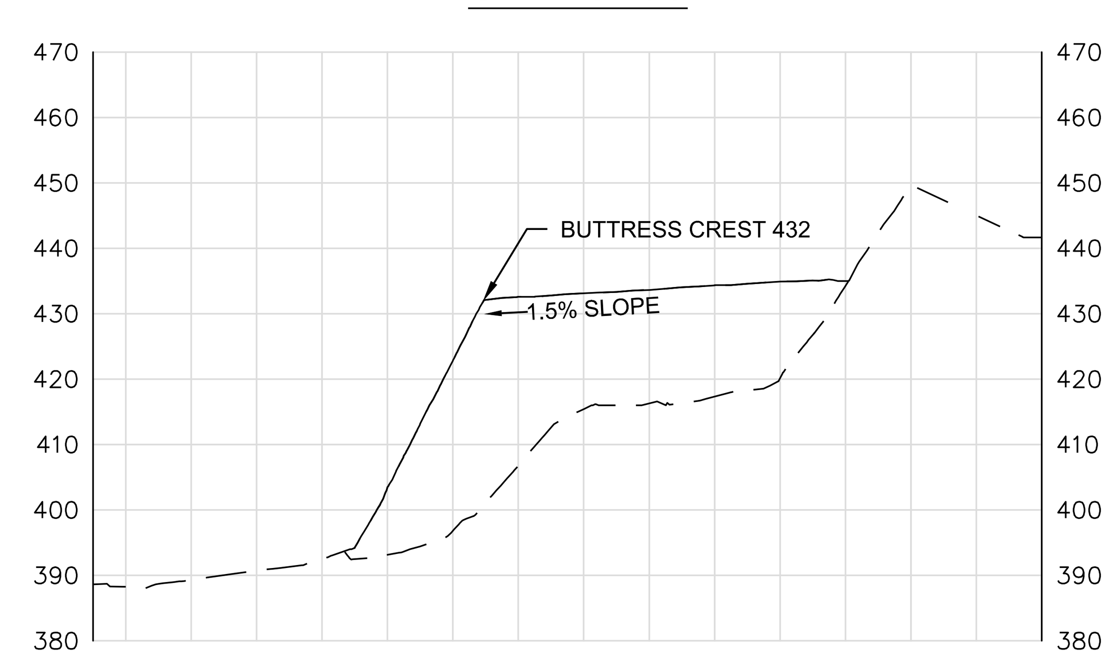

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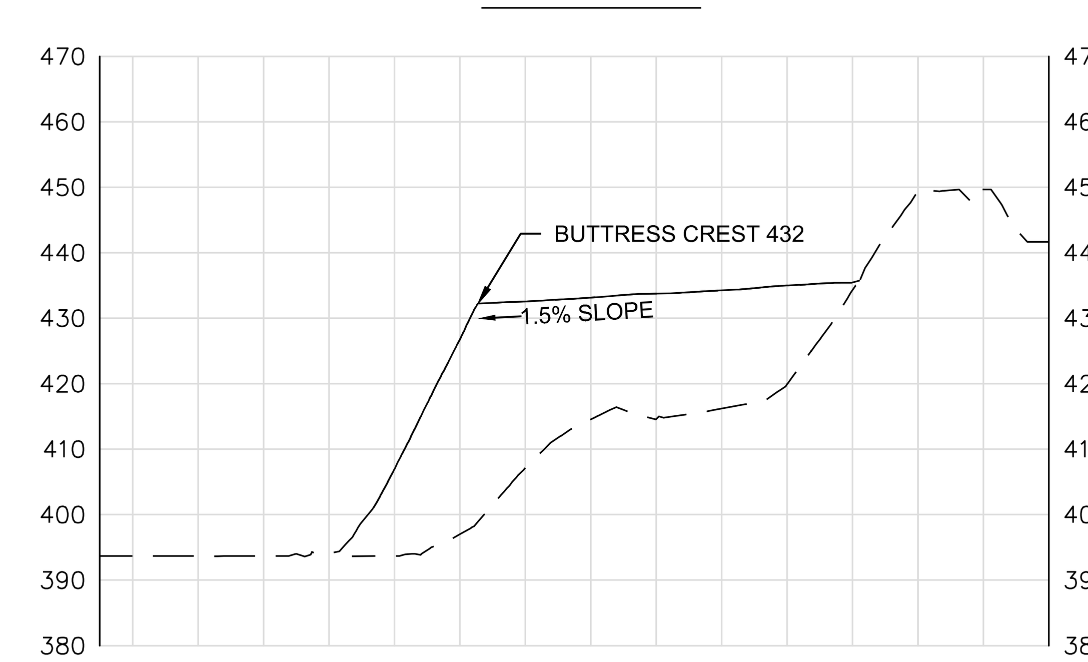

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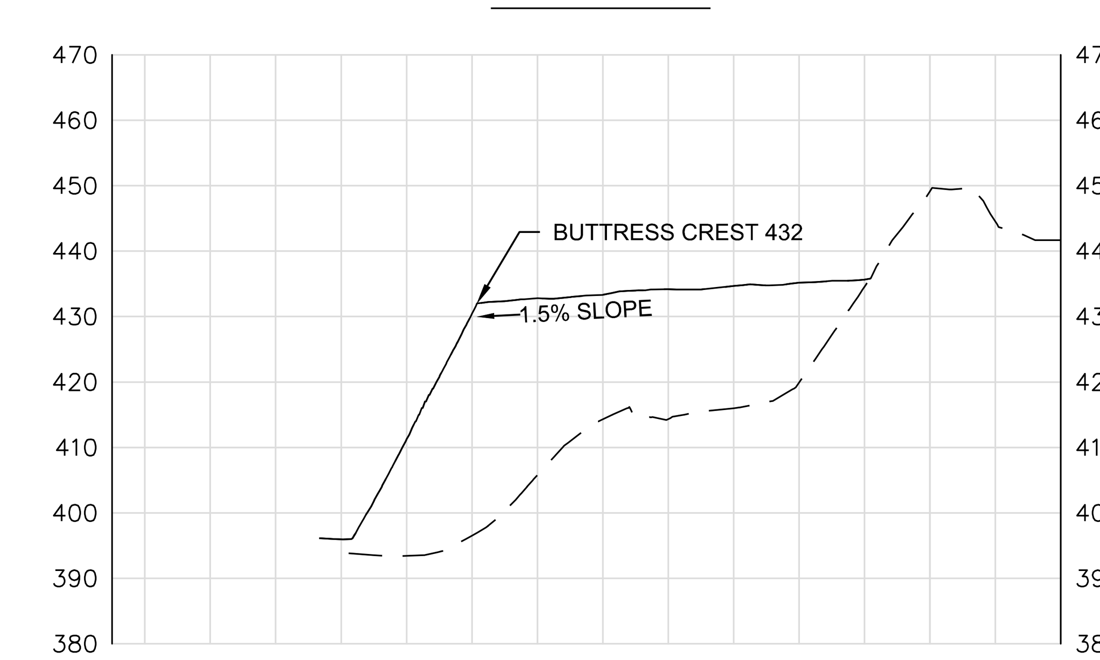

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RECORD DRAWING

AECOM
1300 E. 9TH STREET
SUITE 500
CLEVELAND, OH
216-622-2300 (PHONE)

VECTREN
Live Smart
P.O.BOX 209
EVANSVILLE, IN 47702
1-800-227-1376

A.B. BROWN
GENERATING STATION
POSEY COUNTY, IN

LOWER DAM
STABILIZING
BUTTRESS

ISSUED FOR BIDDING - 3/28/16 VKG
DATE BY

ISSUED FOR CONSTRUCTION 5/12/16 VKG
DATE BY

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CHECKED BY:	VKG
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SCALE:	AS SHOWN
ACAD VER:	AUTOCAD CIVIL 3D 2014

SHEET TITLE

CROSS
SECTIONS - SOIL
BUTTRESS

C-201

SHEET 08 OF 25

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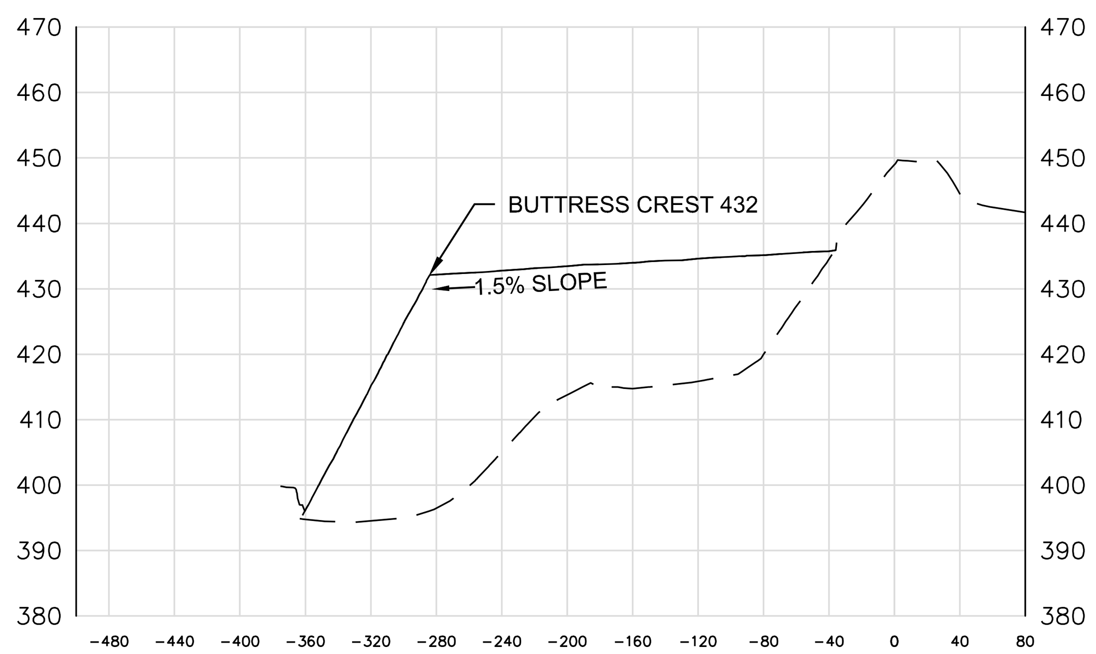

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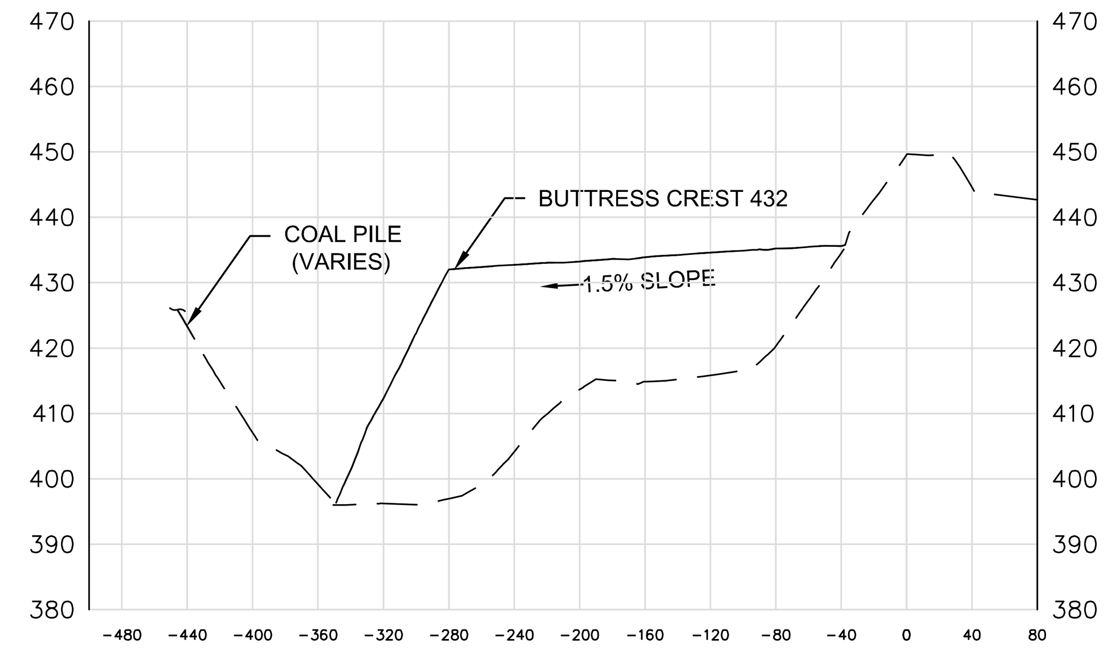

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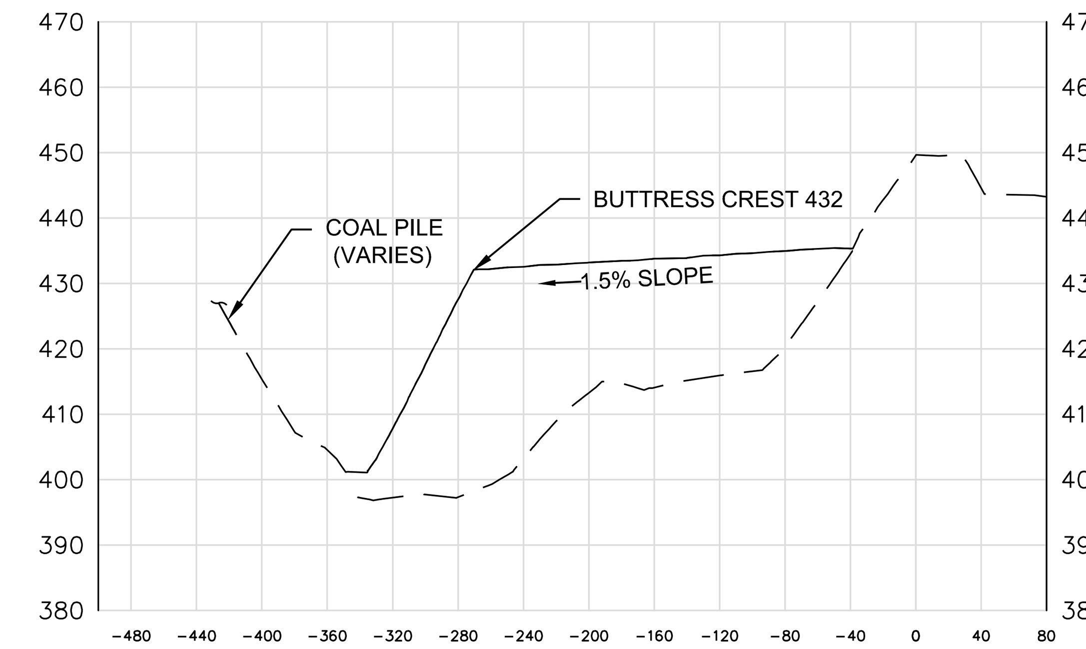

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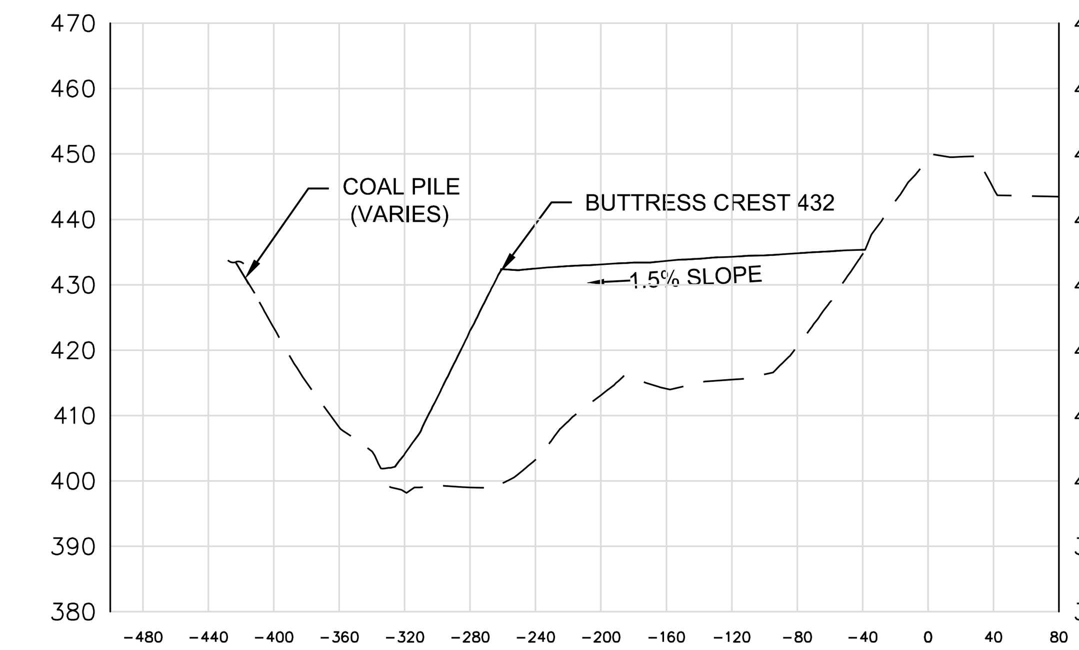

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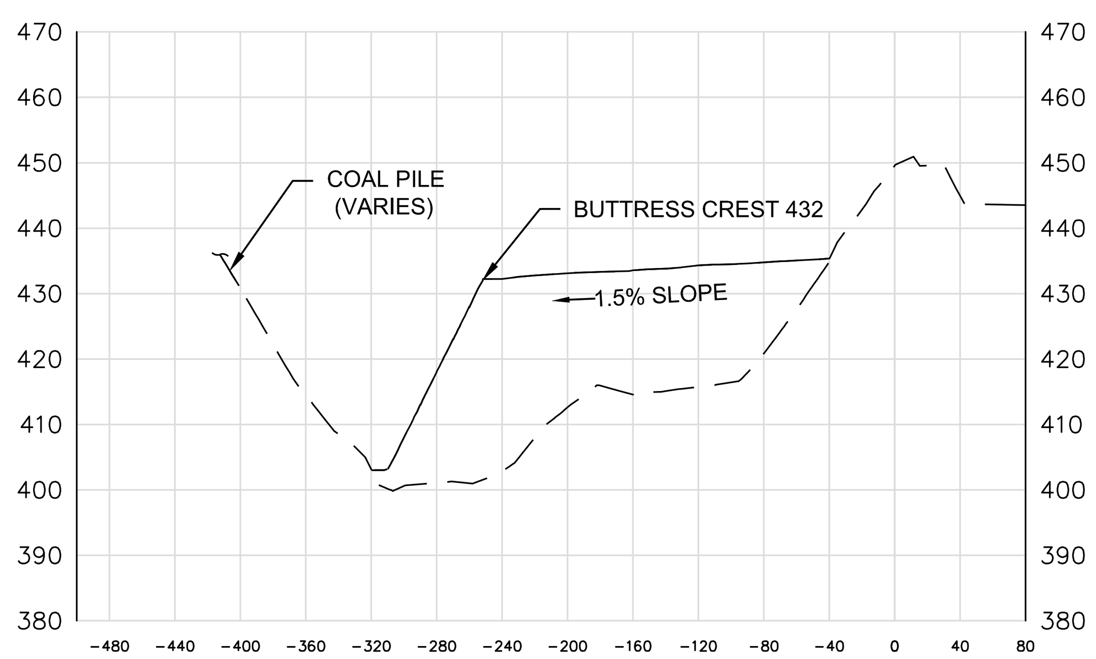

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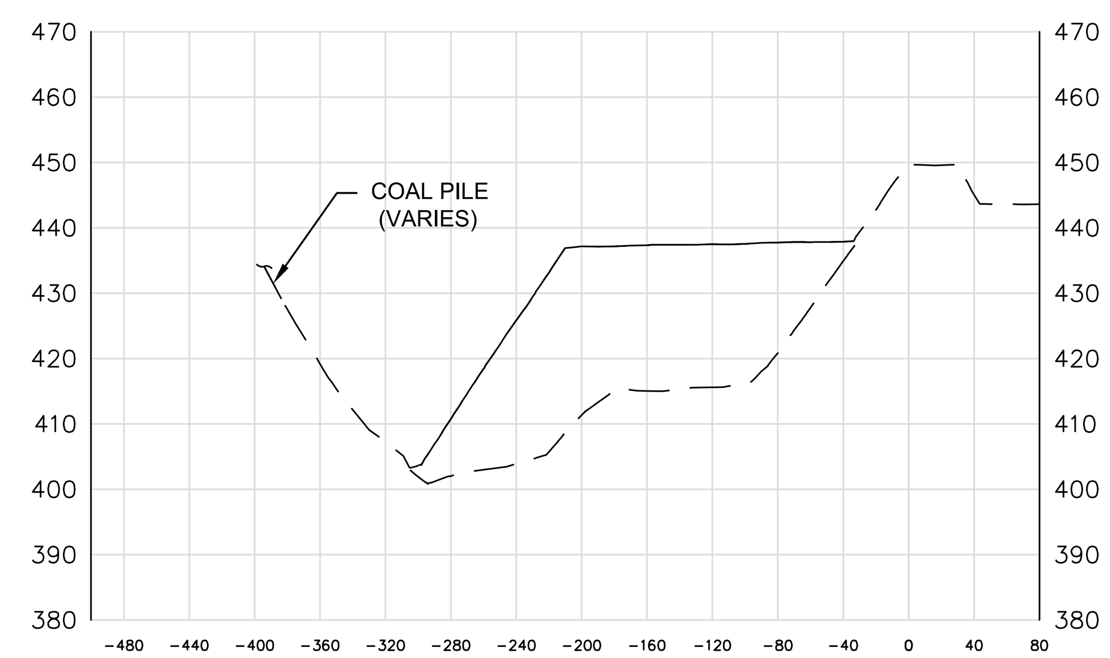

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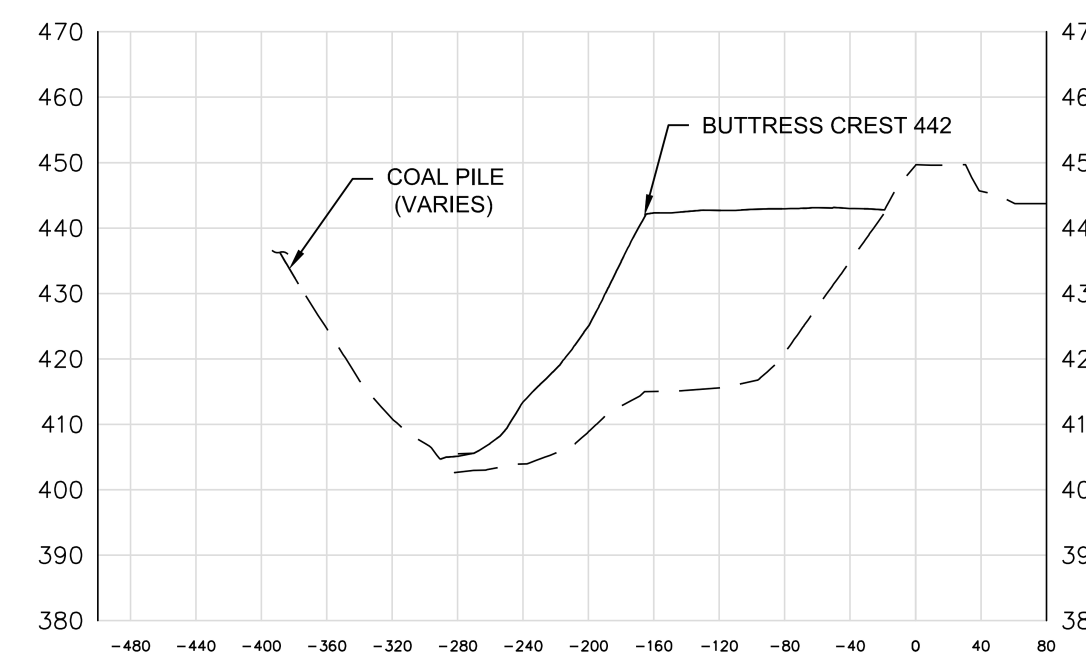

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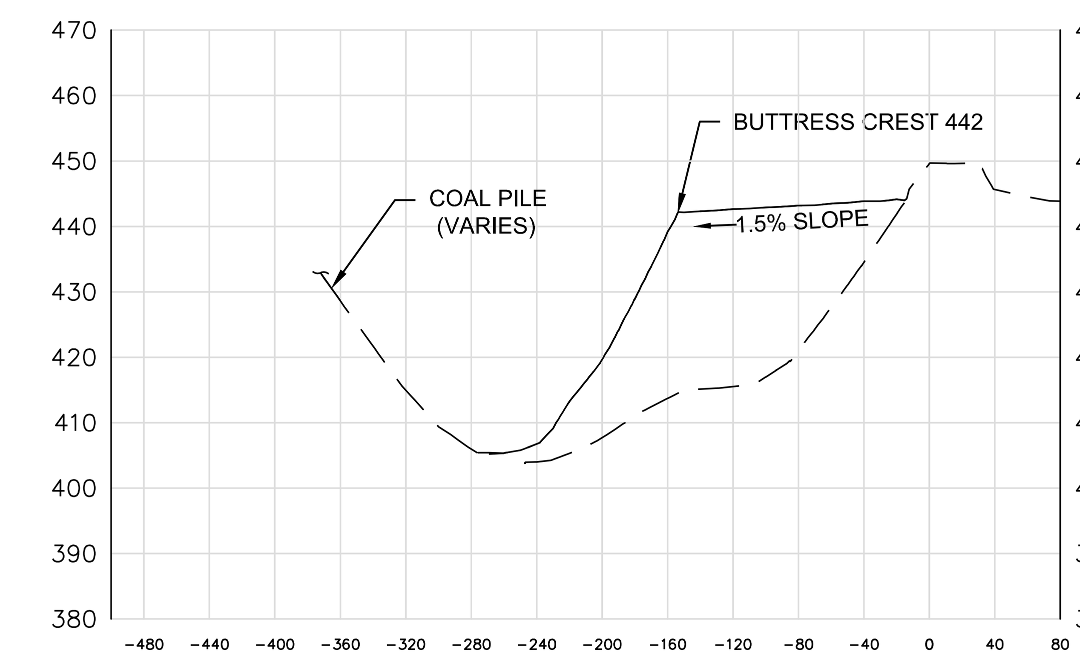

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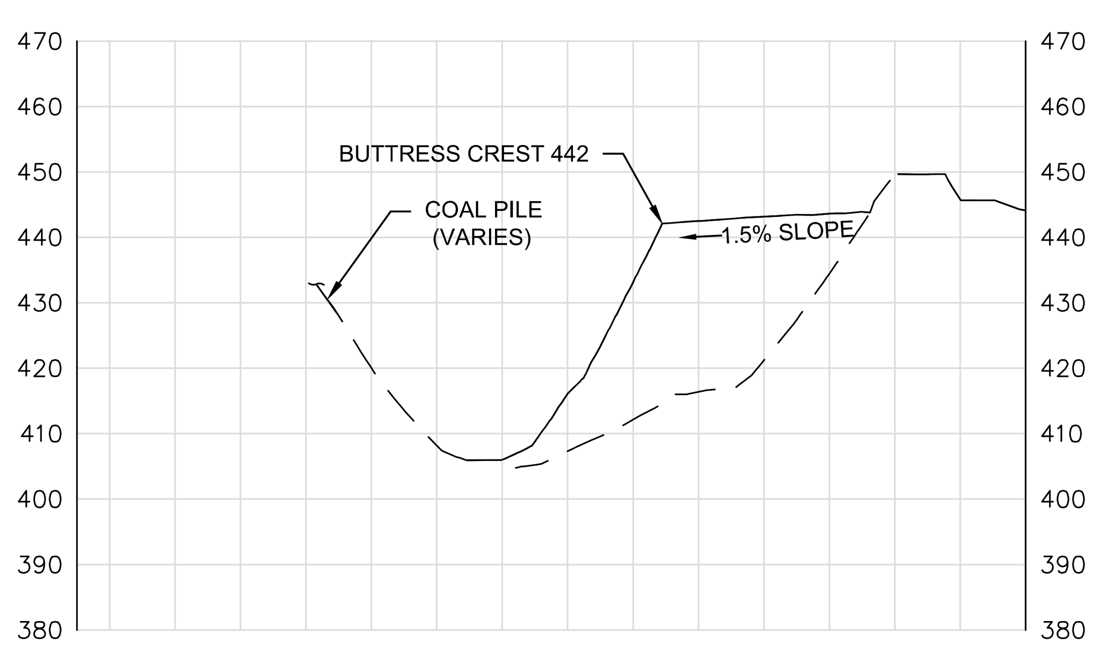

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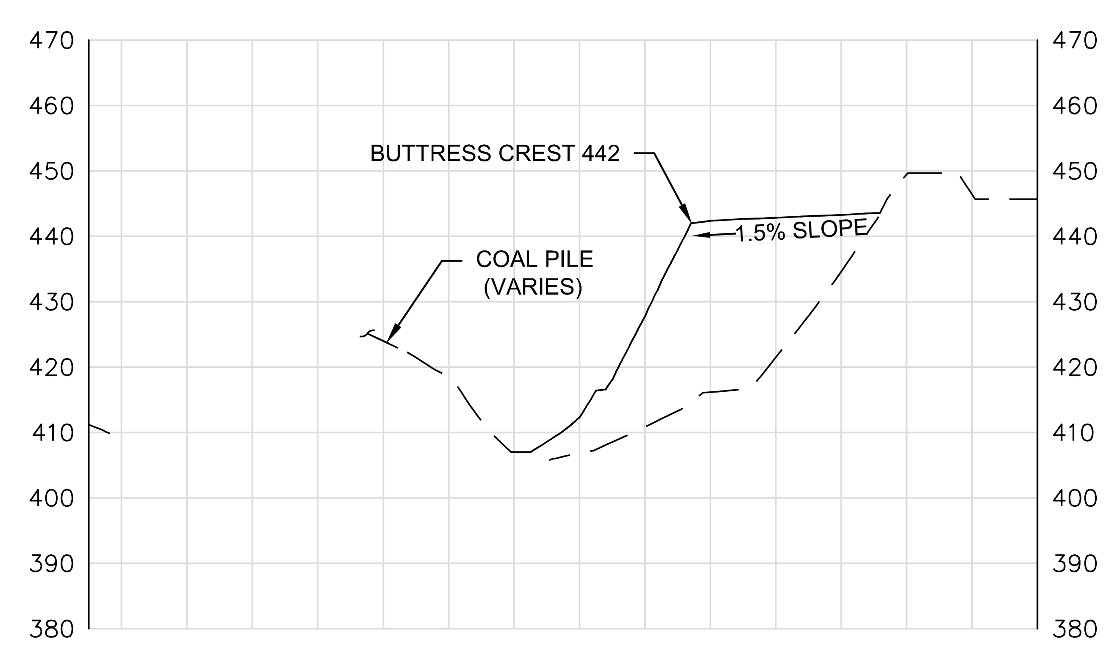

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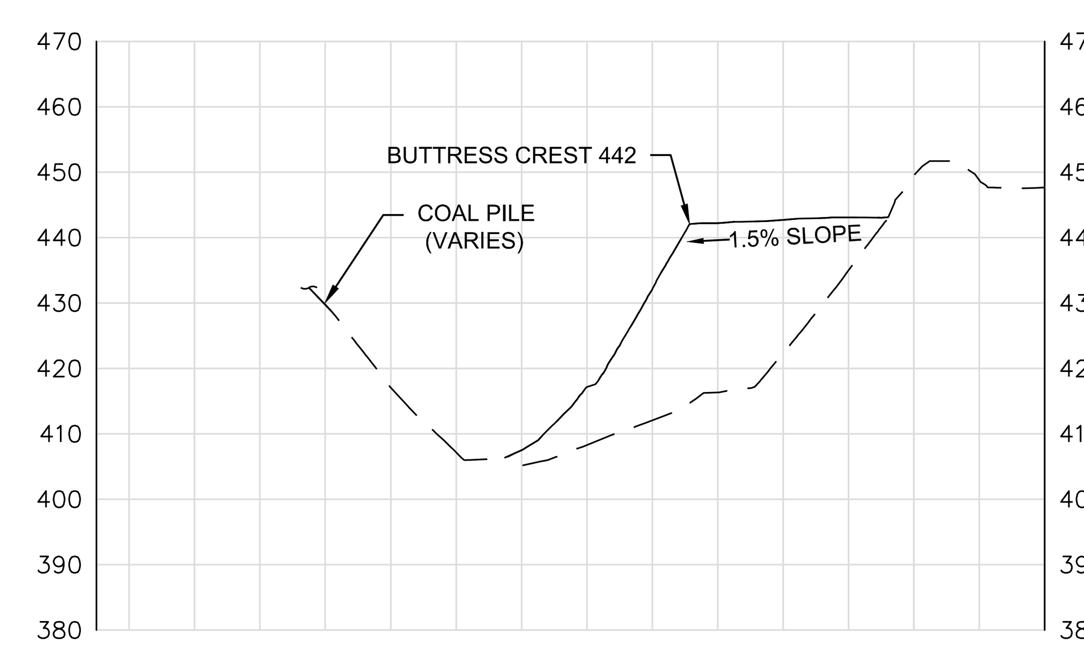

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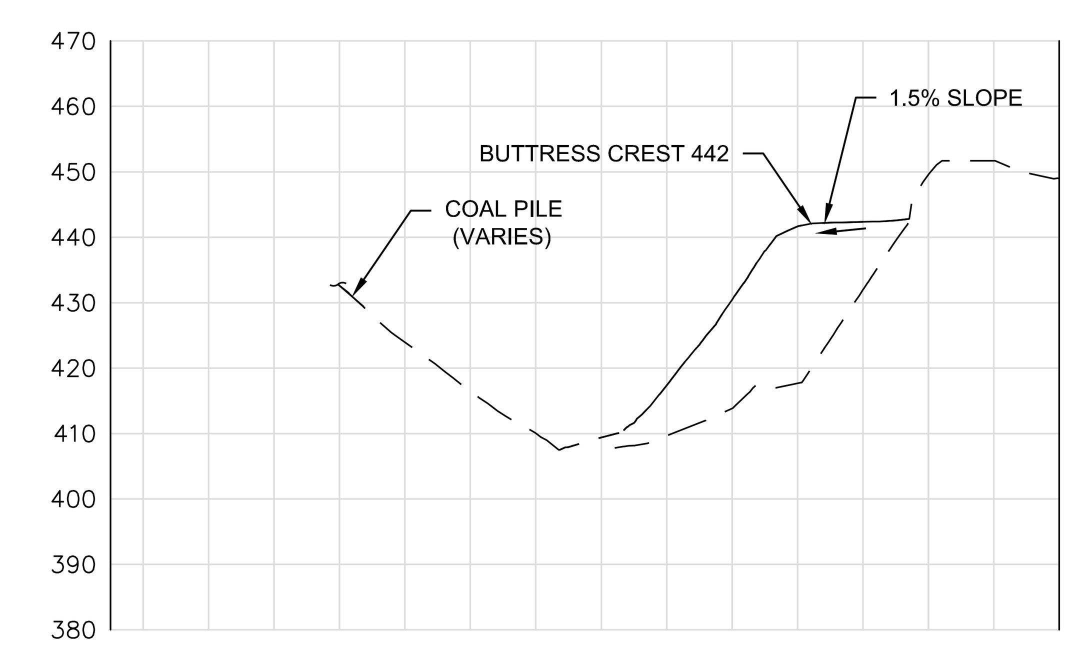

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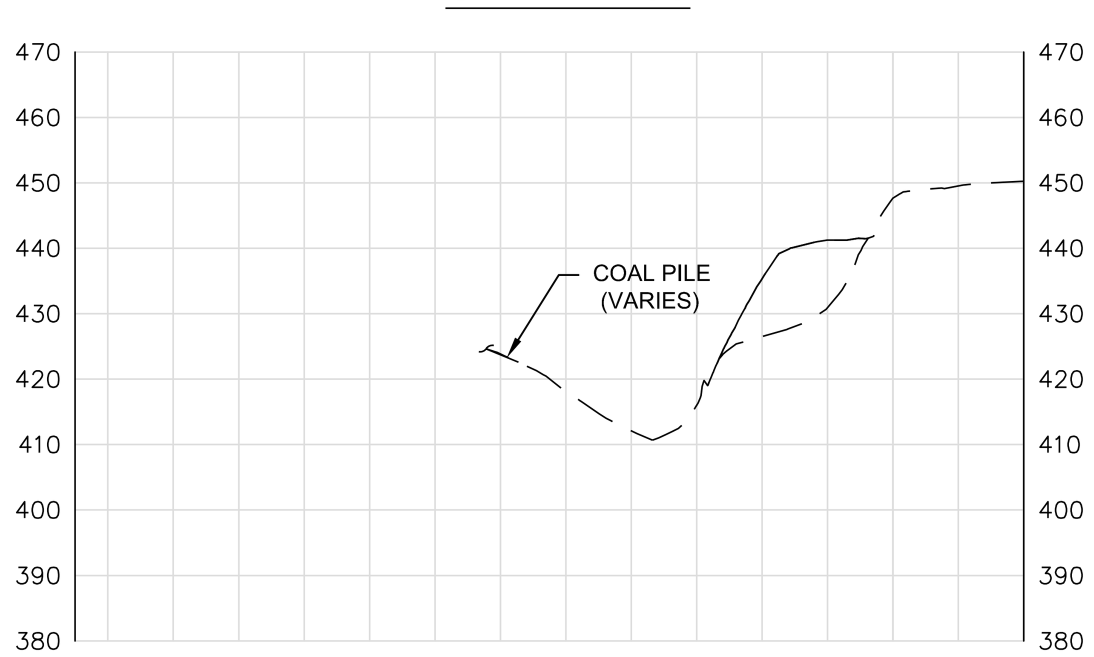

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RECORD DRAWING

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1300 E. 9TH STREET
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216-622-2300 (PHONE)

VECTREN
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1-800-227-1376

A.B. BROWN
GENERATING STATION
POSEY COUNTY, IN

LOWER DAM
STABILIZING
BUTTRESS

VIKRAM K. GAUTAM
REGISTERED
No. PE11600291
STATE OF
INDIANA
PROFESSIONAL ENGINEER
10/11/16

ISSUED FOR BIDDING	3/28/16	VKG
ISSUED FOR CONSTRUCTION	5/12/16	VKG

REVISIONS

NO.	DESCRIPTION	DATE
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1	REVISION 1	7/11/16
2	AS-BUILT DRAWINGS	10/11/16

AECOM PROJECT NO:	60442676
DRAWN BY:	ACI
DESIGNED BY:	ACI
CHECKED BY:	VKG
DATE CREATED:	10/06/2016
PLOT DATE:	10/06/2016
SCALE:	AS SHOWN
ACAD VER:	AUTOCAD CIVIL 3D 2014

SHEET TITLE

CROSS
SECTIONS - SOIL
BUTTRESS II

C-202

SHEET 09 OF 25

APPENDIX C

Basis of Design Report

COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

A.B. BROWN GENERATING STATION

POSEY COUNTY, INDIANA

BASIS OF DESIGN REPORT

POND CLOSURE

Prepared in Support of Issued for Construction (IFC) Submittal

Prepared for

CenterPoint Energy

November, 2021

Prepared by

AECOM

1600 Perimeter Park Drive, Suite 400
Austin, TX 27560-8421
919-461-1100

Project No. 60602575

TABLE OF CONTENTS

APPENDICES

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
BOD	Basis of Design Report
CCR	Coal Combustion Residual
cfs	Cubic feet per second
CMP	Corrugated Metal Pipe
FS	Factor of Safety
H&H	Hydrologic & Hydraulic
HDPE	High Density Polyethylene
IDF	Inflow Design Flood
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation
IFC	Issue For Construction
LiDAR	Light Detection and Ranging
NAVD 88	North American Vertical Datum of 1988
NEH	National Engineering Handbook
NRCS	Natural Resources Conservation Service
PMP	Probable Maximum Precipitation
pcf	Pounds per cubic foot
psf	Pounds per square foot
USEPA	United States Environmental Protection Agency
Reclamation	United States Department of the Interior, Bureau of Reclamation
WSE	Water Surface Elevation

1. Project Description

AECOM has prepared this Basis of Design (BOD) Report in support of the recommended design for the closure and excavation for beneficial reuse of Ash Pond at A.B. Brown Generating Station. CenterPoint Energy Indiana South (CenterPoint) proposes to carry out the following activities at the Ash Pond located at the A.B. Brown Generation Station (AB Brown Station).

- Excavate all CCR (Coal Combustion Residual) materials located within the Ash Pond footprint.
- Haul, stockpile, manage and load "Conforming" CCR materials into Ash Reclaim Hopper for beneficial reuse (recycling). Prior to loading the hopper, CCR materials will be tested at an on-site lab for conformance with recycler's (third party cement manufacturer's) requirements.
- Haul and dispose "Forfeited" material (>12% SO_3 content) or other materials identified by the CQA Inspector requiring disposal at the onsite FGD Landfill.
- Once removal of all CCR materials from within the Ash Pond footprint has been confirmed, regrade post-excavation surface using onsite soil materials to meet minimum and maximum slope requirements and construct stormwater drainage channels.
- Stabilize disturbed surfaces with topsoil and vegetative cover.
- Breach Ash Pond dam to enable stormwater to flow to downgradient stream.

1.1 Existing Conditions

The AB Brown Generating Station (AB Brown) is located in Posey County, Indiana and is owned and operated by Southern Indiana Gas and Electric Company doing business as CenterPoint Energy Indiana South (CenterPoint). AB Brown contains a CCR surface impoundment, identified as the AB Brown Ash Pond (Ash Pond), which was commissioned in 1978 and is actively receiving CCR materials. An earthen dam was constructed across an existing valley to create the impoundment. This is currently referred to as the Lower Dam. In 2003, a second earthen dam (currently referred to as the Upper Dam) was constructed northeast of the original dam and further up the valley to increase the storage capacity. This temporarily created the Upper Pond and Lower Pond. The Upper and Lower Ponds were operated separately until 2016 when the Upper Dam was decommissioned. The Upper Dam was constructed overtop of ponded CCR materials; therefore, the Upper and Lower Ponds are hydraulically connected. In addition, a 10-foot wide breach was installed in the Upper Dam and the normal pool elevation was lowered. Currently, the Upper Pond and the Lower Pond act as a single CCR unit which has a combined surface area of approximately 164 acres.

The Lower Dam embankment is approximately 1,540 feet long and 30 feet high, and has 3H:1V (3 horizontal to 1 vertical) side slopes covered with grassy vegetation. The embankment has a crest elevation of 450.9 feet and a crest width of 20 feet. The operating elevation of the Lower Pond fluctuates from 439.0 feet to 444.0 feet. However, the pool normally operates at an elevation of approximately 441.5 feet. The surface area of the Lower Pond is approximately 57 acres. The Upper Pond has a surface area of approximately 107 acres and a normal operating level of approximately 442 feet. The Ash Pond impounds mixed CCR materials, consisting primarily of fly ash, with a smaller amount of bottom ash and FGD scrubber by-product (calcium sulfite) material.

In order to determine the volume of CCR material present within the Ash Pond, 2018 aerial survey data was compared to pre-development grades from 1975-1976. Based on this comparison, AECOM estimates that currently there are approximately 6.1 million CY of CCR material within the Ash Pond (6.8 million CY if including the 2 feet of underlying native soil materials that may be impacted by CCRs).

1.2 SUBSURFACE CONDITIONS

Multiple geotechnical investigations have been performed within and in the area surrounding the ash pond system at A.B. Brown. These include the following:

- Subsurface explorations performed at the Lower Dam in 2015 and 2016 included 25 soil borings, and a program of 5 cone-penetration test (CPT) soundings, with seismic wave velocity measurements and pore pressure dissipation testing. Boring depths ranged from 26 to 94 feet, and CPT depths ranged from 54 to 94 feet below existing grades.
- A subsurface exploration performed in Fall 2016 within and around the perimeter of the Ash Pond System at CenterPoint's A. B. Brown Generating Station. The exploration included 15 soil borings ranging in depth from 10 to 92.5 feet.

The borings encountered the following generalized soil profile at the site (soil layers are listed from highest elevation to lowest):

Lower Dam Embankment Fill Materials: Embankment Fill materials were typically a mixture of lean clays (CL) and silty clays (CL-ML) with varying amounts of sand. Visual classifications were most often described as slightly moist to moist, reddish brown to brown, silty clay to sandy lean clay. Uncorrected field SPT N-values in the embankment ranged from 1 to 20 blows per foot (bpf) and averaged 9 bpf. Pocket penetrometer values, which estimate the unconfined compressive strength in tons per square foot (tsf), taken in the cohesive materials ranged from 2.5 to 4 tsf and averaged 3.25 tsf indicating a very stiff consistency, on average. Plasticity indices from Atterberg limits testing ranged from 3 to 26, with an average value of 13. Liquid limits ranged from 24 to 38, with an average value of 30.

Sluiced Ash Materials: Ash materials were present within the area of the lower pool, within the area of the upper pool, and at the boring performed on the former Upper Dam. The ash consisted of both fly ash and bottom ash.

- Black bottom ash, primarily classified as silty sand (SM), was present near the surface within the borings drilled in the area of the lower pool, at depths ranging from 0 to 9.5 feet. Within the area of the upper pool, bottom ash was encountered at depths ranging from 0 to 26.5 feet. In the former Upper Ash Pond Dam, bottom ash was encountered with fly ash at 20 to 27 feet depth. The thicknesses of all layers containing bottom ash ranged from 2.3-17.5 feet and averaged 8.1 feet; Uncorrected field SPT N –values varied from 0 to 33 bpf and averaged 9 bpf indicating an average loose consistency.

- Dark gray to black to fly ash, primarily classified as Silt (ML) and less commonly as Silty Sand (SM) was encountered within the area of the lower pool at depths ranging from 6.5 to 41 feet. Within the area of the upper pool it was encountered at depths from 0 to 54 feet. Below the former Upper Ash Pond Dam, fly ash was encountered from 27 to 53 feet. The thickness of the fly ash layers varied from 2.5 to 51.5 feet with an average thickness of 25.5 feet. Uncorrected field SPT N-values results in the fly ash varied from the weight of rods to 42 bpf and averaged 2 bpf, indicating a very loose deposit, on average.

Foundation Silty Clay Materials: Foundation silty clay materials were encountered during drilling and were interspersed within foundation silts materials that made up much of the foundation materials of the site footprint. The foundation silty clay material was encountered at depths varying from 16.5 to 90.5 feet – at shallower depths within borings drilled outside of and at the perimeter of the ash pond system, and deeper for borings drilled within the pond (as with the foundation silts materials). The encountered thickness varied from 3 to 16.9 feet and averaged 9.8 feet. Within the clayey material, Uncorrected field SPT N values varied from 5 to 36 bpf and averaged 14 bpf; within sandy material, Uncorrected field SPT N values varied from 65 bpf to 50 blows for a 5-inch drive indicating a very dense material. Pocket penetrometer values in the silty clay material varied from 1.7 to 4.5 tsf and averaged 2.6 tsf indicating an average very stiff consistency.

Foundation Silts Materials: Foundation silt deposits (ML) were interbedded with the foundation silty clay materials and were encountered in all borings. These deposits were encountered at depths ranging from 0 to 87.5 feet – at shallower depths within borings drilled outside of and at the perimeter of the ash pond system, and deeper for borings drilled within the pond. These deposits were visually described as yellowish brown to brown and moist to wet. The encountered bedding thickness ranged from 4 to 19 feet and averaged 10 feet. Uncorrected field SPT- N values varied from the weight of drilling rods to 12 bpf and averaged 5 bpf indicating a loose relative density, on average.

Phreatic Surface: The phreatic surface within the upper pond varies between El. 450 and 455 feet. Within the lower pond, the phreatic surface corresponds to the pool level, which generally varies from El. 440 to 444 feet depending on operations at the pond. The current operating normal water surface elevations (WSE) at the upper and lower pool are El. 450.9 and El. 440.0 respectively.

1.3 Site Geology

Due to changing climatic conditions, repeated advancements and retreats of continental glaciers into Indiana during the Pleistocene Ice Age (1.8 million to 11.7 thousand years ago) deposited soils north of the site and indirectly affected the landscape and soil deposition within and near the site. The site is located approximately 11 miles south of the Pre-Wisconsin glacial boundary which marked the limit of glacial advances up to approximately 50,000 years ago. The site is also located approximately 130 miles south of the Wisconsin glacial boundary which was the southern-most advancement of glaciers up to approximately 11,700 years ago.

Glacial-related events during the late-Wisconsinan period (approximately 24,000 to 11,700 years ago) and Holocene period (11,700 years ago to present) indirectly caused the deposition of a variety of soil types contemporaneous with drainage development of the Ohio River and its tributaries. As the glaciers melted and receded northward, large volumes of water emanating from the glacial face, deposited outwash consisting of gravel, sand, silt and clay over large flat areas within and bordering the Wabash River. Braided streams, which were created by changing flow and sediment conditions, occupied the lowland area and conveyed both sediment and water to the Ohio River.

During low flow periods, fine-grained sediment deposits within the braided streams were exposed to high westerly winds which transported fine silt and clay sediments to surrounding higher elevations. These wind-blown (aeolian) deposits, termed loess, were deposited up to thicknesses of 25 feet on the former valley bluffs which predated the pond construction.

Within approximately 0.8 miles of the site, the increased glacial melt water caused ancestral Ohio River levels to rise to between elevation 370 and 380 feet. During this river stage, Ohio River levees were formed during flooding events, damming water behind the banks, causing ponding and the deposition of lacustrine sand, silt and clay. As glacial meltwater decreased, the level of the Ohio River fell to successive lower stages, depositing alluvium consisting of layered gravel, sand, silt and clay derived from outwash and former higher-level alluvium. Alluvium was deposited in tributary stream channels up to 26 feet thick consisting largely of silt and clay originating from former loess deposits. The former stream valley which predated pond construction was one of these streams. Additionally, high angle hill slopes underlain by weathered bedrock within the former valley may exhibit sloughing and creep identified as colluvium.

1.4 GROUNDWATER CONDITIONS

During the boring investigation conducted by AECOM in 2016, groundwater was encountered within the lower pool area at depths ranging from the surface (boring B-16-4) to 6.5 feet (boring B-16-2). Groundwater was encountered relatively uniformly at a depth of 3 feet within the upper pool area (borings B-16-7, B-16-9, B-16-10A, B-16-10B, B-16-11, B-16-12). Within the former Upper Ash Pond dam embankment (boring B-16-8), groundwater was encountered at 22 feet. Along the perimeter of both ash ponds, groundwater was encountered at depths of 6.5 feet (in fill at boring B-16-6) to 27.5 feet (very dense sand at boring B-16-13); groundwater was not encountered at perimeter borings B-16-5 and B-16-14.

1.5 PROJECT GOALS

The initial and primary goal of this project is to develop construction level drawings, specifications, and calculations in order to support the excavation design. Below is a list of the proposed improvements that make up the design:

Analyses and calculations provided in this design report include the following:

- Environmental Visualization System (EVS) Analysis of the ponded CCR Materials
- Geotechnical Engineering
- H&H Engineering
    - ✓ Hydraulic Analysis
    - ✓ Stormwater Drainage Channel Design

This Basis of Design Report is intended to support the design drawing set, *A.B Brown Generating Station - Ash Pond Closure By Removal (Issued for Construction).*

2. EVS Analysis

Prior to beginning the closure by removal design, the characteristics of the in-situ CCR were analyzed through a detailed geotechnical investigation and analytical sampling program. This data was used as input for an Environmental Visualization System (EVS) model of the Ash Pond, which provided estimates of the amount of recyclable material available within the pond. Details of the development of the EVS model are provided in this section.

2.1 EVS Model Development

A three-dimensional visualization model of the site was created using Mining Visualization System (MVS) developed by C Tech Development Corporation. MVS is a sophisticated and technically advanced three-dimensional visualization and animation package. MVS performs interpolation using an accurate and geostatistically defensible process called kriging. Kriging is a mathematical process recognized by the US Environmental Protection Agency (EPA) as the best and standard means for interpolation and extrapolation of measured data. Kriging is the only data estimation method which also provides statistical measures of goodness.

To begin, it was first necessary to obtain information regarding the top of ash surface and estimated bottom of ash surface. Data for the top of ash was obtained from a triangulated irregular network (TIN) surface in AutoCAD Civil 3D created from bathymetry and aerial survey performed by 3-I Engineering on February 2, 2020. Data for the bottom of ash was obtained from survey dated March 18, 1973, representing the valley prior to dam construction and ash placement. These surfaces were converted to a 25-foot by 25-foot grid format by sampling the surface at each point on the grid.

To set up the MVS model, the bounds of the ash pond were generated using the top of ash and bottom of ash surfaces exported from AutoCAD Civil 3D. The bounds were then further refined using an irregular shape created in Civil 3D from recent satellite photographs of the pond, in order to limit the lateral extents. This then created a three-dimensional thickness in which to krige the constituent data. Next, parameter data initially from thirty-three locations at multiple sampling depths were used to generate a combined parameter plume kriged within the existing ash pond thickness. This combined parameter plume was used to identify data gaps in the spacing and depths of data set. Subsequently, two additional rounds of sampling were conducted and currently a total of sixty-five locations are utilized in the model. The combined parameter plume was then refined to depict only non-conforming material (out-of-spec) using the specification requirements as thresholds. For example, if the maximum acceptable content (by mass percentage) of sulfite is 1.5%, then only the part of the kriged plume >1.5% (out-of-spec) was depicted. Calculations were run to estimate the ash volume and mass of the non-conforming material.

This procedure was repeated for each of the ten parameters outside of their respective specification thresholds in order to help evaluate the percentage of and location of in-spec and out-of-spec materials within the ash pond. When the parameters are depicted above and/or below their respective out-of-spec thresholds, these plumes are collectively referred to as non-conforming material. Two of these parameters, magnesium oxide (MgO) and titanium dioxide (TiO2), were estimated to have negligible out-of-spec material so the process moved forward with just eight parameters. These parameters were: mercury (Hg), loss on ignition (LOI), silicon dioxide (SiO2), aluminum oxide (Al2O3), iron(III) oxide (Fe2O3), sulfite (SO2-3), total alkali, and phosphorus pentoxide (P2O5). In addition, the project team decided that material with sulfite above 12% would not be suitable for blending and would therefore be forfeited, so the volume of that material was estimated as well.

2.2 EVS Modeling Results

The completed EVS model shows estimated concentrations of each chemical component and their locations throughout the ash pond. The EVS model was used to generate estimated volumes of conforming, non-conforming and forfeited material throughout the pond. Figures illustrating the distribution of conforming, non-conforming, and forfeited material are presented in snapshots at 5-foot elevation increments throughout the pond's depth. These results are provided in **Appendix A**. Modeling results showing distributions of individual components may be requested by the Subcontractor as necessary to facilitate planning of mixing as the excavation progresses.

2.3 Conforming/Nonconforming/Forfeited Material Volume Estimates

The excavated CCR material will be qualified as conforming, non-conforming or forfeited based on its chemical composition. A group of material is considered conforming if it meets the recycling material specification as-is. Non-conforming refers to material that didn't meet the requirements as-is, but can be mixed with conforming and/or other non-conforming materials to meet the specifications.

SO_3 has been identified as the constituent that poses the greatest obstacle to obtaining conforming material in the pond, due both its large quantity within the pond and its low threshold for acceptability in material sent to the recycler (1.5%). Therefore, a mass balance was conducted to determine at what concentration a decision must be made to either blend SO_3 from non-conforming materials to achieve specification or remove it for disposal. It was found that it there is only capacity within the conforming material to only blend CCR materials with a concentration level of SO_3 lesser than 12%. Any CCR material with a level of SO_3 greater than 12% will be considered forfeited and must be disposed of. Ultimately, all the conforming material will be loaded into a new conveying system to a barge in order to be shipped to the recycler for beneficial reuse. The following table provides the estimated breakdown of conforming, non-conforming, and forfeited material within the pond:

Table 1: Estimated Volumes of Conforming, Non-Conforming, and Forfeited Material within the Ash Pond

Material Description	Volume (CY)	Weight (Tons, 20% Moisture)
Conforming Material	3,136,900	3,593,699
Non-Conforming Material	1,694,000	1,940,682
Forfeited Material	1,253,800	1,436,380
Total Material:	6,084,700	6,970,761

3. GEOTECHNICAL ENGINEERING

The geotechnical analysis and design is predominately made up of the following:

- Dewatering Analysis; and
- Slope Stability.

The subsequent sections describe the detailed geotechnical engineering analysis and design of the project.

3.1 DEWATERING ANALYSIS

Dewatering of the ponded ash materials will be an important component of the closure system. Dewatering will condition the ash materials to facilitate mass excavations and will also be required to appropriately improve and maintain the pond surface's ability to support the heavy construction equipment that will be necessary to implement the closure activities.

When in a saturated condition and in the presence of a permanent phreatic surface, fly ash and bottom ash materials are inherently unstable, have very low bearing capacity, and are subject to localized liquefaction when subject to vibrations induced by construction equipment. Therefore it will be of paramount importance to maintain the pond phreatic surface below the elevation on which construction equipment will operate. Construction vibrations tend to wick water upward through the ash mass via capillary action. The phreatic surface must be maintained a sufficient vertical distance underneath the ground surface to mitigate this effect. As such, the primary objective of the dewatering system will be to lower and maintain the pond phreatic surface at any work area to a minimum of 10 ft below the current surface grade in any area of work, at any time, so that a safe and stable working surface is established.

Two types of dewatering systems are envisioned over the course of pond closure-in-place, as follows:

- A passive, gravity dewatering system, which will consist of a network of excavated ditches, into which subsurface water will seep. We envision this system to be applicable early on during the course of construction, to lower the phreatic surface within the pond, and when excavations are above the natural groundwater table. For deeper excavations, this system is not likely to be practical.
- A positive dewatering system, consisting of a network of closely spaced well points, installed in lines and discharging to trunk lines (header piping). Dewatering of the ash will be achieved by creating positive suction at the well points and then pumping the water removed through the header piping. We anticipate that this type of system will be required when excavations extend to significant depth.

  An important component of both dewatering systems will be implementation of a phreatic surface monitoring program, to ensure that the systems are performing as intended. The system should be installed at the beginning of the project and be maintained throughout all excavation activities, as follows:

- The monitoring system should consist of a number of vibrating wire piezometers or conventional standpipe piezometers (or a combination of both), installed on a regular grid throughout the excavation footprint.
- Specifically, the piezometers should be installed at spacings/locations such that there is not less than 1 piezometer per 3 acres of footprint, and such that piezometers are located uniformly across the footprint.
- The piezometers should be configured to be capable of detecting the depth of the static phreatic surface at the location of the piezometer and shall be adjusted as necessary as the excavation proceeds.

The piezometers should be monitored on a regular basis to confirm that the phreatic surface is drawn down to the appropriate level at any time.

3.2 Slope Stability Analysis

The closure design includes removal of all CCR materials and restoration of the Ash Pond footprint to pre-development conditions. All permanent slopes in the Ash Pond footprint will comprise of native soils and vegetated for surface stabilization. Based on the proposed final conditions, no formal slope stability calculations were deemed necessary. All final surfaces within the post-closure Ash Pond footprint will be graded to maximum slopes of 3H:1V. These slopes will be backfilled and compacted in accordance with the specifications to 95% maximum dry density (MDD) to provide a stable subgrade post-closure.

4. Hydrologic and hydraulic (H&H) Engineering

As previously mentioned, the lower pool of the Ash Pond operates as a closed-loop system. This operation will continue until the plant's closure in late 2023.

AECOM generated HydroCAD models to evaluate the design and calculate the required storage capacity within the pond during each assumed storm event, with the goal of minimizing downtime while the pond is being excavated.

Hydrologic and hydraulic (H&H) analyses were performed for each phase (Milestone) of the Ash Pond closure to evaluate the continued management of stormwater throughout the entire closure period. In addition, the size of post-closure stormwater conveyance features are based on these analyses. The following sections describe the H&H design for the project.

4.1 Hydrologic Analysis and Results – Existing Conditions and Closure

To assess the storage capacities of the pond at various phases of closure, a hydraulic model was created in HydroCAD 10.00-12. HydroCAD has the capability to evaluate each subcatchment and ditch within the network, to respond to variable tailwater, permit flow loops, and reversing flows. HydroCAD routing calculations reevaluate the ditch and outfall systems' discharge capability at each time increment, making the program an efficient and dynamic tool for this evaluation. This model was developed based upon existing contour data provided by CenterPoint, field data collected by surveyors from both AECOM and CenterPoint, and site plans designed by AECOM. The general site configuration as set up in HydroCAD with an aerial imagery overlay is presented in the figure below.

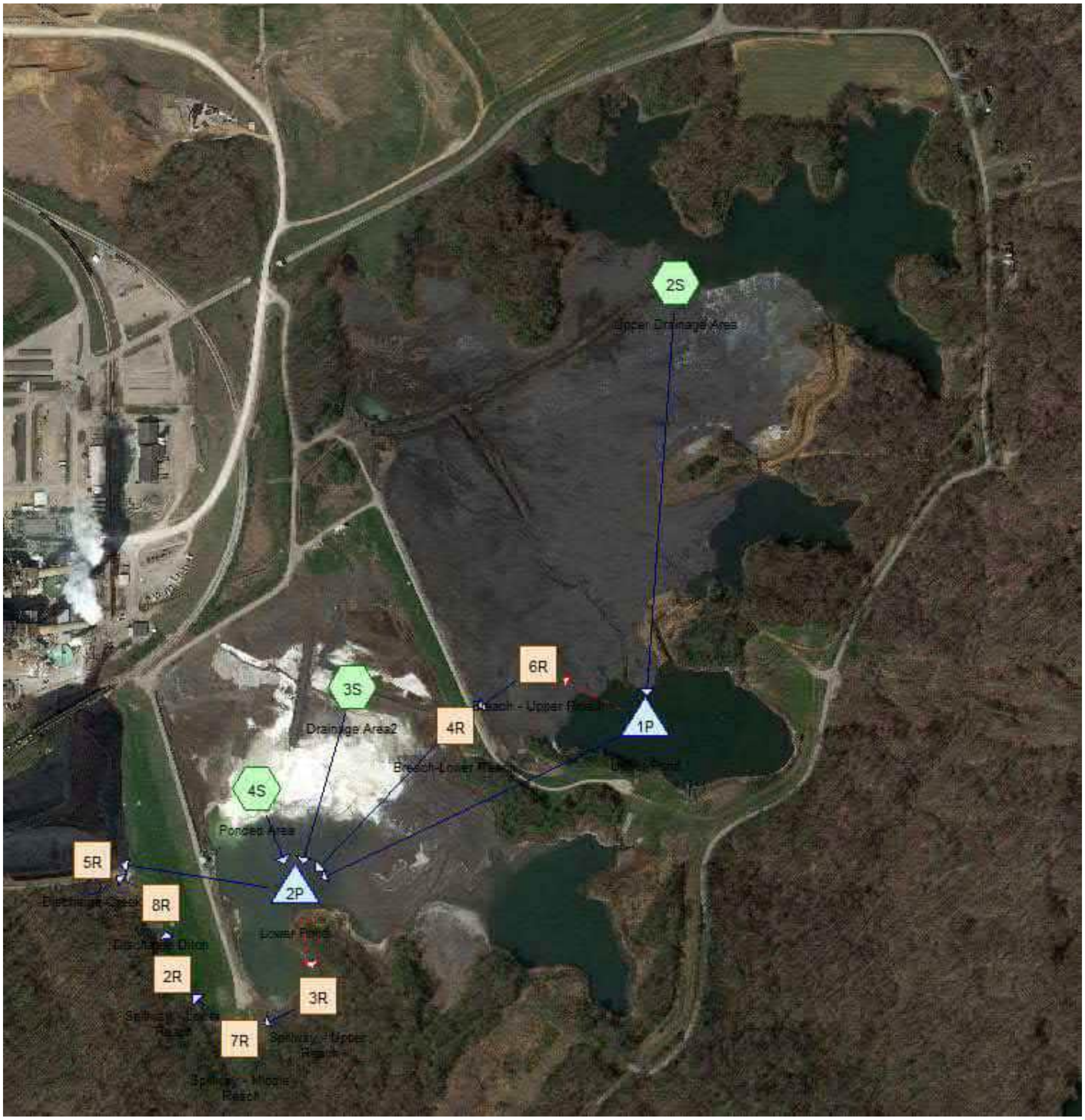

Figure 1. HydroCAD model schematic.

4.1.1 PHASES (MILESTONES) OF CLOSURE

Stormwater management during the entire duration of the closure was analyzed as multiple phases of the project with each phase having a target elevation set based on the EVS analyses. The different phases were delineated with watershed boundaries that reflected the phase of closure the Upper and Lower Ponds are anticipated to be undergoing. These boundaries were drawn based upon the most viable excavation methods to be utilized during construction in addition to the existing topographic data available for the Ash Pond area. Runoff from each drainage area was calculated using the SCS Curve Number Method by entering a runoff curve number based on the type of surface cover and soil characteristics of the area. Surface cover and Curve number data was also adjusted based on the phase of the closure. Time of concentration for each drainage area was also entered based on the estimated slope and projected flow length of the drainage area during each phase. Drainage areas contributing to flows into the Ash Pond were then routed through the stormwater ditches and culverts to the stormwater outfall at the Lower Ash Pond.

Three design storms were modeled for each phase: 1-inch 1-hr, 2-inch 1-hr and 10-yr 24-hr (4.74 inch) to estimate potential downtimes for the closure contractor and time taken to lower the pond footprint after a design storm event. It was assumed that until plant closure (Milestone 1), construction stormwater can be managed within the ash pond while pumping at 6,500 gpm. After plant closure (Milestones 2 -5), stormwater is anticipated to be maintained, up to the 10-yr 24-hr event, within the ash pond system after pond closure, on the basis of the pumping rate assumptions, without discharge through the emergency spillway. Based on this it was projected that the maximum downtime for contractor is 2.5 days including the duration of the storm. The HydroCAD results are included in **Appendix B.**

The phases of closure are summarized as shown below.

Milestone 1	Plant is operating, plant inflows to Lower Pond. Maintain Lower Pond water elev. 440'. Excavation commences in Upper Pond.	Target Excavation Elevation: 450'
Milestone 2	Plant is closed. Lower Pond ceases receiving plant flows. Excavation commences in Lower Pond, continues in Upper Pond.	Target Excavation Elevation: 450'-445'
Milestone 3	Upper Dam is removed. Upper Pond storage is limited to Pool A. Due to upper dam removal; additional stormwater is managed by Lower Pond.	Target Excavation Elevation: 445'
Milestone 4	Upper Pond has no active pool. All stormwater is managed in the Lower Pond. Excavation and closure continue to target elevations.	Target Excavation Elevation: 435'

Milestone 5	Excavation and closure continue to final bottom of ash elevations.	Target Excavation Elevation: Varies (To pre-development grades 420' – 430')

4.1.2 PRE-CONSTRUCTION CONDITIONS

The AB Brown Ash Ponds currently receive flows from the Coal Pile Runoff, Mercury Treatment System, Bottom Ash Transport Water and Fly Ash Transport via the Hydroveyor. In addition to these plant flows, the pond also receives runon and runoff from its upstream drainage areas.

Upper Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	450.62	451.22	452.45
Inflow Rate (cfs)	81.17	242.08	74.08
Inflow Volume (acre-feet)	108.53	119.12	153.79

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	441.59	442.23	444.08
Inflow Rate (cfs)	82.93	162.88	52.12
Inflow Volume (acre-feet)	111.61	127.36	178.31

4.1.3 MILESTONE 1

Milestone 1 is expected to begin at the Upper Pond with the excavation activities moving concentrically or radially inwards as the elevation of the ponds are lowered. As the excavation progresses, the ponded area in the Upper Pond decreases due to a combination of dewatering and reduction in surface area. The Upper Ash Pond dam that was decommissioned in 2016 is assumed to be active during this phase with no breach taking place, essentially letting the Upper Ash Pond and the Lower Ash Pond act separately with only a hydraulic connection via an outlet. The approximate target elevation during this Milestone is expected to be 450'.

Upper Pond (Pool A)	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	447.02	448.51	451.31
Inflow Rate (cfs)	42.68	126.06	58.95
Inflow Volume (acre-feet)	7.26	17.67	52.02

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	440.59	441.37	443.69
Inflow Rate (cfs)	82.81	162.75	58.80
Inflow Volume (acre-feet)	113.82	129.349	179.67

4.1.4 MILESTONE 2

Milestone 2 activities, excavation expands to the Lower Ash Pond. While the excavation activities are ongoing, the primary storage for runoff will be provided by the Lower Ash Pond. The approximate target elevation during this phase is expected to be 445'.

Upper Pond (Pool A)	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	447.02	448.51	451.31
Inflow Rate (cfs)	42.68	126.06	58.95
Inflow Volume (acre-feet)	7.26	17.67	52.02

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	435.14	435.69	437.75
Inflow Rate (cfs)	70.21	150.15	46.20
Inflow Volume (acre-feet)	9.68	25.21	75.53

4.1.5 MILESTONE 3

The approximate target elevation during this Milestone is expected to be 440'. Towards the end of this phase the upper dam is expected to be breached. Some additional stormwater diverted from the Upper Pond and contributing drainage areas in preparation for the upper dam breach are expected to be managed at the Lower Pond.

Upper Pond (Pool A)	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	440.04	441.62	445.17
Inflow Rate (cfs)	19.29	105.54	36.88
Inflow Volume (acre-feet)	1.66	7.30	28.20

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	435.49	436.54	439.00
Inflow Rate (cfs)	81.37	197.48	68.54
Inflow Volume (acre-feet)	7.96	23.68	74.95

4.1.6 MILESTONE 4

Once the upper dam is breached, all the stormwater during Ash Pond closure will be managed at the Lower Pond pool. The approximate target elevation during this Milestone is expected to be 435'.

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)
Peak Elevation (feet)	430.66	432.69	435.56
Inflow Rate (cfs)	89.91	307.60	90.20
Inflow Volume (acre-feet)	7.41	23.166	74.12

4.1.7 MILESTONE 5 (FINAL PHASE)

It is anticipated that excavation will progress to pre-development native grades as the Lower Pond pool continues to manage the stormwater. The approximate target elevation during this Milestone is expected to be 425'.

Lower Pond	1 inch-1 hour	2 inch-1 hour	10 yr-24 hr (4.73 inch)

Peak Elevation (feet)	423.06	428.01	432.49
Inflow Rate (cfs)	98.80	281.02	89.55
Inflow Volume (acre-feet)	7.83	23.53	74.18

4.2 Hydrologic Analysis and Results – Post-closure Conditions

Once closure is completed and all CCR materials excavated from the Ash Pond, the excavation surface will be graded to facilitate stormwater management from the entire footprint of the Ash Pond through a series of interior conveyance channels, eventually to the outfall located on the Lower Pond after its dike has been breached. Interior stormwater channels for this design were designed with a minimum of 0.5 percent slope. The interior drainage channels will be grass-lined earthen channels and do not require permanent armoring.

Storm water management features and erosion controls will be integrated with the grading to promote positive surface drainage, minimize erosion, and minimize long-term maintenance. Storm water management plans are provided as Sheets C-09 and C-10 on the Engineering Plans.

Hydrologic analysis was conducted similar to the closure conditions using HydroCAD and delineation of post-closure watershed boundaries. These boundaries were drawn based upon the proposed final excavation surface and anticipated grading post-closure as shown on Sheets C-13 through C-16 on the Engineering Plans. Runoff from each drainage area was calculated using the SCS Curve Number Method by entering a runoff curve number based on the type of surface cover and soil characteristics of the area. Time of concentration for each drainage area was also entered based on the slope and flow length of the drainage area. Drainage areas across the site were then routed through ditches to the outfall.

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APPENDIX A

ENVIRONMENTAL VISUALIZATION SYSTEM (EVS) MODELING RESULTS

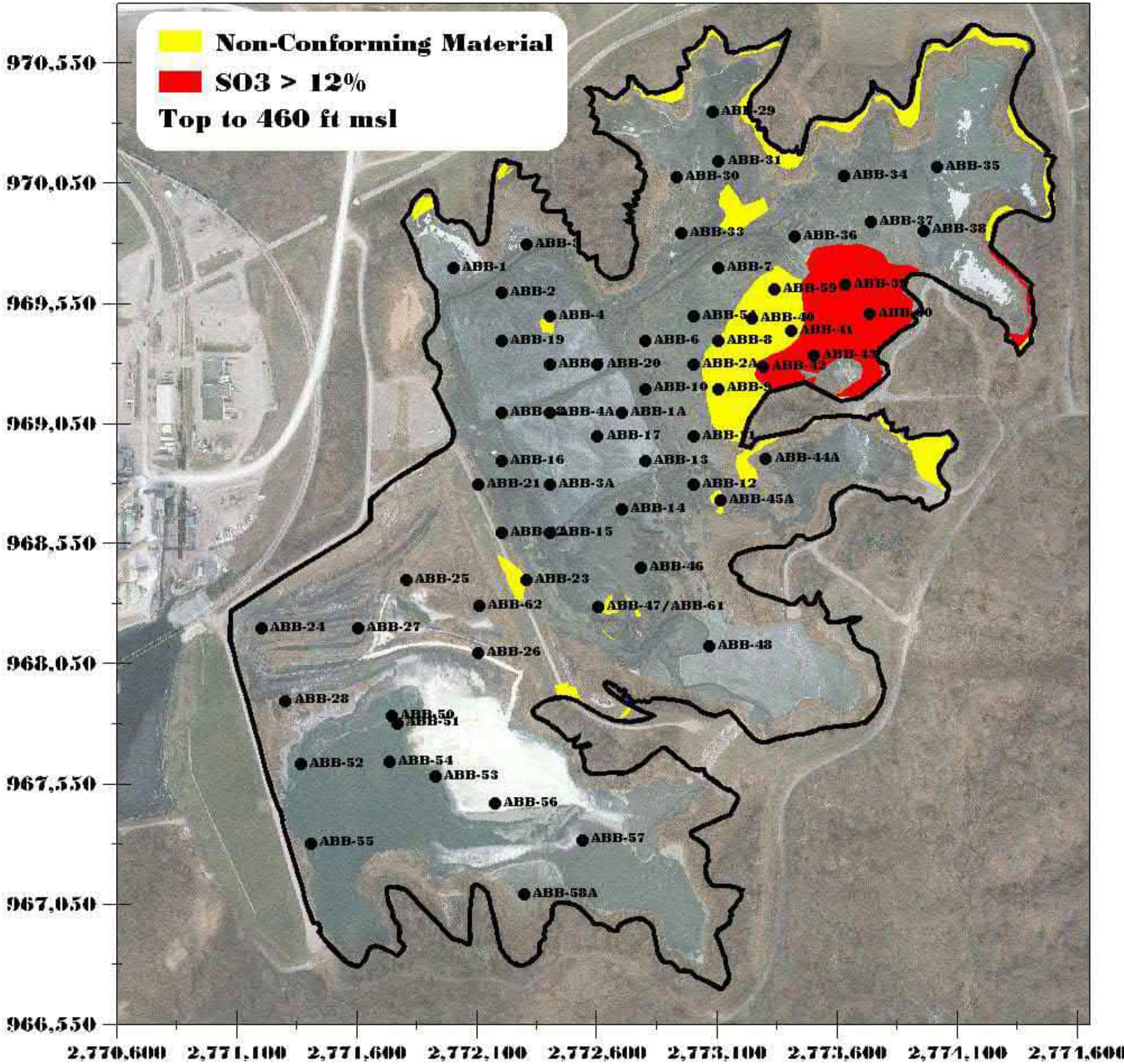
Non-Conforming Material
SO3 > 12%
Top to 460 ft msl
970,550
970,050
969,550
969,050
968,550
968,050
967,550
967,050
966,550
2,770,600
2,771,100
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ABB-29
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ABB-2A
ABB-10
ABB-4A
ABB-1A
ABB-17
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ABB-13
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ABB-3A
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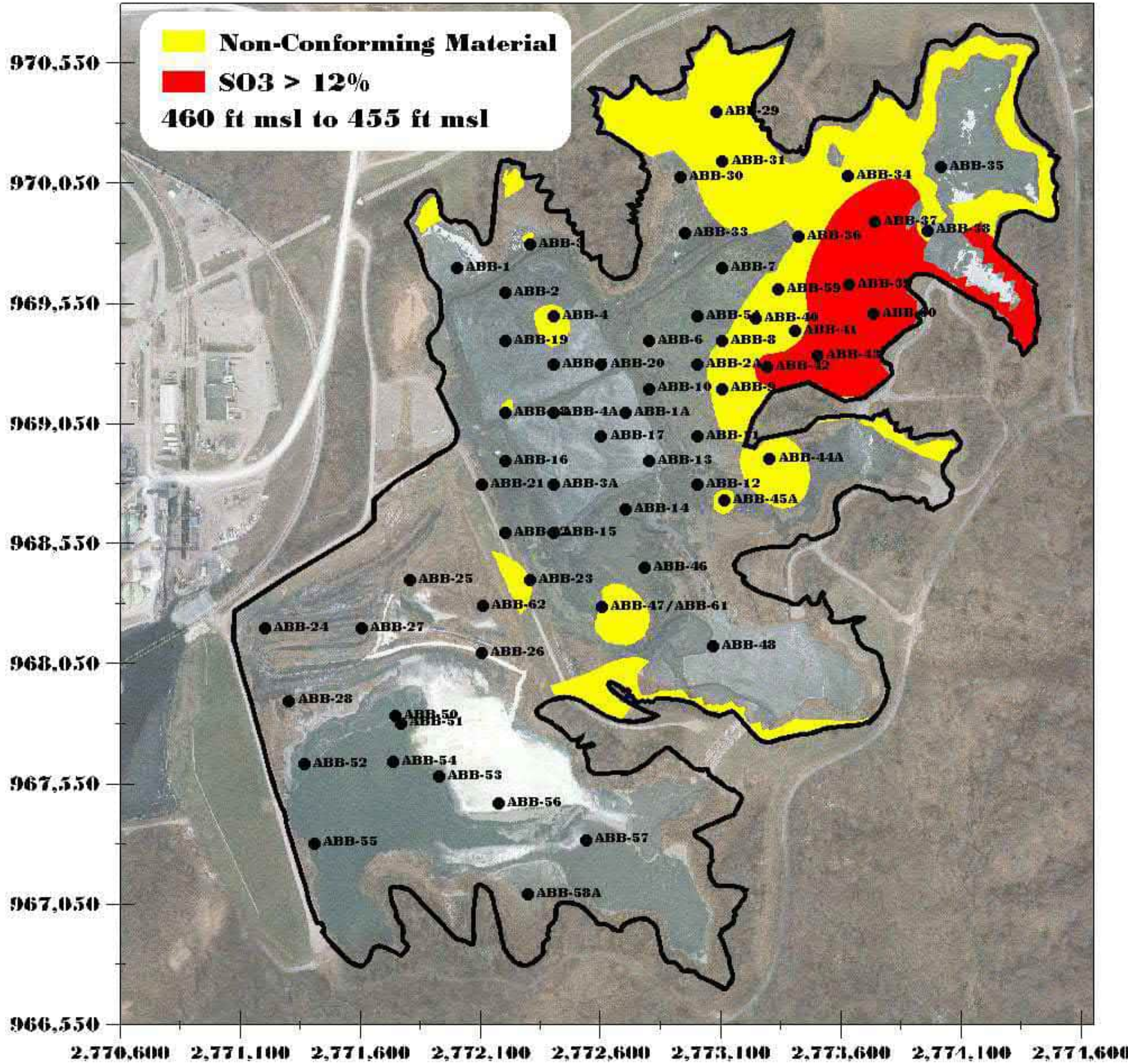
ABB-57
ABB-58A



Non-Conforming Material
SO3 > 12%
460 ft msl to 455 ft msl
970,550
970,050
969,550
969,050
968,550
968,050
967,550
967,050
966,550
2,770,600
2,771,100
2,771,600
2,772,100
2,772,600
2,773,100
2,773,600
2,774,100
2,774,600
ABB-29
ABB-31
ABB-30
ABB-34
ABB-35
ABB-37
ABB-33
ABB-36
ABB-1
ABB-7
ABB-2
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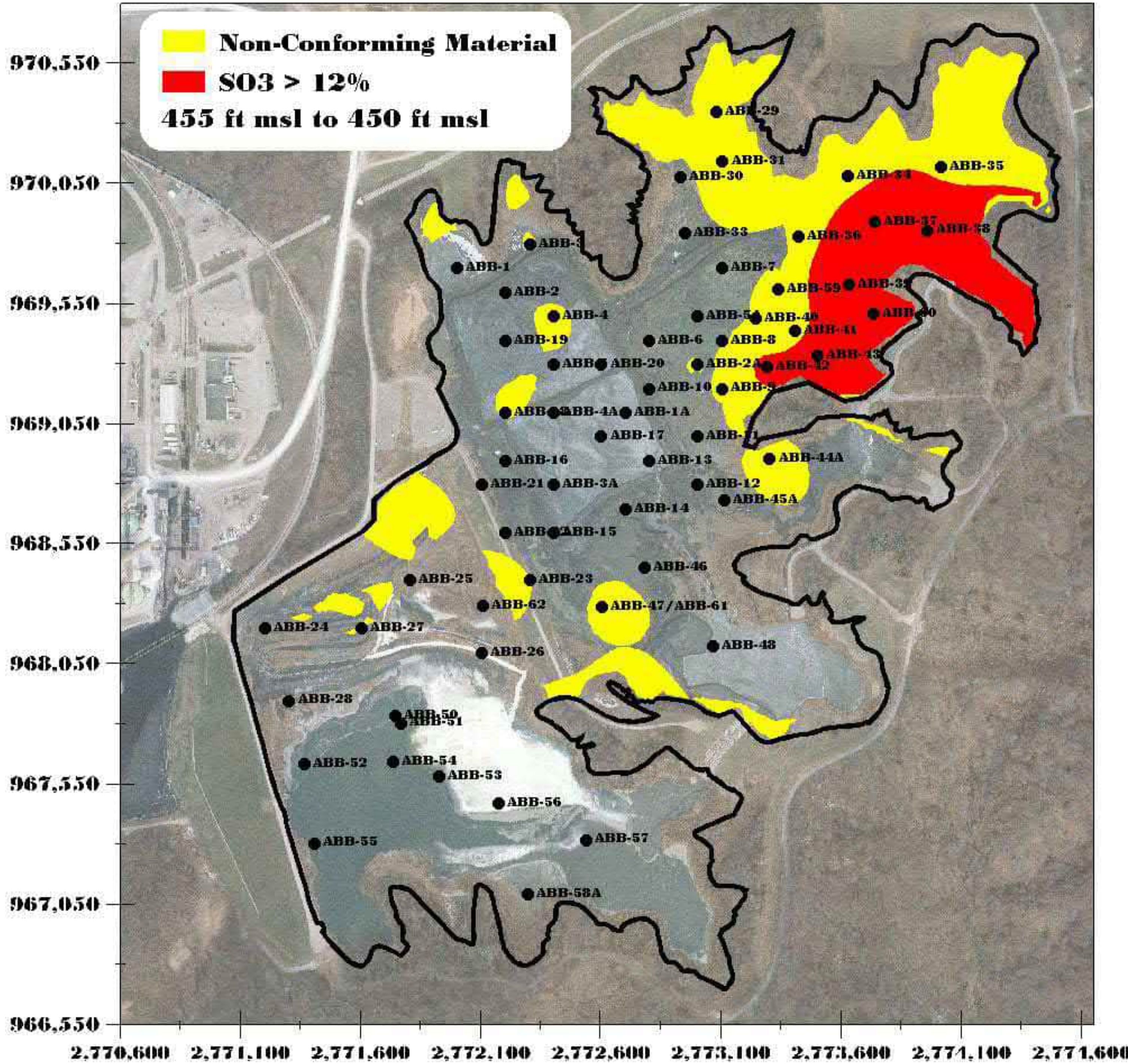
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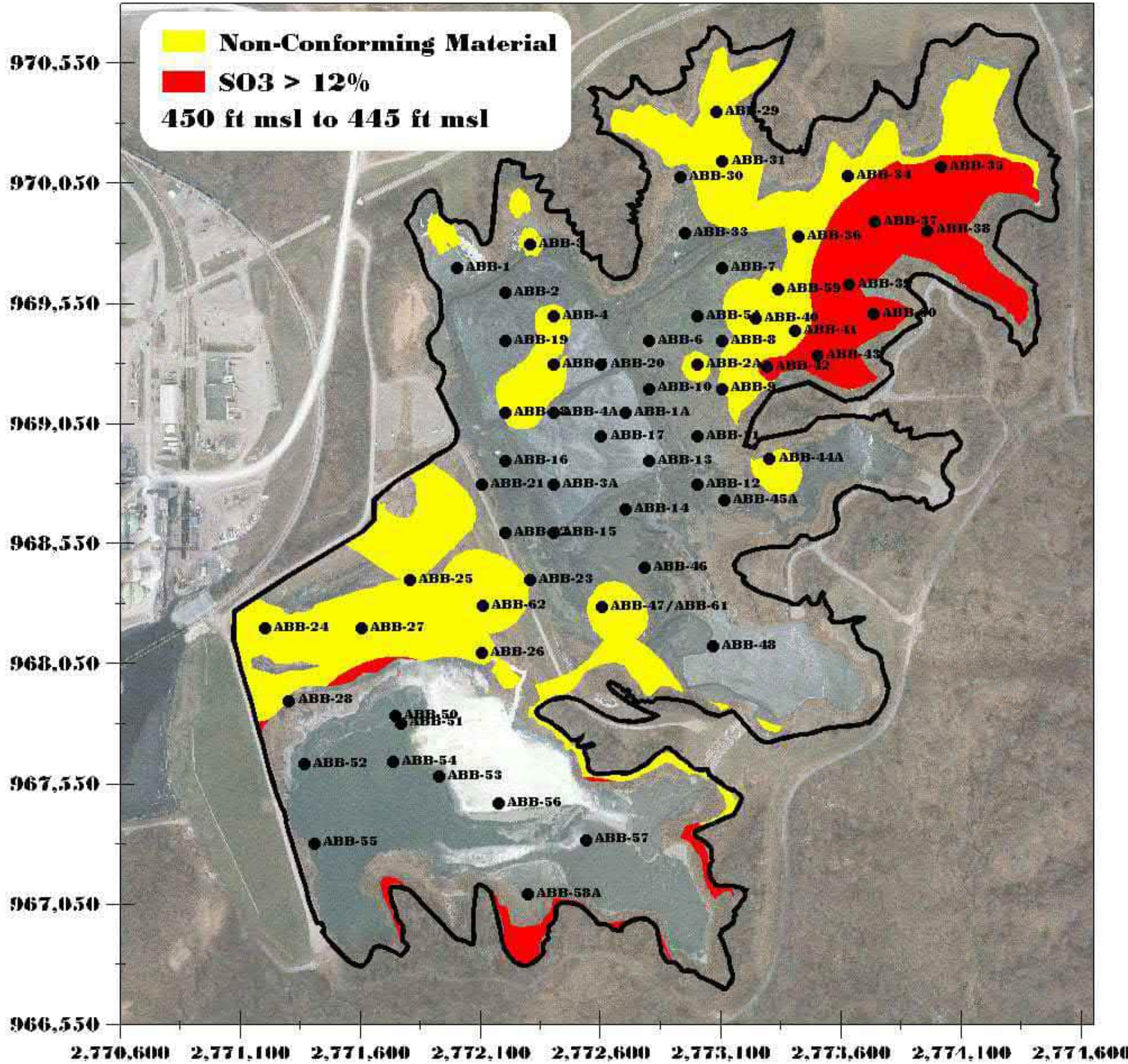

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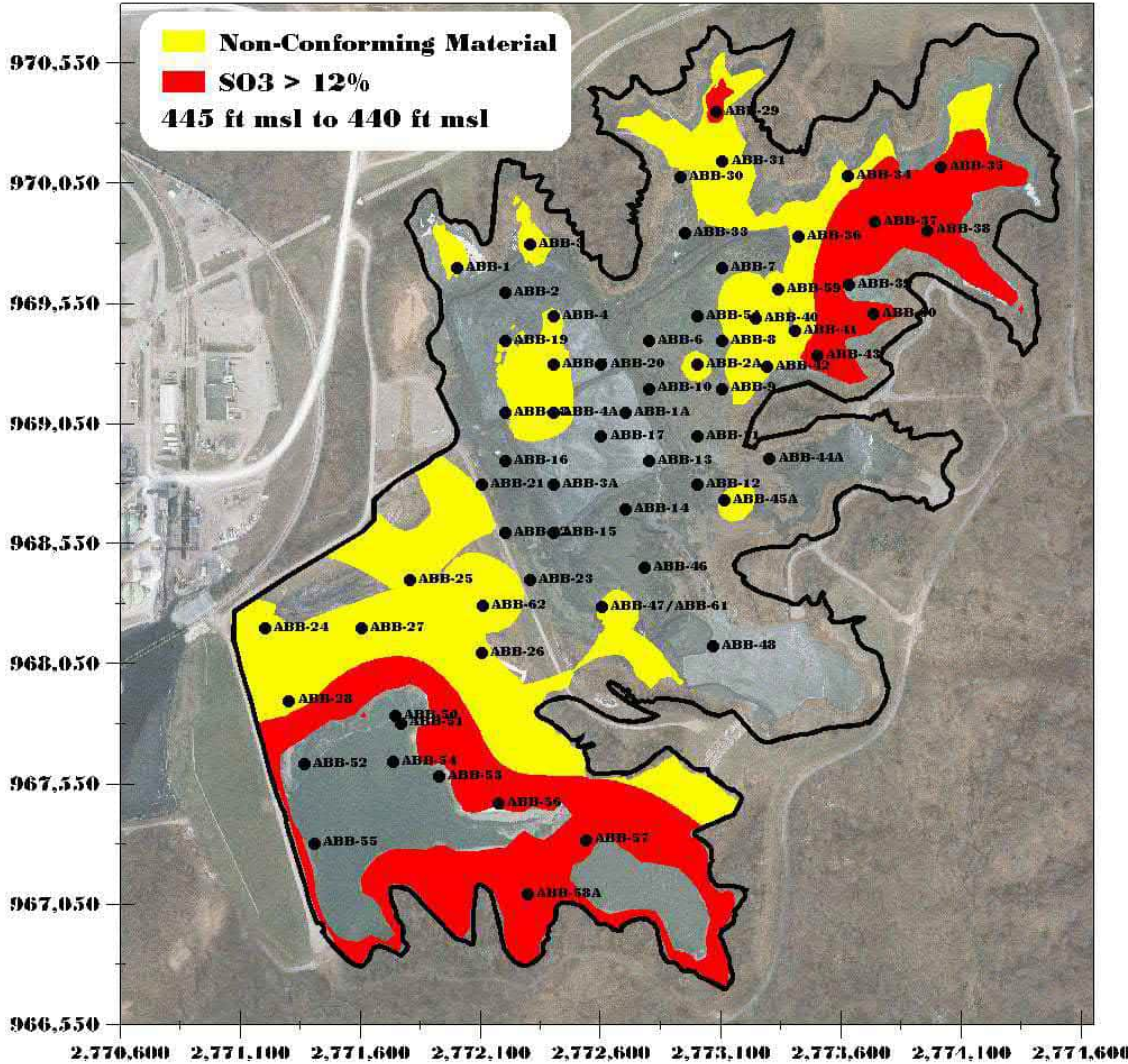

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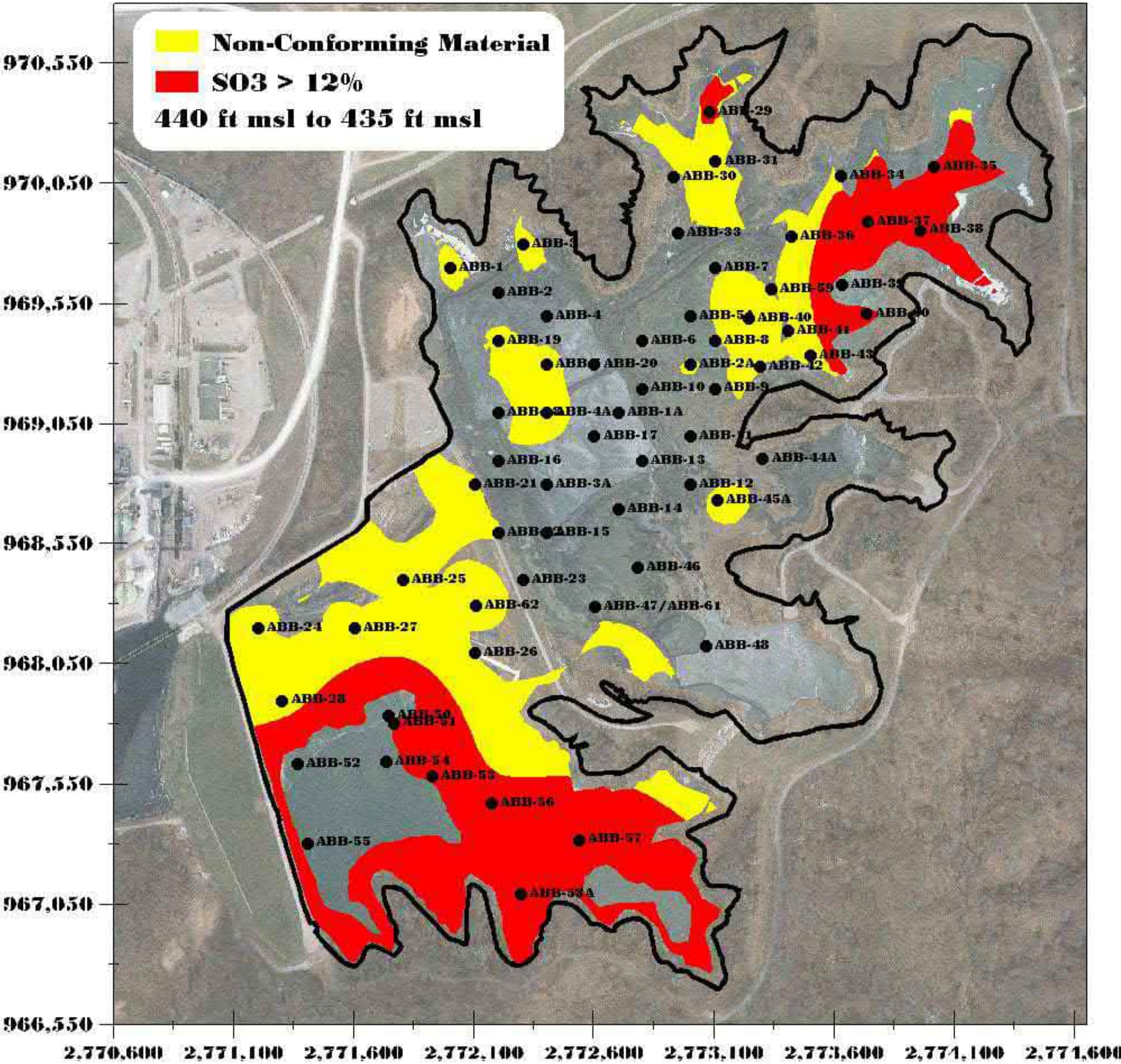

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440 ft msl to 435 ft msl
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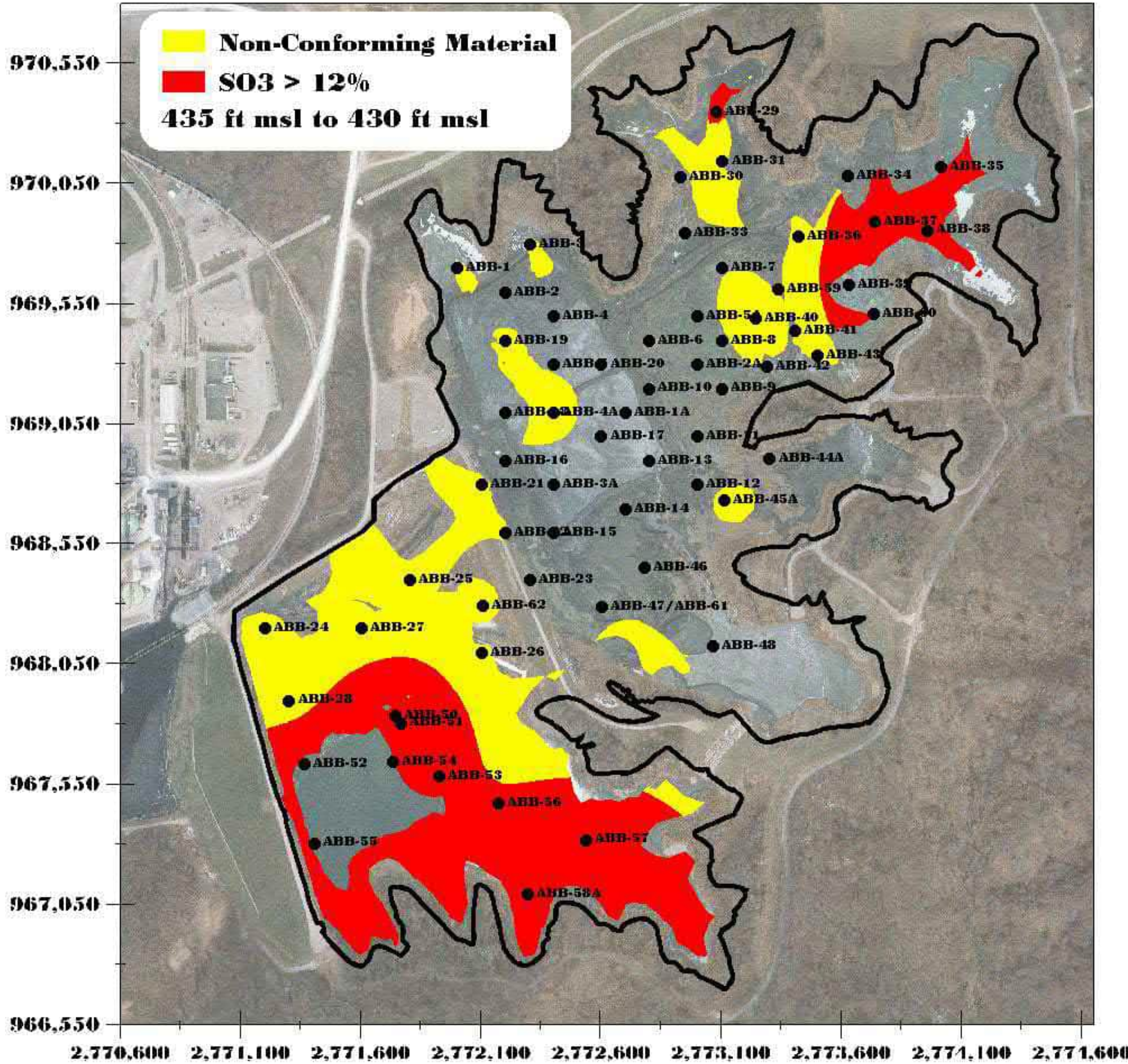
Non-Conforming Material
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435 ft msl to 430 ft msl
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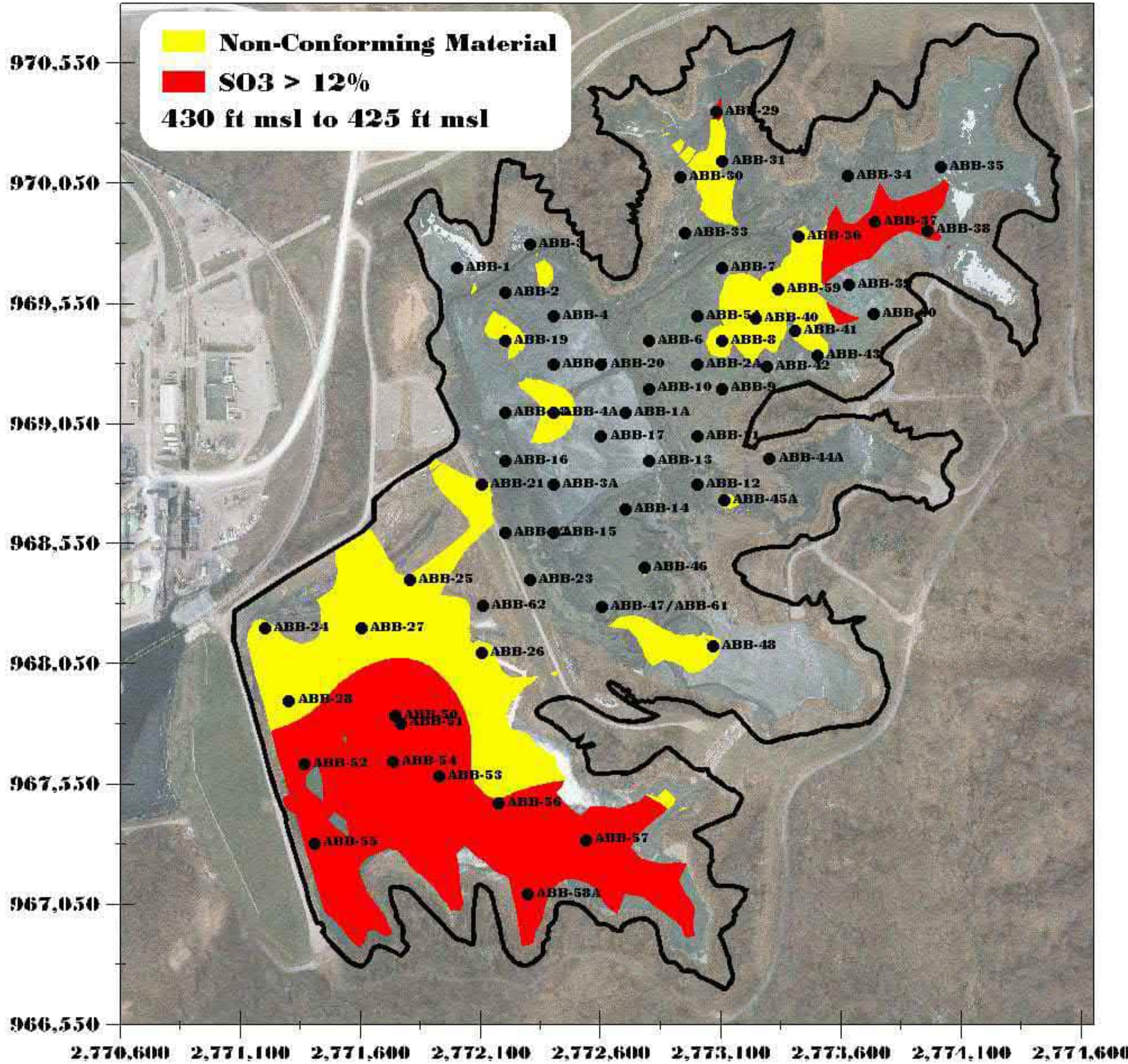

Non-Conforming Material
SO3 > 12%
430 ft msl to 425 ft msl
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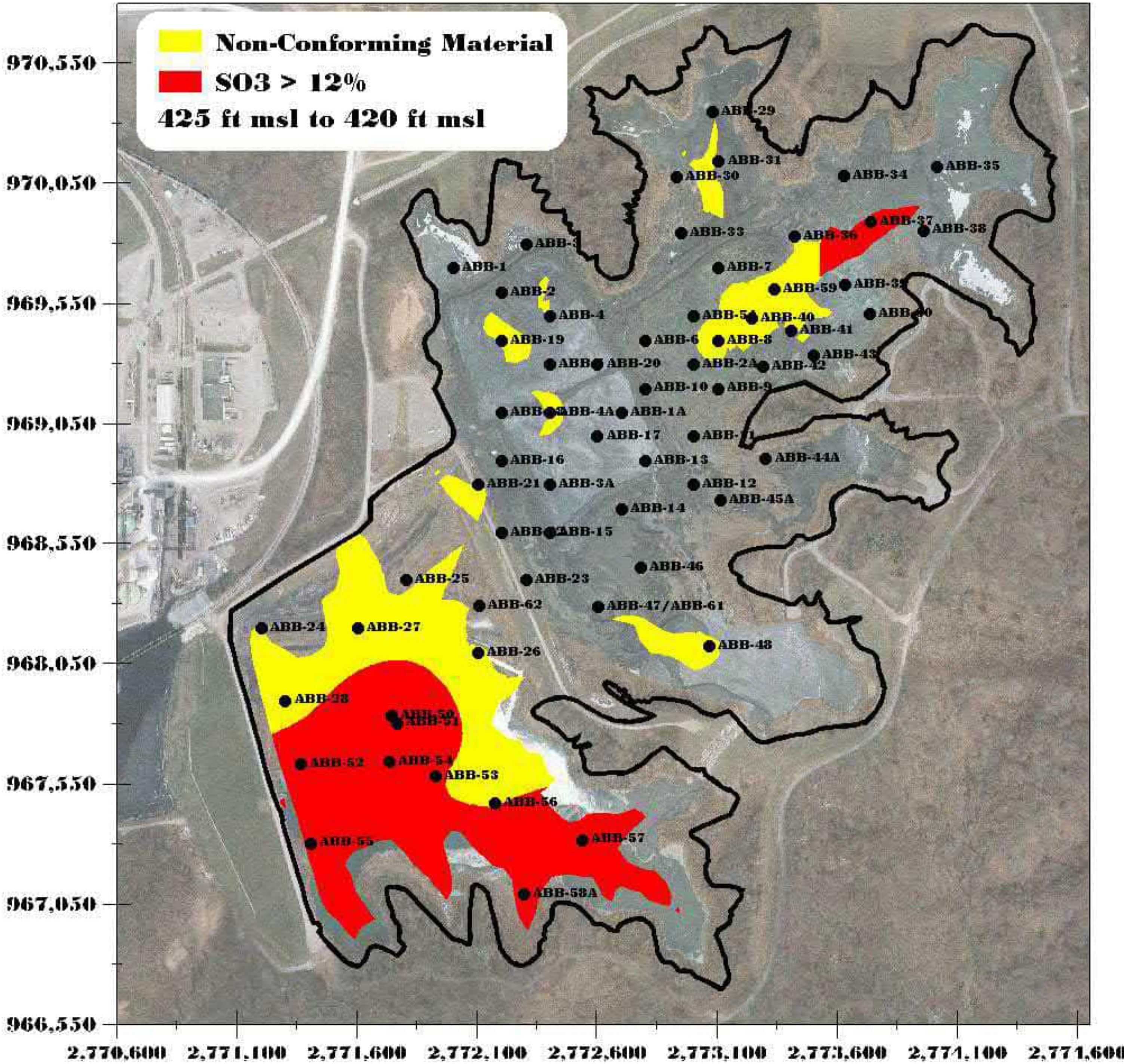

Non-Conforming Material
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425 ft msl to 420 ft msl
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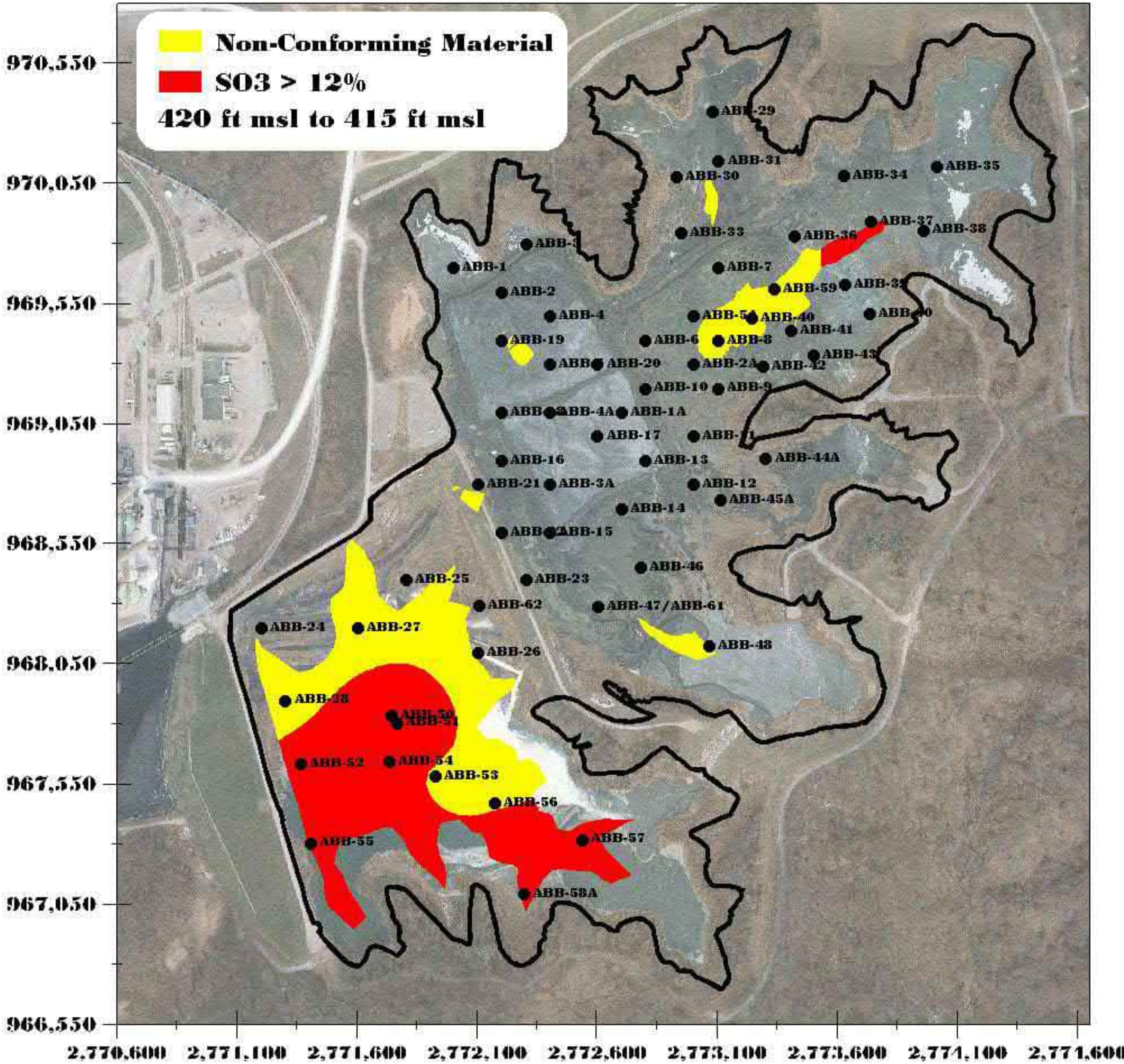

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420 ft msl to 415 ft msl
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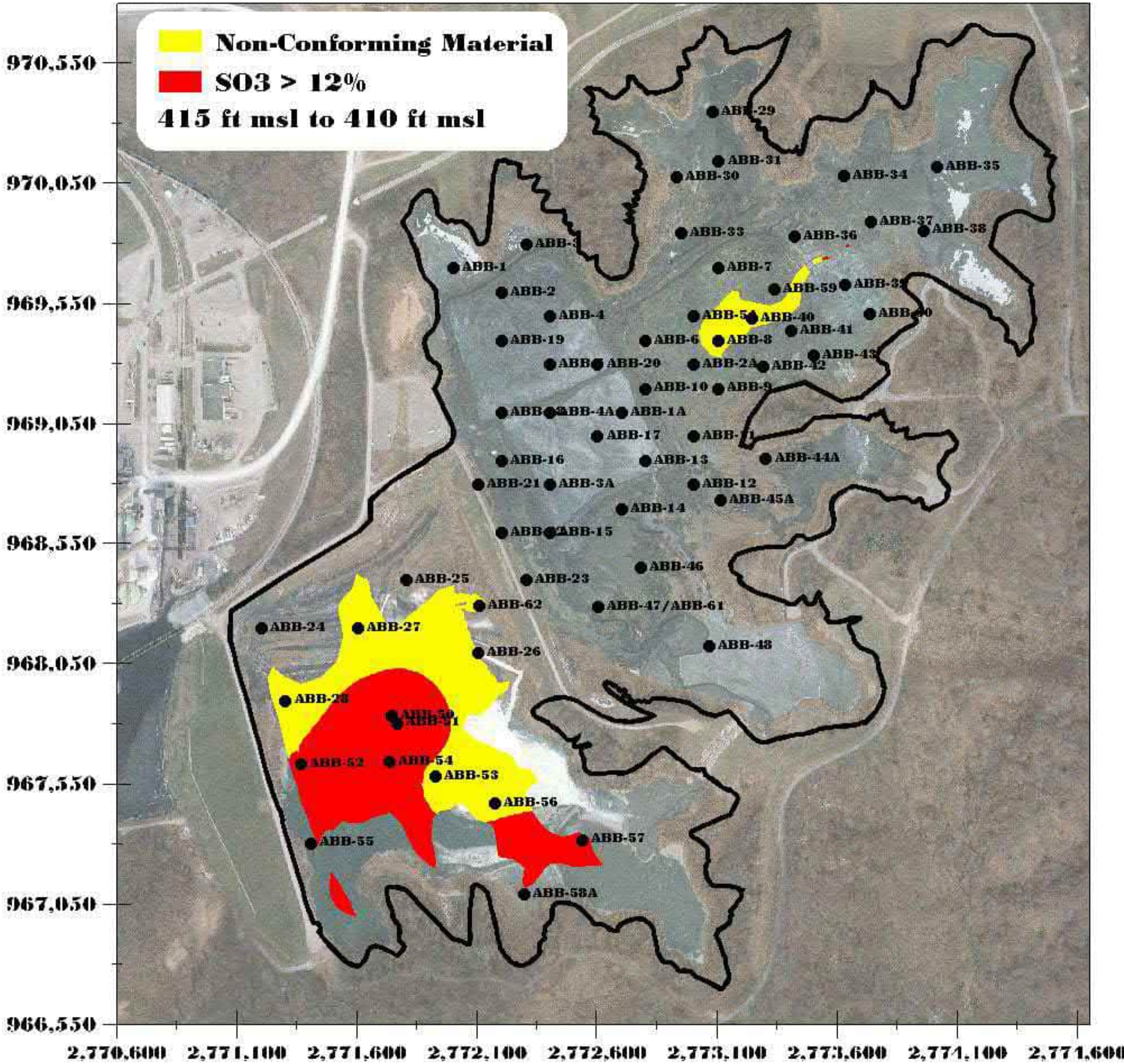

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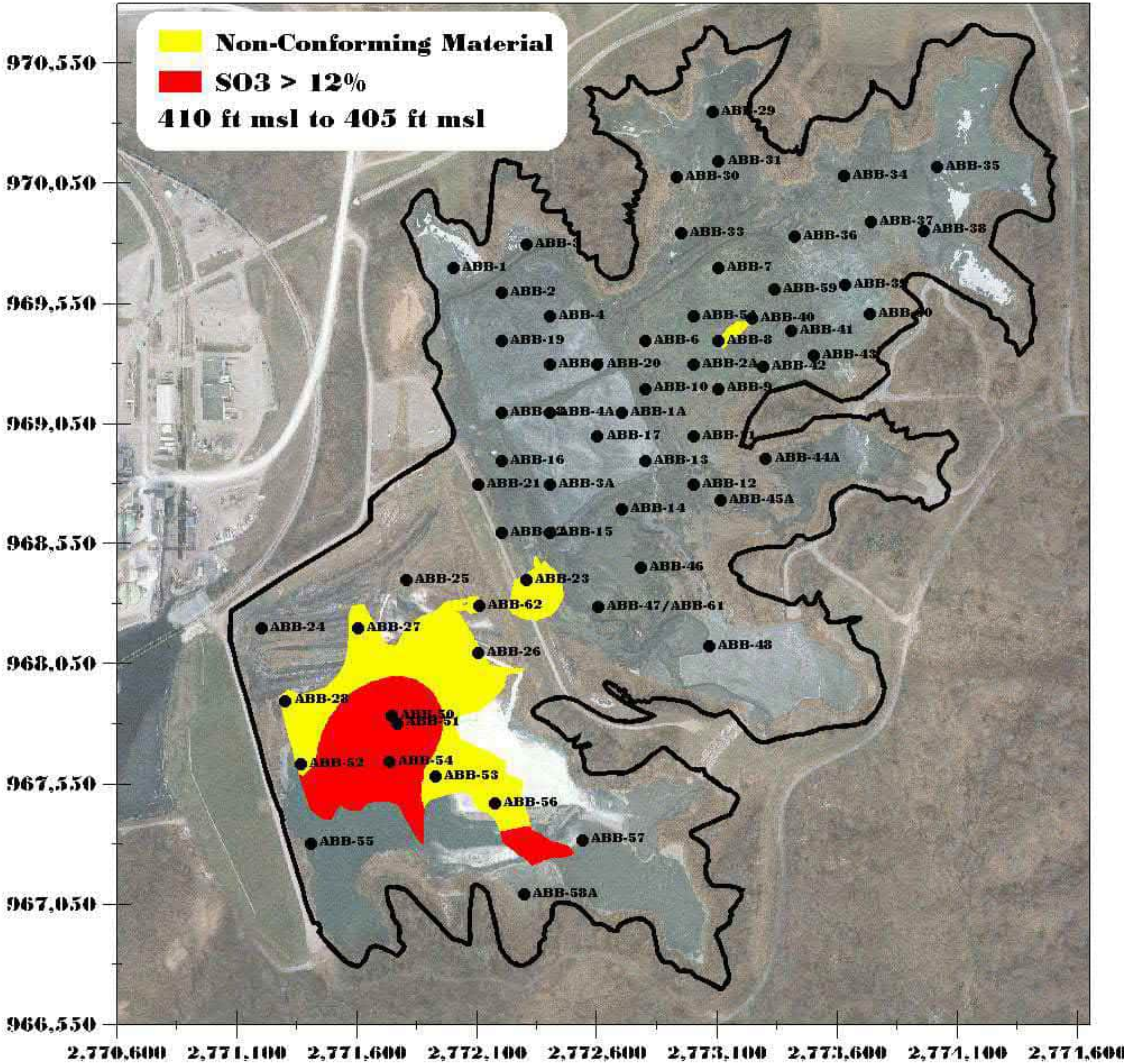

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410 ft msl to 405 ft msl
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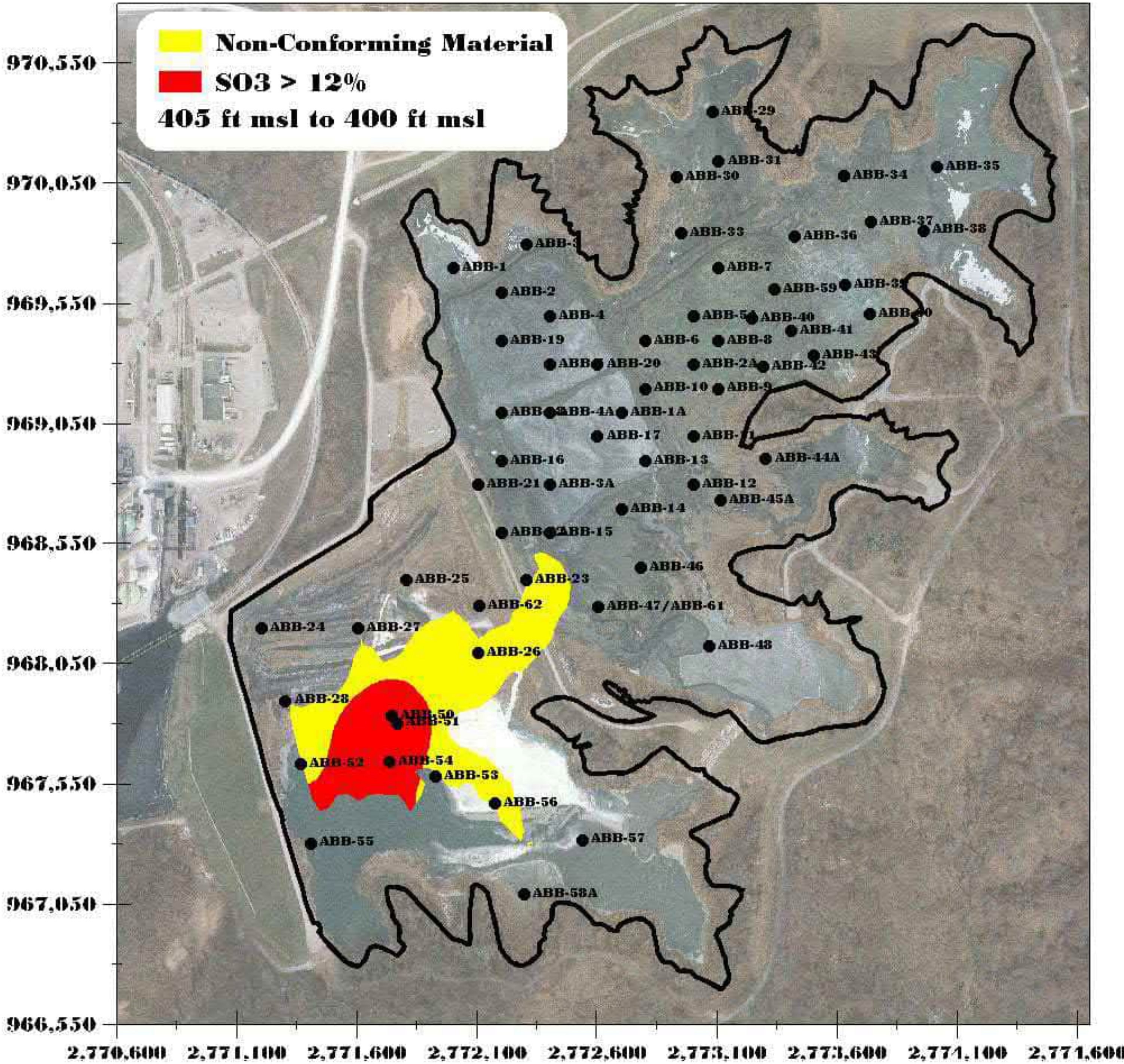

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405 ft msl to 400 ft msl
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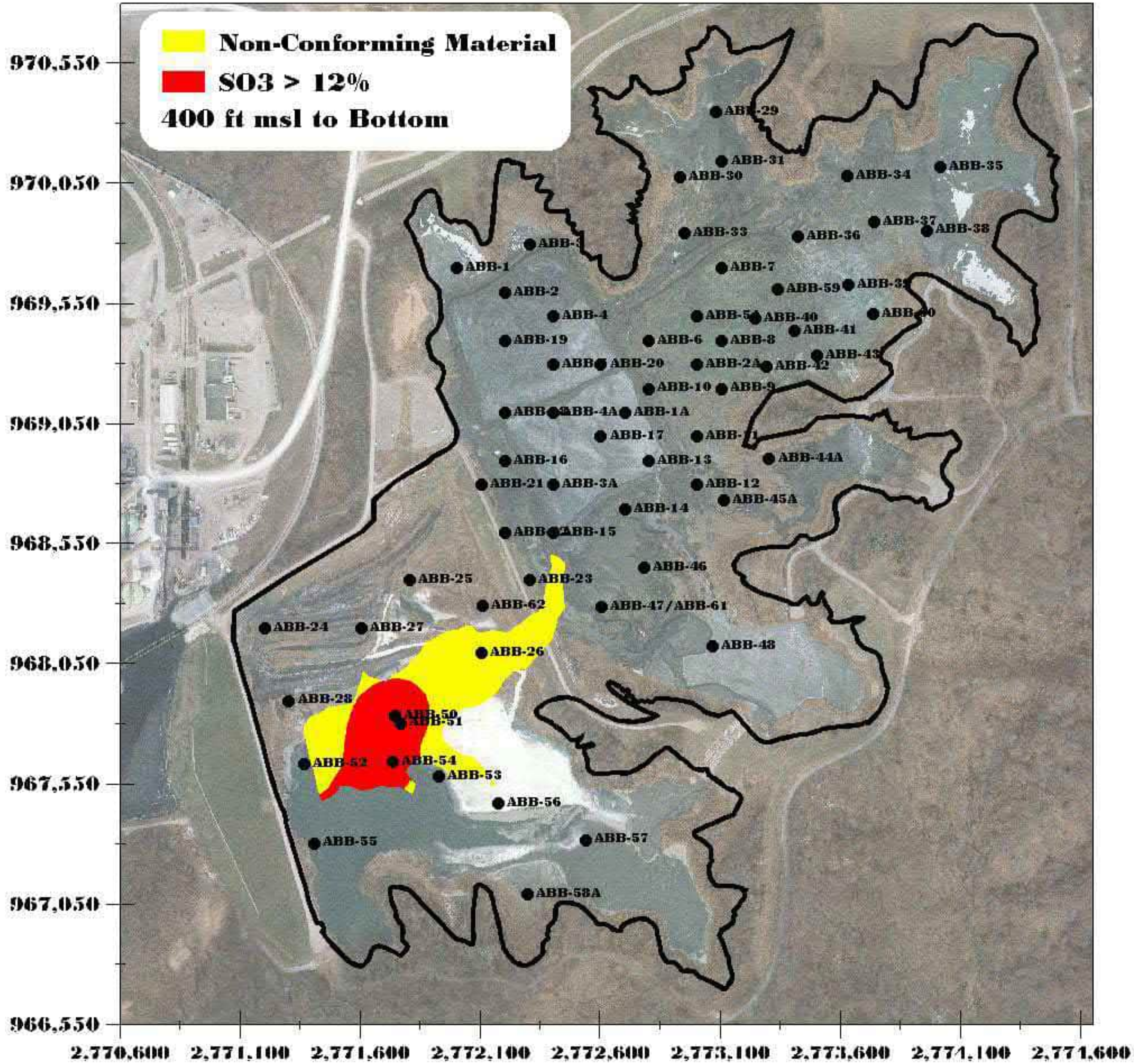
Non-Conforming Material
SO3 > 12%
400 ft msl to Bottom
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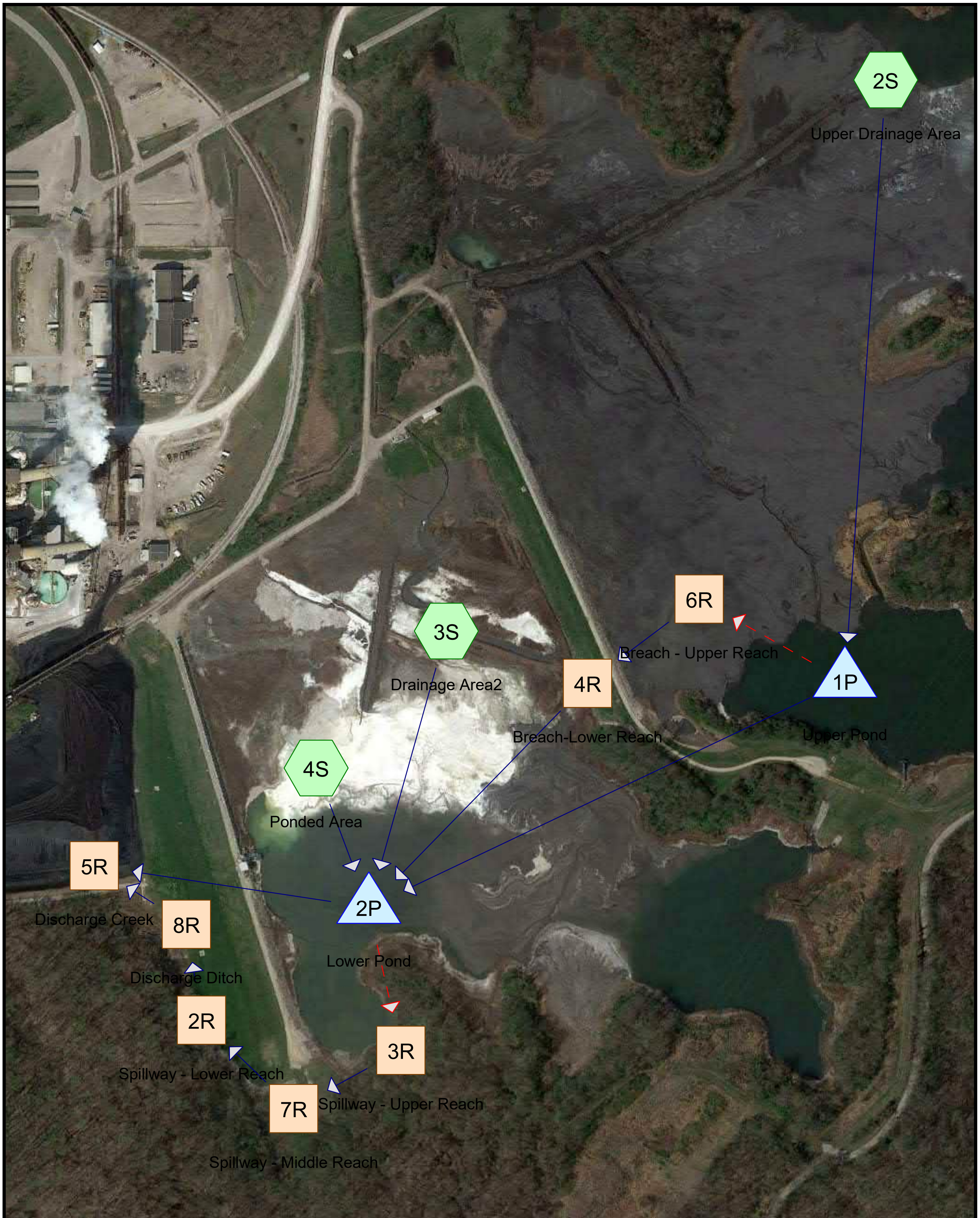
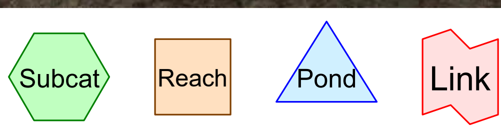
Appendix B

Hydrologic and Hydraulic (H&H) Engineering

EXISTING CONDITIONS





Routing Diagram for Brown - Existing Conditions_JMM
Prepared by AECOM, Printed 10/15/2021
HydroCAD® 10.00 s/n 01723 © 2013 HydroCAD Software Solutions LLC

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	99.830	0.000	0.000	99.830	50-75% Grass cover, Fair	2S, 3S
0.000	0.000	0.000	0.000	71.720	71.720	Ash	2S, 3S
0.000	0.000	69.710	0.000	0.000	69.710	Water Surface	2S, 4S
0.000	**0.000**	**169.540**	**0.000**	**71.720**	**241.260**	**TOTAL AREA**	

Summary for Subcatchment 2S: Upper Drainage Area

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

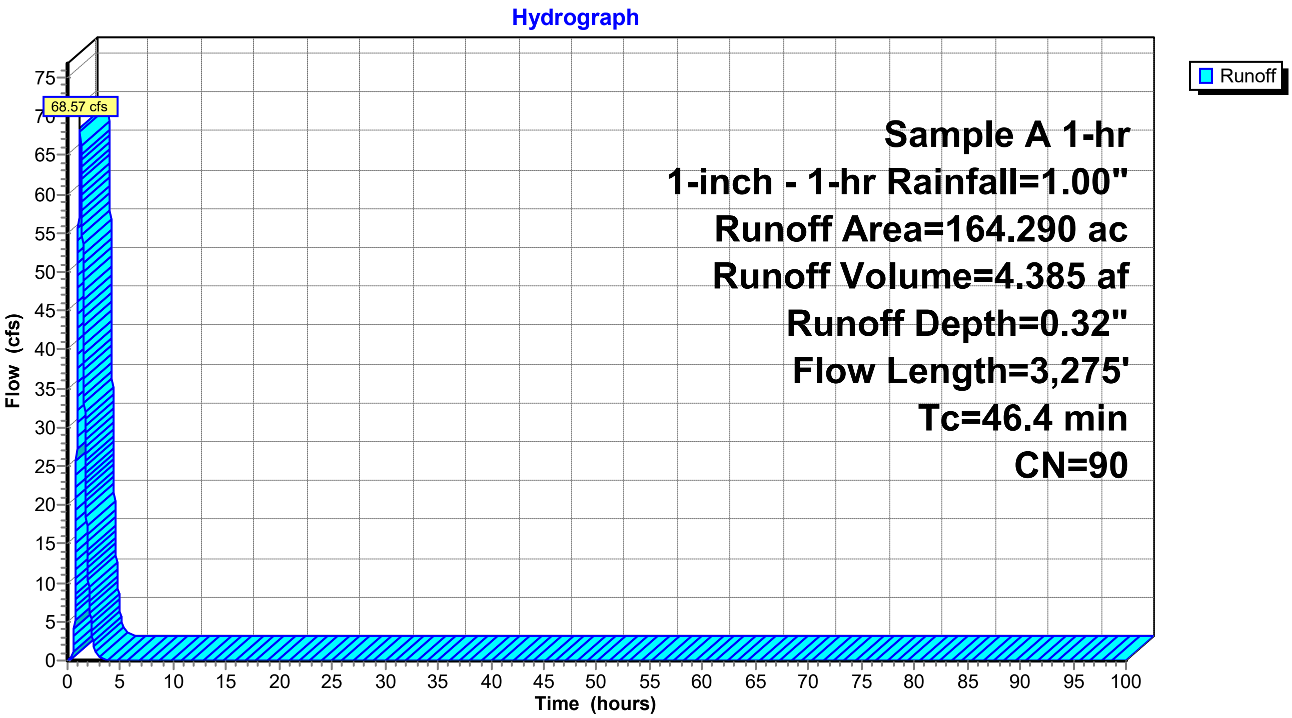
Runoff = 68.57 cfs @ 1.19 hrs, Volume= 4.385 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
	22.630	98	Water Surface, HSG C
	5.590	98	Water Surface, HSG C
*	57.410	98	Ash
*	5.930	98	Water Surface, HSG C
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	300	0.0600	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.29"
0.8	225	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
46.4	3,275	Total			

Subcatchment 2S: Upper Drainage Area



Summary for Subcatchment 3S: Drainage Area2

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

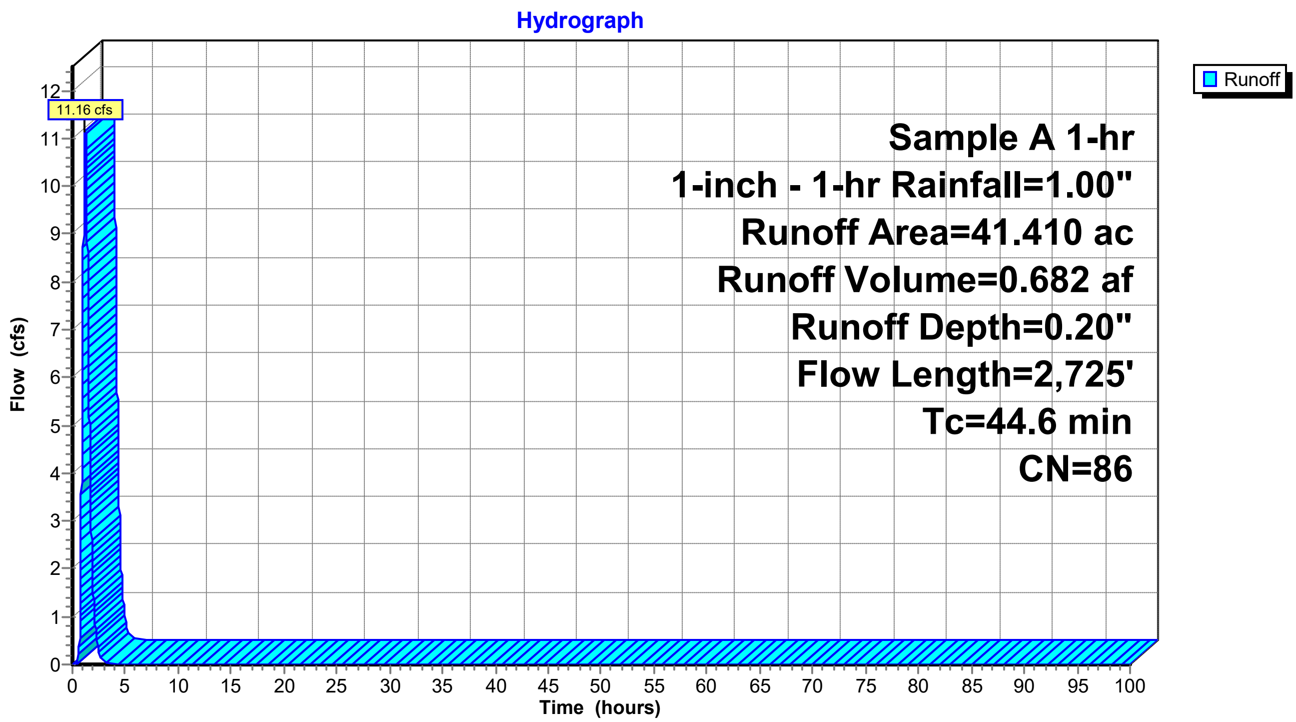
Runoff = 11.16 cfs @ 1.23 hrs, Volume= 0.682 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Drainage Area2



Summary for Subcatchment 4S: Ponded Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

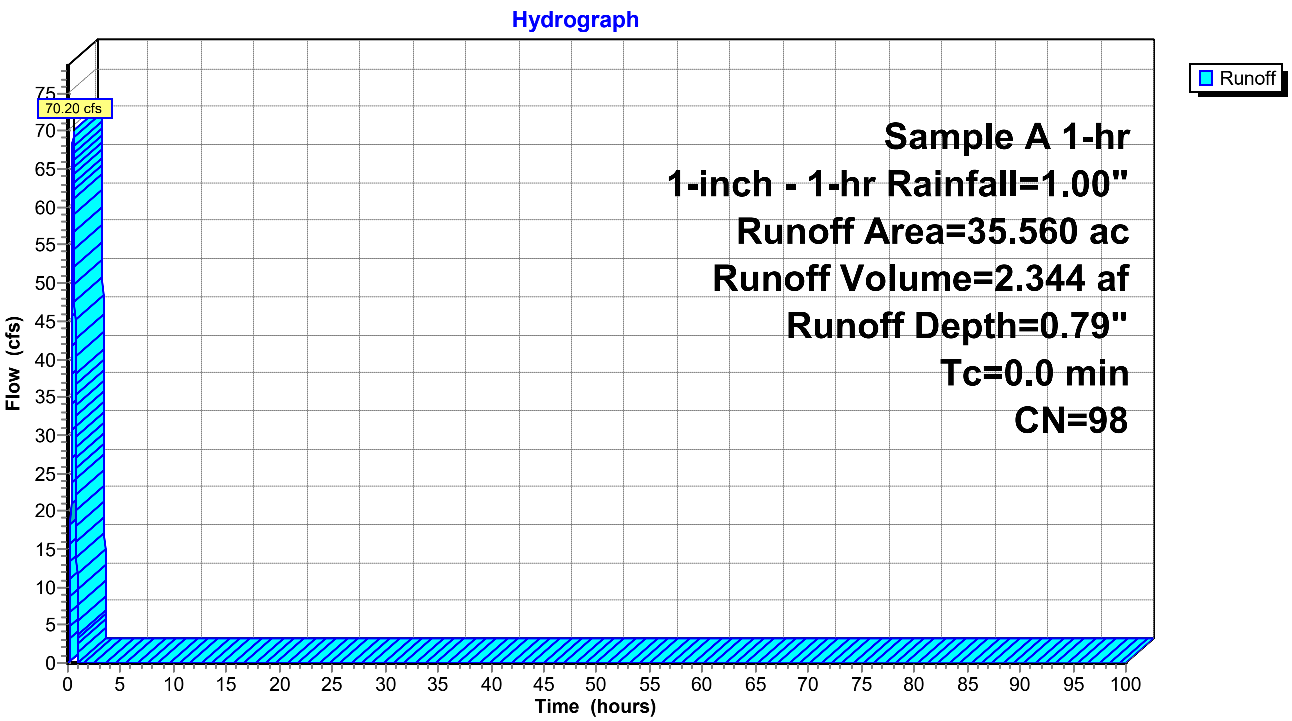
Runoff = 70.20 cfs @ 0.50 hrs, Volume= 2.344 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



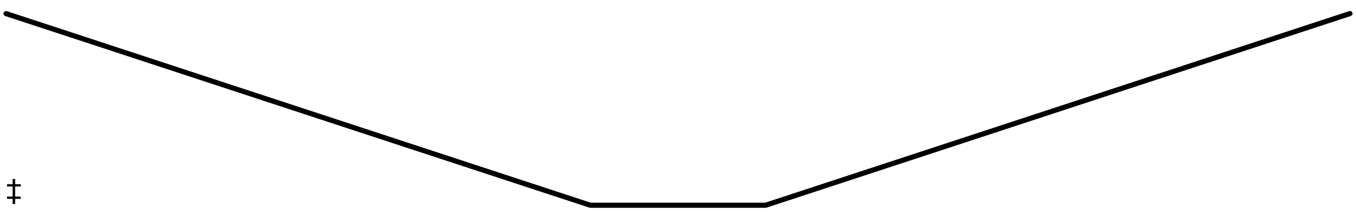
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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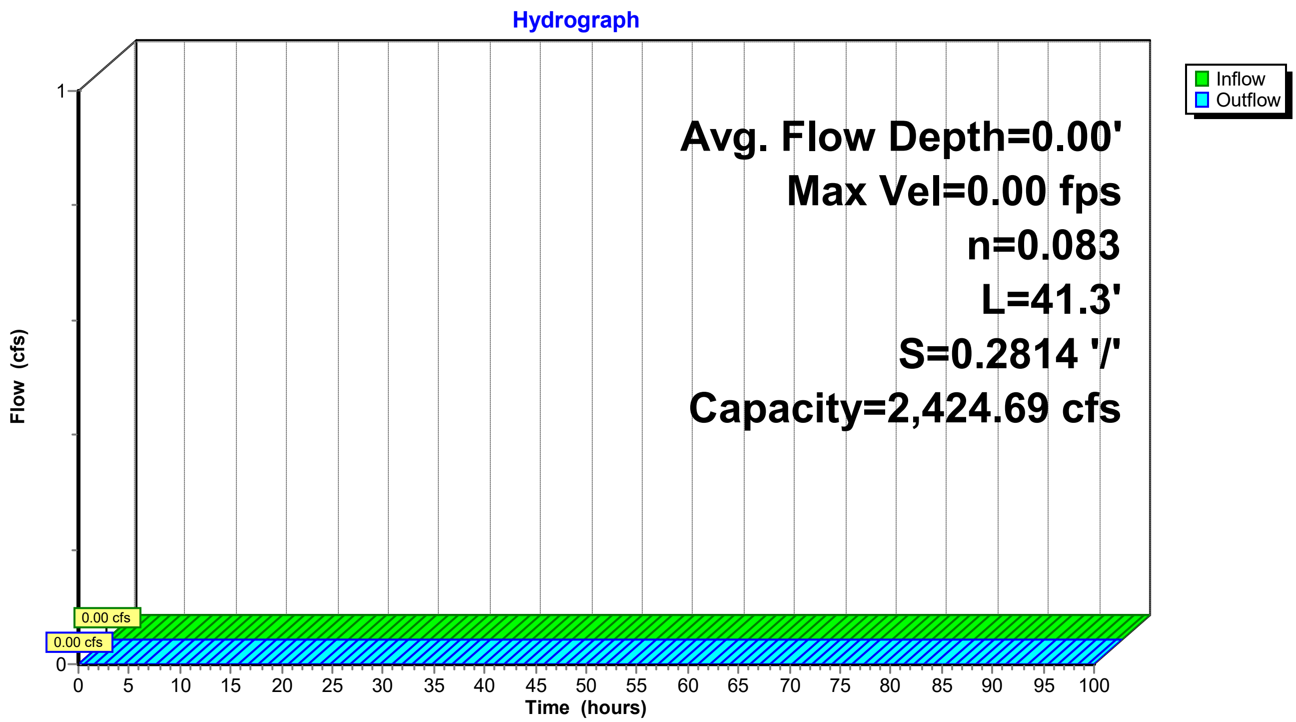
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

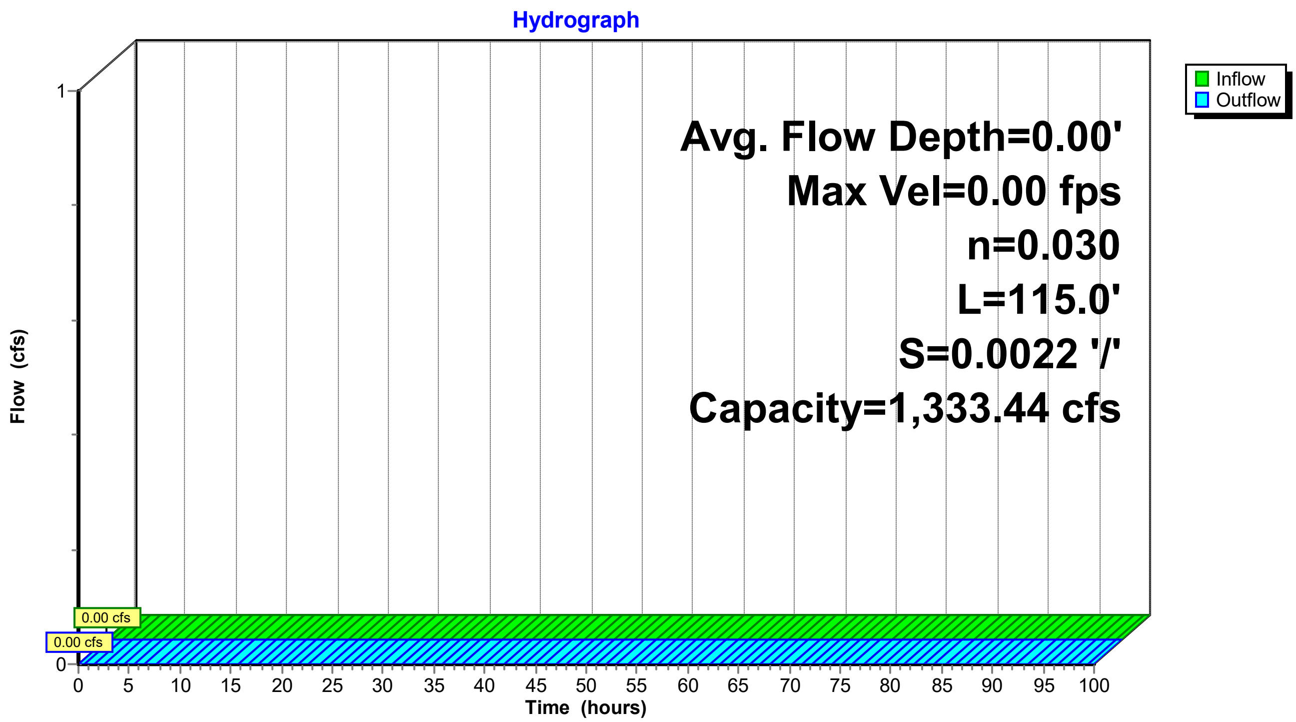
Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

Reach 3R: Spillway - Upper Reach



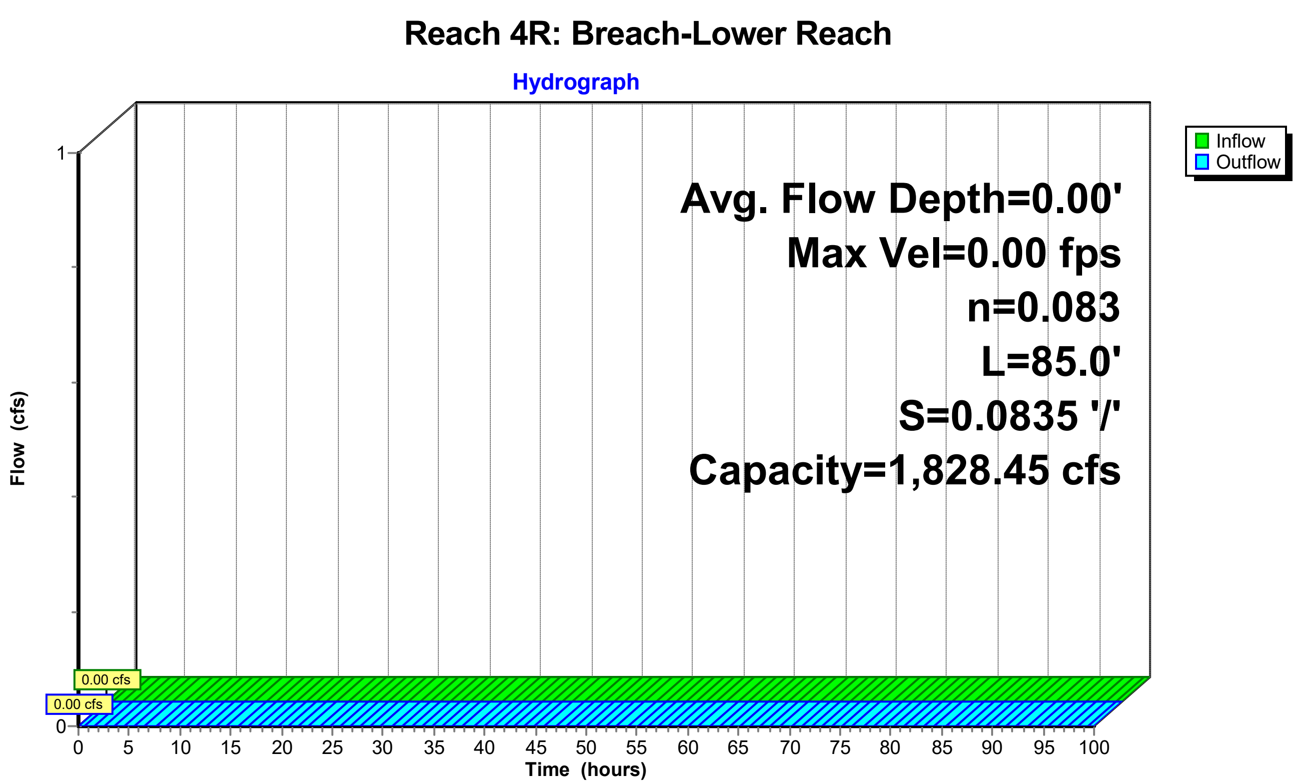
Summary for Reach 4R: Breach-Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'



Summary for Reach 5R: Discharge Creek

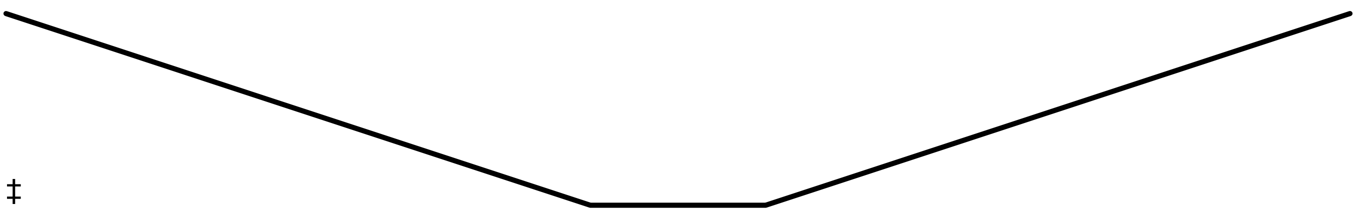
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.26' @ 0.00 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.00" for 1-inch - 1-hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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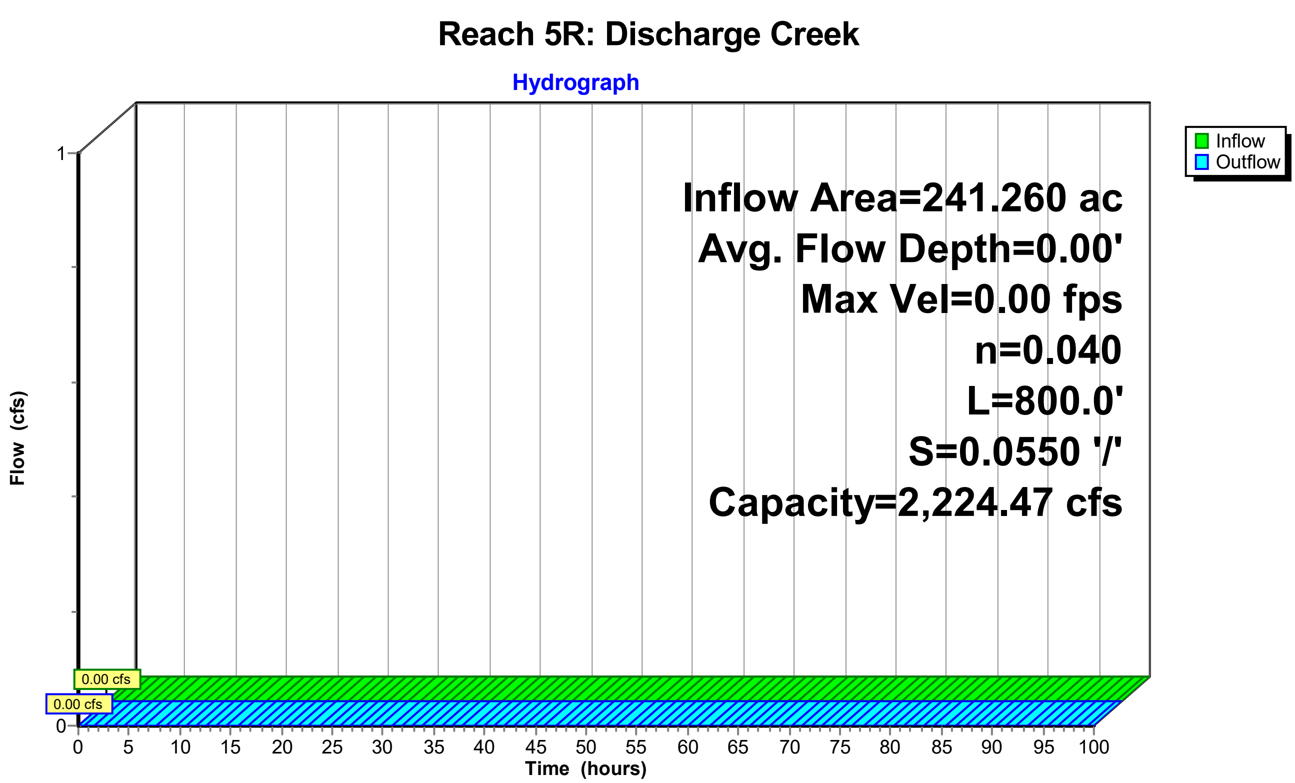


Summary for Reach 6R: Breach - Upper Reach

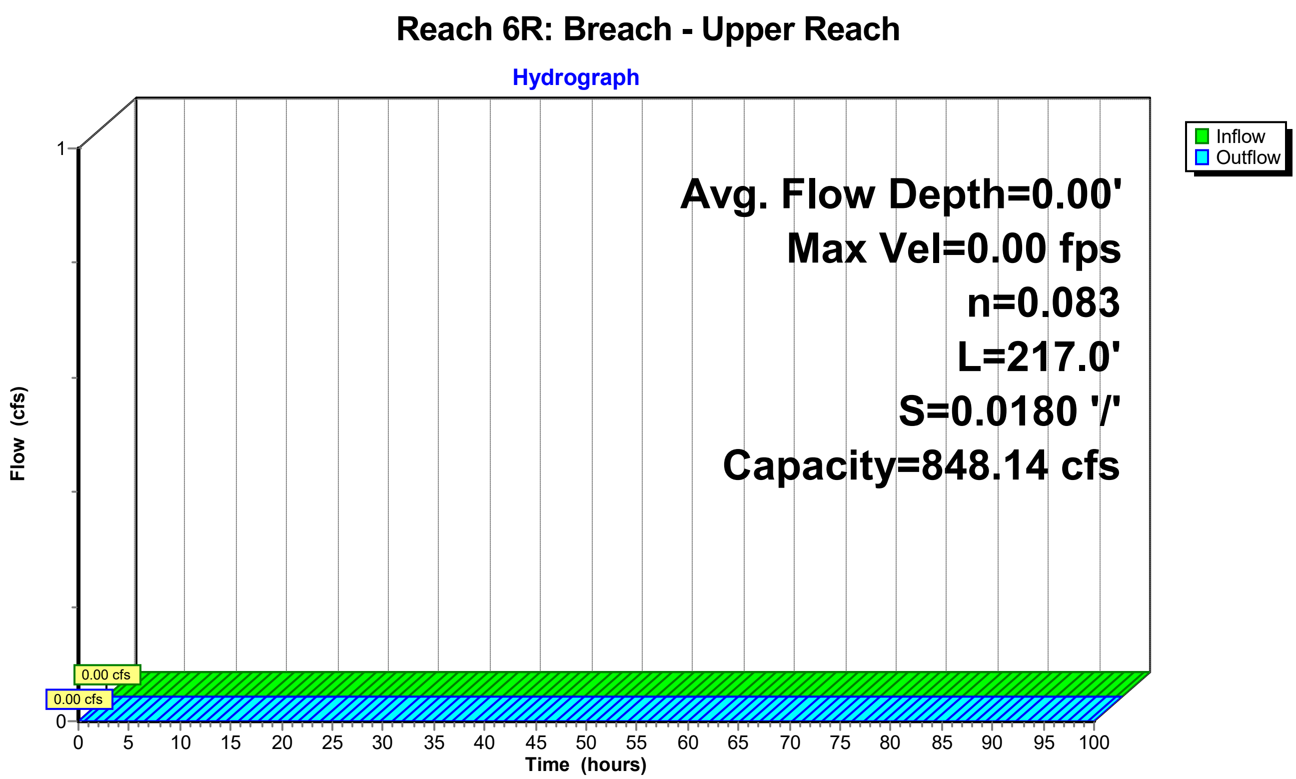
Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡



Summary for Reach 7R: Spillway - Middle Reach

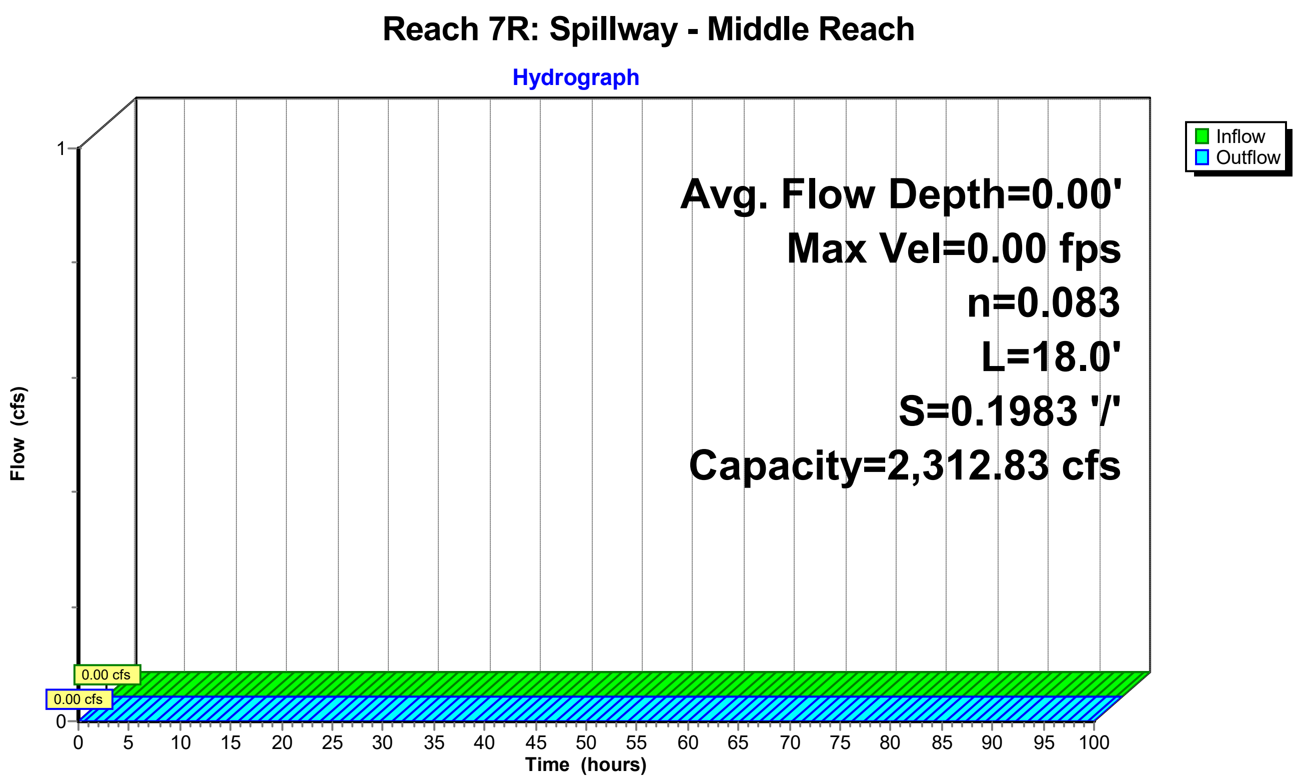
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡



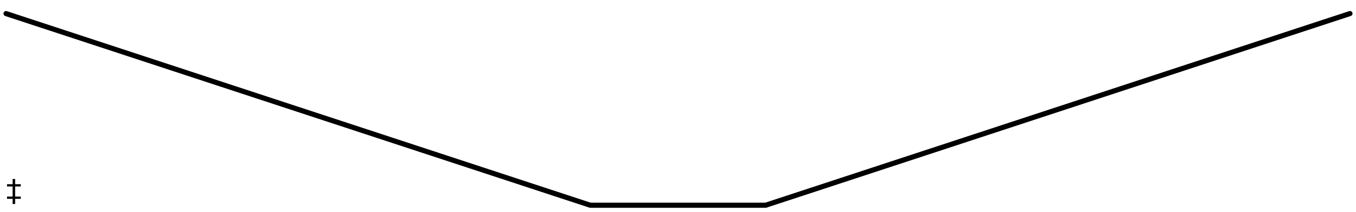
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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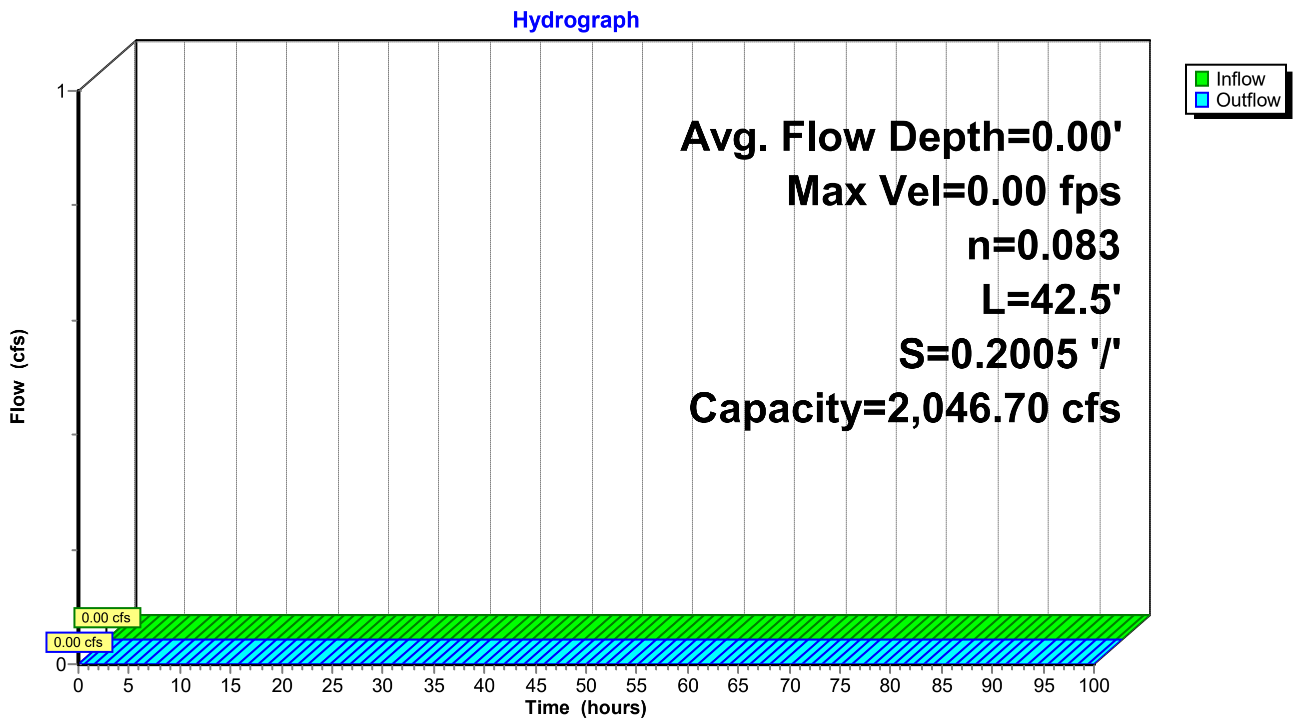
Reach 8R: Discharge Ditch



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow Area = 164.290 ac, 55.73% Impervious, Inflow Depth > 7.93" for 1-inch - 1-hr event
Inflow = 81.17 cfs @ 1.19 hrs, Volume= 108.527 af, Incl. 12.60 cfs Base Flow
Outflow = 20.64 cfs @ 2.05 hrs, Volume= 108.579 af, Atten= 75%, Lag= 51.3 min
Primary = 20.64 cfs @ 2.05 hrs, Volume= 108.579 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 450.41' Surf.Area= 0.000 ac Storage= 78.442 af
Peak Elev= 450.62' @ 2.05 hrs Surf.Area= 0.000 ac Storage= 82.008 af (3.567 af above start)

Plug-Flow detention time= 4,486.9 min calculated for 30.129 af (28% of inflow)
Center-of-Mass det. time= 9.7 min (2,891.7 - 2,882.0)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	889.000 af	**Custom Stage Data** Listed below

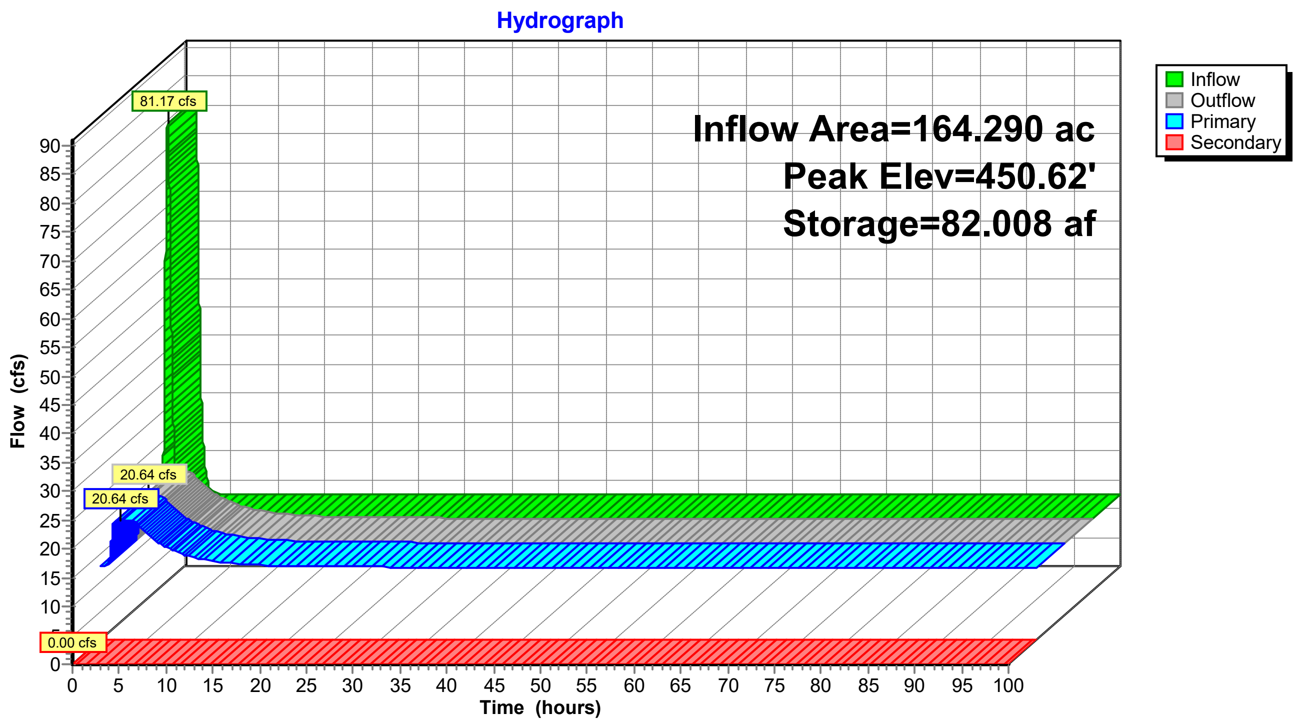
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	8.200
442.00	10.410
443.00	16.000
444.00	19.200
445.00	27.330
446.00	31.840
447.00	42.590
448.00	49.050
449.00	62.870
450.00	71.410
451.00	88.560
452.00	104.620
454.00	144.360
456.00	152.310
458.00	249.410
460.00	342.630
462.00	489.560
464.00	679.630
466.00	889.000

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=20.64 cfs @ 2.05 hrs HW=450.62' TW=441.37' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 20.64 cfs @ 7.28 fps)
  └─**2=Orifice/Grate** (Passes 20.64 cfs of 23.54 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=450.41' TW=455.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Inflow Area =	241.260 ac, 58.62% Impervious,	Inflow Depth > 5.55"	for 1-inch - 1-hr event
Inflow =	82.93 cfs @ 0.50 hrs,	Volume= 111.604 af	
Outflow =	14.52 cfs @ 9.54 hrs,	Volume= 107.507 af,	Atten= 82%, Lag= 542.4 min
Primary =	0.00 cfs @ 0.00 hrs,	Volume= 0.000 af	
Secondary =	0.00 cfs @ 0.00 hrs,	Volume= 0.000 af	
Tertiary =	14.52 cfs @ 9.54 hrs,	Volume= 107.507 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 441.00' Surf.Area= 0.000 ac Storage= 152.440 af
Peak Elev= 441.59' @ 9.54 hrs Surf.Area= 0.000 ac Storage= 161.499 af (9.059 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 173.2 min (2,987.7 - 2,814.5)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	441.50'	**Pump** Discharges@450.90' Turns Off@441.01' Flow (gpm)= 6,516.0 6,516.1

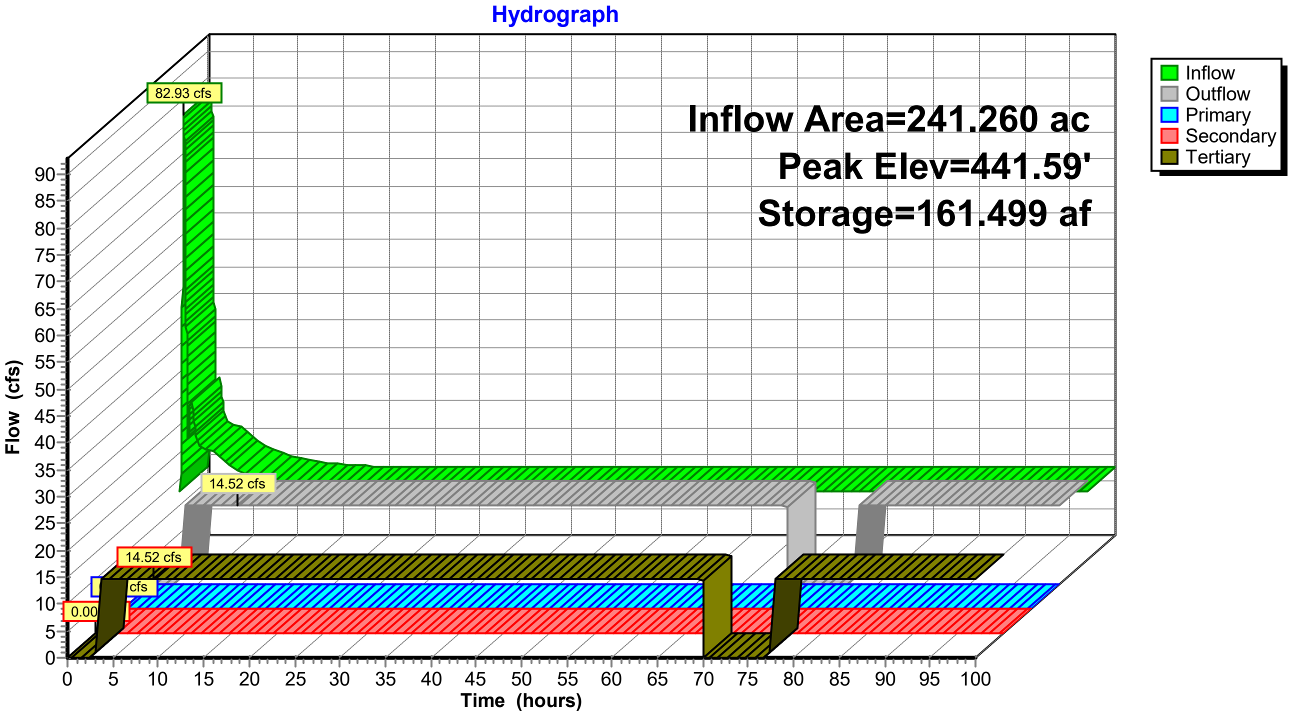
Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 115.16 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 9.54 hrs HW=441.59' (Free Discharge)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 2P: Lower Pond



Summary for Subcatchment 2S: Upper Drainage Area

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

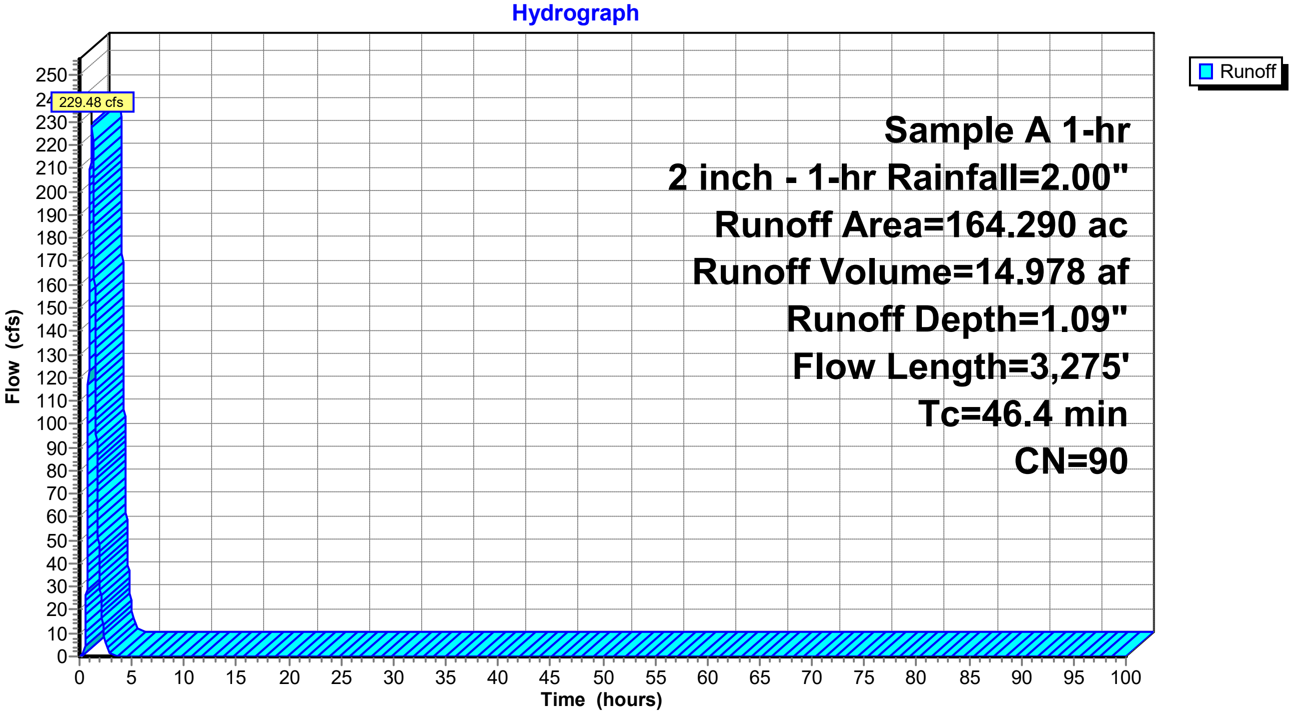
Runoff = 229.48 cfs @ 1.18 hrs, Volume= 14.978 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
	22.630	98	Water Surface, HSG C
	5.590	98	Water Surface, HSG C
*	57.410	98	Ash
*	5.930	98	Water Surface, HSG C
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	300	0.0600	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.29"
0.8	225	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
46.4	3,275	Total			

Subcatchment 2S: Upper Drainage Area



Summary for Subcatchment 3S: Drainage Area2

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

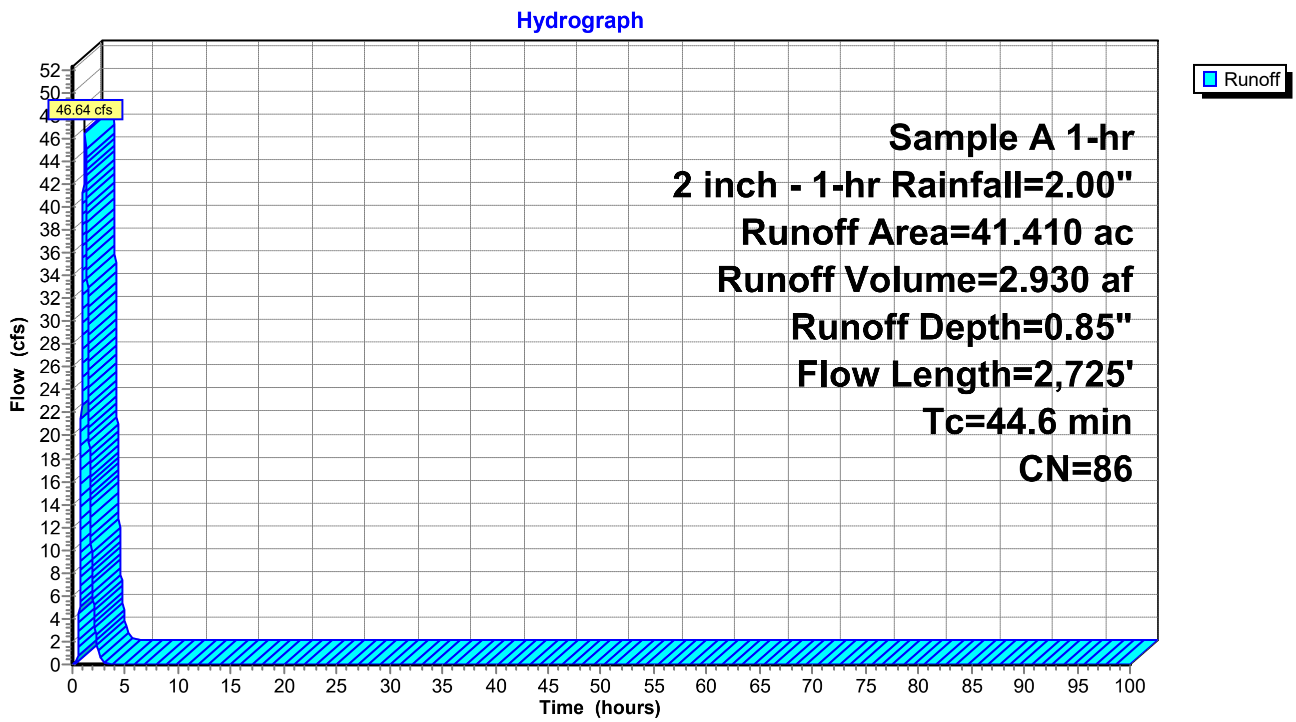
Runoff = 46.64 cfs @ 1.15 hrs, Volume= 2.930 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Drainage Area2



Summary for Subcatchment 4S: Ponded Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

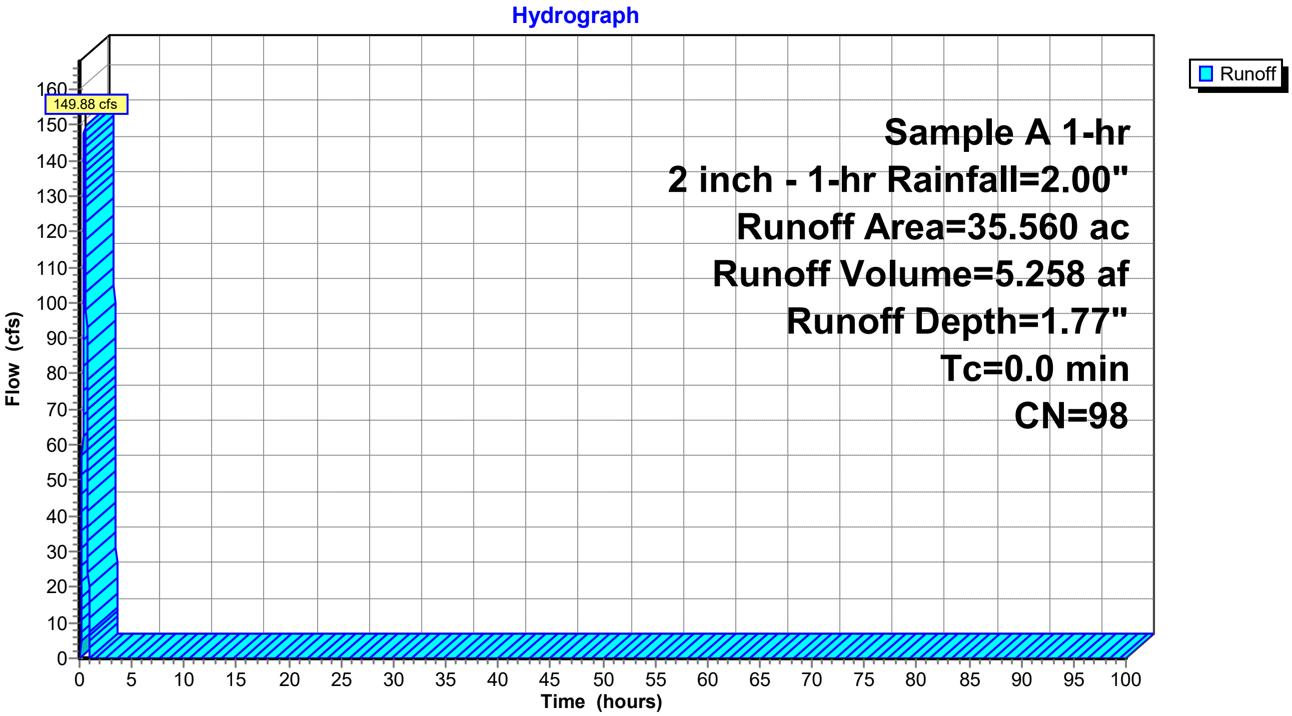
Runoff = 149.88 cfs @ 0.50 hrs, Volume= 5.258 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



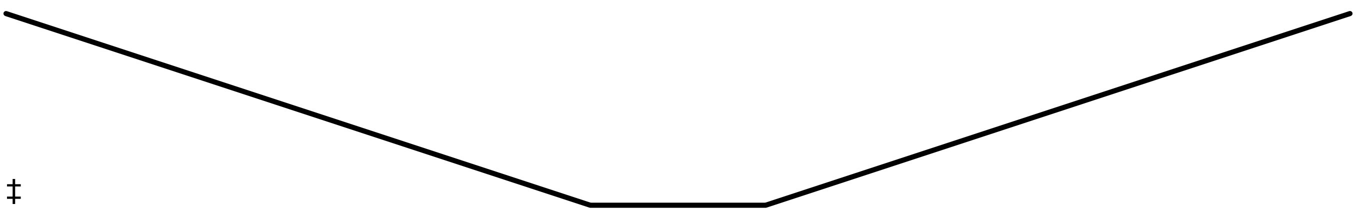
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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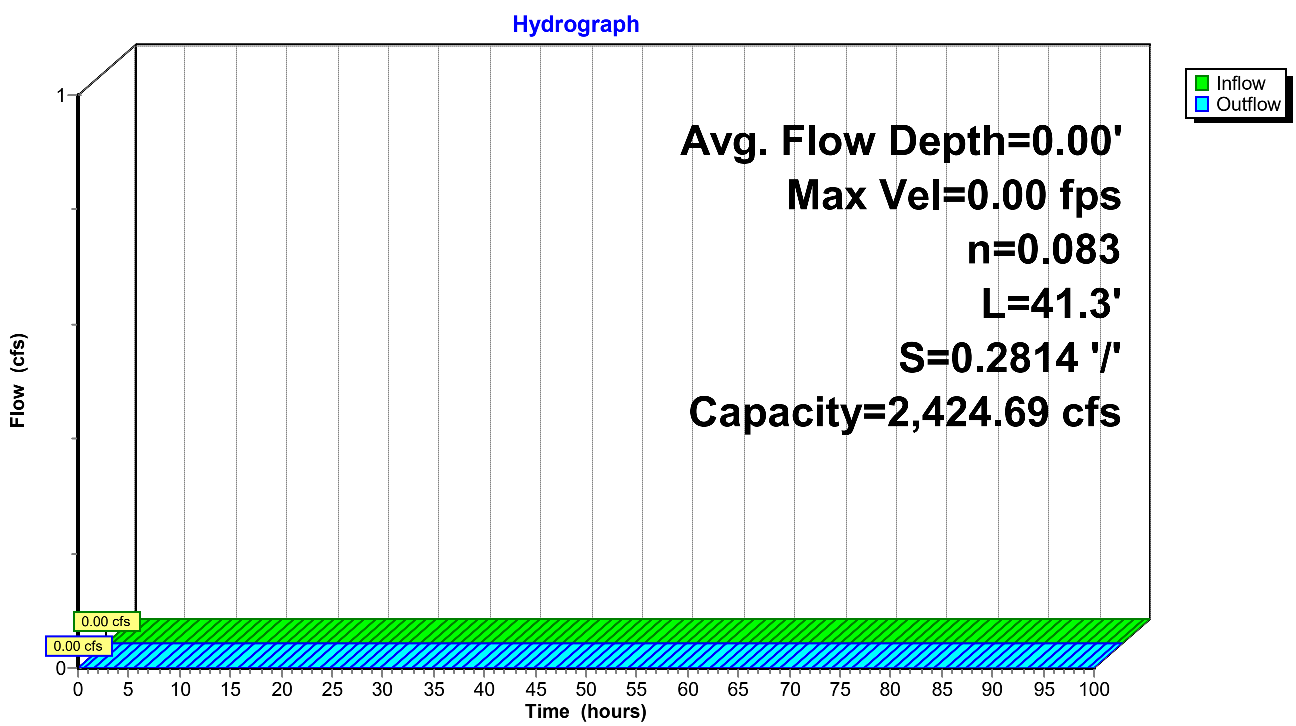
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

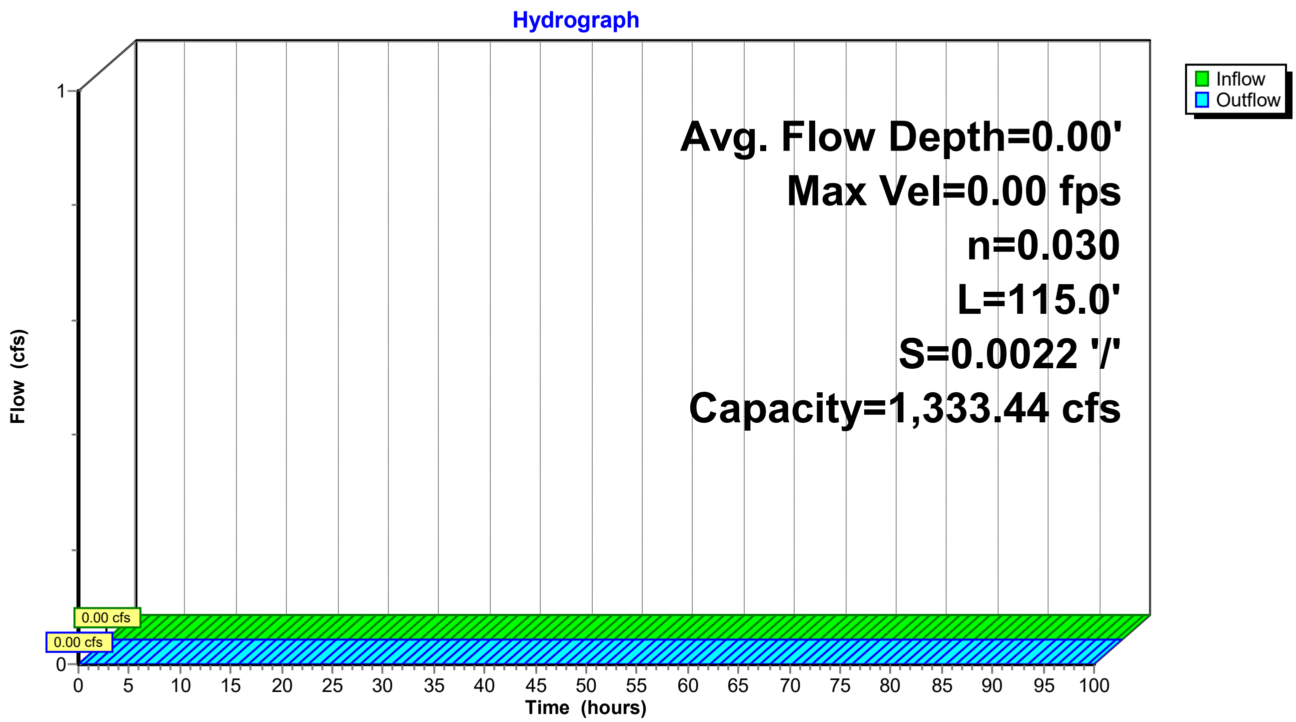
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Breach-Lower Reach

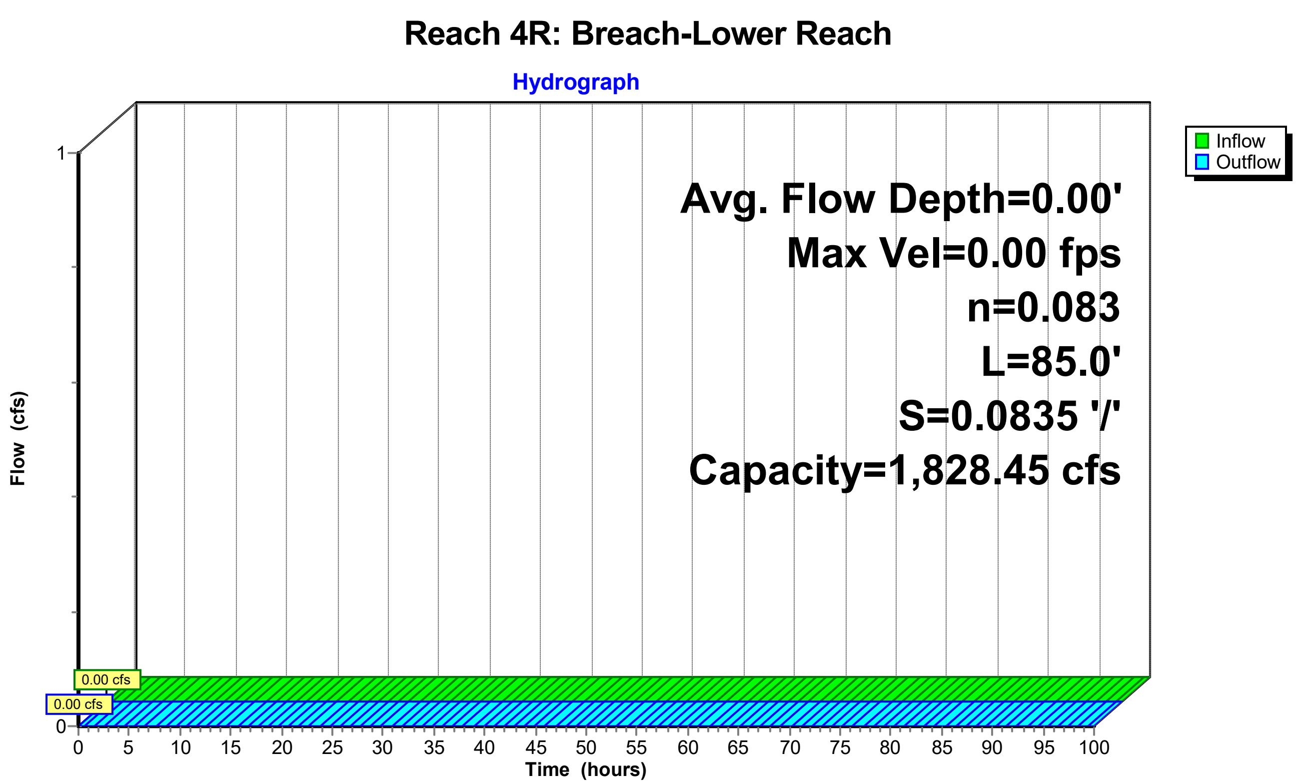
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡



Summary for Reach 5R: Discharge Creek

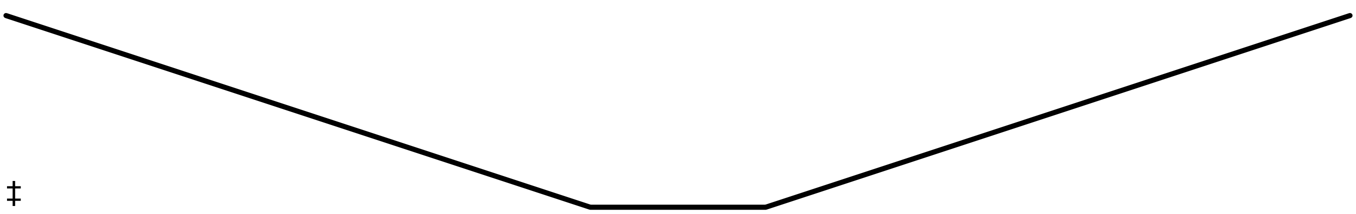
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.26' @ 0.00 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.00" for 2 inch - 1-hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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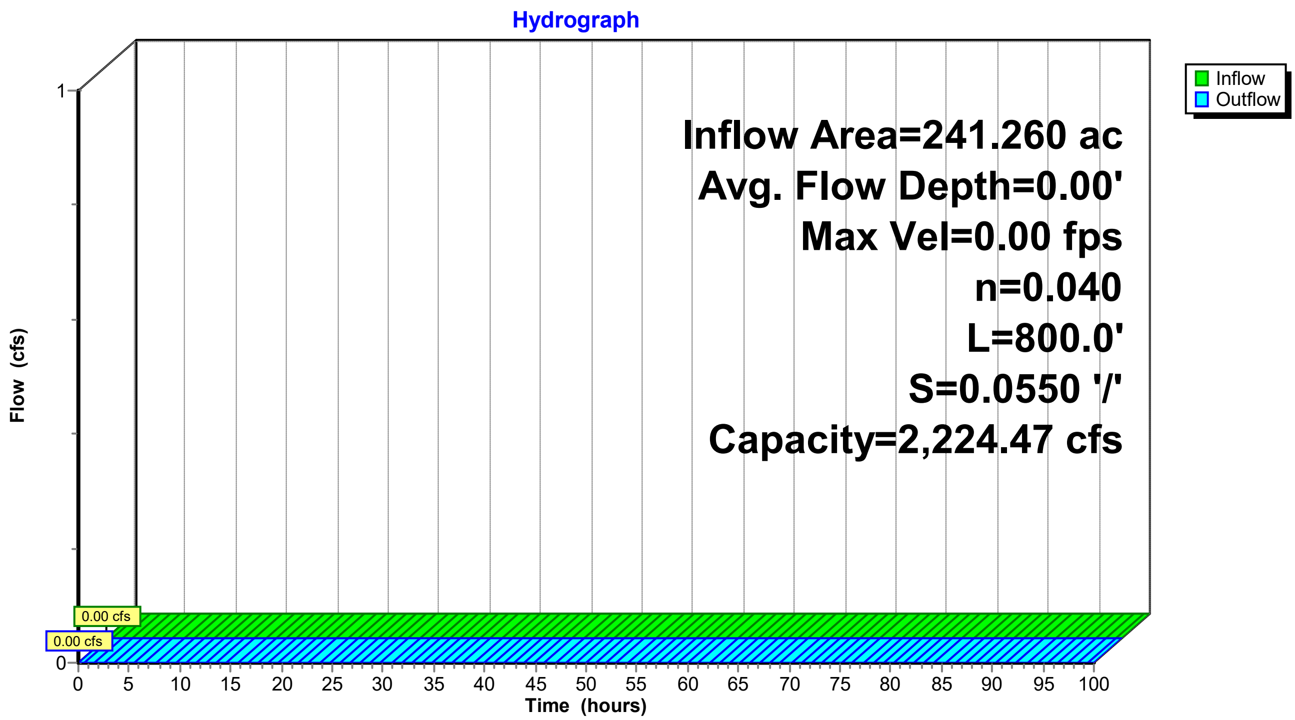
Reach 5R: Discharge Creek



Summary for Reach 6R: Breach - Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

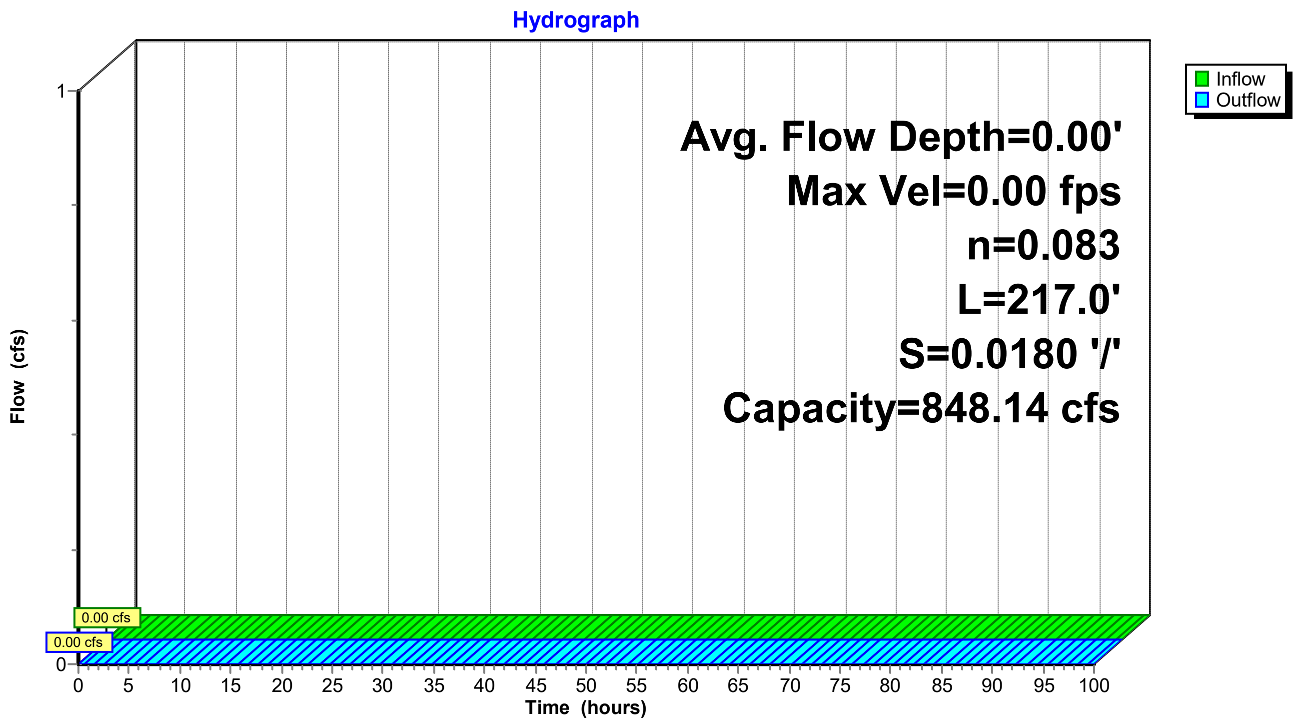
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Breach - Upper Reach



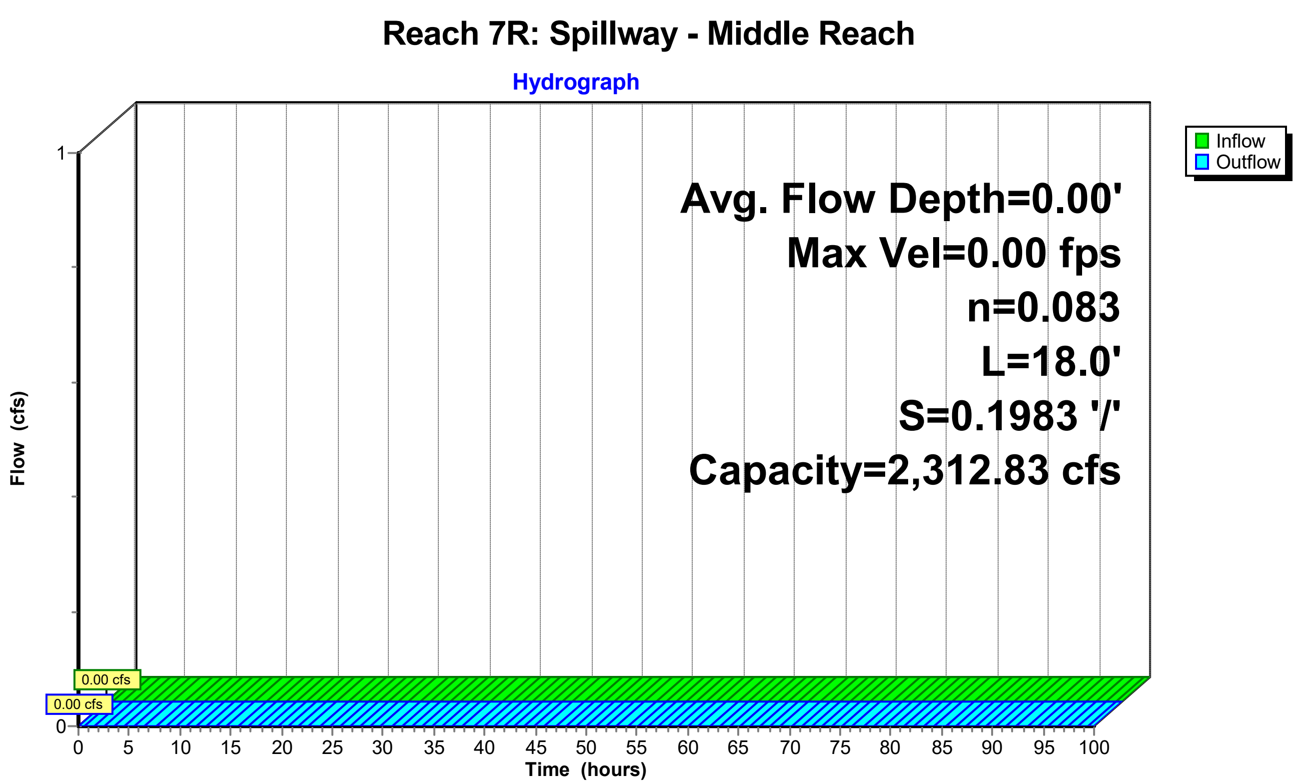
Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'



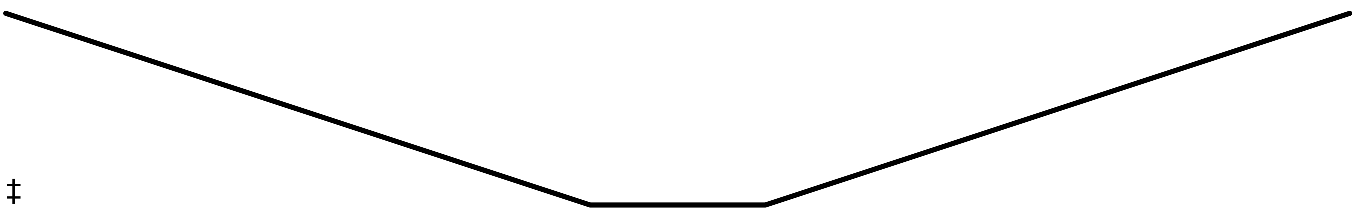
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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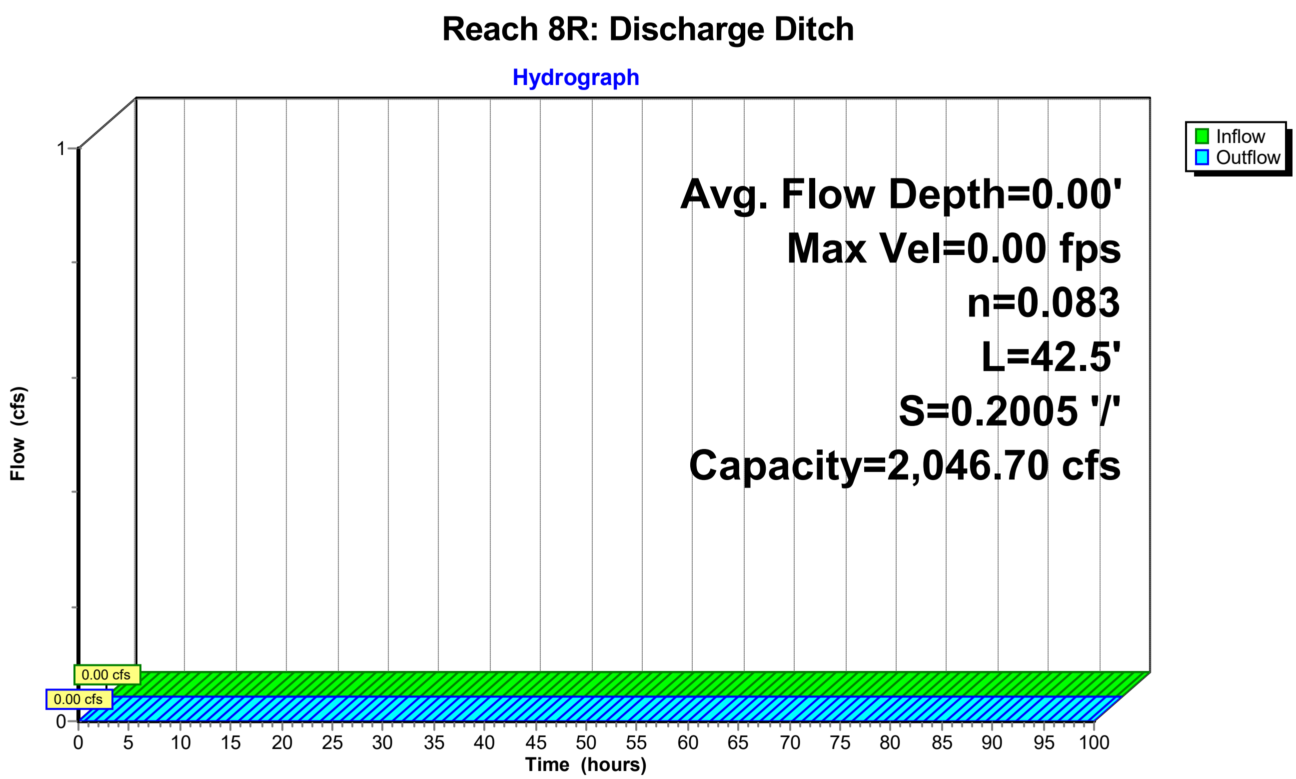


Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow Area = 164.290 ac, 55.73% Impervious, Inflow Depth > 8.70" for 2 inch - 1-hr event
Inflow = 242.08 cfs @ 1.18 hrs, Volume= 119.121 af, Incl. 12.60 cfs Base Flow
Outflow = 22.27 cfs @ 2.35 hrs, Volume= 119.172 af, Atten= 91%, Lag= 69.8 min
Primary = 22.27 cfs @ 2.35 hrs, Volume= 119.172 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 450.41' Surf.Area= 0.000 ac Storage= 78.442 af
Peak Elev= 451.22' @ 2.35 hrs Surf.Area= 0.000 ac Storage= 92.061 af (13.620 af above start)

Plug-Flow detention time= 4,329.6 min calculated for 40.726 af (34% of inflow)
Center-of-Mass det. time= 75.4 min (2,708.0 - 2,632.6)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	889.000 af	**Custom Stage Data** Listed below

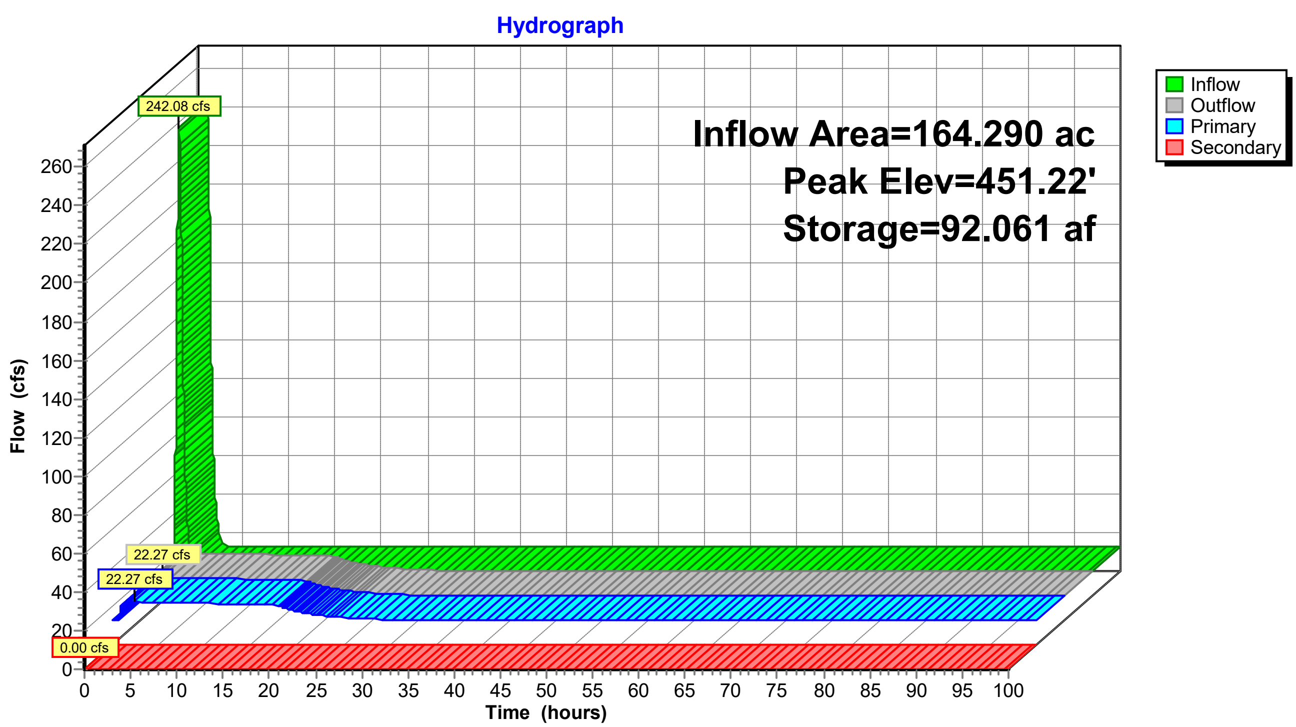
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	8.200
442.00	10.410
443.00	16.000
444.00	19.200
445.00	27.330
446.00	31.840
447.00	42.590
448.00	49.050
449.00	62.870
450.00	71.410
451.00	88.560
452.00	104.620
454.00	144.360
456.00	152.310
458.00	249.410
460.00	342.630
462.00	489.560
464.00	679.630
466.00	889.000

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=22.27 cfs @ 2.35 hrs HW=451.22' TW=441.67' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 22.27 cfs @ 7.85 fps)
  ↑—**2=Orifice/Grate** (Passes 22.27 cfs of 65.13 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=450.41' TW=455.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth > 6.33" for 2 inch - 1-hr event
Inflow = 162.88 cfs @ 0.50 hrs, Volume= 127.360 af
Outflow = 14.52 cfs @ 23.60 hrs, Volume= 118.628 af, Atten= 91%, Lag= 1,386.5 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 23.60 hrs, Volume= 118.628 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 441.00' Surf.Area= 0.000 ac Storage= 152.440 af
Peak Elev= 442.23' @ 23.60 hrs Surf.Area= 0.000 ac Storage= 172.583 af (20.143 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 497.1 min (3,034.0 - 2,536.9)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	441.50'	**Pump** Discharges@450.90' Turns Off@441.01' Flow (gpm)= 6,516.0 6,516.1

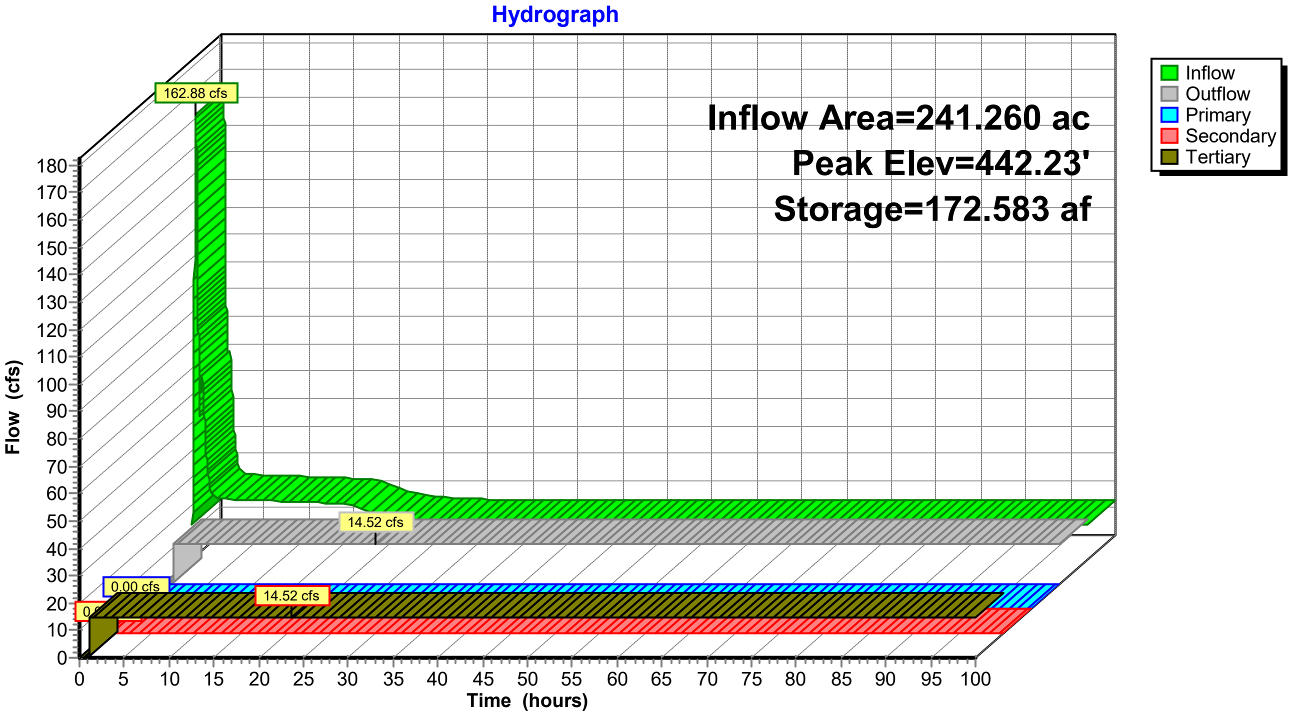
Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.00' TW=428.00' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 115.16 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.00' TW=447.00' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 23.60 hrs HW=442.23' (Free Discharge)
4=Pump (Pump Controls 14.52 cfs)

Pond 2P: Lower Pond



Summary for Subcatchment 2S: Upper Drainage Area

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

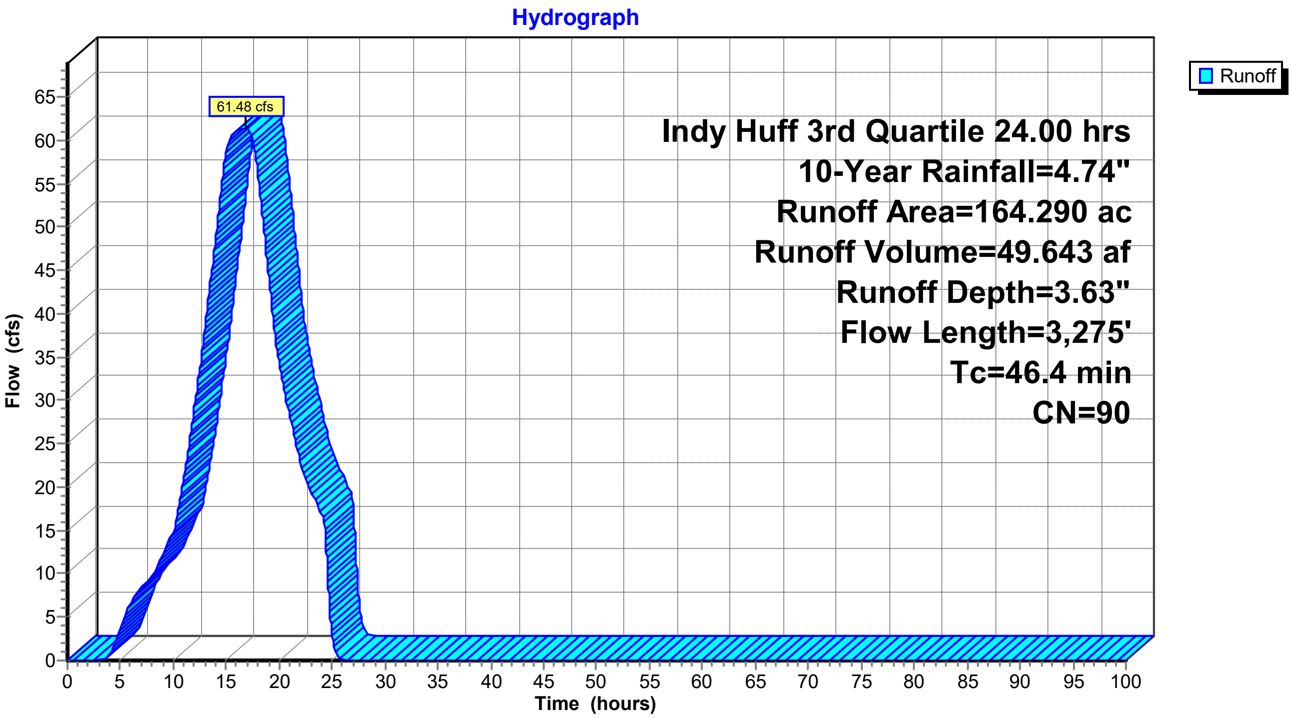
Runoff = 61.48 cfs @ 16.86 hrs, Volume= 49.643 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
	22.630	98	Water Surface, HSG C
	5.590	98	Water Surface, HSG C
*	57.410	98	Ash
*	5.930	98	Water Surface, HSG C
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	300	0.0600	0.33		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.29"
0.8	225	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
46.4	3,275	Total			

Subcatchment 2S: Upper Drainage Area



Summary for Subcatchment 3S: Drainage Area2

see autoCAD file Brown-Ash-Pond-Hydro.dwg for lenghts, slopes for Tc

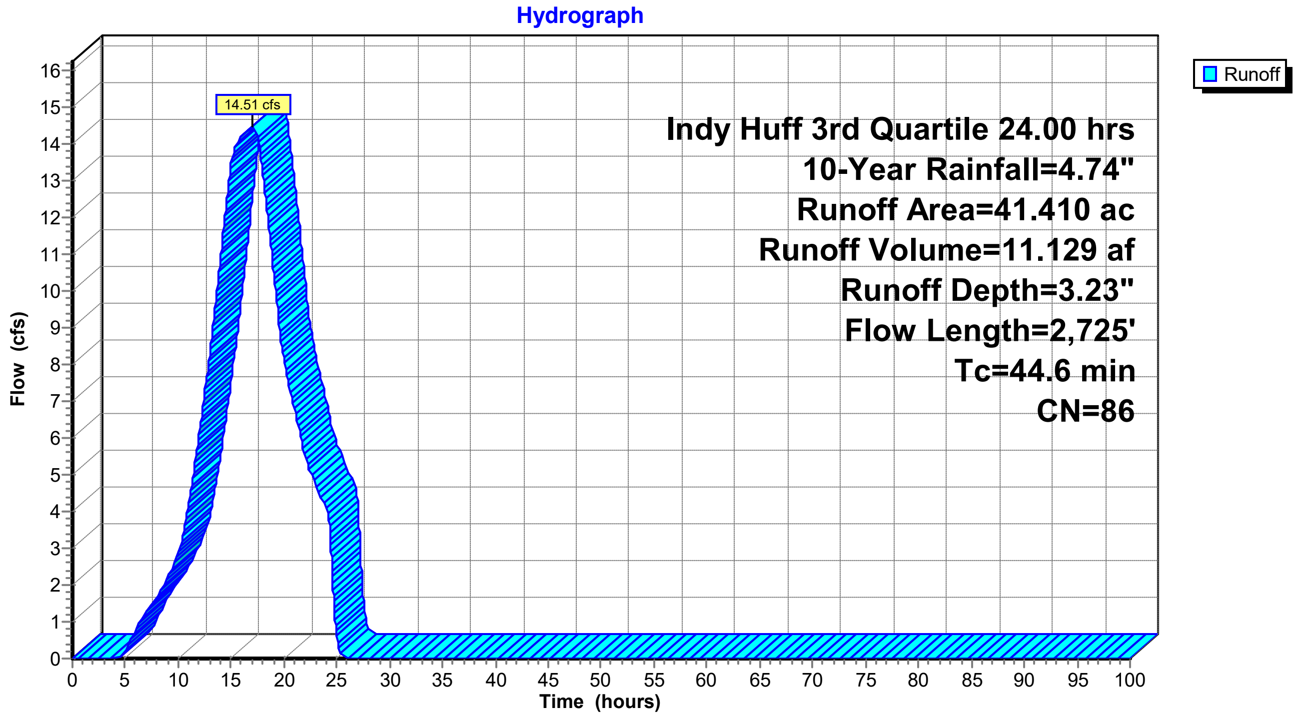
Runoff = 14.51 cfs @ 17.10 hrs, Volume= 11.129 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Drainage Area2



Summary for Subcatchment 4S: Ponded Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

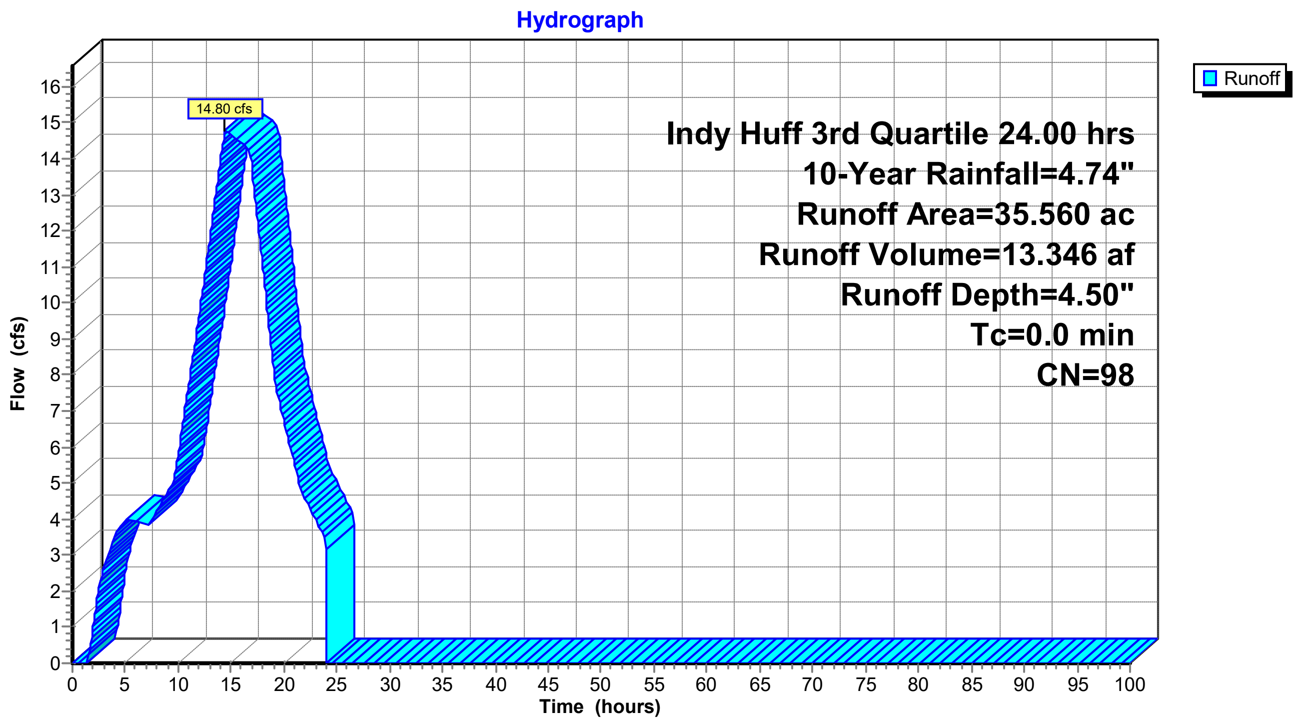
Runoff = 14.80 cfs @ 14.41 hrs, Volume= 13.346 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



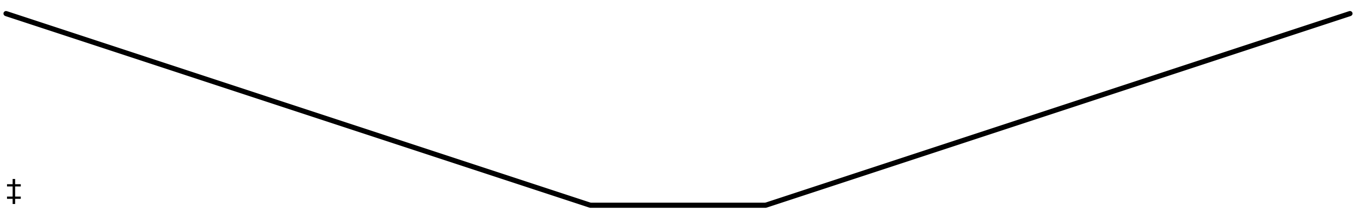
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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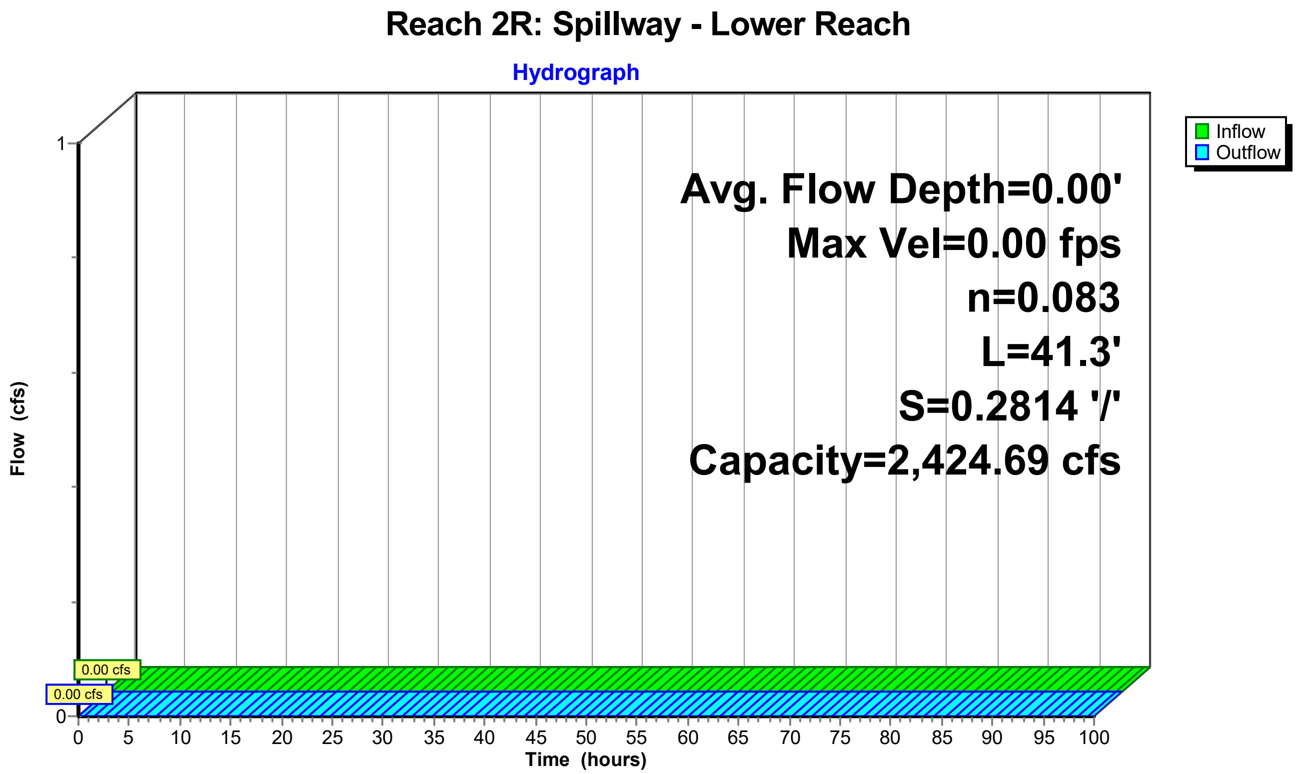


Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

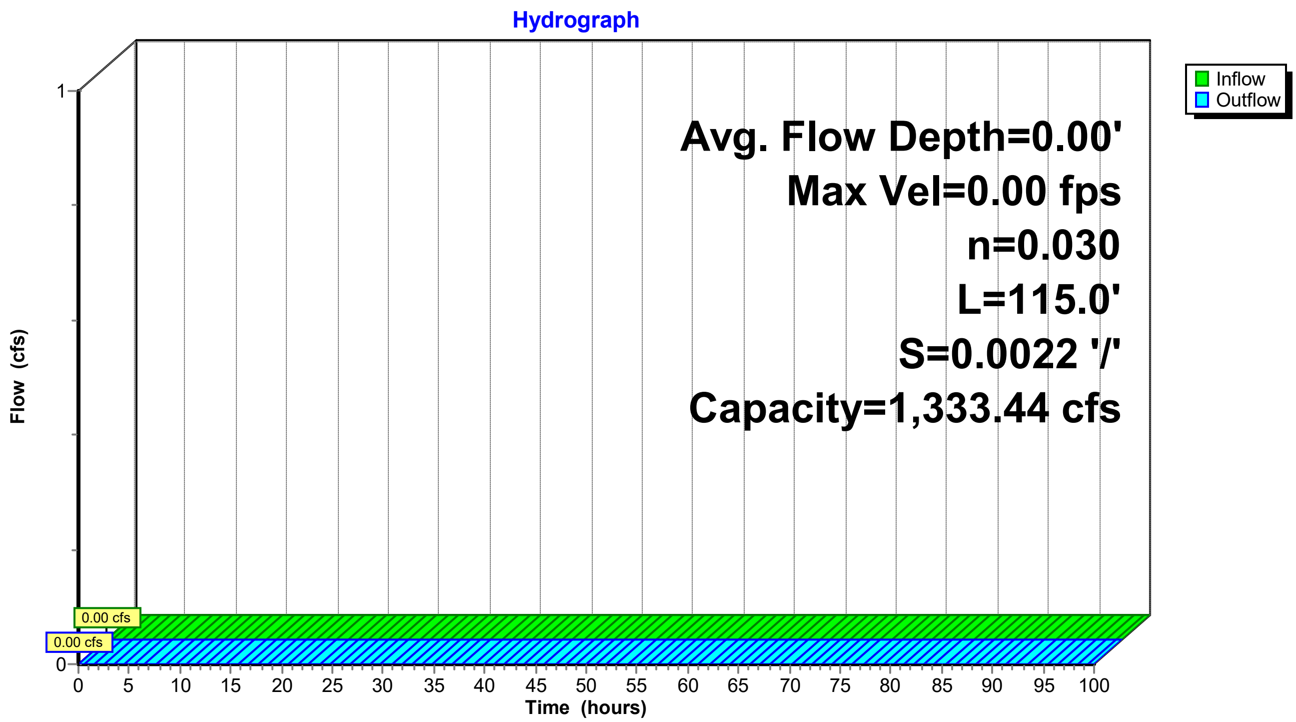
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



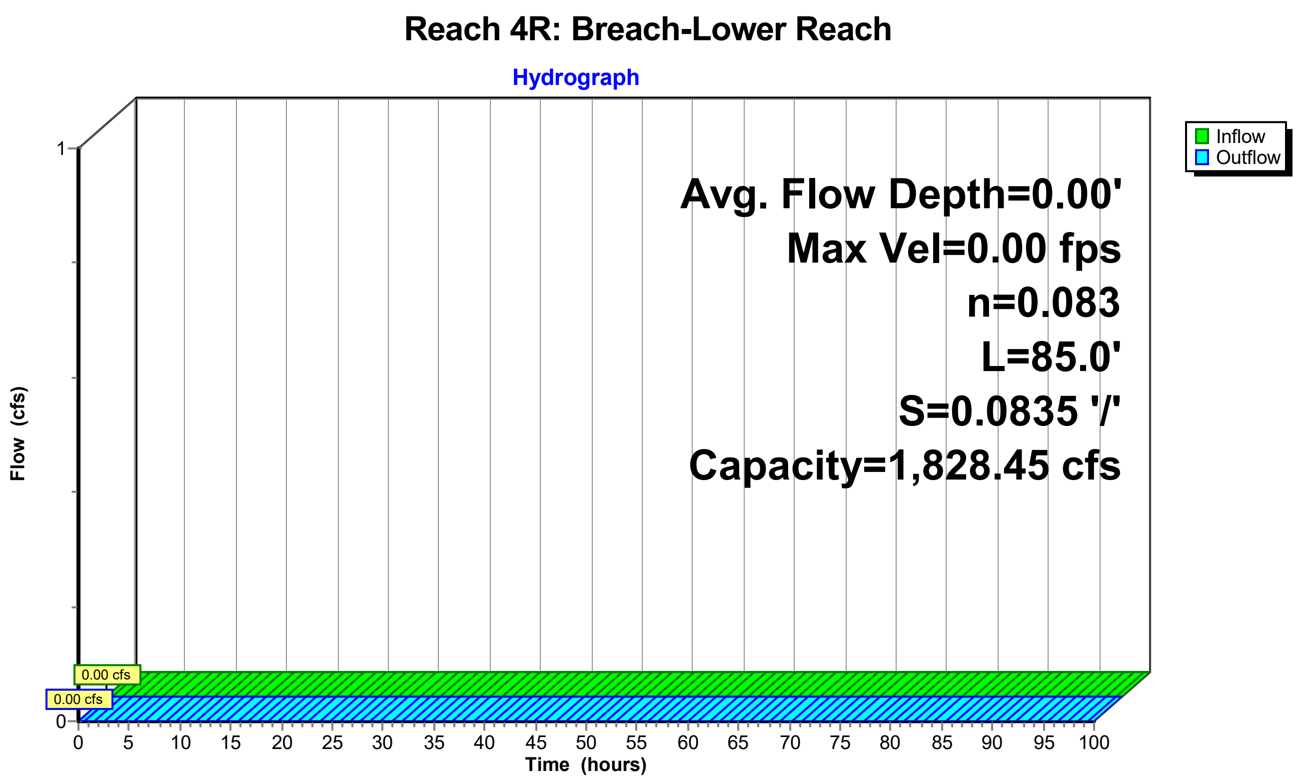
Summary for Reach 4R: Breach-Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'



Summary for Reach 5R: Discharge Creek

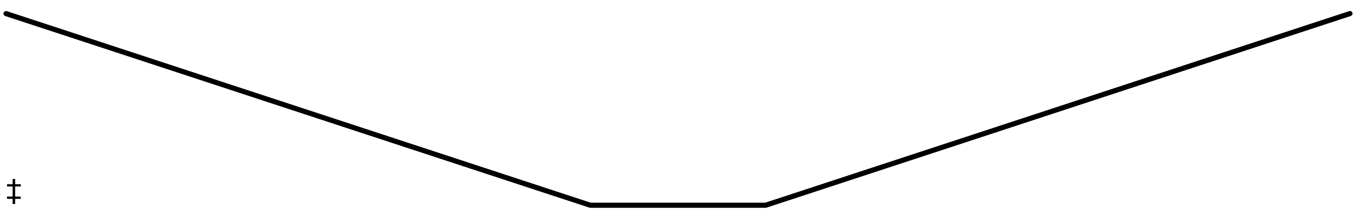
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.27' @ 68.96 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.06 cfs @ 68.77 hrs, Volume= 0.093 af
Outflow = 0.06 cfs @ 68.96 hrs, Volume= 0.093 af, Atten= 0%, Lag= 11.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.16 fps, Min. Travel Time= 11.5 min
Avg. Velocity = 1.16 fps, Avg. Travel Time= 11.5 min

Peak Storage= 43 cf @ 68.96 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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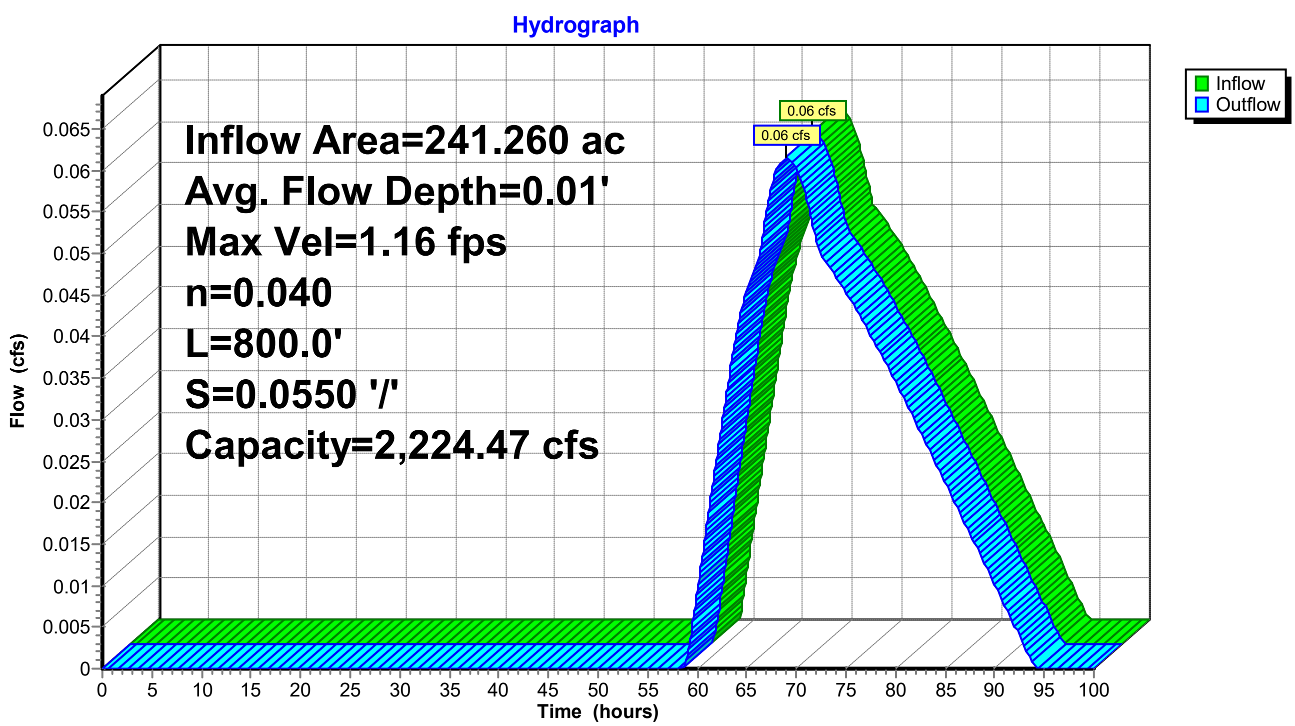
Reach 5R: Discharge Creek



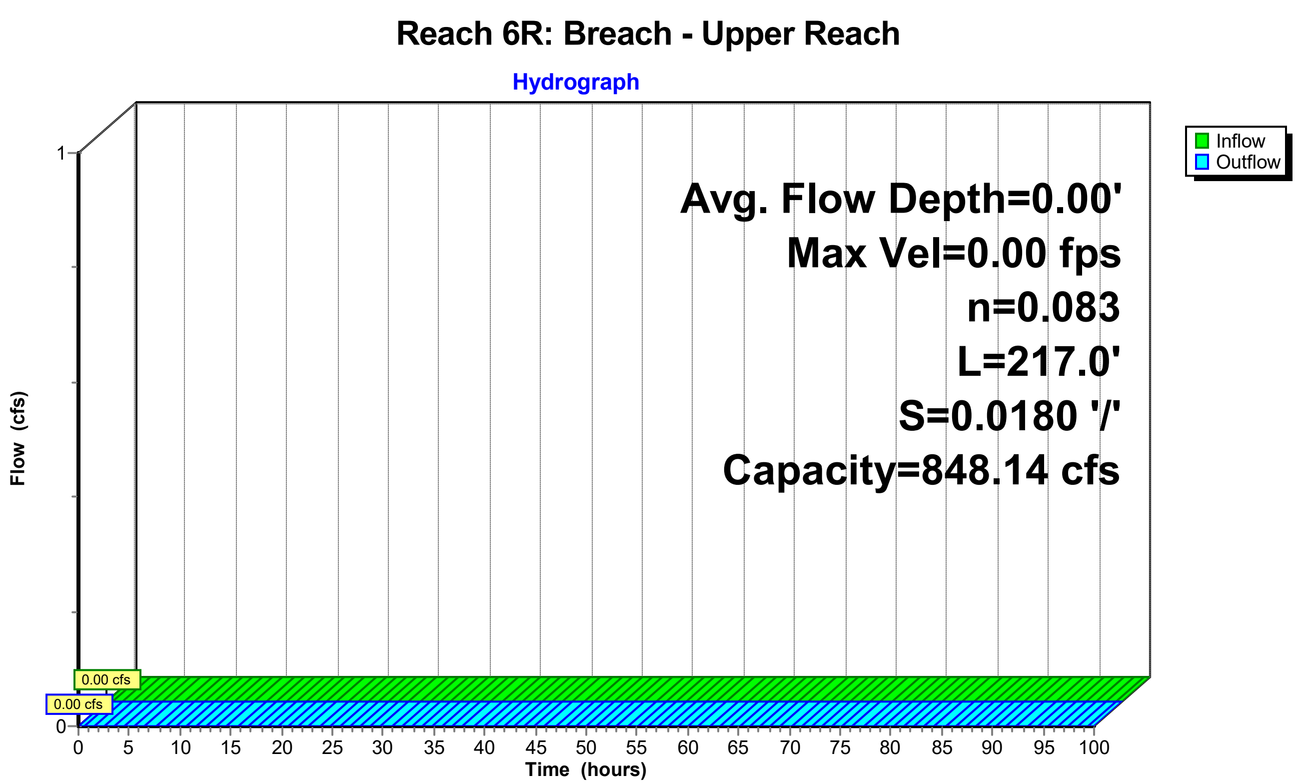
Summary for Reach 6R: Breach - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'



Summary for Reach 7R: Spillway - Middle Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

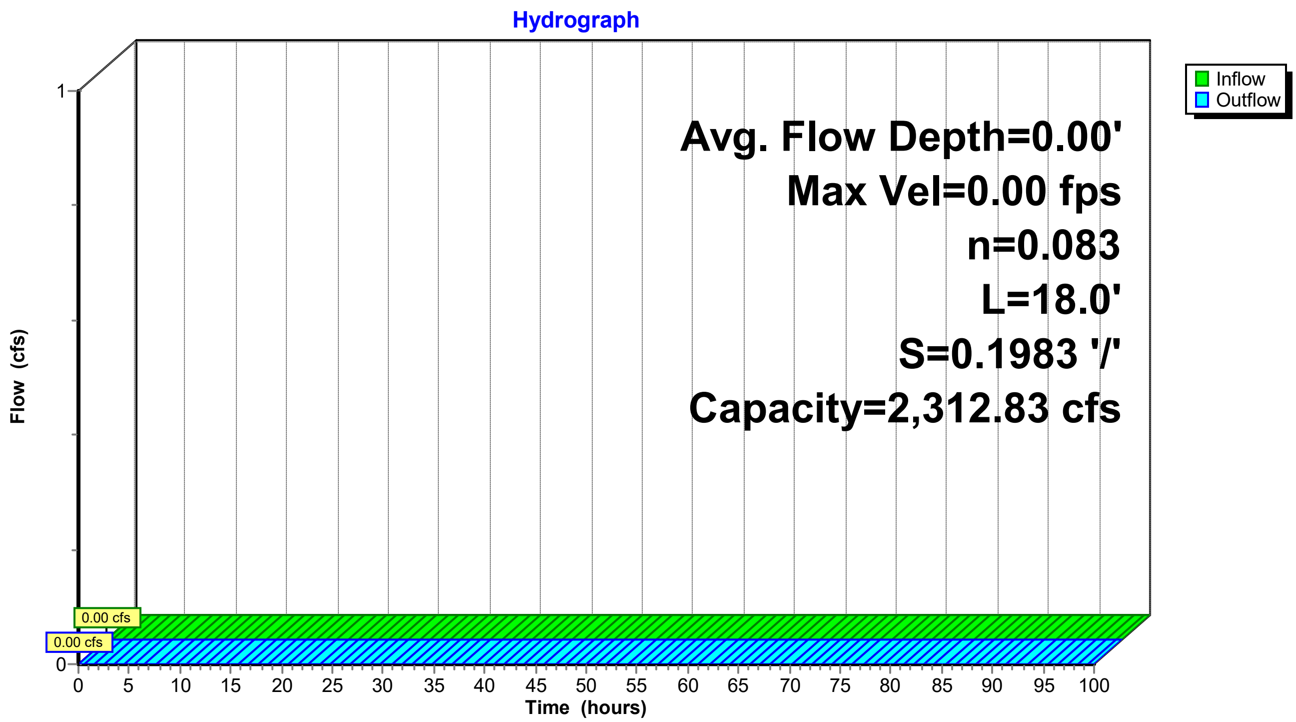
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



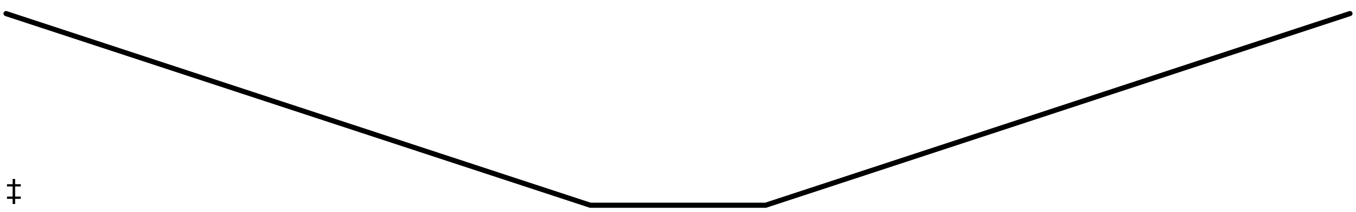
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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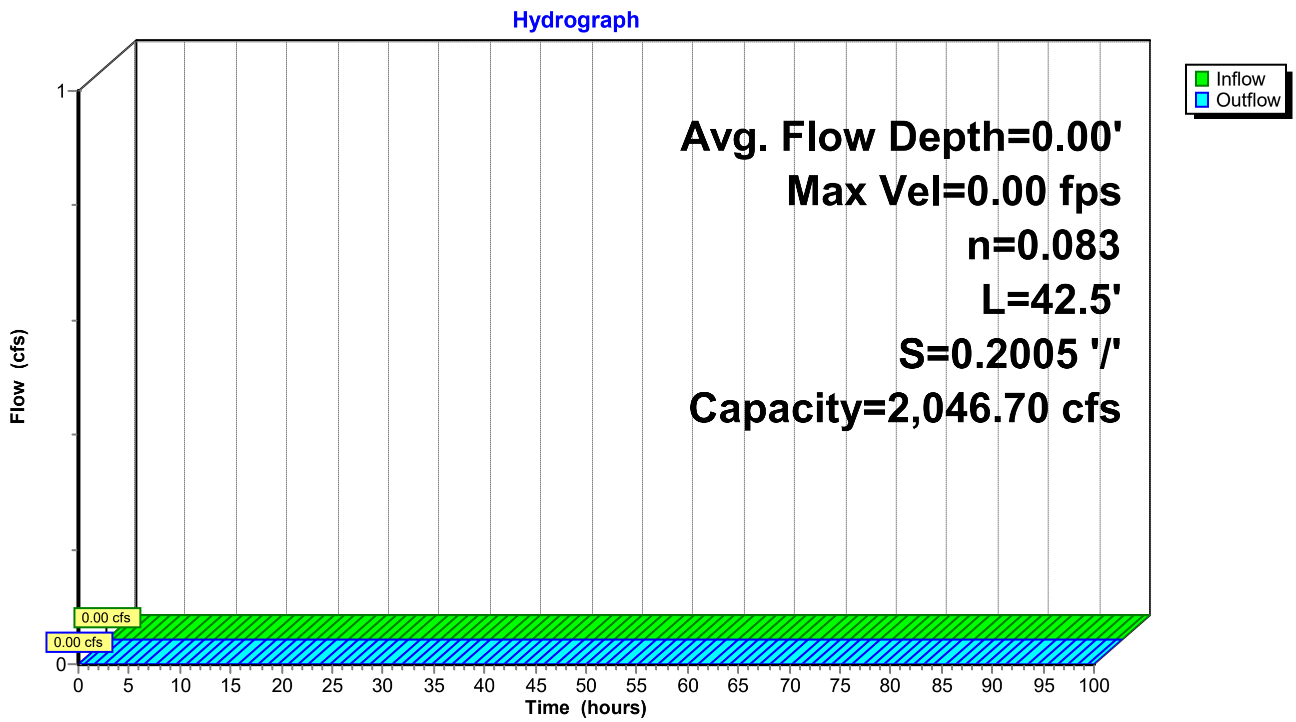
Reach 8R: Discharge Ditch



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow Area = 164.290 ac, 55.73% Impervious, Inflow Depth > 11.23" for 10-Year event
Inflow = 74.08 cfs @ 16.86 hrs, Volume= 153.786 af, Incl. 12.60 cfs Base Flow
Outflow = 25.26 cfs @ 24.45 hrs, Volume= 153.836 af, Atten= 66%, Lag= 455.5 min
Primary = 25.26 cfs @ 24.45 hrs, Volume= 153.836 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 450.41' Surf.Area= 0.000 ac Storage= 78.442 af
Peak Elev= 452.45' @ 24.45 hrs Surf.Area= 0.000 ac Storage= 113.464 af (35.023 af above start)

Plug-Flow detention time= 3,202.1 min calculated for 75.382 af (49% of inflow)
Center-of-Mass det. time= 390.5 min (2,734.8 - 2,344.3)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	889.000 af	**Custom Stage Data** Listed below

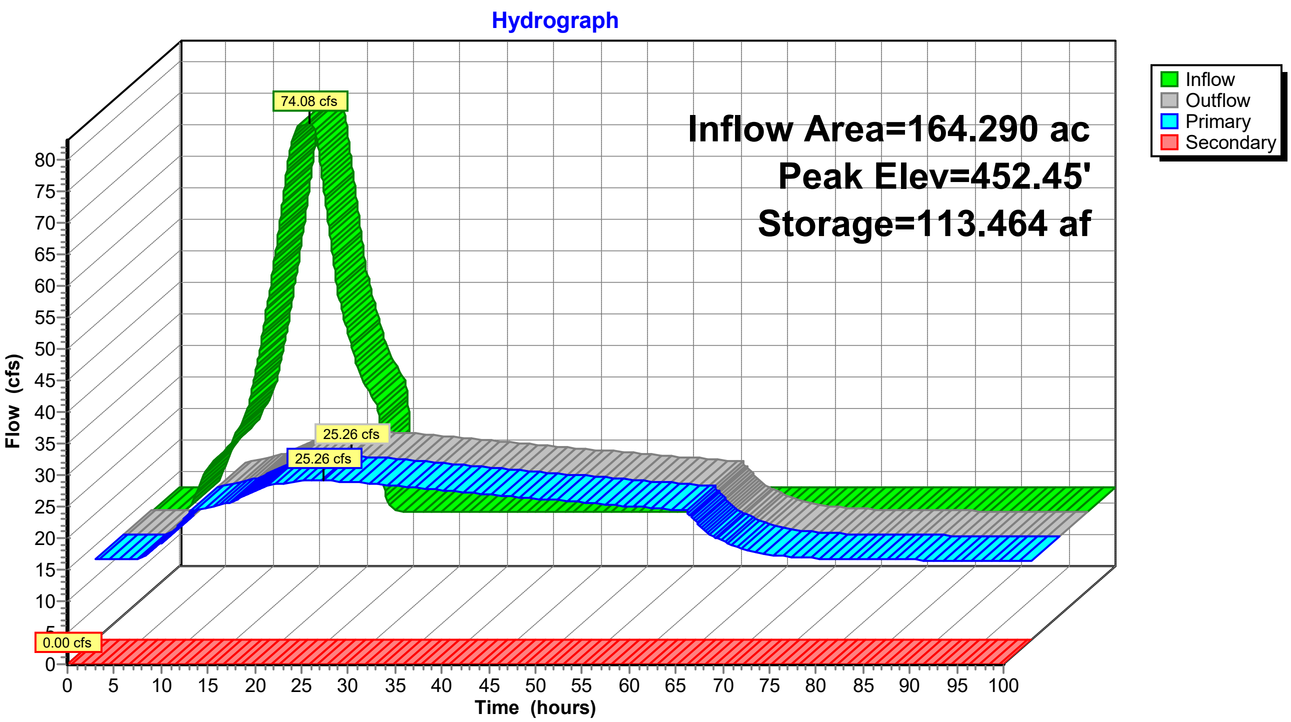
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	8.200
442.00	10.410
443.00	16.000
444.00	19.200
445.00	27.330
446.00	31.840
447.00	42.590
448.00	49.050
449.00	62.870
450.00	71.410
451.00	88.560
452.00	104.620
454.00	144.360
456.00	152.310
458.00	249.410
460.00	342.630
462.00	489.560
464.00	679.630
466.00	889.000

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=25.26 cfs @ 24.45 hrs HW=452.45' TW=443.19' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 25.26 cfs @ 8.91 fps)
  └─**2=Orifice/Grate** (Passes 25.26 cfs of 131.55 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=450.41' TW=455.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

[62] Hint: Exceeded Reach 4R OUTLET depth by 0.08' @ 68.77 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth > 8.87" for 10-Year event
Inflow = 52.12 cfs @ 16.80 hrs, Volume= 178.311 af
Outflow = 14.58 cfs @ 68.77 hrs, Volume= 112.750 af, Atten= 72%, Lag= 3,118.2 min
Primary = 0.06 cfs @ 68.77 hrs, Volume= 0.093 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 68.77 hrs, Volume= 112.657 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 441.00' Surf.Area= 0.000 ac Storage= 152.440 af
Peak Elev= 444.08' @ 68.77 hrs Surf.Area= 0.000 ac Storage= 222.299 af (69.859 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 699.0 min (3,184.3 - 2,485.3)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

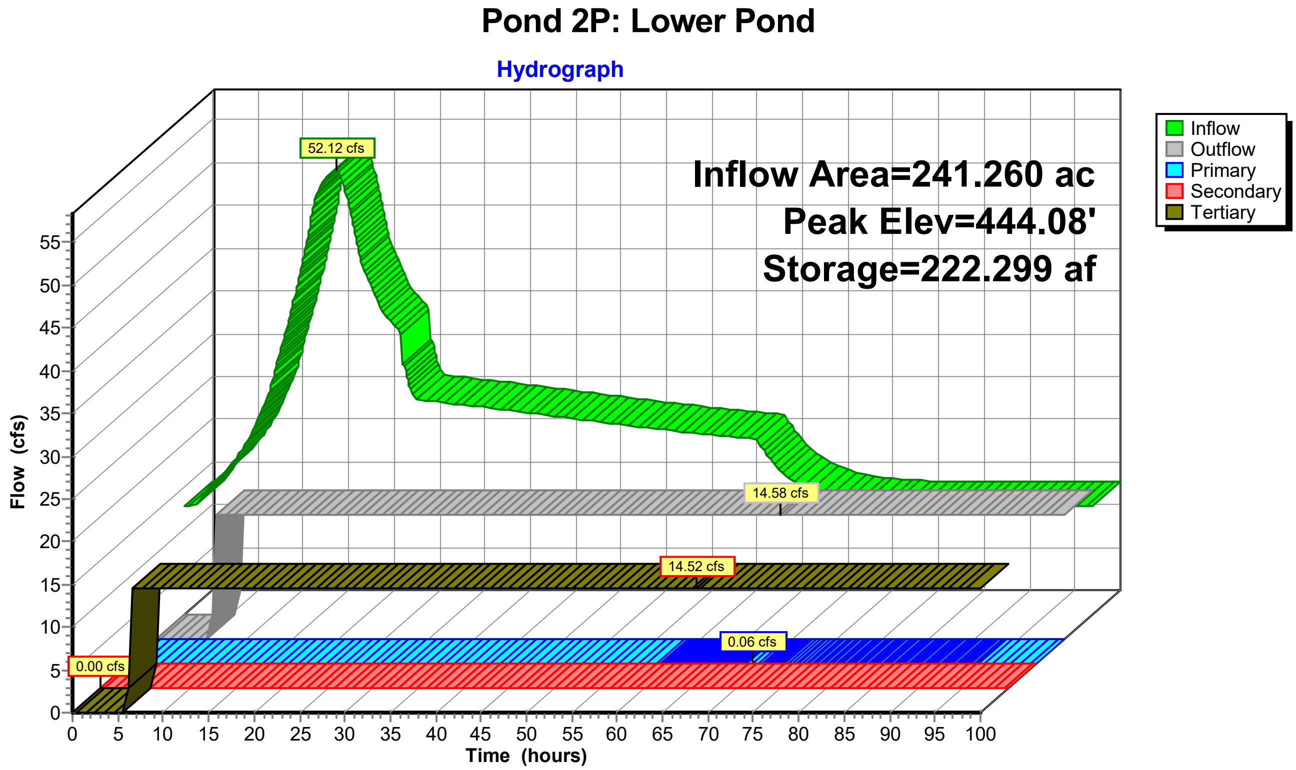
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	441.50'	**Pump**

Discharges@450.90' Turns Off@441.01'
Flow (gpm)= 6,516.0 6,516.1
Head (feet)= 500.00 0.00

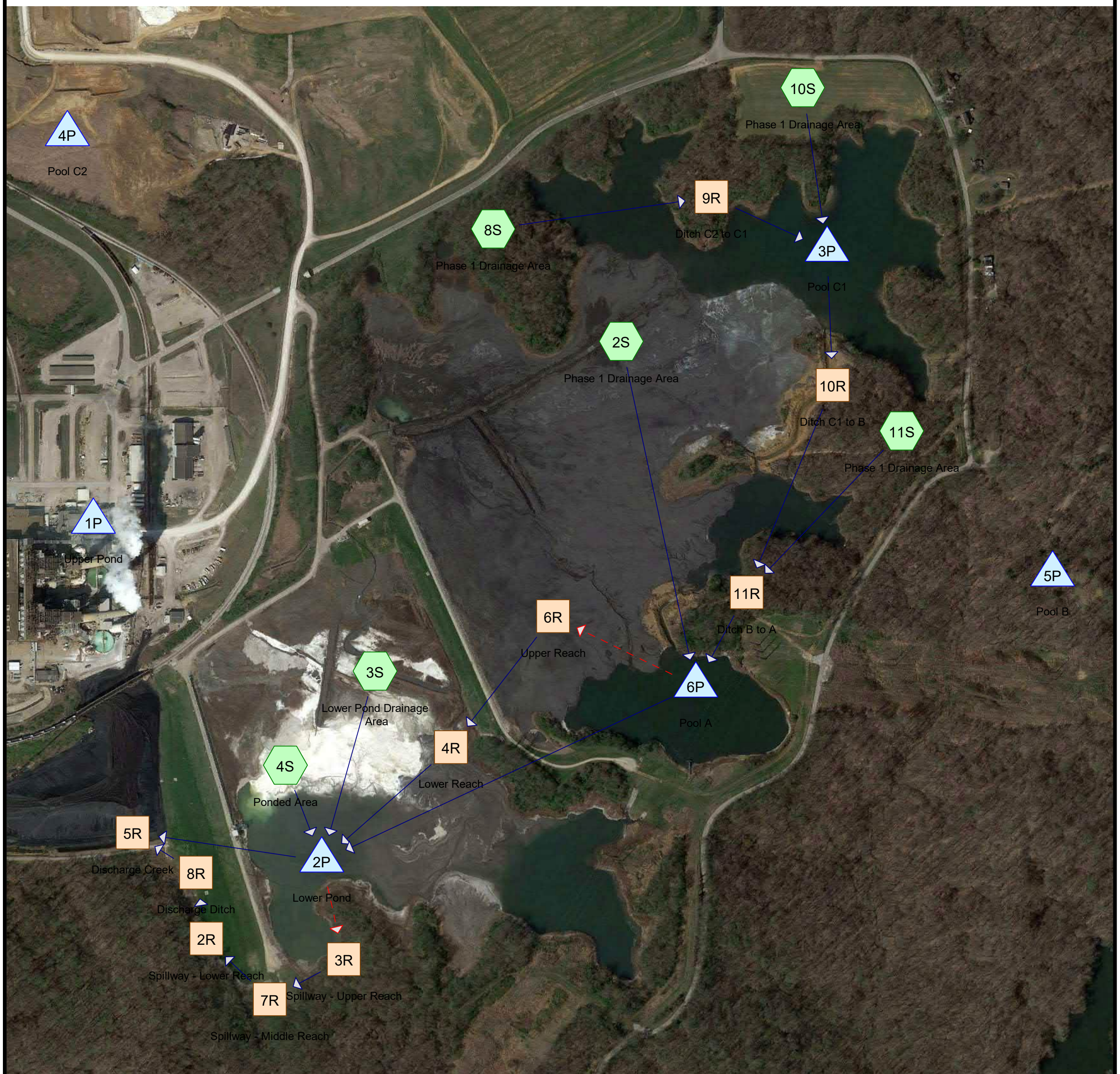
Primary OutFlow Max=0.06 cfs @ 68.77 hrs HW=444.08' TW=428.01' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.06 cfs of 128.06 cfs potential flow)
└─**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 0.99 fps)

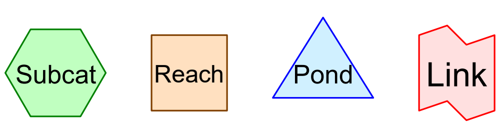
Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 68.77 hrs HW=444.08' (Free Discharge)
└─**4=Pump** (Pump Controls 14.52 cfs)



MILESTONE 1





Routing Diagram for Brown - Phase 1_End
Prepared by AECOM, Printed 10/15/2021
HydroCAD® 10.00 s/n 01723 © 2013 HydroCAD Software Solutions LLC

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchm Numbers
0.000	0.000	99.830	0.000	0.000	99.830	50-75% Grass cover, Fair	
0.000	0.000	0.000	0.000	71.720	71.720	Ash	
0.000	0.000	0.000	0.000	11.532	11.532	Ash (Due to Pool C2 being dry)	
0.000	0.000	0.000	0.000	14.760	14.760	Ash from dewatering	
0.000	0.000	0.000	0.000	1.440	1.440	Ash within Pool Limits - Dewatered	
0.000	0.000	35.560	0.000	0.000	35.560	Water Surface	
0.000	0.000	0.000	0.000	4.490	4.490	Water Surface (Pools A, B, C1, C2)	
0.000	0.000	0.000	0.000	1.930	1.930	Water Surface (Pools C1)	
0.000	**0.000**	**135.390**	**0.000**	**105.872**	**241.262**	**TOTAL AREA**	

Summary for Subcatchment 2S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

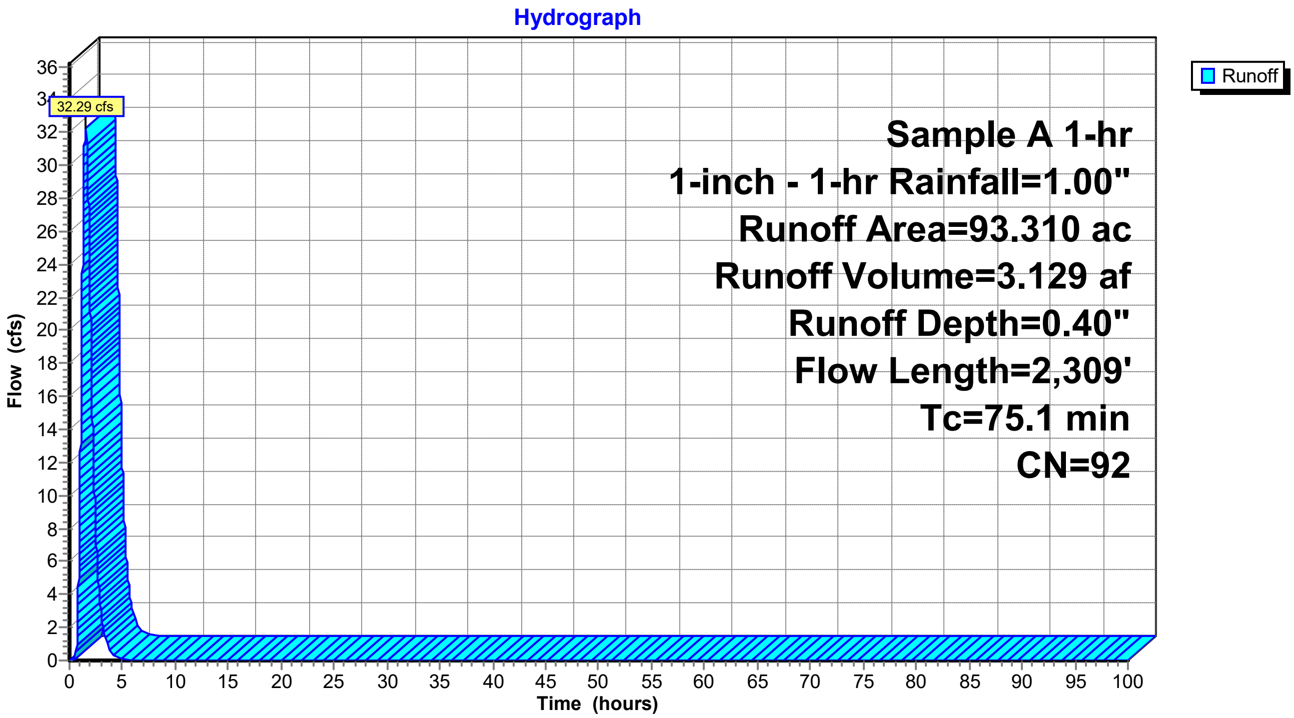
Runoff = 32.29 cfs @ 1.58 hrs, Volume= 3.129 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
*	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

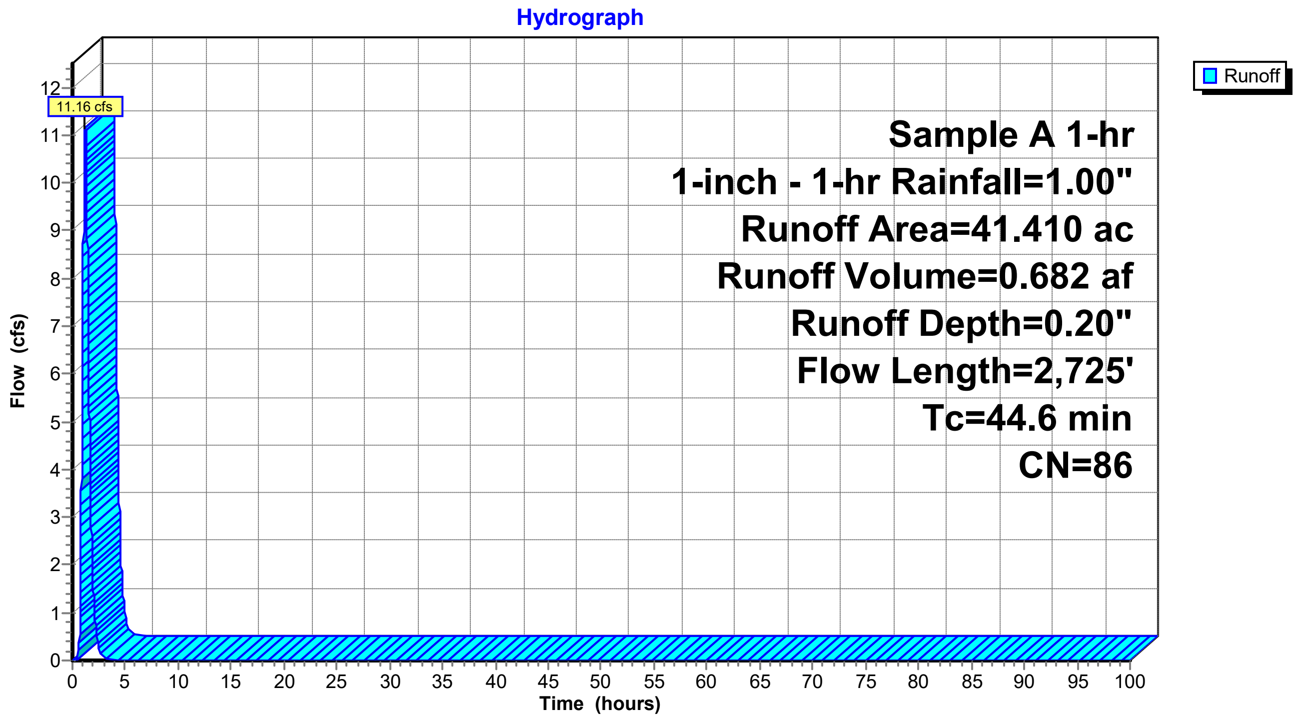
Runoff = 11.16 cfs @ 1.23 hrs, Volume= 0.682 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

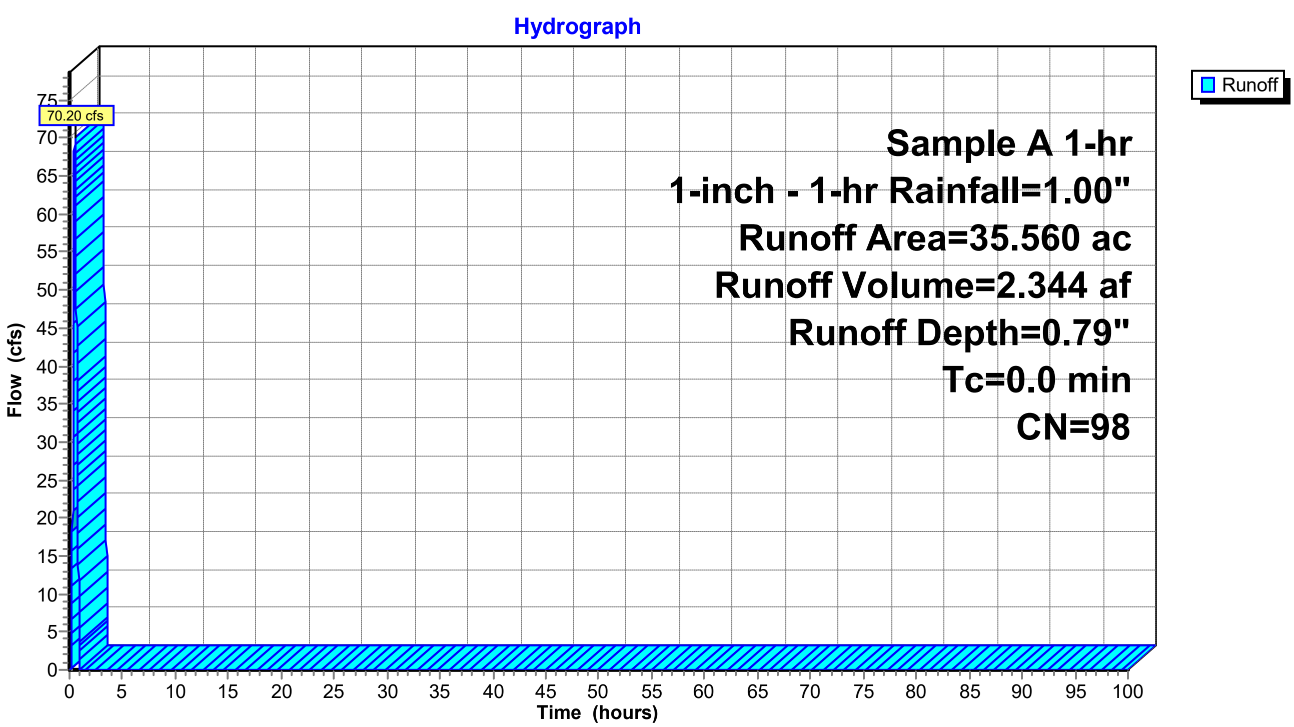
Runoff = 70.20 cfs @ 0.50 hrs, Volume= 2.344 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

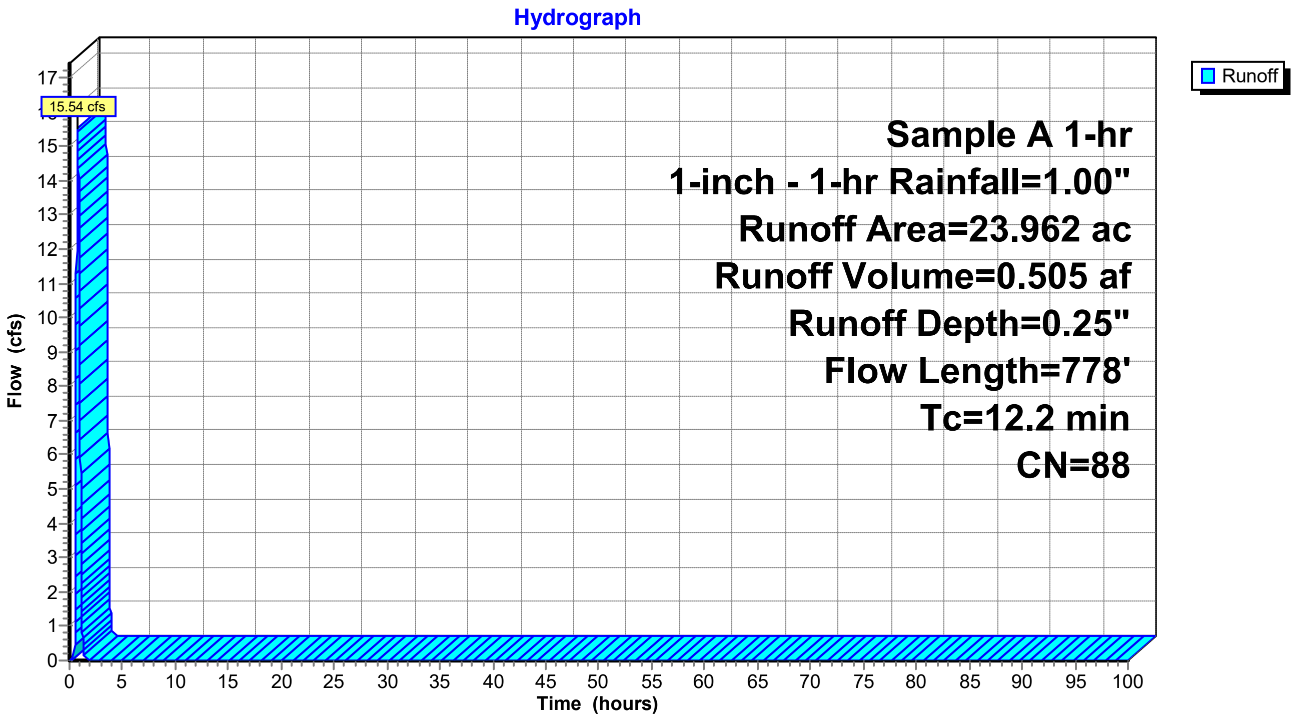
Runoff = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

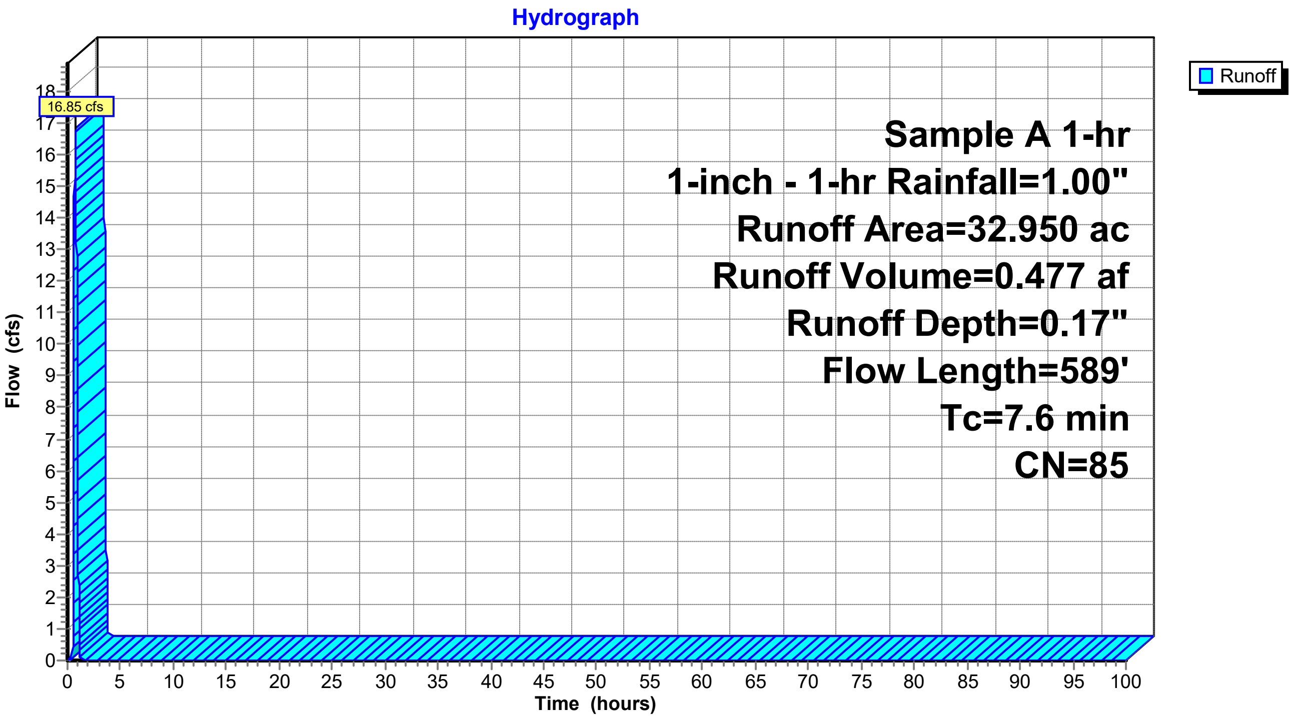
Runoff = 16.85 cfs @ 0.73 hrs, Volume= 0.477 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

EndPhase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

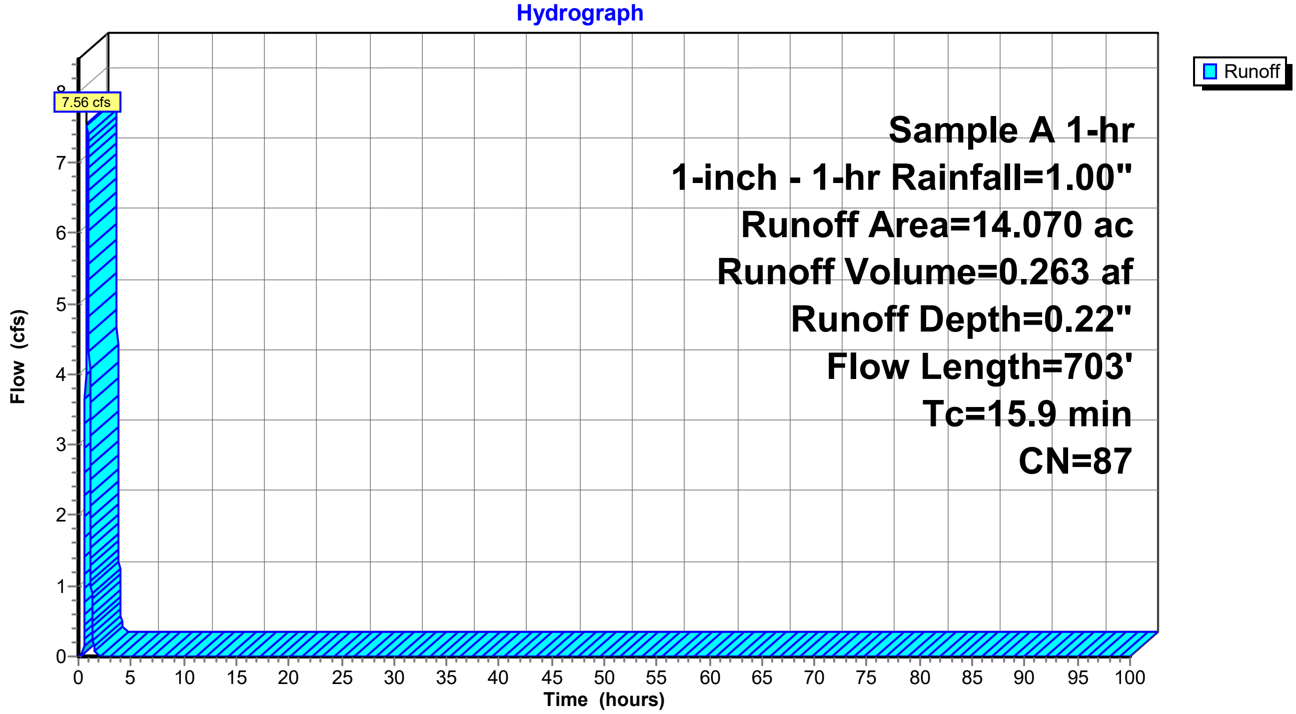
Runoff = 7.56 cfs @ 0.84 hrs, Volume= 0.263 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



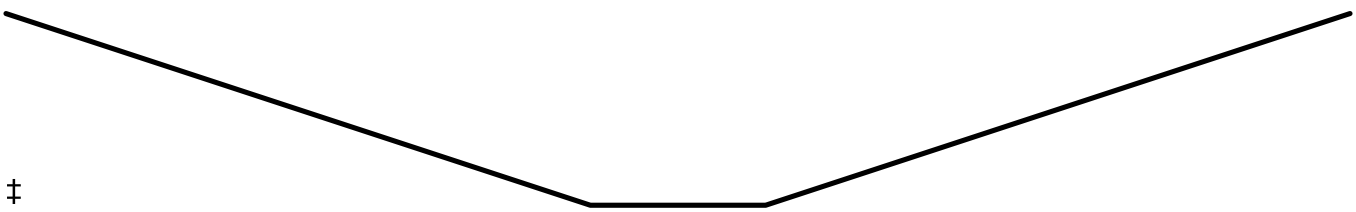
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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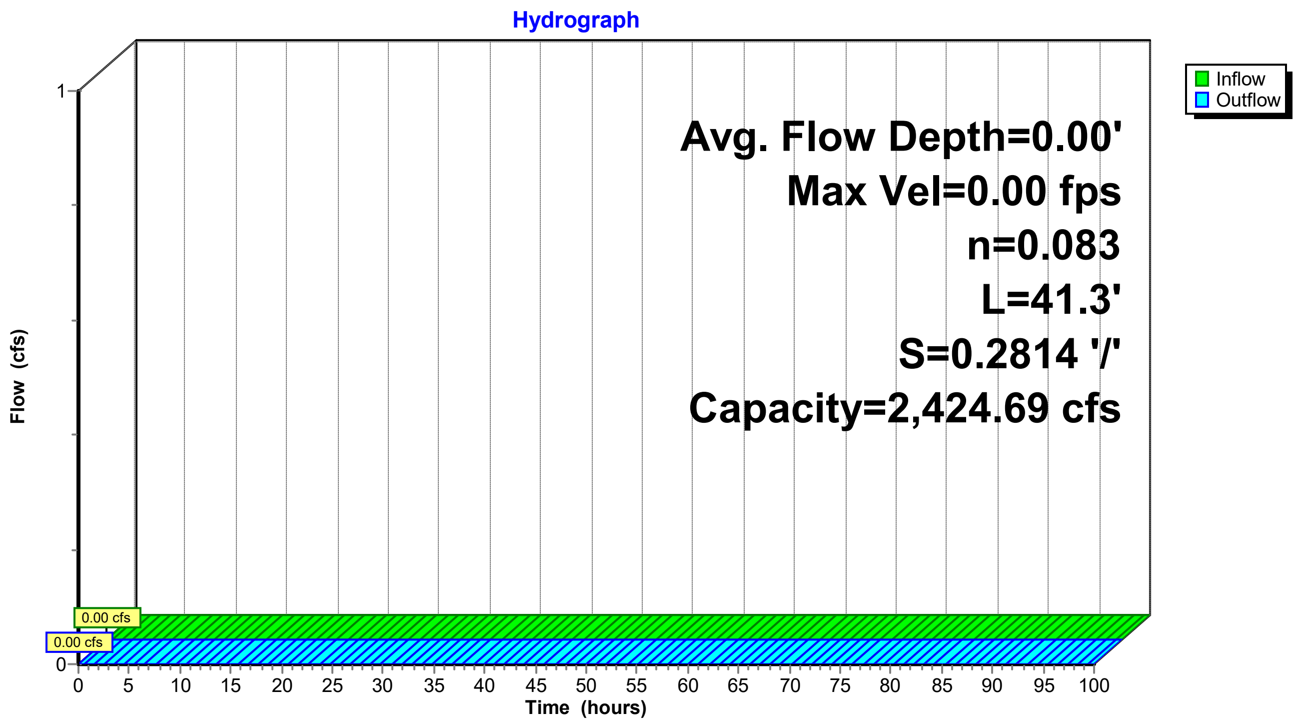
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

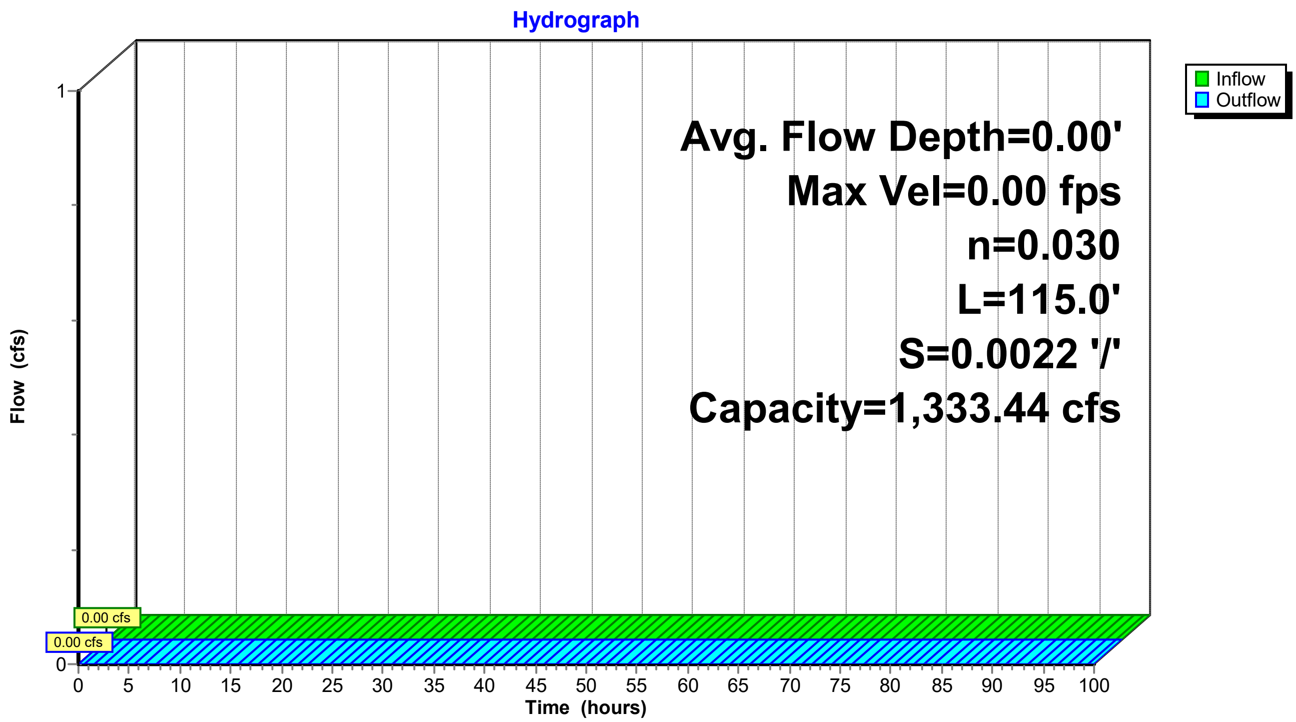
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

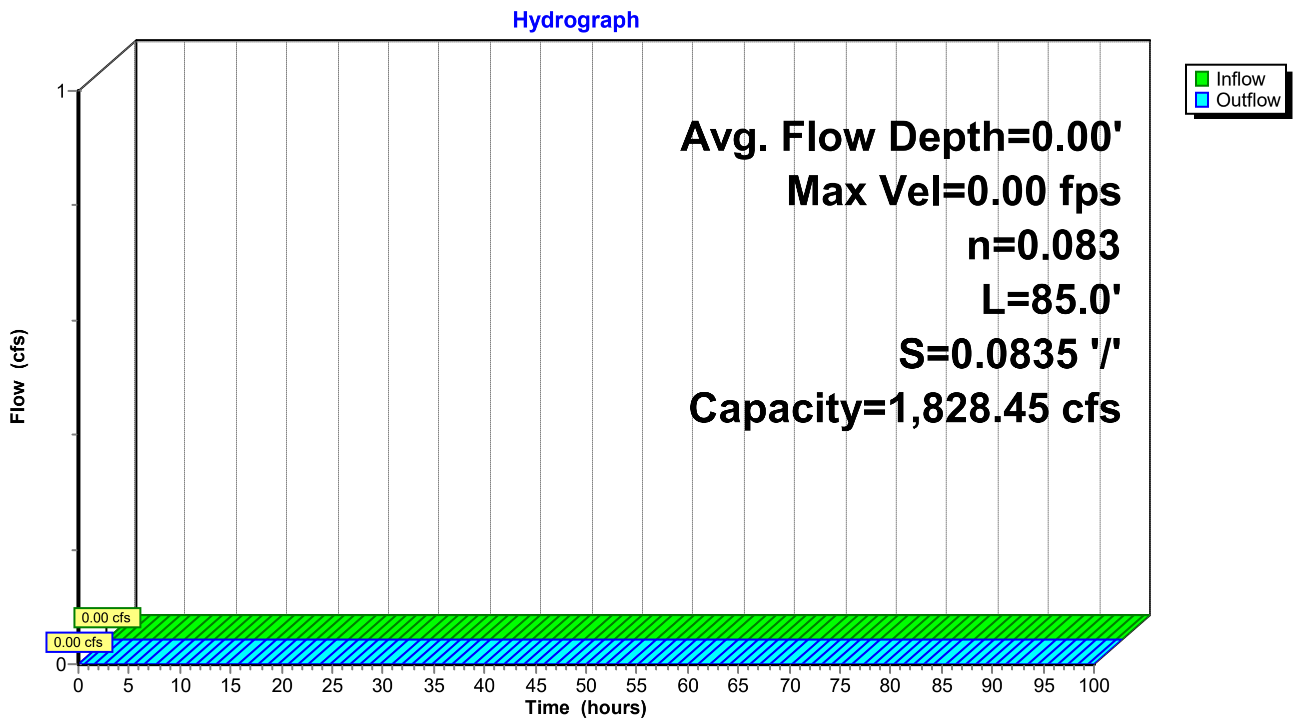
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

[62] Hint: Exceeded Reach 8R OUTLET depth by 5.26' @ 0.00 hrs

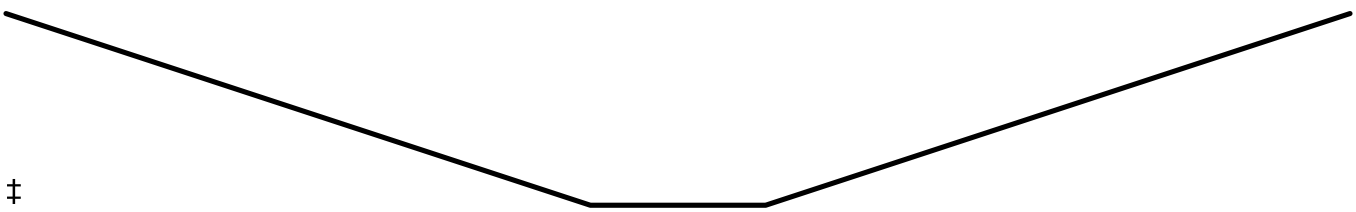
Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth = 0.00" for 1-inch - 1-hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

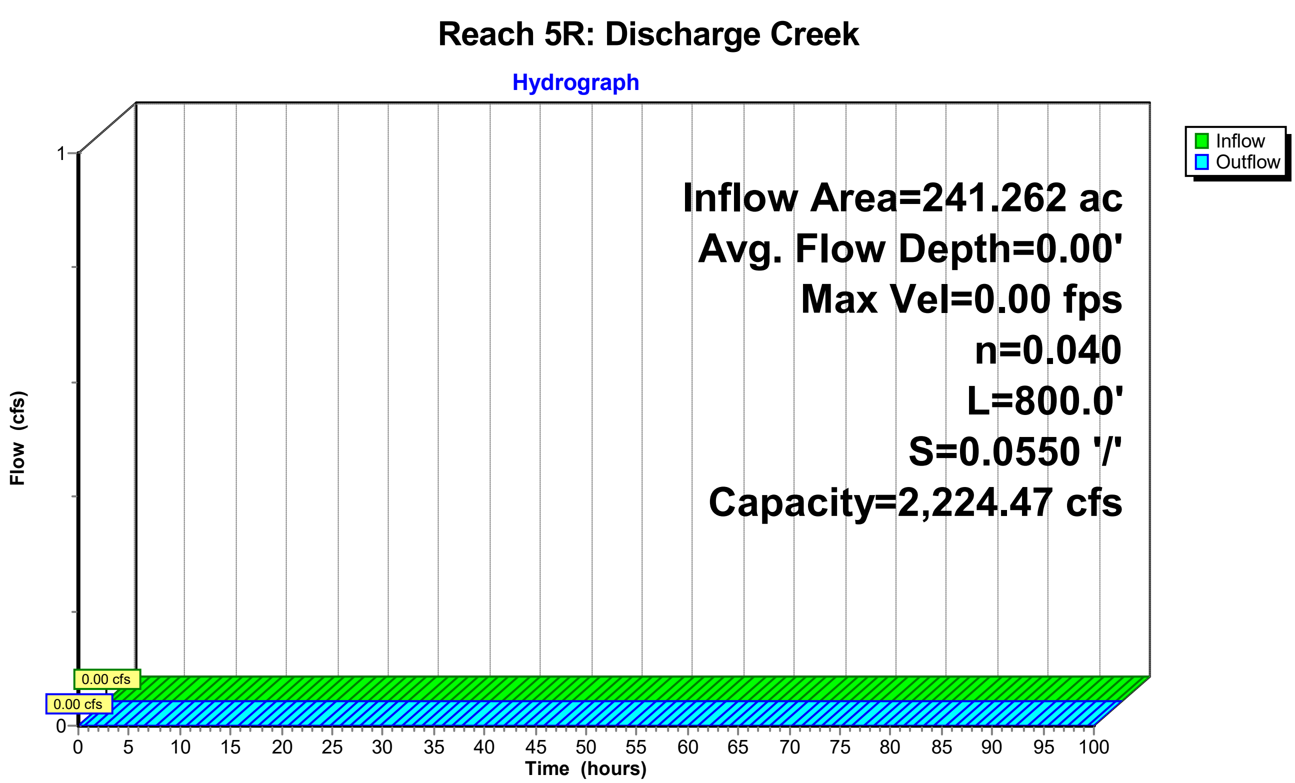
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'

‡





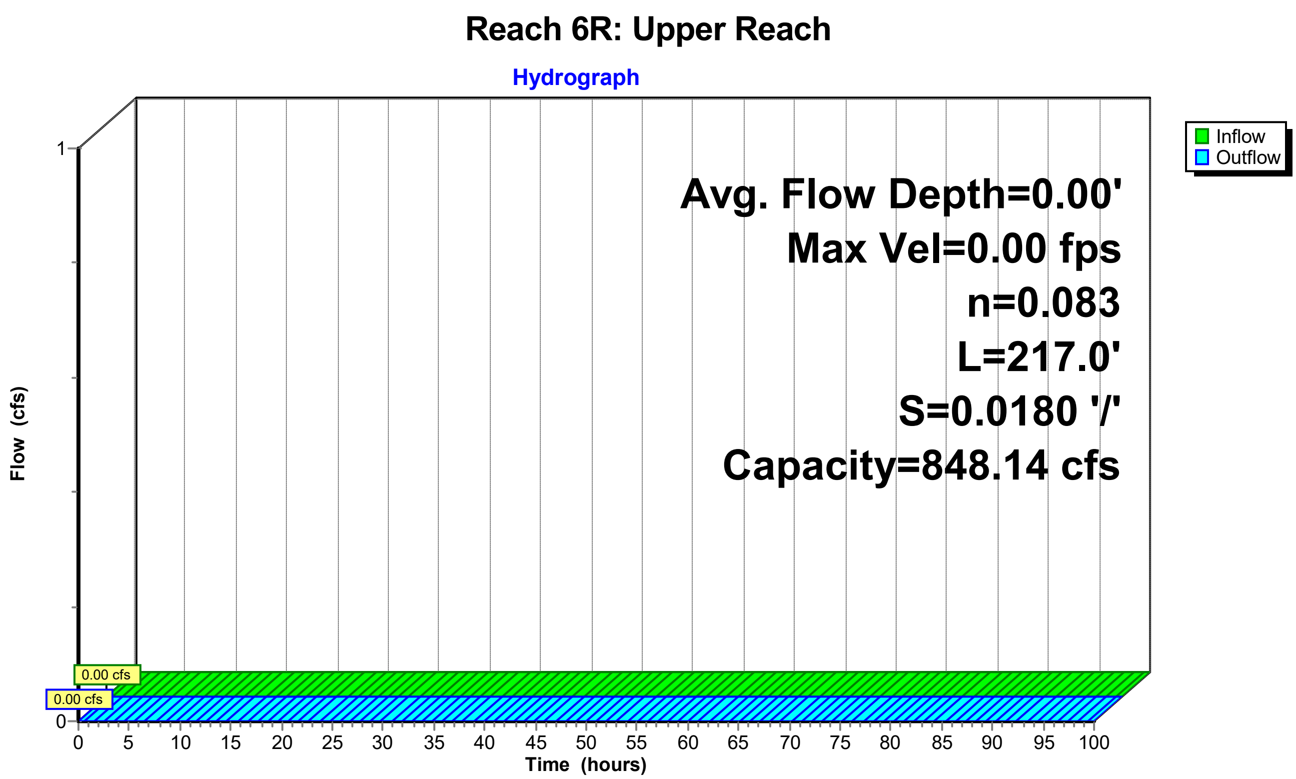
Summary for Reach 6R: Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

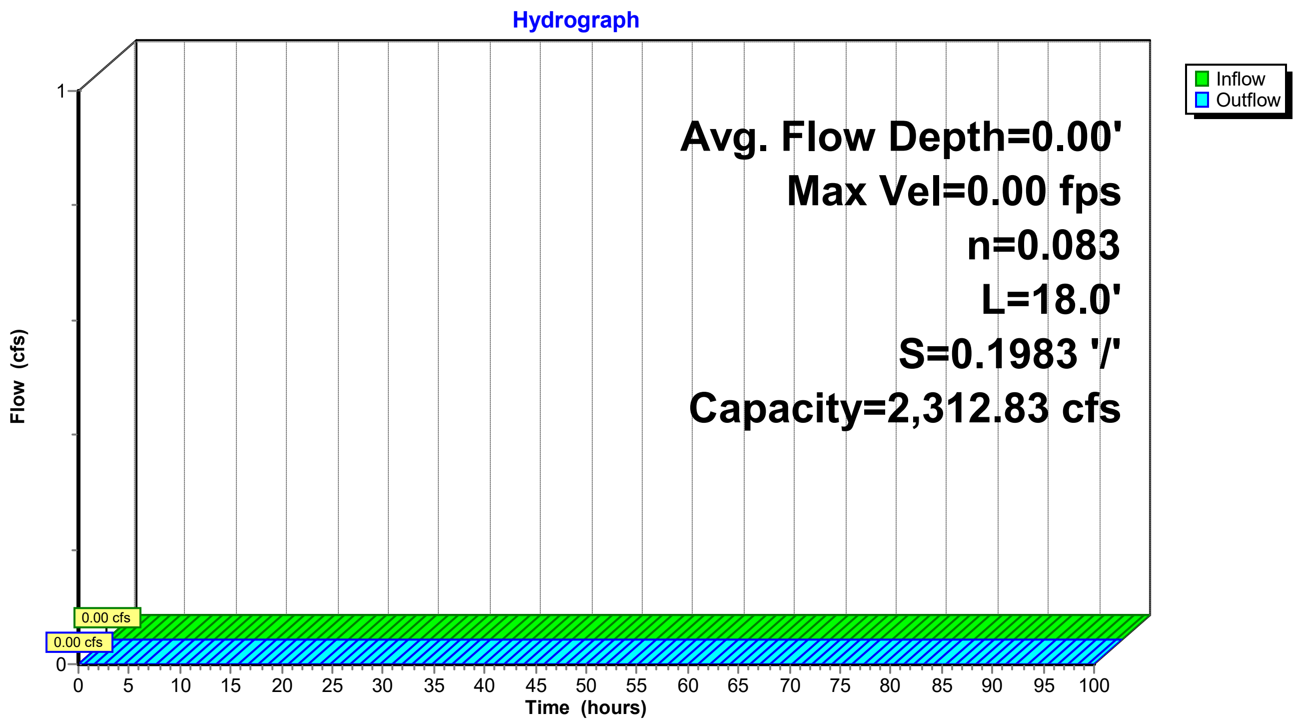
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



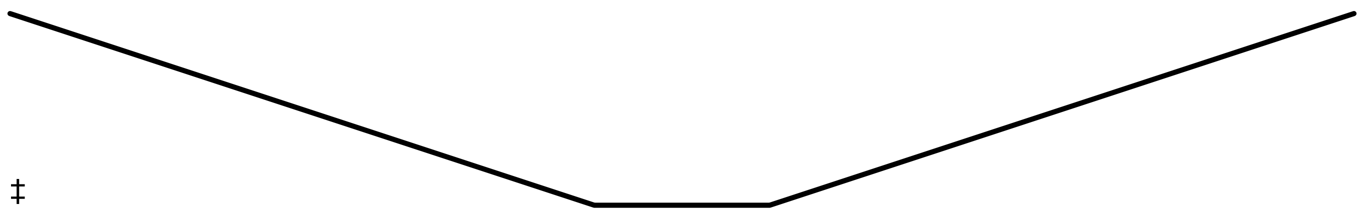
Summary for Reach 8R: Discharge Ditch

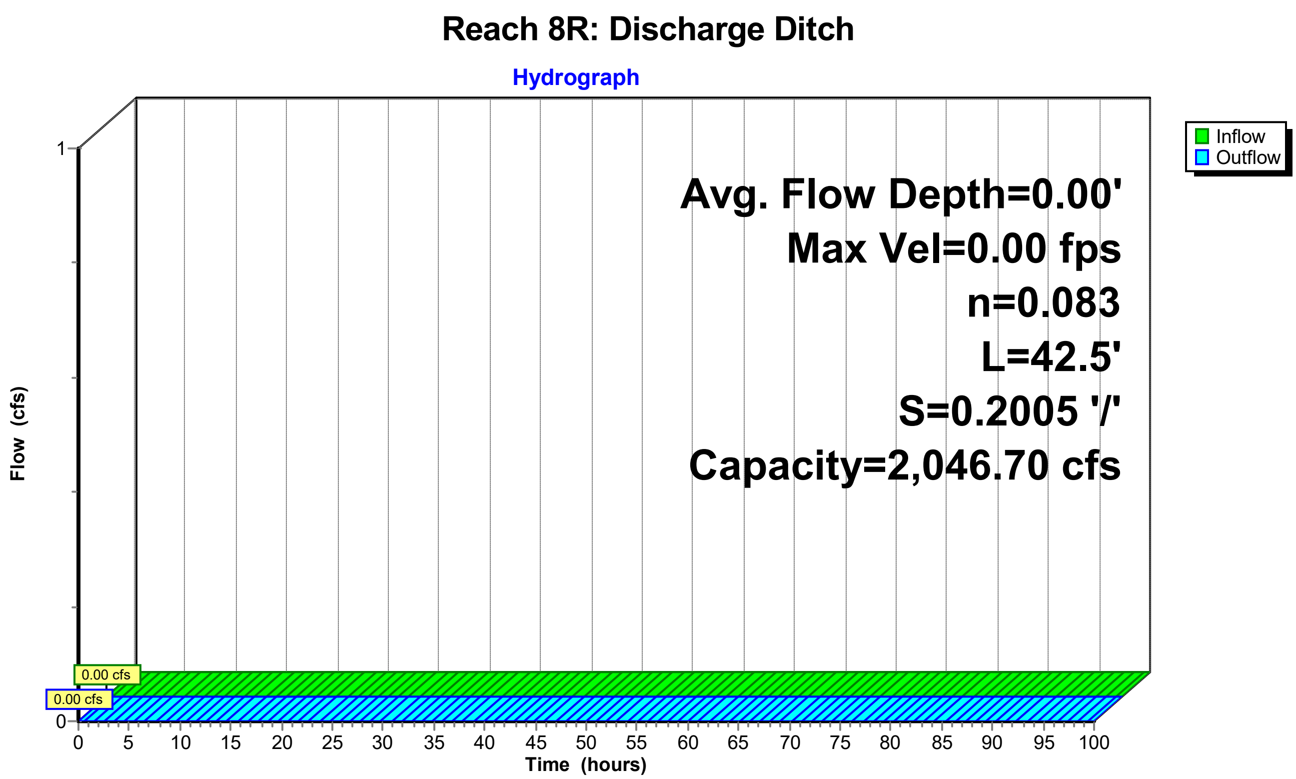
Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'





Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

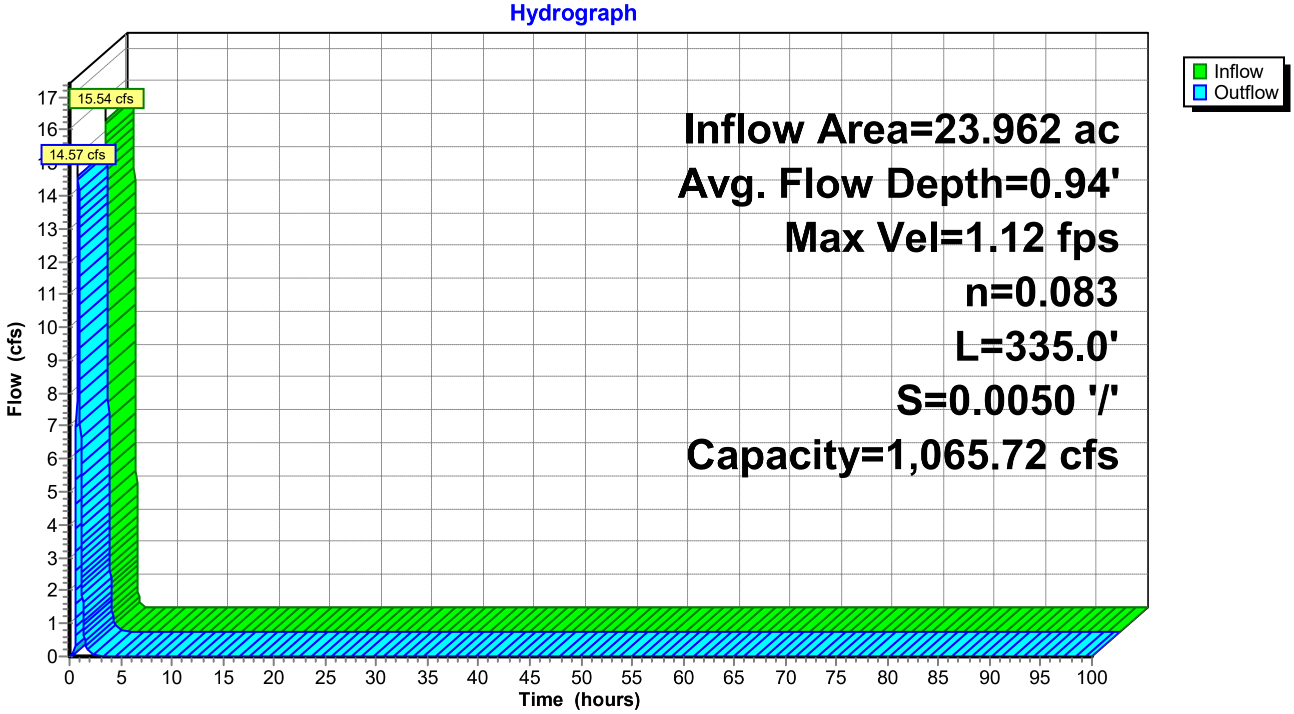
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.25" for 1-inch - 1-hr event
Inflow = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af
Outflow = 14.57 cfs @ 0.84 hrs, Volume= 0.505 af, Atten= 6%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 15.0 min

Peak Storage= 4,362 cf @ 0.84 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

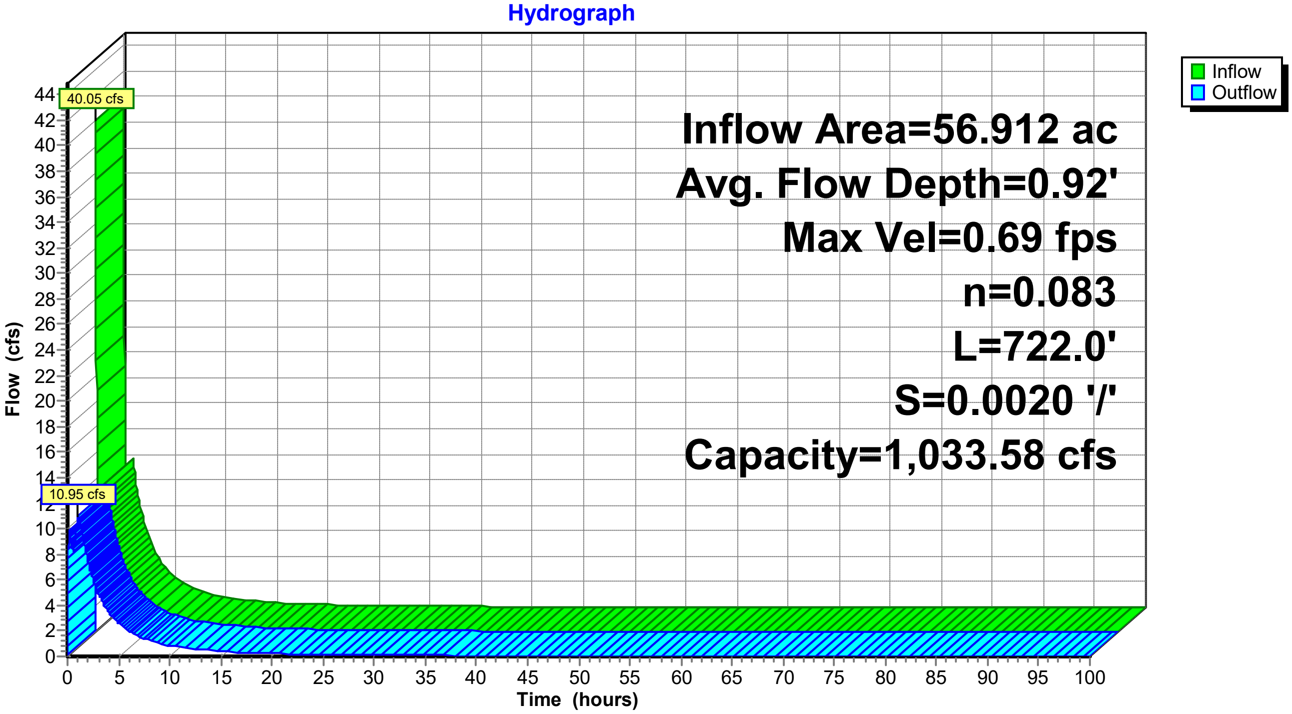
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.81" for 1-inch - 1-hr event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af
Outflow = 10.95 cfs @ 1.05 hrs, Volume= 3.865 af, Atten= 73%, Lag= 63.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.69 fps, Min. Travel Time= 17.5 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 59.7 min

Peak Storage= 11,487 cf @ 1.05 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.32' @ 0.97 hrs

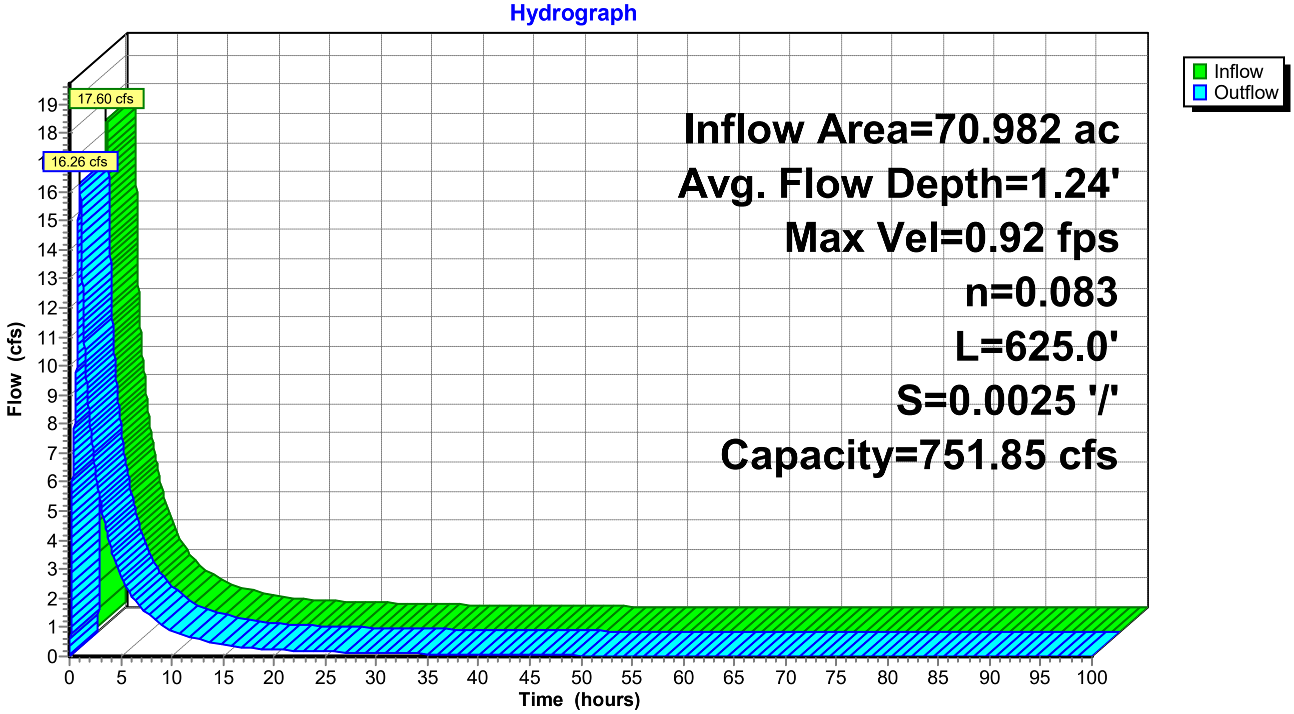
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth = 0.70" for 1-inch - 1-hr event
Inflow = 17.60 cfs @ 0.88 hrs, Volume= 4.127 af
Outflow = 16.26 cfs @ 1.00 hrs, Volume= 4.127 af, Atten= 8%, Lag= 7.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 11.3 min
Avg. Velocity = 0.23 fps, Avg. Travel Time= 45.3 min

Peak Storage= 10,991 cf @ 1.00 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow =	13.58 cfs @ 0.00 hrs,	Volume=	112.243 af,	Incl. 13.58 cfs Base Flow
Outflow =	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af,	Atten= 0%, Lag= 6,000.0 min
Primary =	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af	
Secondary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

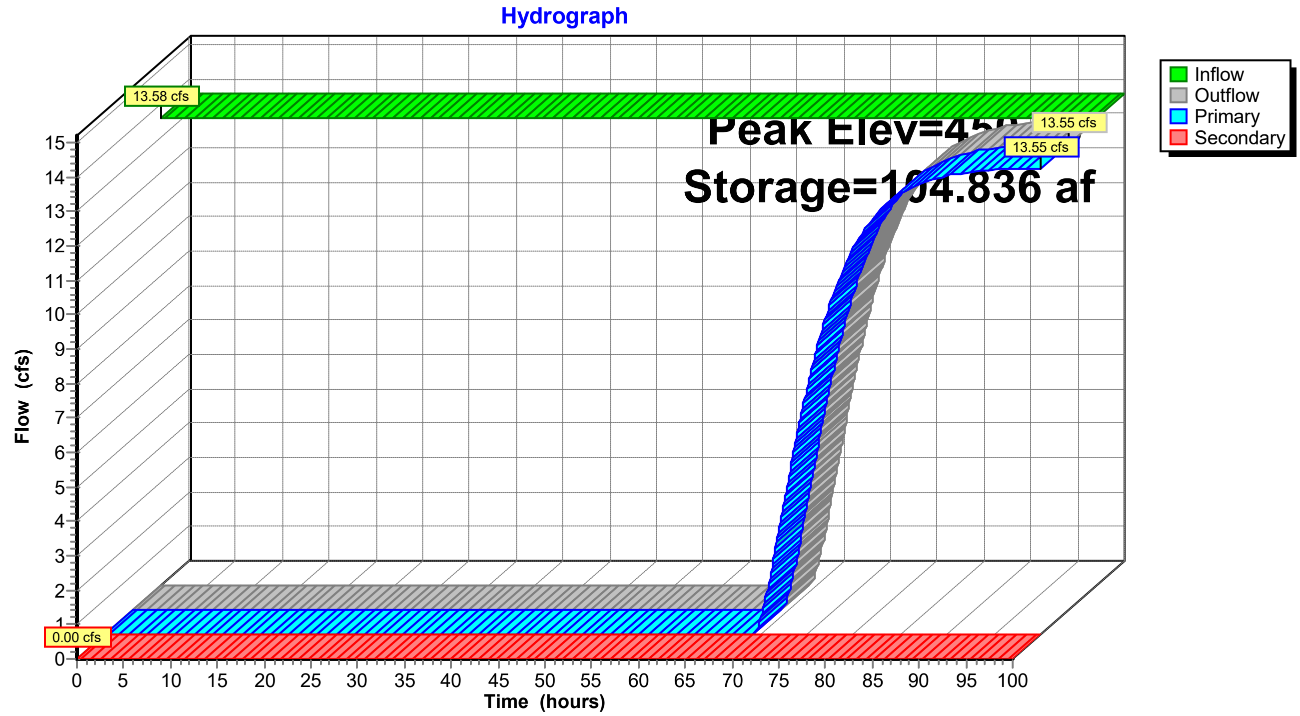
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
↑—**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

During Phase 1, excavation is limited to Upper Ash Pond. Lower Ash Pond remains active and collects all existing flows. Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A. Pool A will eventually drain to the Lower Ash Pond in addition to the existing (base) flows.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 5.66" for 1-inch - 1-hr event
Inflow = 82.81 cfs @ 0.50 hrs, Volume= 113.817 af, Incl. 12.60 cfs Base Flow
Outflow = 14.52 cfs @ 15.73 hrs, Volume= 108.046 af, Atten= 82%, Lag= 913.8 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 15.73 hrs, Volume= 108.046 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 138.500 af
Peak Elev= 440.59' @ 15.73 hrs Surf.Area= 0.000 ac Storage= 146.722 af (8.222 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 116.2 min (2,935.1 - 2,819.0)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf

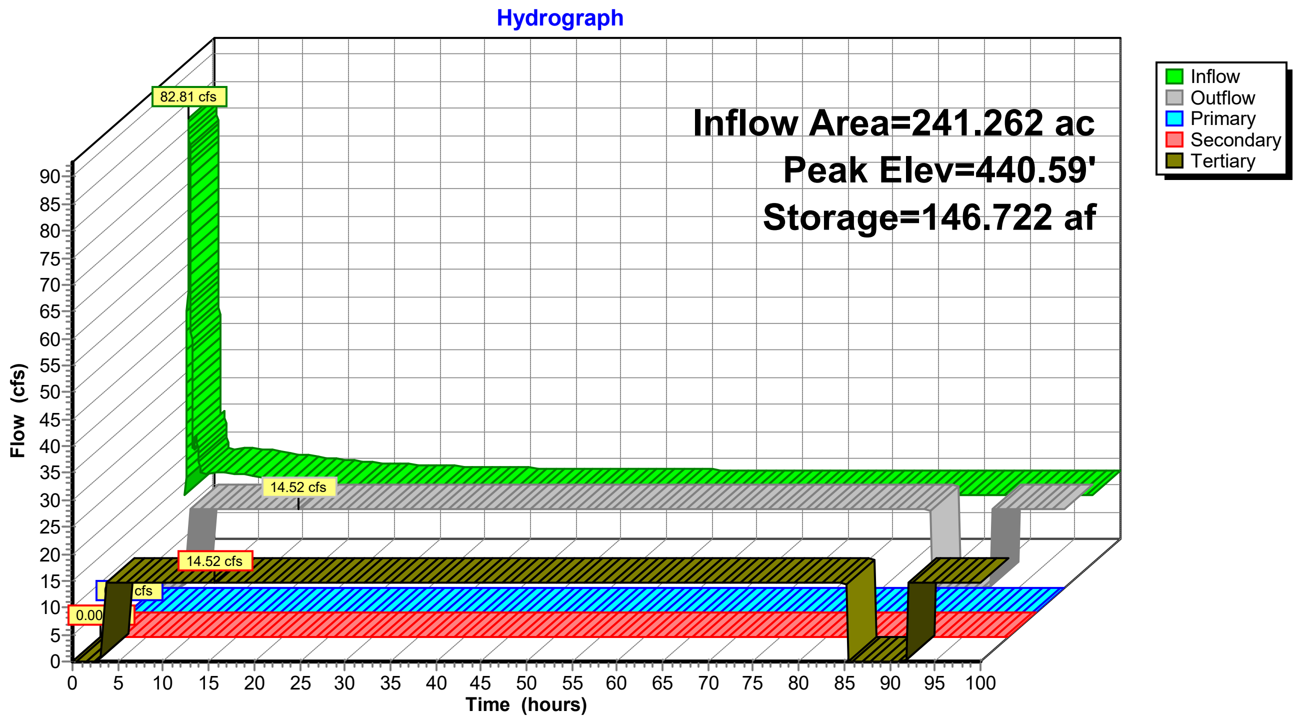
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	440.50'	**Pump** Discharges@450.90' Turns Off@440.00' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 110.64 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 15.73 hrs HW=440.59' (Free Discharge)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 2P: Lower Pond



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.00' @ 0.00 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.21" for 1-inch - 1-hr event
Inflow = 29.35 cfs @ 0.79 hrs, Volume= 0.982 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af, Atten= 0%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 7.570 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 290.0 min (341.2 - 51.2)

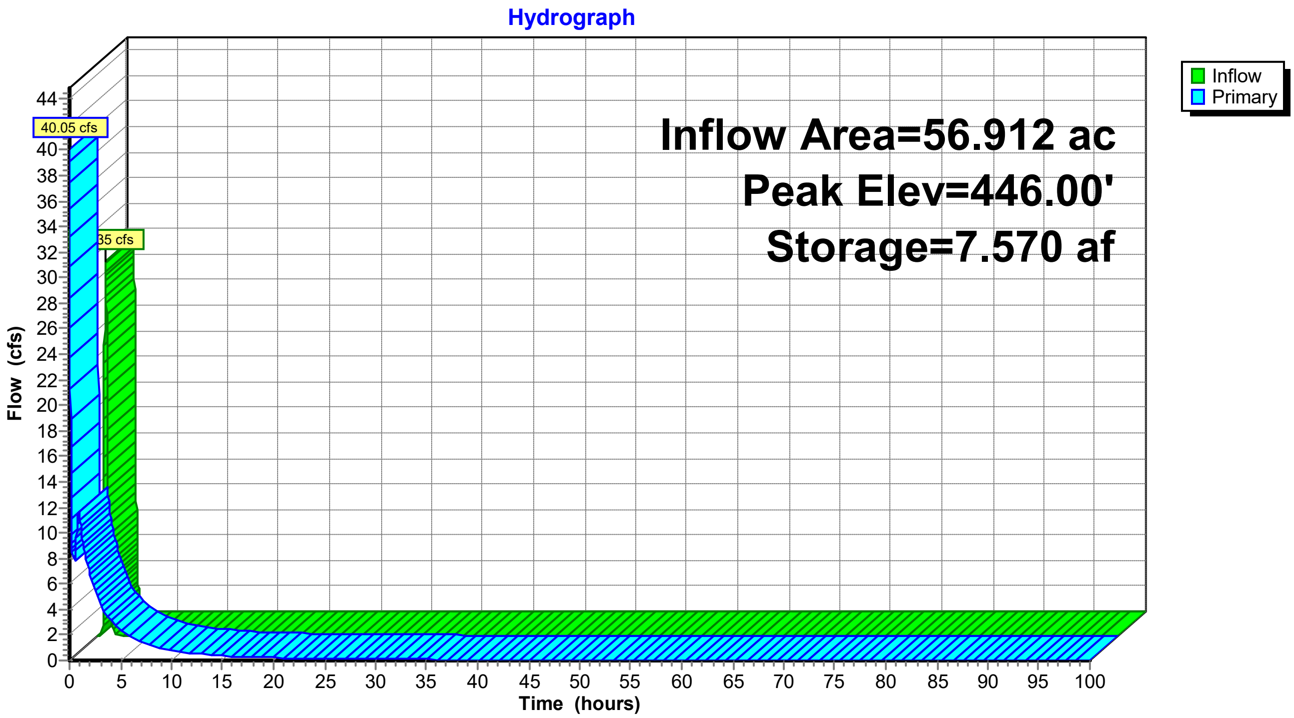
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

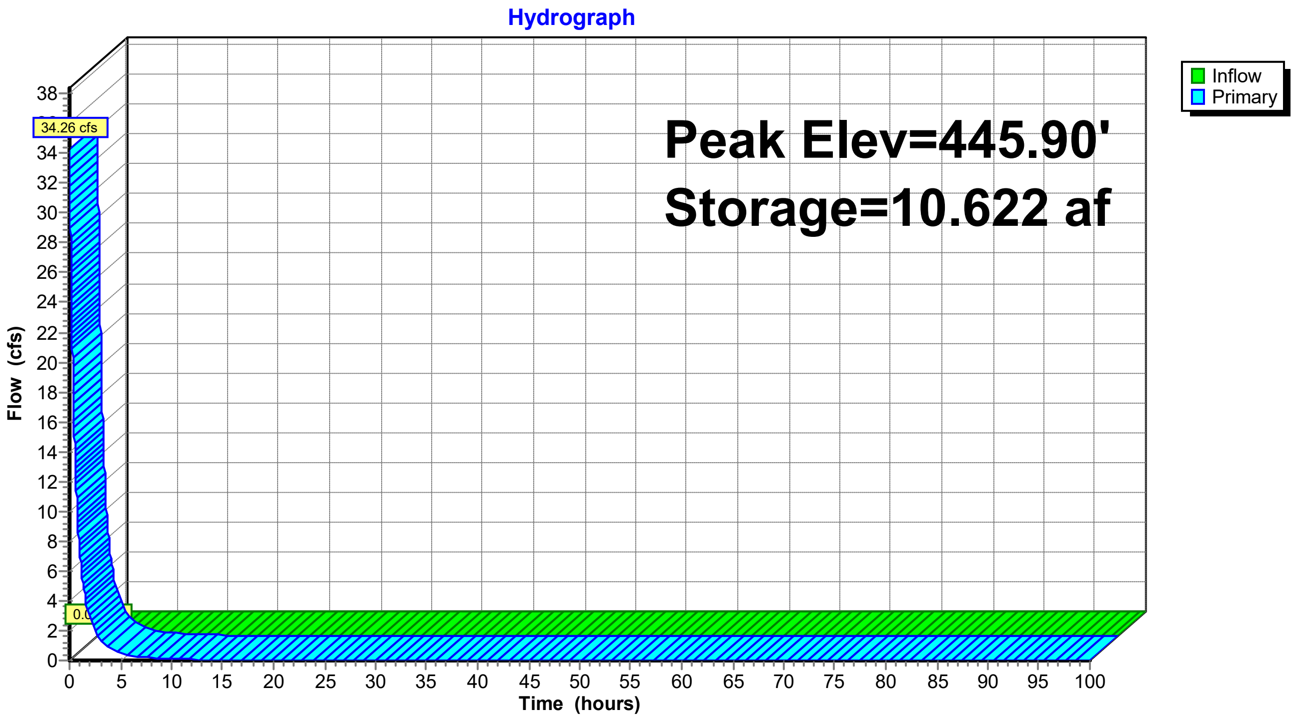
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

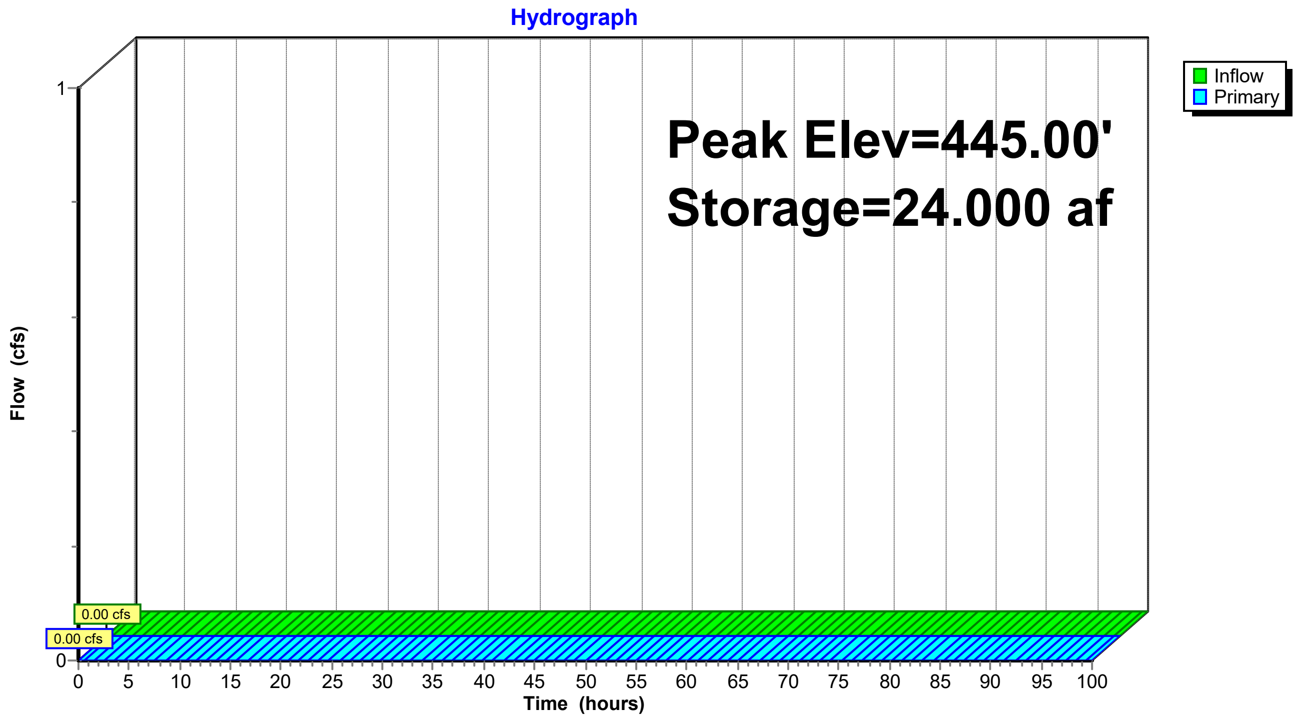
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 3.08' @ 7.27 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 0.53" for 1-inch - 1-hr event
Inflow = 42.68 cfs @ 1.50 hrs, Volume= 7.256 af
Outflow = 4.25 cfs @ 3.97 hrs, Volume= 6.649 af, Atten= 90%, Lag= 148.3 min
Primary = 4.25 cfs @ 3.97 hrs, Volume= 6.649 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 447.02' @ 3.97 hrs Surf.Area= 0.000 ac Storage= 32.282 af (4.892 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 989.0 min (1,246.3 - 257.3)

Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

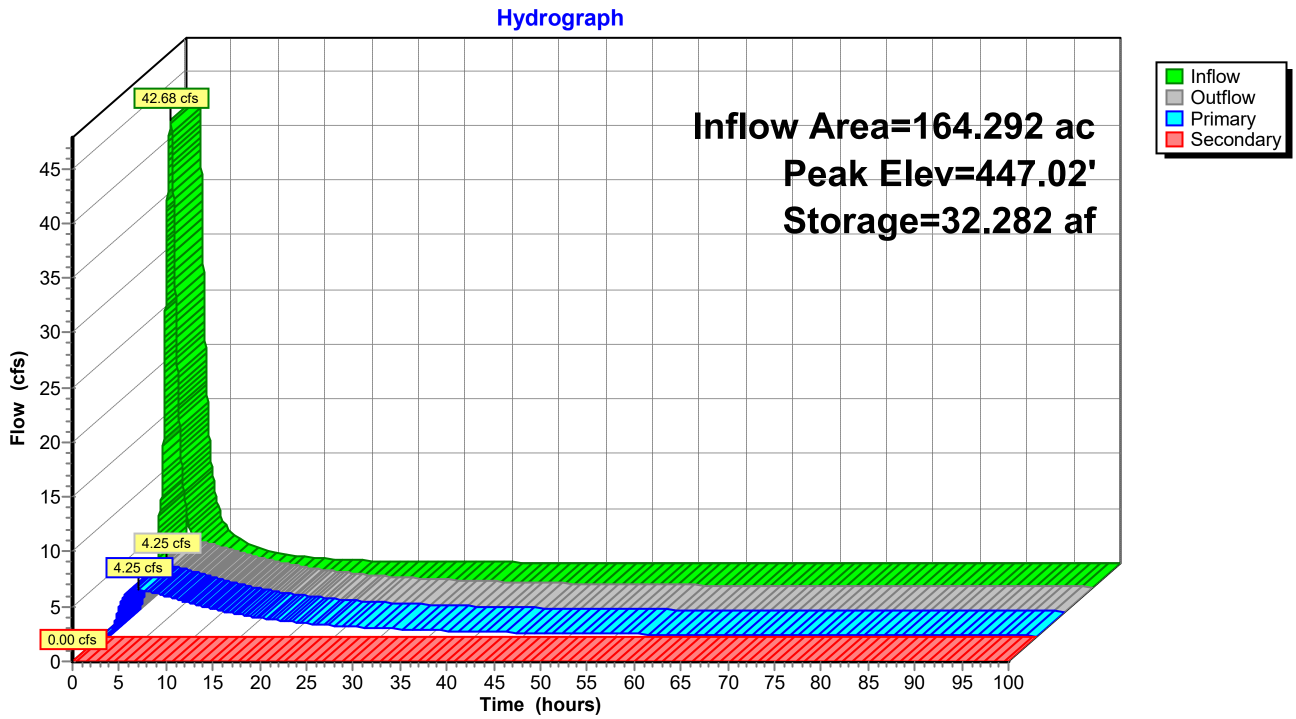
Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

Primary OutFlow Max=4.24 cfs @ 3.97 hrs HW=447.02' TW=440.51' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 4.24 cfs @ 2.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Subcatchment 2S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

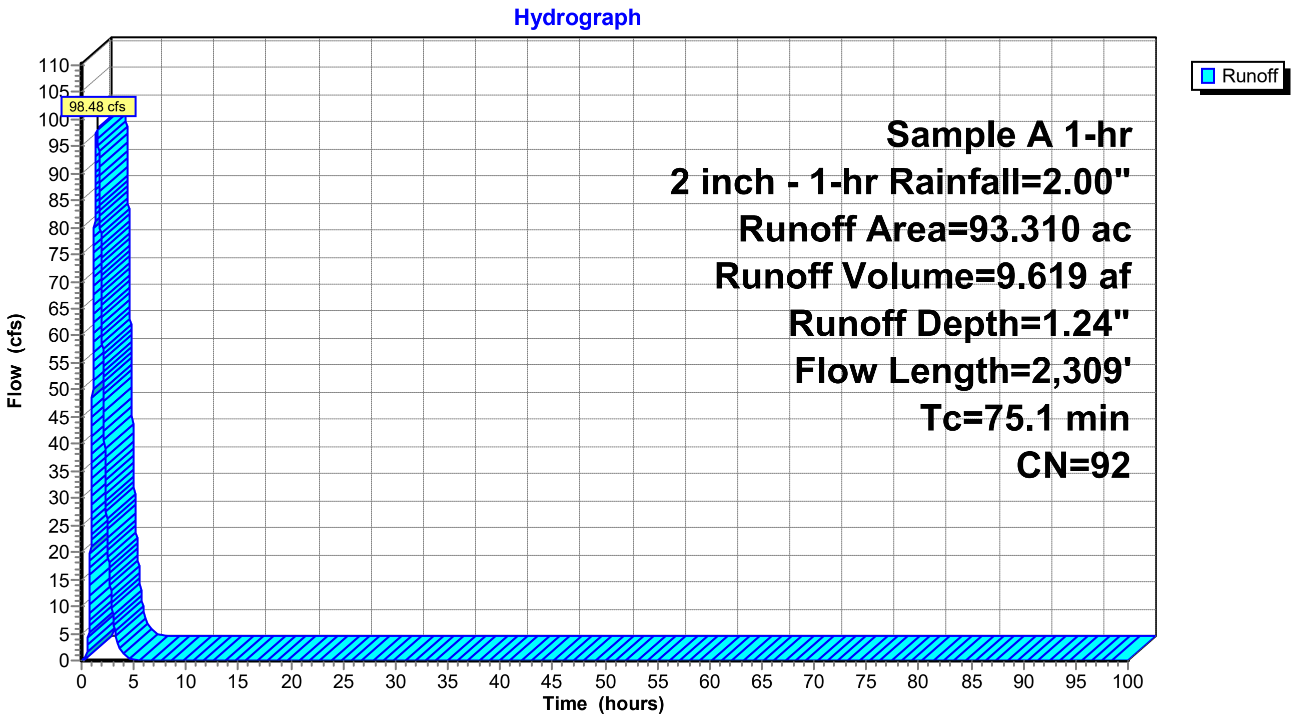
Runoff = 98.48 cfs @ 1.50 hrs, Volume= 9.619 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
*	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

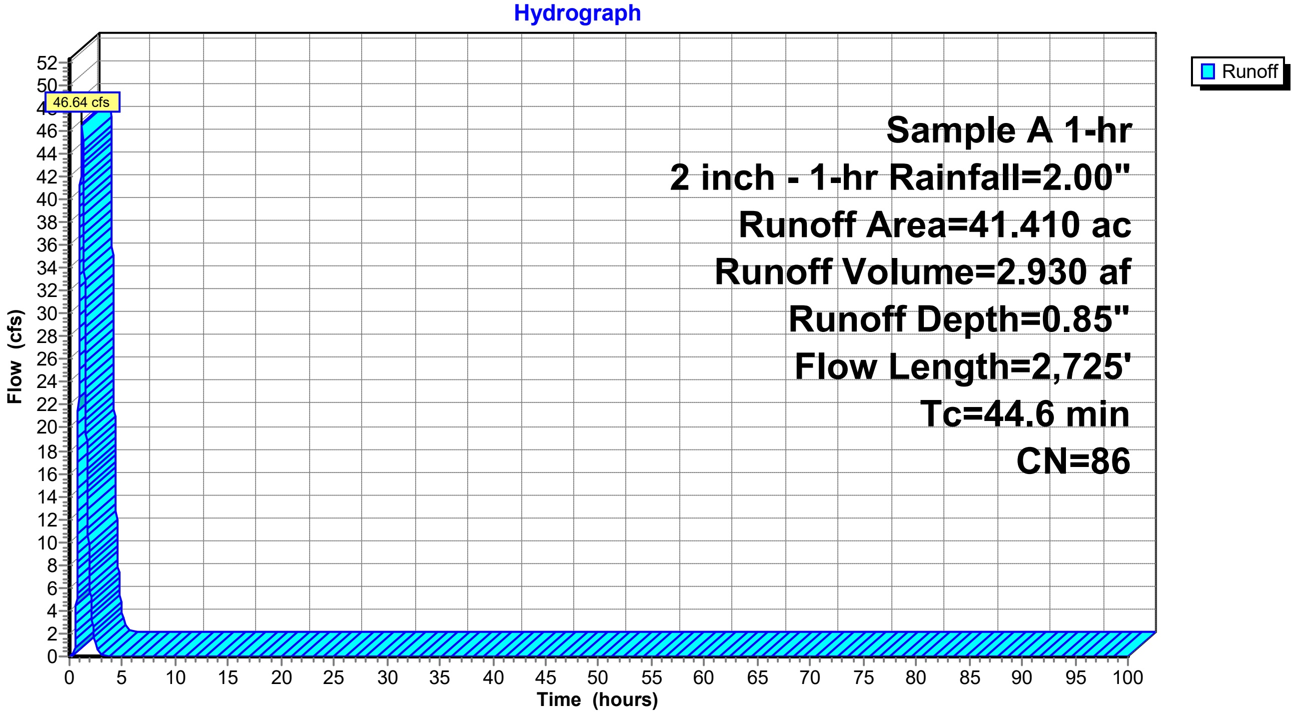
Runoff = 46.64 cfs @ 1.15 hrs, Volume= 2.930 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

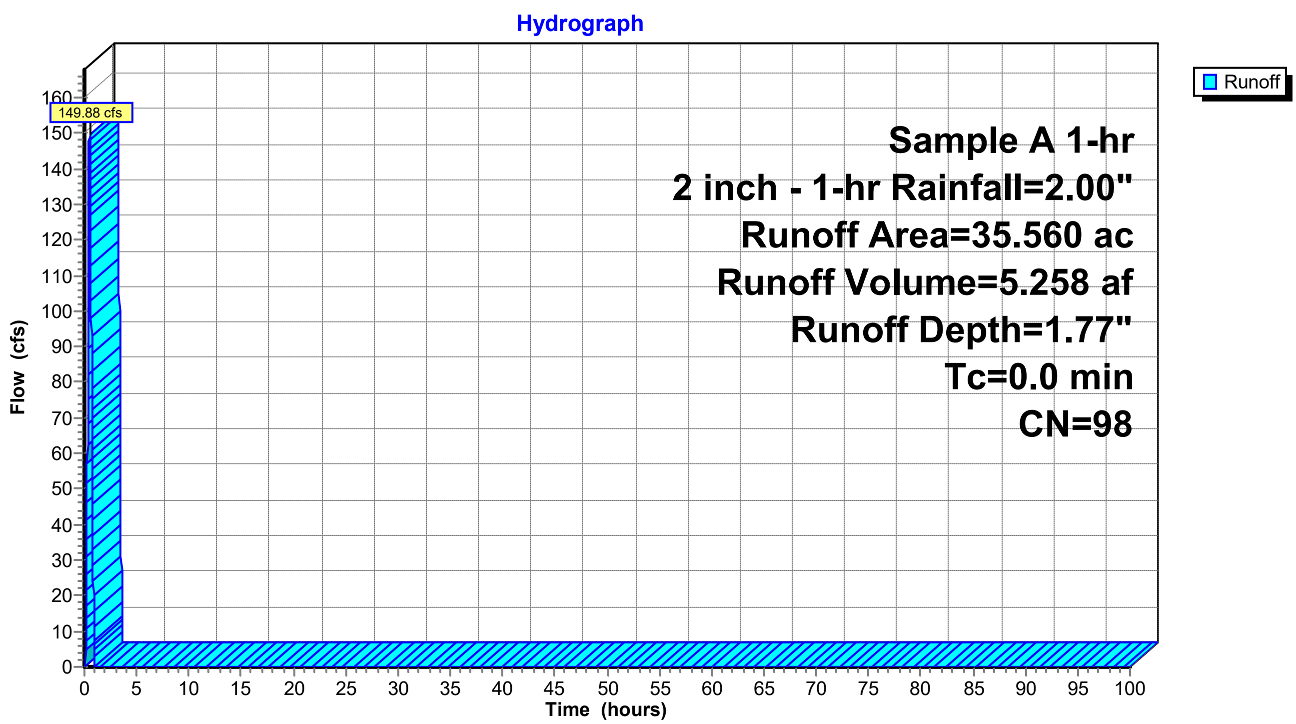
Runoff = 149.88 cfs @ 0.50 hrs, Volume= 5.258 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

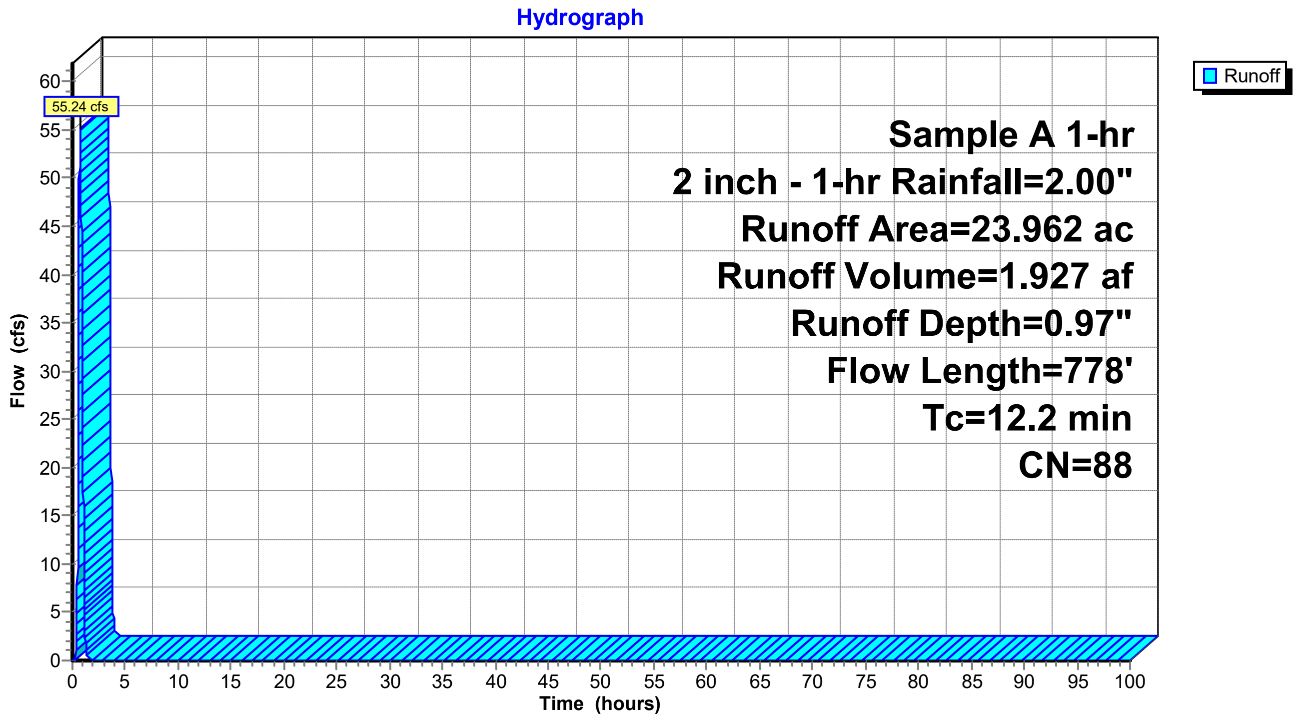
Runoff = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

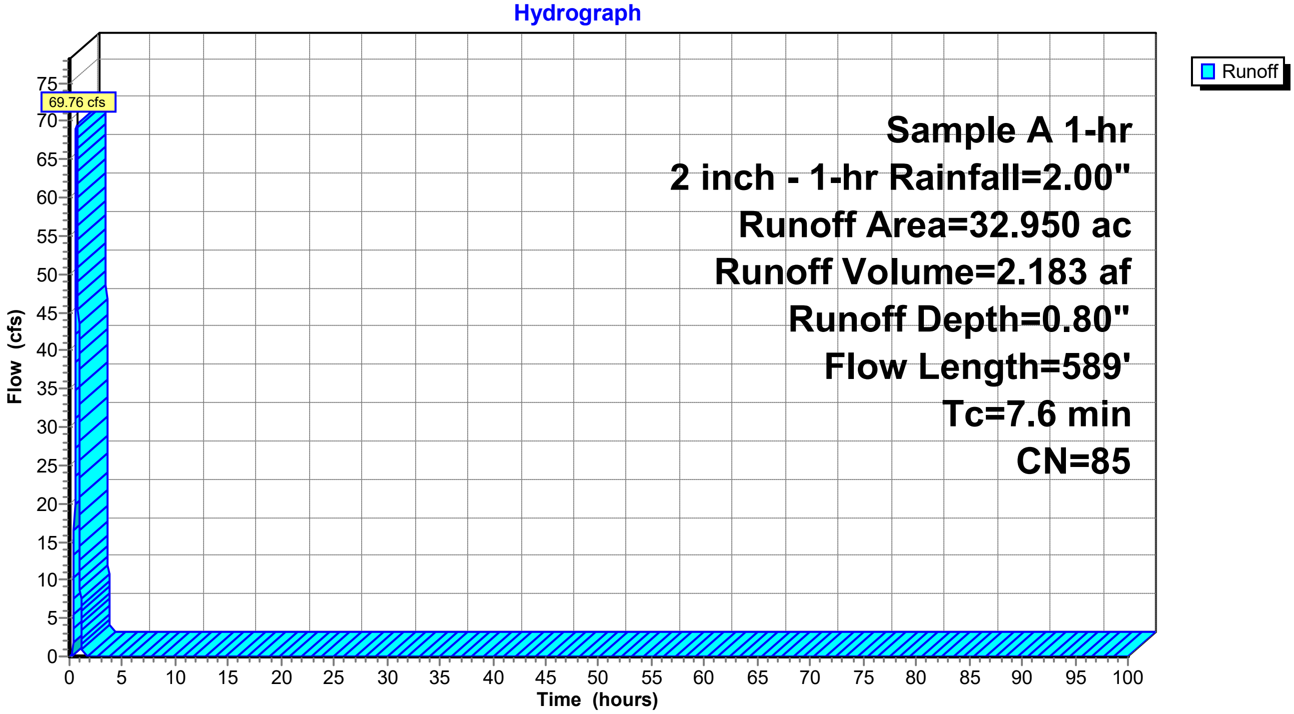
Runoff = 69.76 cfs @ 0.68 hrs, Volume= 2.183 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

EndPhase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

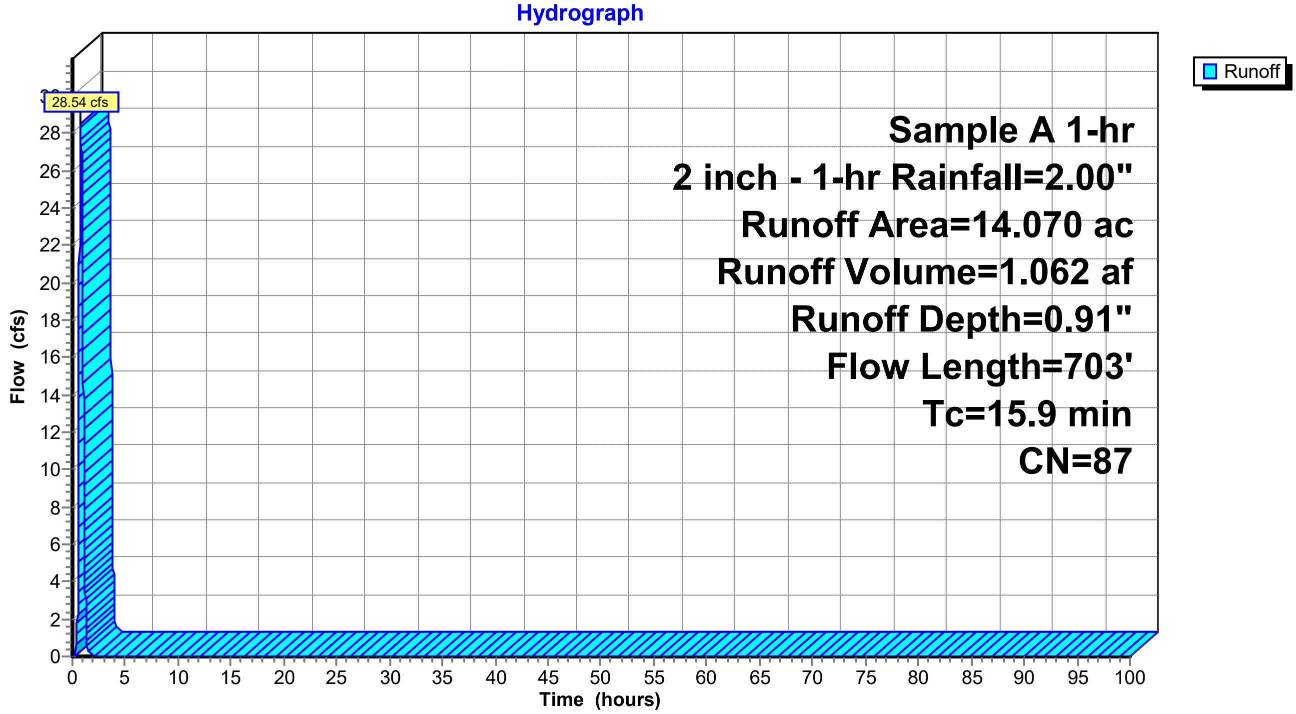
Runoff = 28.54 cfs @ 0.79 hrs, Volume= 1.062 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



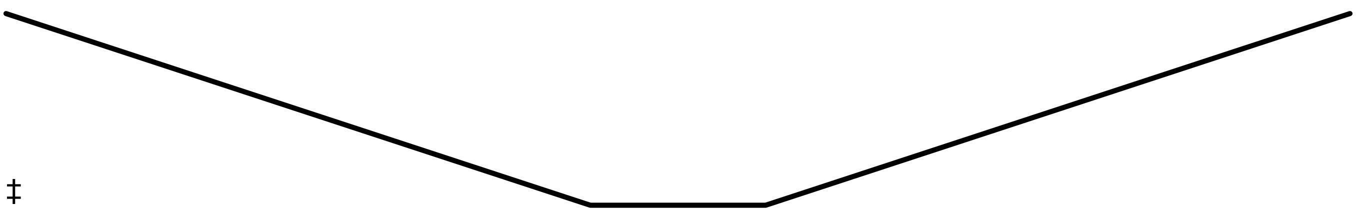
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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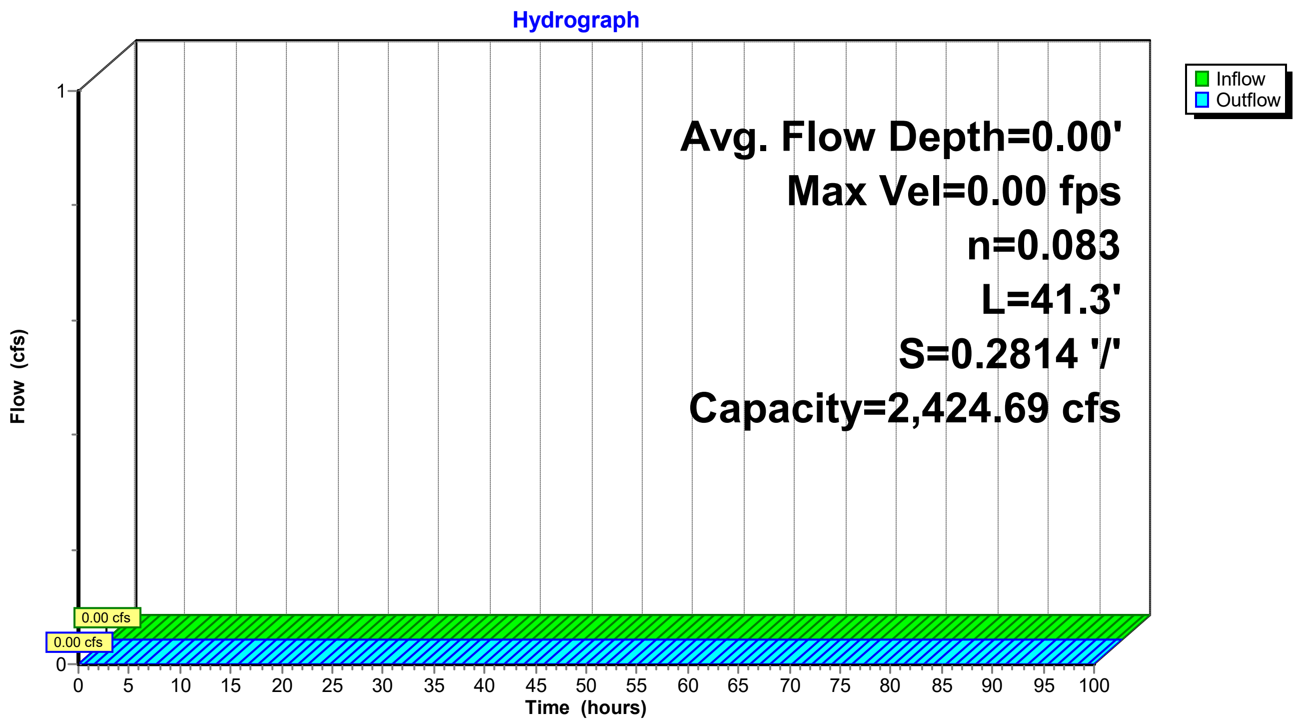
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

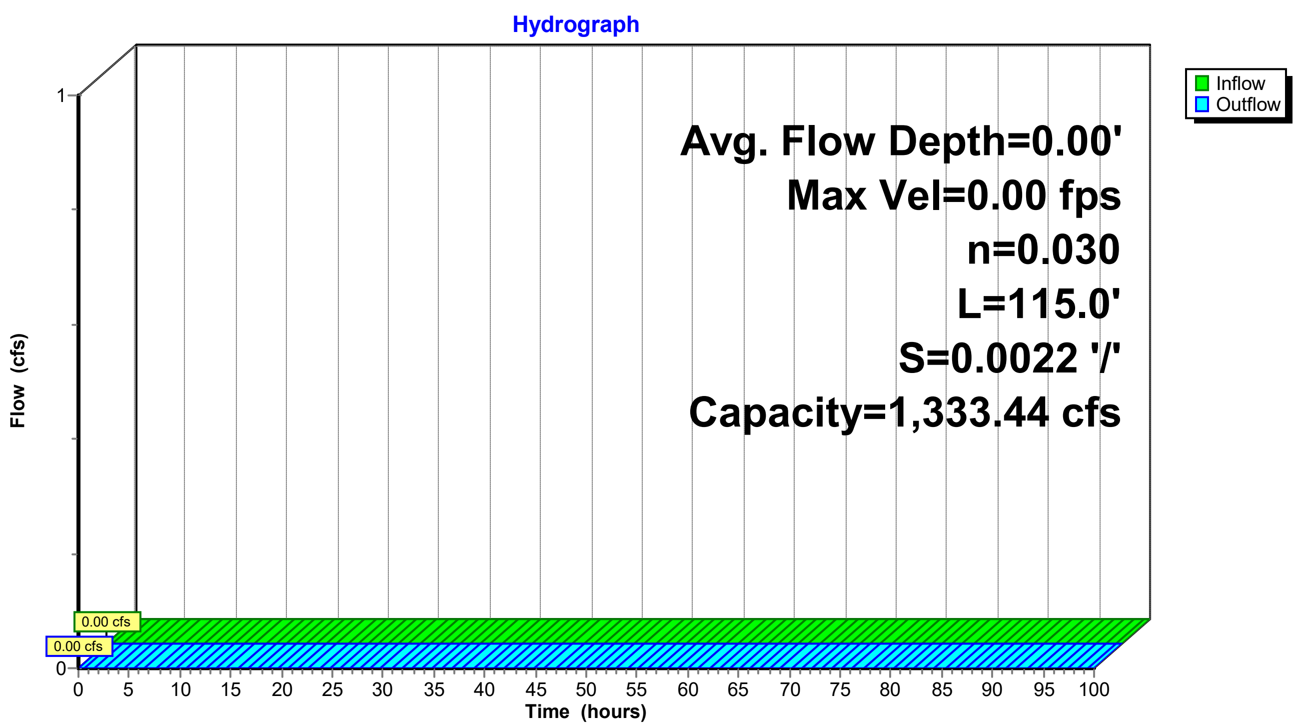
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Lower Reach

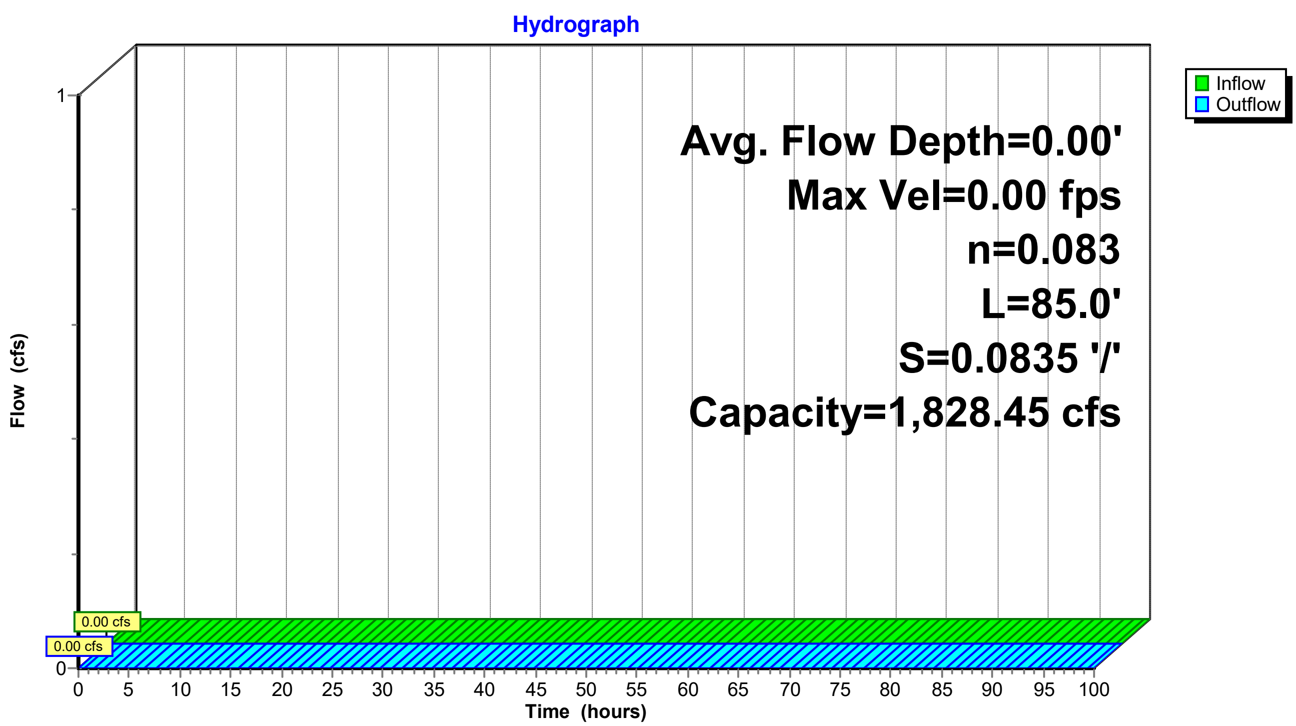
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

[62] Hint: Exceeded Reach 8R OUTLET depth by 5.26' @ 0.00 hrs

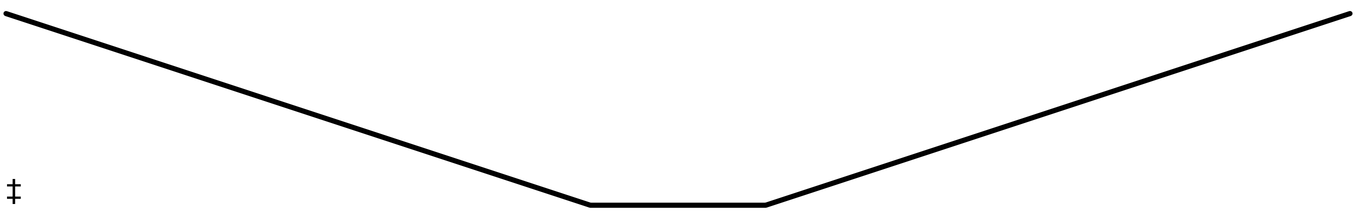
Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth = 0.00" for 2 inch - 1-hr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

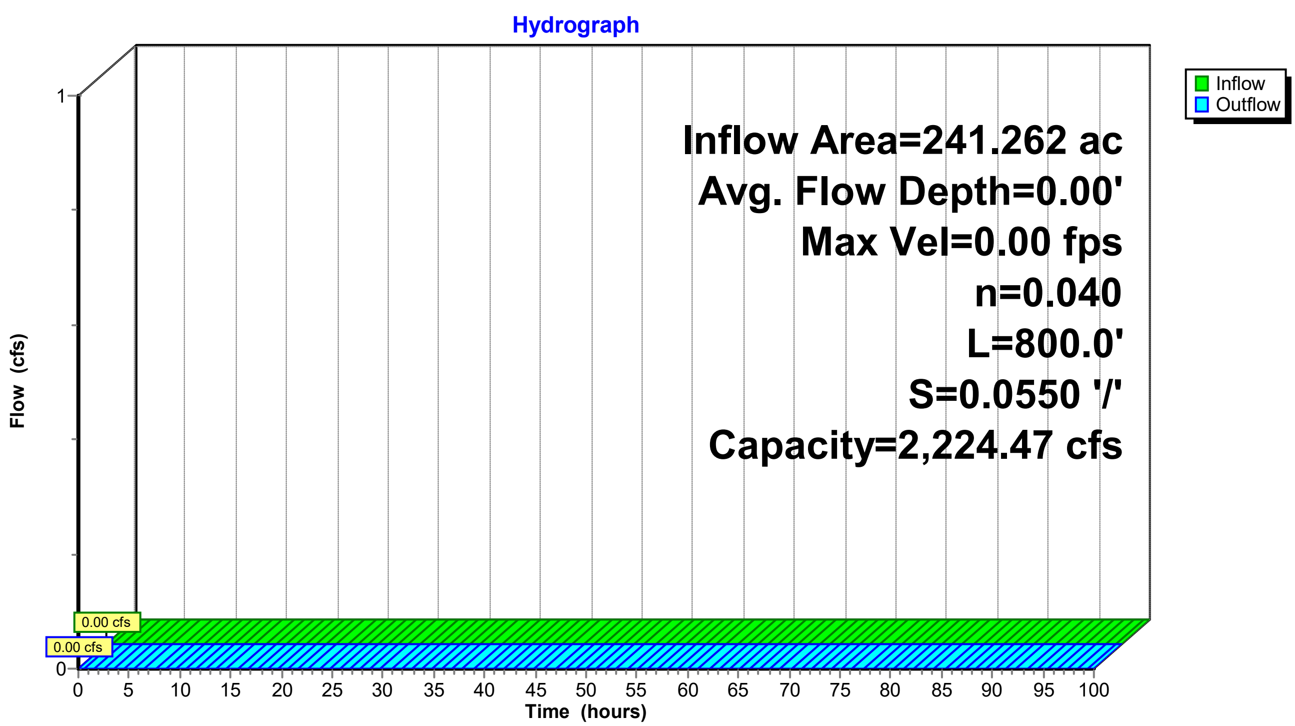
Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'

‡



Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

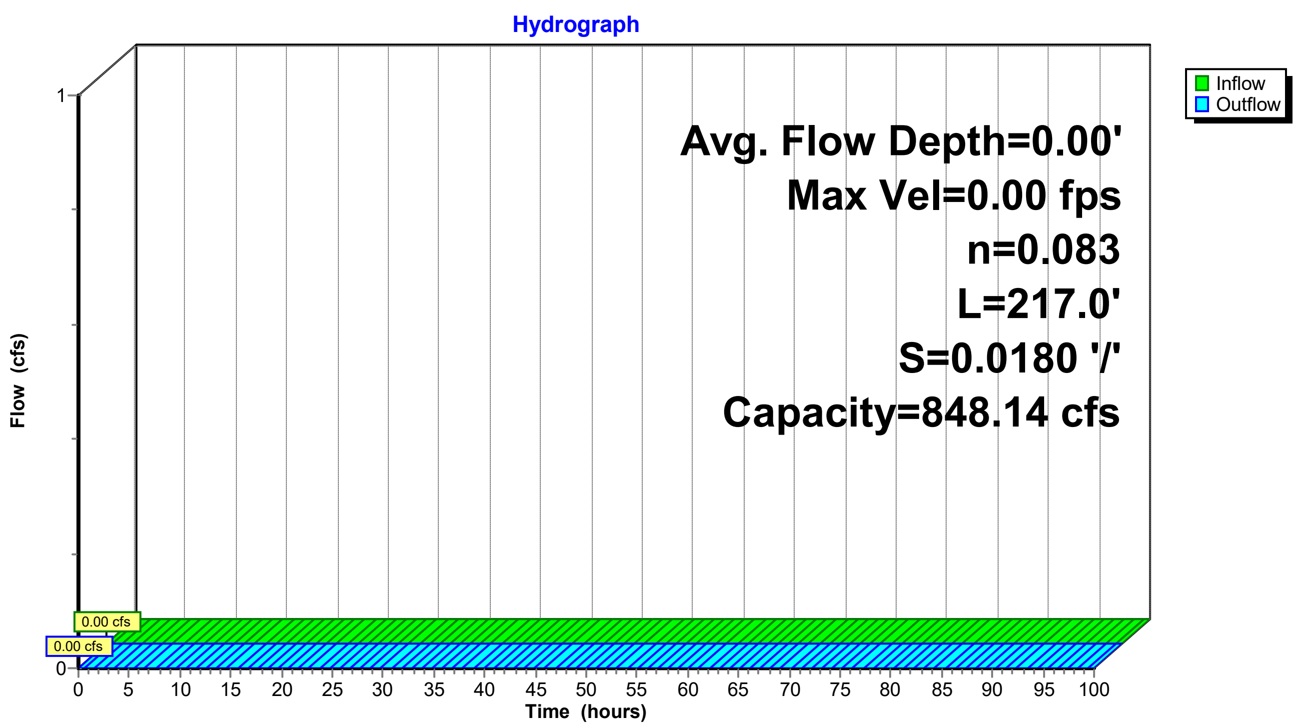
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

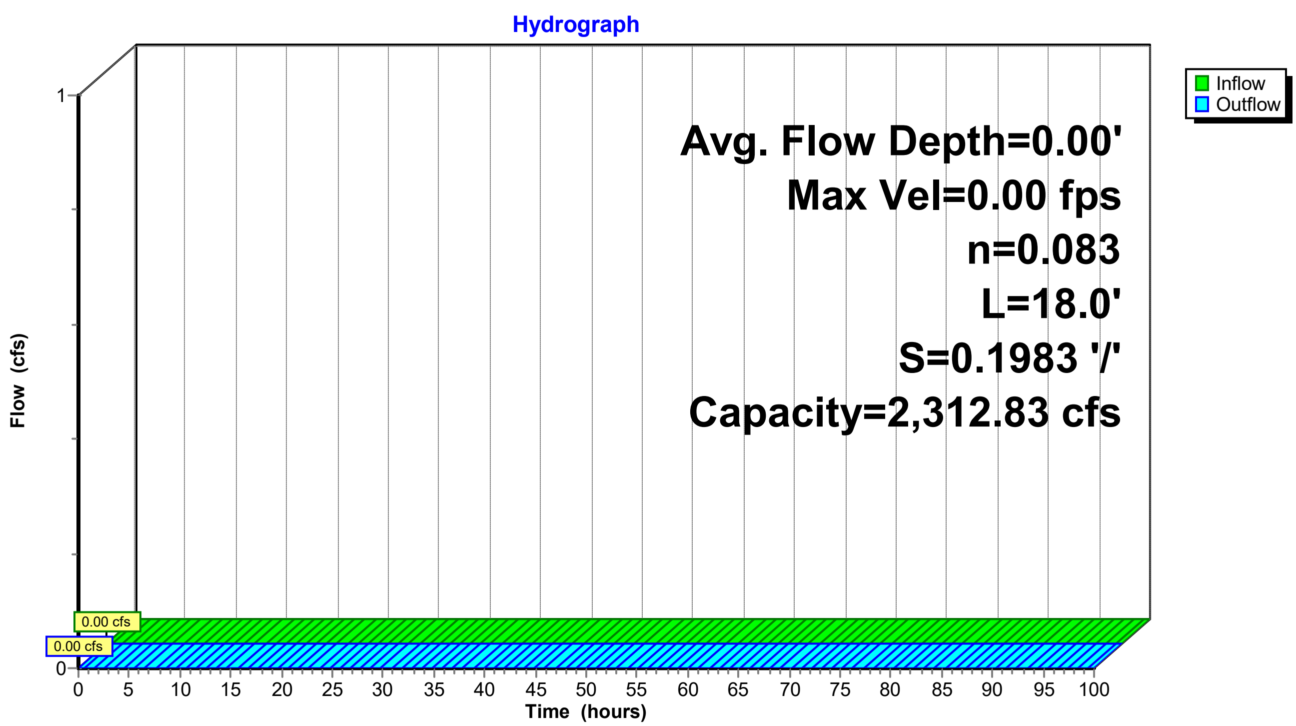
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



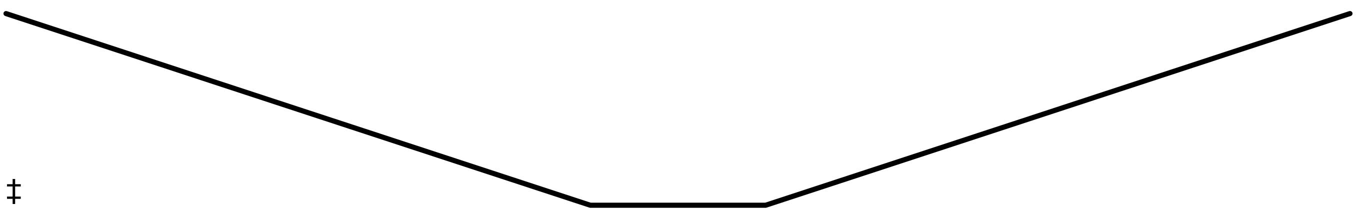
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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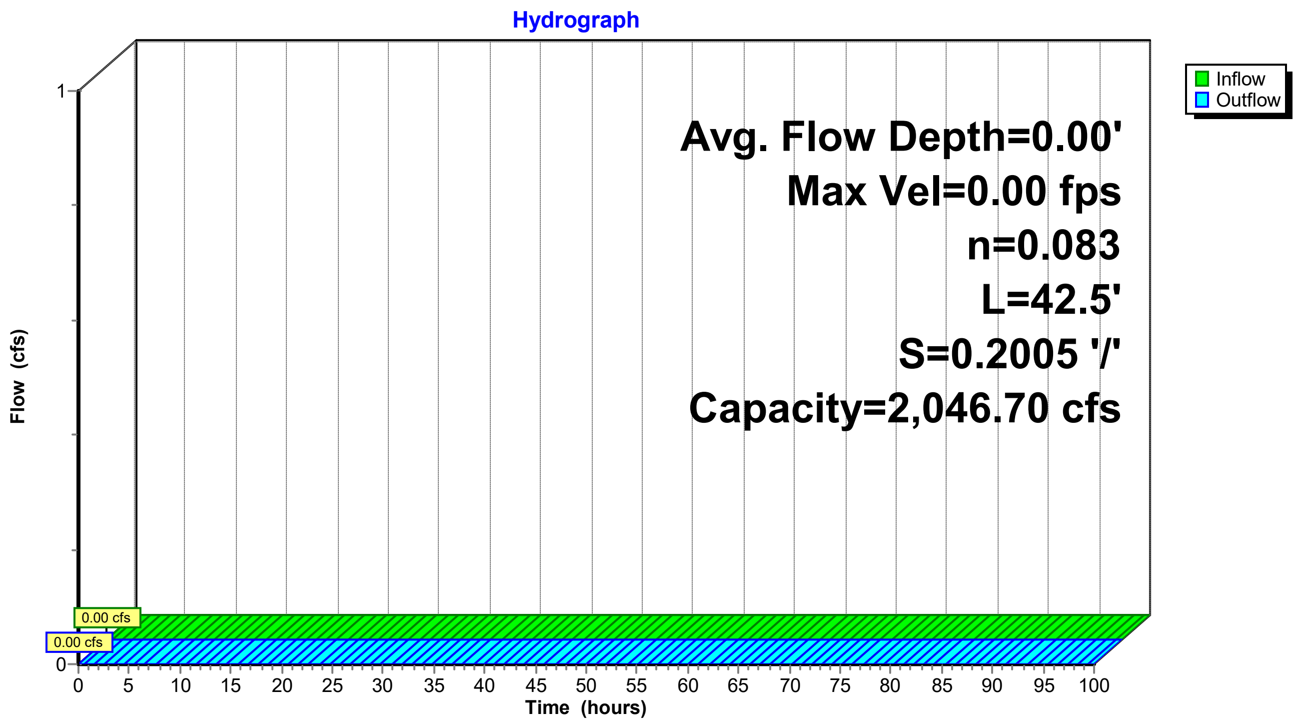
Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

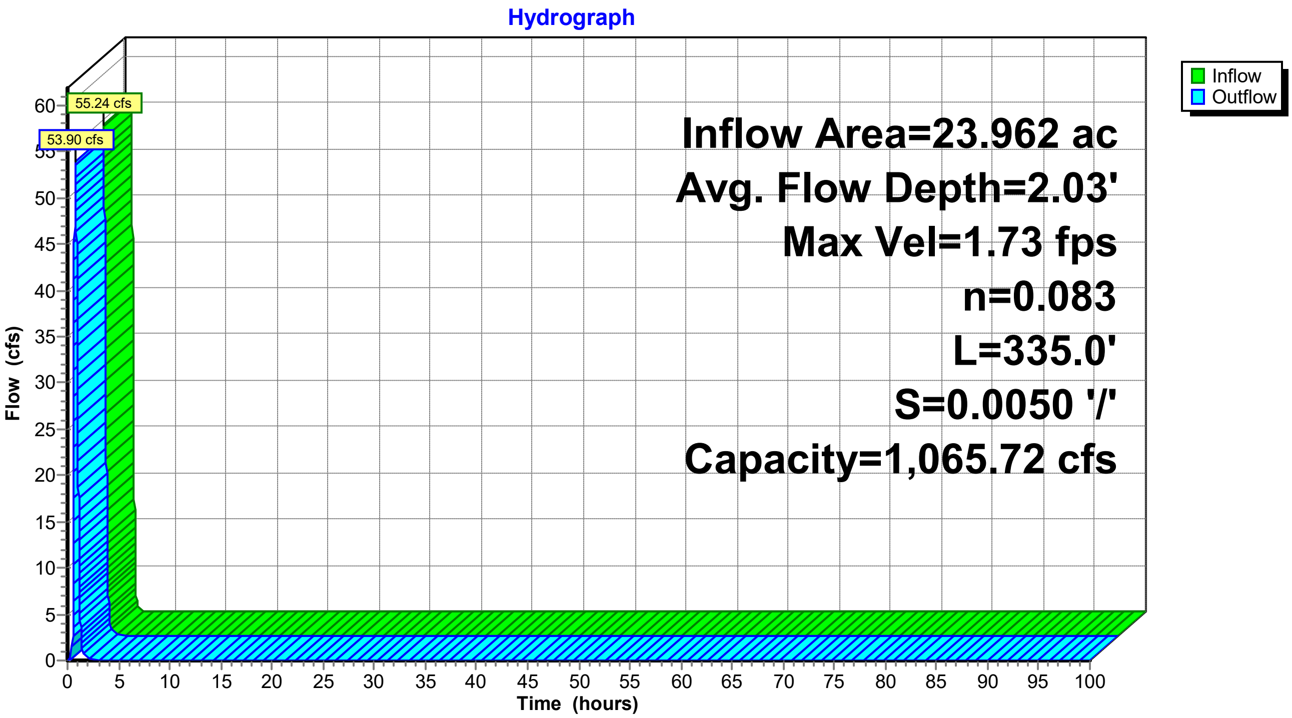
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.97" for 2 inch - 1-hr event
Inflow = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af
Outflow = 53.90 cfs @ 0.77 hrs, Volume= 1.927 af, Atten= 2%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.73 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.9 min

Peak Storage= 10,421 cf @ 0.77 hrs
Average Depth at Peak Storage= 2.03'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

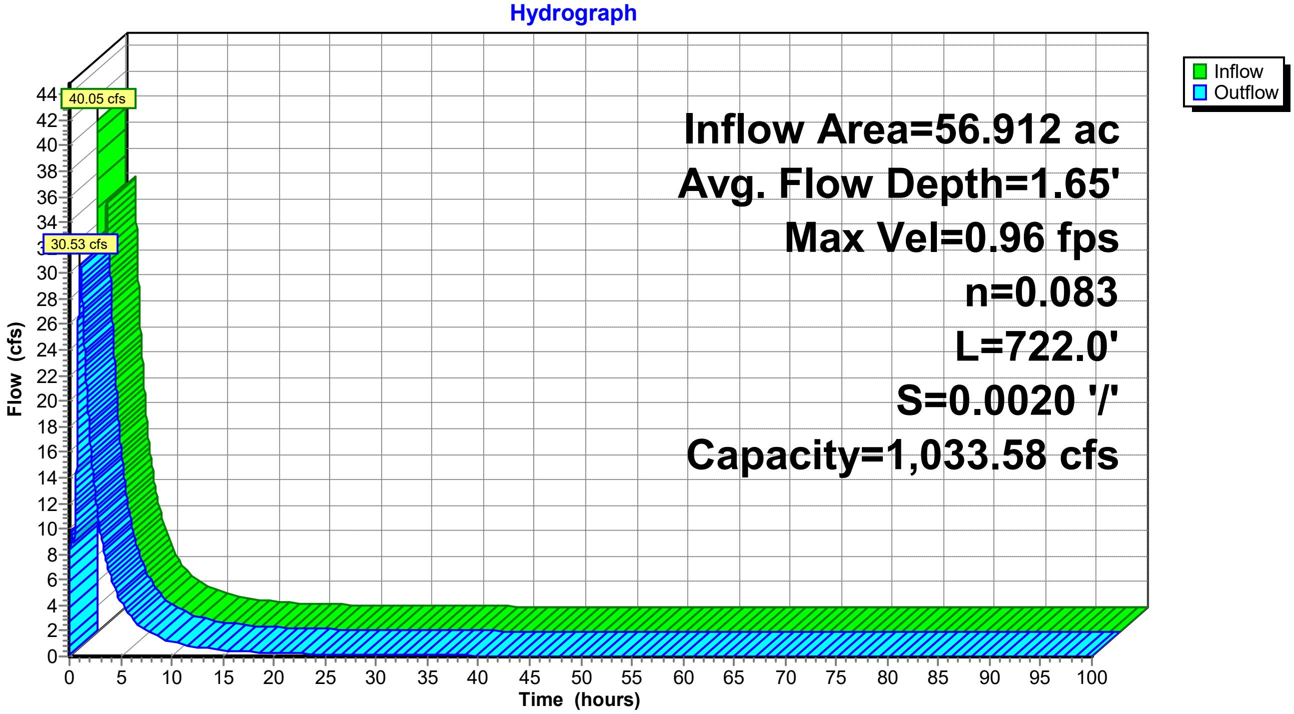
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 1.47" for 2 inch - 1-hr event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af
Outflow = 30.53 cfs @ 1.05 hrs, Volume= 6.993 af, Atten= 24%, Lag= 63.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.96 fps, Min. Travel Time= 12.5 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 56.5 min

Peak Storage= 22,856 cf @ 1.05 hrs
Average Depth at Peak Storage= 1.65'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.75' @ 0.90 hrs

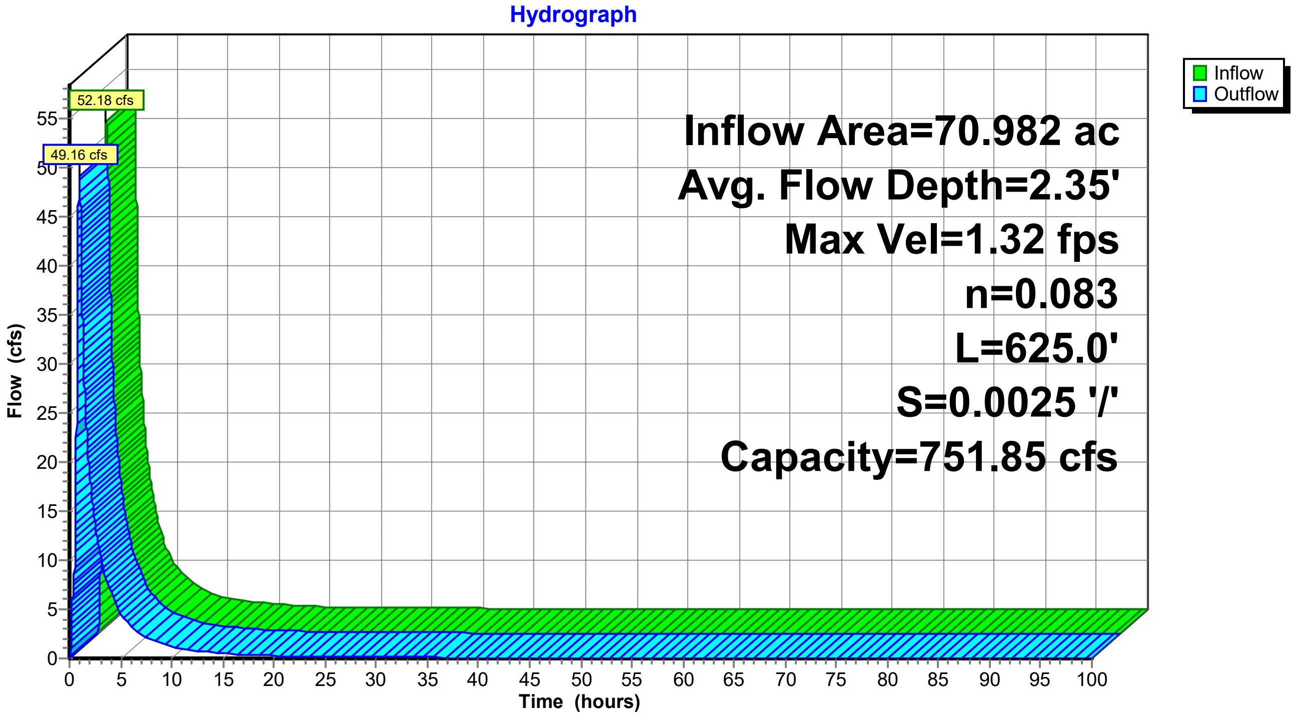
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth = 1.36" for 2 inch - 1-hr event
Inflow = 52.18 cfs @ 0.87 hrs, Volume= 8.055 af
Outflow = 49.16 cfs @ 0.97 hrs, Volume= 8.055 af, Atten= 6%, Lag= 6.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.32 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 42.6 min

Peak Storage= 23,191 cf @ 0.97 hrs
Average Depth at Peak Storage= 2.35'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow	=	13.58 cfs @ 0.00 hrs,	Volume=	112.243 af,	Incl. 13.58 cfs Base Flow
Outflow	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af,	Atten= 0%, Lag= 6,000.0 min
Primary	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af	
Secondary	=	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

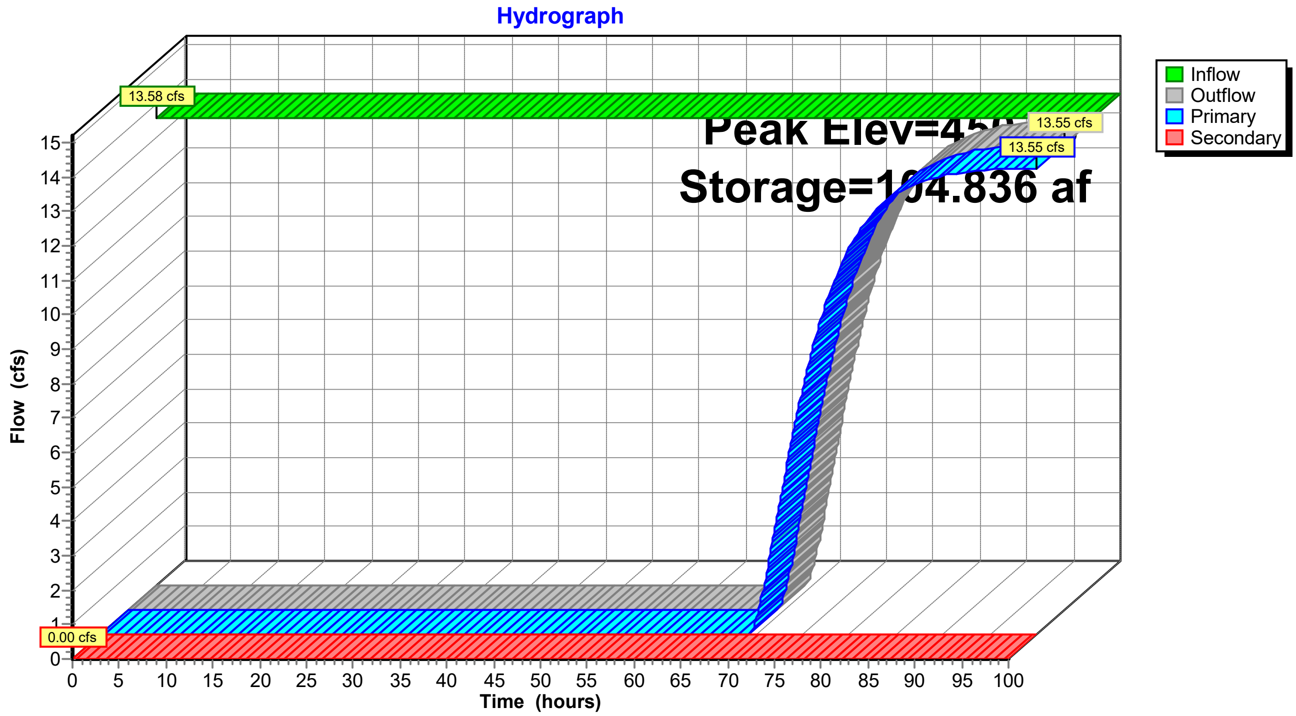
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
└─**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

During Phase 1, excavation is limited to Upper Ash Pond. Lower Ash Pond remains active and collects all existing flows. Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A. Pool A will eventually drain to the Lower Ash Pond in addition to the existing (base) flows.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 6.43" for 2 inch - 1-hr event
Inflow = 162.75 cfs @ 0.50 hrs, Volume= 129.349 af, Incl. 12.60 cfs Base Flow
Outflow = 14.52 cfs @ 25.51 hrs, Volume= 118.763 af, Atten= 91%, Lag= 1,500.7 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 25.51 hrs, Volume= 118.763 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 138.500 af
Peak Elev= 441.37' @ 25.51 hrs Surf.Area= 0.000 ac Storage= 158.176 af (19.676 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 490.7 min (3,030.6 - 2,539.9)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

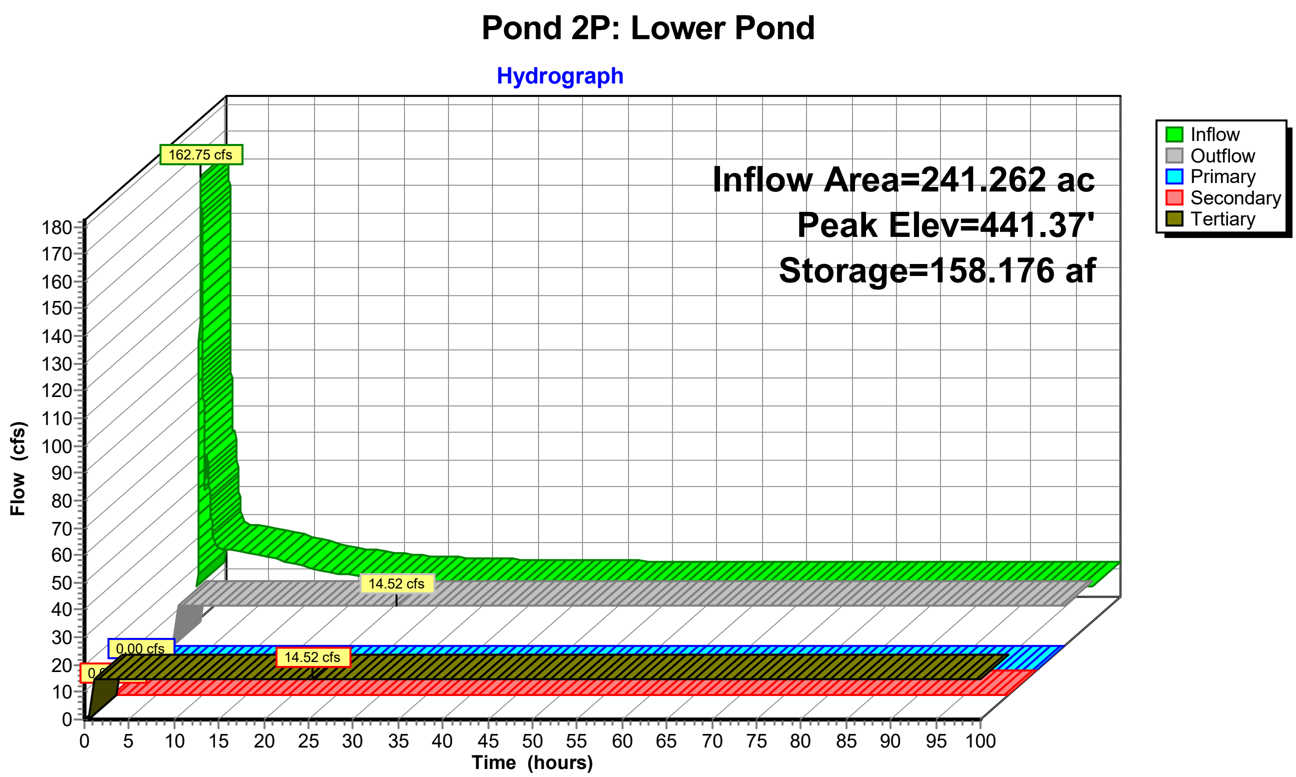
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf

#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	440.50'	**Pump** Discharges@450.90' Turns Off@440.00' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=428.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.00 cfs of 110.64 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=447.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 25.51 hrs HW=441.37' (Free Discharge)
↑—**4=Pump** (Pump Controls 14.52 cfs)



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.33' @ 1.50 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.87" for 2 inch - 1-hr event
Inflow = 118.81 cfs @ 0.72 hrs, Volume= 4.111 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af, Atten= 66%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.72' @ 1.04 hrs Surf.Area= 0.000 ac Storage= 9.648 af (2.078 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 220.9 min (267.8 - 46.8)

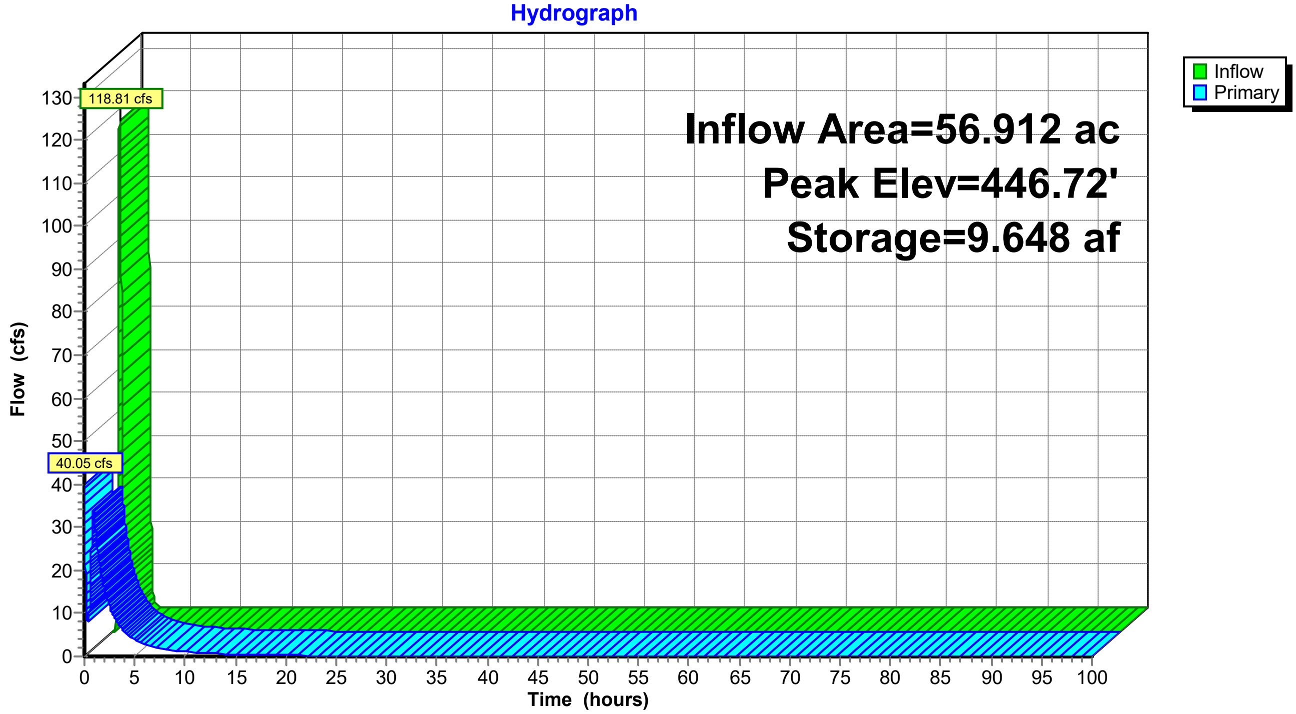
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

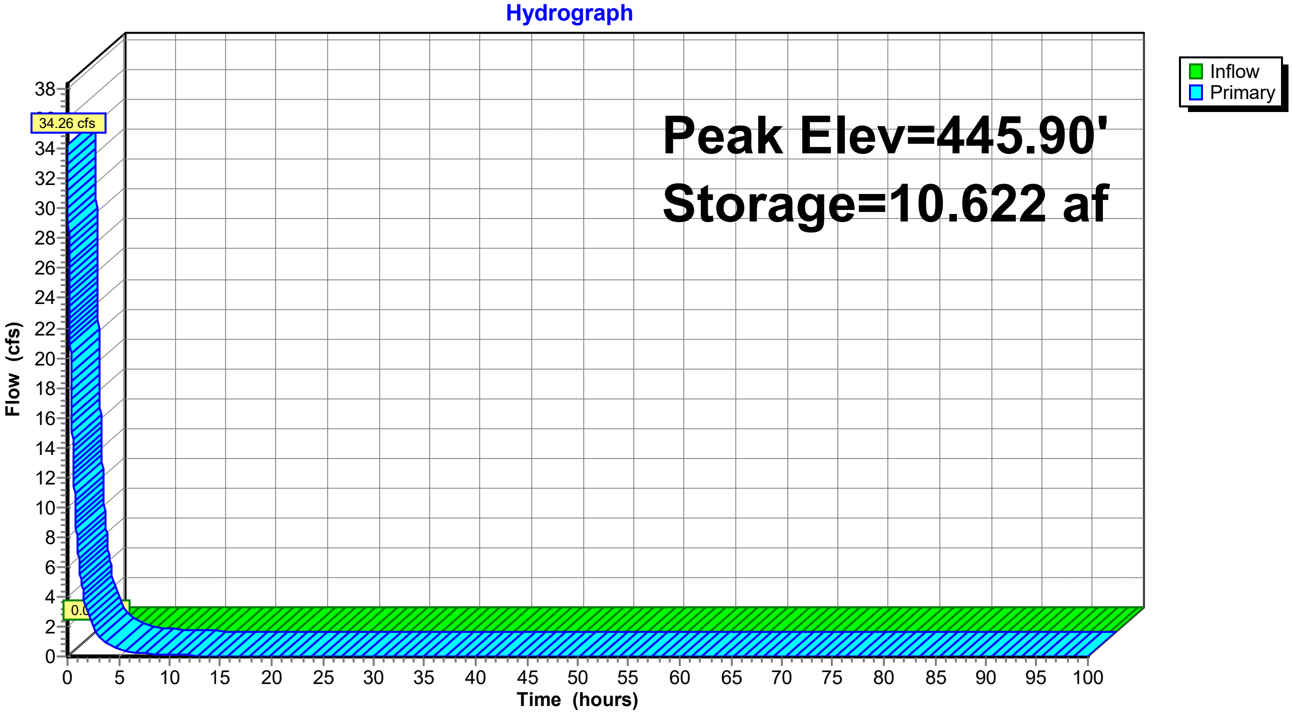
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

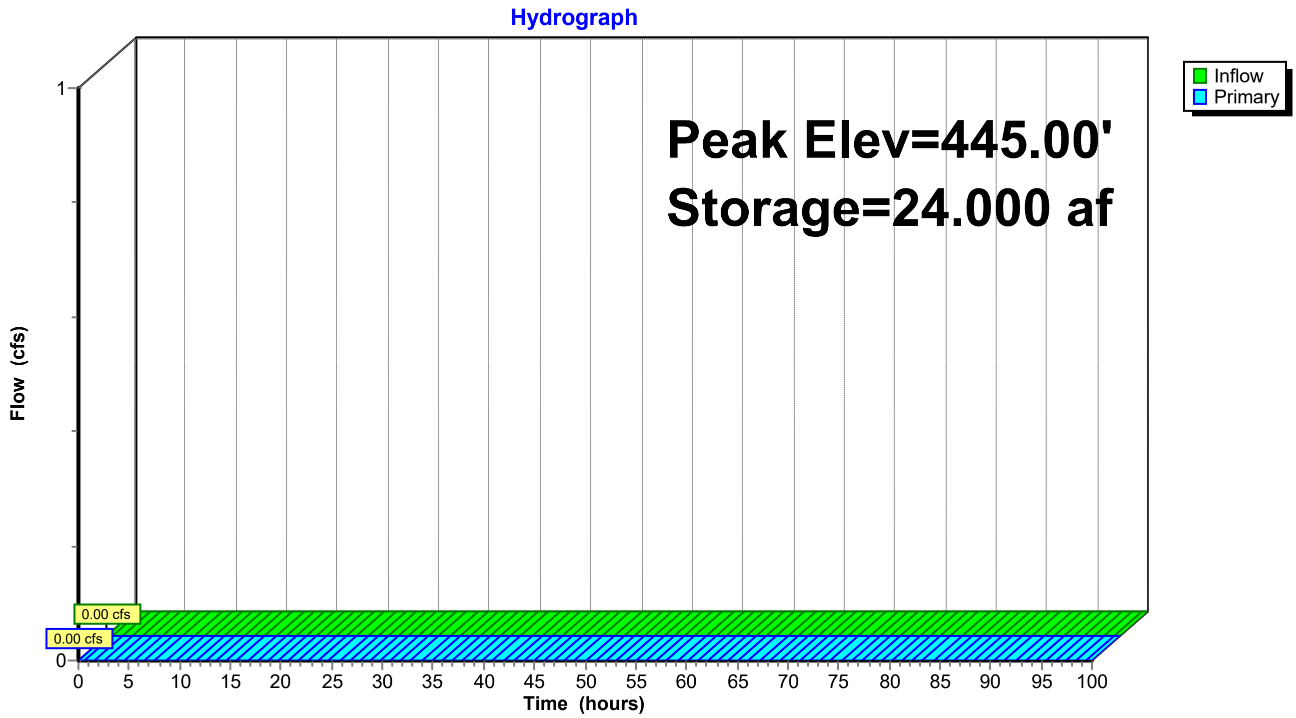
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 4.22' @ 4.97 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 1.29" for 2 inch - 1-hr event
Inflow = 126.06 cfs @ 1.42 hrs, Volume= 17.674 af
Outflow = 13.44 cfs @ 3.33 hrs, Volume= 17.019 af, Atten= 89%, Lag= 114.4 min
Primary = 13.44 cfs @ 3.33 hrs, Volume= 17.019 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 448.51' @ 3.33 hrs Surf.Area= 0.000 ac Storage= 40.212 af (12.822 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 742.2 min (923.6 - 181.4)

Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

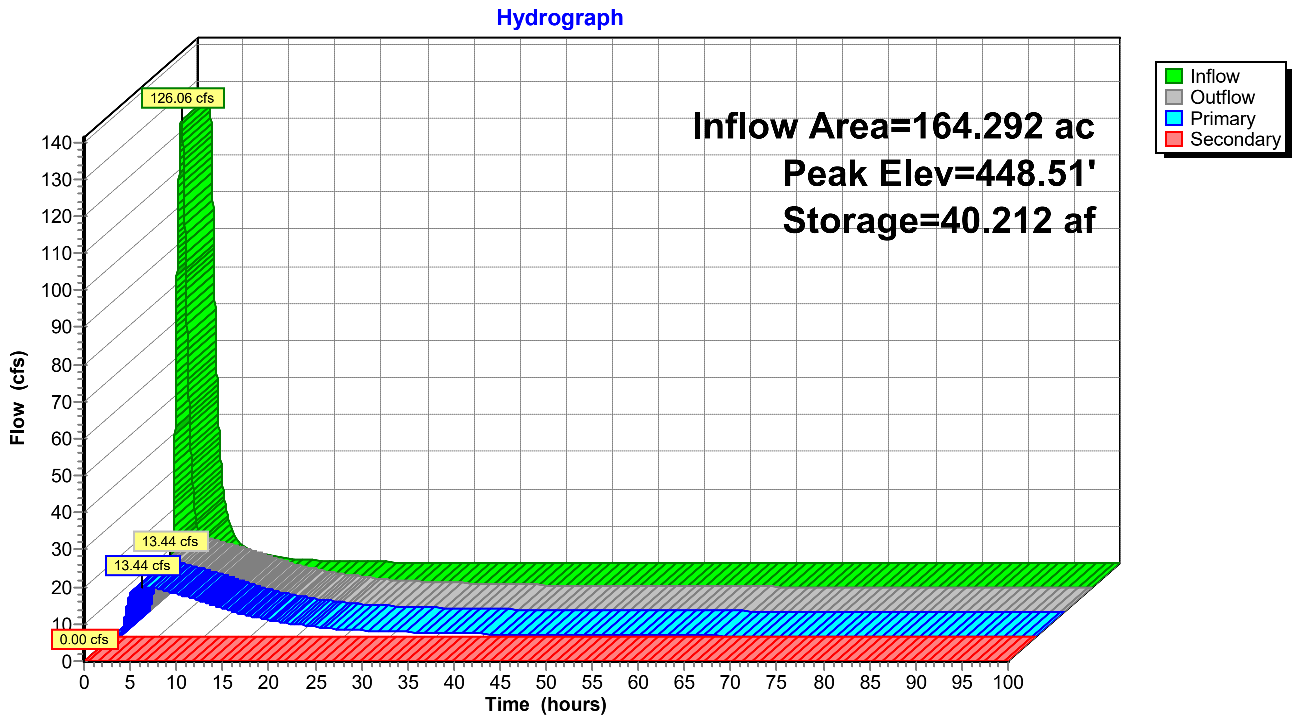
Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

Primary OutFlow Max=13.45 cfs @ 3.33 hrs HW=448.51' TW=440.78' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 13.45 cfs @ 4.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Subcatchment 2S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

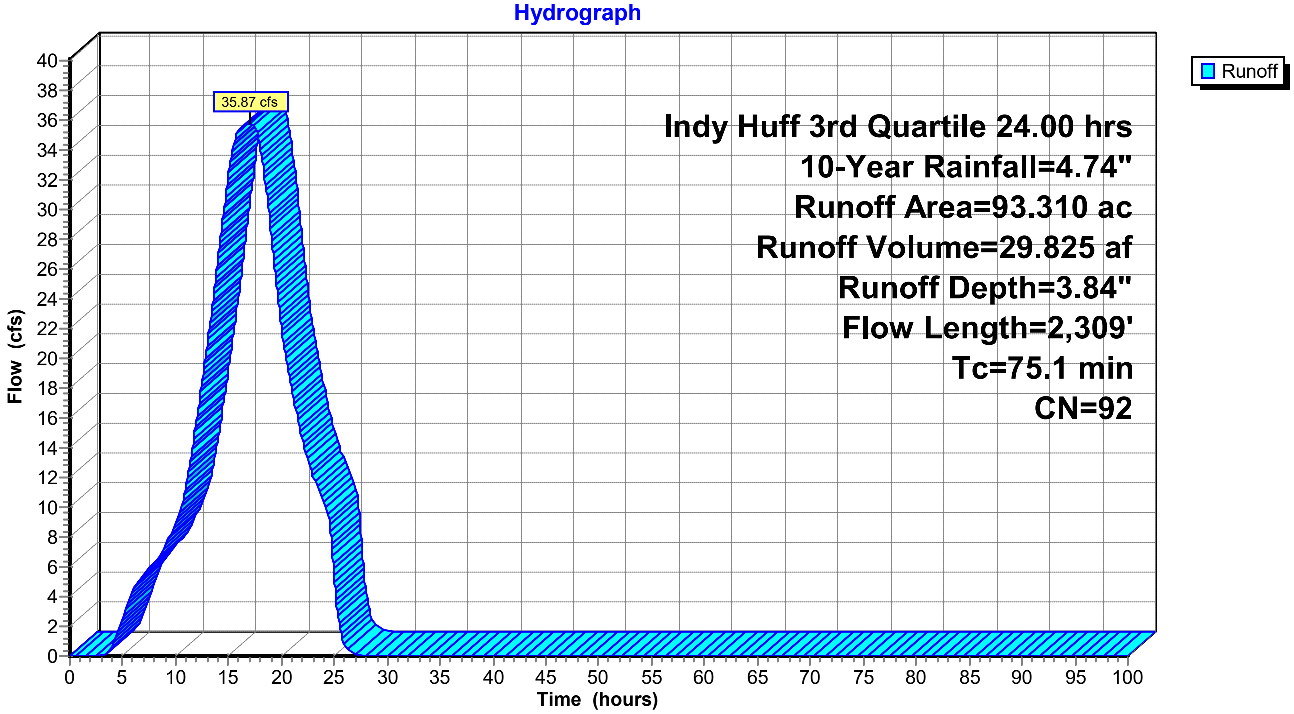
Runoff = 35.87 cfs @ 16.94 hrs, Volume= 29.825 af, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
*	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

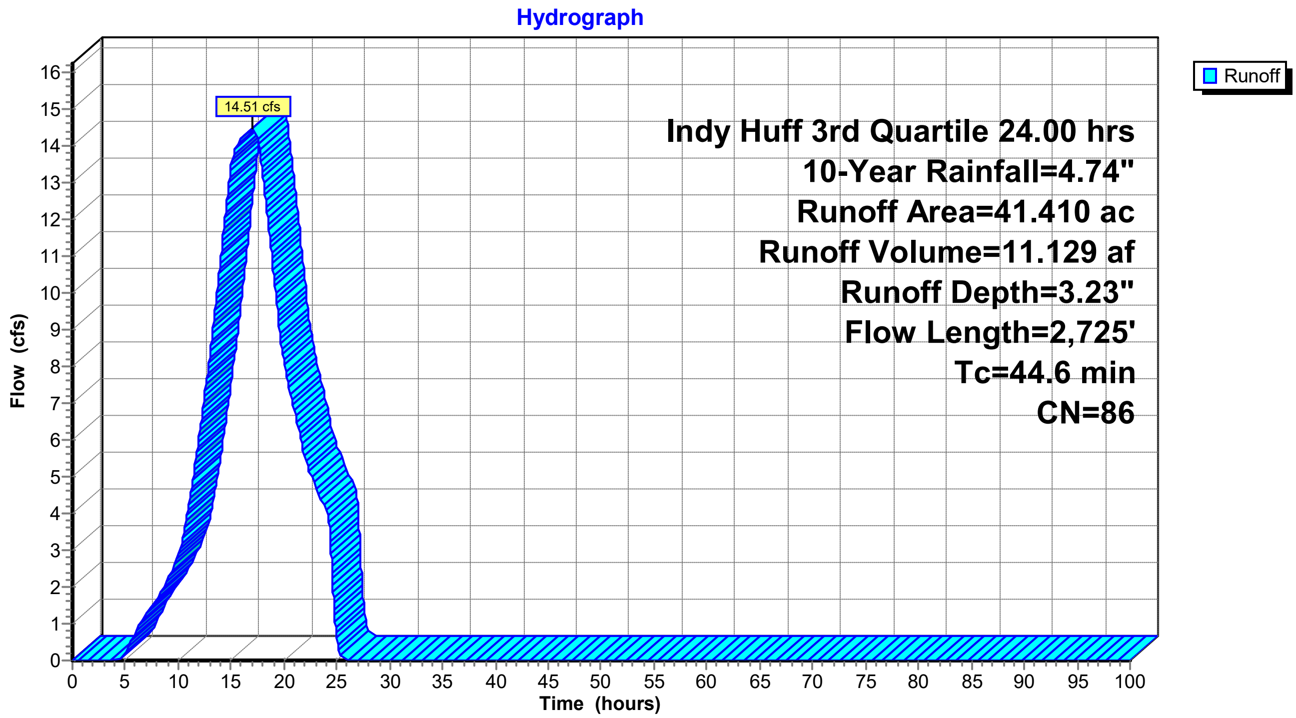
Runoff = 14.51 cfs @ 17.10 hrs, Volume= 11.129 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 1 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

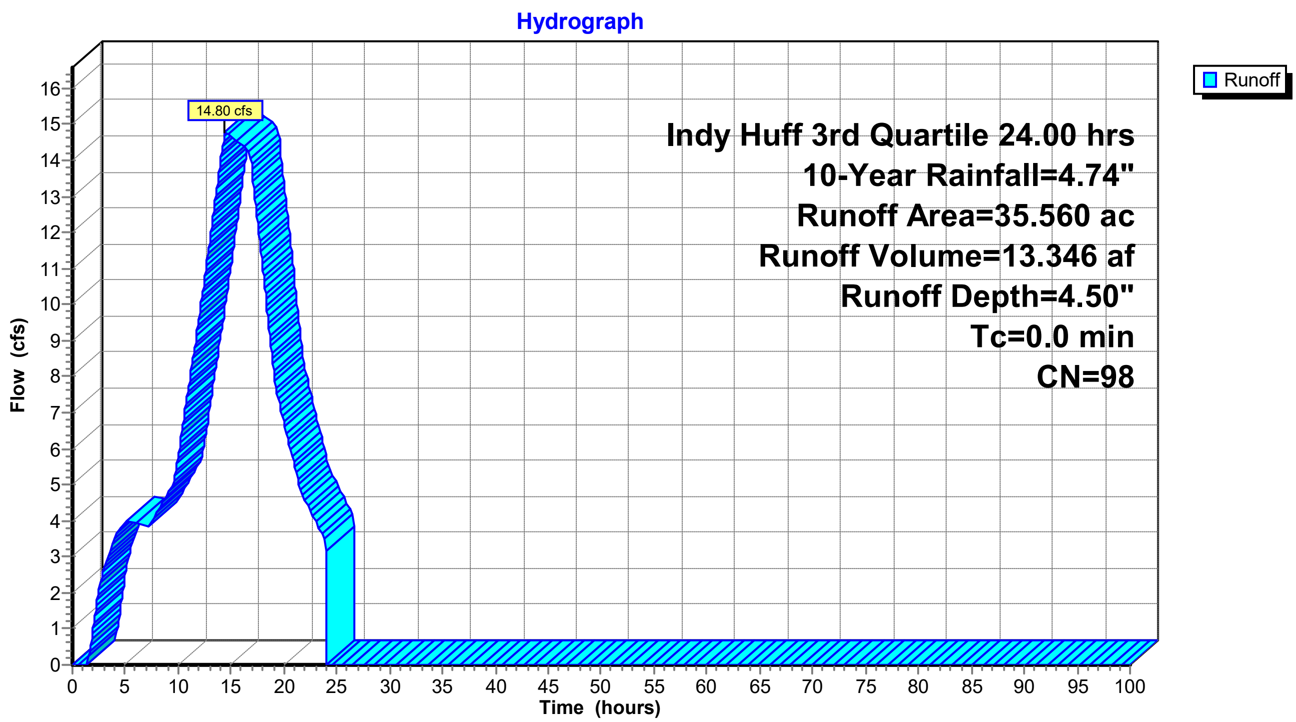
Runoff = 14.80 cfs @ 14.41 hrs, Volume= 13.346 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

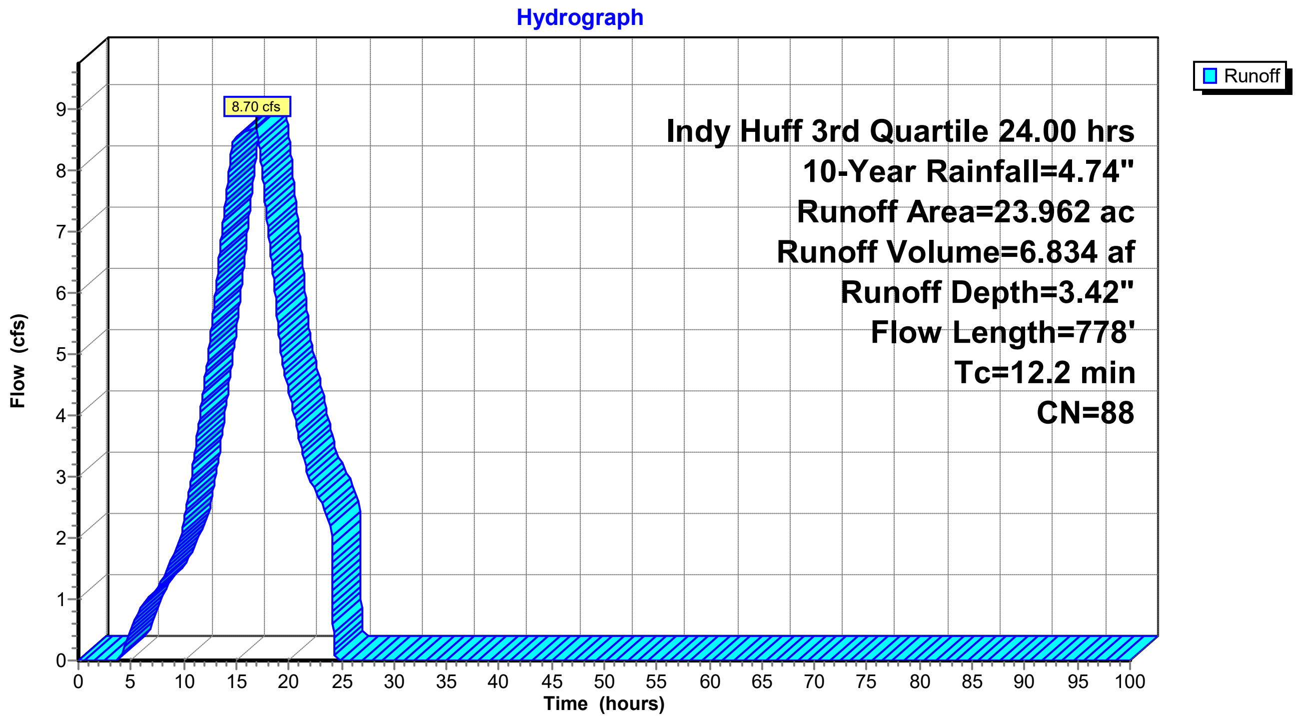
Runoff = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

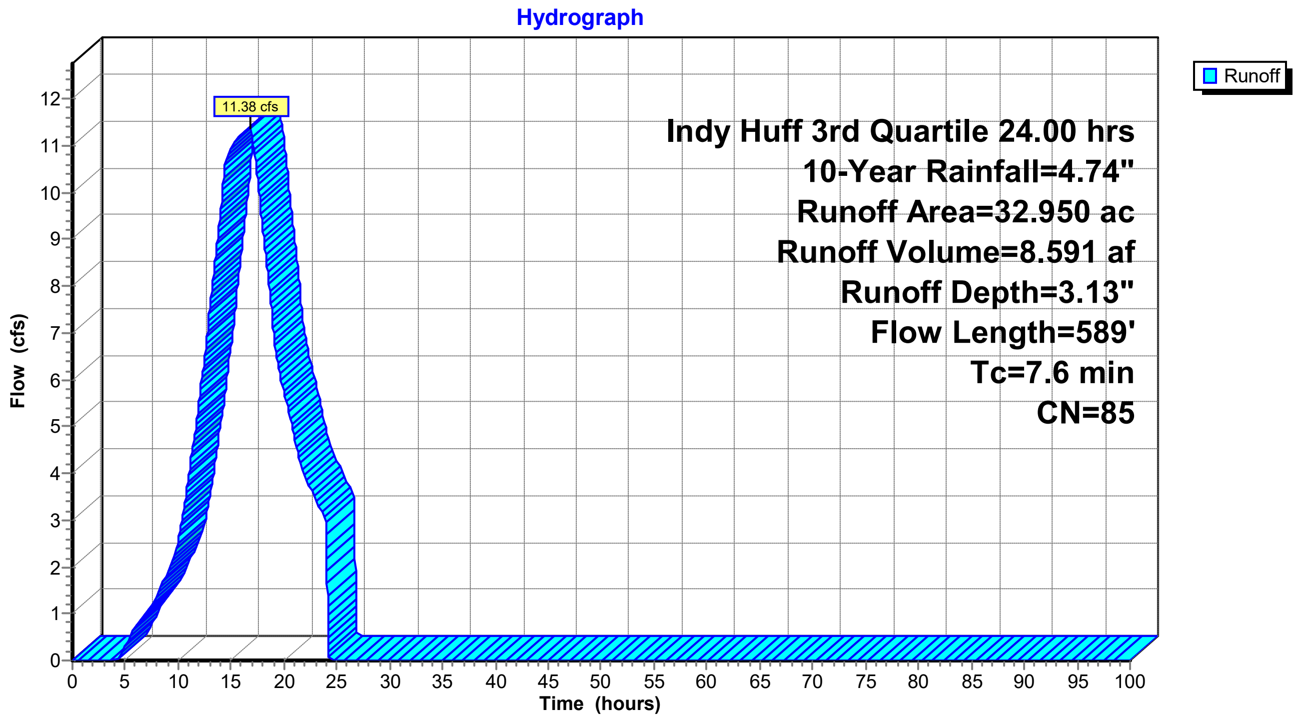
Runoff = 11.38 cfs @ 16.83 hrs, Volume= 8.591 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

EndPhase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

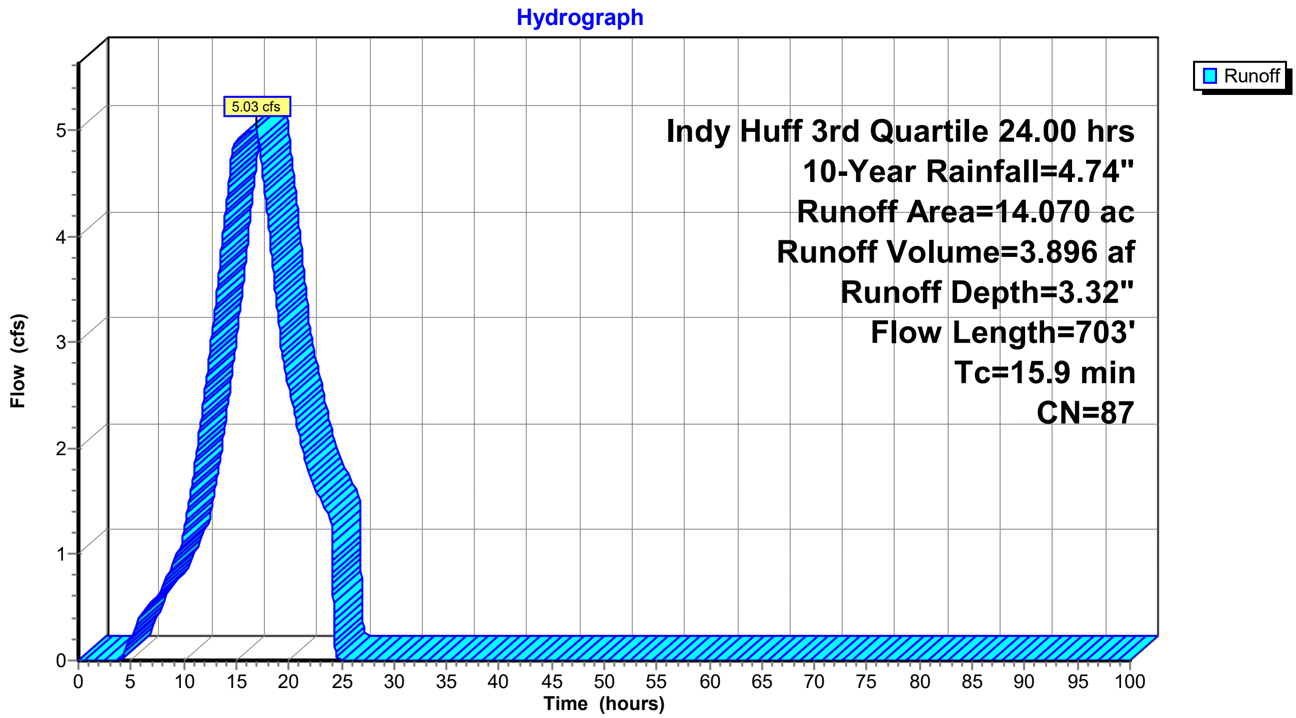
Runoff = 5.03 cfs @ 16.87 hrs, Volume= 3.896 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



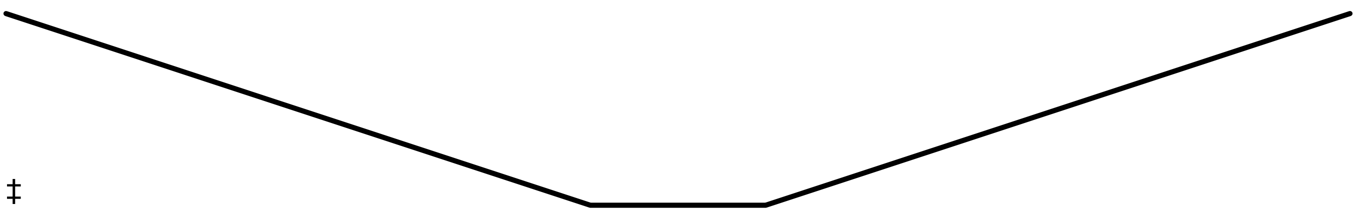
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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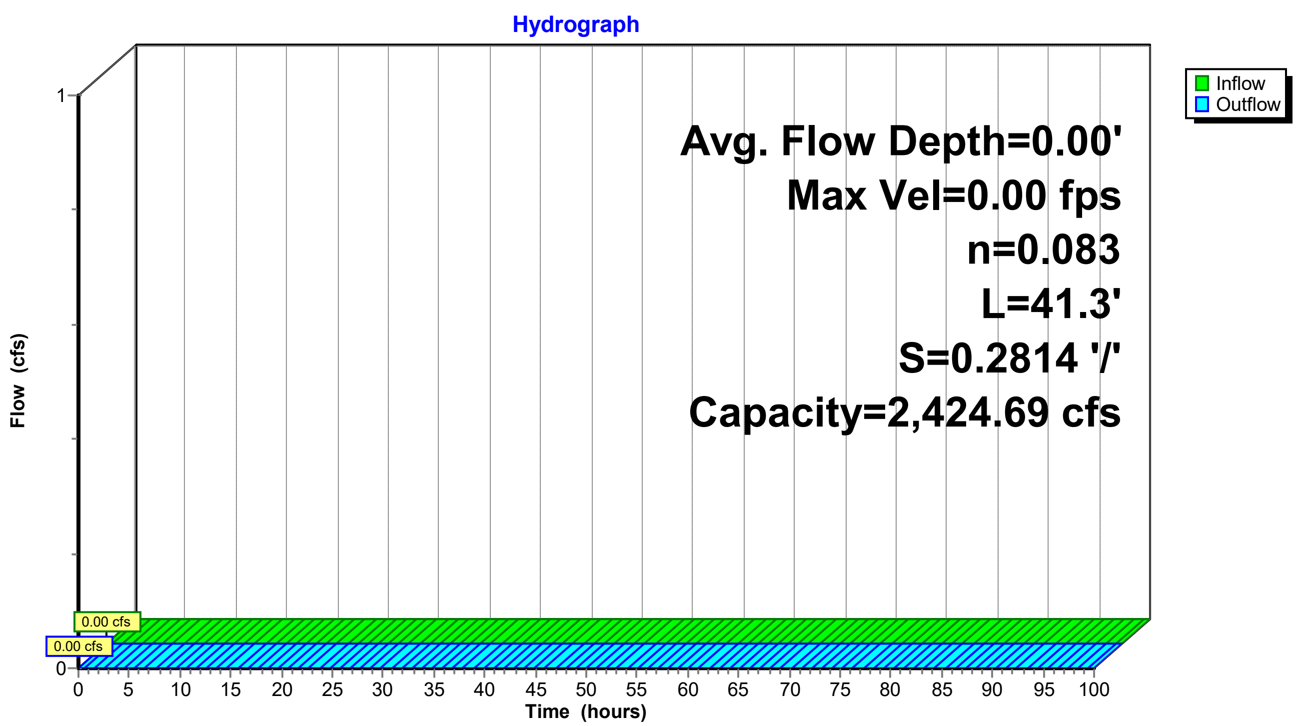
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

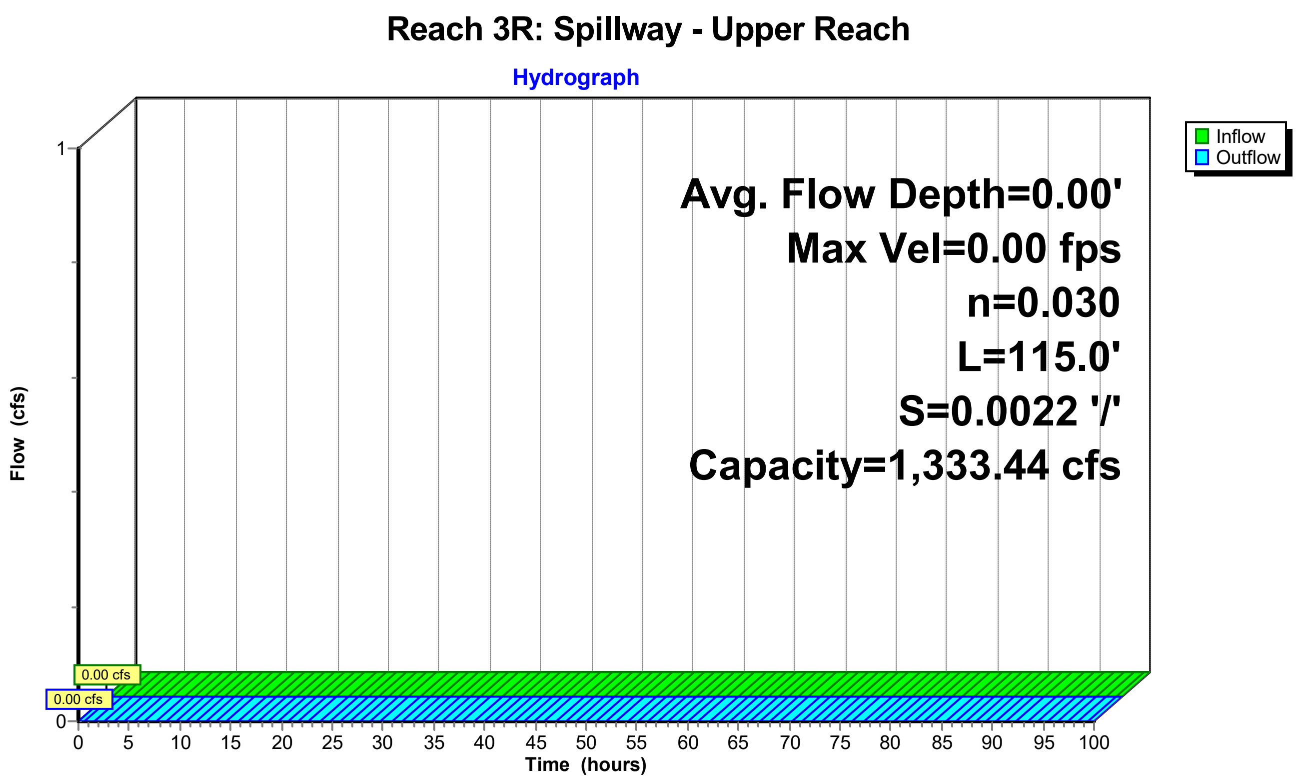
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡



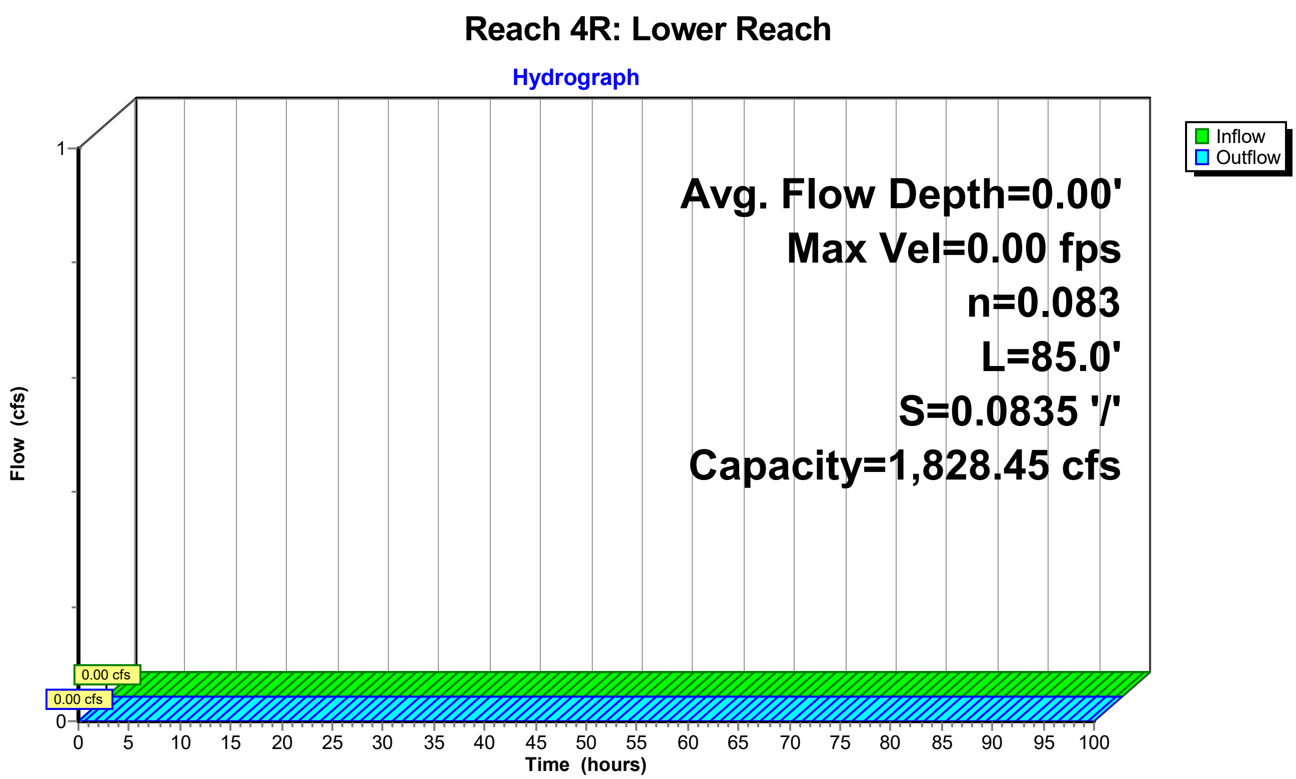
Summary for Reach 4R: Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'



Summary for Reach 5R: Discharge Creek

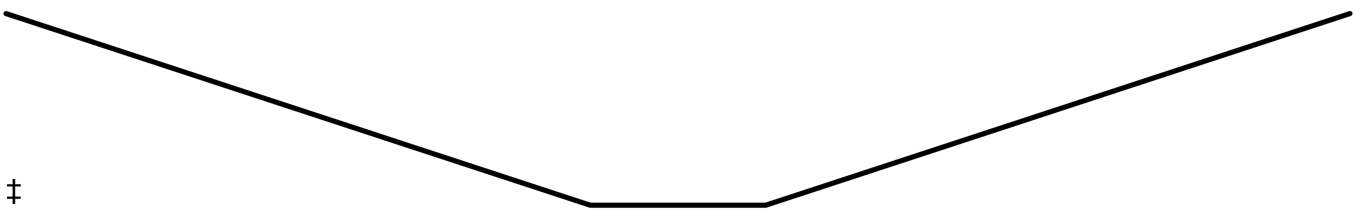
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.26' @ 0.00 hrs

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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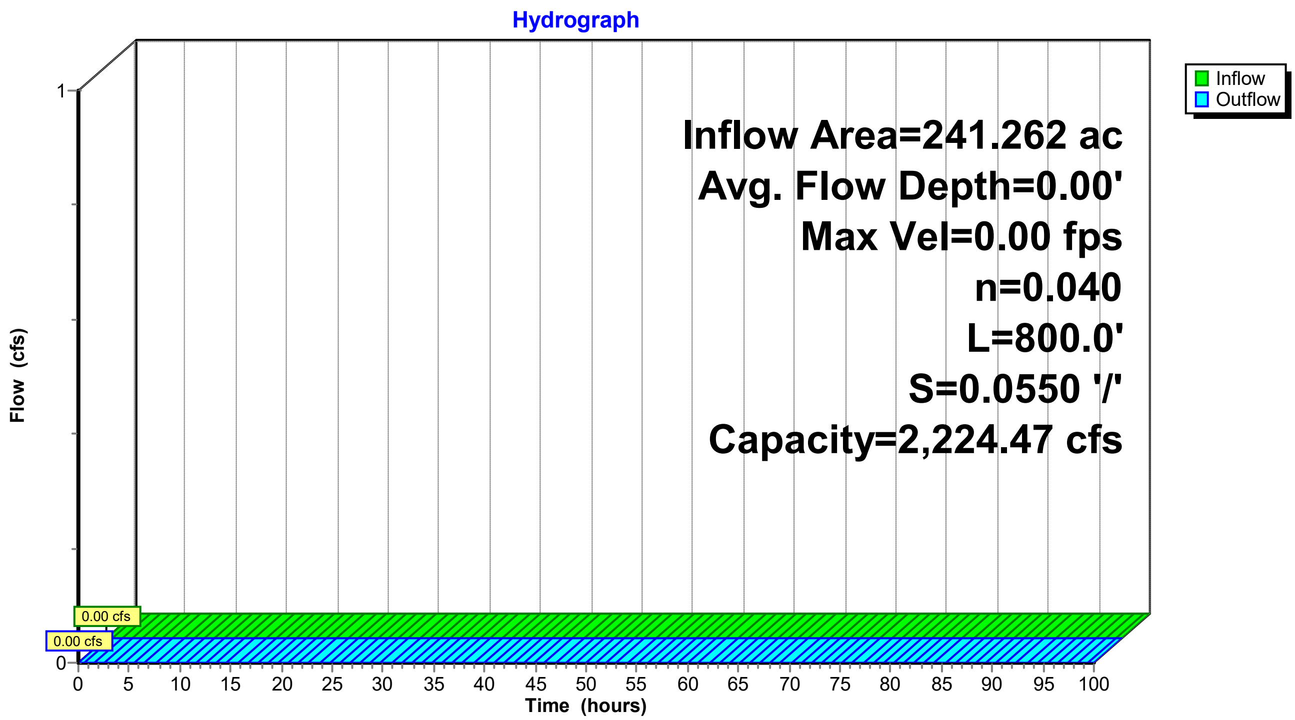
Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

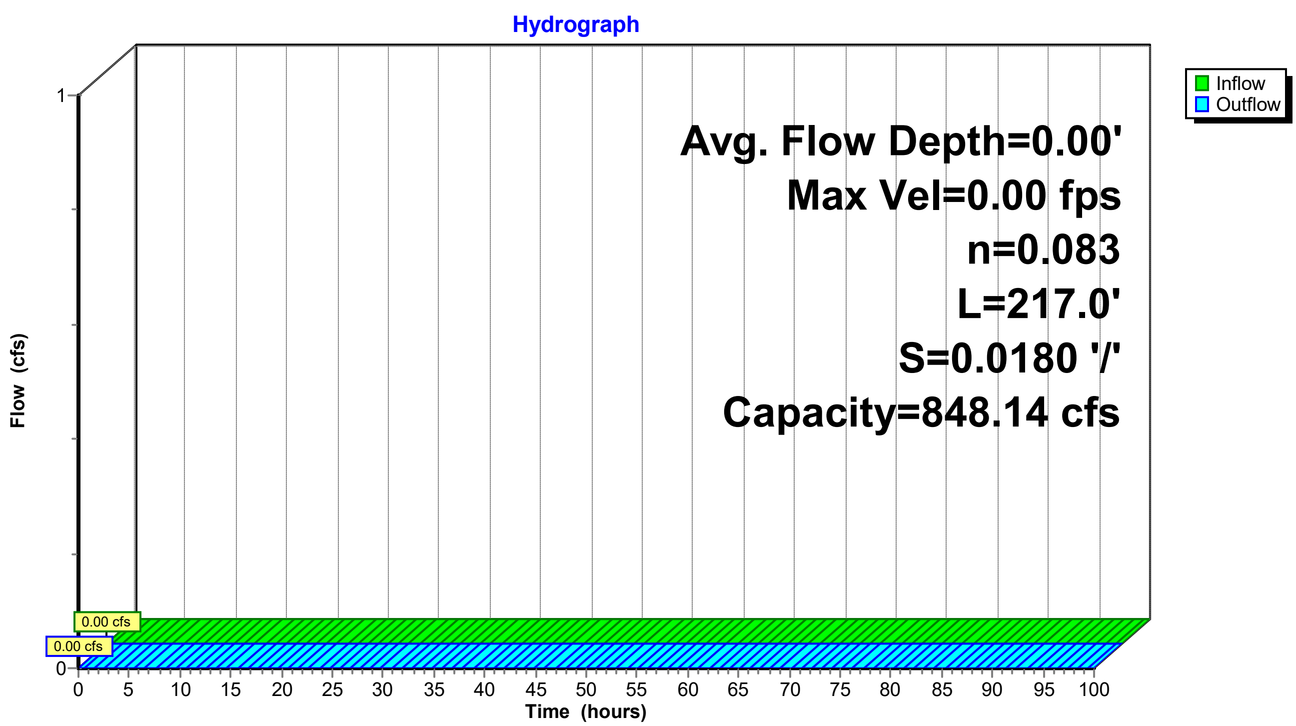
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

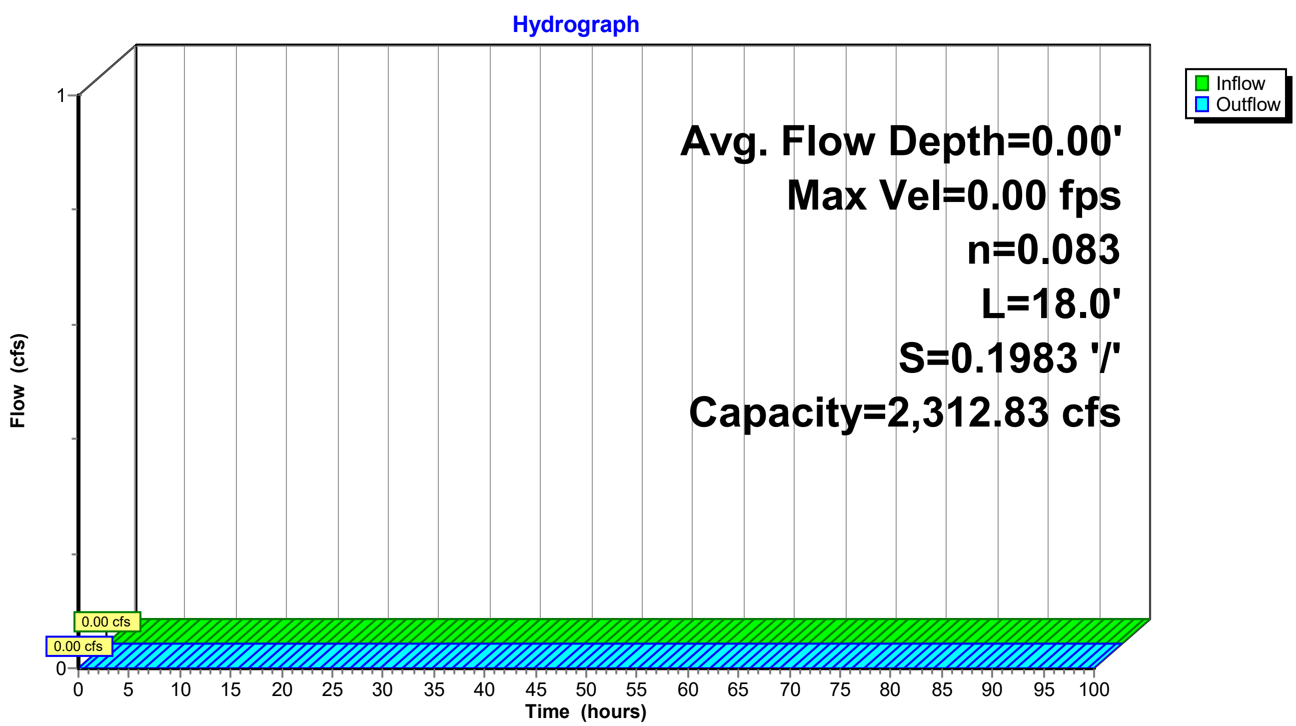
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



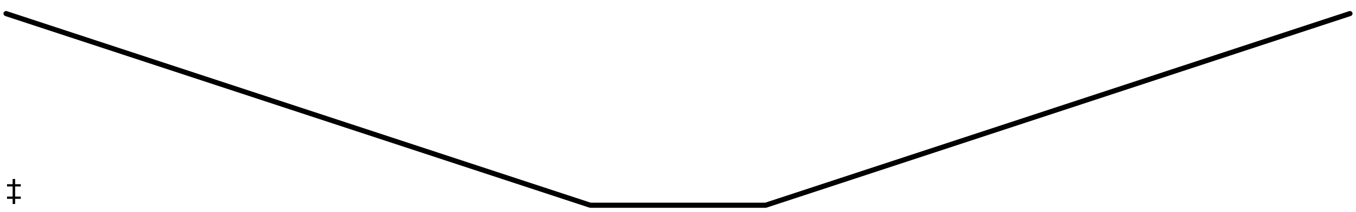
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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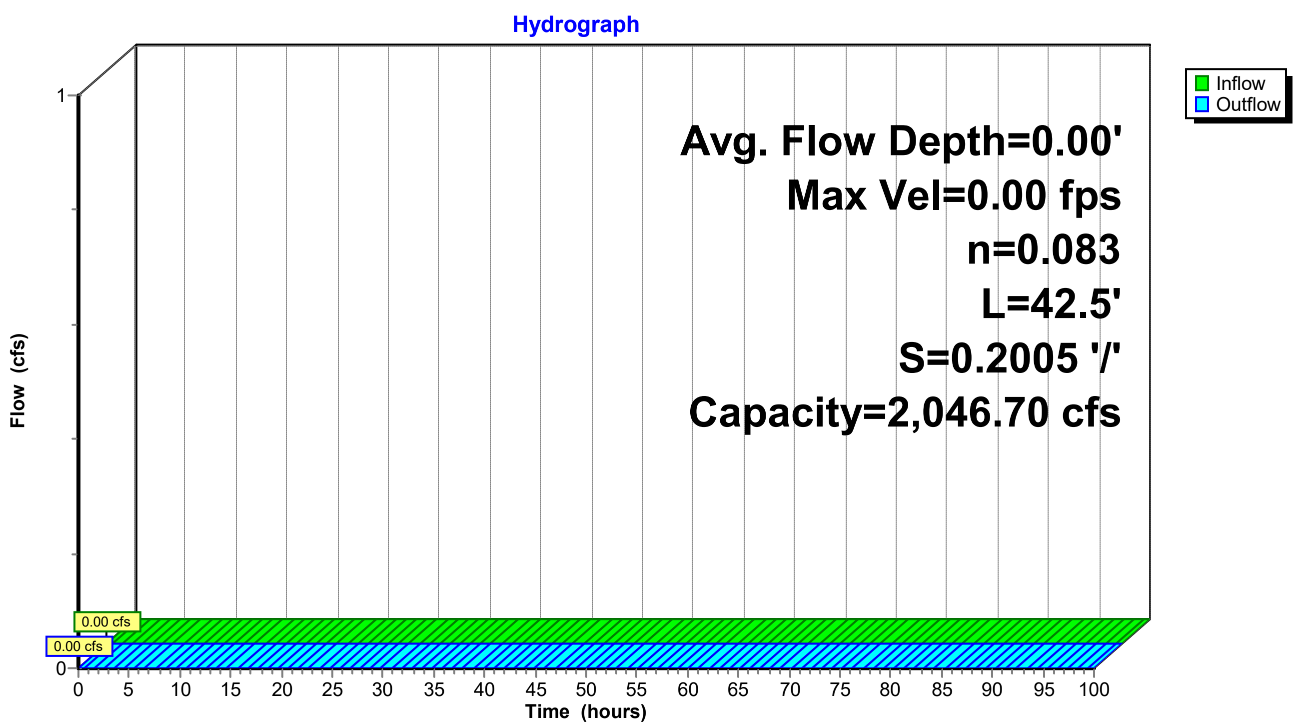
Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

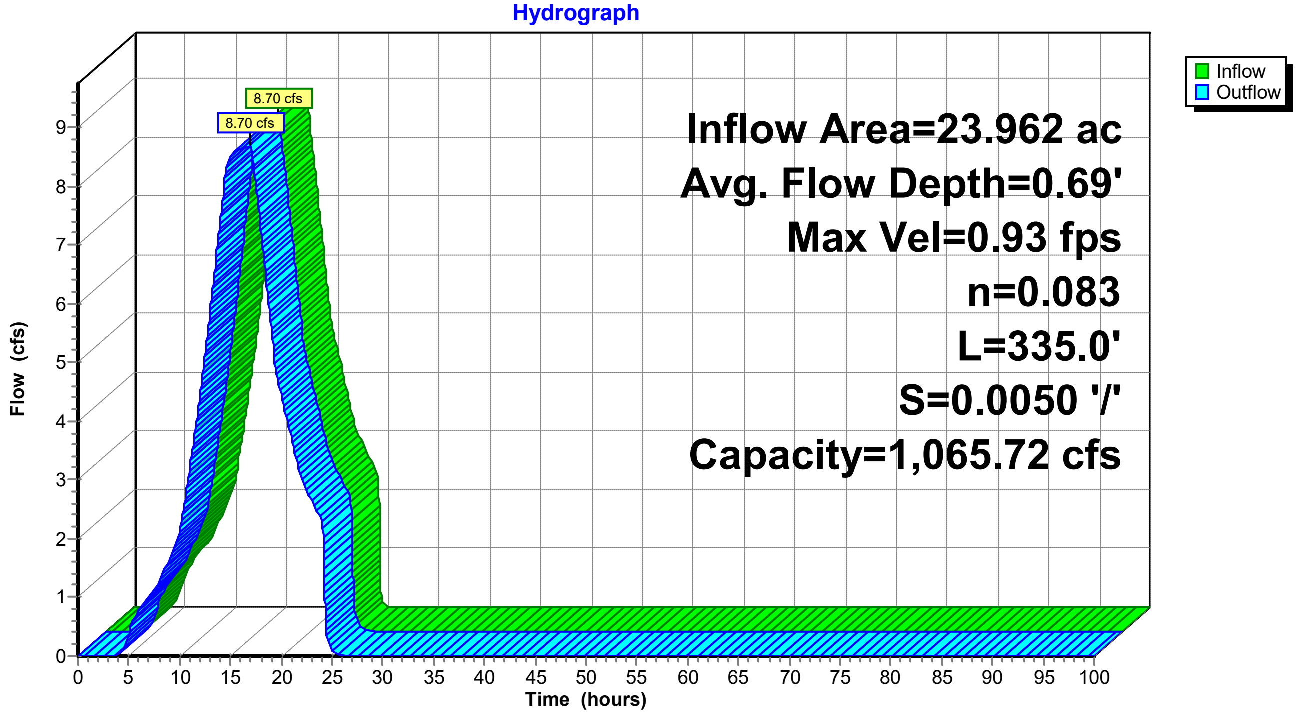
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af
Outflow = 8.70 cfs @ 16.88 hrs, Volume= 6.834 af, Atten= 0%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 9.3 min

Peak Storage= 3,133 cf @ 16.88 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

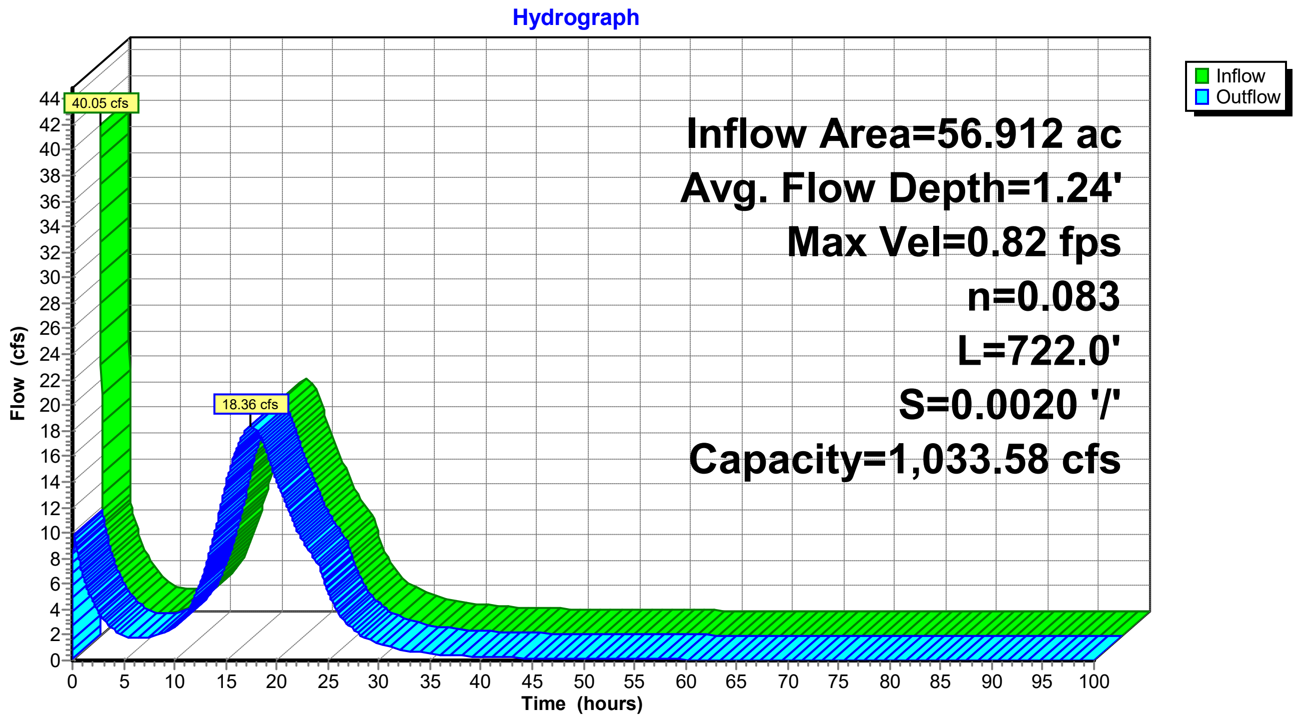
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth > 3.86" for 10-Year event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af
Outflow = 18.36 cfs @ 17.49 hrs, Volume= 18.302 af, Atten= 54%, Lag= 1,049.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.82 fps, Min. Travel Time= 14.7 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 41.5 min

Peak Storage= 16,194 cf @ 17.49 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.28' @ 17.02 hrs

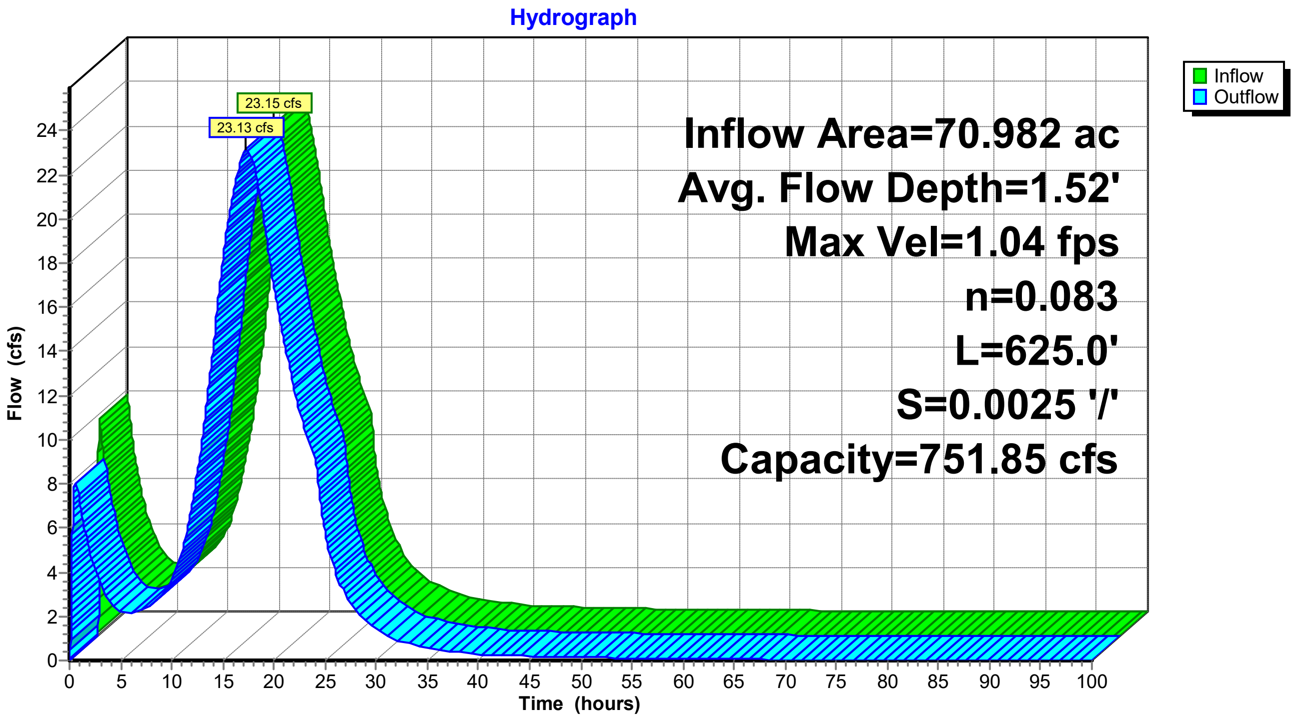
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth > 3.75" for 10-Year event
Inflow = 23.15 cfs @ 17.19 hrs, Volume= 22.199 af
Outflow = 23.13 cfs @ 17.30 hrs, Volume= 22.198 af, Atten= 0%, Lag= 6.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.04 fps, Min. Travel Time= 10.0 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 30.0 min

Peak Storage= 13,893 cf @ 17.30 hrs
Average Depth at Peak Storage= 1.52'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow	=	13.58 cfs @ 0.00 hrs,	Volume=	112.243 af,	Incl. 13.58 cfs Base Flow
Outflow	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af,	Atten= 0%, Lag= 6,000.0 min
Primary	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af	
Secondary	=	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

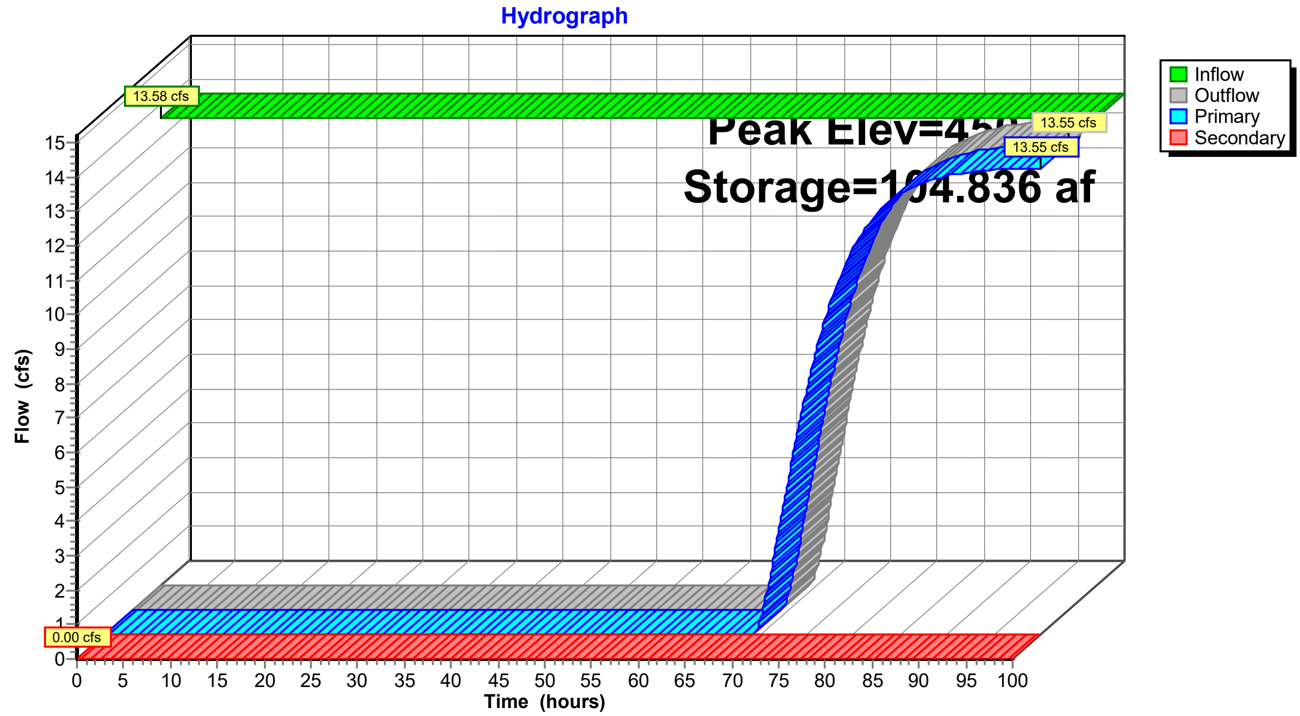
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
└─**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 2P: Lower Pond

During Phase 1, excavation is limited to Upper Ash Pond. Lower Ash Pond remains active and collects all existing flows. Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A. Pool A will eventually drain to the Lower Ash Pond in addition to the existing (base) flows.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 8.94" for 10-Year event
Inflow = 58.80 cfs @ 16.80 hrs, Volume= 179.673 af, Incl. 12.60 cfs Base Flow
Outflow = 14.52 cfs @ 56.17 hrs, Volume= 113.268 af, Atten= 75%, Lag= 2,362.1 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 56.17 hrs, Volume= 113.268 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 138.500 af
Peak Elev= 443.69' @ 56.17 hrs Surf.Area= 0.000 ac Storage= 209.566 af (71.066 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 794.4 min (3,168.0 - 2,373.6)

Volume	Invert	Avail.Storage	Storage Description
#1	430.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
430.00	0.000
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

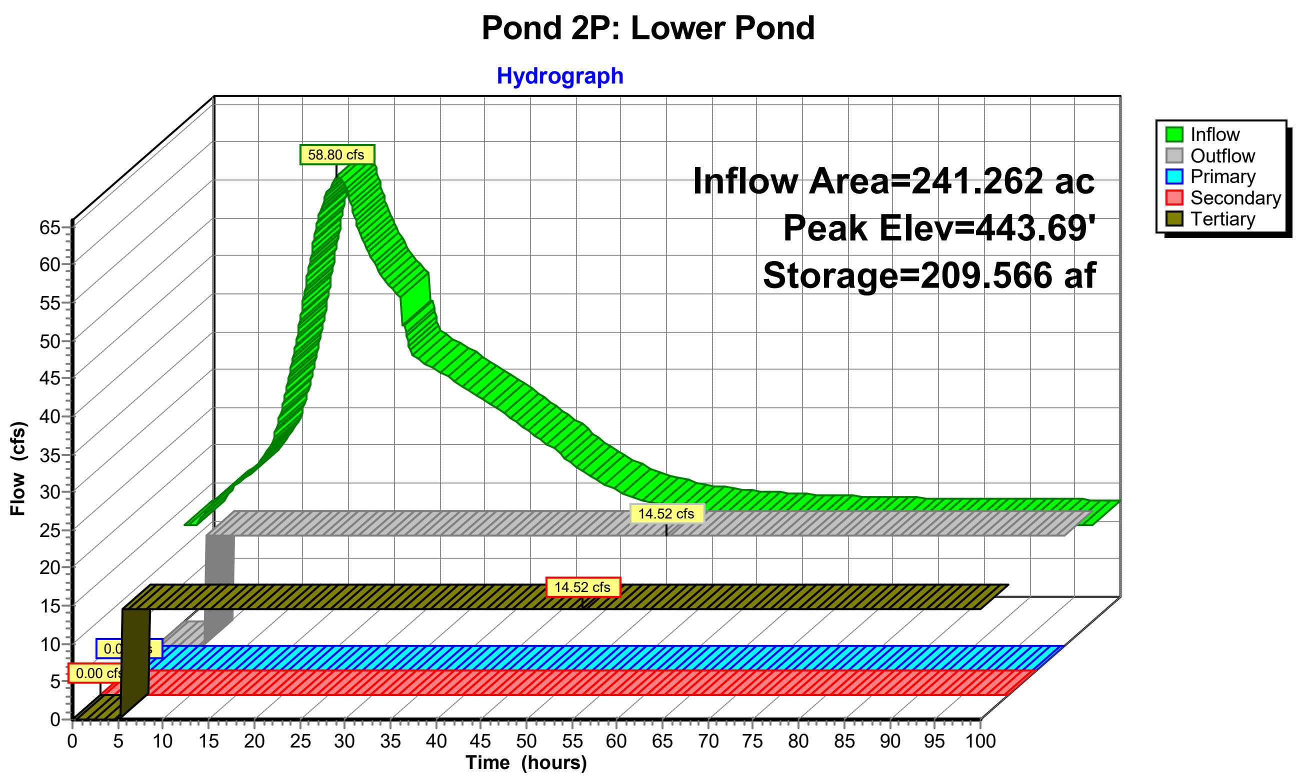
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf

#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	440.50'	**Pump** Discharges@450.90' Turns Off@440.00' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 110.64 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 56.17 hrs HW=443.69' (Free Discharge)
└─**4=Pump** (Pump Controls 14.52 cfs)



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.00' @ 0.00 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 3.25" for 10-Year event
Inflow = 20.08 cfs @ 16.83 hrs, Volume= 15.425 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af, Atten= 0%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.28' @ 17.48 hrs Surf.Area= 0.000 ac Storage= 8.381 af (0.811 af above start)

Plug-Flow detention time= 477.7 min calculated for 10.733 af (70% of inflow)
Center-of-Mass det. time= 67.4 min (1,028.1 - 960.7)

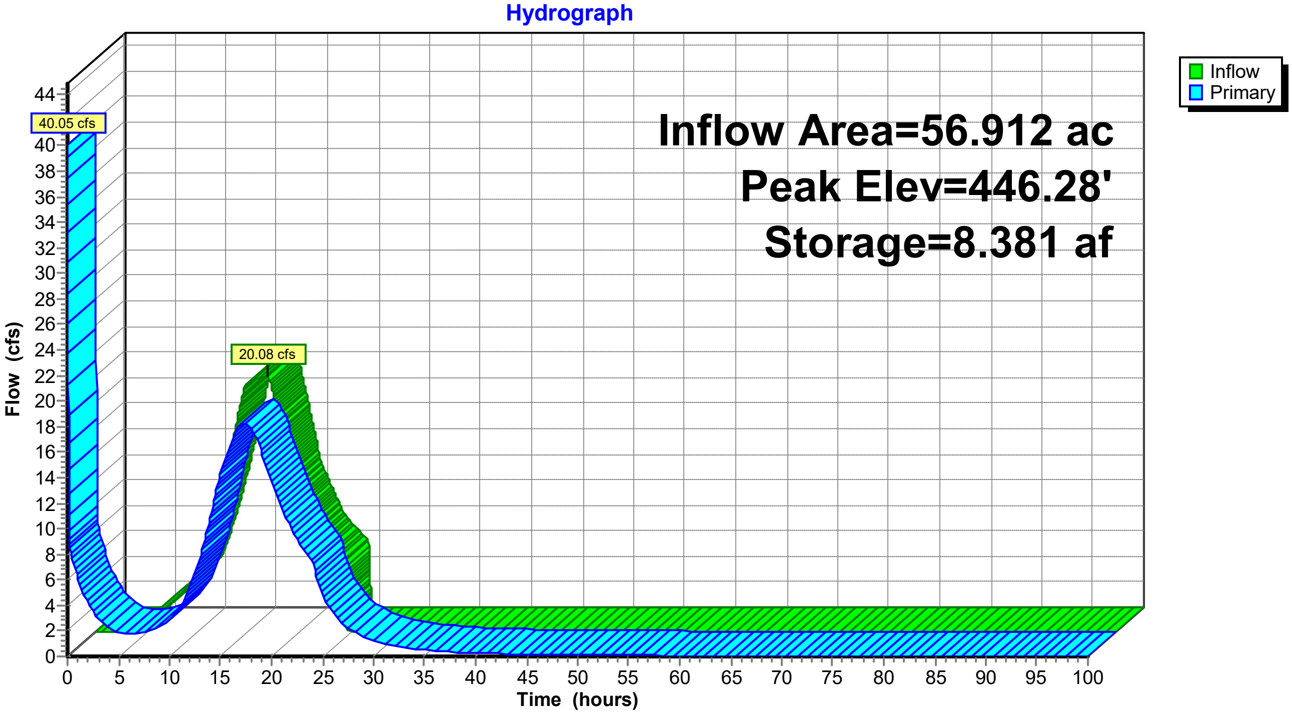
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

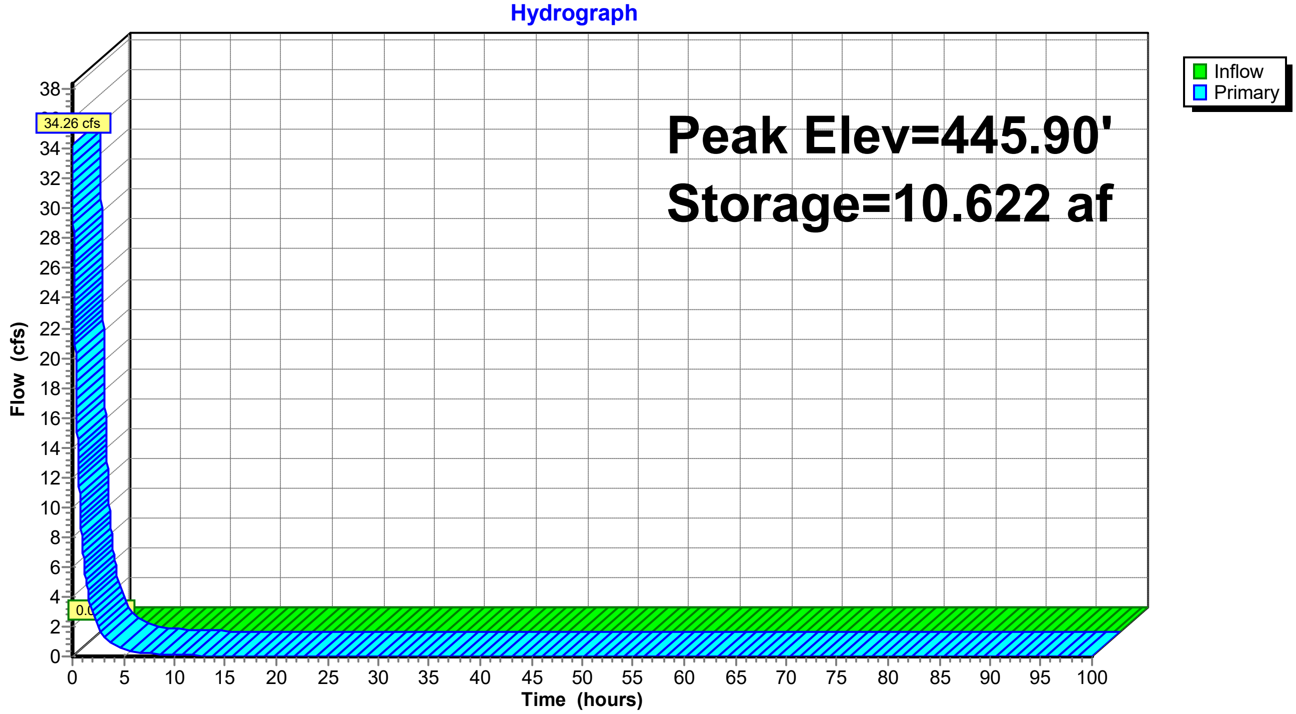
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

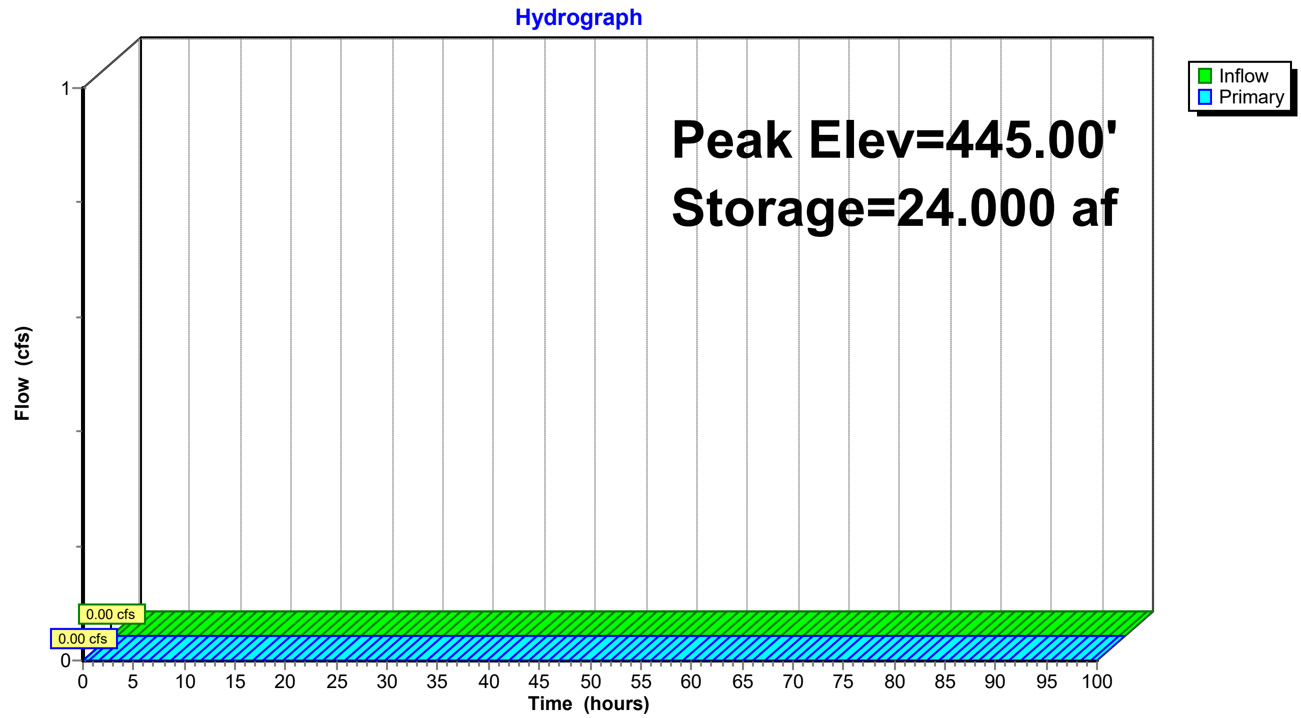
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

[63] Warning: Exceeded Reach 11R INLET depth by 6.98' @ 25.10 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 3.80" for 10-Year event
Inflow = 58.95 cfs @ 17.27 hrs, Volume= 52.024 af
Outflow = 22.50 cfs @ 23.03 hrs, Volume= 51.056 af, Atten= 62%, Lag= 345.9 min
Primary = 22.50 cfs @ 23.03 hrs, Volume= 51.056 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 451.31' @ 23.03 hrs Surf.Area= 0.000 ac Storage= 56.721 af (29.331 af above start)

Plug-Flow detention time= 1,715.6 min calculated for 23.666 af (45% of inflow)
Center-of-Mass det. time= 784.5 min (1,793.9 - 1,009.4)

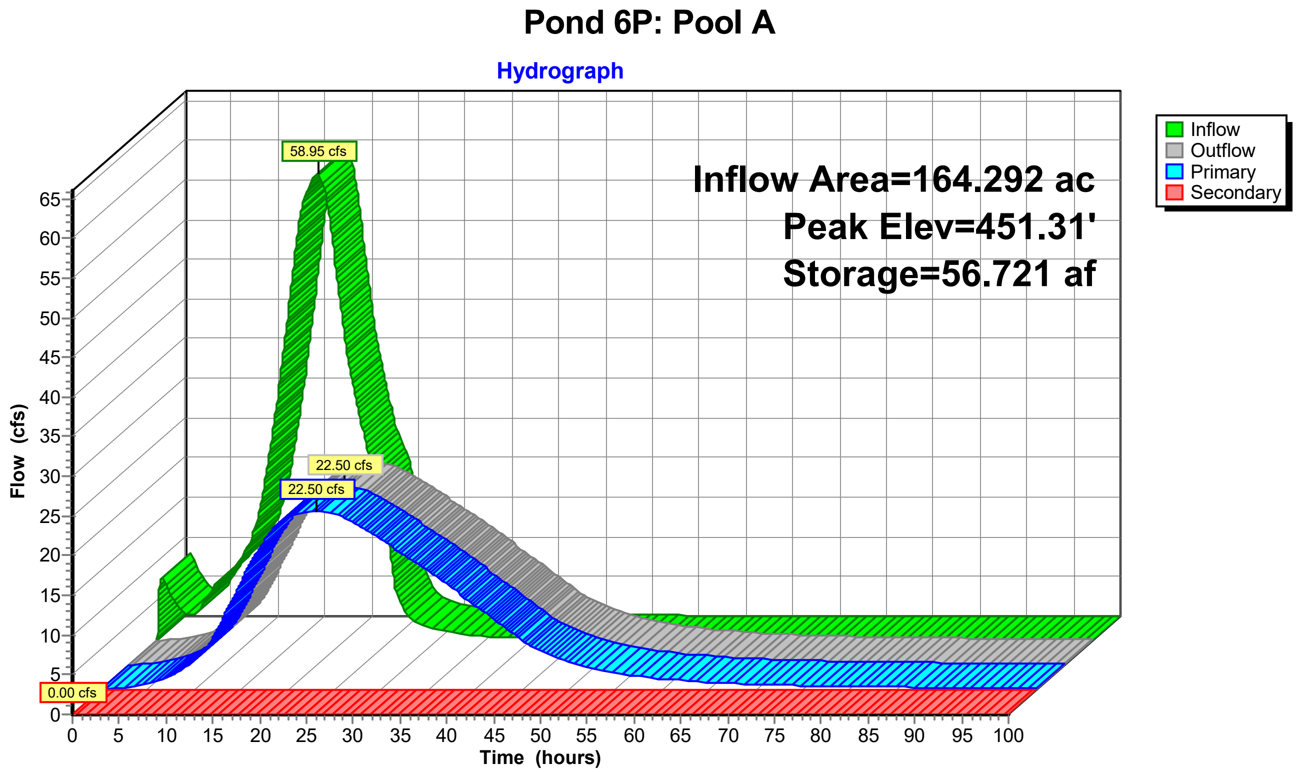
Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

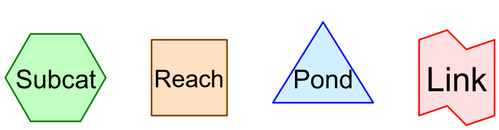
Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

Primary OutFlow Max=22.50 cfs @ 23.03 hrs HW=451.31' TW=442.70' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 22.50 cfs @ 7.94 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



MILESTONE 2



Routing Diagram for Brown - Phase 2_Begin
Prepared by AECOM, Printed 10/15/2021
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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchm Numbers
0.000	0.000	99.830	0.000	0.000	99.830	50-75% Grass cover, Fair	
0.000	0.000	0.000	0.000	71.720	71.720	Ash	
0.000	0.000	0.000	0.000	11.532	11.532	Ash (Due to Pool C2 being dry)	
0.000	0.000	0.000	0.000	14.760	14.760	Ash from dewatering	
0.000	0.000	0.000	0.000	1.440	1.440	Ash within Pool Limits - Dewatered	
0.000	0.000	35.560	0.000	0.000	35.560	Water Surface	
0.000	0.000	0.000	0.000	4.490	4.490	Water Surface (Pools A, B, C1, C2)	
0.000	0.000	0.000	0.000	1.930	1.930	Water Surface (Pools C1)	
0.000	**0.000**	**135.390**	**0.000**	**105.872**	**241.262**	**TOTAL AREA**	

Summary for Subcatchment 2S: Phase 2 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

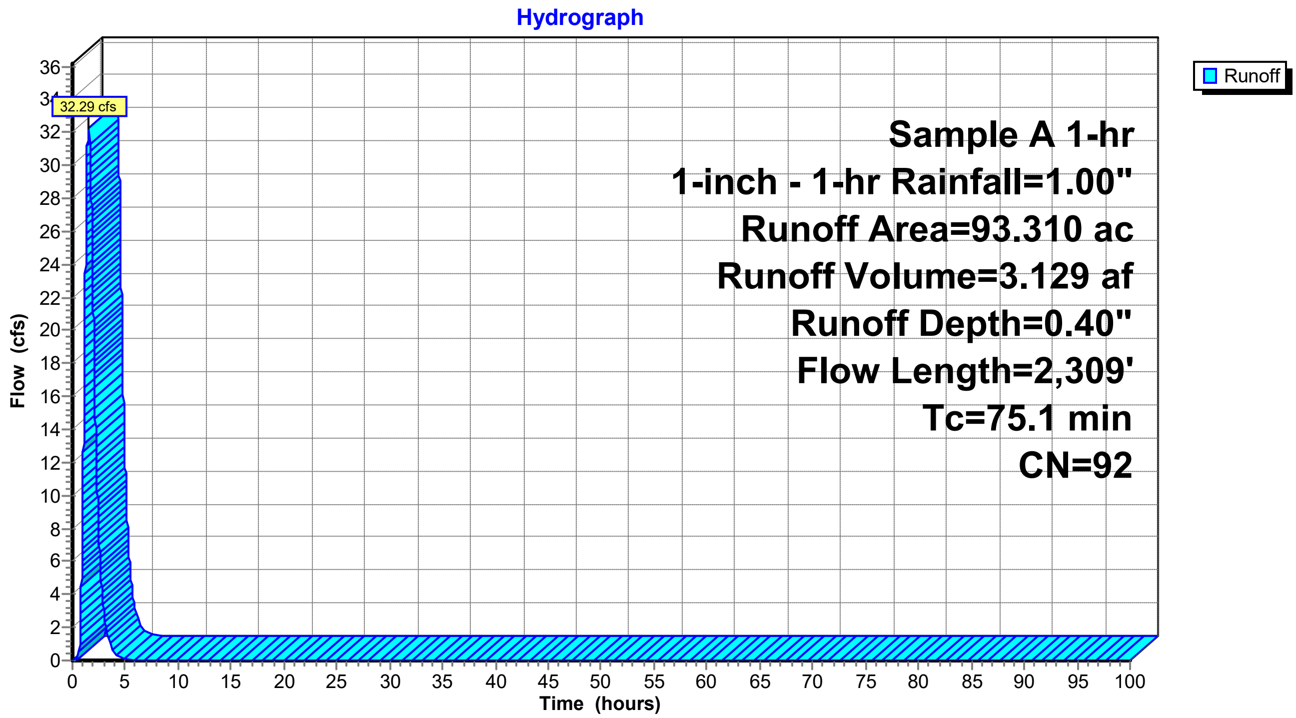
Runoff = 32.29 cfs @ 1.58 hrs, Volume= 3.129 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 2 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

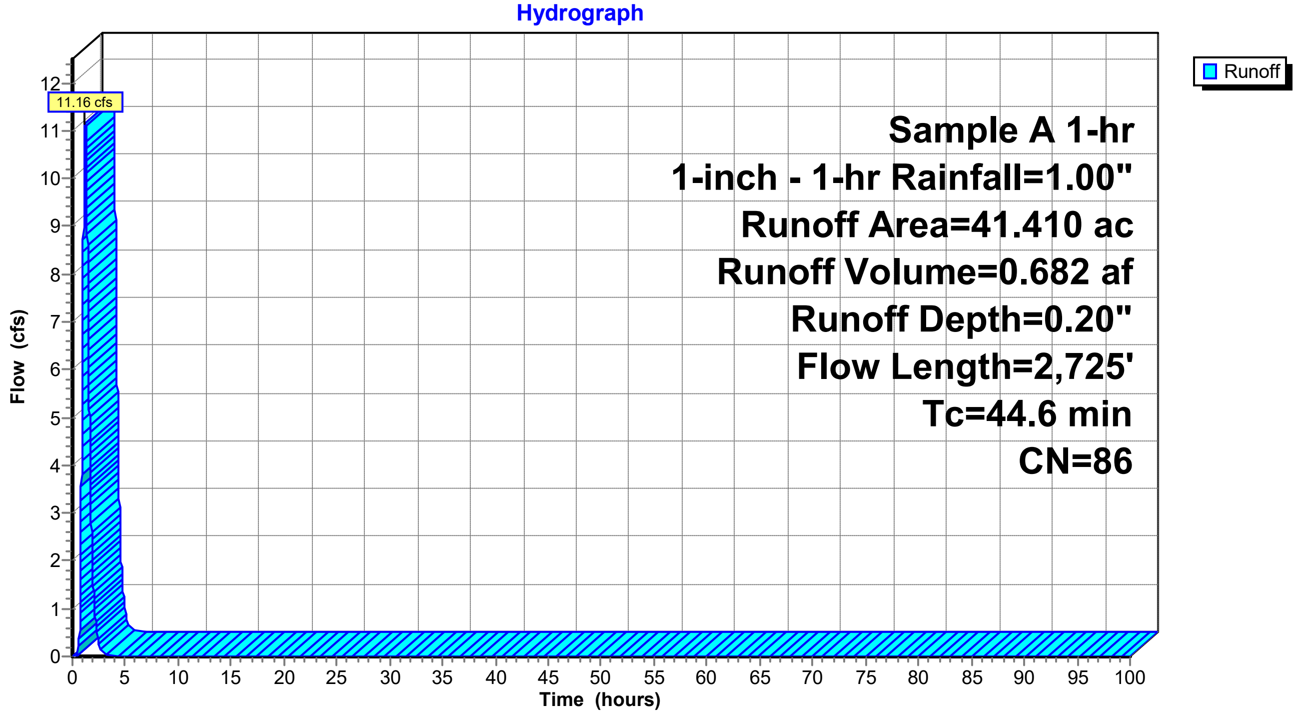
Runoff = 11.16 cfs @ 1.23 hrs, Volume= 0.682 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

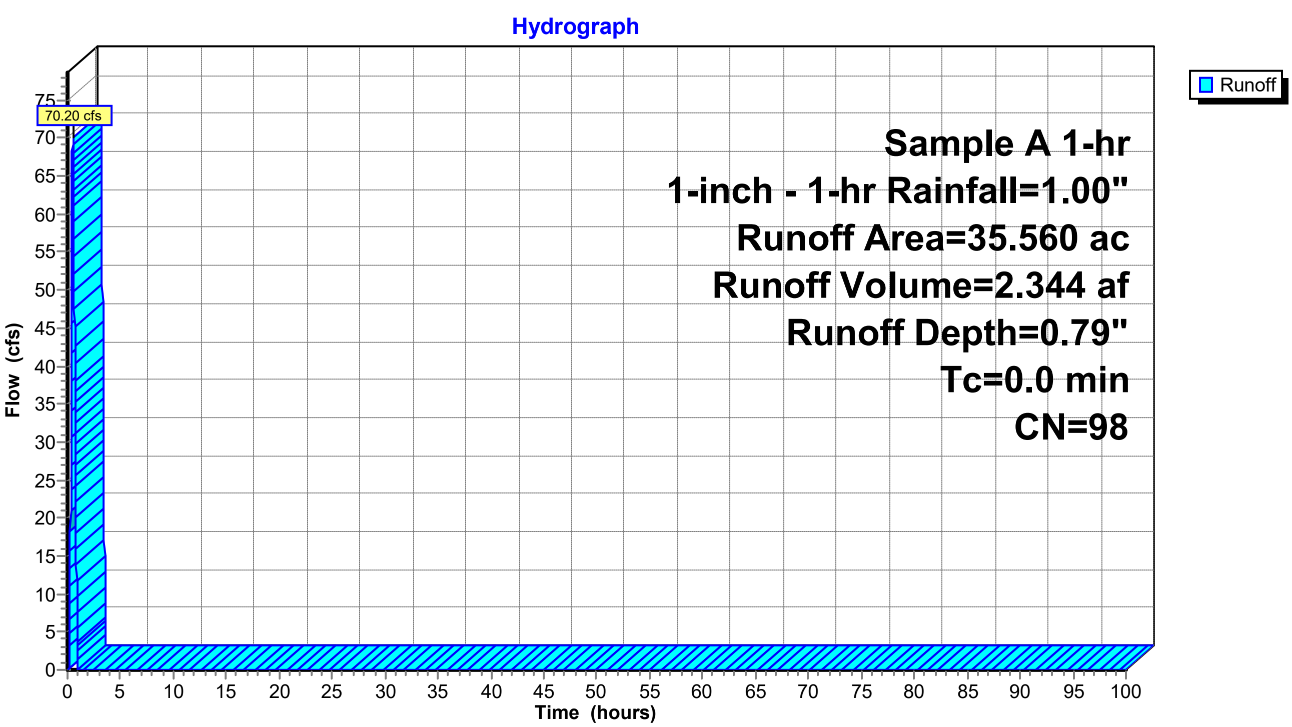
Runoff = 70.20 cfs @ 0.50 hrs, Volume= 2.344 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

The early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

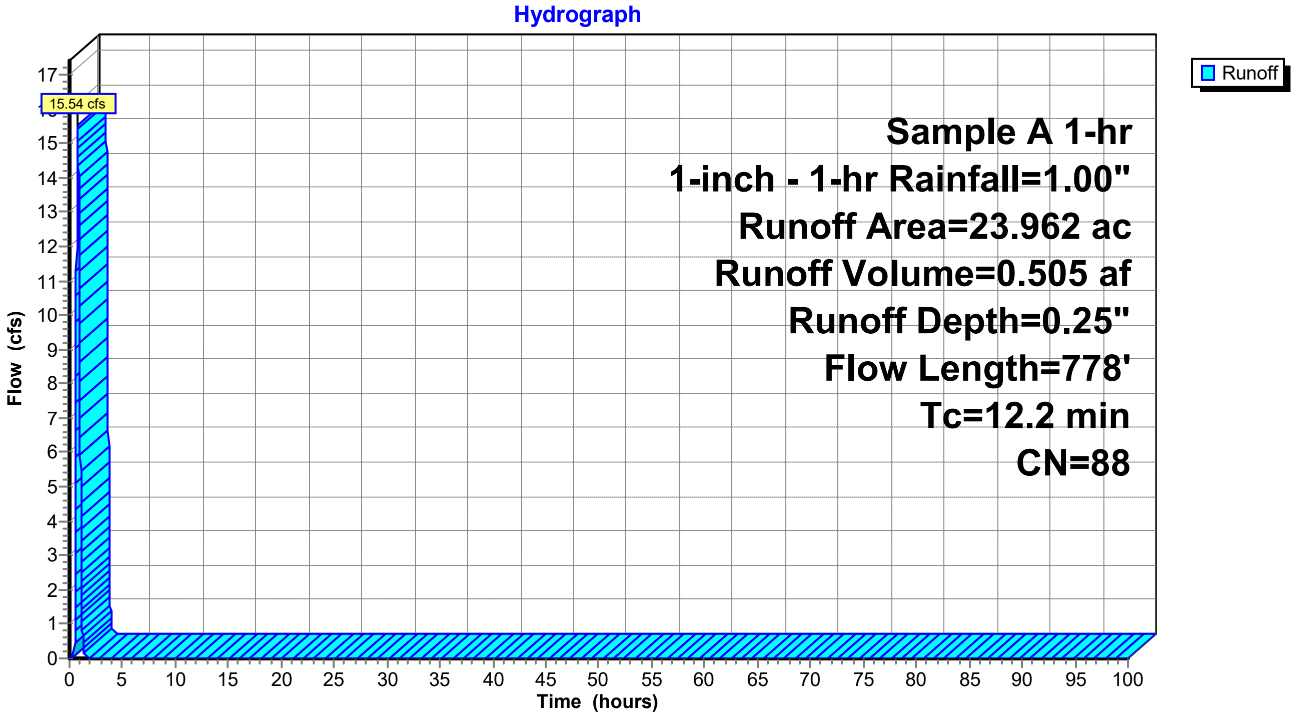
Runoff = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

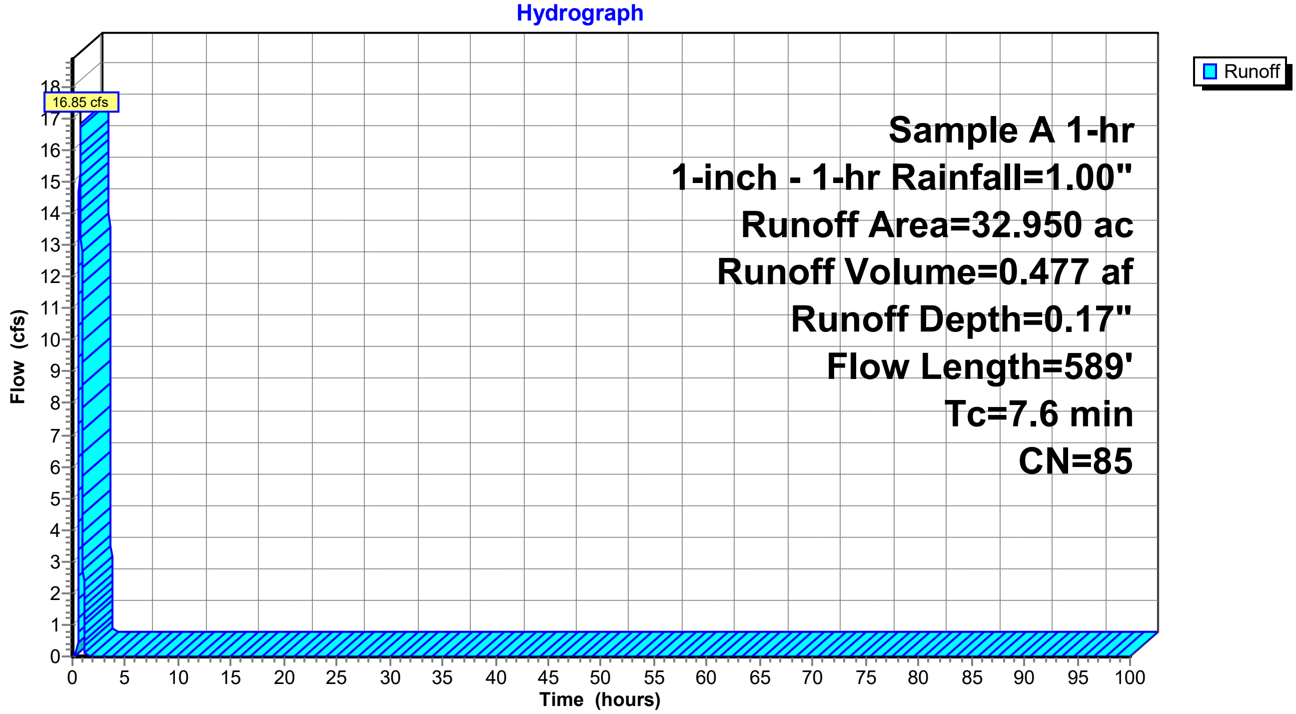
Runoff = 16.85 cfs @ 0.73 hrs, Volume= 0.477 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

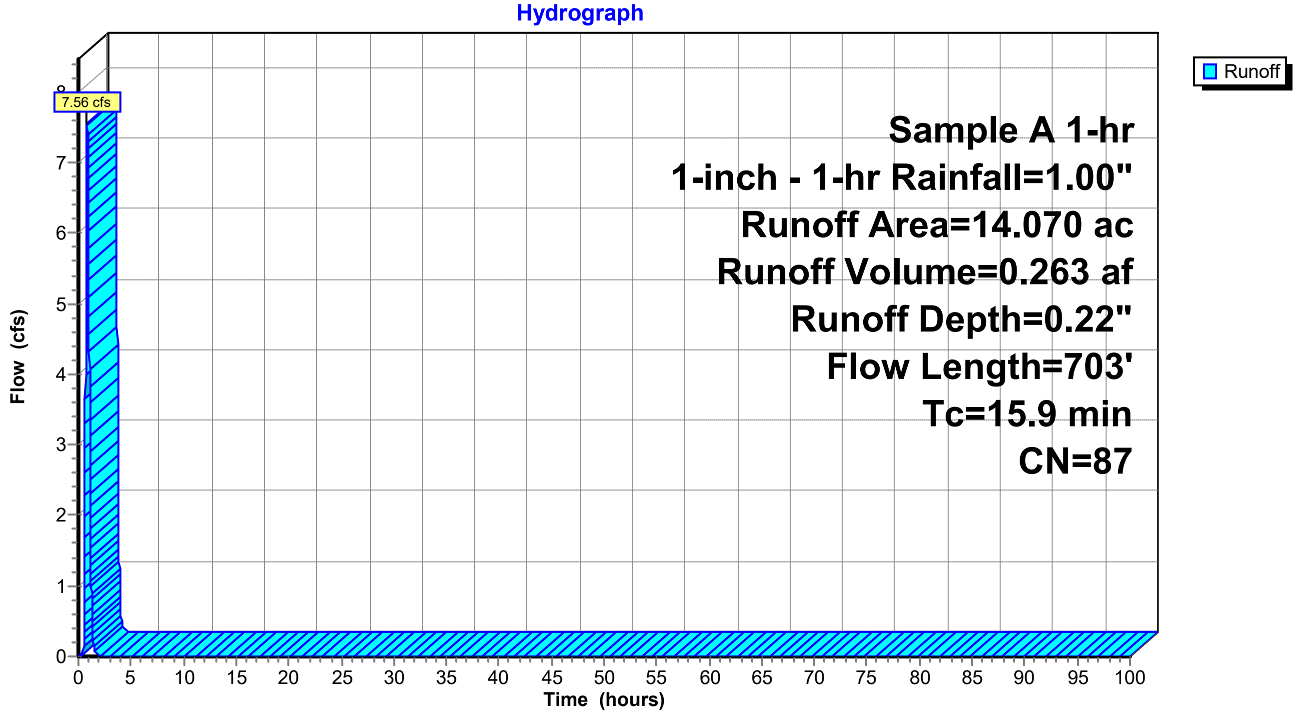
Runoff = 7.56 cfs @ 0.84 hrs, Volume= 0.263 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



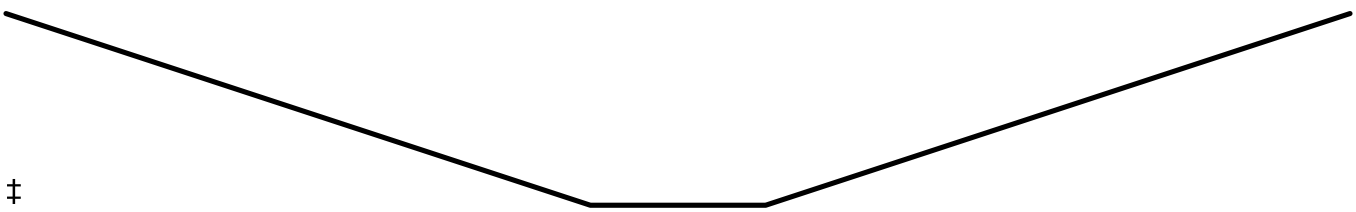
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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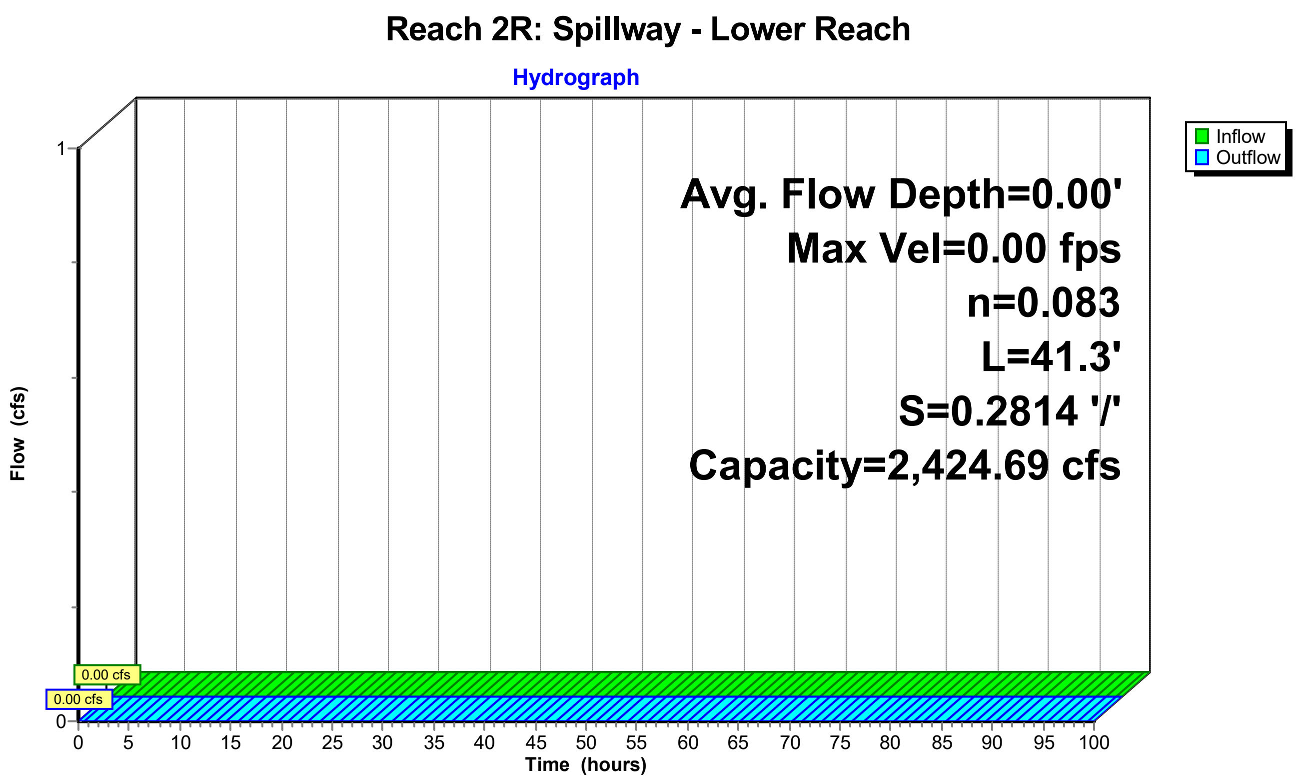


Summary for Reach 3R: Spillway - Upper Reach

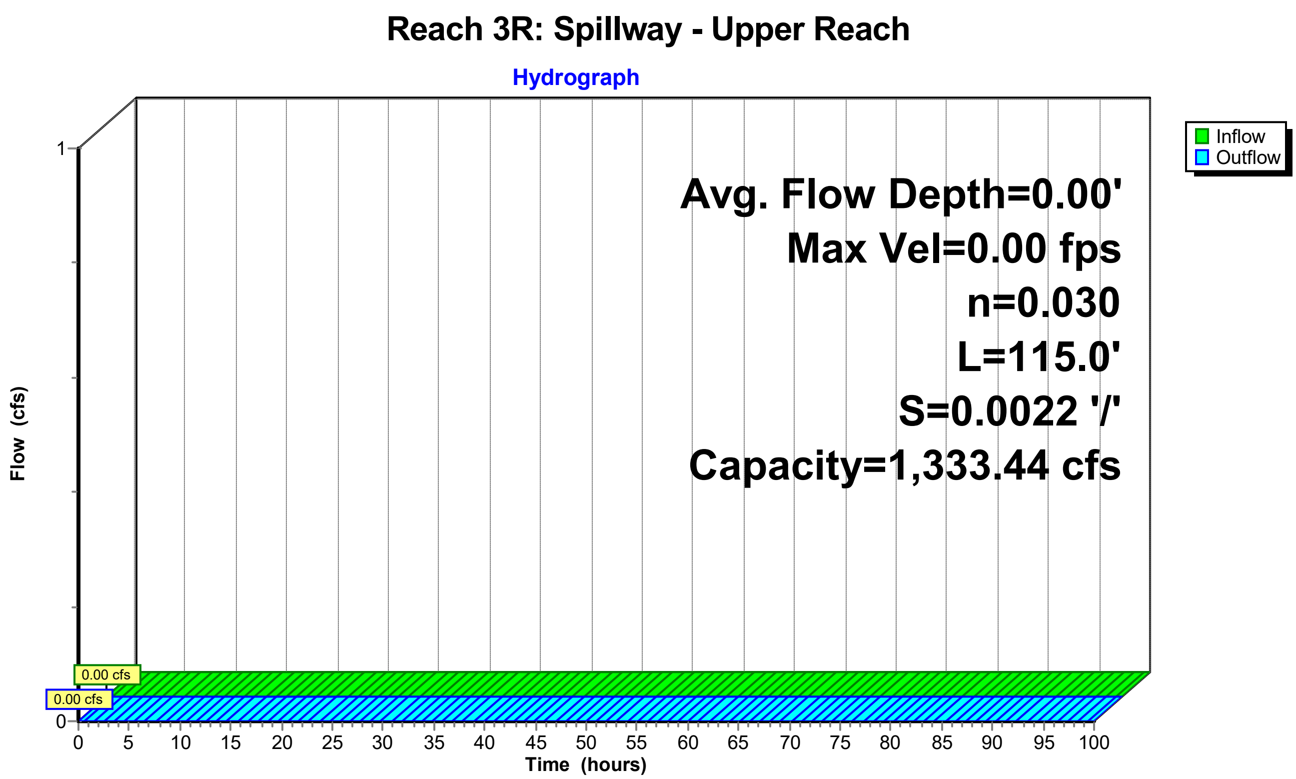
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡



Summary for Reach 4R: Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

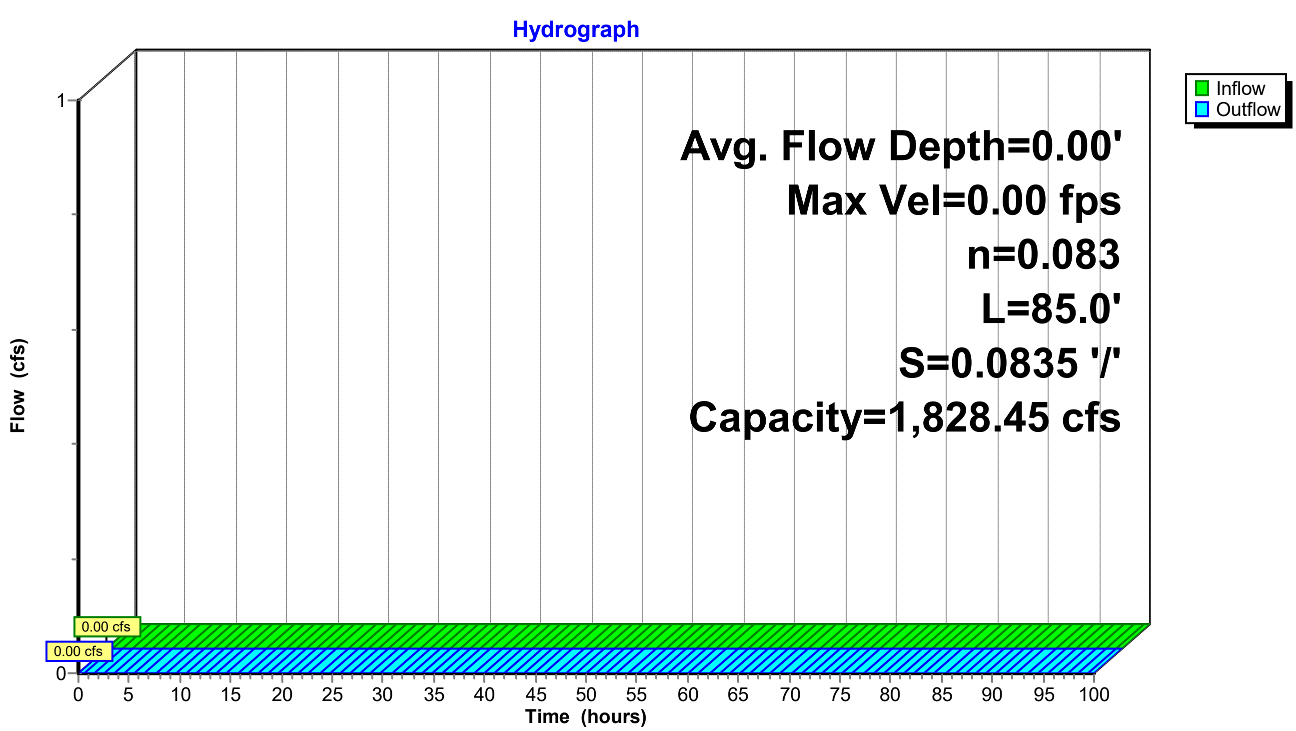
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

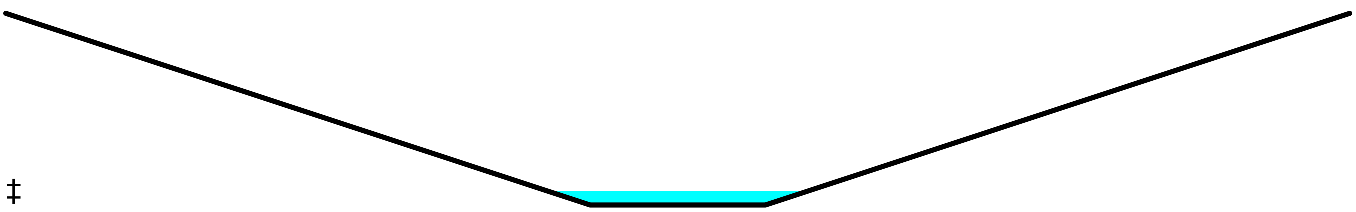
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 1.39 hrs

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth = 2.34" for 1-inch - 1-hr event
Inflow = 10.38 cfs @ 0.89 hrs, Volume= 46.980 af
Outflow = 10.38 cfs @ 1.40 hrs, Volume= 46.980 af, Atten= 0%, Lag= 30.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.81 fps, Avg. Travel Time= 3.5 min

Peak Storage= 2,135 cf @ 1.40 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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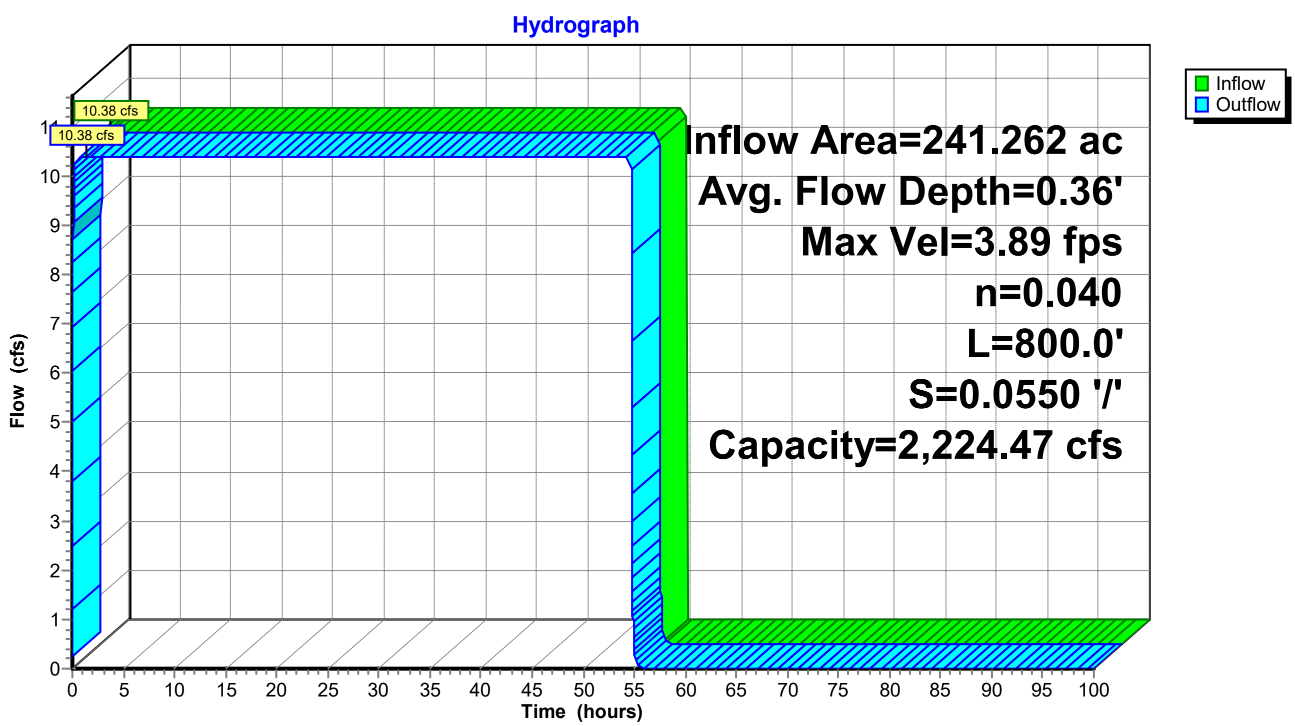
Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

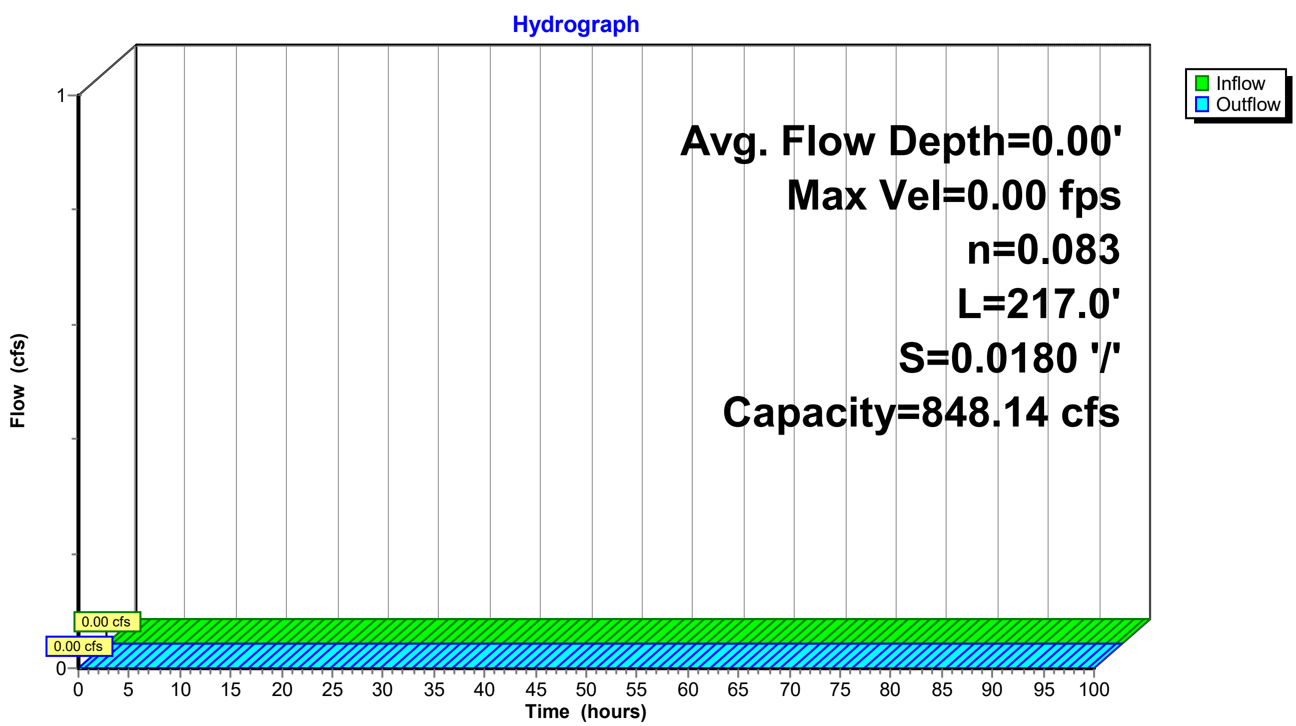
Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

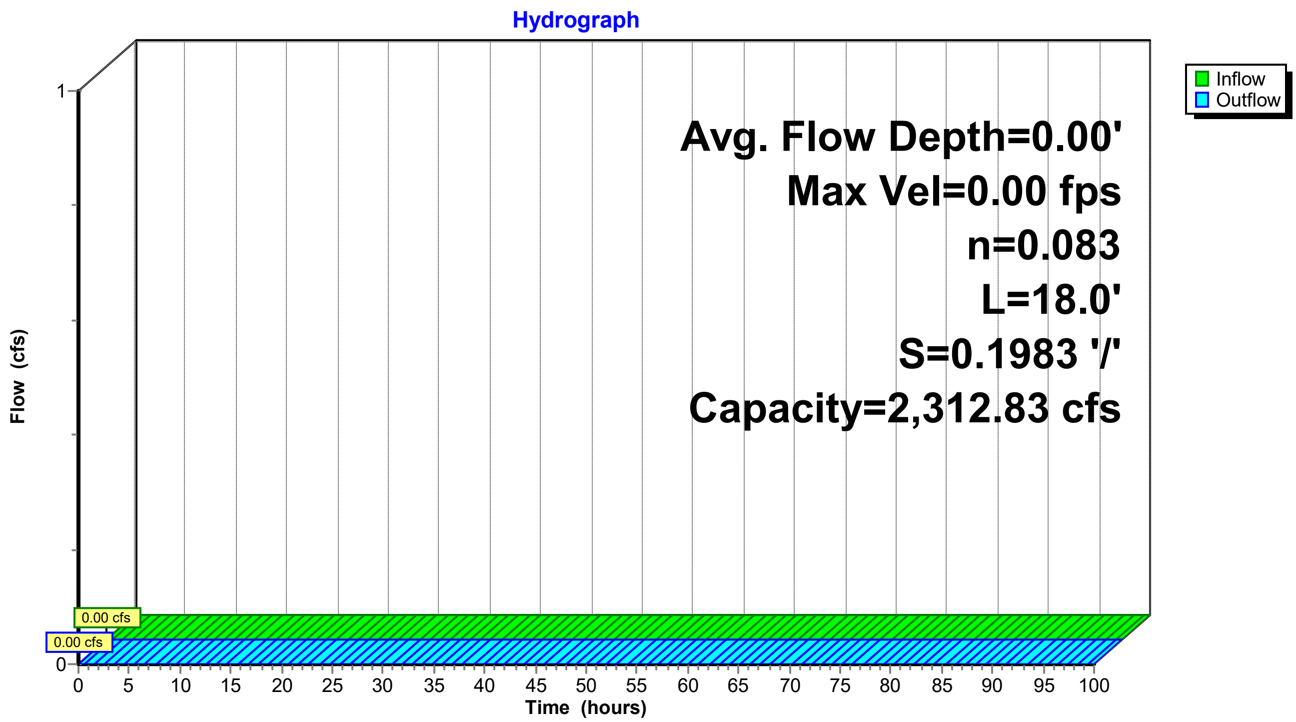
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



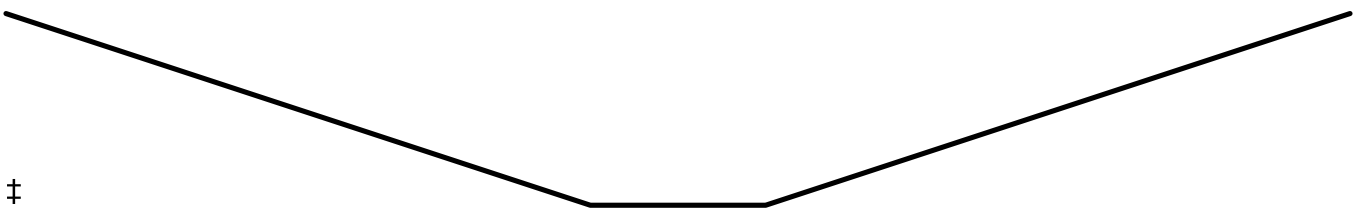
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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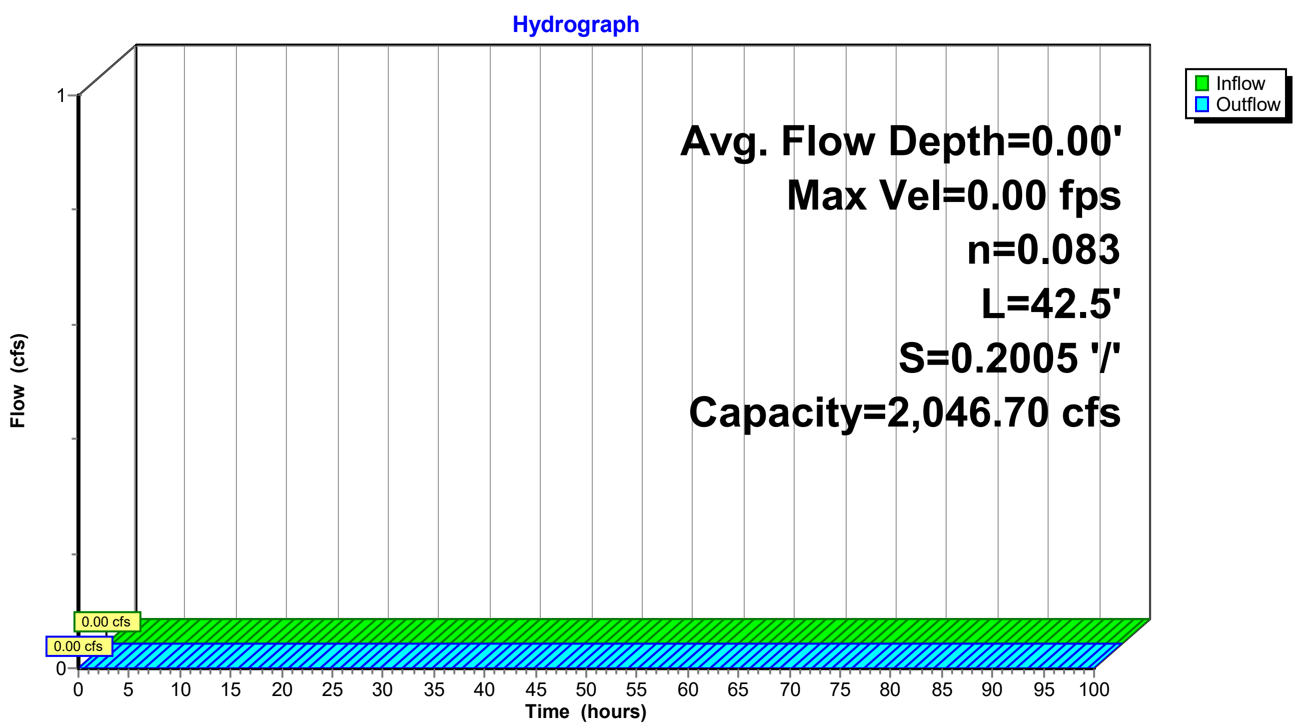
Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

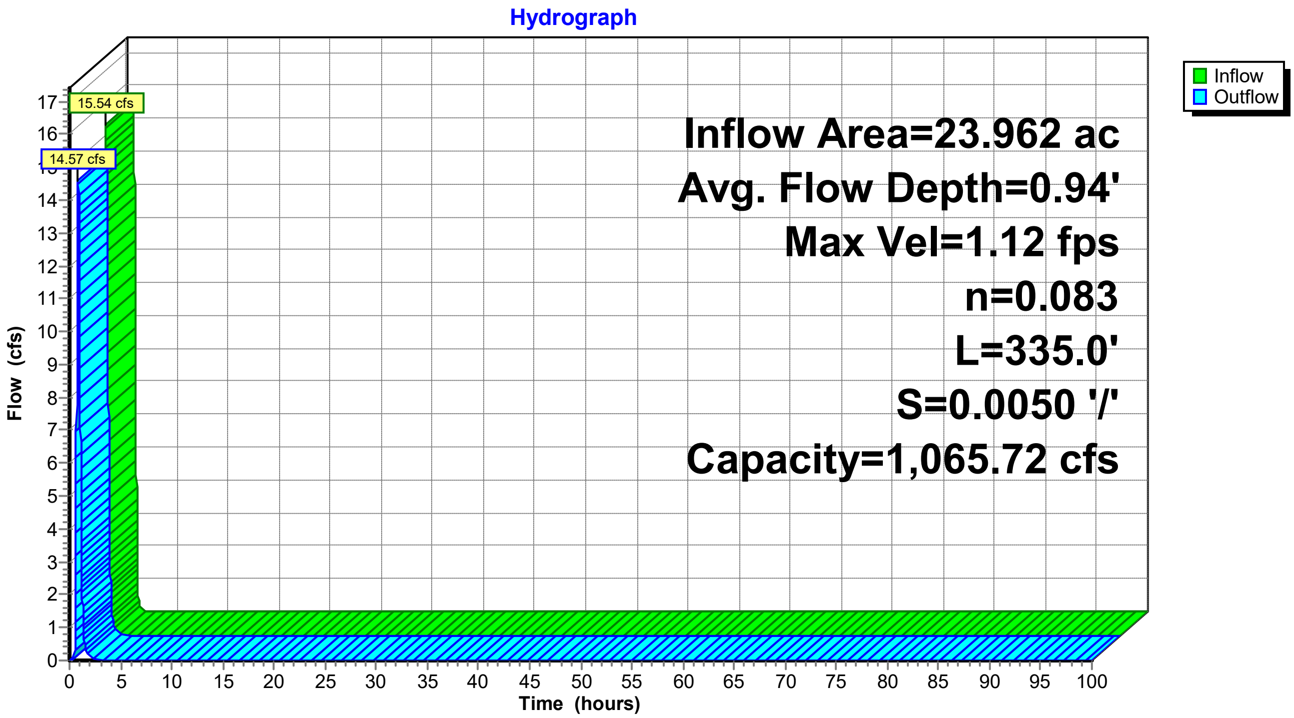
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.25" for 1-inch - 1-hr event
Inflow = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af
Outflow = 14.57 cfs @ 0.84 hrs, Volume= 0.505 af, Atten= 6%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 15.0 min

Peak Storage= 4,362 cf @ 0.84 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

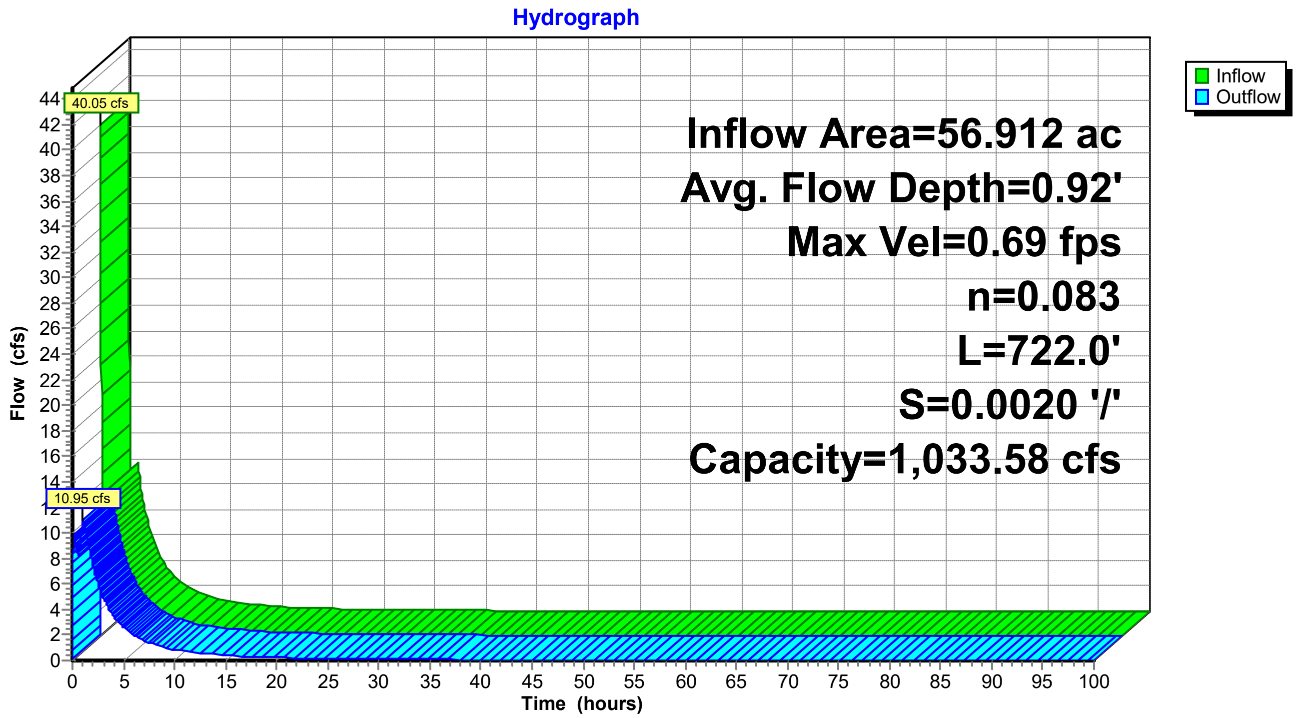
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.81" for 1-inch - 1-hr event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af
Outflow = 10.95 cfs @ 1.05 hrs, Volume= 3.865 af, Atten= 73%, Lag= 63.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.69 fps, Min. Travel Time= 17.5 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 59.7 min

Peak Storage= 11,487 cf @ 1.05 hrs
Average Depth at Peak Storage= 0.92'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.32' @ 0.97 hrs

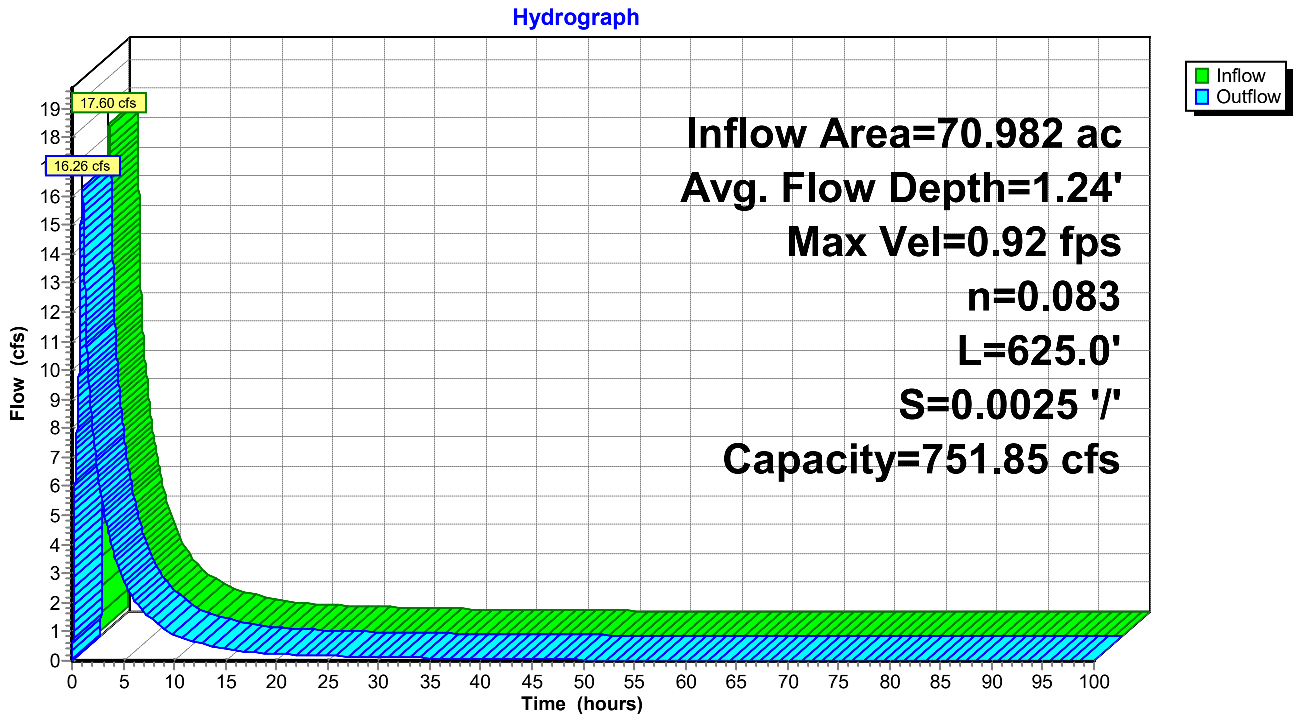
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth = 0.70" for 1-inch - 1-hr event
Inflow = 17.60 cfs @ 0.88 hrs, Volume= 4.127 af
Outflow = 16.26 cfs @ 1.00 hrs, Volume= 4.127 af, Atten= 8%, Lag= 7.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.92 fps, Min. Travel Time= 11.3 min
Avg. Velocity = 0.23 fps, Avg. Travel Time= 45.3 min

Peak Storage= 10,991 cf @ 1.00 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 2P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 0.48" for 1-inch - 1-hr event
Inflow = 70.21 cfs @ 0.50 hrs, Volume= 9.675 af
Outflow = 10.38 cfs @ 0.89 hrs, Volume= 46.980 af, Atten= 85%, Lag= 23.4 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 0.89 hrs, Volume= 46.980 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 435.14' @ 0.89 hrs Surf.Area= 0.000 ac Storage= 81.837 af (1.597 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 772.6 min (1,642.7 - 870.1)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

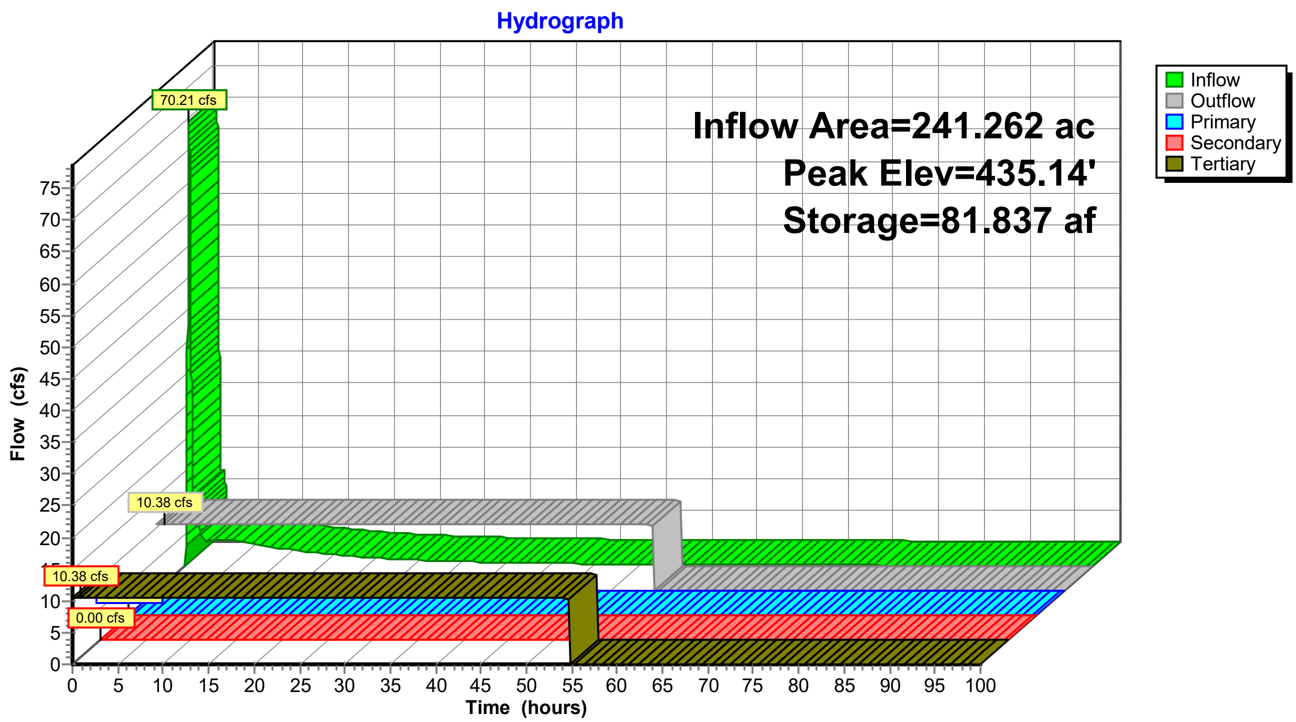
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 84.28 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 0.89 hrs HW=435.14' TW=428.36' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 10.38 cfs)

Pond 2P: Lower Pond



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.00' @ 0.00 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.21" for 1-inch - 1-hr event
Inflow = 29.35 cfs @ 0.79 hrs, Volume= 0.982 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af, Atten= 0%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 3.865 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 7.570 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 290.0 min (341.2 - 51.2)

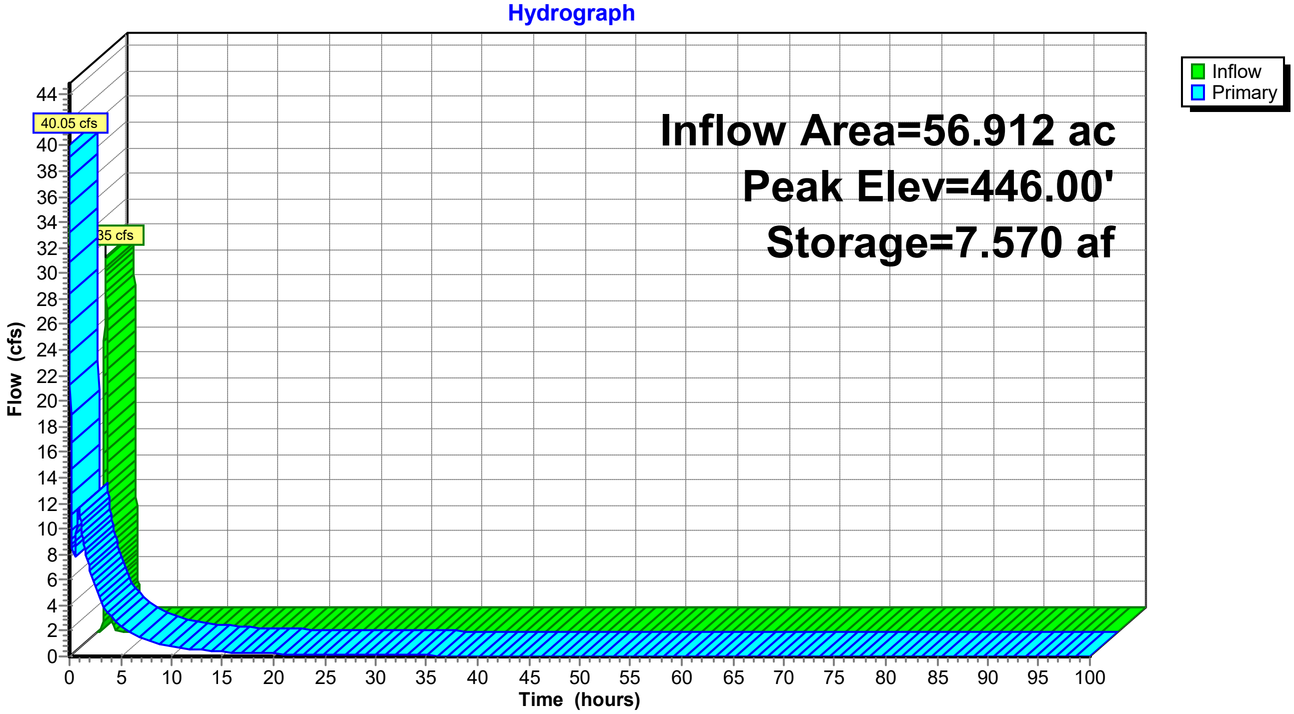
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

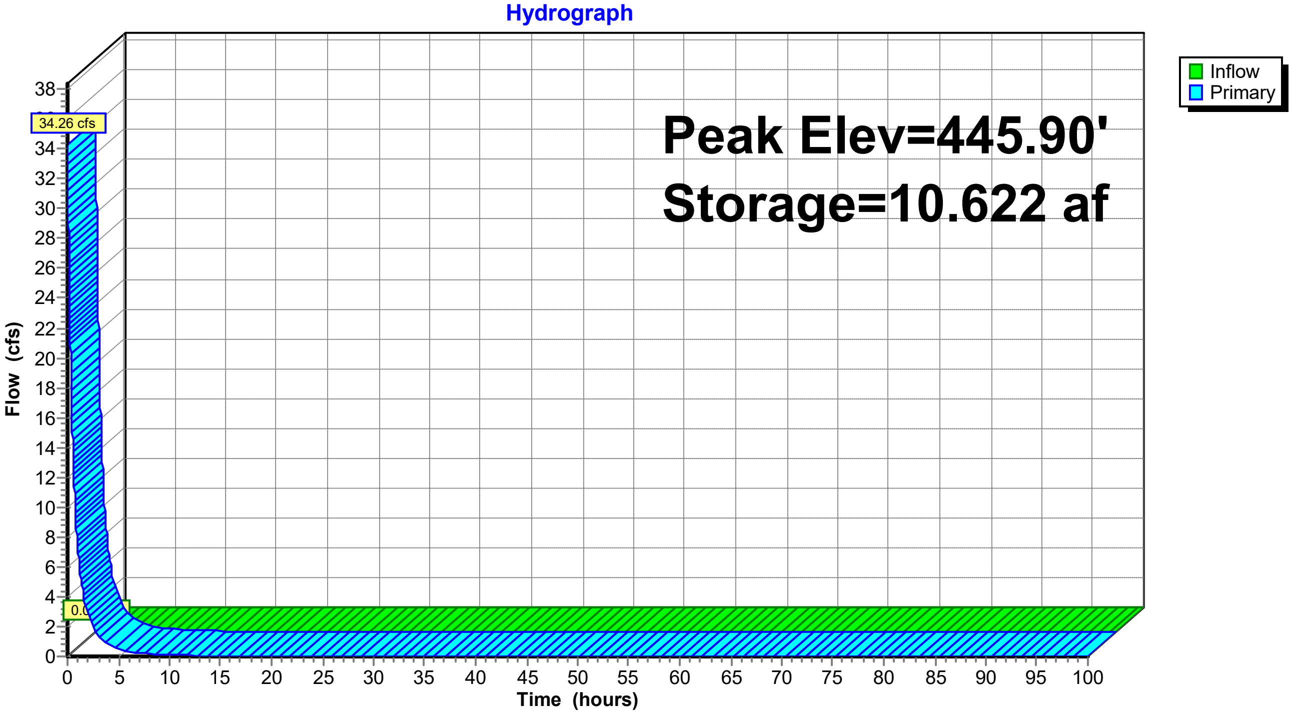
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 3.08' @ 7.27 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 0.53" for 1-inch - 1-hr event
Inflow = 42.68 cfs @ 1.50 hrs, Volume= 7.256 af
Outflow = 4.25 cfs @ 3.97 hrs, Volume= 6.649 af, Atten= 90%, Lag= 148.3 min
Primary = 4.25 cfs @ 3.97 hrs, Volume= 6.649 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 447.02' @ 3.97 hrs Surf.Area= 0.000 ac Storage= 32.282 af (4.892 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 989.0 min (1,246.3 - 257.3)

Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

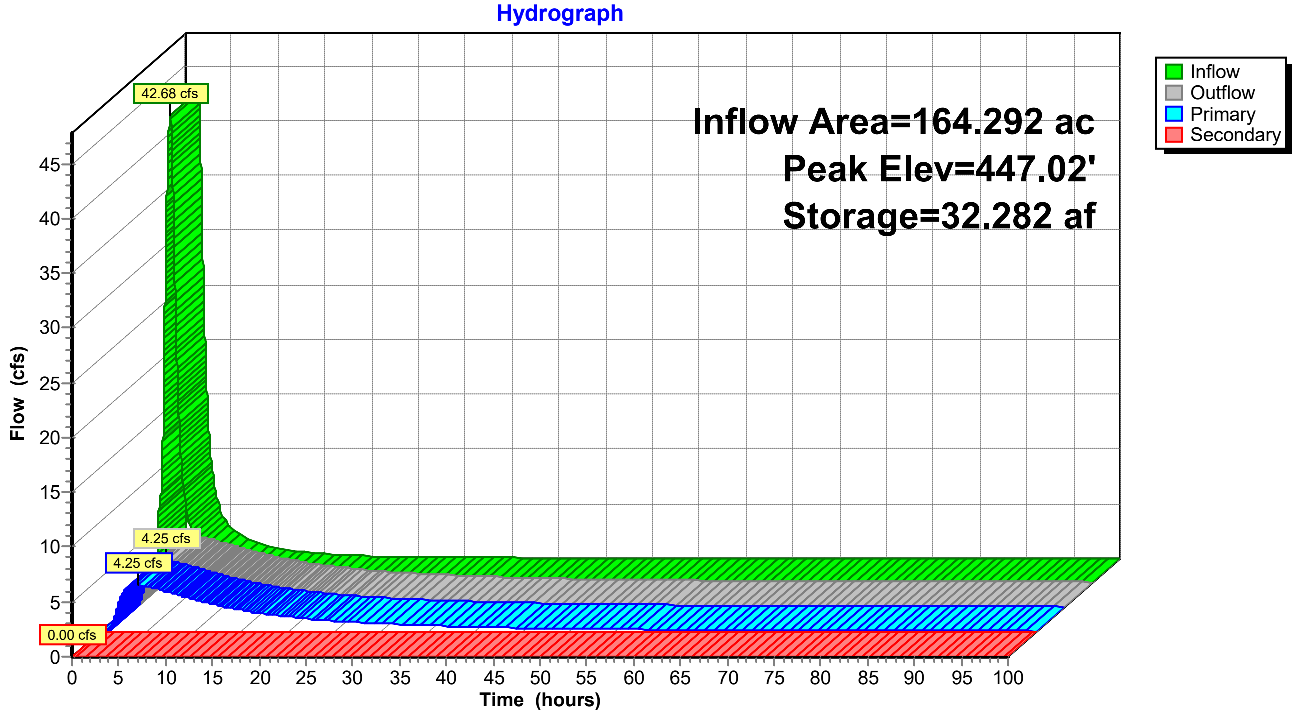
Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

Primary OutFlow Max=4.24 cfs @ 3.97 hrs HW=447.02' TW=435.03' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 4.24 cfs @ 2.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Subcatchment 2S: Phase 2 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

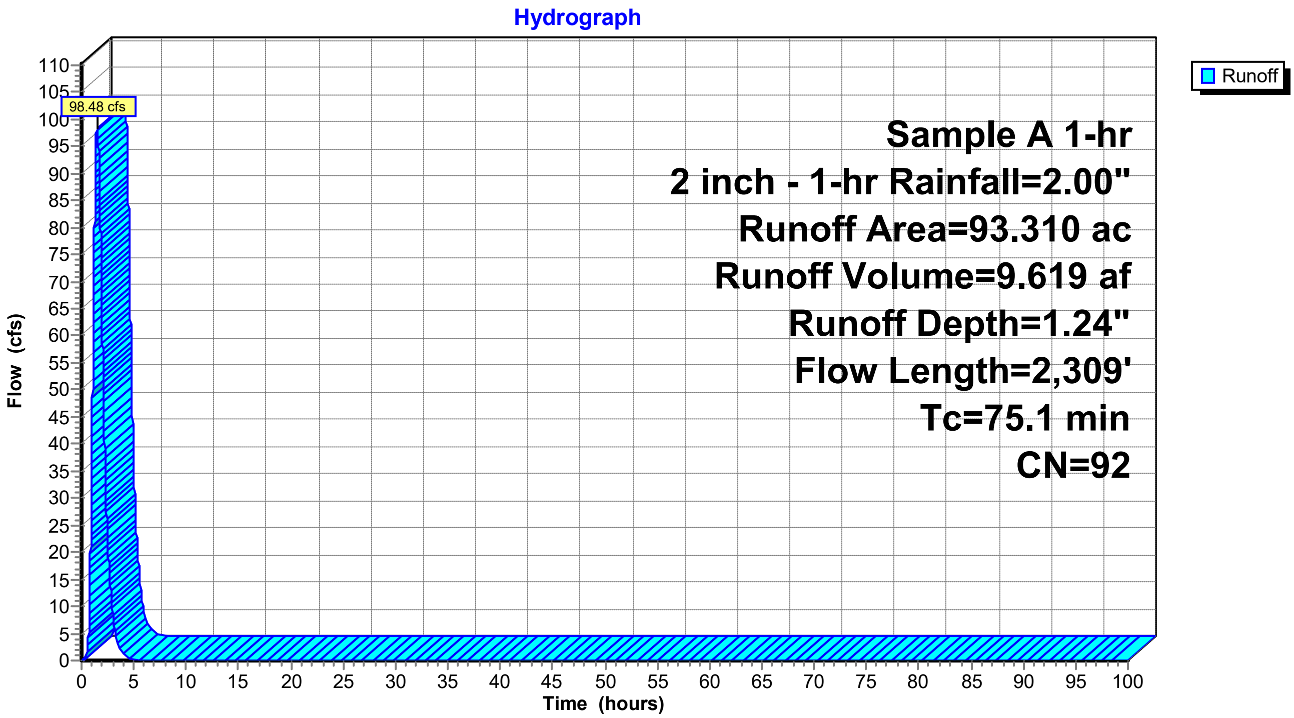
Runoff = 98.48 cfs @ 1.50 hrs, Volume= 9.619 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 2 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

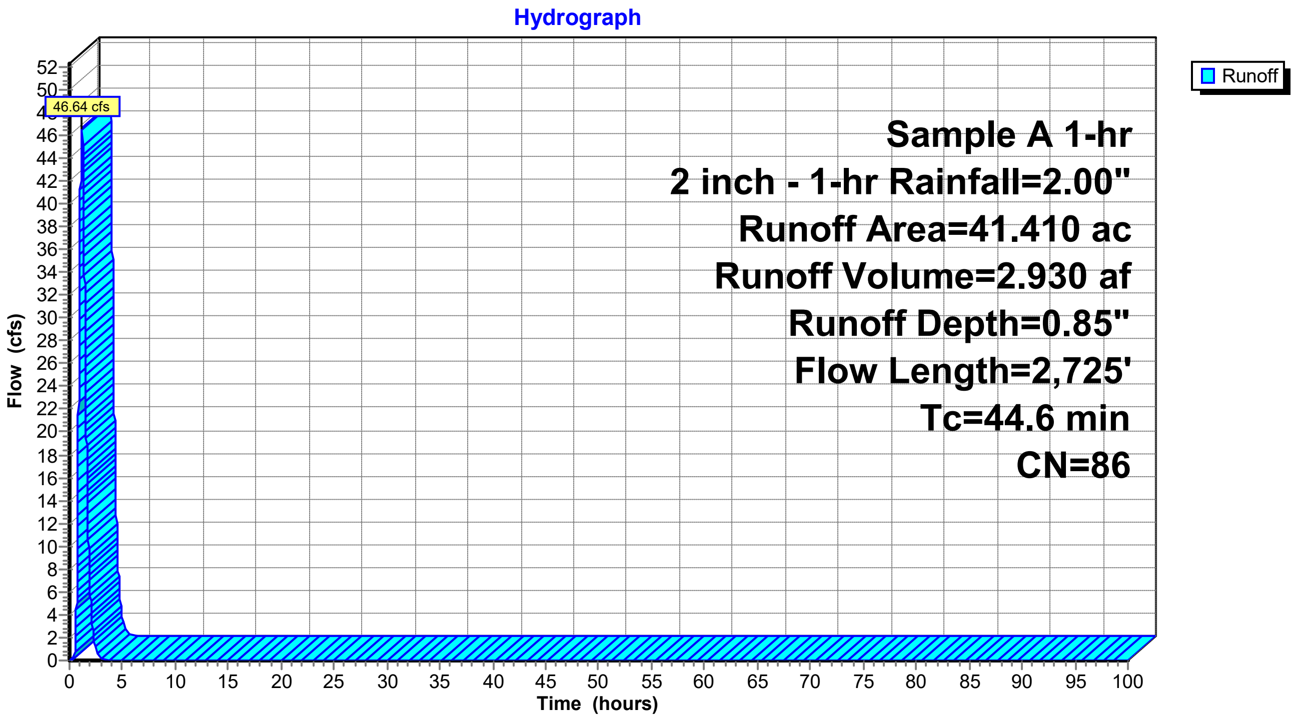
Runoff = 46.64 cfs @ 1.15 hrs, Volume= 2.930 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

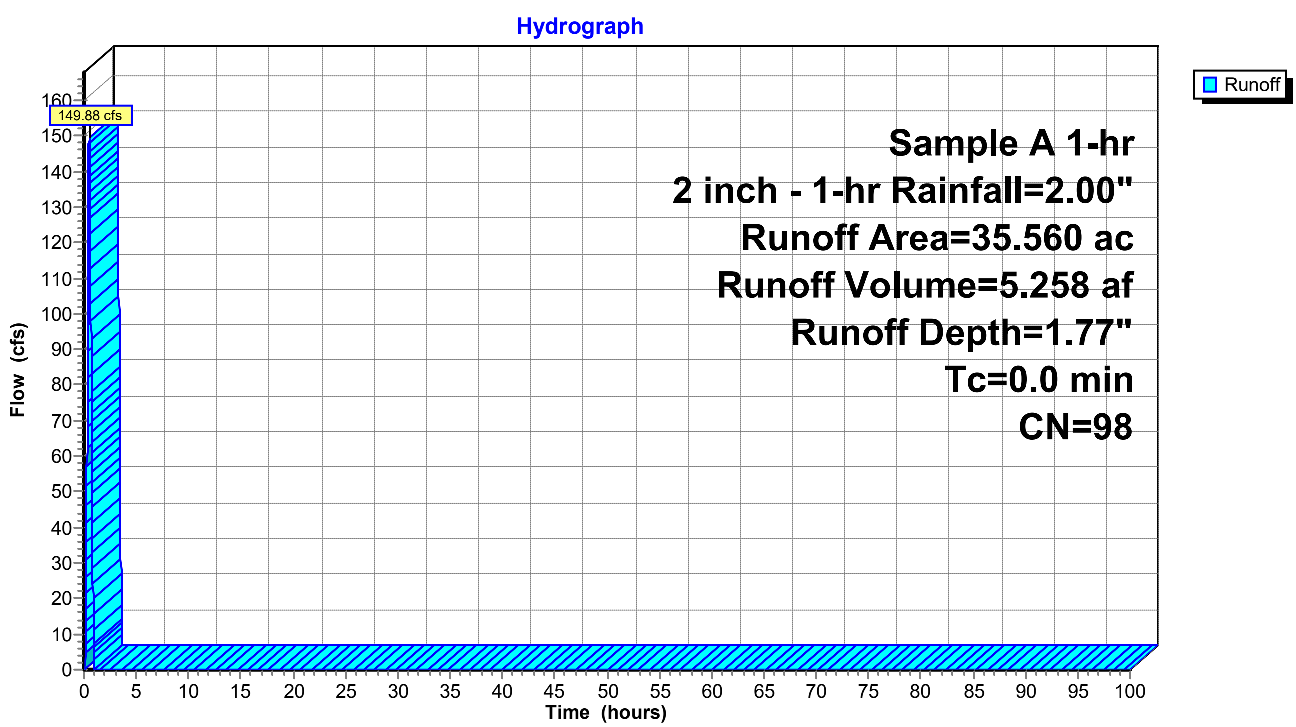
Runoff = 149.88 cfs @ 0.50 hrs, Volume= 5.258 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

The early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

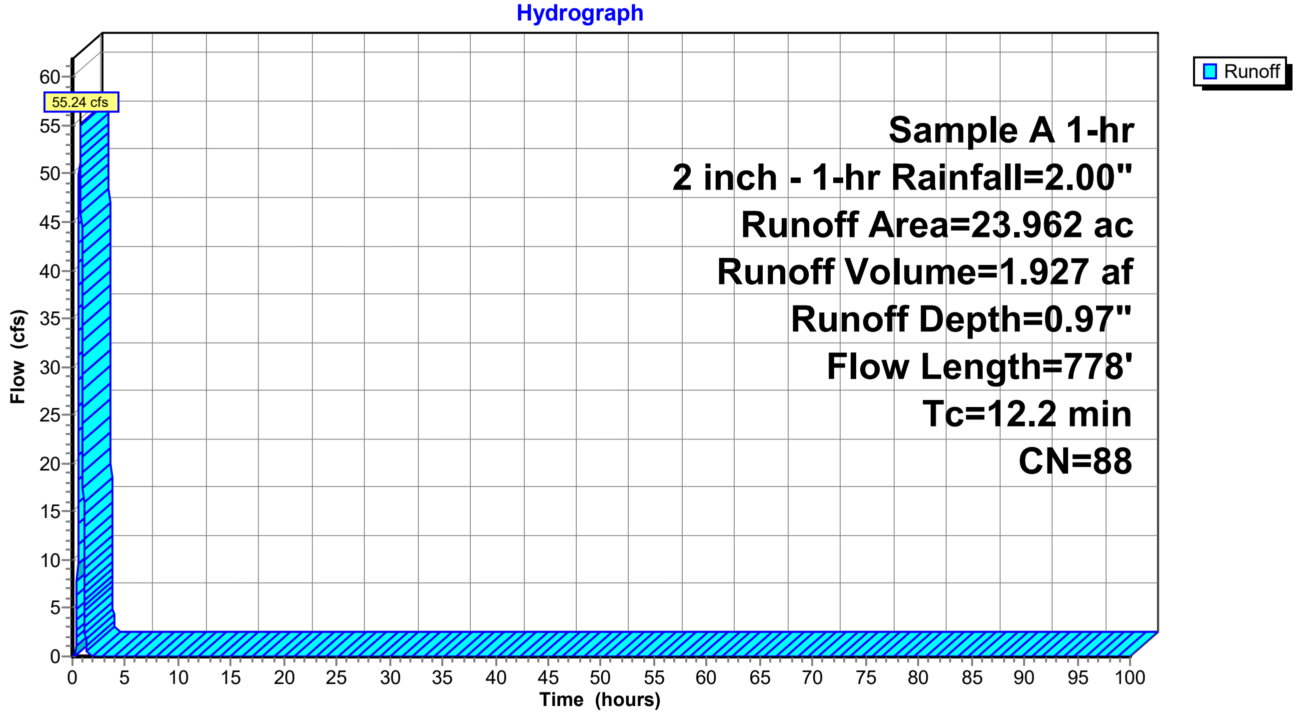
Runoff = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

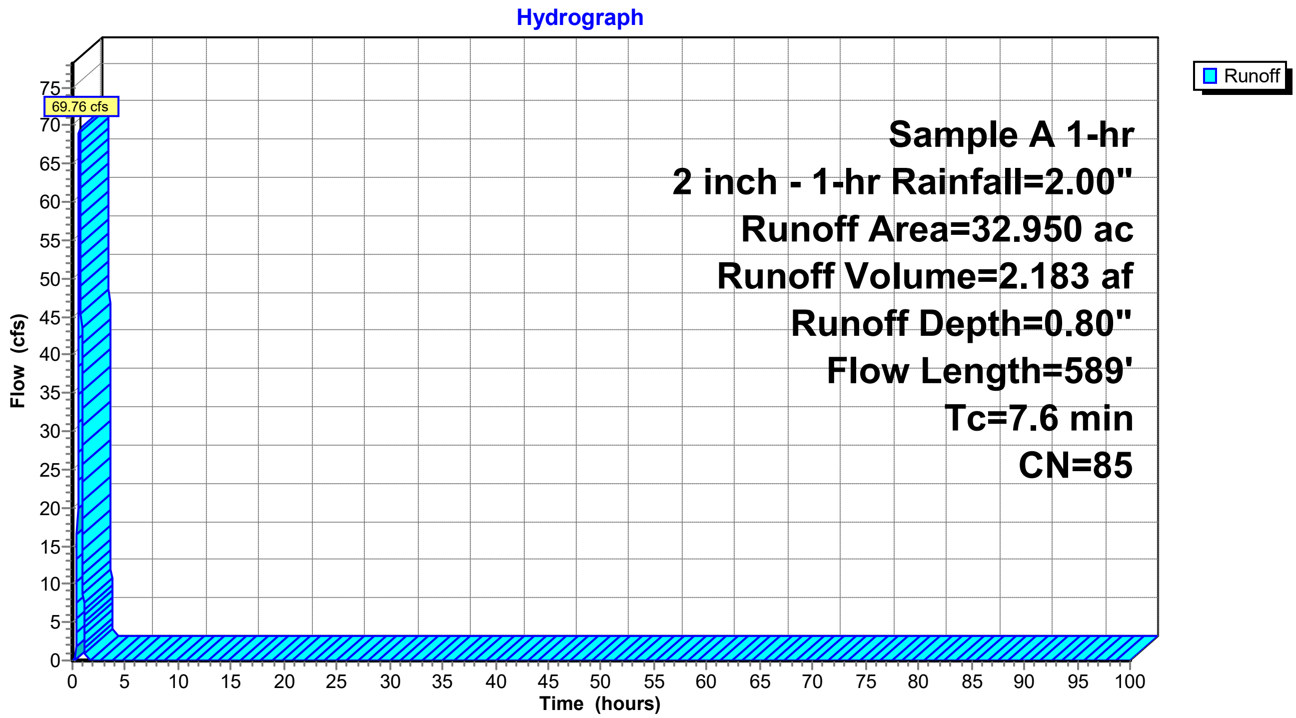
Runoff = 69.76 cfs @ 0.68 hrs, Volume= 2.183 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

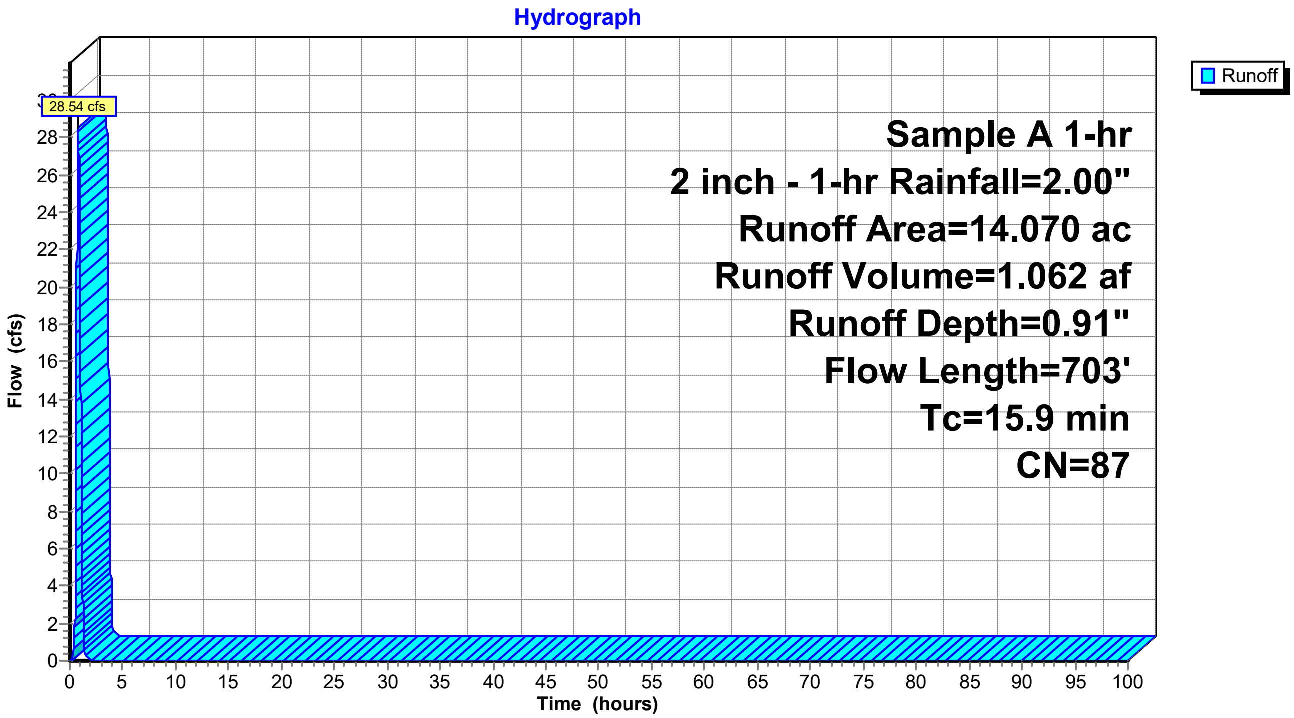
Runoff = 28.54 cfs @ 0.79 hrs, Volume= 1.062 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



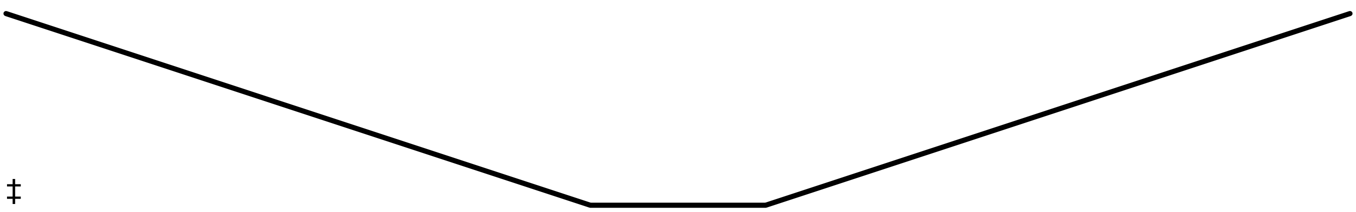
Summary for Reach 2R: Spillway - Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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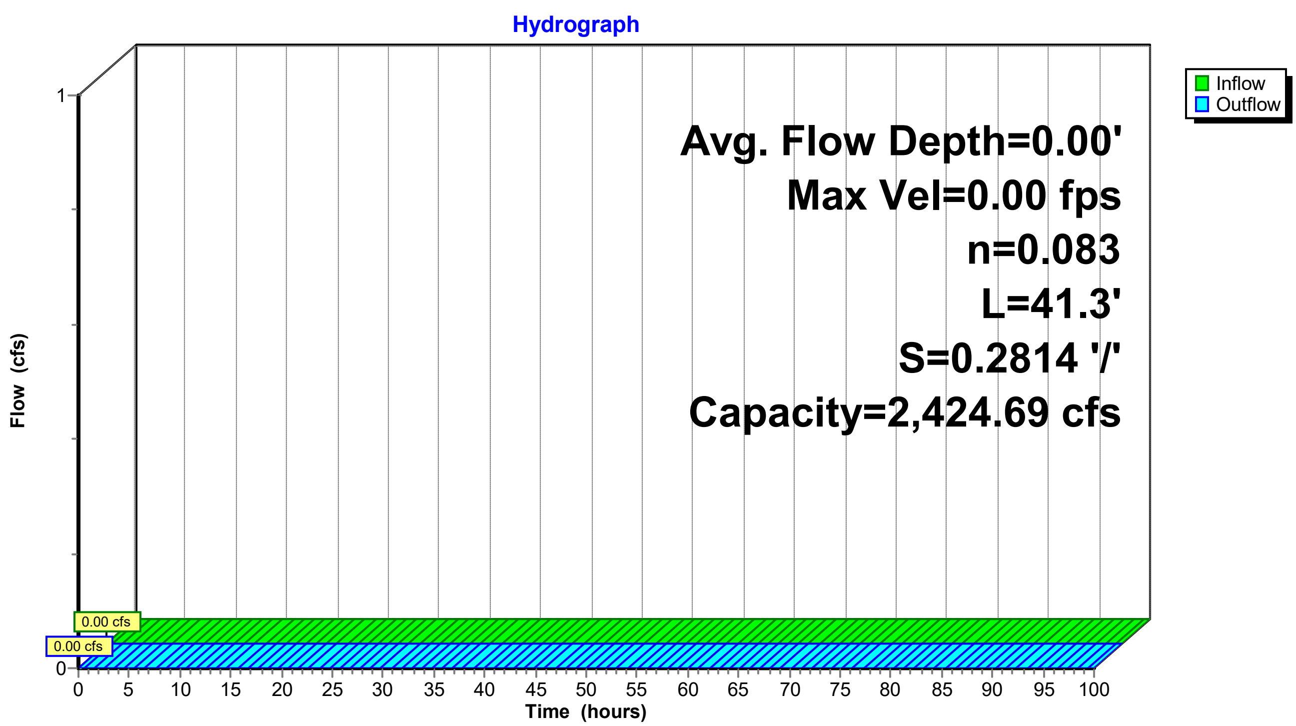
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

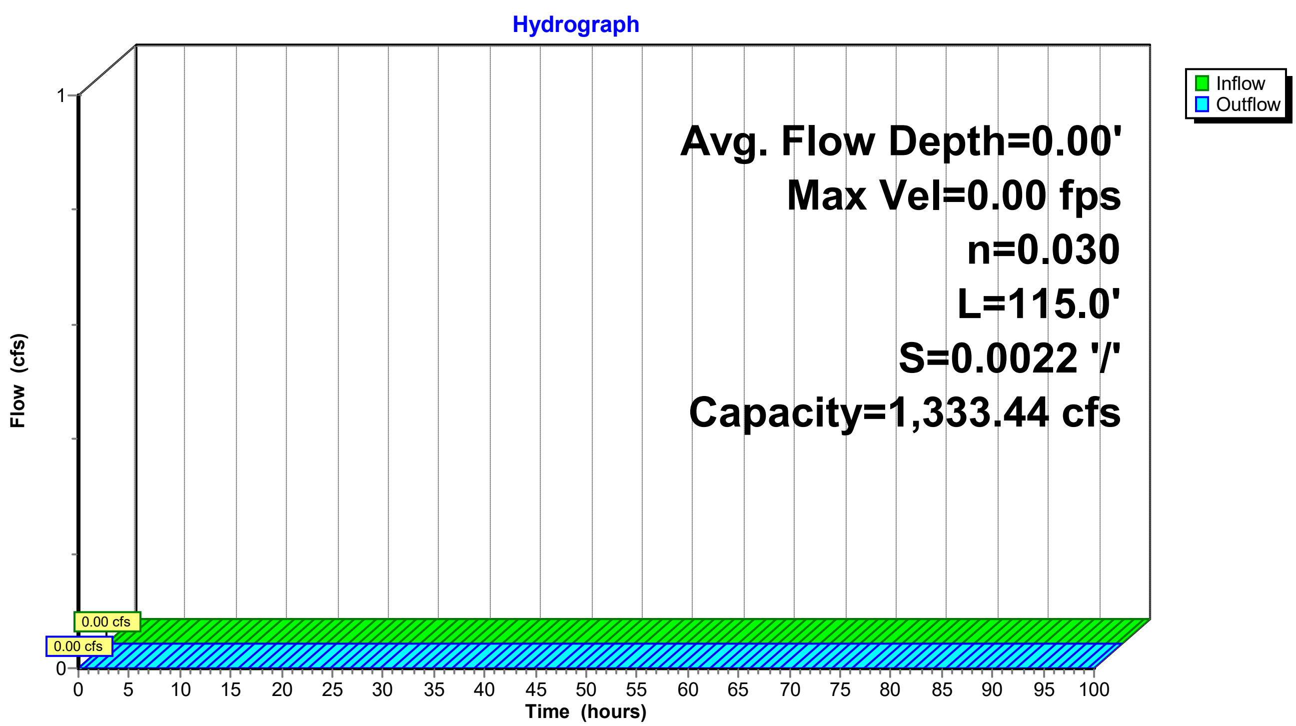
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

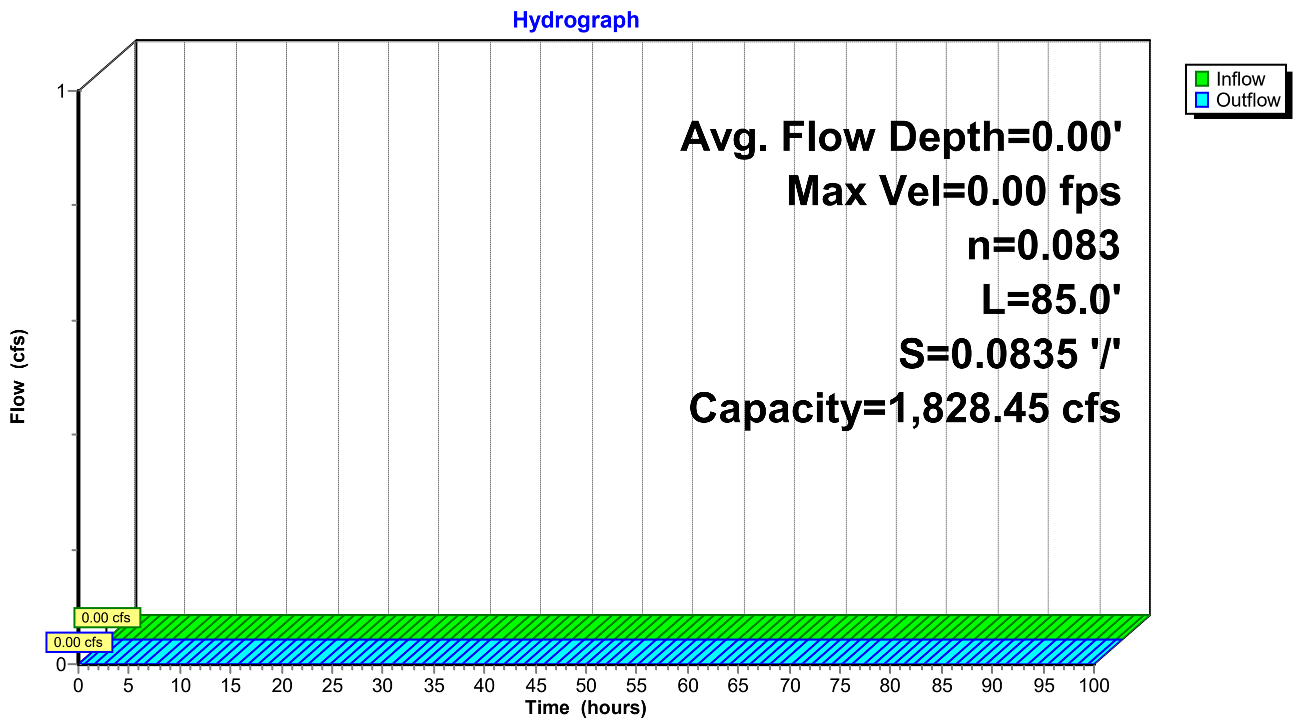
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 8.66 hrs

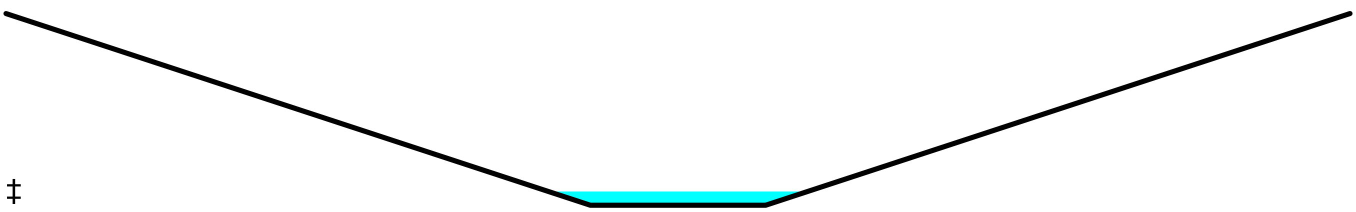
Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth = 3.12" for 2 inch - 1-hr event
Inflow = 10.38 cfs @ 8.63 hrs, Volume= 62.768 af
Outflow = 10.38 cfs @ 8.68 hrs, Volume= 62.768 af, Atten= 0%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.83 fps, Avg. Travel Time= 3.5 min

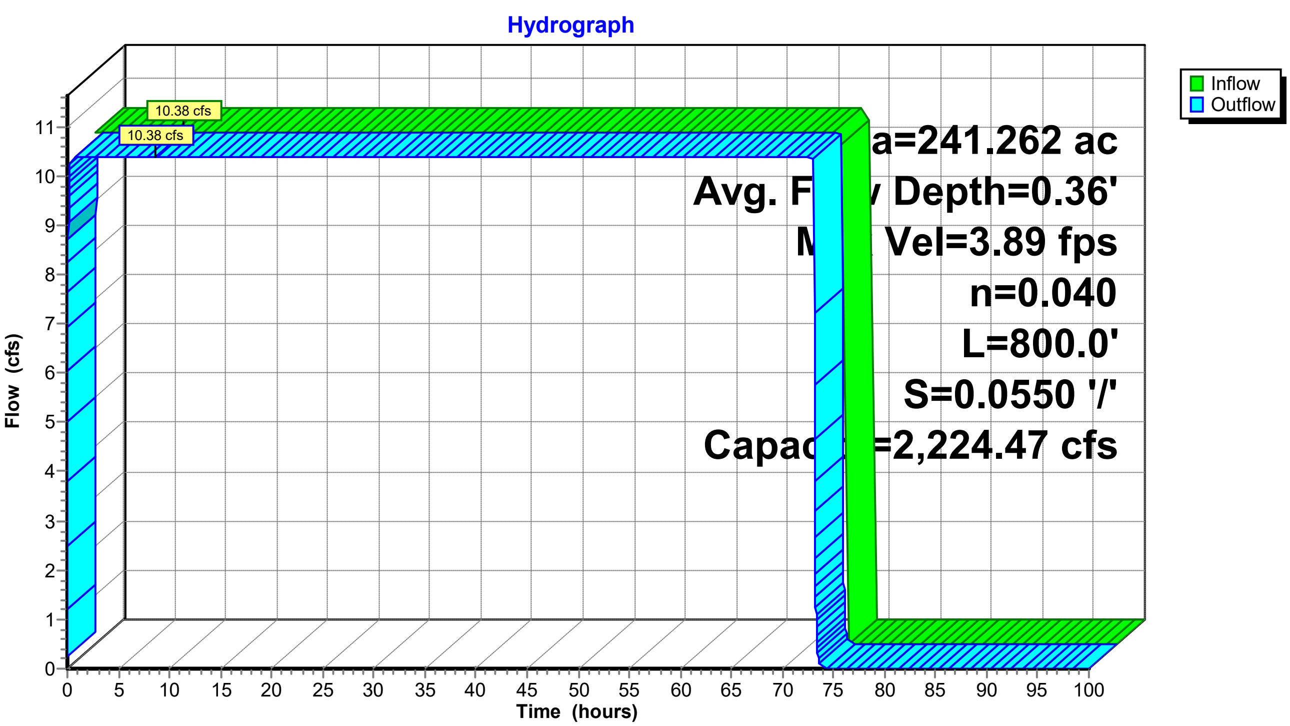
Peak Storage= 2,135 cf @ 8.68 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'

‡



Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

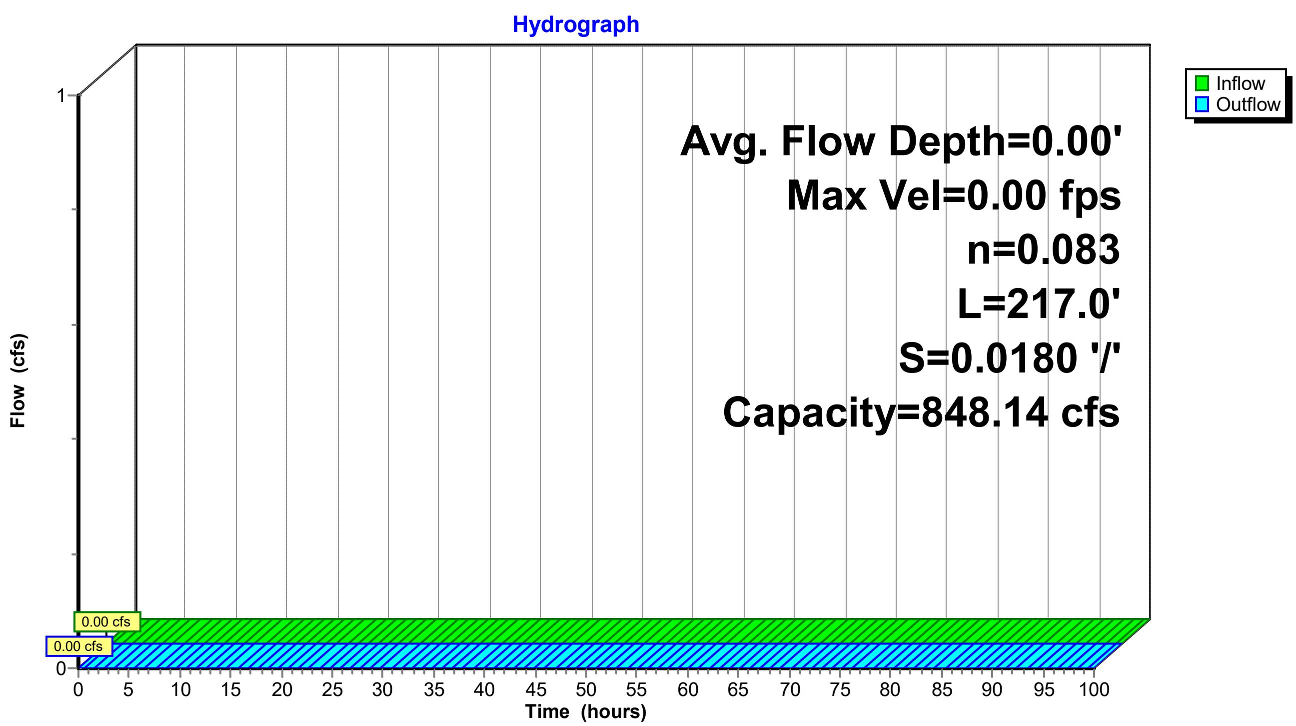
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

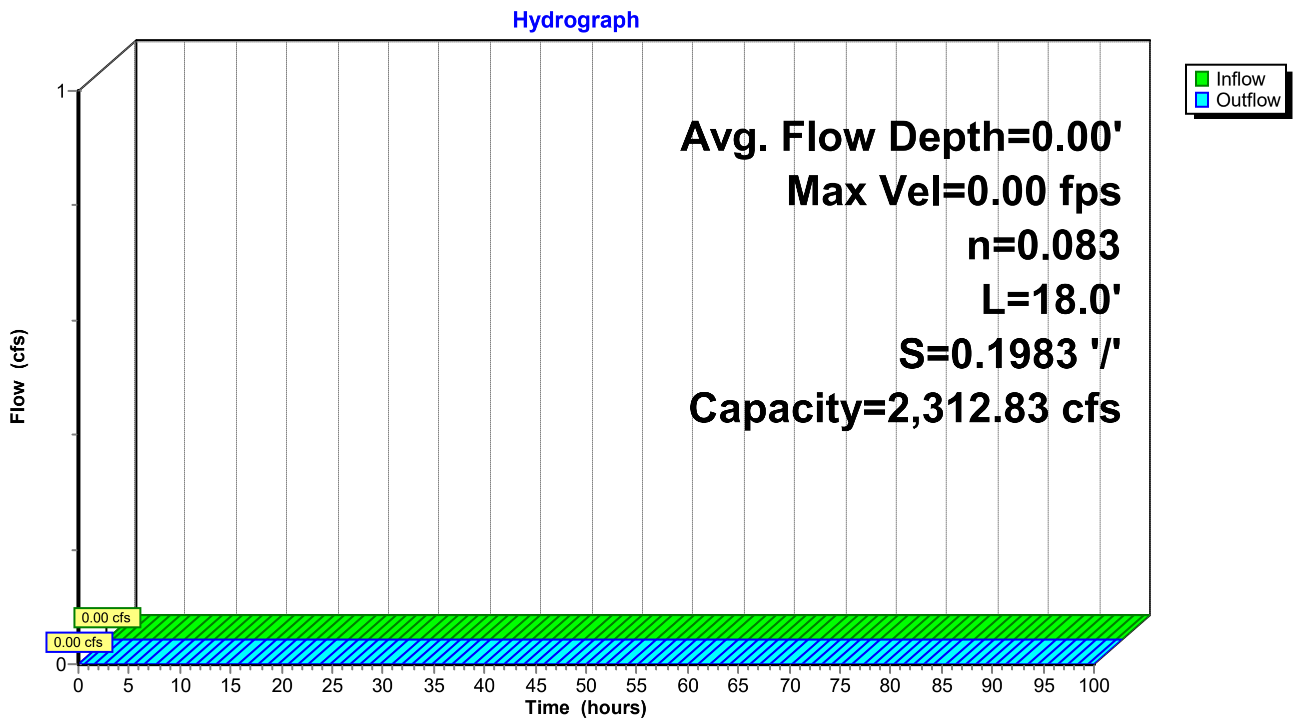
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

Reach 7R: Spillway - Middle Reach



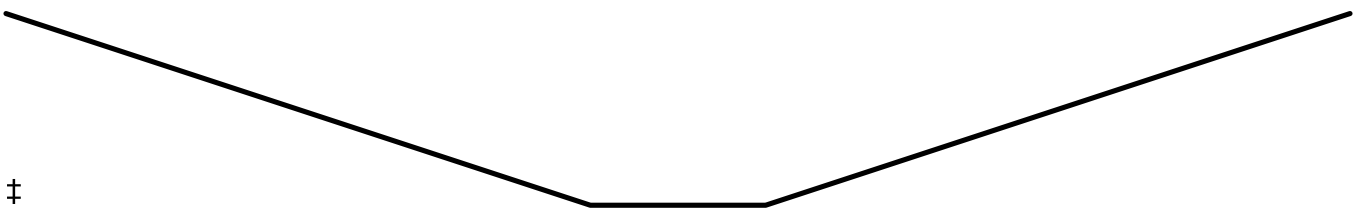
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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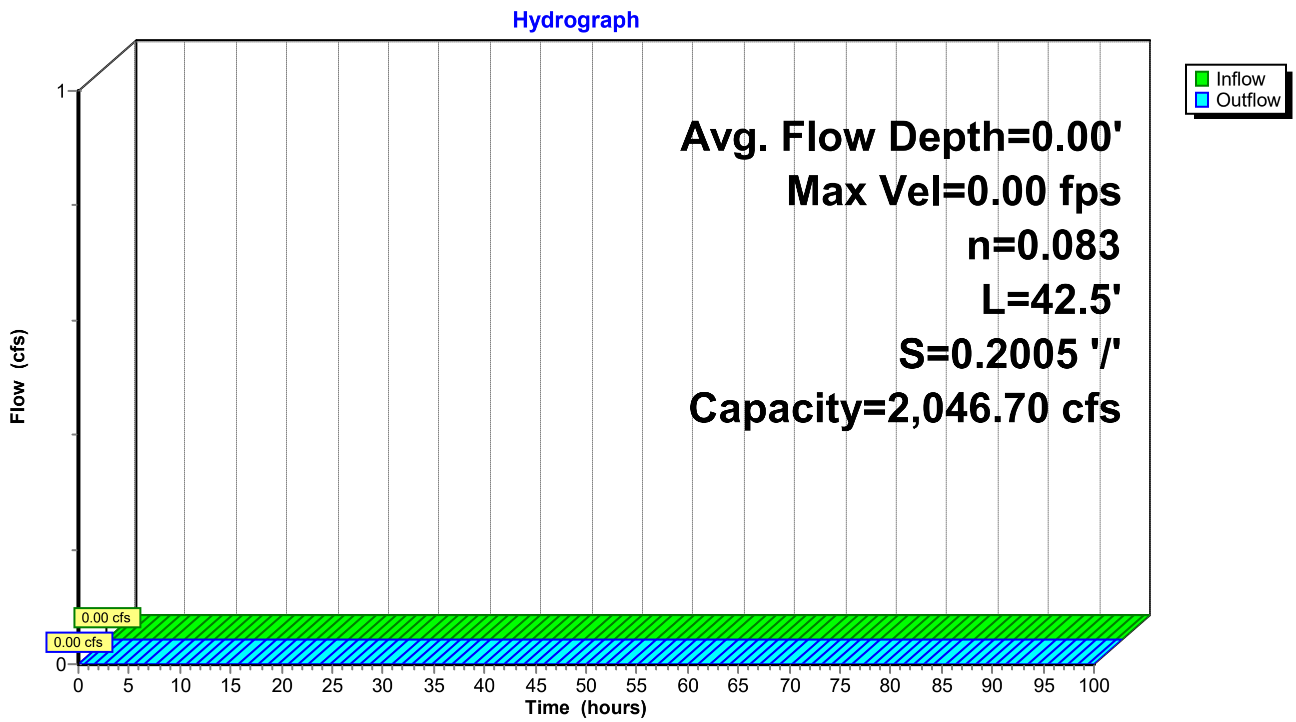
Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

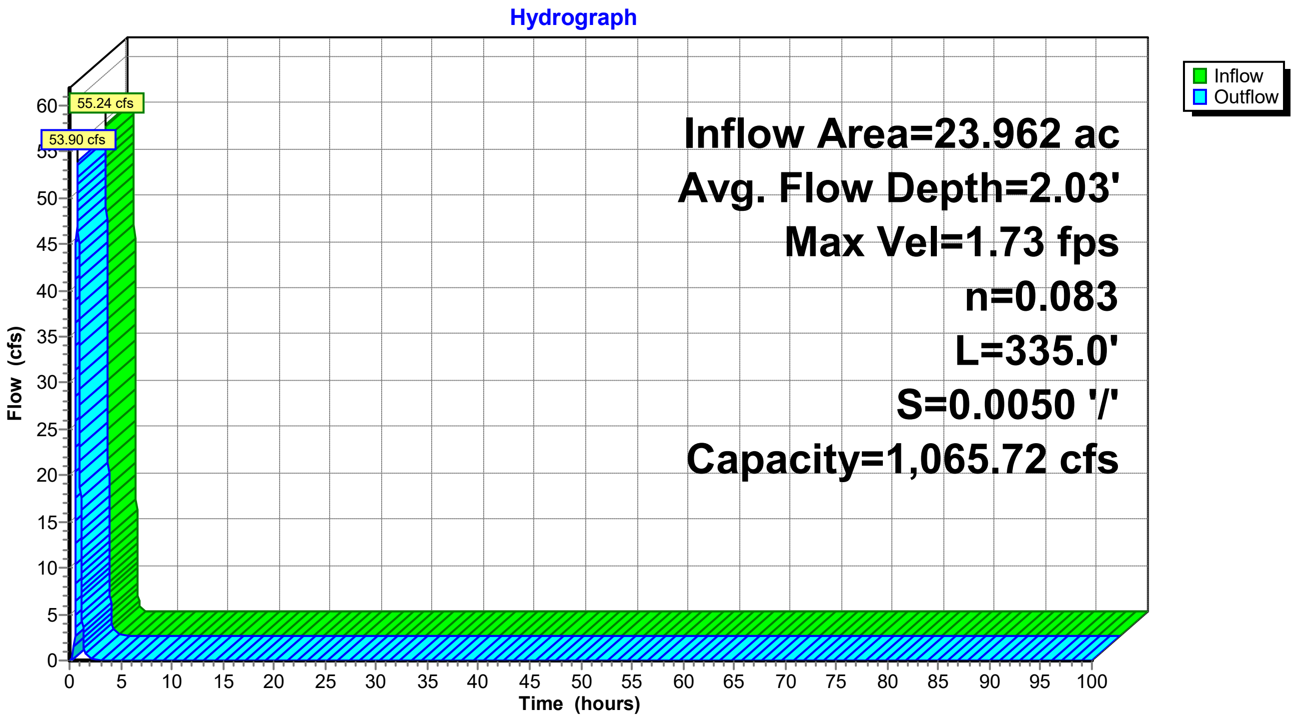
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.97" for 2 inch - 1-hr event
Inflow = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af
Outflow = 53.90 cfs @ 0.77 hrs, Volume= 1.927 af, Atten= 2%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.73 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.9 min

Peak Storage= 10,421 cf @ 0.77 hrs
Average Depth at Peak Storage= 2.03'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

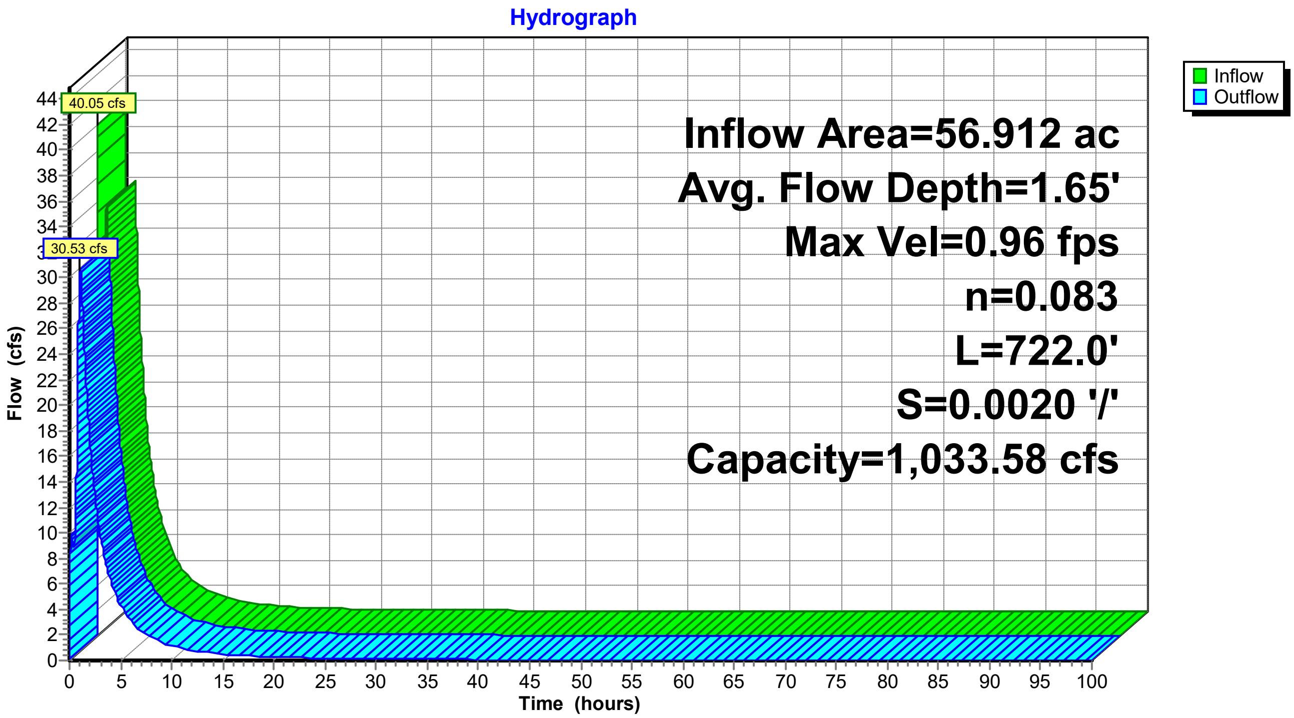
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 1.47" for 2 inch - 1-hr event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af
Outflow = 30.53 cfs @ 1.05 hrs, Volume= 6.993 af, Atten= 24%, Lag= 63.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.96 fps, Min. Travel Time= 12.5 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 56.5 min

Peak Storage= 22,856 cf @ 1.05 hrs
Average Depth at Peak Storage= 1.65'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.75' @ 0.90 hrs

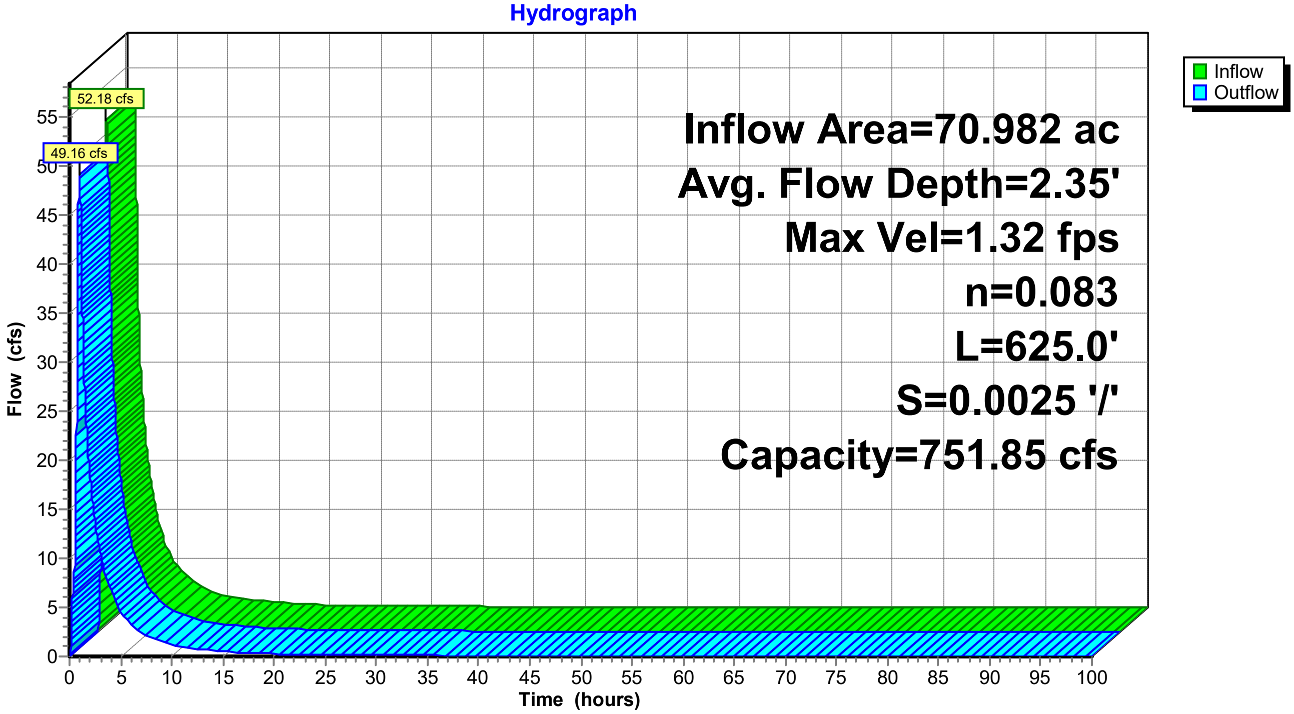
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth = 1.36" for 2 inch - 1-hr event
Inflow = 52.18 cfs @ 0.87 hrs, Volume= 8.055 af
Outflow = 49.16 cfs @ 0.97 hrs, Volume= 8.055 af, Atten= 6%, Lag= 6.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.32 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 42.6 min

Peak Storage= 23,191 cf @ 0.97 hrs
Average Depth at Peak Storage= 2.35'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 2P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 1.25" for 2 inch - 1-hr event
Inflow = 150.15 cfs @ 0.50 hrs, Volume= 25.207 af
Outflow = 10.38 cfs @ 8.63 hrs, Volume= 62.768 af, Atten= 93%, Lag= 487.9 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 8.63 hrs, Volume= 62.768 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 435.69' @ 8.63 hrs Surf.Area= 0.000 ac Storage= 88.298 af (8.058 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,555.6 min (2,194.8 - 639.2)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

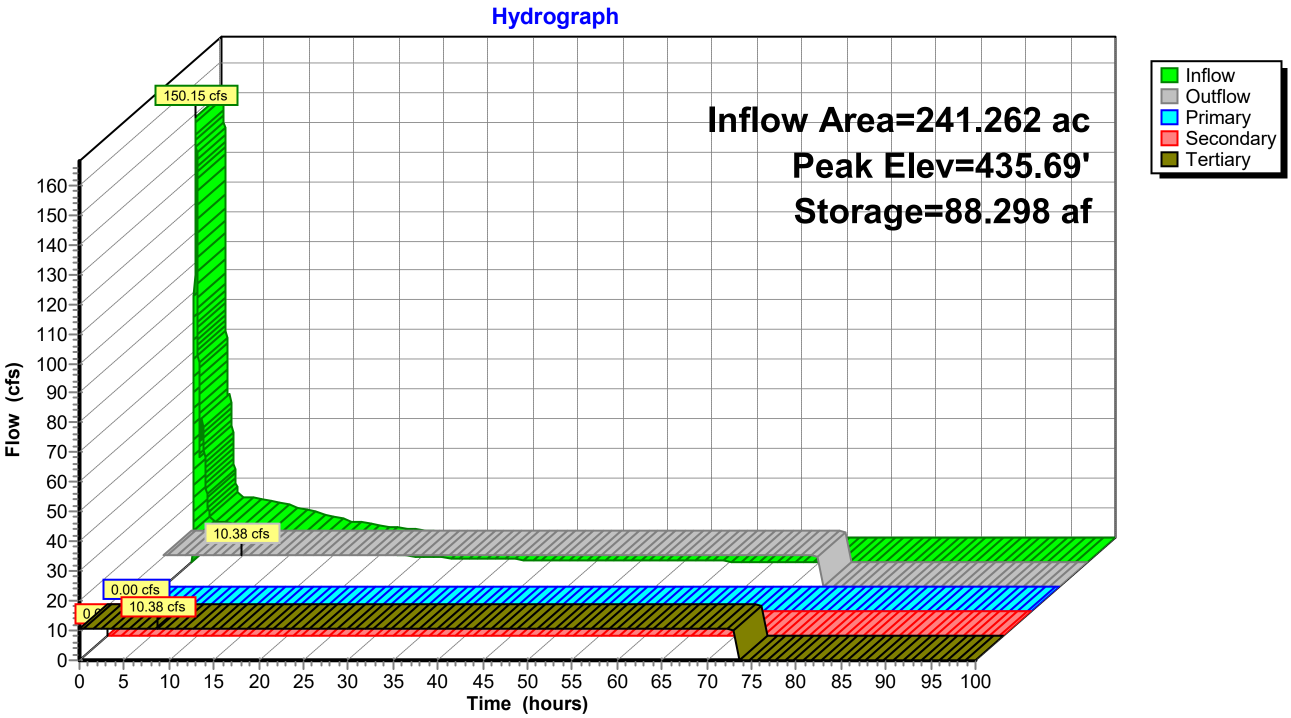
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.00 cfs of 84.28 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 8.63 hrs HW=435.69' TW=428.36' (Dynamic Tailwater)
↑—**4=Pump** (Pump Controls 10.38 cfs)

Pond 2P: Lower Pond



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.33' @ 1.50 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 0.87" for 2 inch - 1-hr event
Inflow = 118.81 cfs @ 0.72 hrs, Volume= 4.111 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af, Atten= 66%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 6.993 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.72' @ 1.04 hrs Surf.Area= 0.000 ac Storage= 9.648 af (2.078 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 220.9 min (267.8 - 46.8)

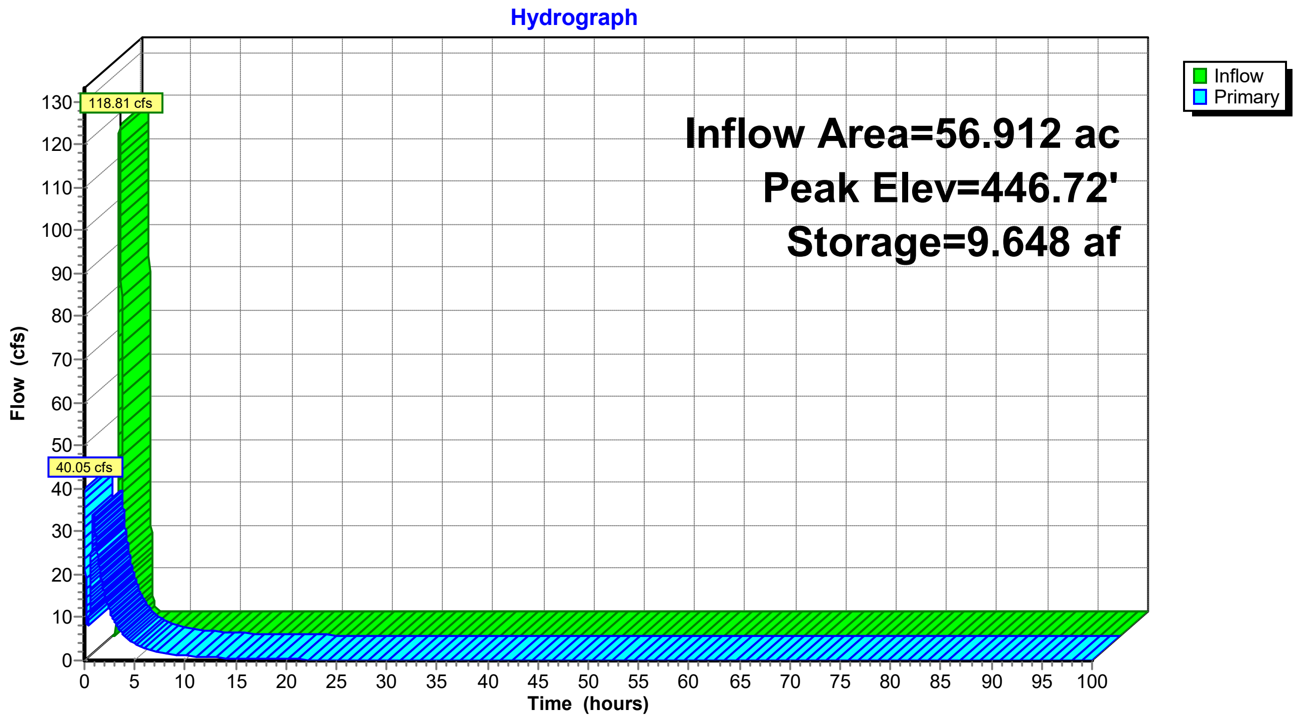
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

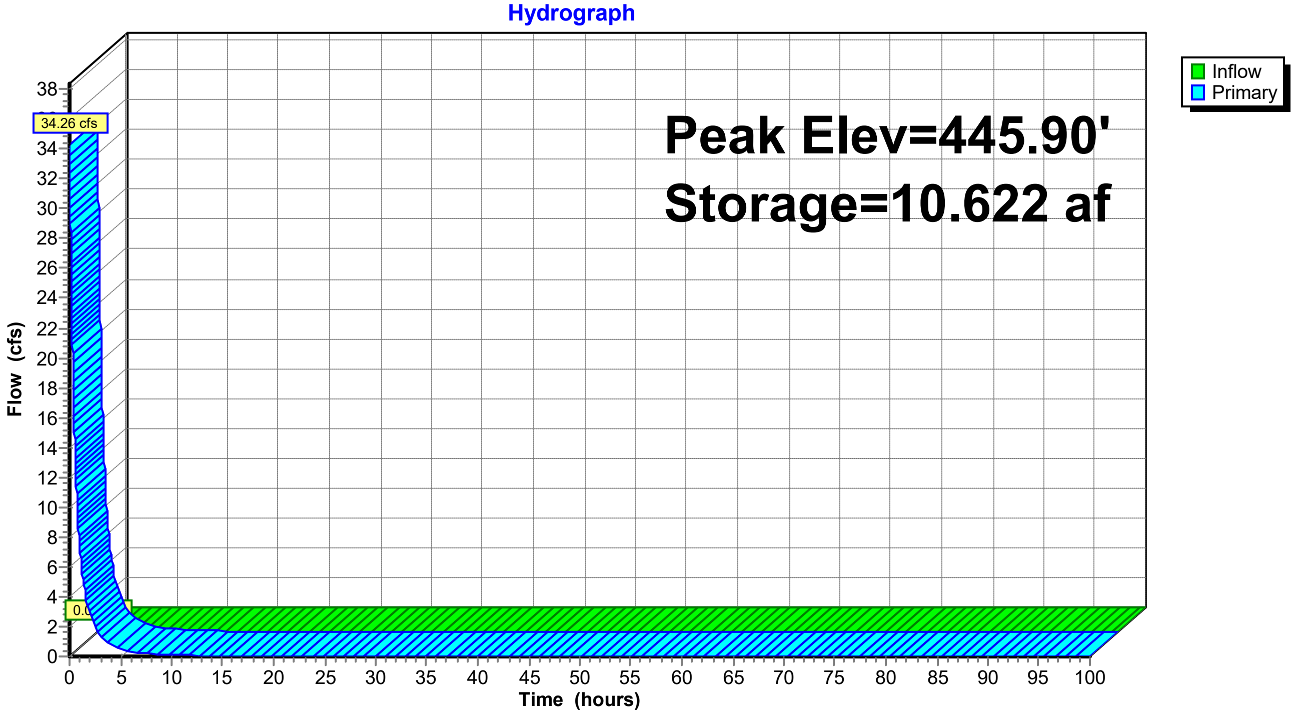
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 4.22' @ 4.97 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 1.29" for 2 inch - 1-hr event
Inflow = 126.06 cfs @ 1.42 hrs, Volume= 17.674 af
Outflow = 13.44 cfs @ 3.33 hrs, Volume= 17.019 af, Atten= 89%, Lag= 114.4 min
Primary = 13.44 cfs @ 3.33 hrs, Volume= 17.019 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 448.51' @ 3.33 hrs Surf.Area= 0.000 ac Storage= 40.212 af (12.822 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 742.2 min (923.6 - 181.4)

Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

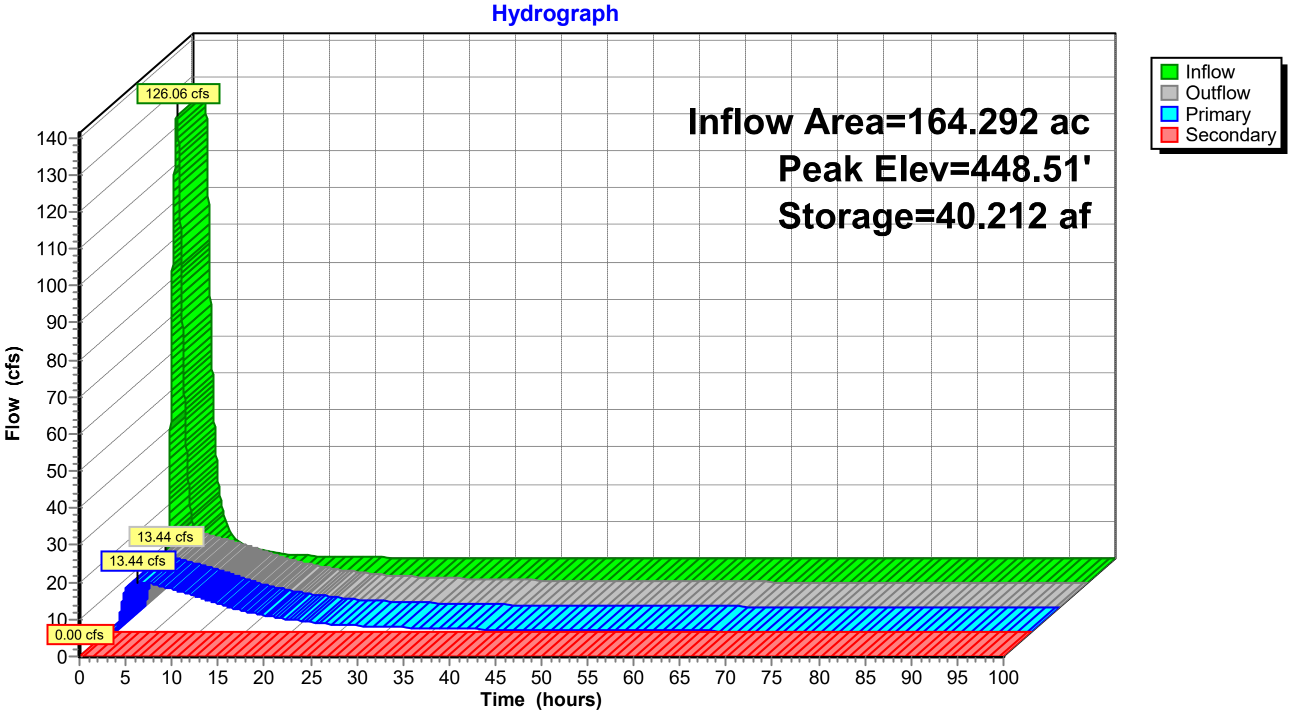
Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

Primary OutFlow Max=13.45 cfs @ 3.33 hrs HW=448.51' TW=435.63' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 13.45 cfs @ 4.74 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Subcatchment 2S: Phase 2 Drainage Area

End Phase 1 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

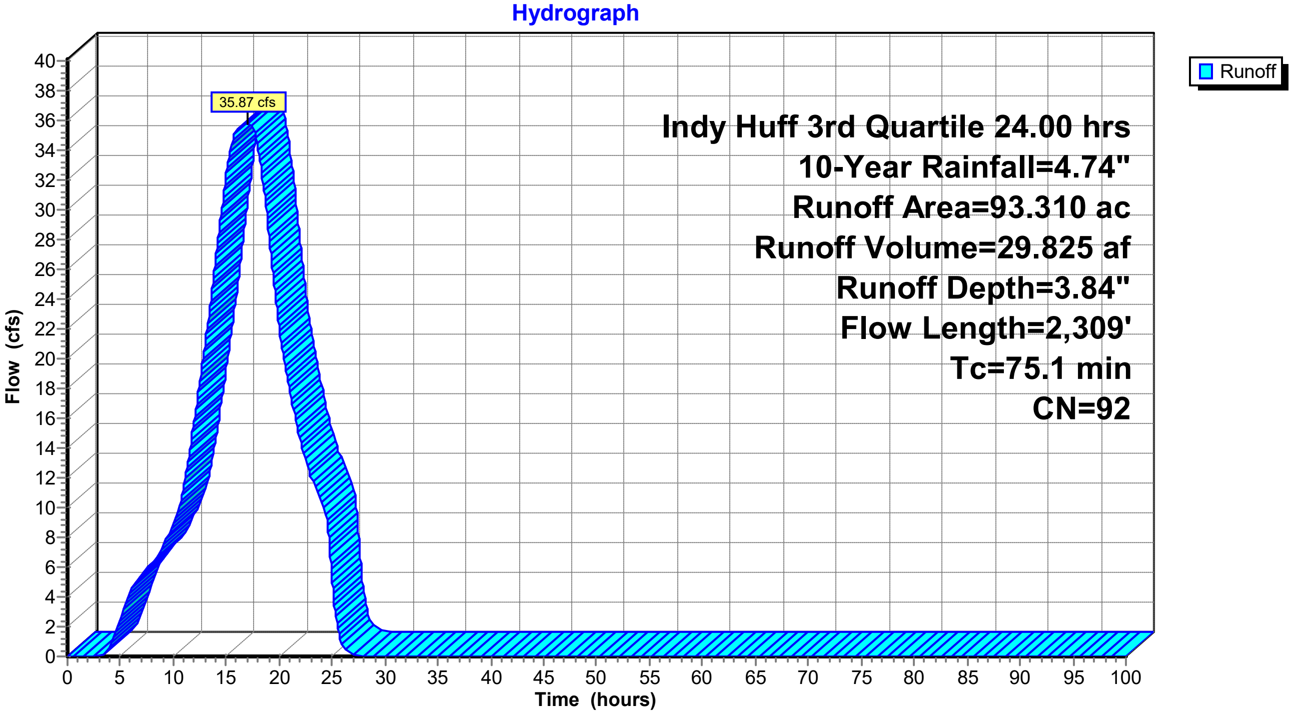
Runoff = 35.87 cfs @ 16.94 hrs, Volume= 29.825 af, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	4.490	98	Water Surface (Pools A, B, C1, C2)
*	1.440	98	Ash within Pool Limits - Dewatered
	5.200	79	50-75% Grass cover, Fair, HSG C
	93.310	92	Weighted Average
	29.970		32.12% Pervious Area
	63.340		67.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.6	250	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
41.5	1,759	0.0050	0.71		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
75.1	2,309	Total			

Subcatchment 2S: Phase 2 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

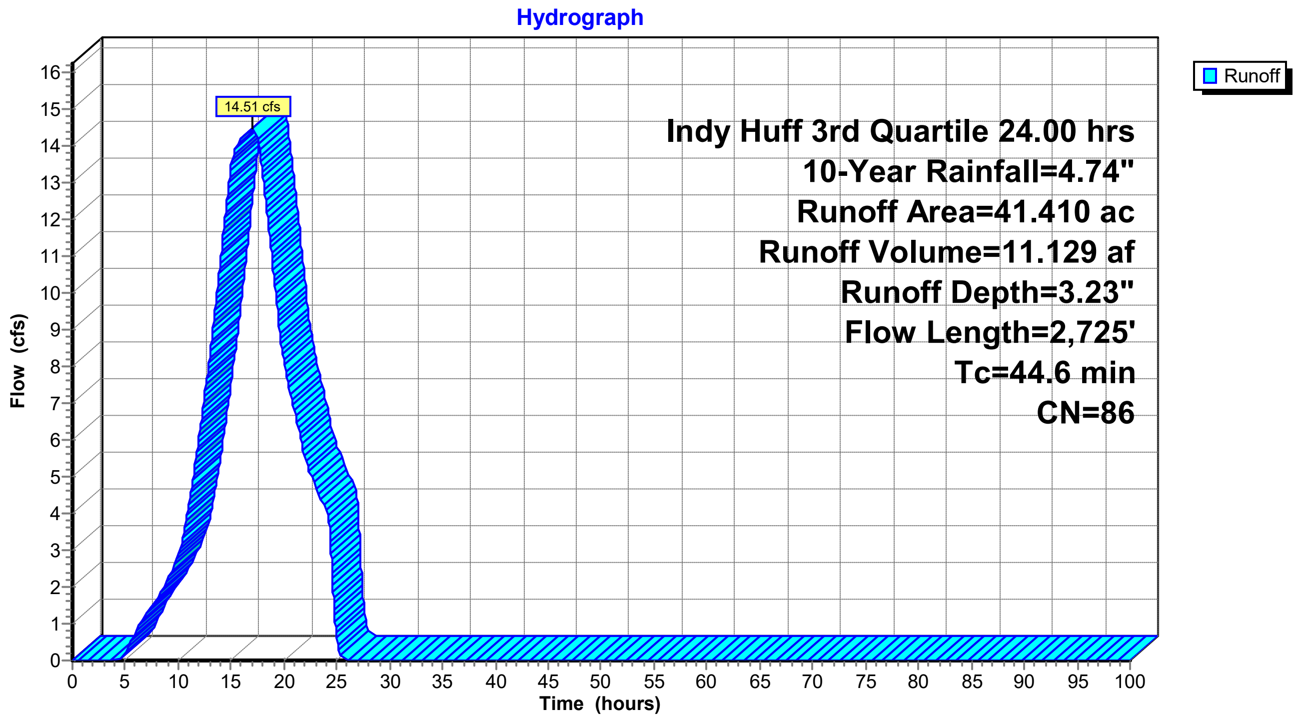
Runoff = 14.51 cfs @ 17.10 hrs, Volume= 11.129 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

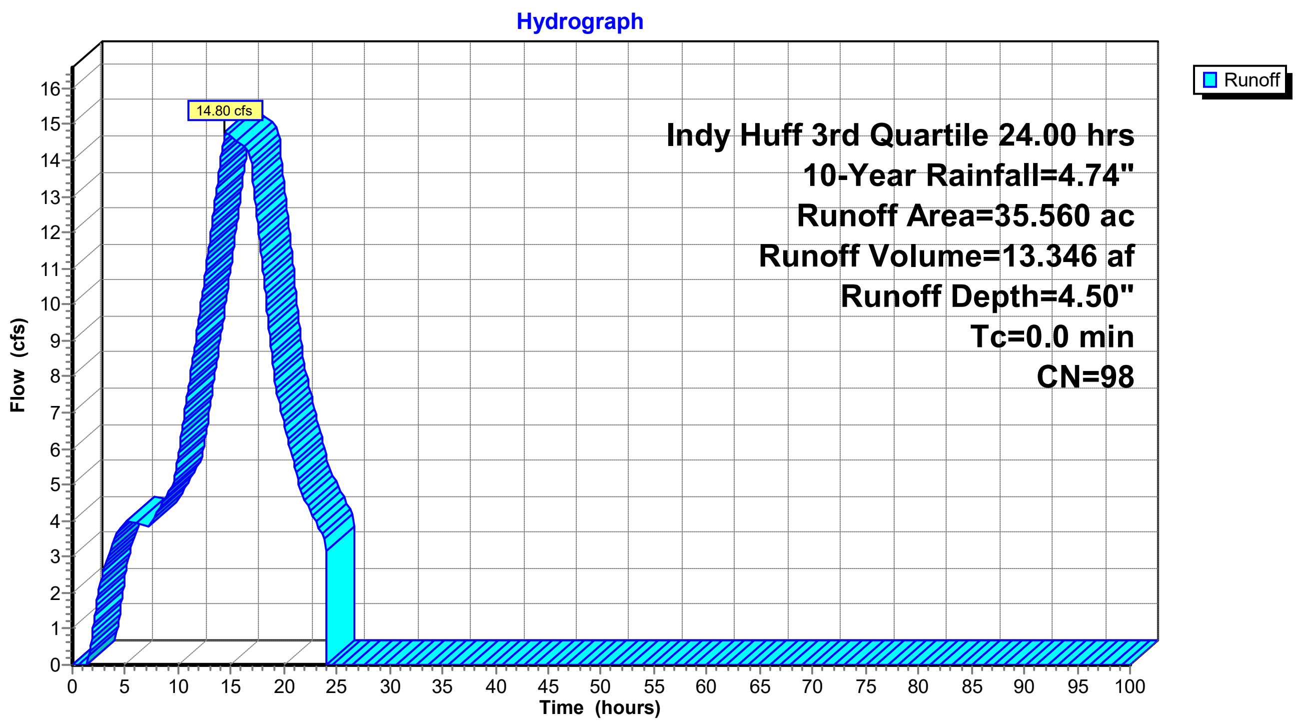
Runoff = 14.80 cfs @ 14.41 hrs, Volume= 13.346 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

The early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

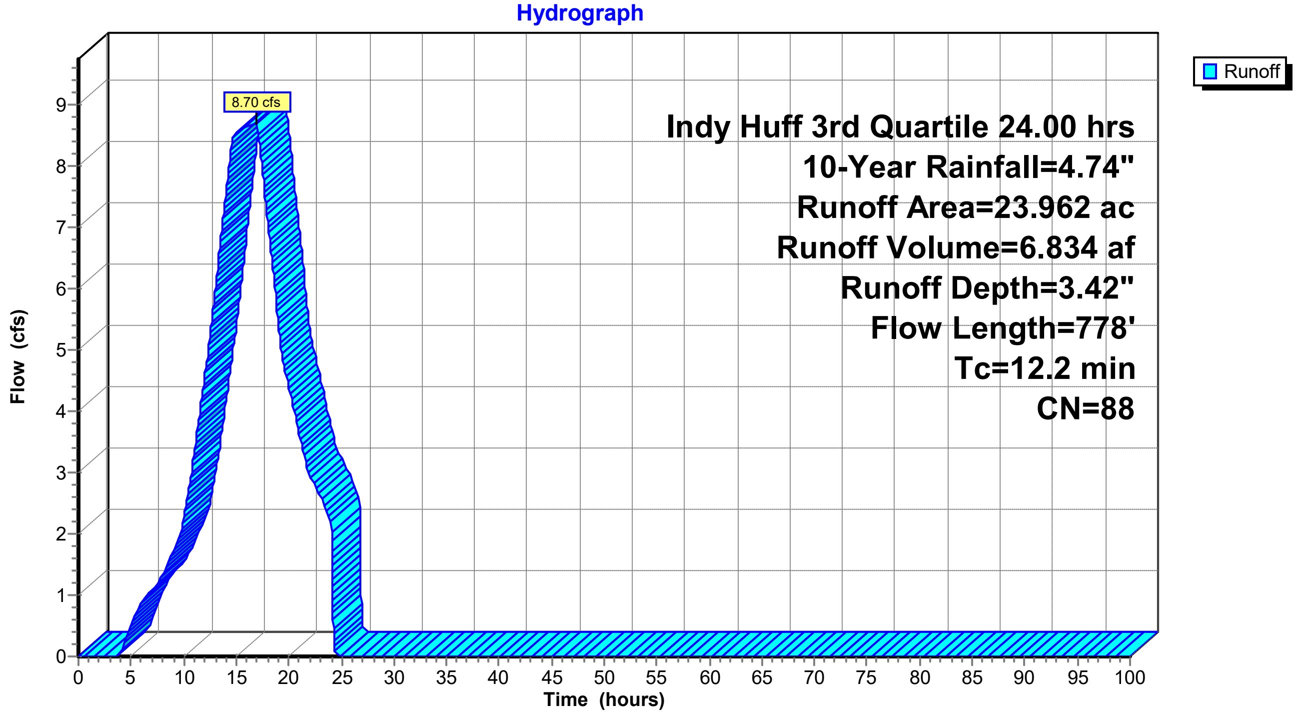
Runoff = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash (Due to Pool C2 being dry)
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

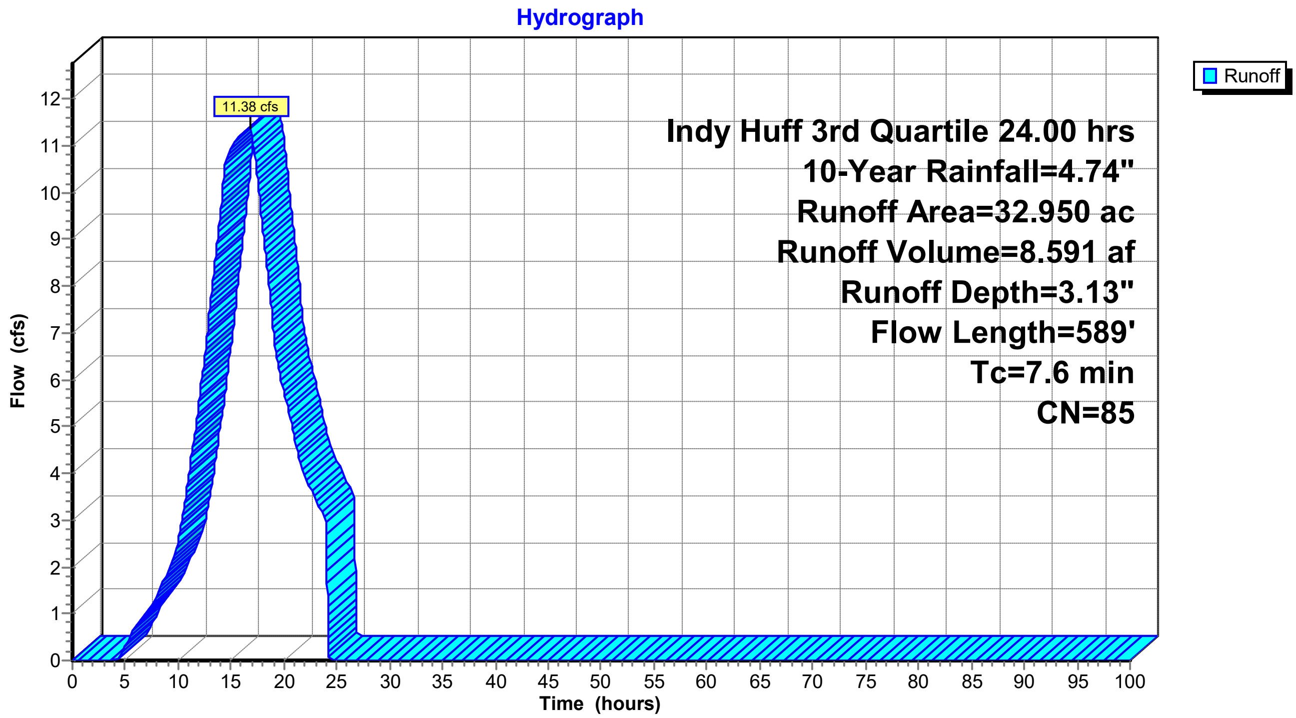
Runoff = 11.38 cfs @ 16.83 hrs, Volume= 8.591 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
	32.950	85	Weighted Average
	21.850		66.31% Pervious Area
	11.100		33.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Early Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

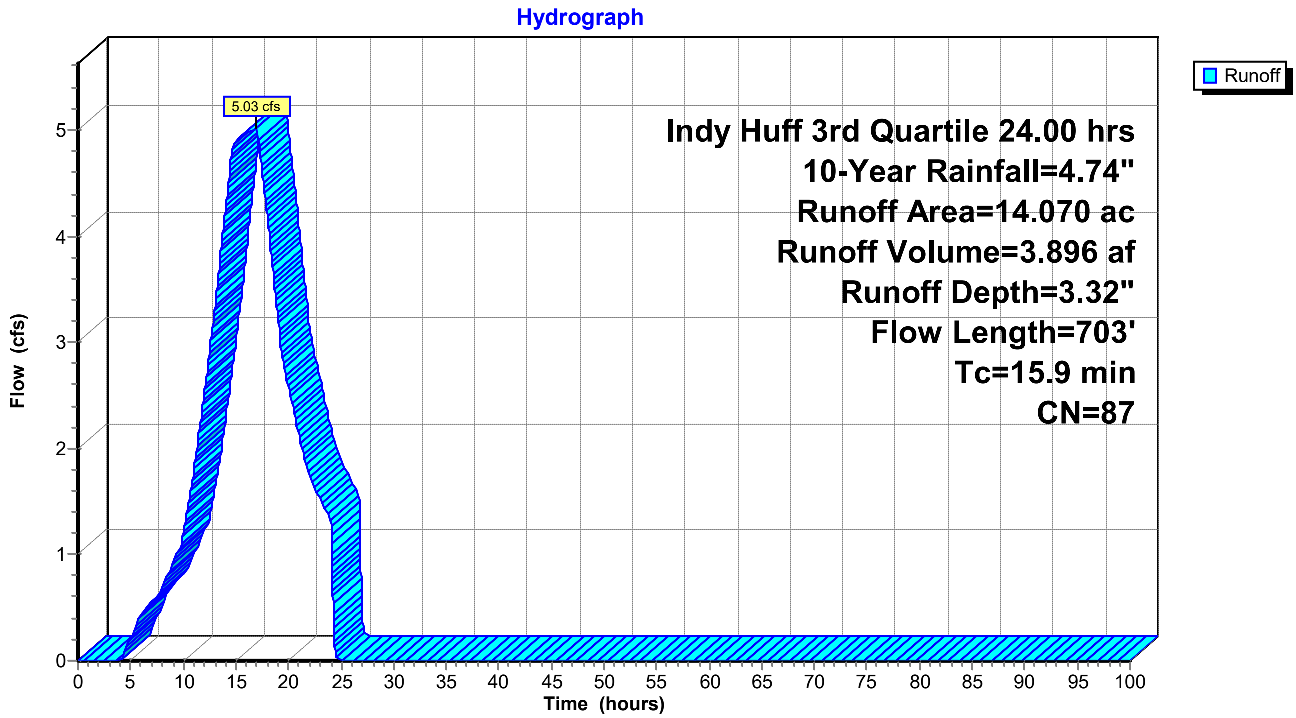
Runoff = 5.03 cfs @ 16.87 hrs, Volume= 3.896 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



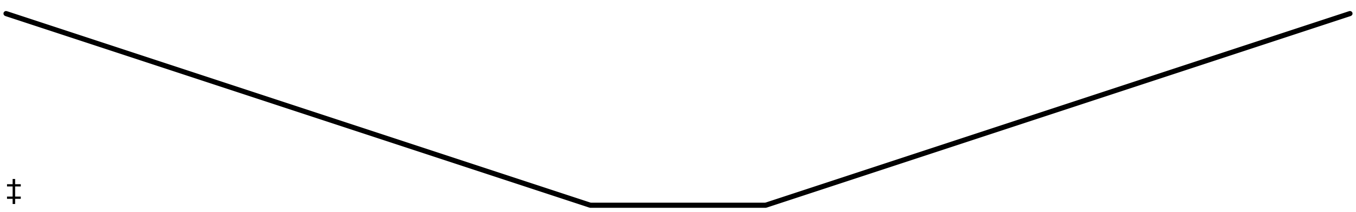
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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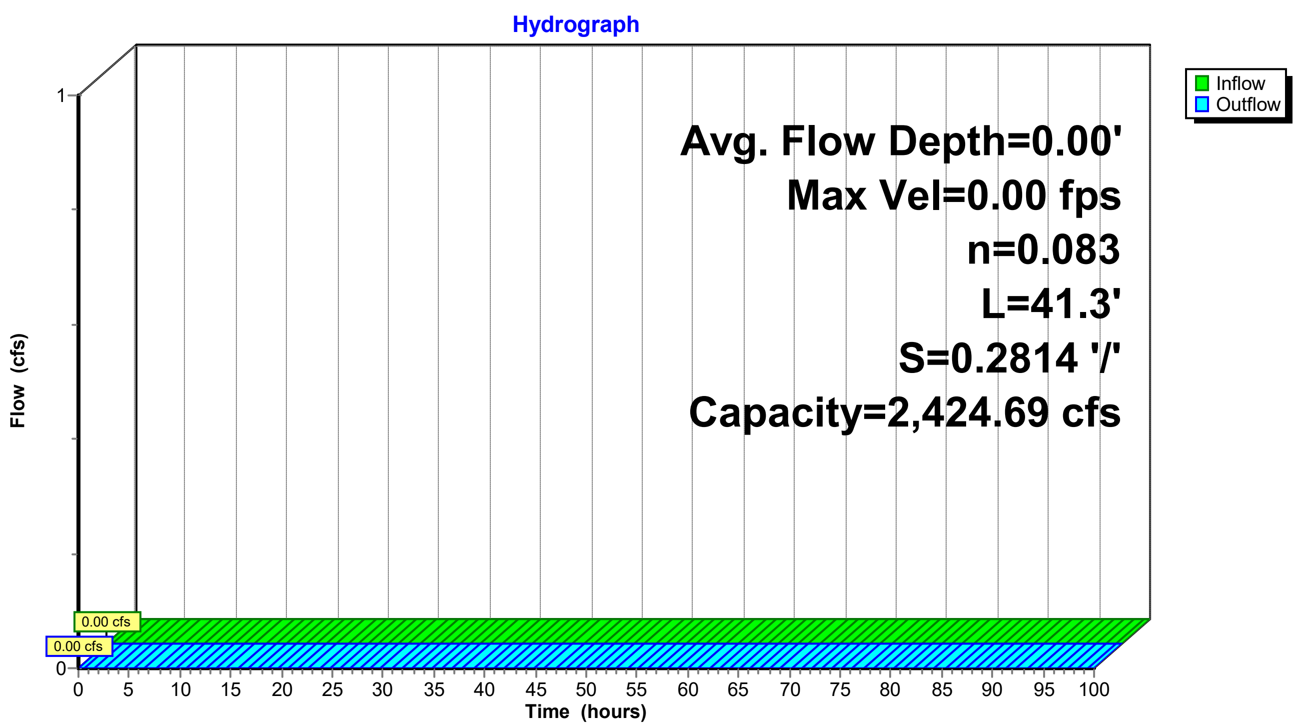
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

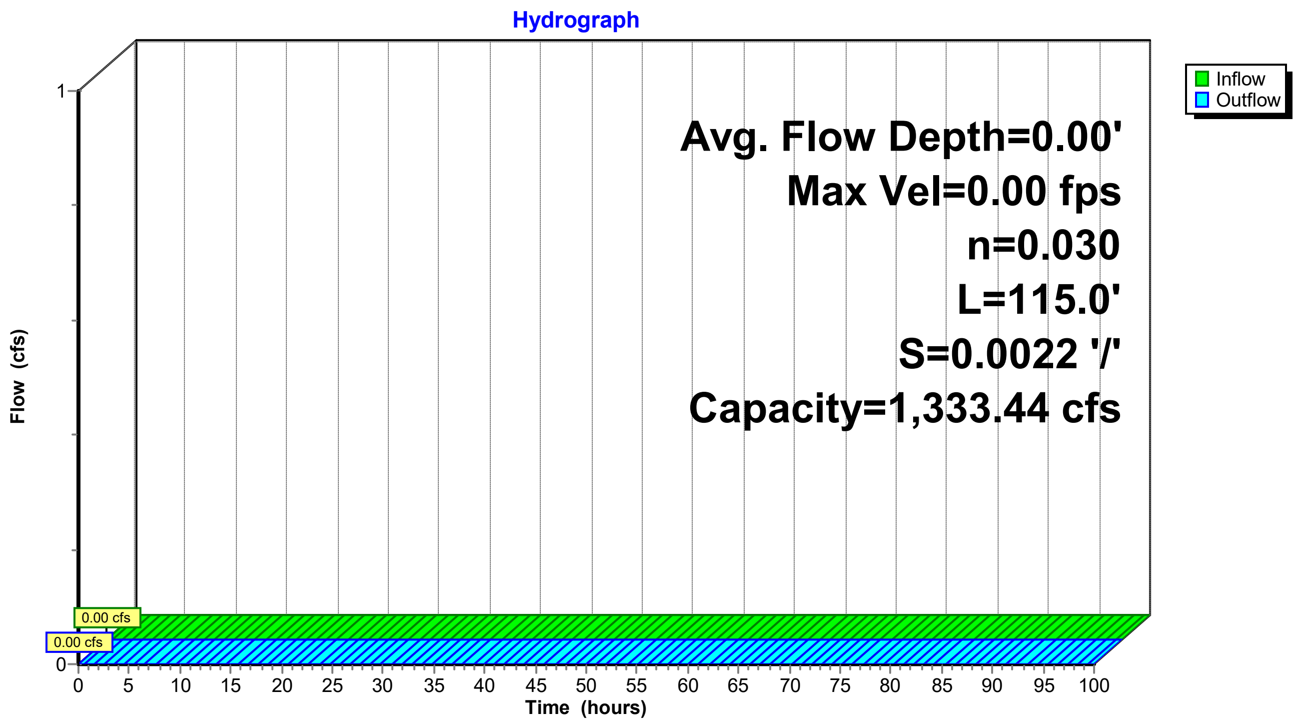
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

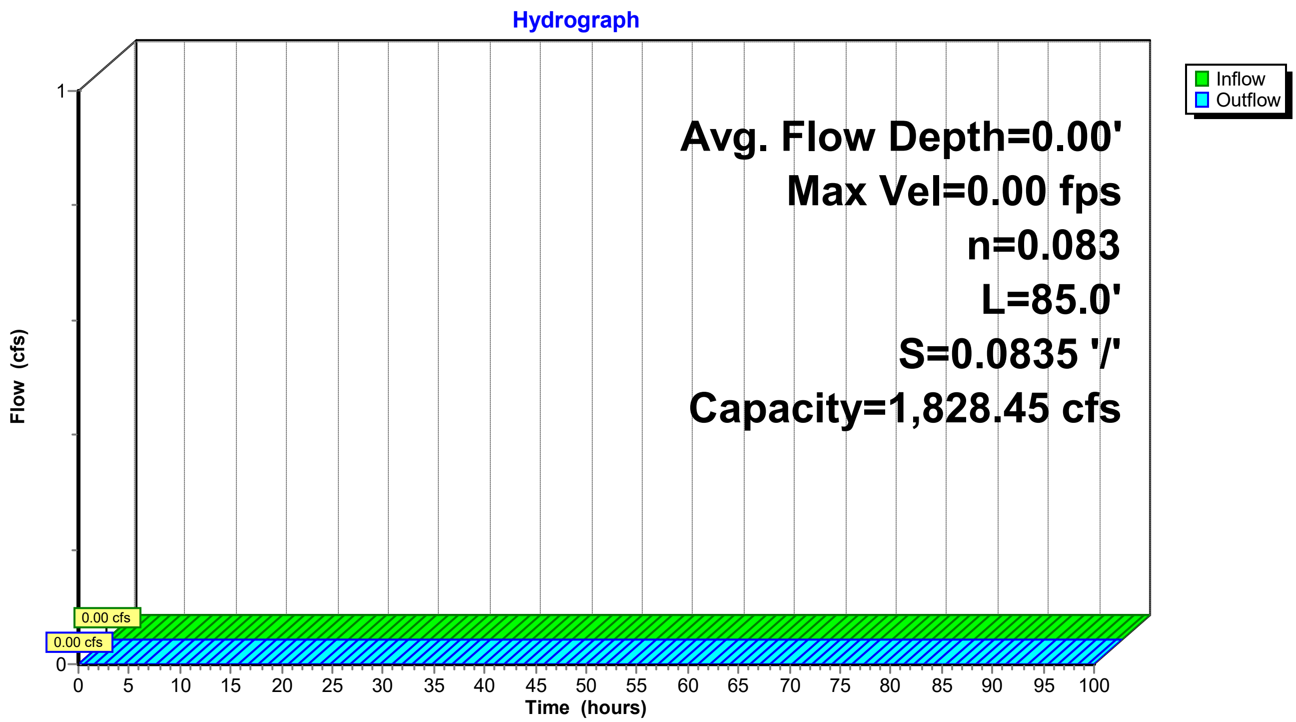
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

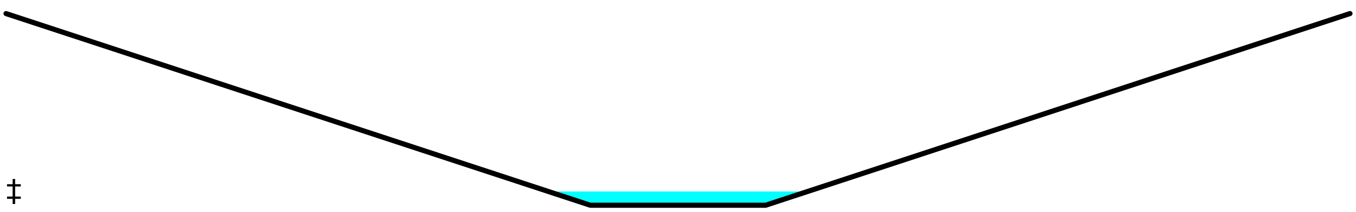
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 40.40 hrs

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 4.27" for 10-Year event
Inflow = 10.38 cfs @ 40.40 hrs, Volume= 85.792 af
Outflow = 10.38 cfs @ 40.45 hrs, Volume= 85.743 af, Atten= 0%, Lag= 3.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.89 fps, Avg. Travel Time= 3.4 min

Peak Storage= 2,135 cf @ 40.45 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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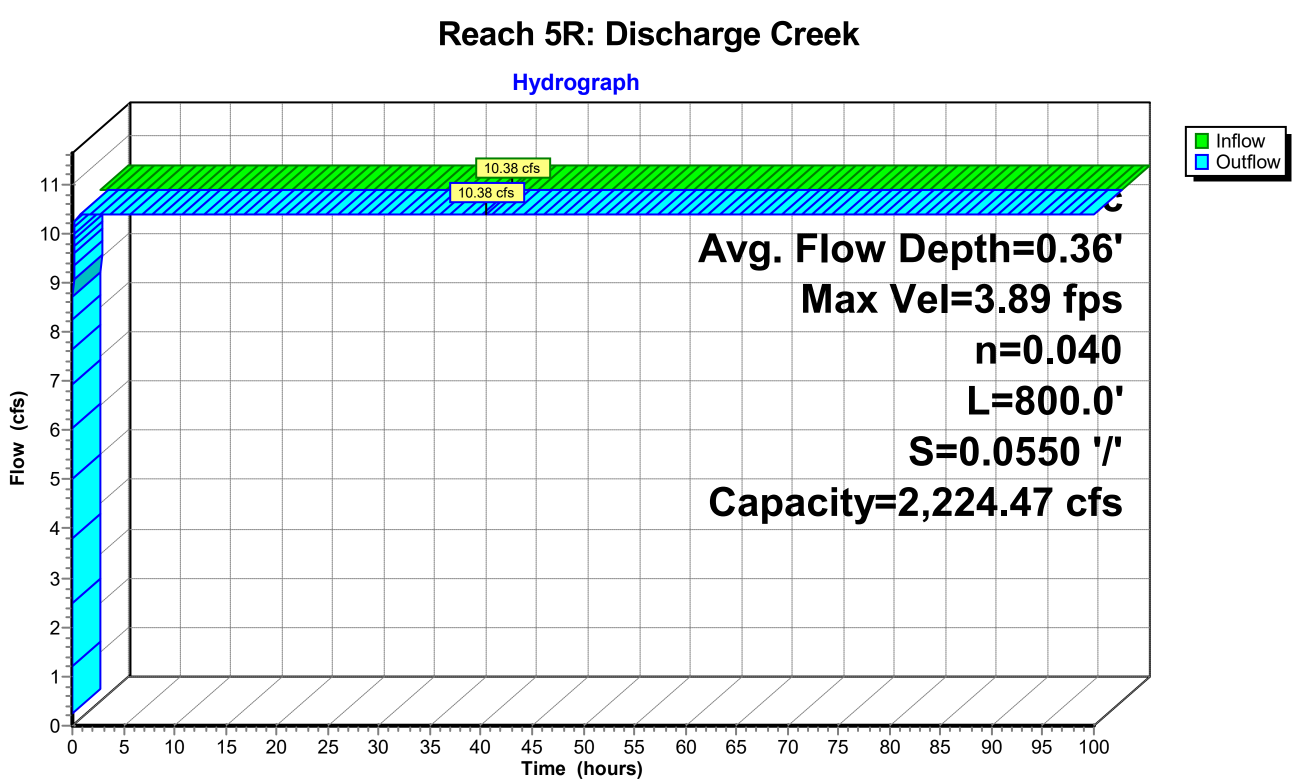


Summary for Reach 6R: Upper Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

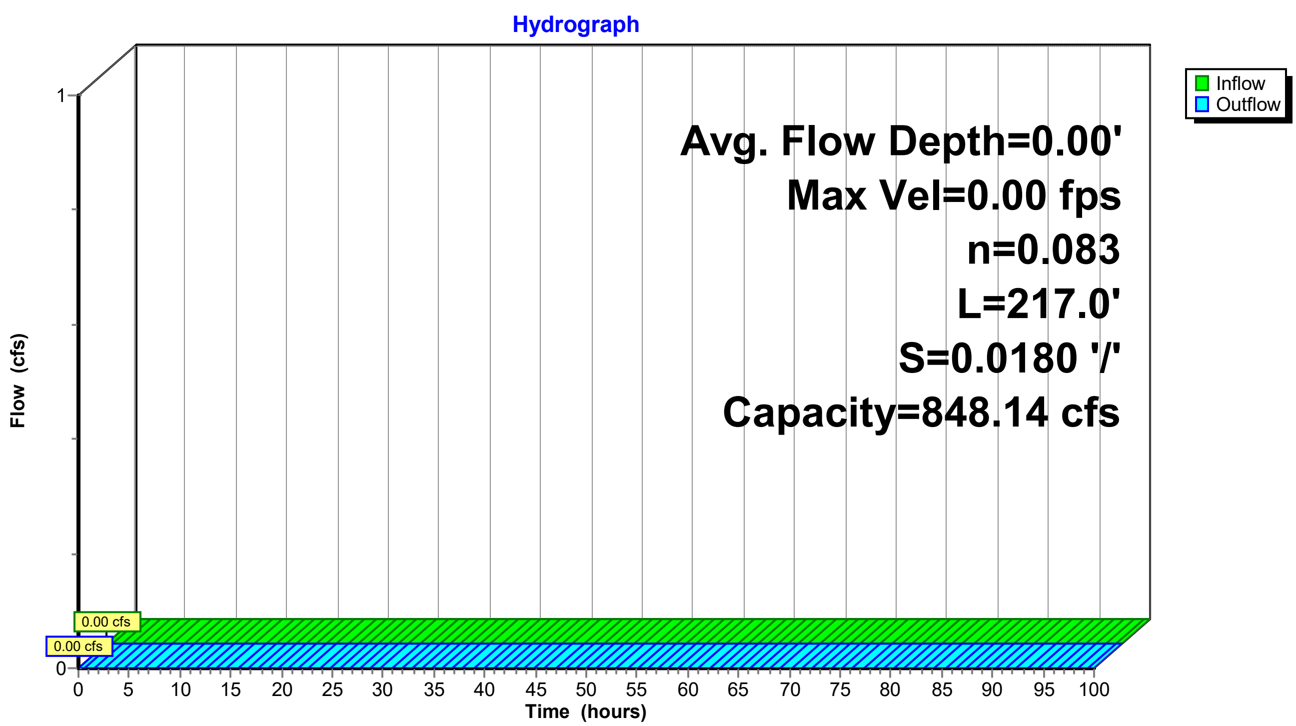
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

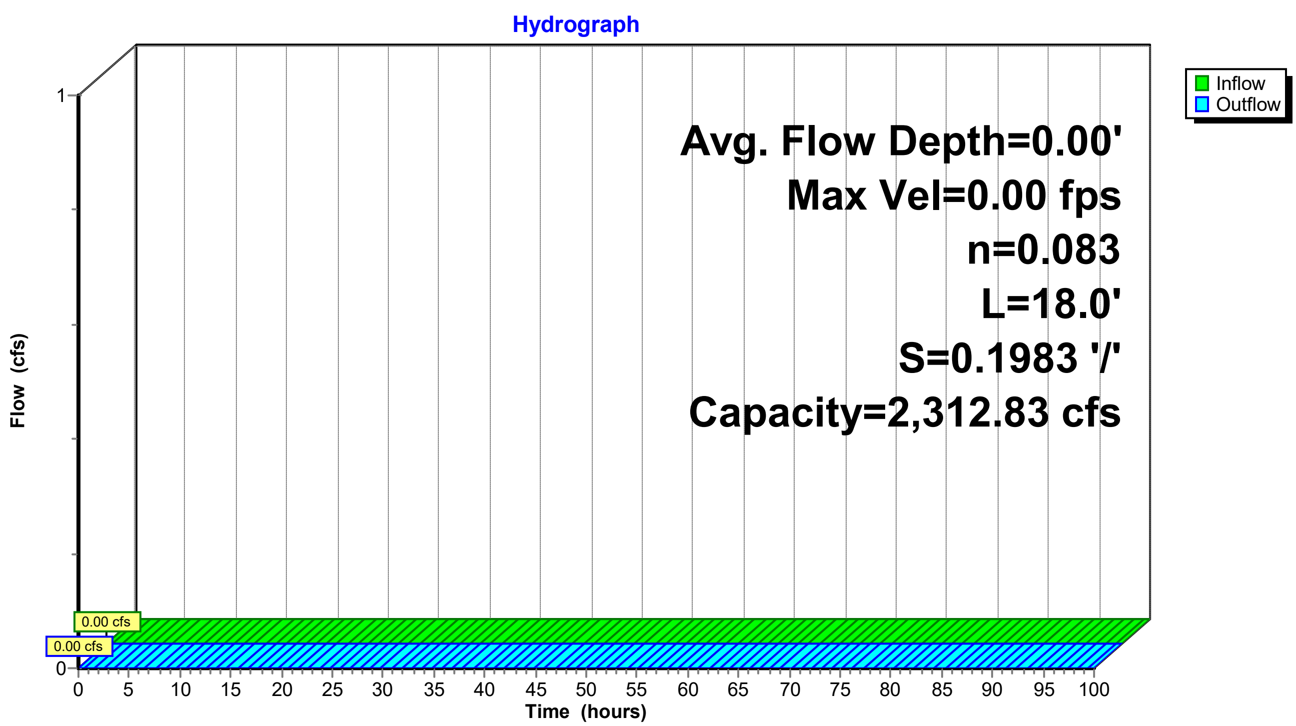
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



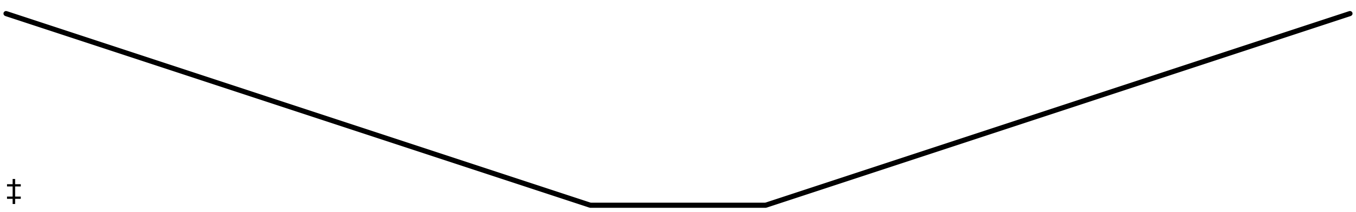
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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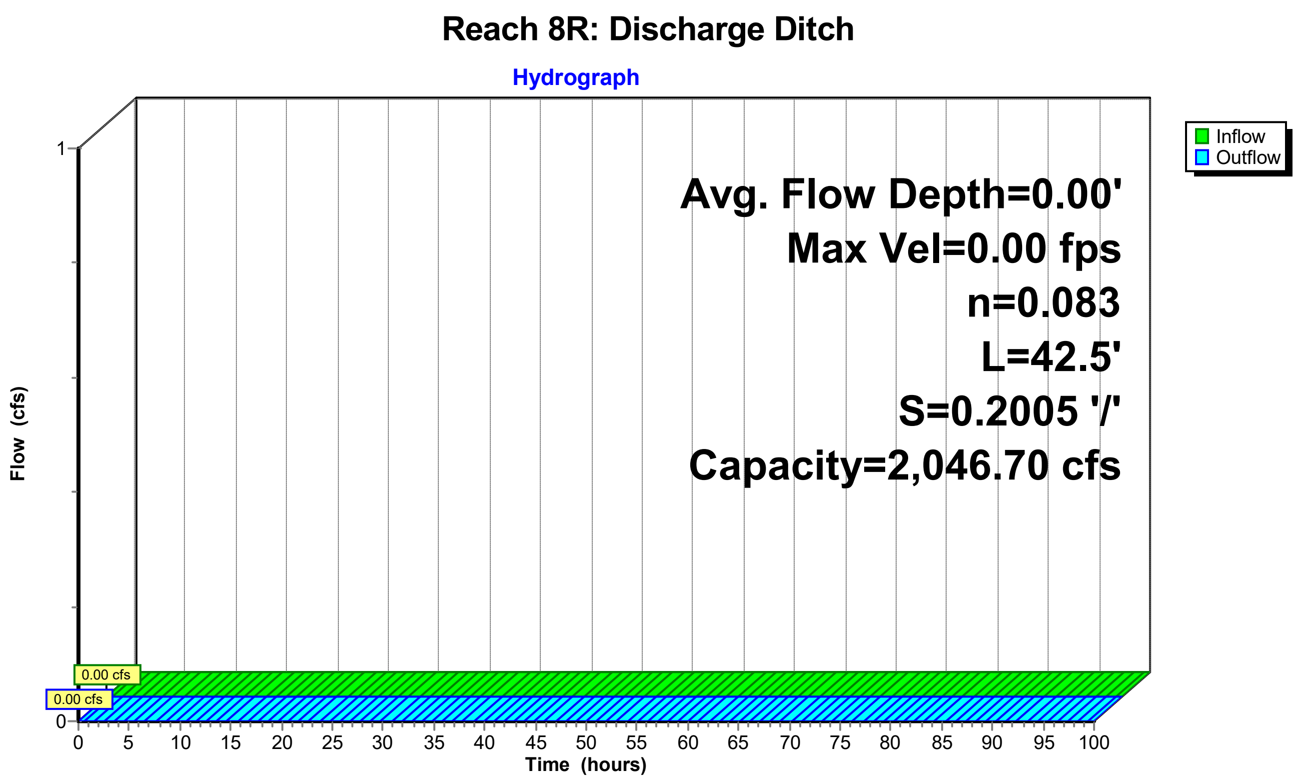


Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

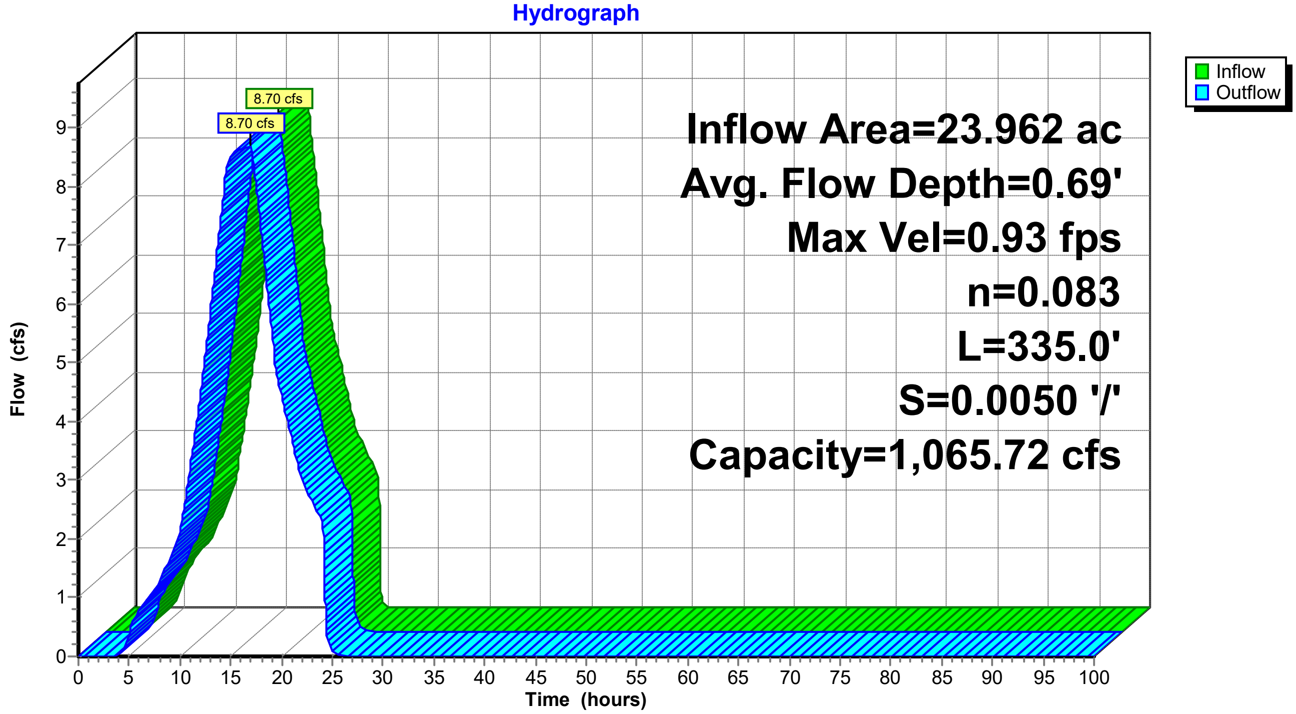
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af
Outflow = 8.70 cfs @ 16.88 hrs, Volume= 6.834 af, Atten= 0%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 9.3 min

Peak Storage= 3,133 cf @ 16.88 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,065.72 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 335.0' Slope= 0.0050 '/'
Inlet Invert= 445.00', Outlet Invert= 443.32'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

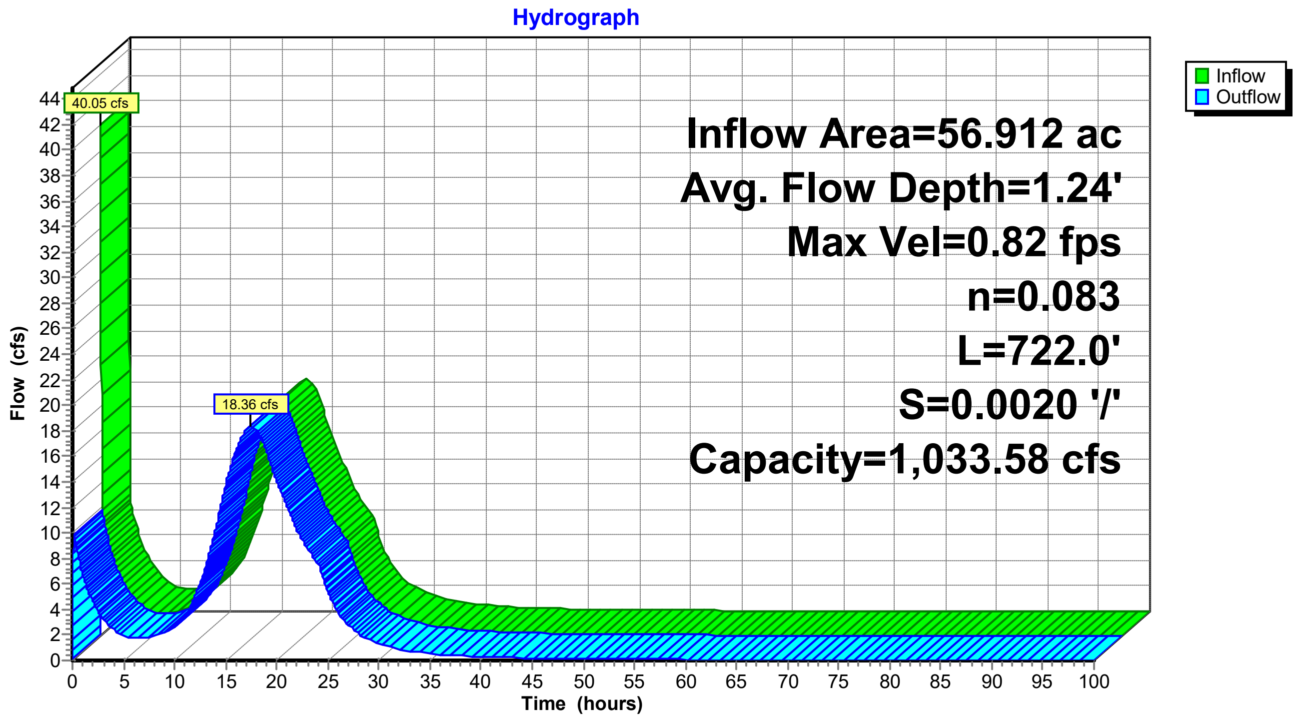
Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth > 3.86" for 10-Year event
Inflow = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af
Outflow = 18.36 cfs @ 17.49 hrs, Volume= 18.302 af, Atten= 54%, Lag= 1,049.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.82 fps, Min. Travel Time= 14.7 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 41.5 min

Peak Storage= 16,194 cf @ 17.49 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'

Reach 10R: Ditch C1 to B



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 10R OUTLET depth by 0.28' @ 17.02 hrs

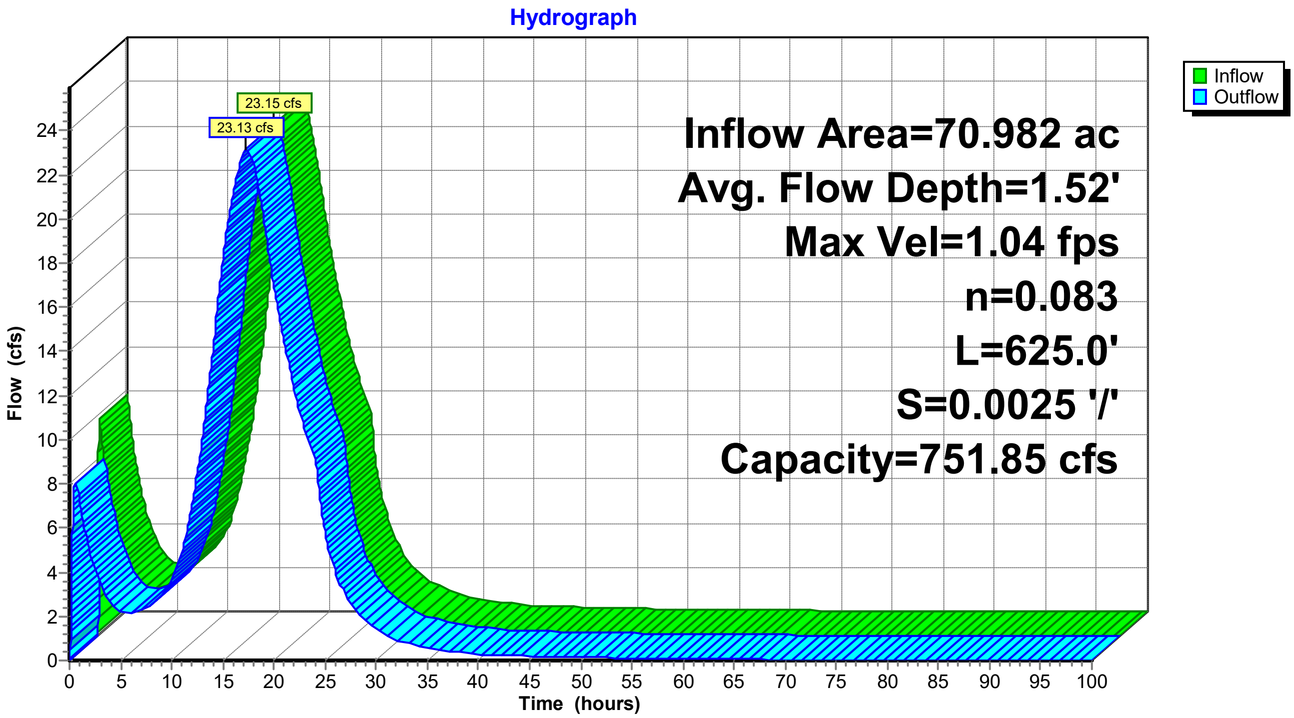
Inflow Area = 70.982 ac, 39.76% Impervious, Inflow Depth > 3.75" for 10-Year event
Inflow = 23.15 cfs @ 17.19 hrs, Volume= 22.199 af
Outflow = 23.13 cfs @ 17.30 hrs, Volume= 22.198 af, Atten= 0%, Lag= 6.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.04 fps, Min. Travel Time= 10.0 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 30.0 min

Peak Storage= 13,893 cf @ 17.30 hrs
Average Depth at Peak Storage= 1.52'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 751.85 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 625.0' Slope= 0.0025 '/'
Inlet Invert= 443.56', Outlet Invert= 442.00'

Reach 11R: Ditch B to A



Summary for Pond 2P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.262 ac, 58.62% Impervious, Inflow Depth > 3.76" for 10-Year event
Inflow = 46.20 cfs @ 16.80 hrs, Volume= 75.531 af
Outflow = 10.38 cfs @ 40.40 hrs, Volume= 85.792 af, Atten= 78%, Lag= 1,415.8 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 40.40 hrs, Volume= 85.792 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 437.75' @ 40.40 hrs Surf.Area= 0.000 ac Storage= 112.338 af (32.098 af above start)

Plug-Flow detention time= 5,328.8 min calculated for 5.552 af (7% of inflow)
Center-of-Mass det. time= 1,490.1 min (3,000.0 - 1,509.9)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	580.200 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	580.200

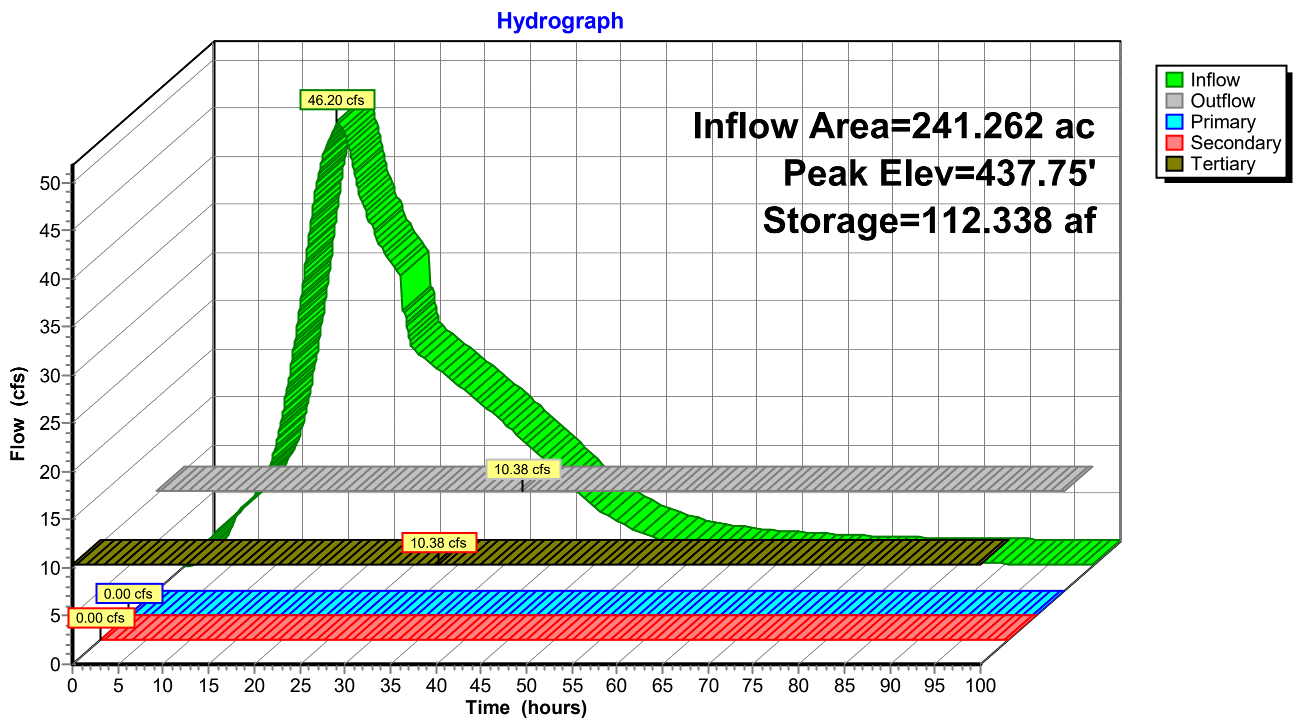
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.00 cfs of 84.28 cfs potential flow)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 40.40 hrs HW=437.75' TW=428.36' (Dynamic Tailwater)
↑—**4=Pump** (Pump Controls 10.38 cfs)

Pond 2P: Lower Pond



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 9R INLET depth by 1.00' @ 0.00 hrs

Inflow Area = 56.912 ac, 39.77% Impervious, Inflow Depth = 3.25" for 10-Year event
Inflow = 20.08 cfs @ 16.83 hrs, Volume= 15.425 af
Outflow = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af, Atten= 0%, Lag= 0.0 min
Primary = 40.05 cfs @ 0.00 hrs, Volume= 18.303 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.28' @ 17.48 hrs Surf.Area= 0.000 ac Storage= 8.381 af (0.811 af above start)

Plug-Flow detention time= 477.7 min calculated for 10.733 af (70% of inflow)
Center-of-Mass det. time= 67.4 min (1,028.1 - 960.7)

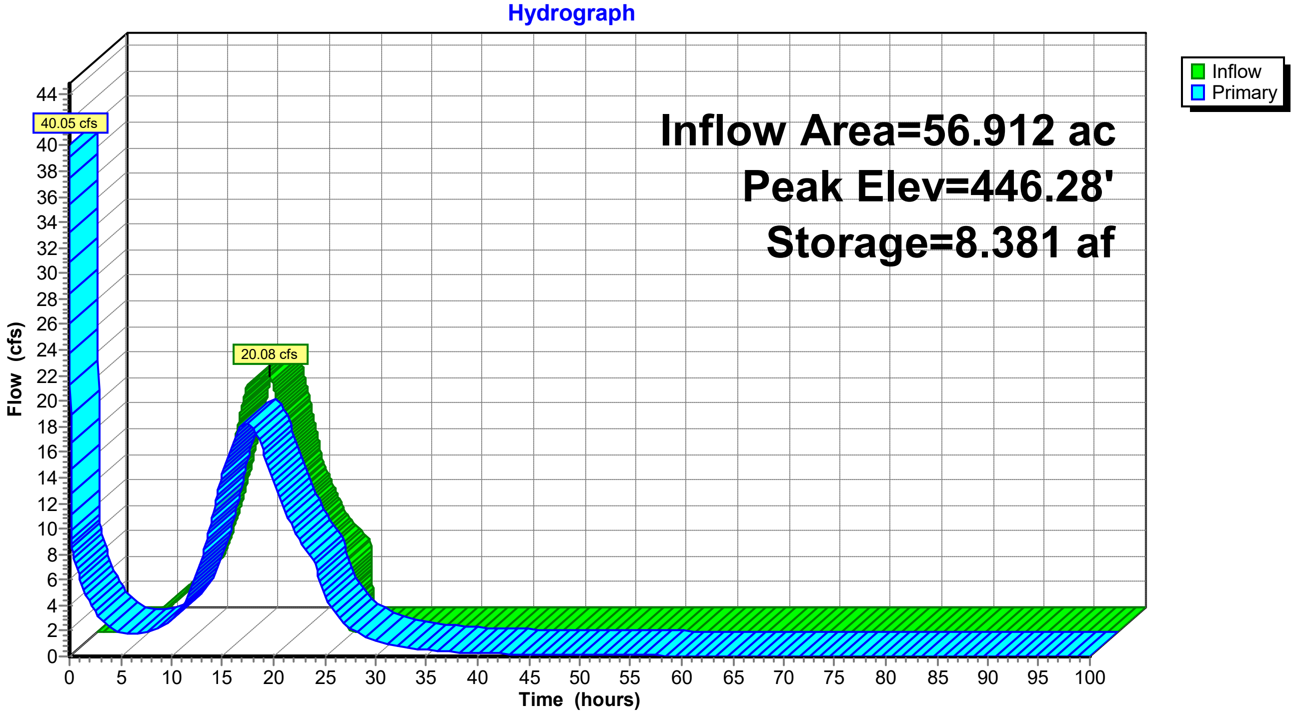
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=39.79 cfs @ 0.00 hrs HW=446.00' TW=445.07' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 39.79 cfs @ 2.65 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af, Atten= 0%, Lag= 0.0 min
Primary	=	34.26 cfs @	0.00 hrs, Volume=	2.197 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.90' Surf.Area= 0.000 ac Storage= 10.622 af
Peak Elev= 445.90' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 10.622 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

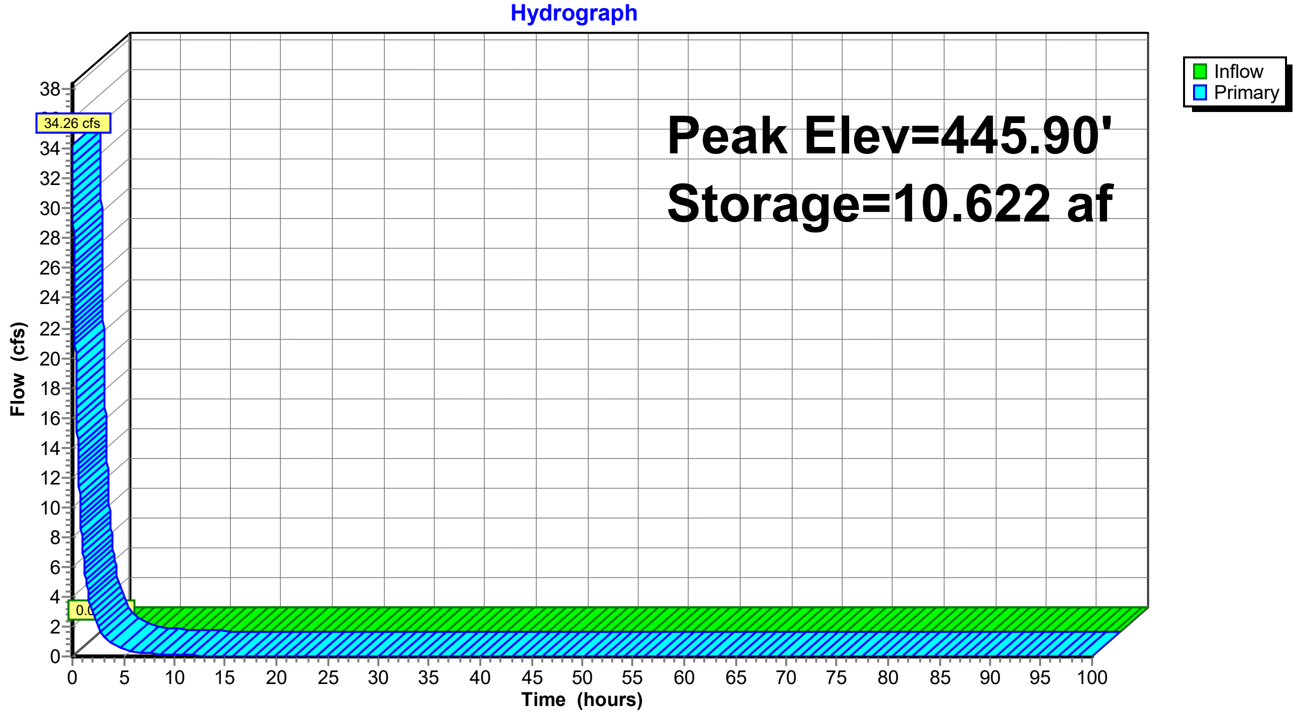
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=34.26 cfs @ 0.00 hrs HW=445.90' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 34.26 cfs @ 2.54 fps)

Pond 4P: Pool C2



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 6.98' @ 25.10 hrs

Inflow Area = 164.292 ac, 55.73% Impervious, Inflow Depth = 3.80" for 10-Year event
Inflow = 58.95 cfs @ 17.27 hrs, Volume= 52.024 af
Outflow = 22.50 cfs @ 23.03 hrs, Volume= 51.056 af, Atten= 62%, Lag= 345.9 min
Primary = 22.50 cfs @ 23.03 hrs, Volume= 51.056 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 27.390 af
Peak Elev= 451.31' @ 23.03 hrs Surf.Area= 0.000 ac Storage= 56.721 af (29.331 af above start)

Plug-Flow detention time= 1,715.6 min calculated for 23.666 af (45% of inflow)
Center-of-Mass det. time= 784.5 min (1,793.9 - 1,009.4)

Volume	Invert	Avail.Storage	Storage Description
#1	435.00'	106.960 af	**Custom Stage Data** Listed below

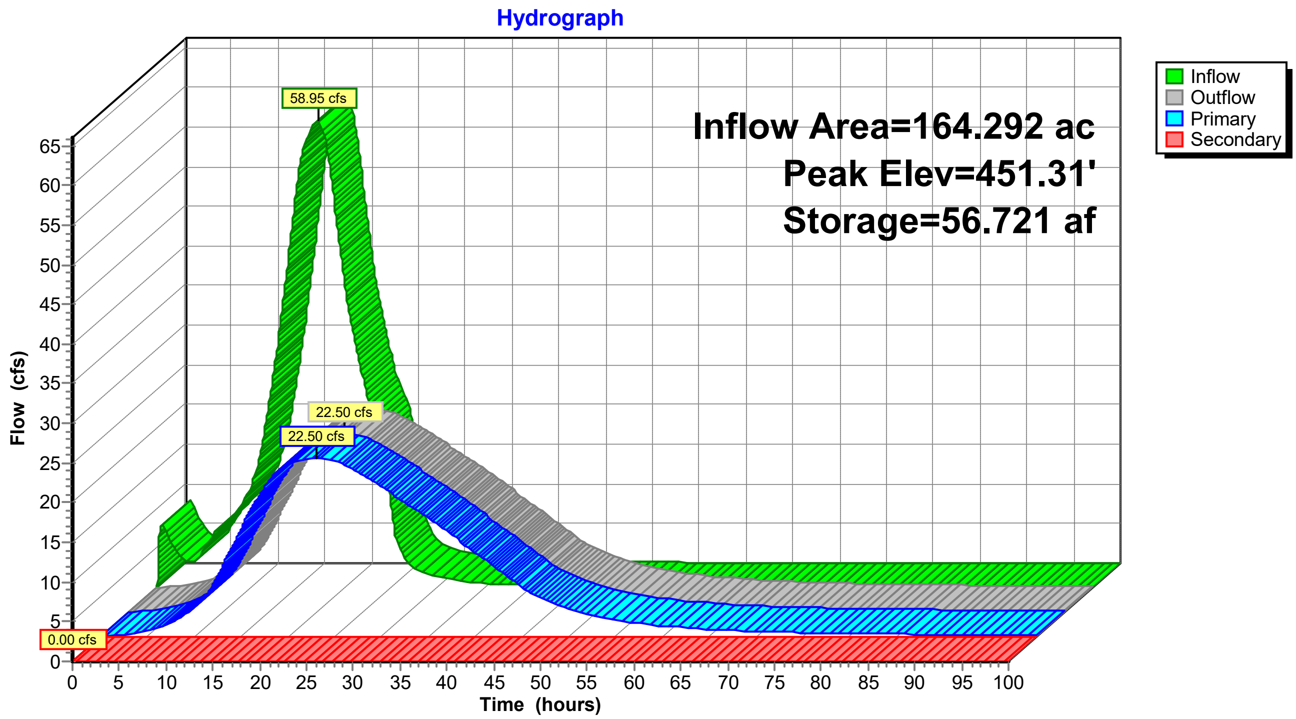
Elevation (feet)	Cum.Store (acre-feet)
435.00	0.000
436.00	0.010
440.00	5.580
443.00	14.560
445.00	22.630
447.00	32.150
449.00	42.850
451.00	54.690
453.00	67.810
455.00	82.530
456.00	90.470
457.00	98.790
458.00	106.960

Device	Routing	Invert	Outlet Devices
#1	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf

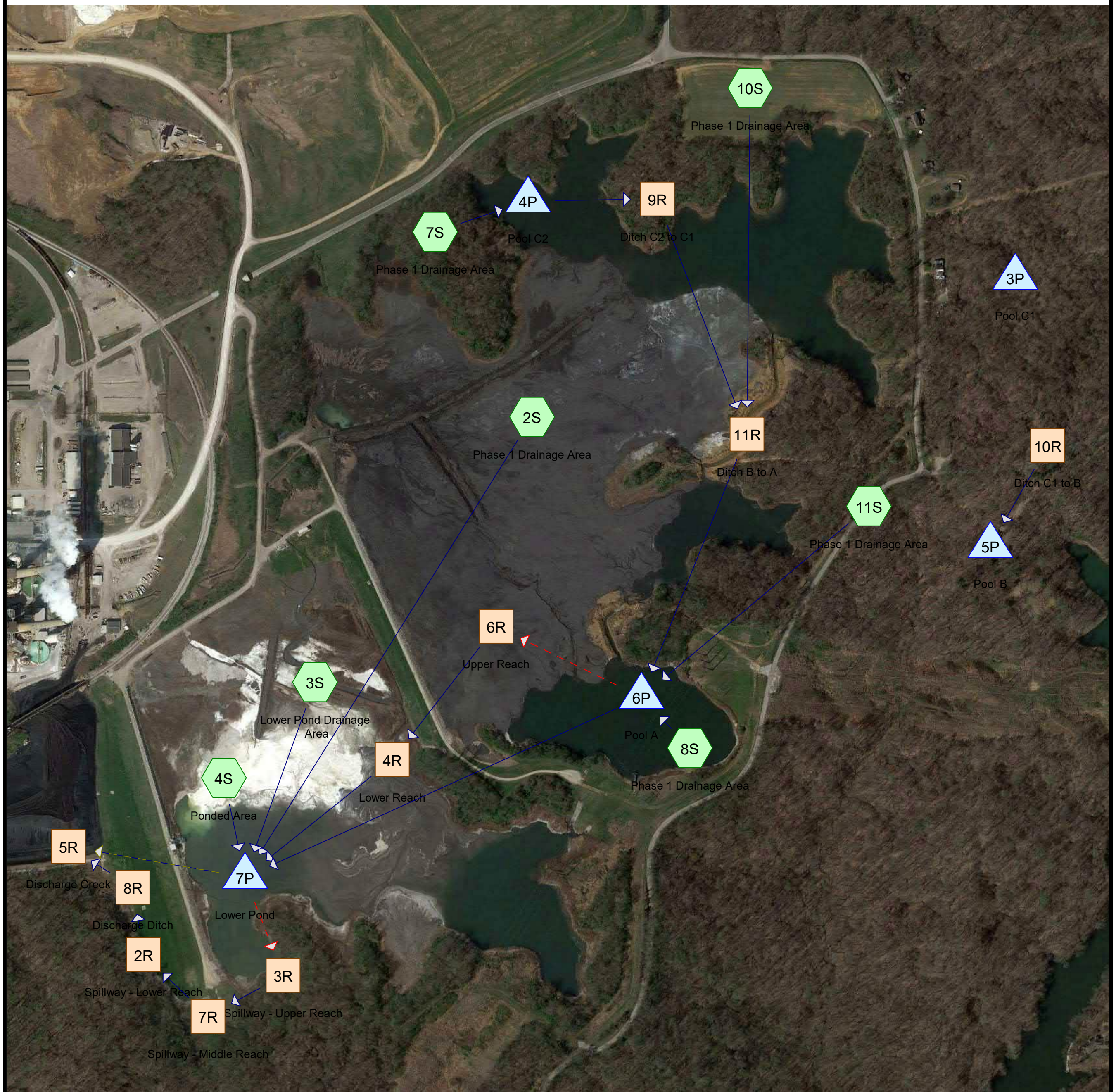
Primary OutFlow Max=22.50 cfs @ 23.03 hrs HW=451.31' TW=436.82' (Dynamic Tailwater)
2=Culvert (Inlet Controls 22.50 cfs @ 7.94 fps)

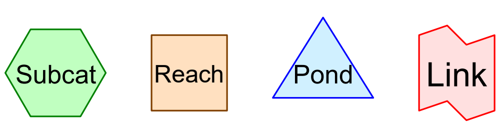
Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=446.00' TW=455.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 6P: Pool A



MILESTONE 3





Routing Diagram for Brown - Phase 2_End_Excavation to 445
Prepared by AECOM, Printed 10/15/2021
HydroCAD® 10.00 s/n 01723 © 2013 HydroCAD Software Solutions LLC

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchme Numbers
0.000	0.000	105.030	0.000	0.000	105.030	50-75% Grass cover, Fair	
0.000	0.000	0.000	0.000	71.720	71.720	Ash	
0.000	0.000	0.000	0.000	26.292	26.292	Ash from dewatering	
0.000	0.000	0.000	0.000	1.440	1.440	Ash within Pool Limits - Dewatered	
0.000	0.000	35.560	0.000	0.000	35.560	Water Surface	
0.000	0.000	0.000	0.000	4.490	4.490	Water Surface (Pool A)	
0.000	0.000	0.000	0.000	1.930	1.930	Water Surface (Pools C1)	
0.000	**0.000**	**140.590**	**0.000**	**105.872**	**246.462**	**TOTAL AREA**	

Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

This subcatchment is intended to drain directly to the Lower Ash Pond post Upper dam breach during late Phase 2.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

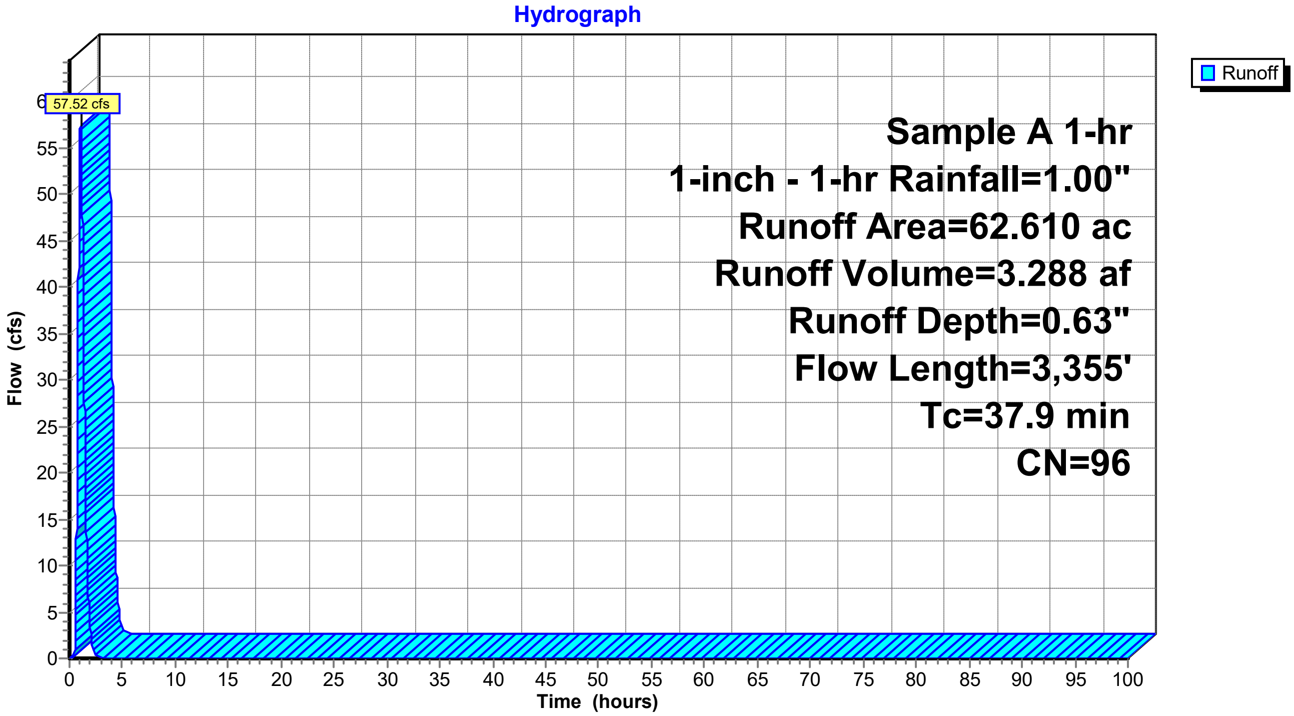
Runoff = 57.52 cfs @ 1.05 hrs, Volume= 3.288 af, Depth= 0.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	57.410	98	Ash
	5.200	79	50-75% Grass cover, Fair, HSG C
	62.610	96	Weighted Average
	5.200		8.31% Pervious Area
	57.410		91.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

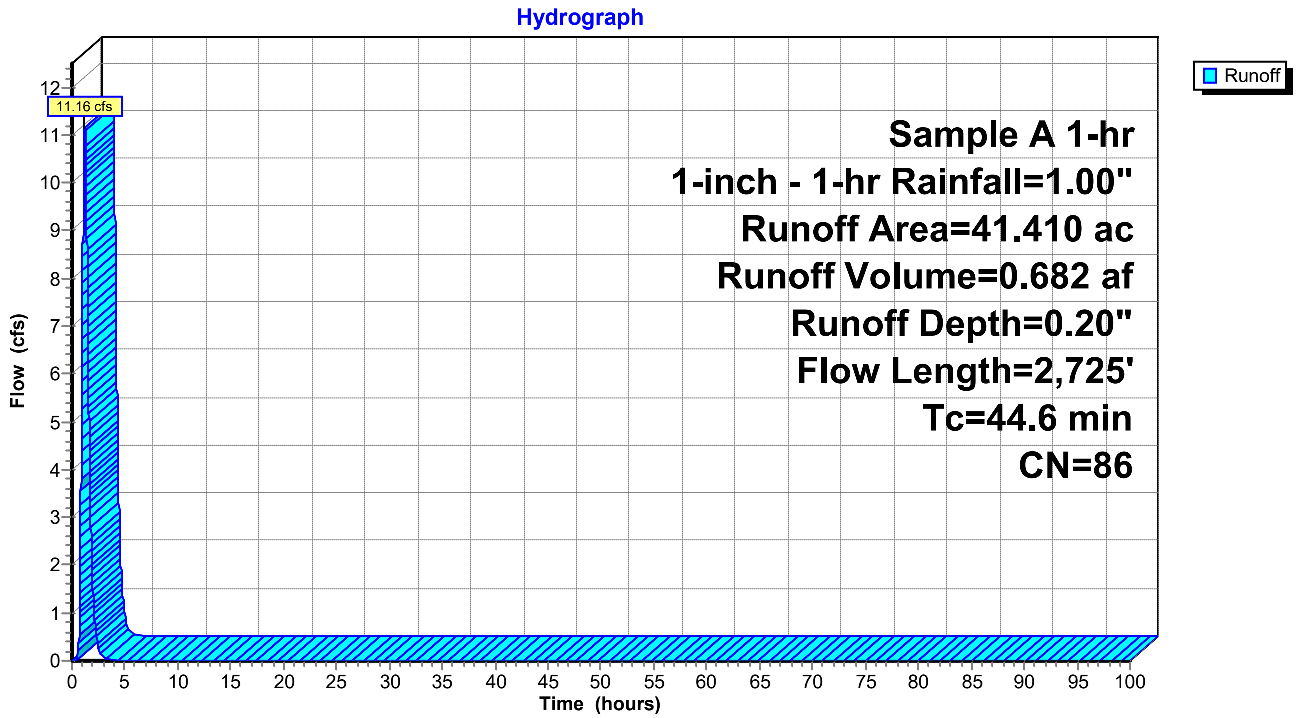
Runoff = 11.16 cfs @ 1.23 hrs, Volume= 0.682 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

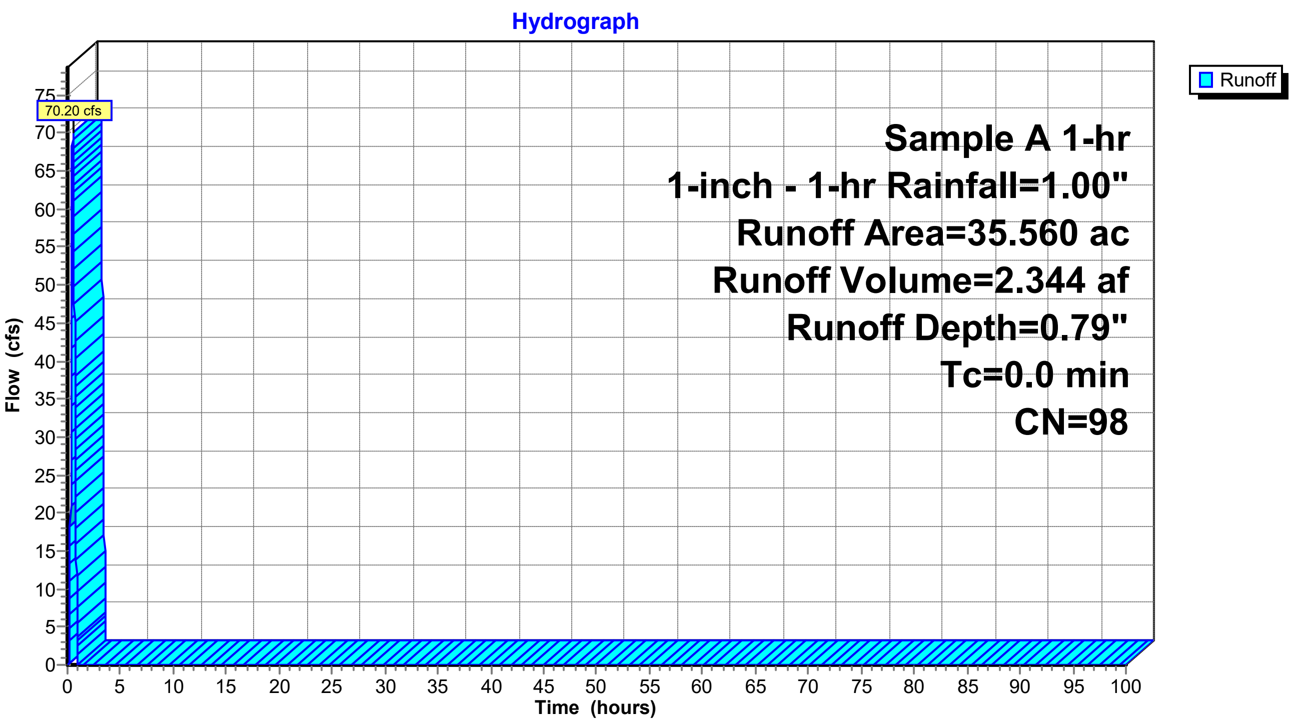
Runoff = 70.20 cfs @ 0.50 hrs, Volume= 2.344 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

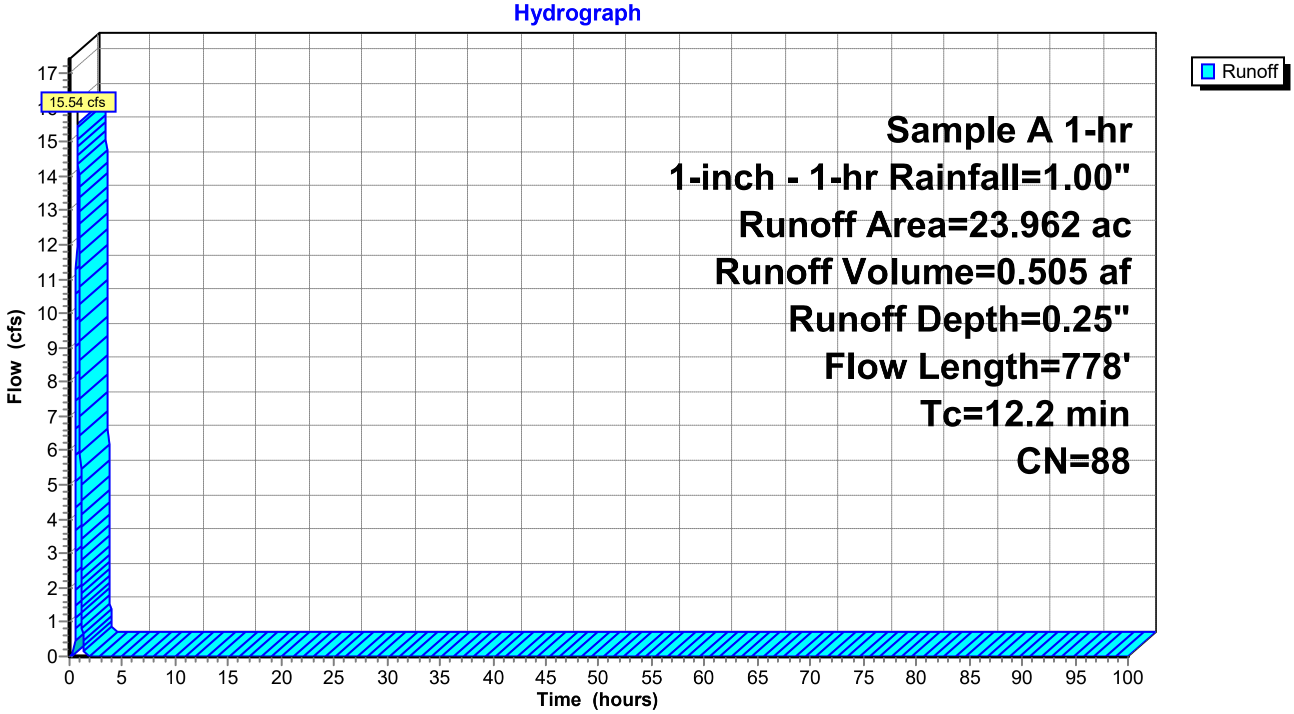
Runoff = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash from dewatering
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

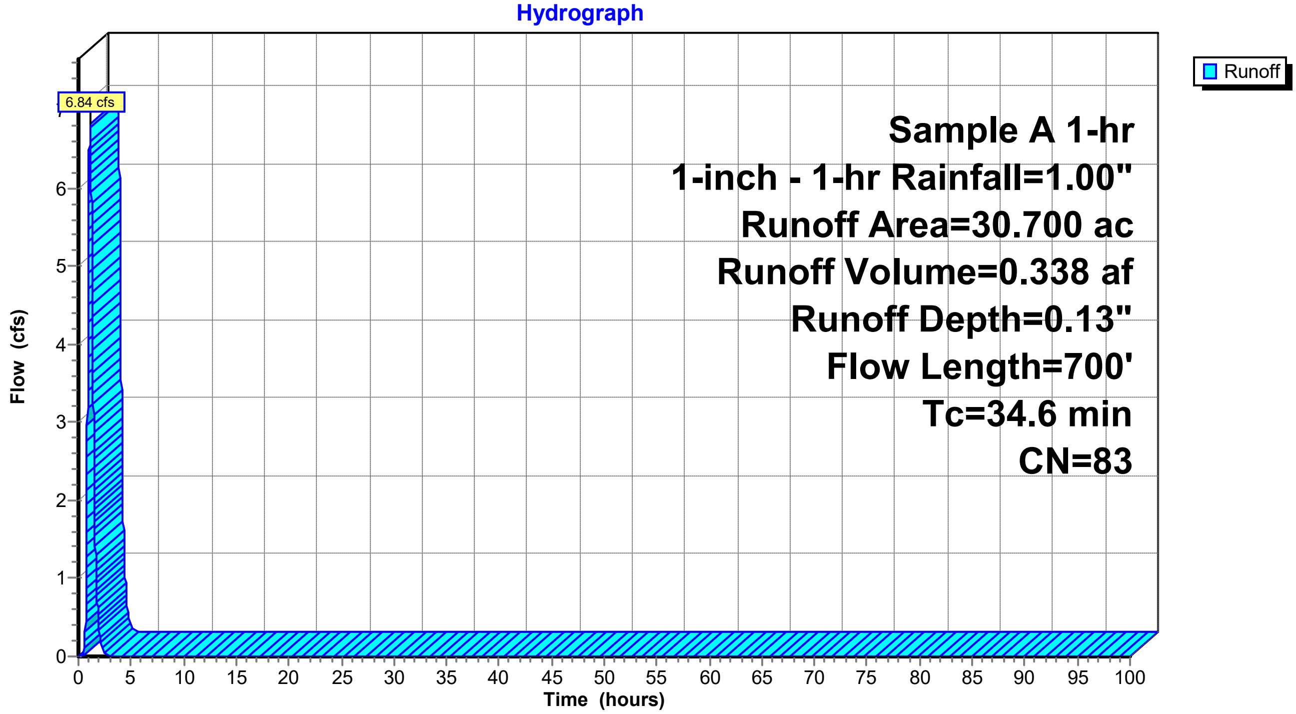
Runoff = 6.84 cfs @ 1.11 hrs, Volume= 0.338 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	4.490	98	Water Surface (Pool A)
*	1.440	98	Ash within Pool Limits - Dewatered
	30.700	83	Weighted Average
	24.770		80.68% Pervious Area
	5.930		19.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	400	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
34.6	700	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Late Phase 2 drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

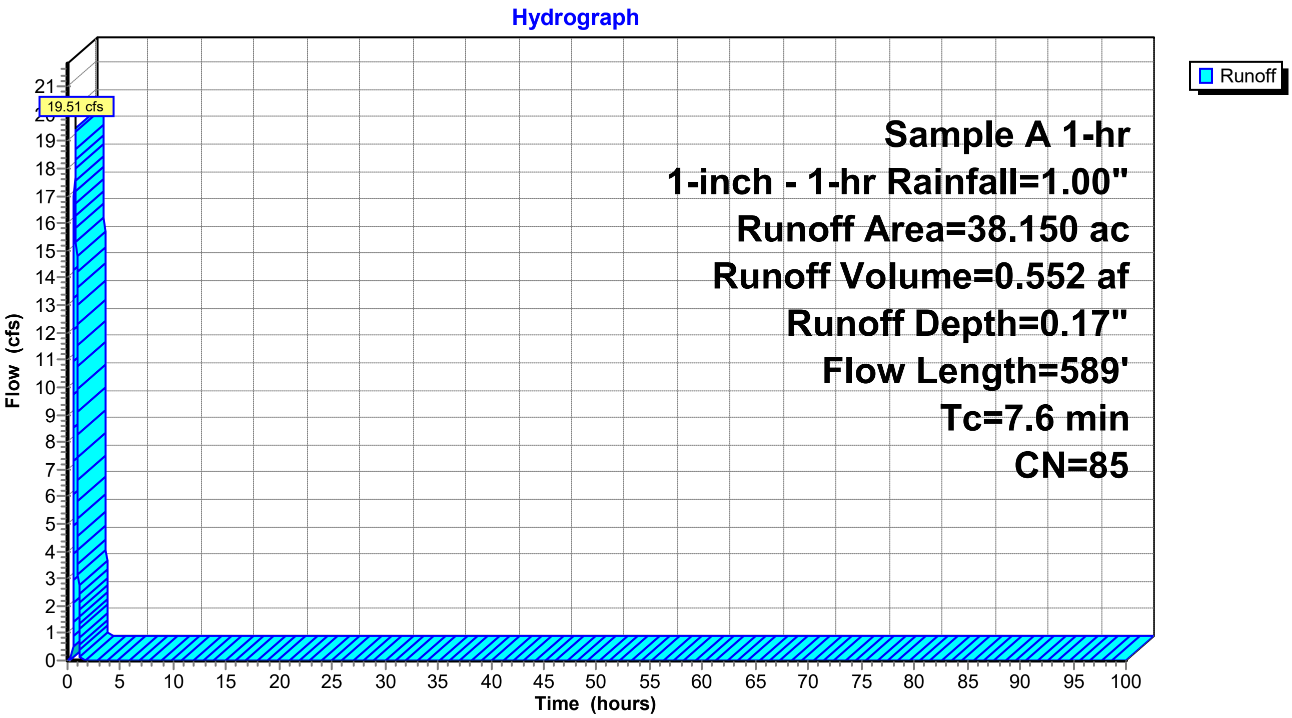
Runoff = 19.51 cfs @ 0.73 hrs, Volume= 0.552 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
*	5.200	79	50-75% Grass cover, Fair, HSG C
	38.150	85	Weighted Average
	27.050		70.90% Pervious Area
	11.100		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool B and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

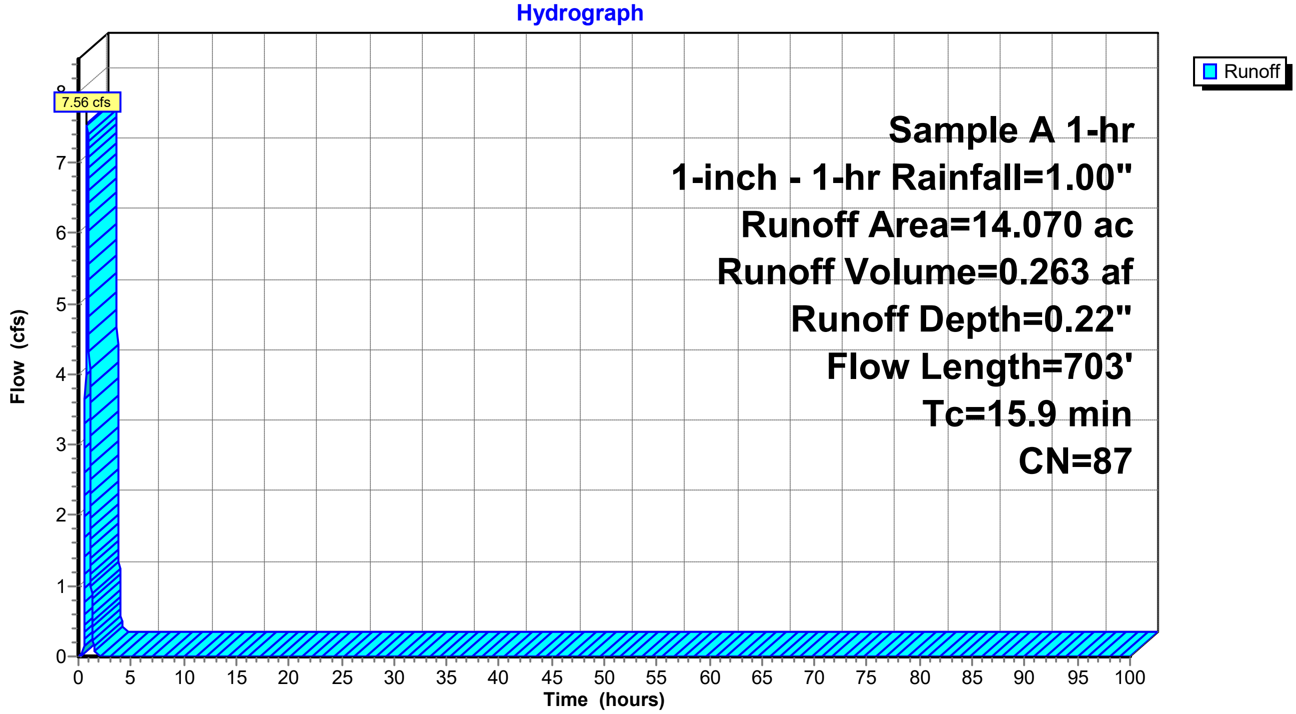
Runoff = 7.56 cfs @ 0.84 hrs, Volume= 0.263 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



Summary for Reach 2R: Spillway - Lower Reach

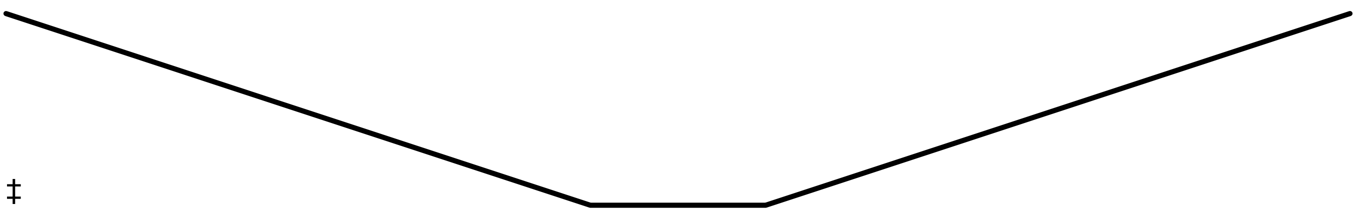
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

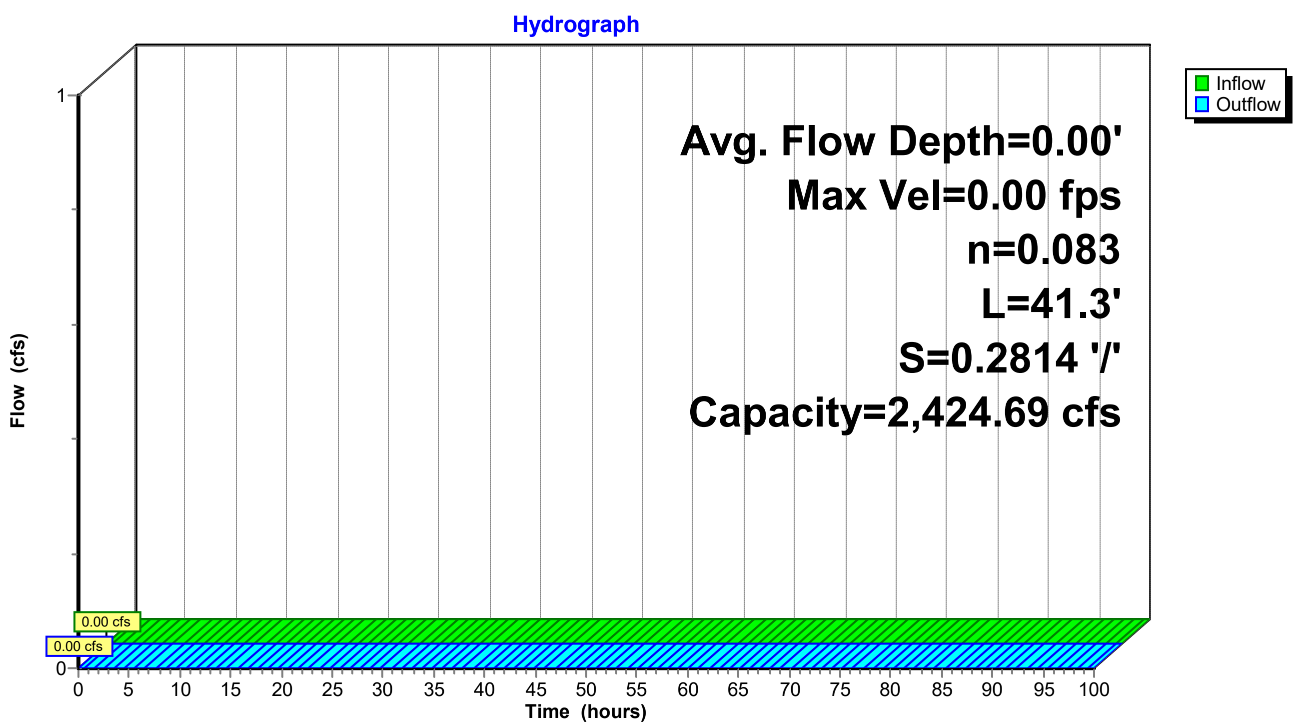
Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'

‡



Reach 2R: Spillway - Lower Reach



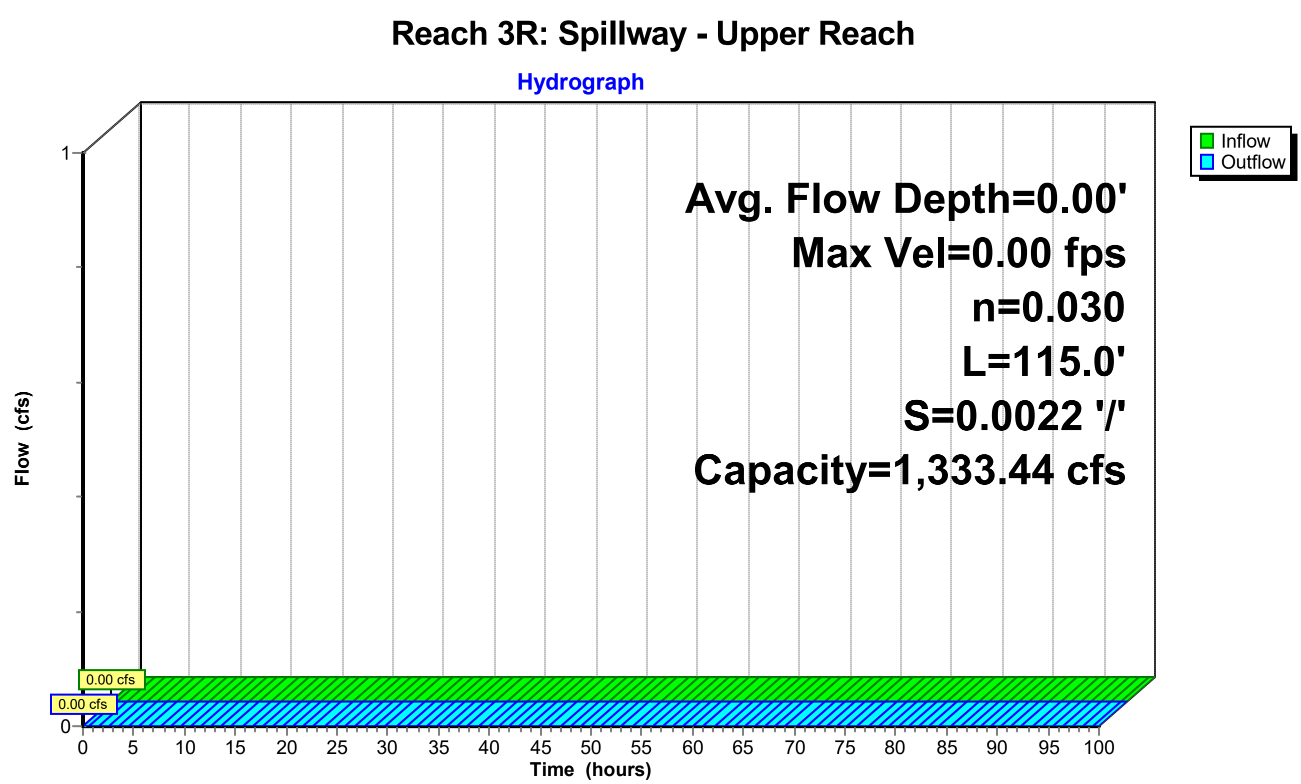
Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'



Summary for Reach 4R: Lower Reach

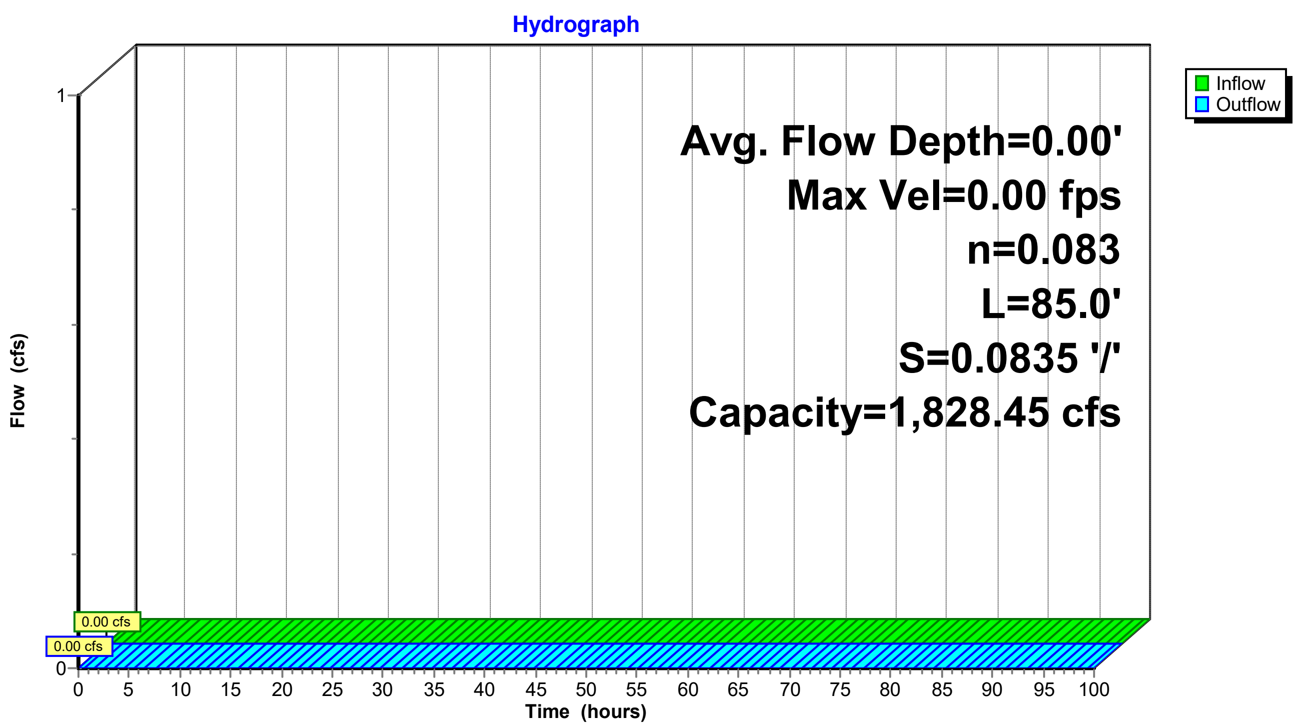
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

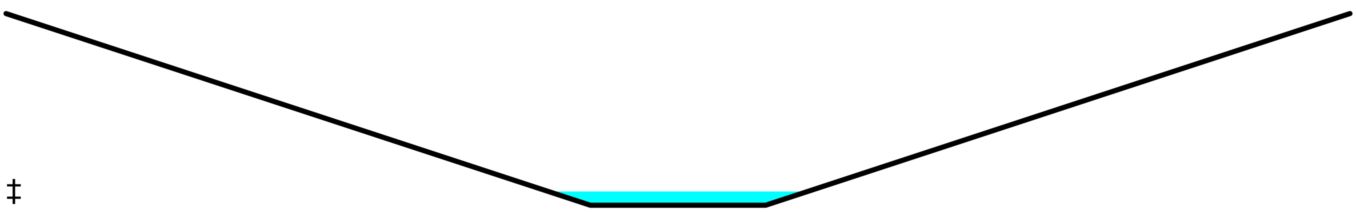
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 1.91 hrs

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth = 2.23" for 1-inch - 1-hr event
Inflow = 10.38 cfs @ 1.88 hrs, Volume= 45.809 af
Outflow = 10.38 cfs @ 1.91 hrs, Volume= 45.809 af, Atten= 0%, Lag= 1.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.80 fps, Avg. Travel Time= 3.5 min

Peak Storage= 2,135 cf @ 1.91 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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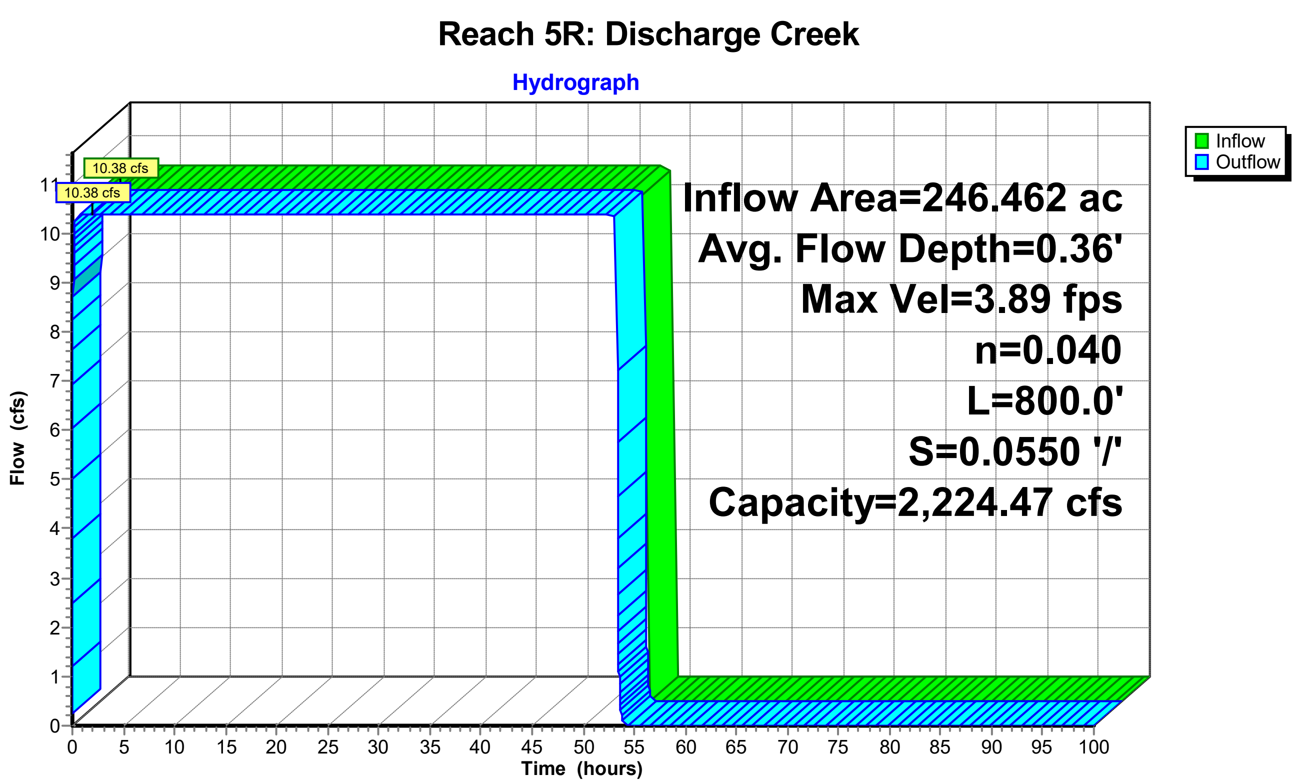


Summary for Reach 6R: Upper Reach

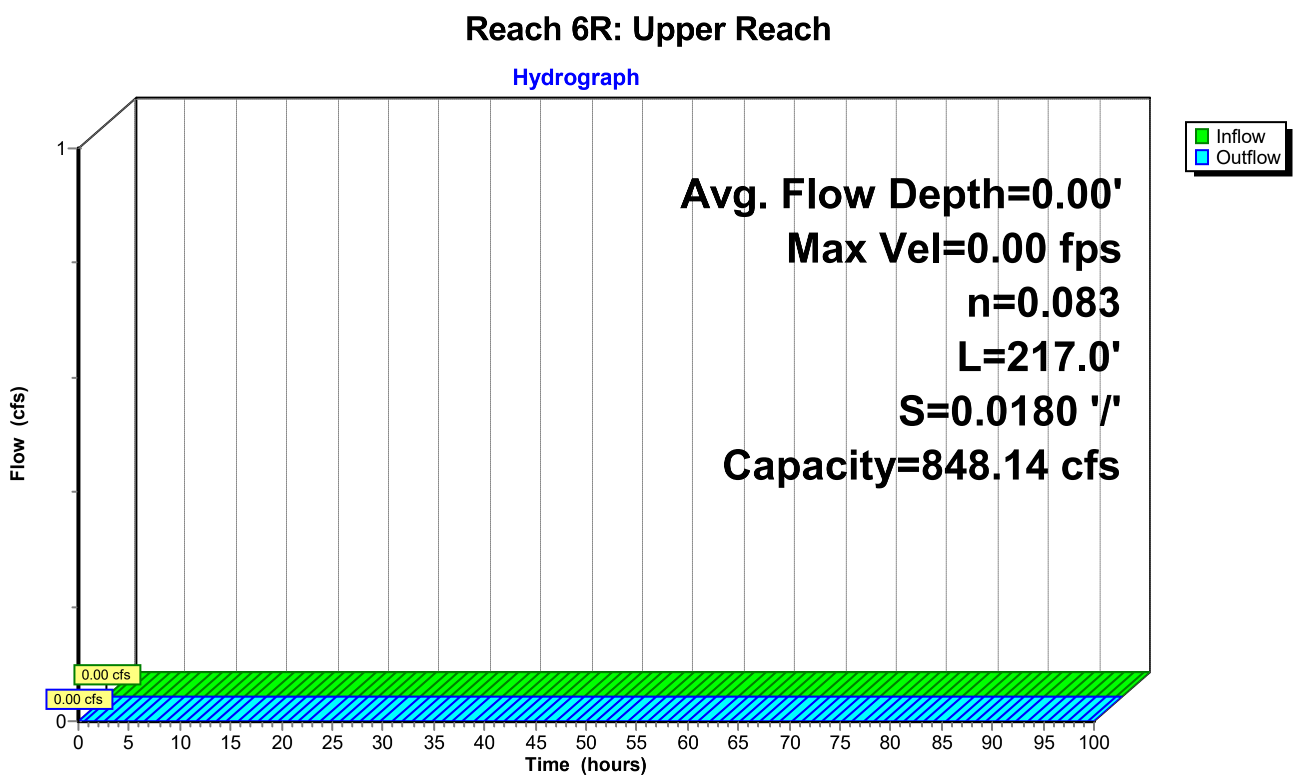
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡



Summary for Reach 7R: Spillway - Middle Reach

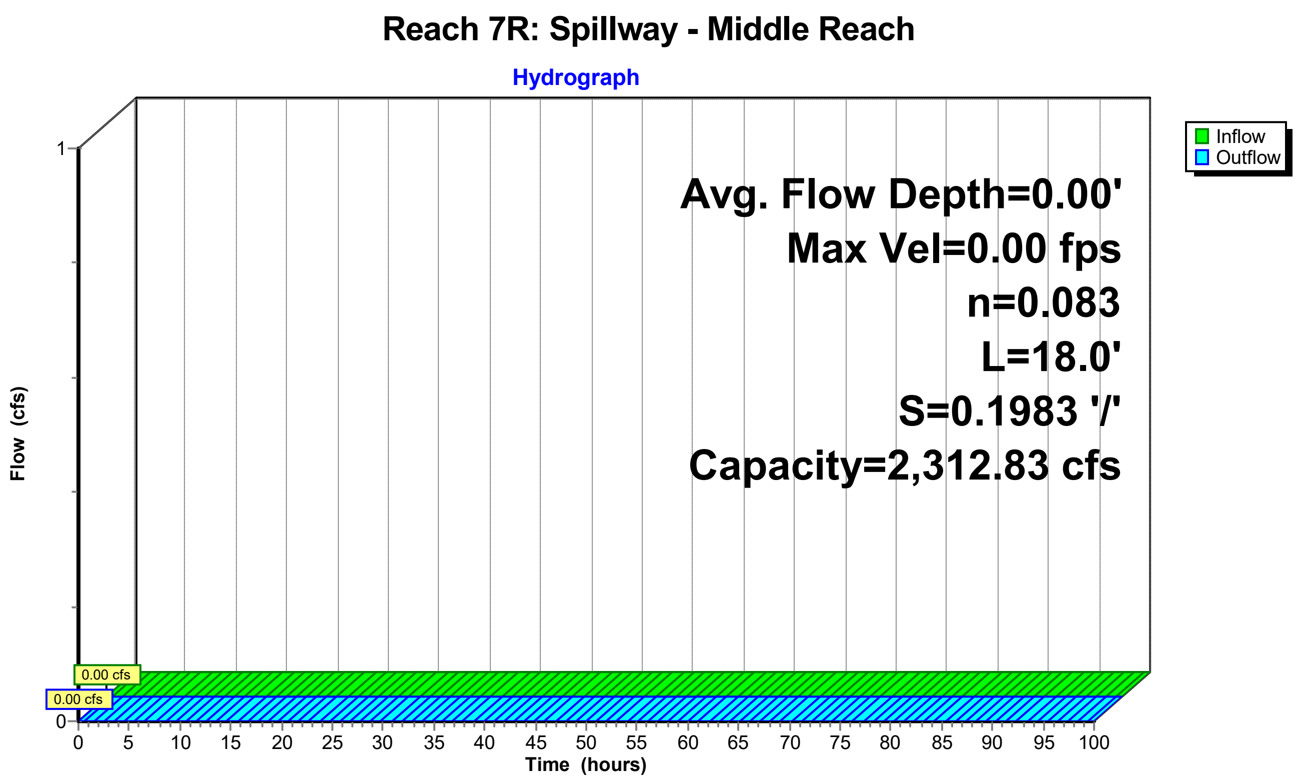
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡



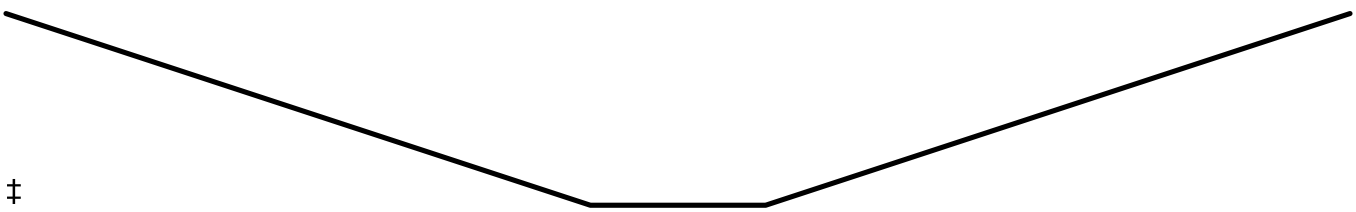
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

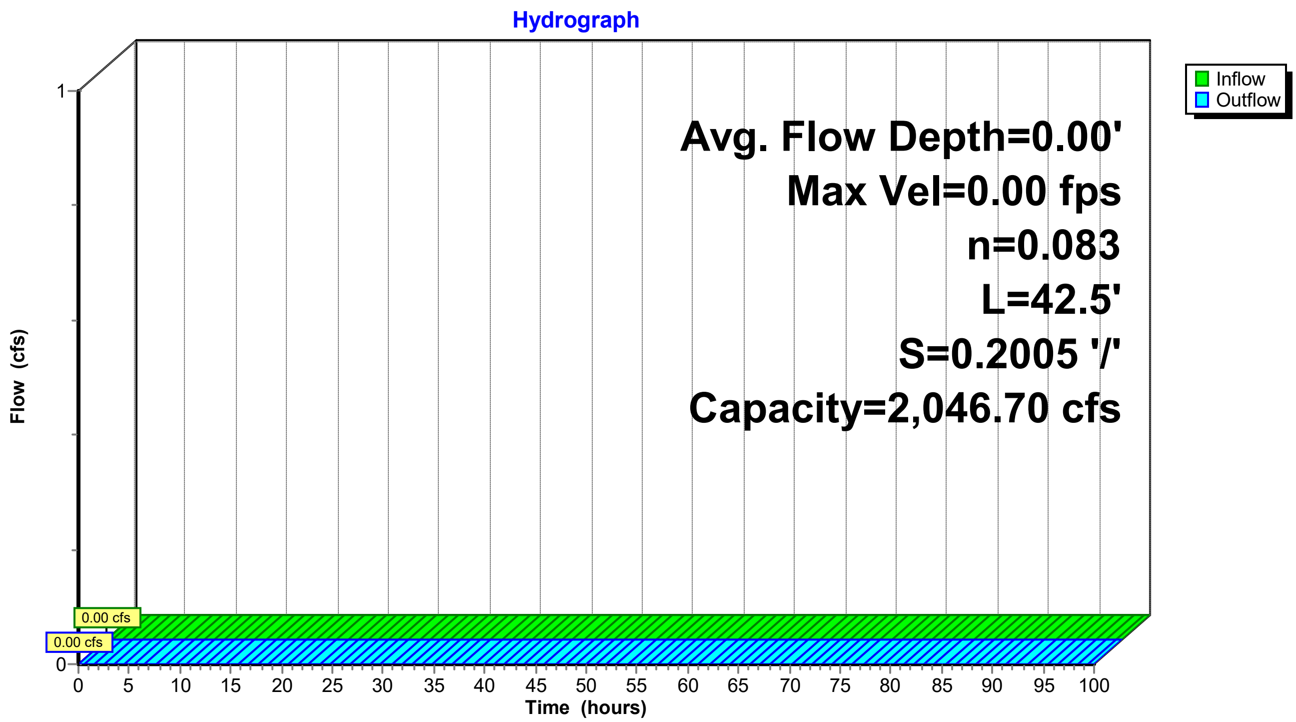
Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



‡

Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

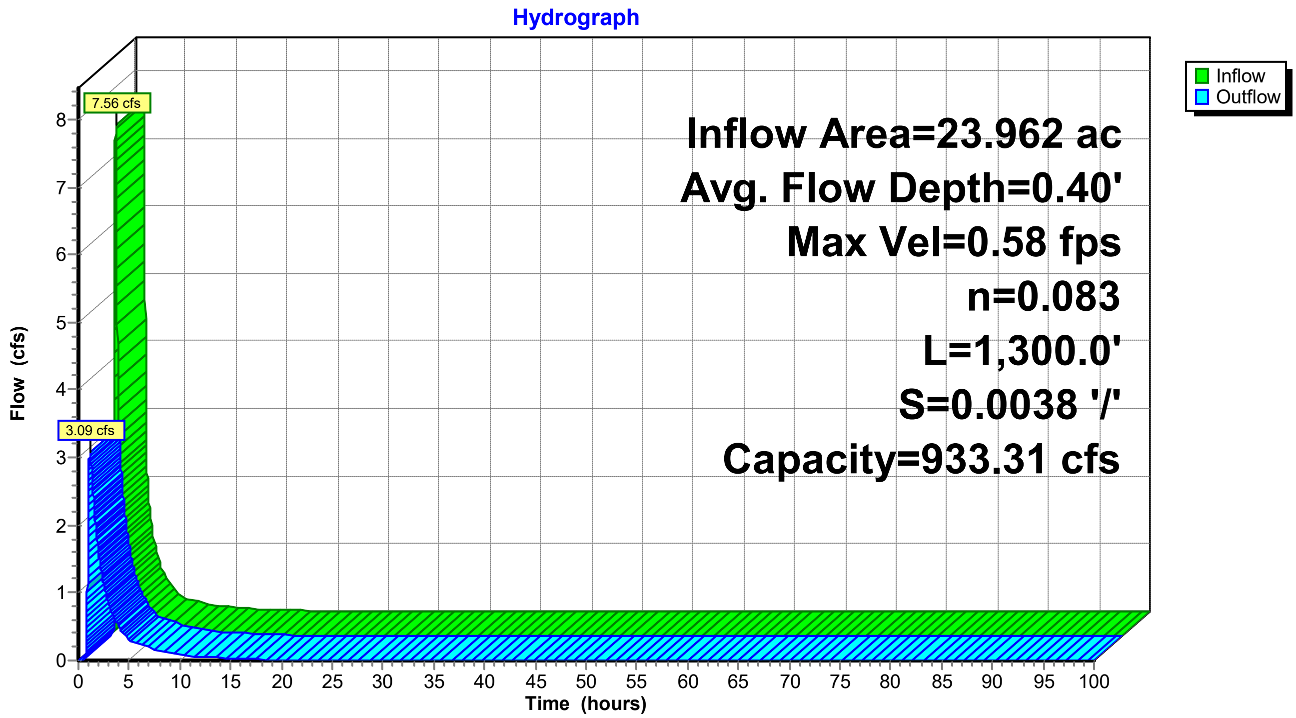
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.25" for 1-inch - 1-hr event
Inflow = 7.56 cfs @ 0.92 hrs, Volume= 0.505 af
Outflow = 3.09 cfs @ 1.14 hrs, Volume= 0.505 af, Atten= 59%, Lag= 13.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.58 fps, Min. Travel Time= 37.1 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 88.1 min

Peak Storage= 6,875 cf @ 1.14 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 933.31 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 1,300.0' Slope= 0.0038 '/'
Inlet Invert= 440.00', Outlet Invert= 435.00'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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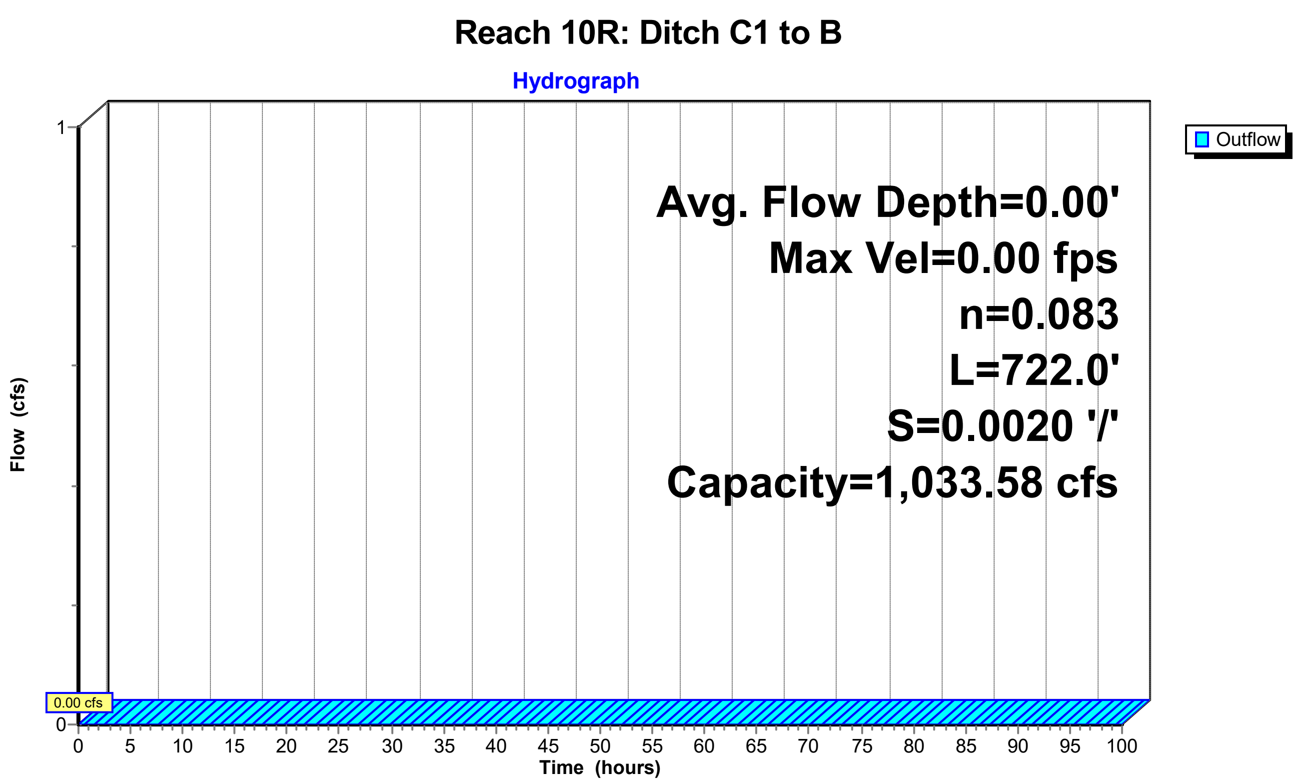
[43] Hint: Has no inflow (Outflow=Zero)

Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A. - REV to include ditch from C1 to B and ditch cut through pool B area - assuming contractor will not excavate out a pool here.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 9R OUTLET depth by 0.40' @ 0.85 hrs

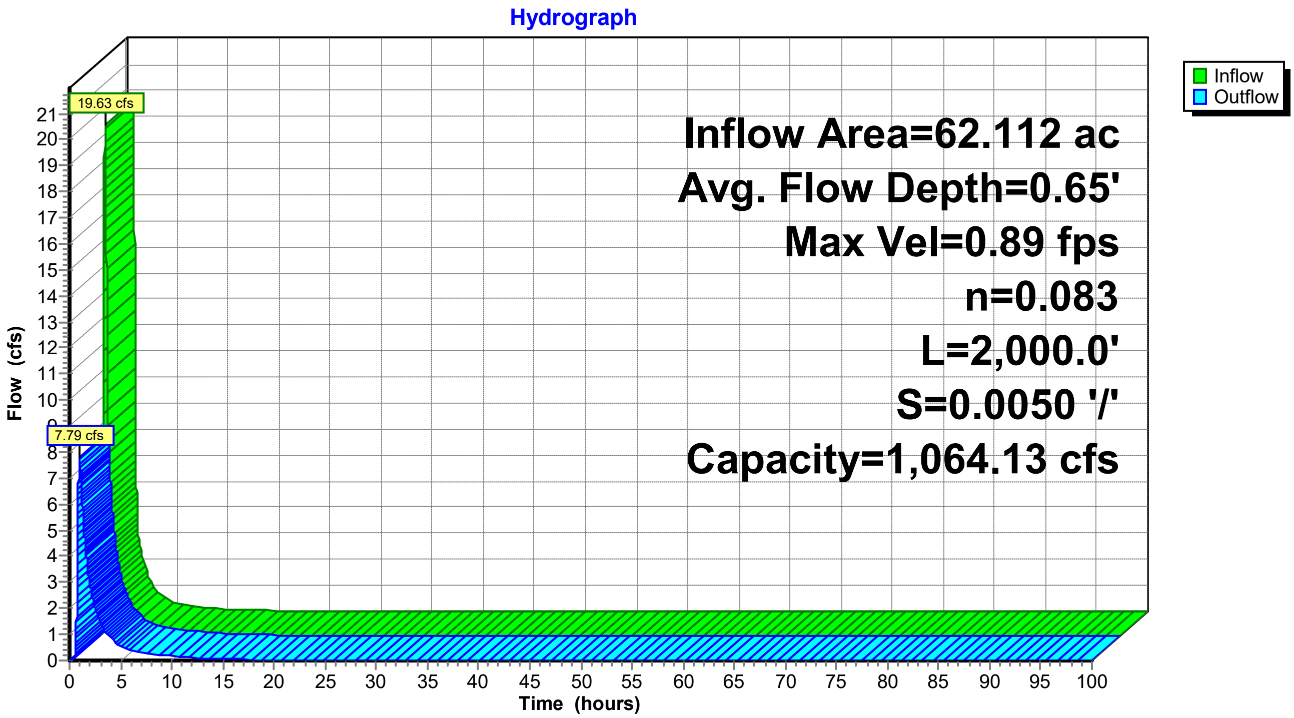
Inflow Area = 62.112 ac, 36.44% Impervious, Inflow Depth = 0.20" for 1-inch - 1-hr event
Inflow = 19.63 cfs @ 0.73 hrs, Volume= 1.057 af
Outflow = 7.79 cfs @ 0.98 hrs, Volume= 1.057 af, Atten= 60%, Lag= 15.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.89 fps, Min. Travel Time= 37.3 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 116.0 min

Peak Storage= 17,419 cf @ 0.98 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,064.13 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 2,000.0' Slope= 0.0050 '/'
Inlet Invert= 435.00', Outlet Invert= 425.00'

Reach 11R: Ditch B to A



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af, Atten= 0%, Lag= 0.0 min
Primary	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 7.570 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

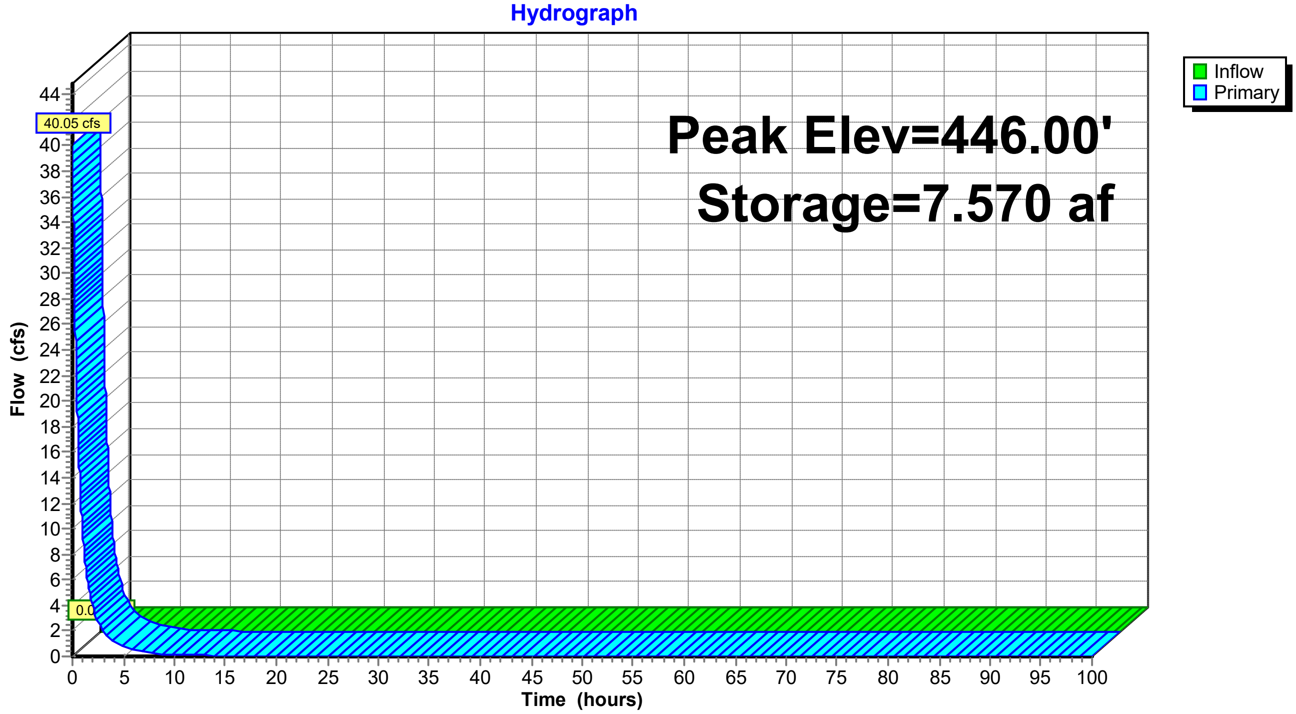
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=40.05 cfs @ 0.00 hrs HW=446.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 40.05 cfs @ 2.67 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.25" for 1-inch - 1-hr event
Inflow = 15.54 cfs @ 0.77 hrs, Volume= 0.505 af
Outflow = 7.56 cfs @ 0.92 hrs, Volume= 0.505 af, Atten= 51%, Lag= 8.7 min
Primary = 7.56 cfs @ 0.92 hrs, Volume= 0.505 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 1.995 af
Peak Elev= 440.43' @ 1.03 hrs Surf.Area= 0.000 ac Storage= 2.279 af (0.284 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 111.3 min (160.6 - 49.3)

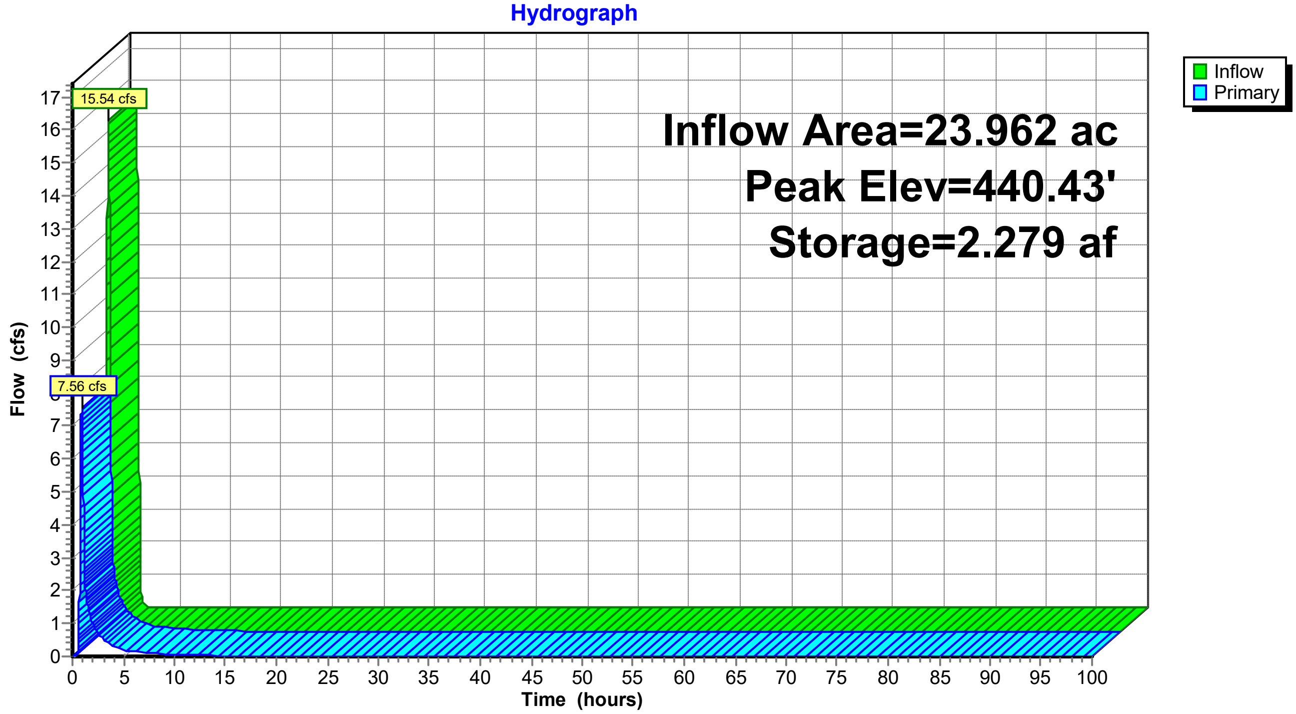
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	440.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=7.34 cfs @ 0.92 hrs HW=440.40' TW=440.26' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 7.34 cfs @ 1.22 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

[61] Hint: Exceeded Reach 10R outlet invert by 1.44' @ 0.00 hrs

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

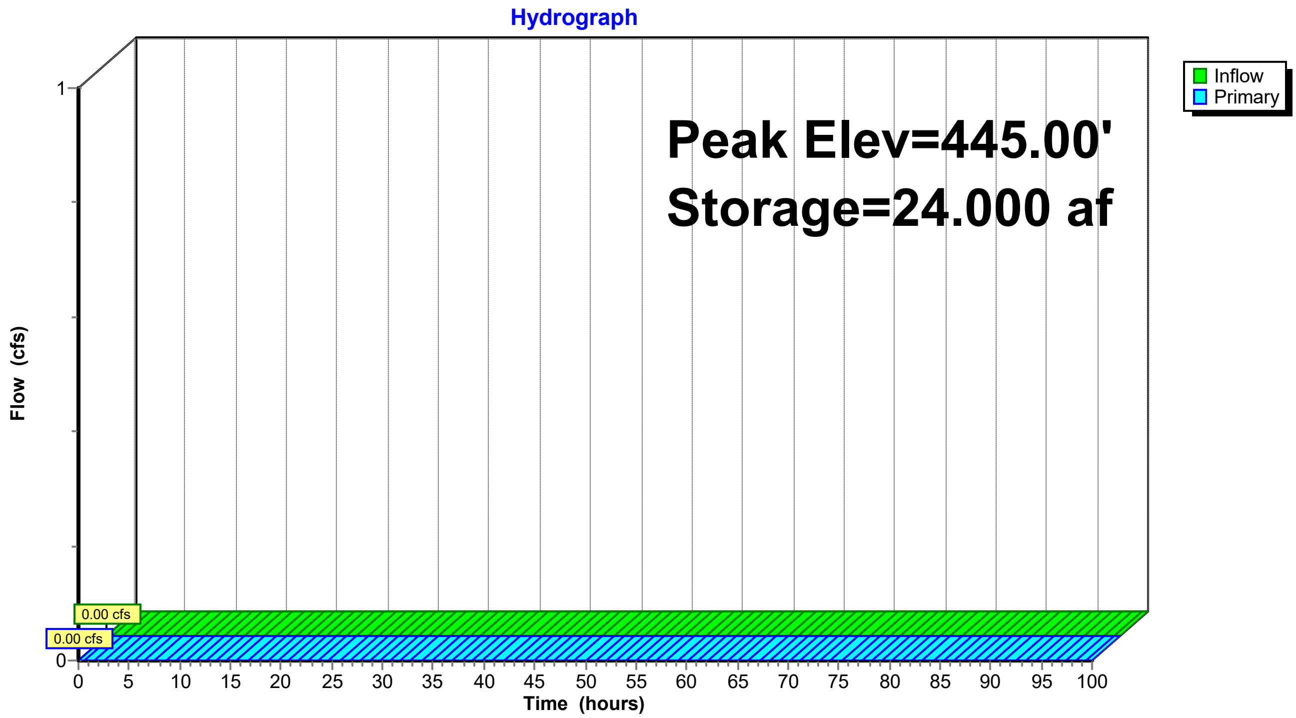
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 5.01' @ 99.99 hrs

Inflow Area = 106.882 ac, 31.95% Impervious, Inflow Depth = 0.19" for 1-inch - 1-hr event
Inflow = 19.29 cfs @ 0.96 hrs, Volume= 1.658 af
Outflow = 14.52 cfs @ 1.18 hrs, Volume= 1.643 af, Atten= 25%, Lag= 13.1 min
Primary = 14.52 cfs @ 1.18 hrs, Volume= 1.643 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 98.790 af
Peak Elev= 440.04' @ 1.18 hrs Surf.Area= 0.000 ac Storage= 98.908 af (0.118 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	425.00'	120.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
425.00	0.000
426.00	0.010
427.00	5.580
428.00	14.560
429.00	22.630
430.00	32.150
431.00	40.000
432.00	45.000
433.00	54.690
434.00	67.810
435.00	82.530
436.00	90.470
440.00	98.790
443.00	106.960
445.00	108.000
447.00	120.000

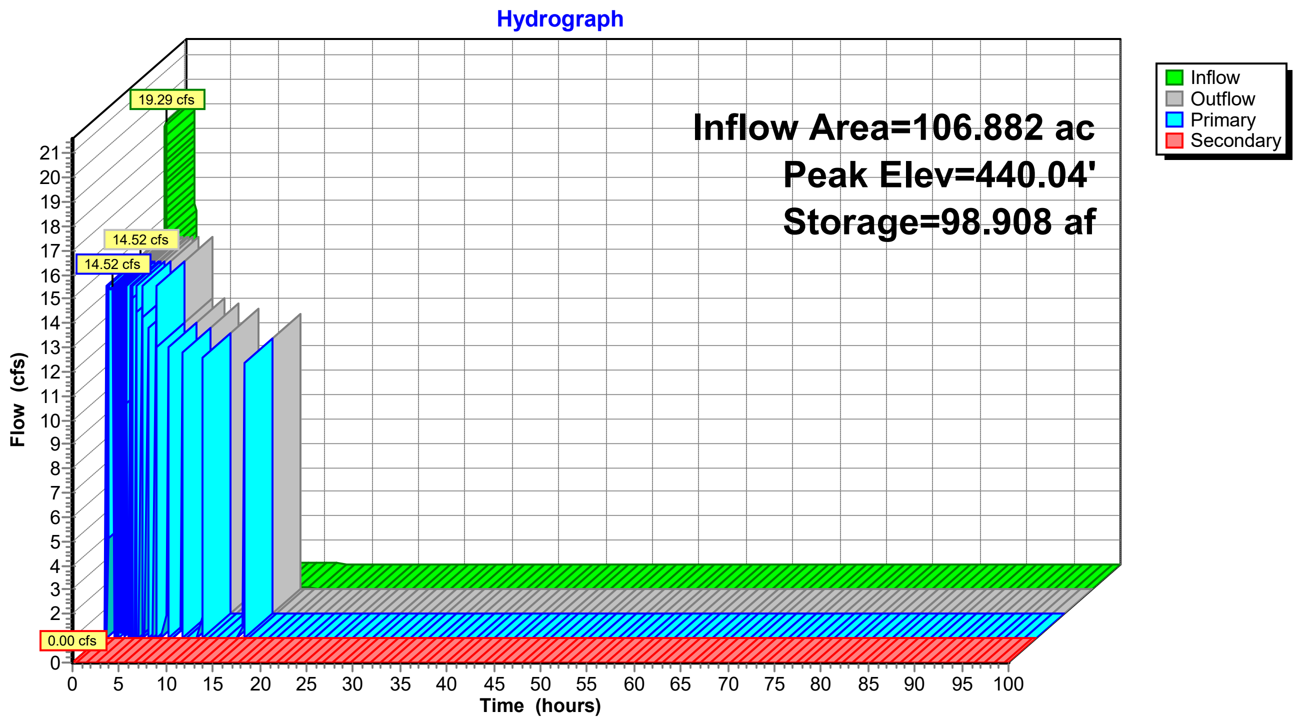
Device	Routing	Invert	Outlet Devices
#1	Primary	440.01'	**Pump** Discharges@455.00' Turns Off@440.00' 12.0" Diam. x 1,000.0' Long Discharge, Hazen-Williams C= 130 Flow (gpm)= 6,516.0 6,516.1

			Head (feet)= 500.00 0.00
			-Loss (feet)= 81.57 81.57
			=Lift (feet)= 418.43 -81.57
#2	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=14.52 cfs @ 1.18 hrs HW=440.04' TW=435.35' (Dynamic Tailwater)
└─**1=Pump** (Pump Controls 14.52 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=455.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Pond 7P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth = 0.39" for 1-inch - 1-hr event
Inflow = 81.37 cfs @ 1.06 hrs, Volume= 7.956 af
Outflow = 10.38 cfs @ 1.88 hrs, Volume= 45.809 af, Atten= 87%, Lag= 49.4 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 1.88 hrs, Volume= 45.809 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 435.49' @ 1.88 hrs Surf.Area= 0.000 ac Storage= 85.914 af (5.674 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,526.6 min (1,601.7 - 75.1)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

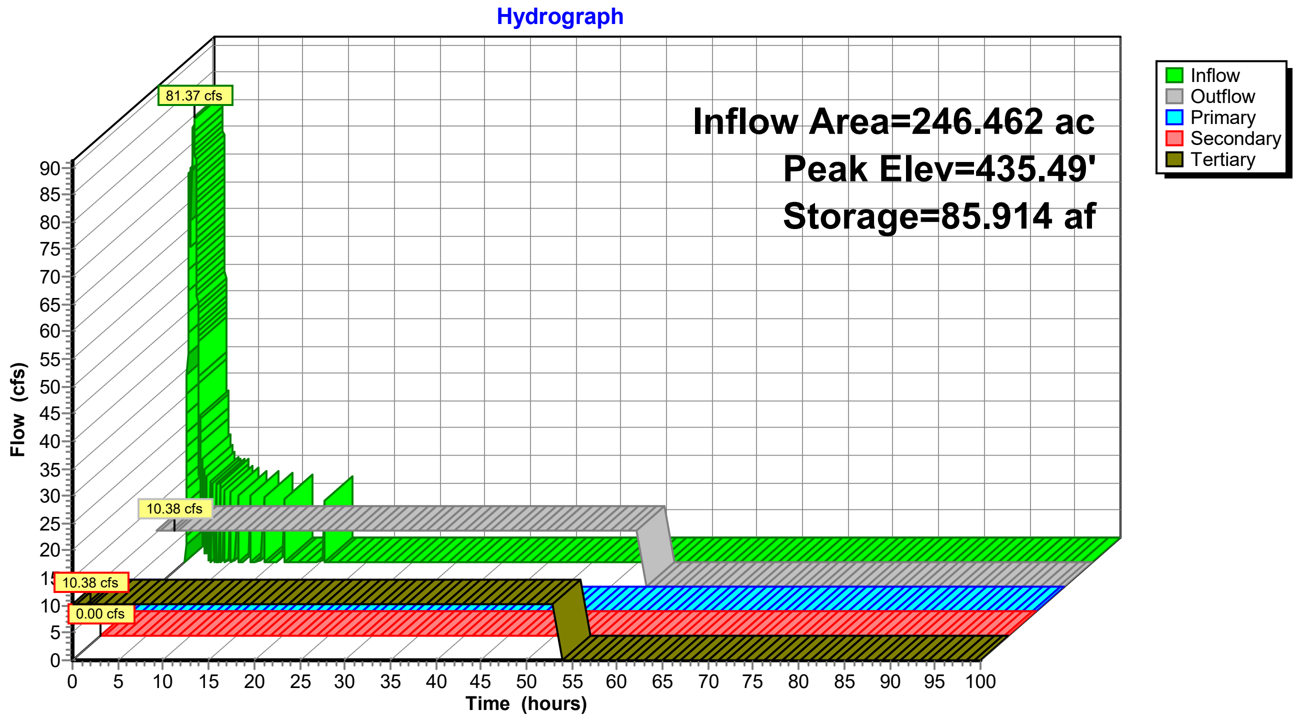
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 84.28 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 1.88 hrs HW=435.49' TW=428.36' (Dynamic Tailwater)
4=Pump (Pump Controls 10.38 cfs)

Pond 7P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

This subcatchment is intended to drain directly to the Lower Ash Pond post Upper dam breach during late Phase 2.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

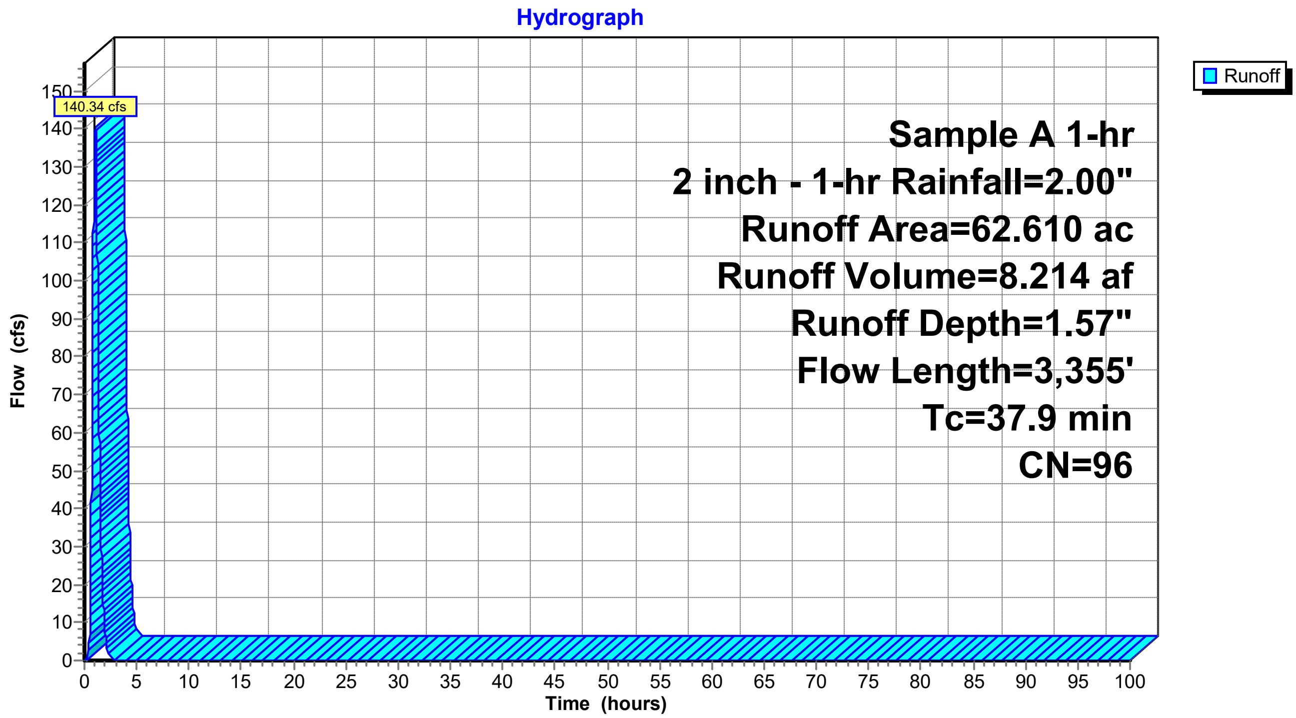
Runoff = 140.34 cfs @ 1.05 hrs, Volume= 8.214 af, Depth= 1.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
*	57.410	98	Ash
	5.200	79	50-75% Grass cover, Fair, HSG C
	62.610	96	Weighted Average
	5.200		8.31% Pervious Area
	57.410		91.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

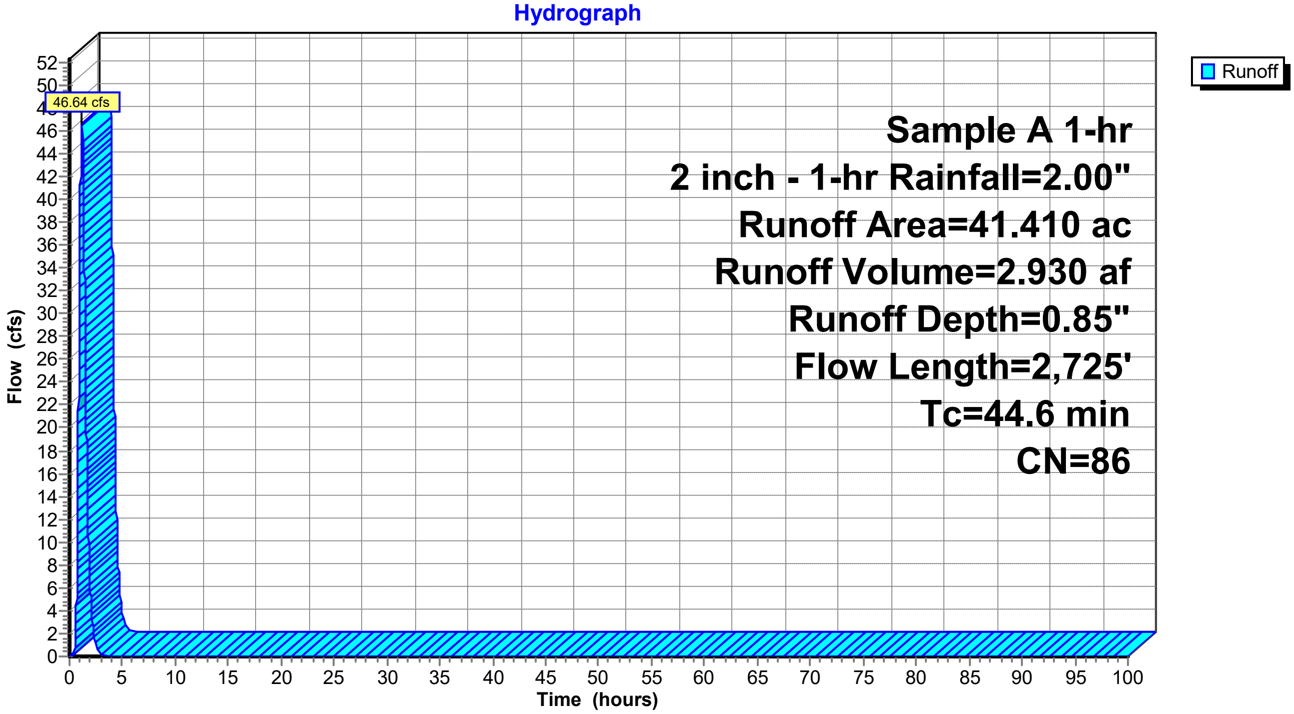
Runoff = 46.64 cfs @ 1.15 hrs, Volume= 2.930 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

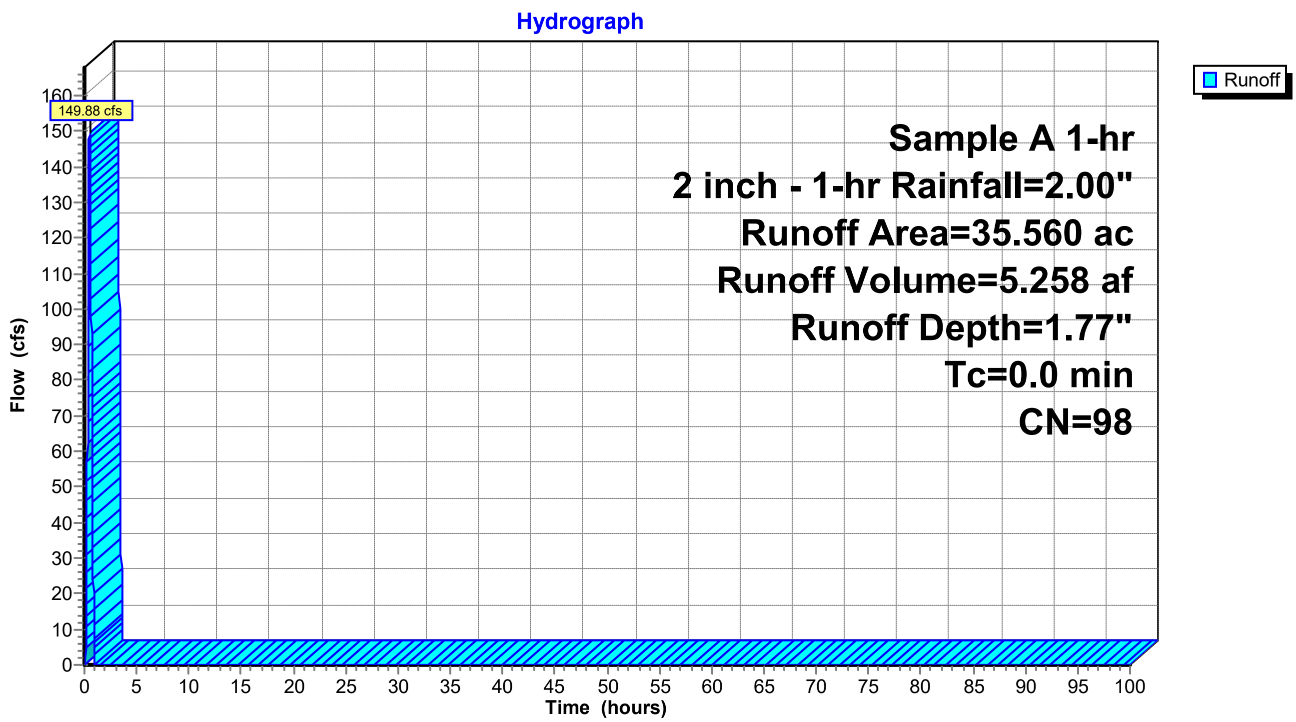
Runoff = 149.88 cfs @ 0.50 hrs, Volume= 5.258 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

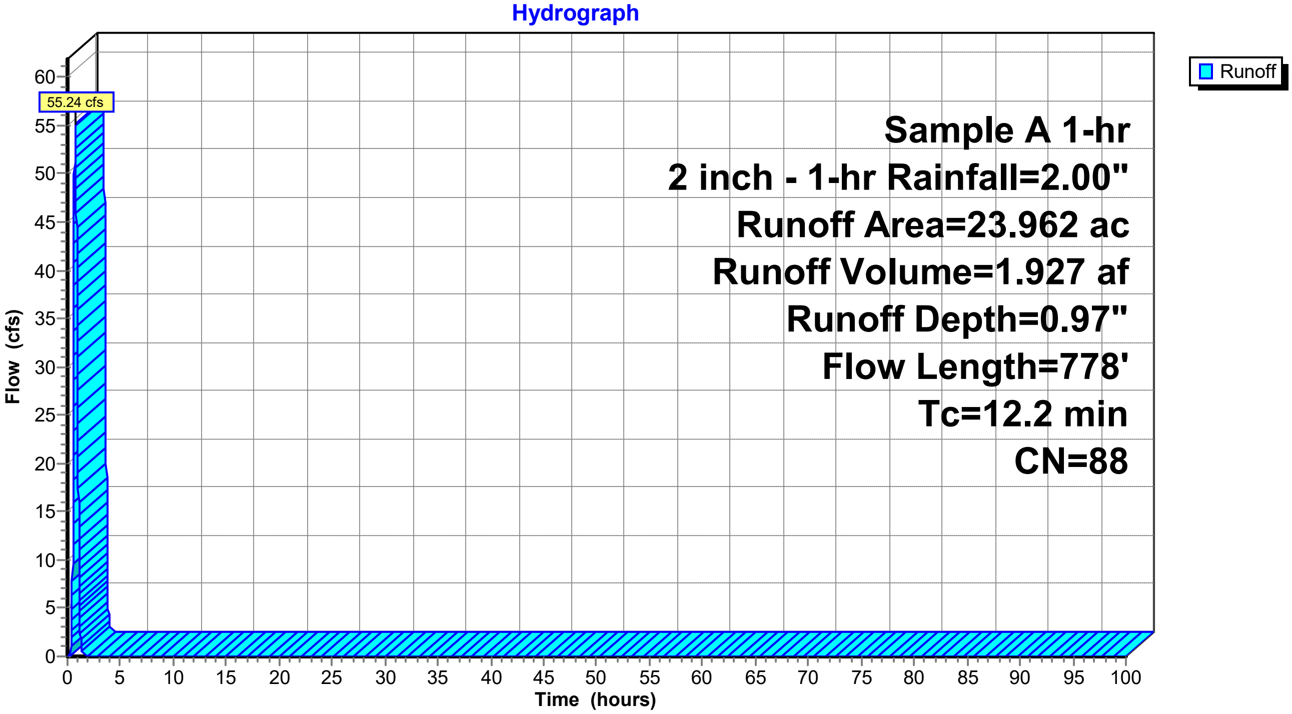
Runoff = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash from dewatering
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

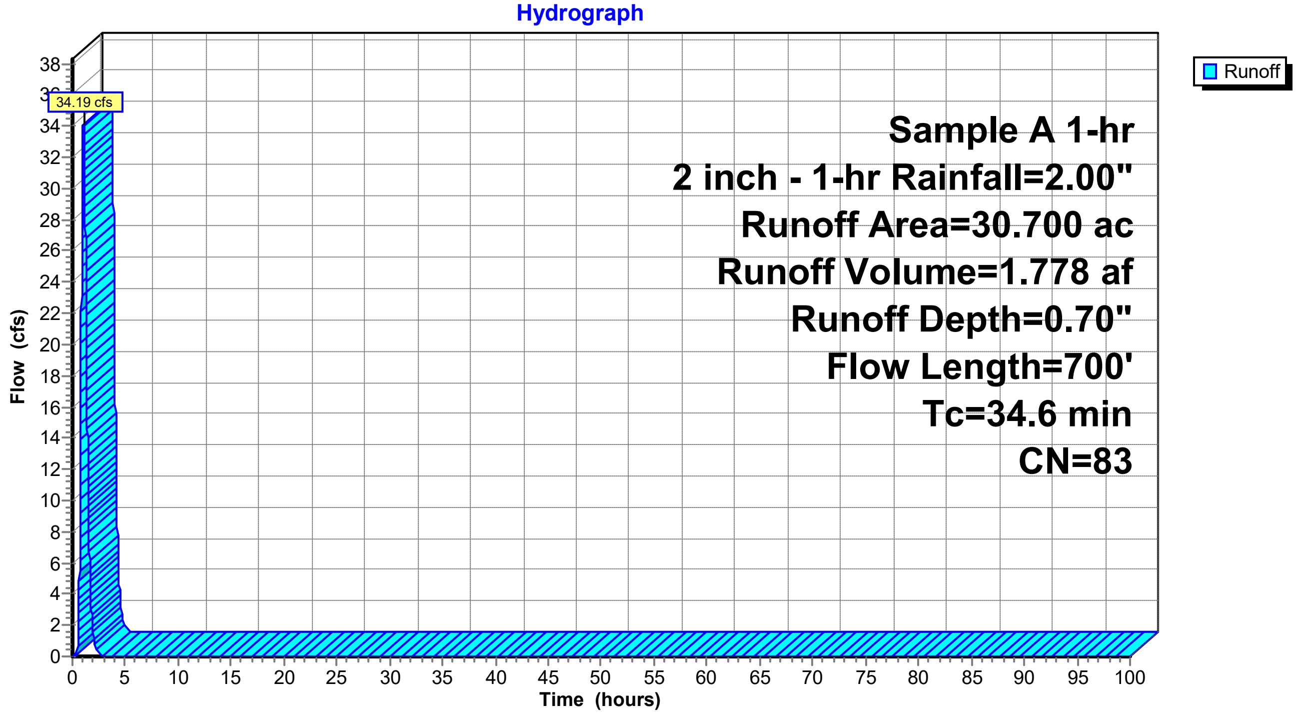
Runoff = 34.19 cfs @ 1.04 hrs, Volume= 1.778 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	4.490	98	Water Surface (Pool A)
*	1.440	98	Ash within Pool Limits - Dewatered
	30.700	83	Weighted Average
	24.770		80.68% Pervious Area
	5.930		19.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	400	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
34.6	700	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Late Phase 2 drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

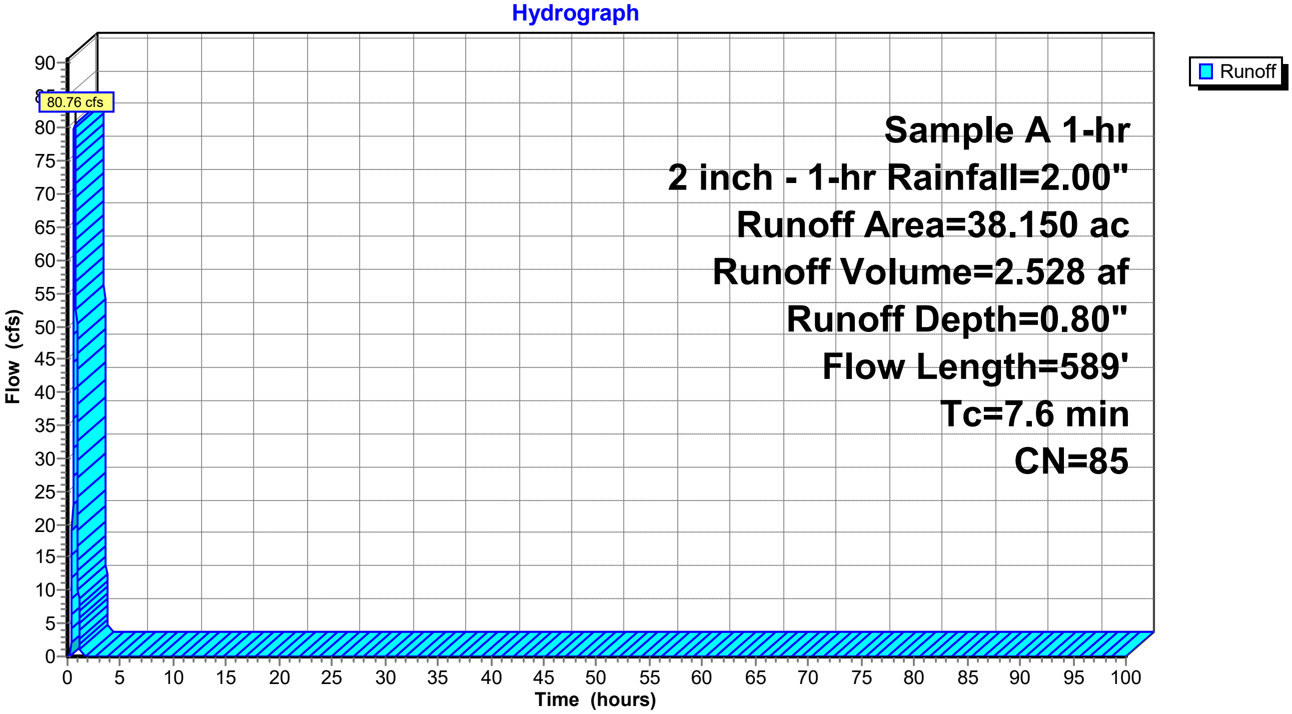
Runoff = 80.76 cfs @ 0.68 hrs, Volume= 2.528 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
*	5.200	79	50-75% Grass cover, Fair, HSG C
	38.150	85	Weighted Average
	27.050		70.90% Pervious Area
	11.100		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool B and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

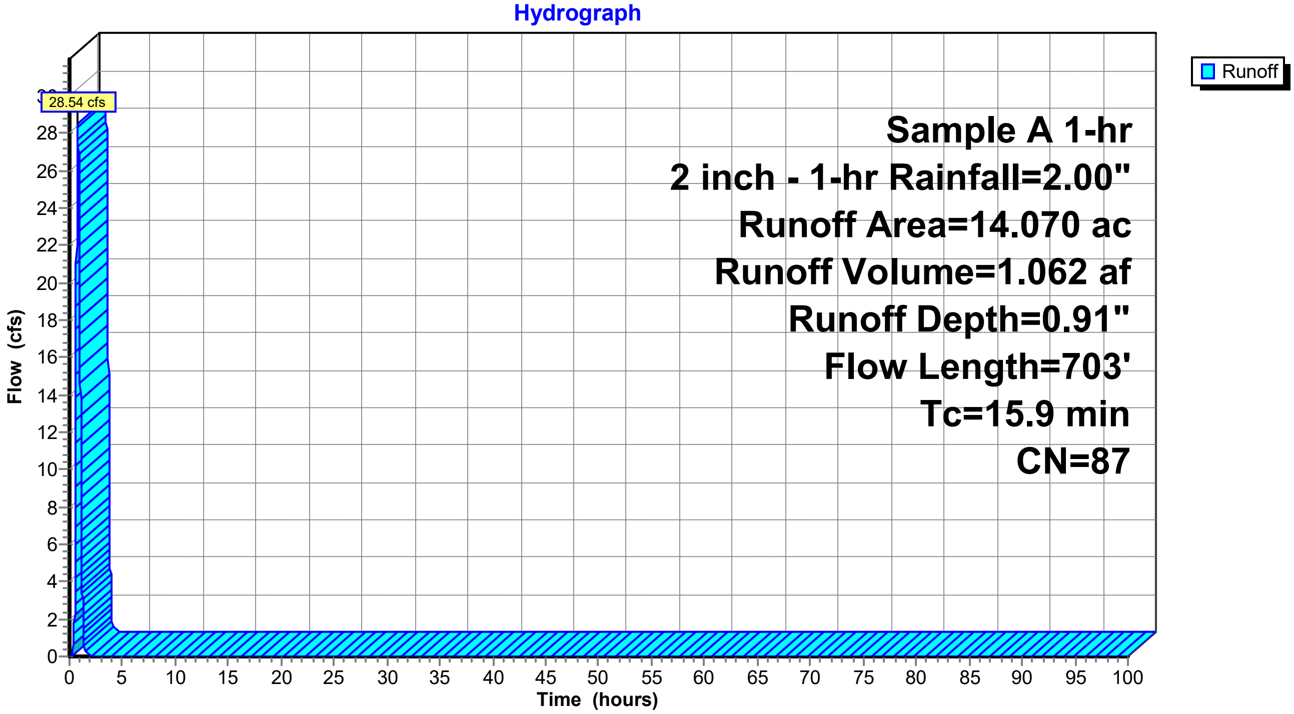
Runoff = 28.54 cfs @ 0.79 hrs, Volume= 1.062 af, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



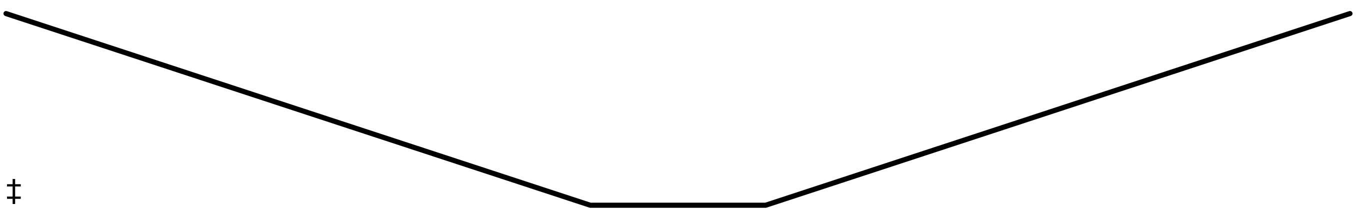
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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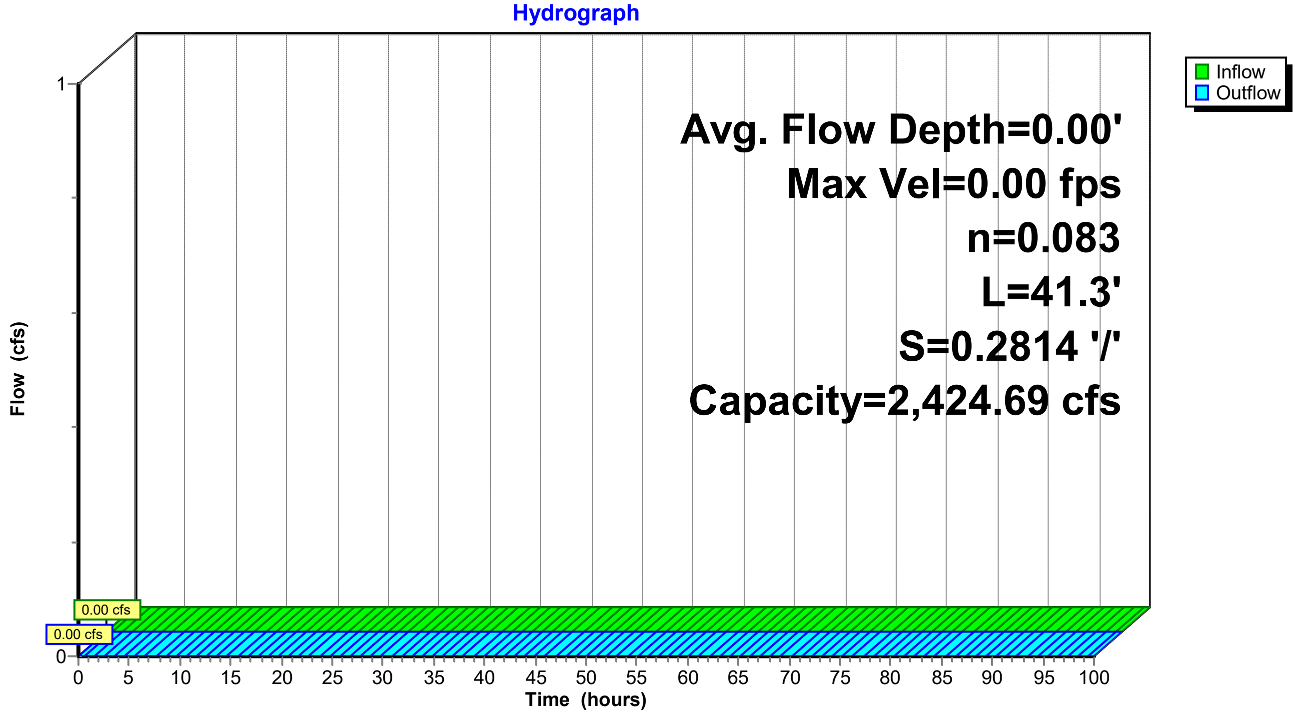
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

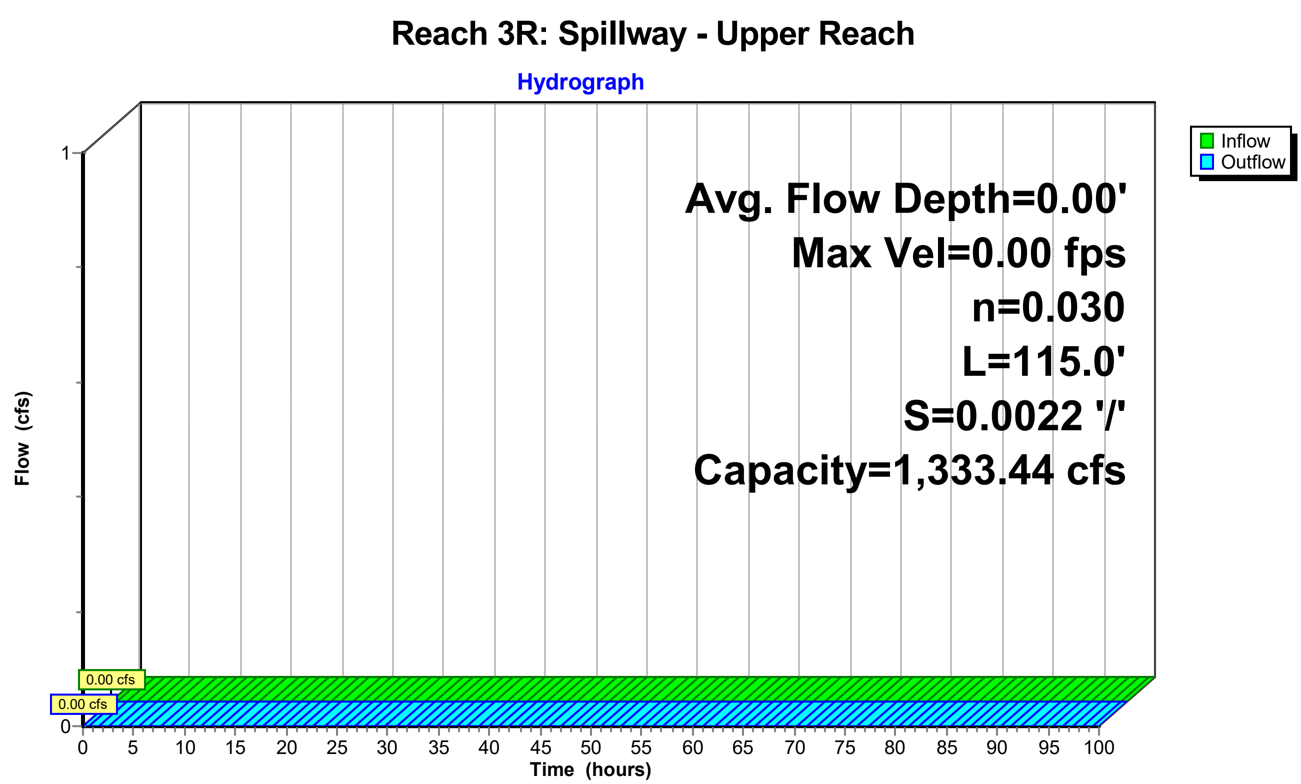
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡



Summary for Reach 4R: Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

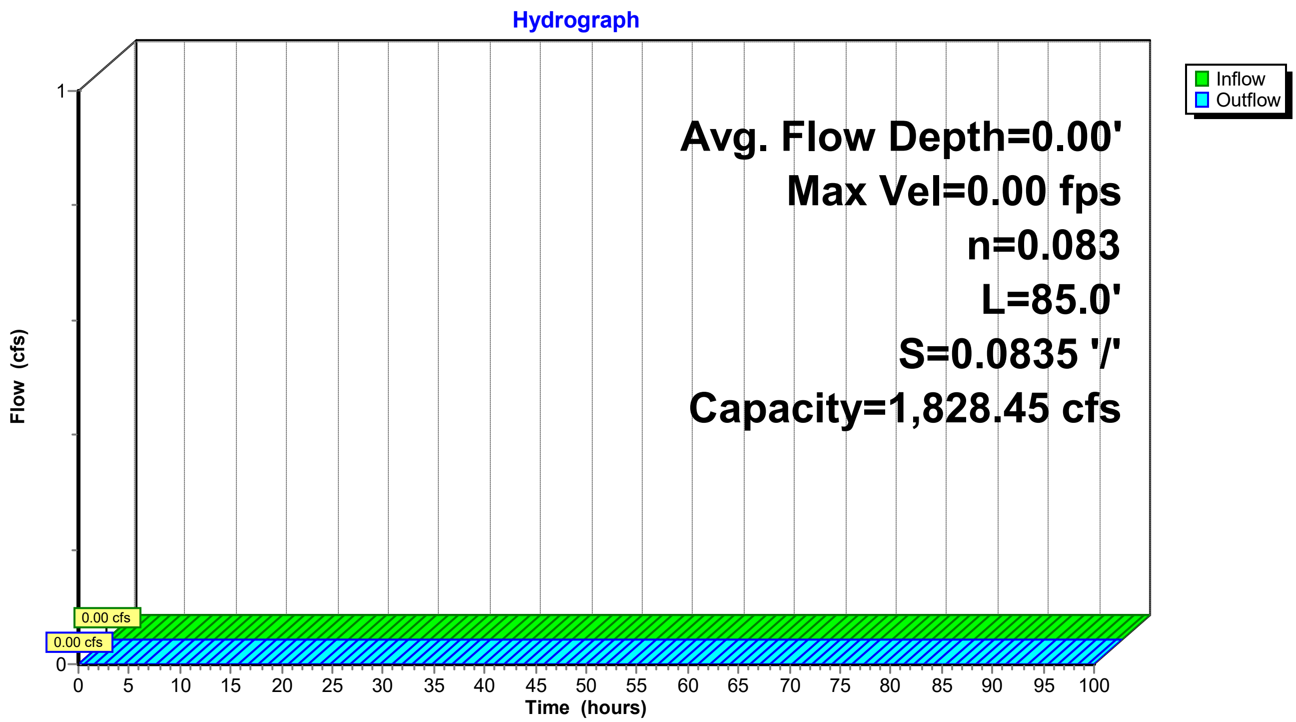
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

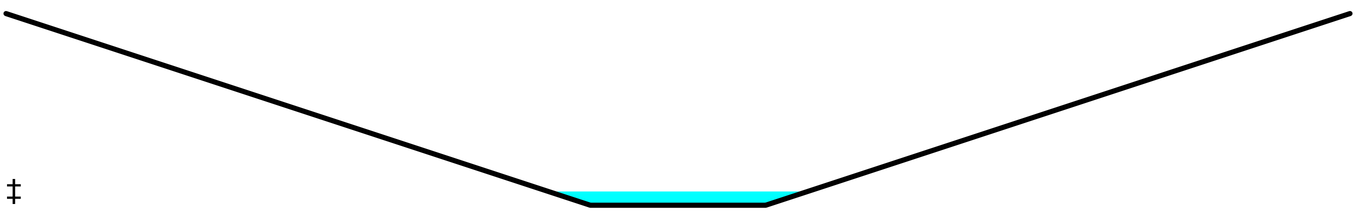
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 6.48 hrs

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth = 3.00" for 2 inch - 1-hr event
Inflow = 10.38 cfs @ 6.46 hrs, Volume= 61.533 af
Outflow = 10.38 cfs @ 6.48 hrs, Volume= 61.533 af, Atten= 0%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.83 fps, Avg. Travel Time= 3.5 min

Peak Storage= 2,135 cf @ 6.48 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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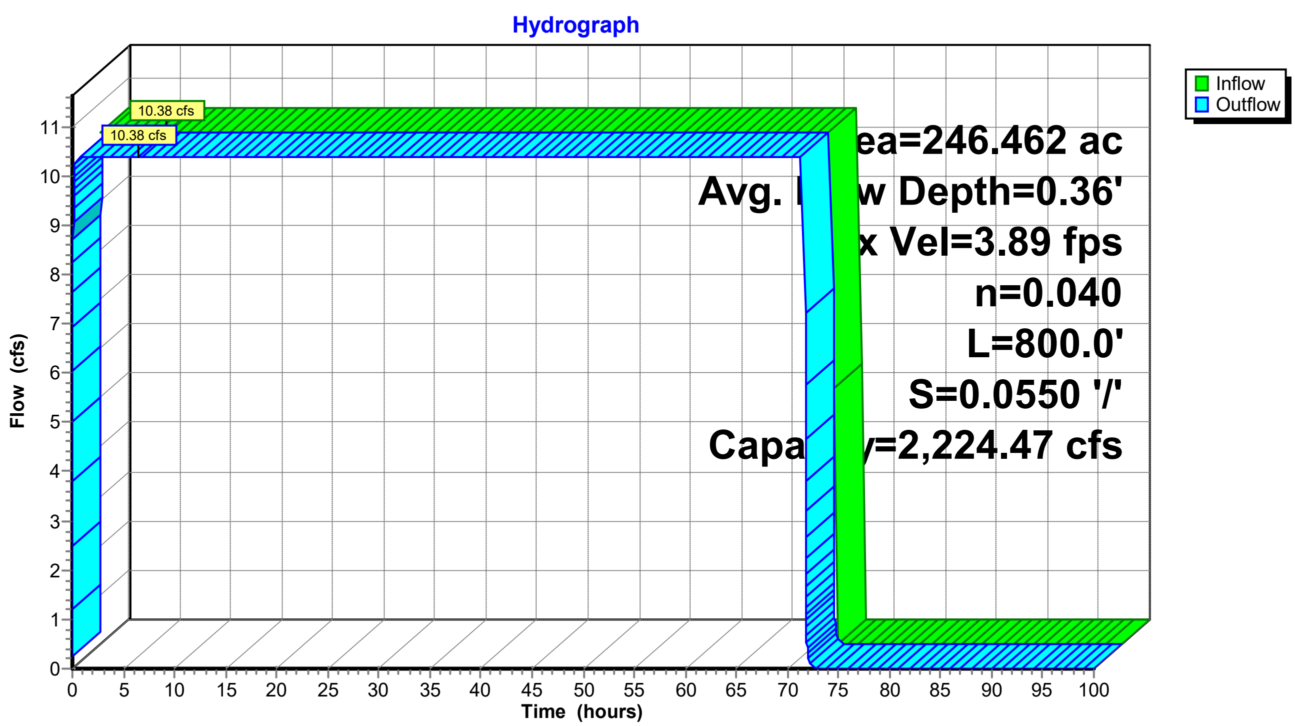
Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

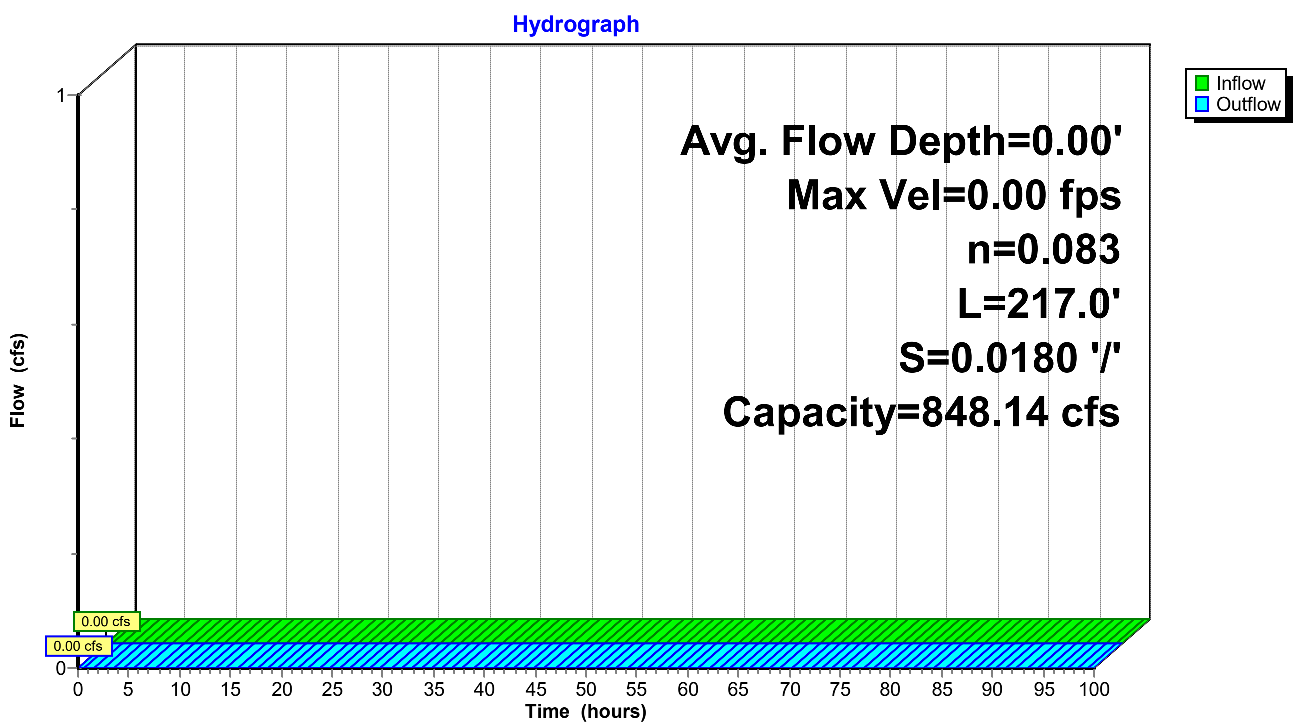
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

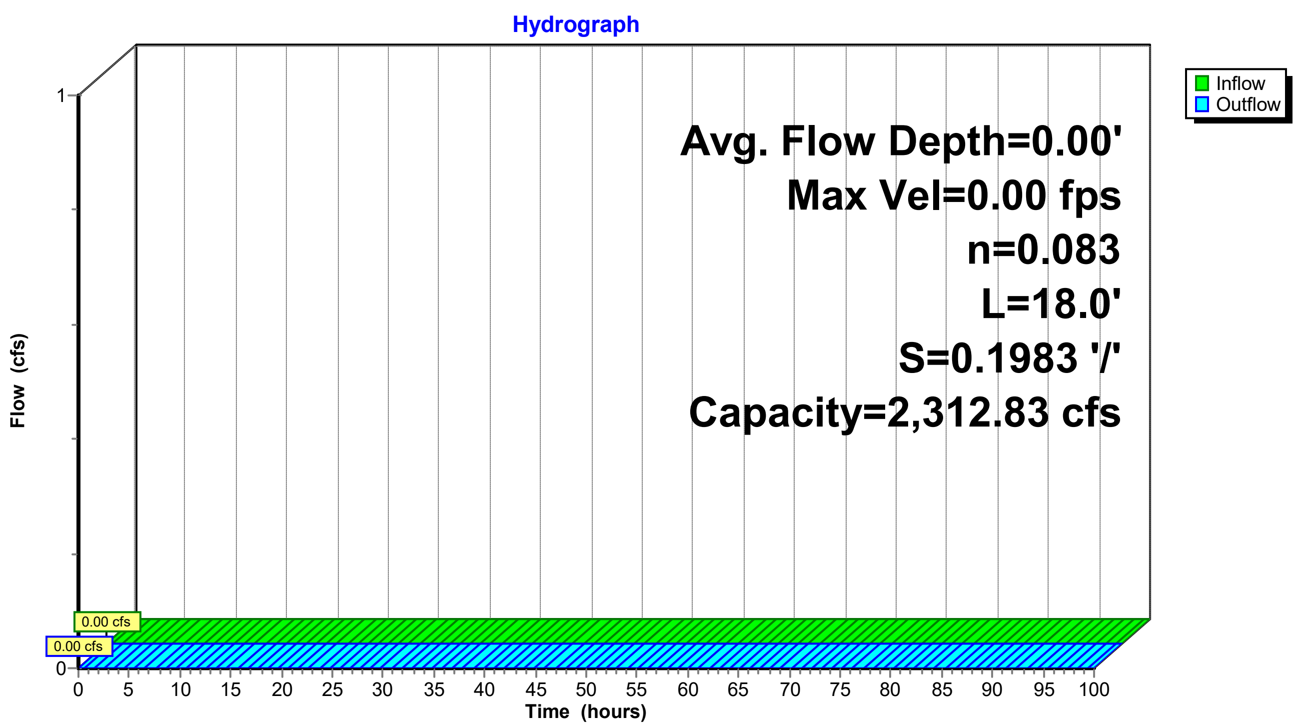
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



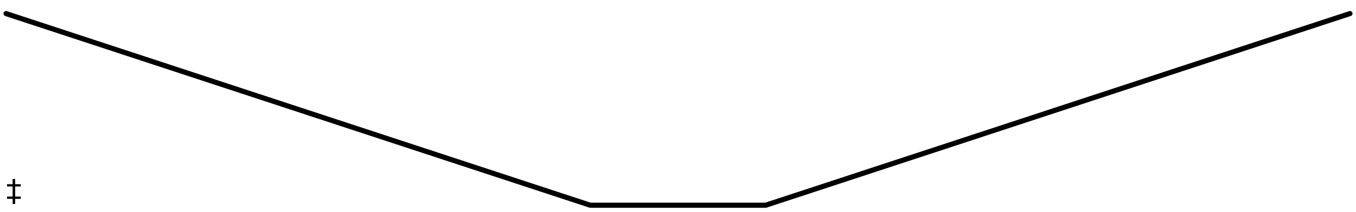
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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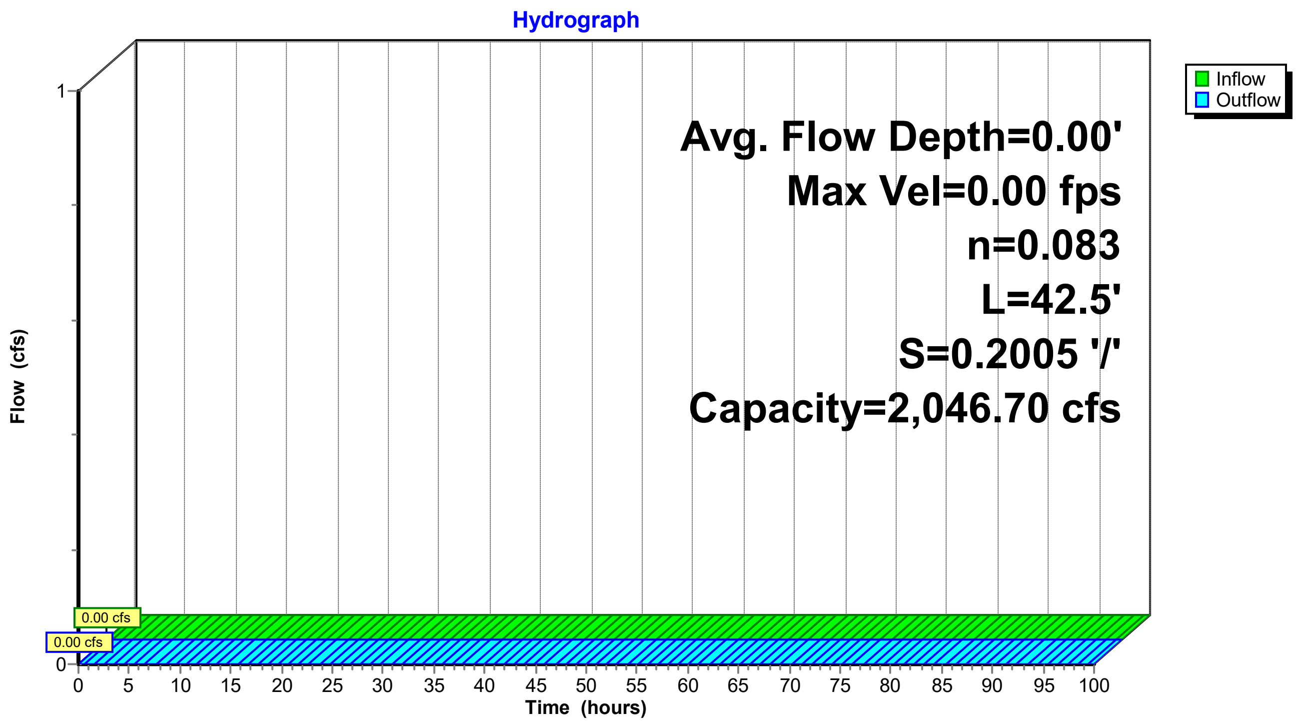
Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

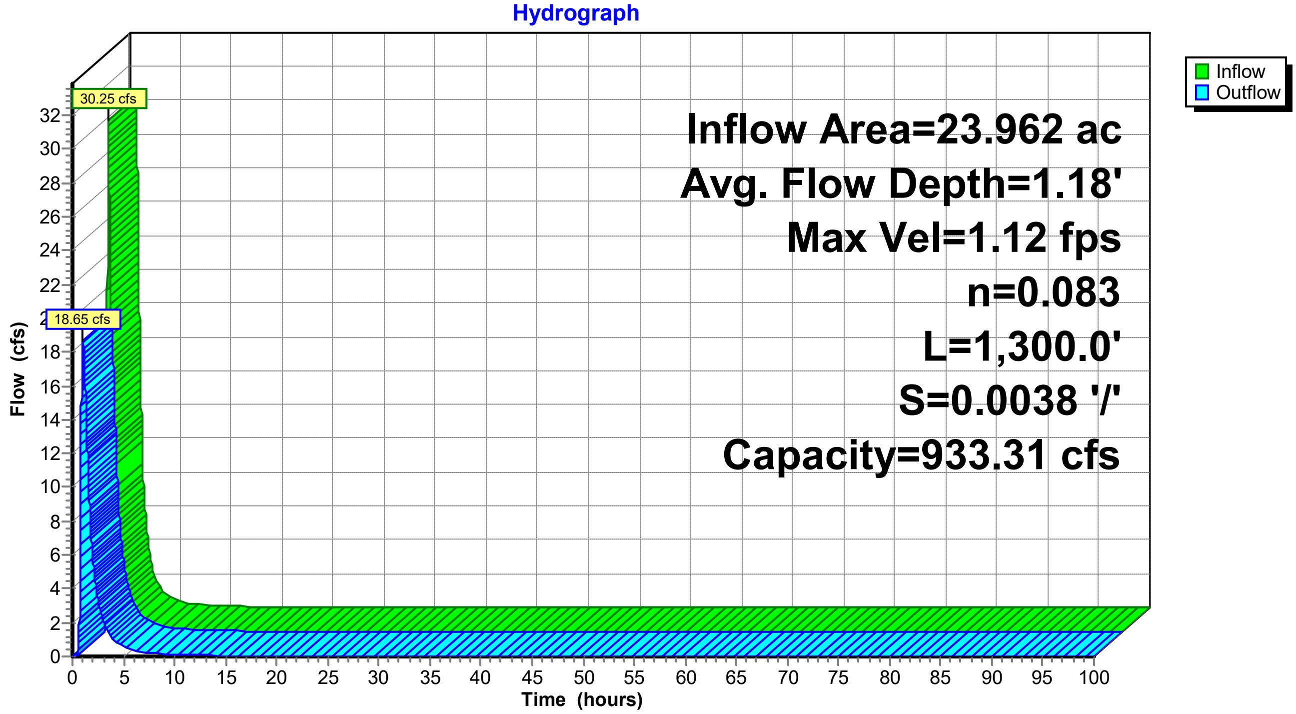
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.97" for 2 inch - 1-hr event
Inflow = 30.25 cfs @ 0.77 hrs, Volume= 1.927 af
Outflow = 18.65 cfs @ 1.04 hrs, Volume= 1.927 af, Atten= 38%, Lag= 16.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 19.4 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 82.9 min

Peak Storage= 21,709 cf @ 1.04 hrs
Average Depth at Peak Storage= 1.18'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 933.31 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 1,300.0' Slope= 0.0038 '/'
Inlet Invert= 440.00', Outlet Invert= 435.00'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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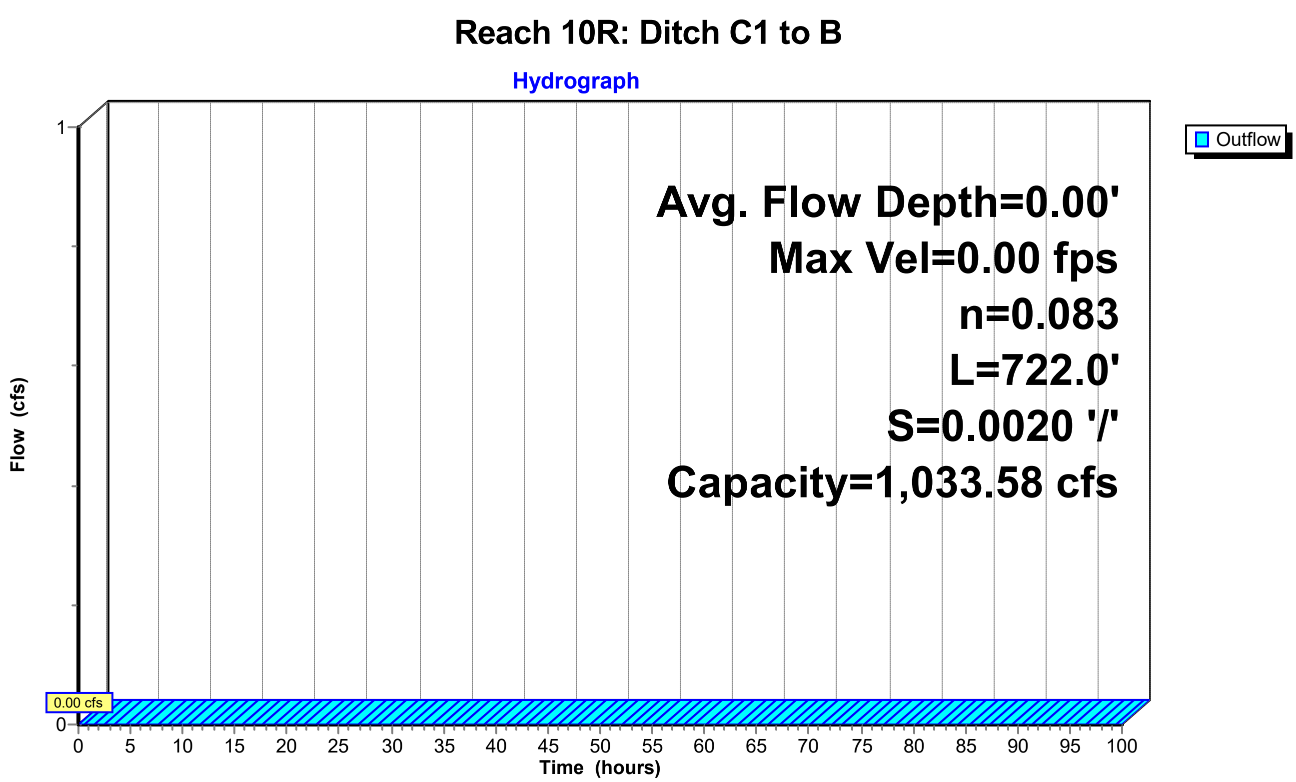
[43] Hint: Has no inflow (Outflow=Zero)

Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A. - REV to include ditch from C1 to B and ditch cut through pool B area - assuming contractor will not excavate out a pool here.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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[62] Hint: Exceeded Reach 9R OUTLET depth by 1.12' @ 0.74 hrs

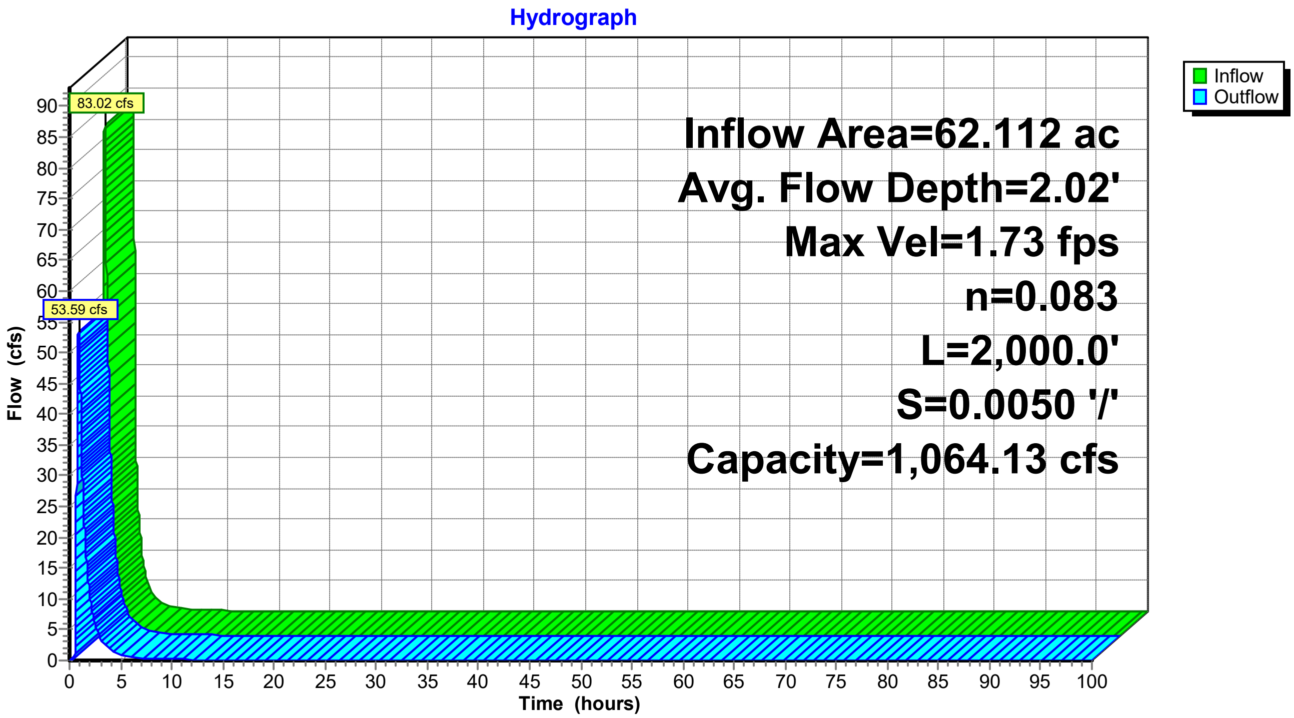
Inflow Area = 62.112 ac, 36.44% Impervious, Inflow Depth = 0.86" for 2 inch - 1-hr event
Inflow = 83.02 cfs @ 0.70 hrs, Volume= 4.455 af
Outflow = 53.59 cfs @ 0.91 hrs, Volume= 4.455 af, Atten= 35%, Lag= 13.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.73 fps, Min. Travel Time= 19.3 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 107.6 min

Peak Storage= 62,035 cf @ 0.91 hrs
Average Depth at Peak Storage= 2.02'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,064.13 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 2,000.0' Slope= 0.0050 '/'
Inlet Invert= 435.00', Outlet Invert= 425.00'

Reach 11R: Ditch B to A



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af, Atten= 0%, Lag= 0.0 min
Primary	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 7.570 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

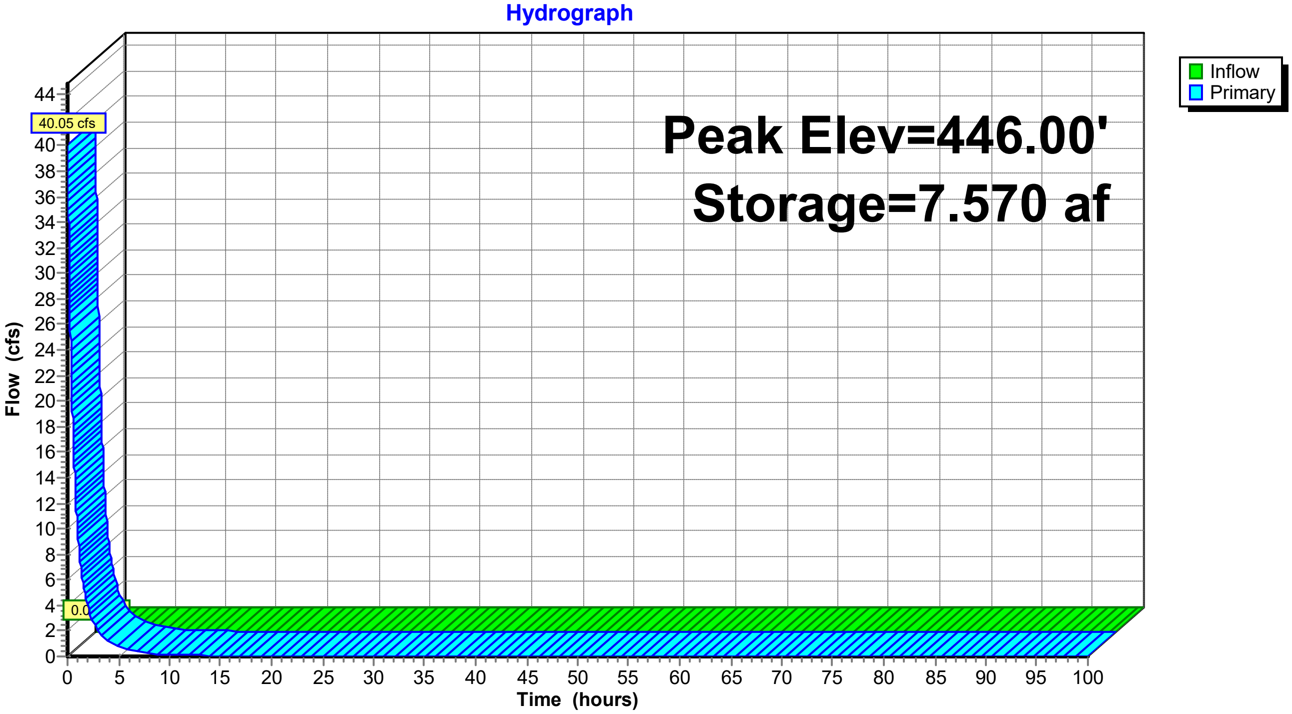
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=40.05 cfs @ 0.00 hrs HW=446.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 40.05 cfs @ 2.67 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 0.97" for 2 inch - 1-hr event
Inflow = 55.24 cfs @ 0.74 hrs, Volume= 1.927 af
Outflow = 30.25 cfs @ 0.77 hrs, Volume= 1.927 af, Atten= 45%, Lag= 2.2 min
Primary = 30.25 cfs @ 0.77 hrs, Volume= 1.927 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 1.995 af
Peak Elev= 441.23' @ 1.01 hrs Surf.Area= 0.000 ac Storage= 2.931 af (0.936 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 59.4 min (106.2 - 46.8)

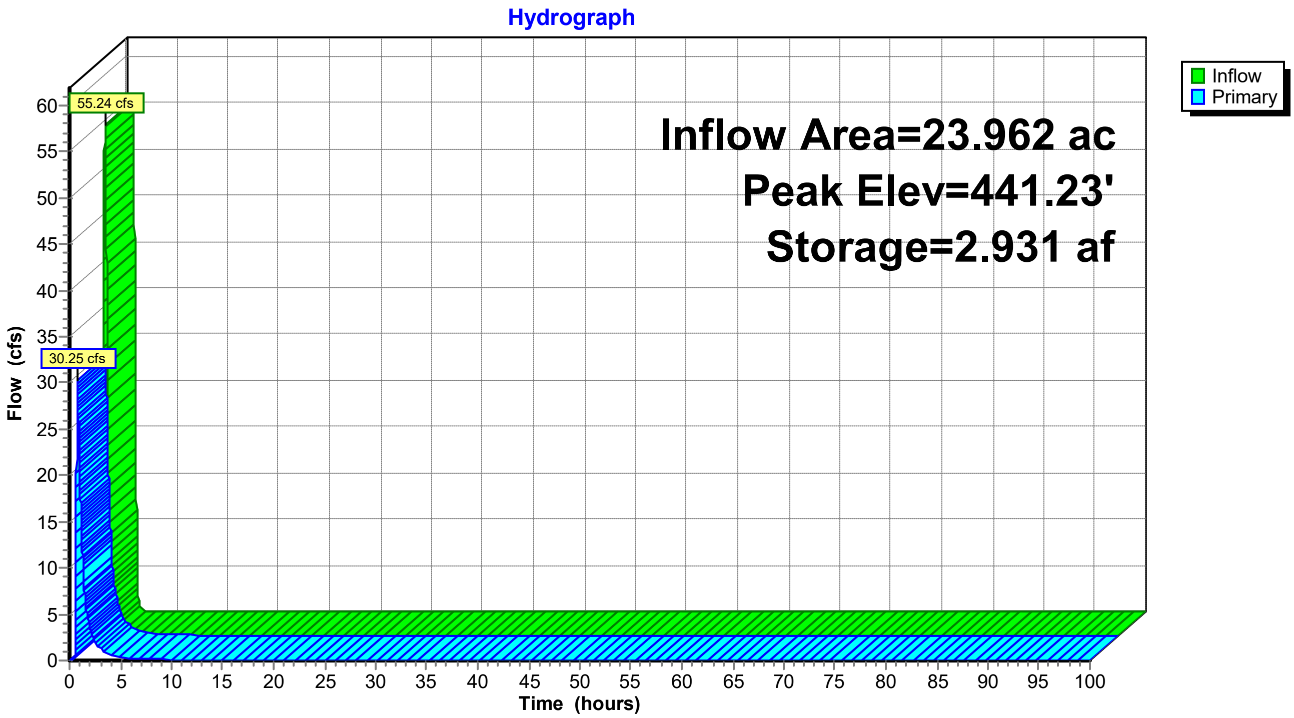
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	440.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=28.81 cfs @ 0.77 hrs HW=441.00' TW=440.70' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 28.81 cfs @ 1.92 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

[61] Hint: Exceeded Reach 10R outlet invert by 1.44' @ 0.00 hrs

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

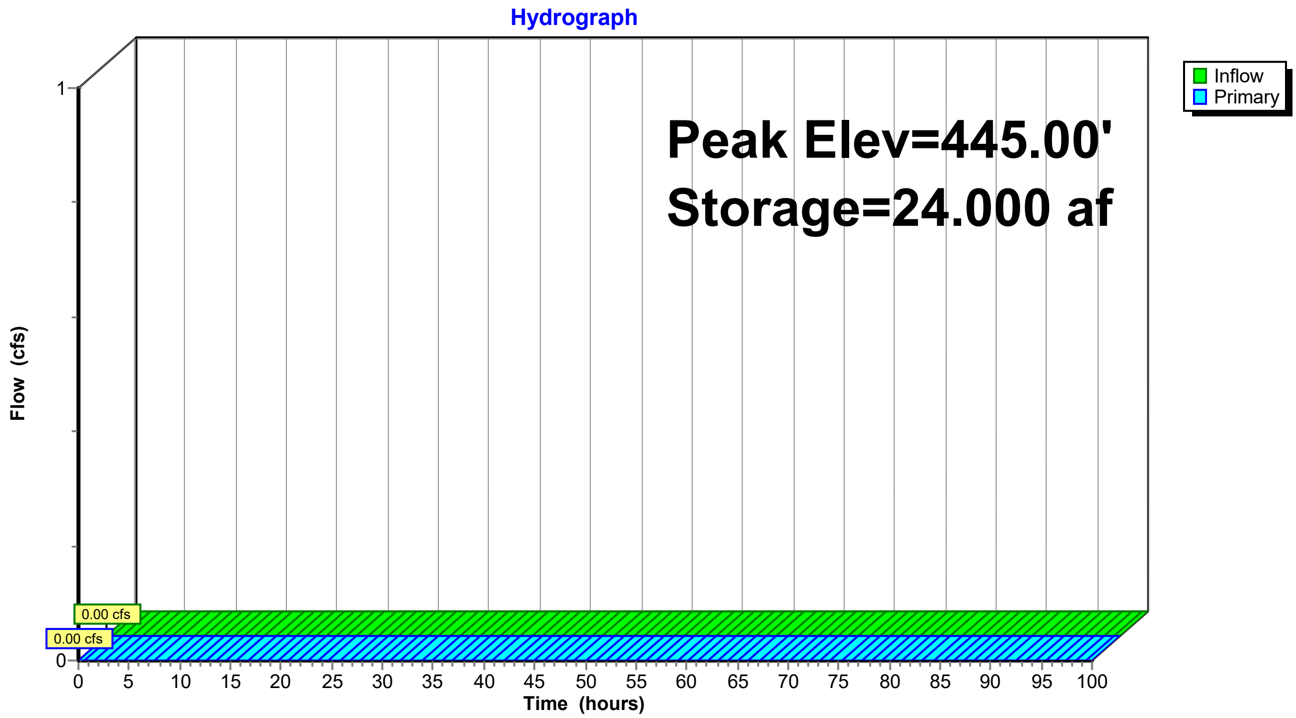
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 5.98' @ 2.65 hrs

Inflow Area = 106.882 ac, 31.95% Impervious, Inflow Depth = 0.82" for 2 inch - 1-hr event
Inflow = 105.54 cfs @ 0.92 hrs, Volume= 7.296 af
Outflow = 14.52 cfs @ 1.86 hrs, Volume= 7.279 af, Atten= 86%, Lag= 56.3 min
Primary = 14.52 cfs @ 1.86 hrs, Volume= 7.279 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 98.790 af
Peak Elev= 441.62' @ 1.86 hrs Surf.Area= 0.000 ac Storage= 103.212 af (4.422 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 123.2 min (219.3 - 96.1)

Volume	Invert	Avail.Storage	Storage Description
#1	425.00'	120.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
425.00	0.000
426.00	0.010
427.00	5.580
428.00	14.560
429.00	22.630
430.00	32.150
431.00	40.000
432.00	45.000
433.00	54.690
434.00	67.810
435.00	82.530
436.00	90.470
440.00	98.790
443.00	106.960
445.00	108.000
447.00	120.000

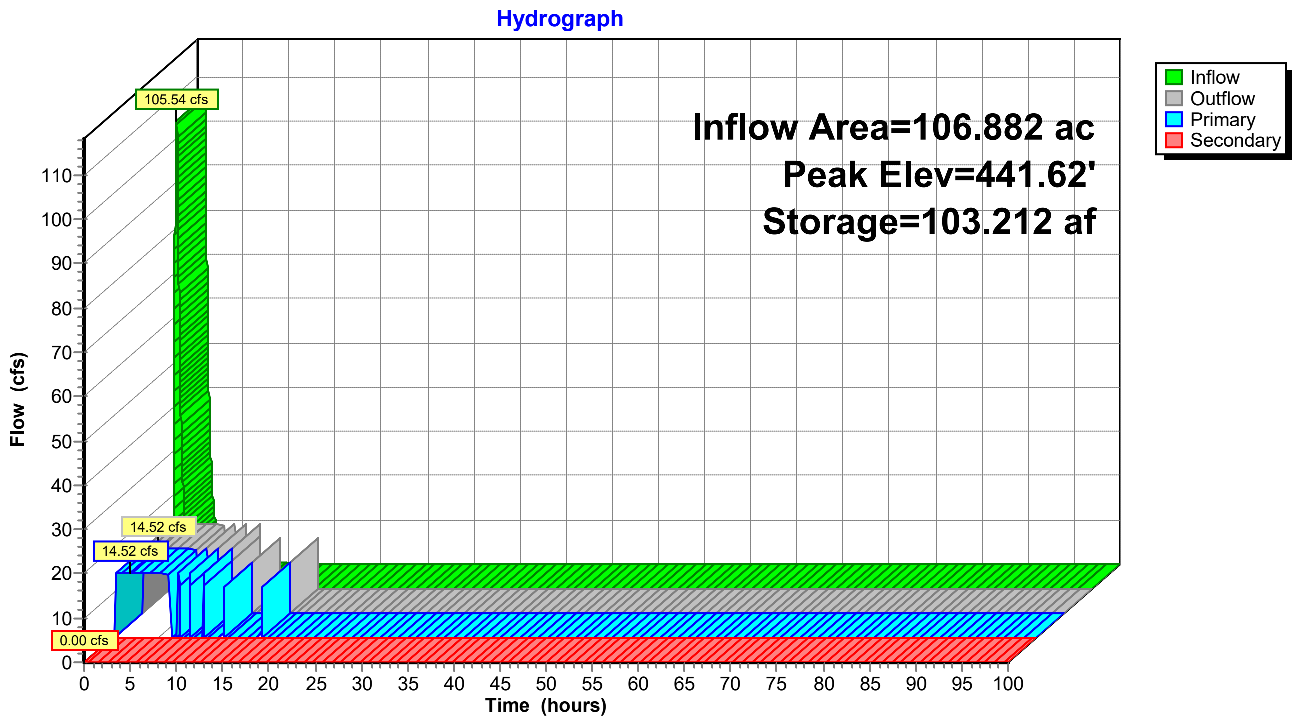
Device	Routing	Invert	Outlet Devices
#1	Primary	440.01'	**Pump** Discharges@455.00' Turns Off@440.00' 12.0" Diam. x 1,000.0' Long Discharge, Hazen-Williams C= 130 Flow (gpm)= 6,516.0 6,516.1

			Head (feet)= 500.00 0.00
			-Loss (feet)= 81.57 81.57
			=Lift (feet)= 418.43 -81.57
#2	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=14.52 cfs @ 1.86 hrs HW=441.62' TW=436.37' (Dynamic Tailwater)
└─**1=Pump** (Pump Controls 14.52 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=455.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Pond 7P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth = 1.15" for 2 inch - 1-hr event
Inflow = 197.48 cfs @ 1.05 hrs, Volume= 23.681 af
Outflow = 10.38 cfs @ 6.46 hrs, Volume= 61.533 af, Atten= 95%, Lag= 324.4 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 6.46 hrs, Volume= 61.533 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 436.54' @ 6.46 hrs Surf.Area= 0.000 ac Storage= 98.216 af (17.976 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 2,044.1 min (2,151.6 - 107.5)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

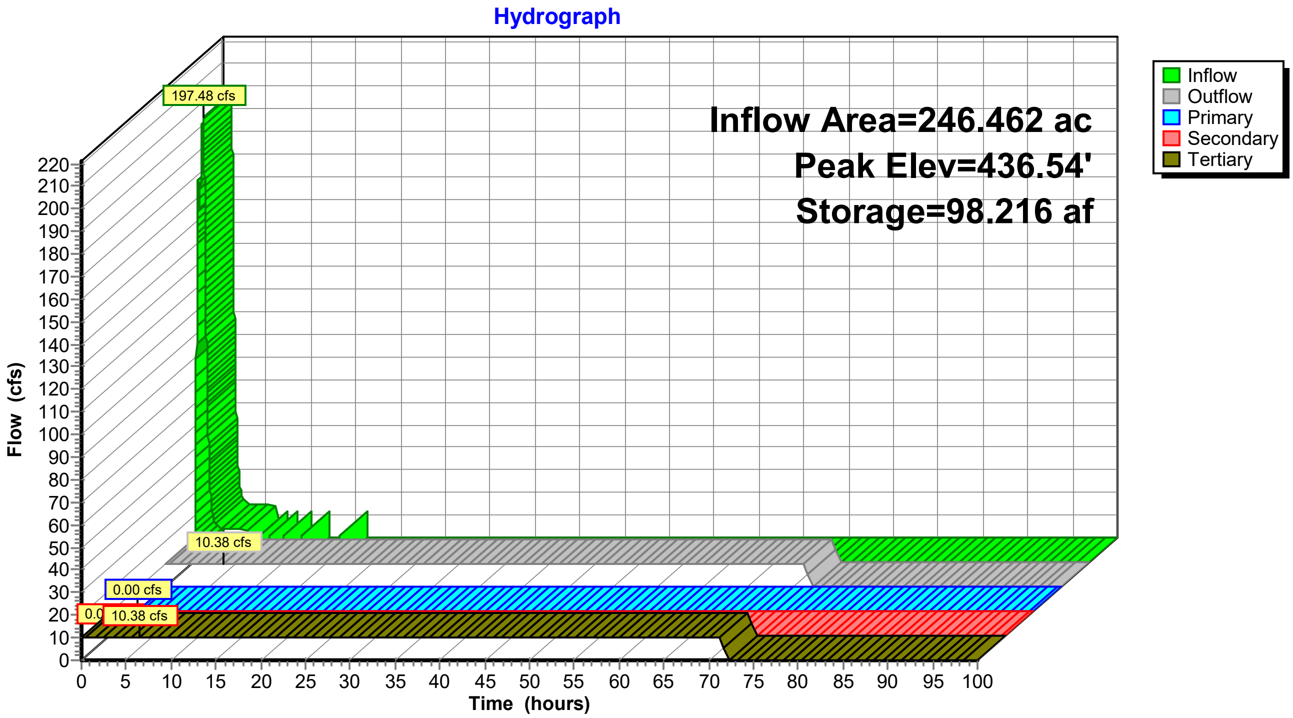
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 84.28 cfs potential flow)
 └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 6.46 hrs HW=436.54' TW=428.36' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 10.38 cfs)

Pond 7P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

This subcatchment is intended to drain directly to the Lower Ash Pond post Upper dam breach during late Phase 2.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

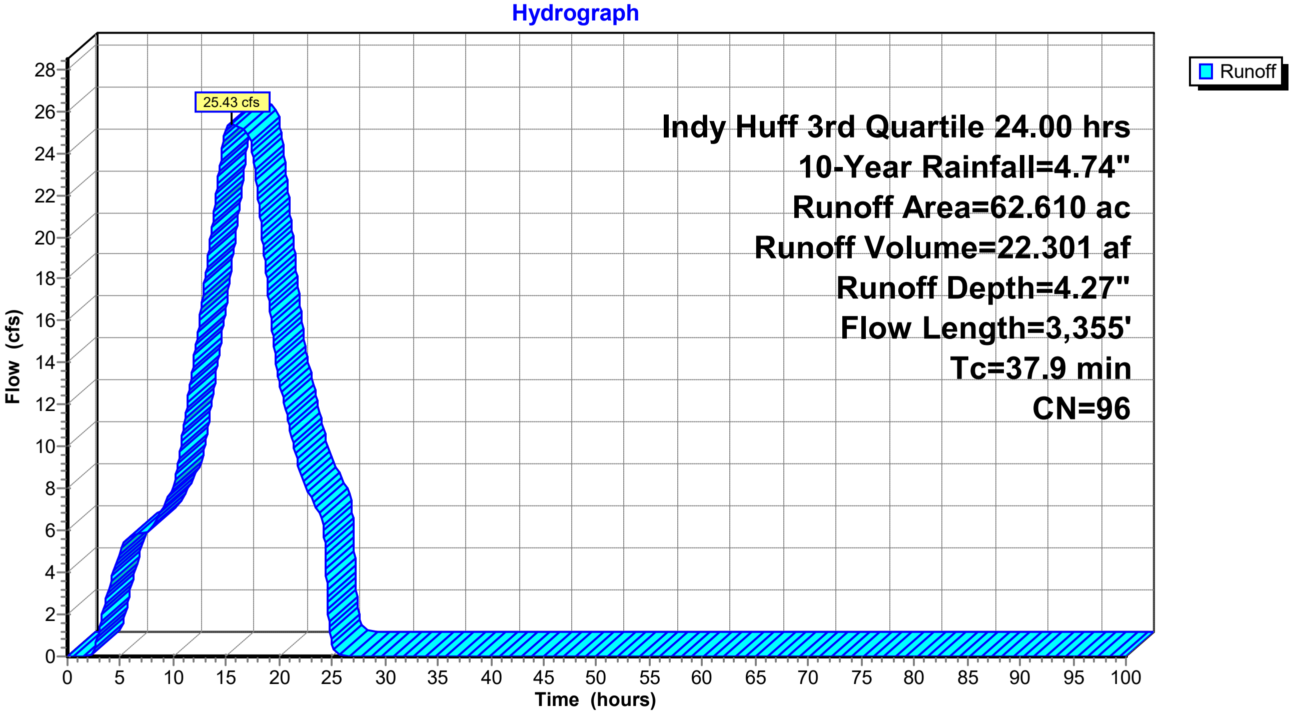
Runoff = 25.43 cfs @ 15.45 hrs, Volume= 22.301 af, Depth= 4.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
*	57.410	98	Ash
	5.200	79	50-75% Grass cover, Fair, HSG C
	62.610	96	Weighted Average
	5.200		8.31% Pervious Area
	57.410		91.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

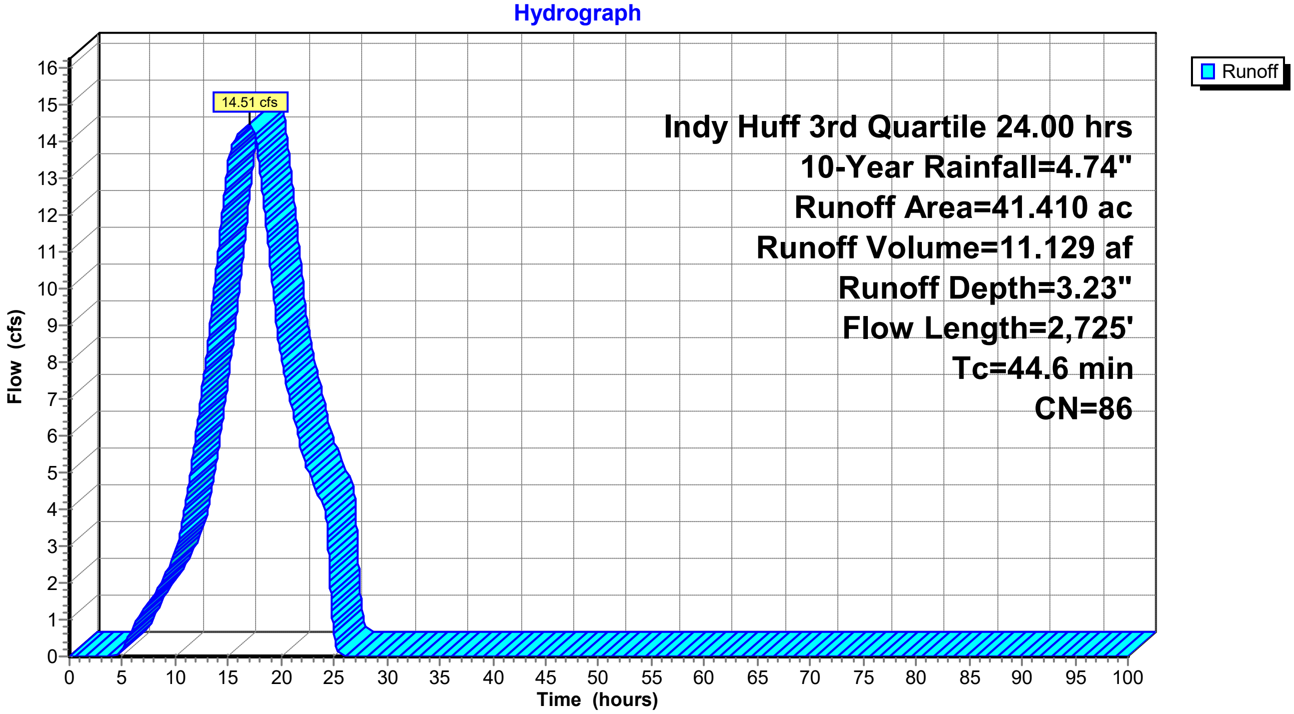
Runoff = 14.51 cfs @ 17.10 hrs, Volume= 11.129 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

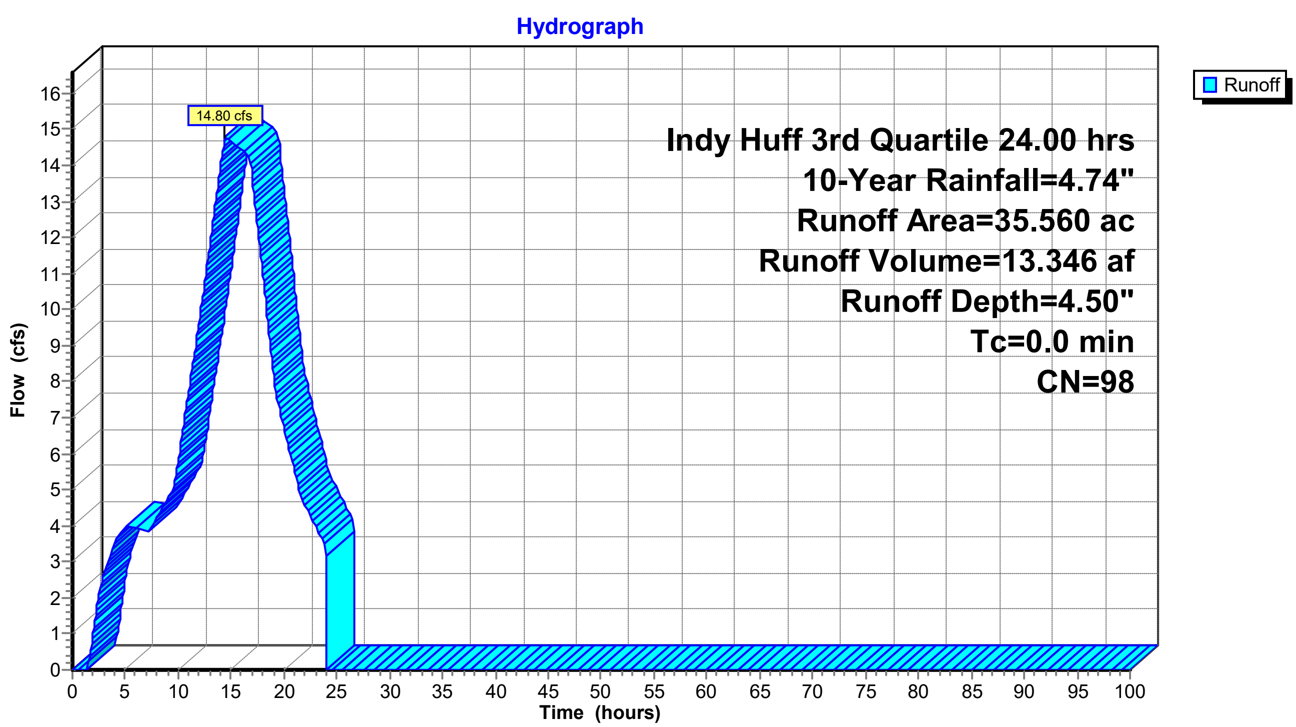
Runoff = 14.80 cfs @ 14.41 hrs, Volume= 13.346 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



Summary for Subcatchment 7S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool C2 and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

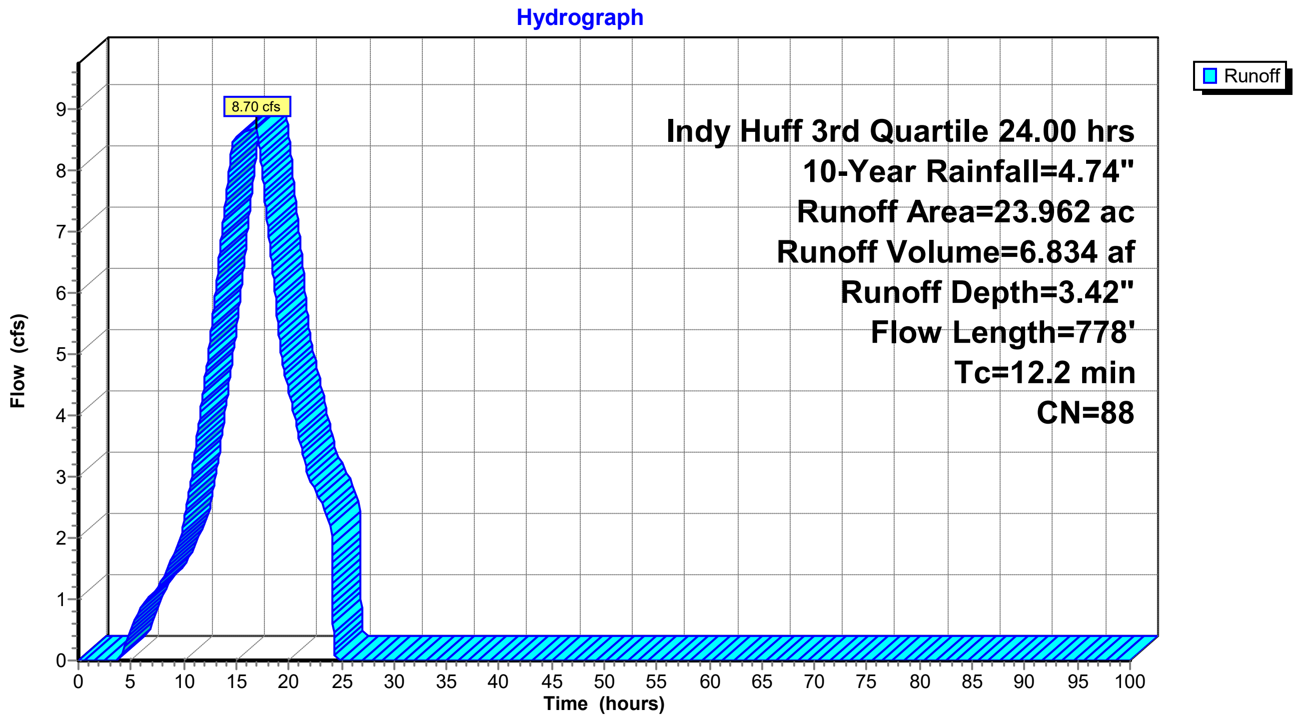
Runoff = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	12.430	79	50-75% Grass cover, Fair, HSG C
*	11.532	98	Ash from dewatering
	23.962	88	Weighted Average
	12.430		51.87% Pervious Area
	11.532		48.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	300	0.0220	0.54		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	349	0.0220	2.22		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	129	0.2290	7.18		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
12.2	778	Total			

Subcatchment 7S: Phase 1 Drainage Area



Summary for Subcatchment 8S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

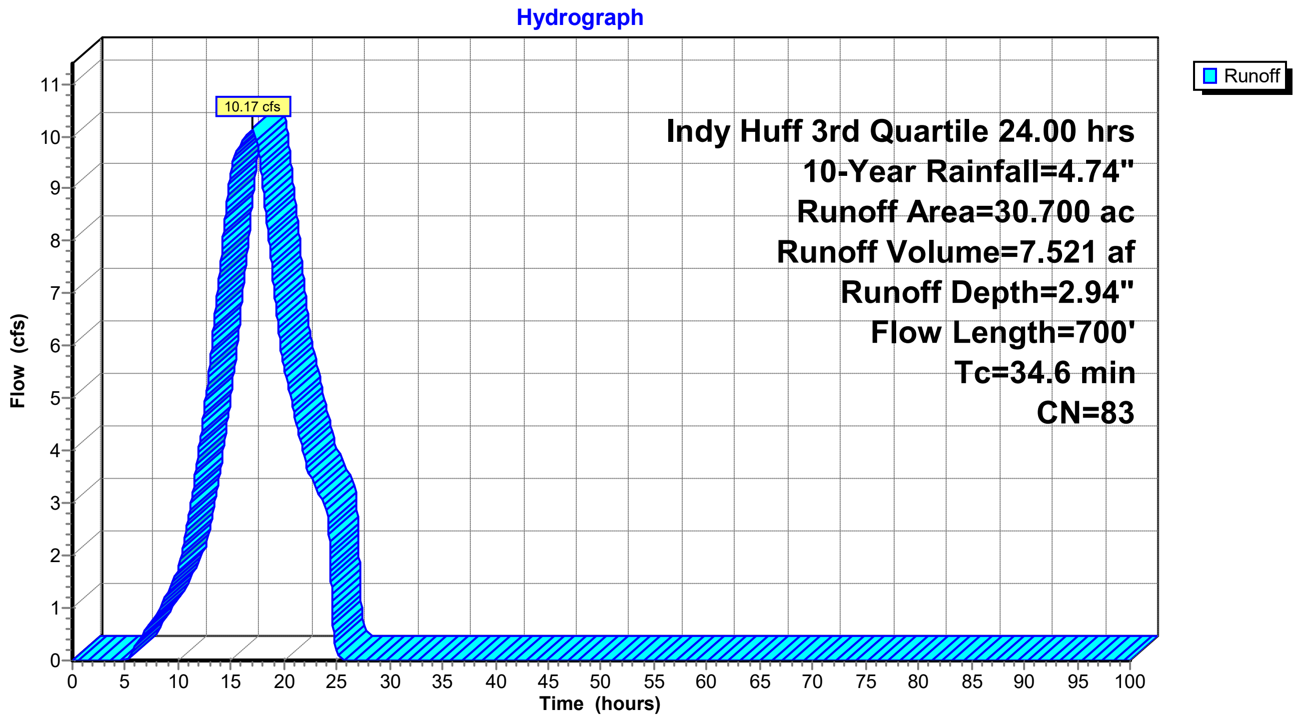
Runoff = 10.17 cfs @ 17.03 hrs, Volume= 7.521 af, Depth= 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	24.770	79	50-75% Grass cover, Fair, HSG C
*	4.490	98	Water Surface (Pool A)
*	1.440	98	Ash within Pool Limits - Dewatered
	30.700	83	Weighted Average
	24.770		80.68% Pervious Area
	5.930		19.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.0	300	0.0010	0.16		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
2.6	400	0.0640	2.53		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
34.6	700	Total			

Subcatchment 8S: Phase 1 Drainage Area



Summary for Subcatchment 10S: Phase 1 Drainage Area

Late Phase 2 drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

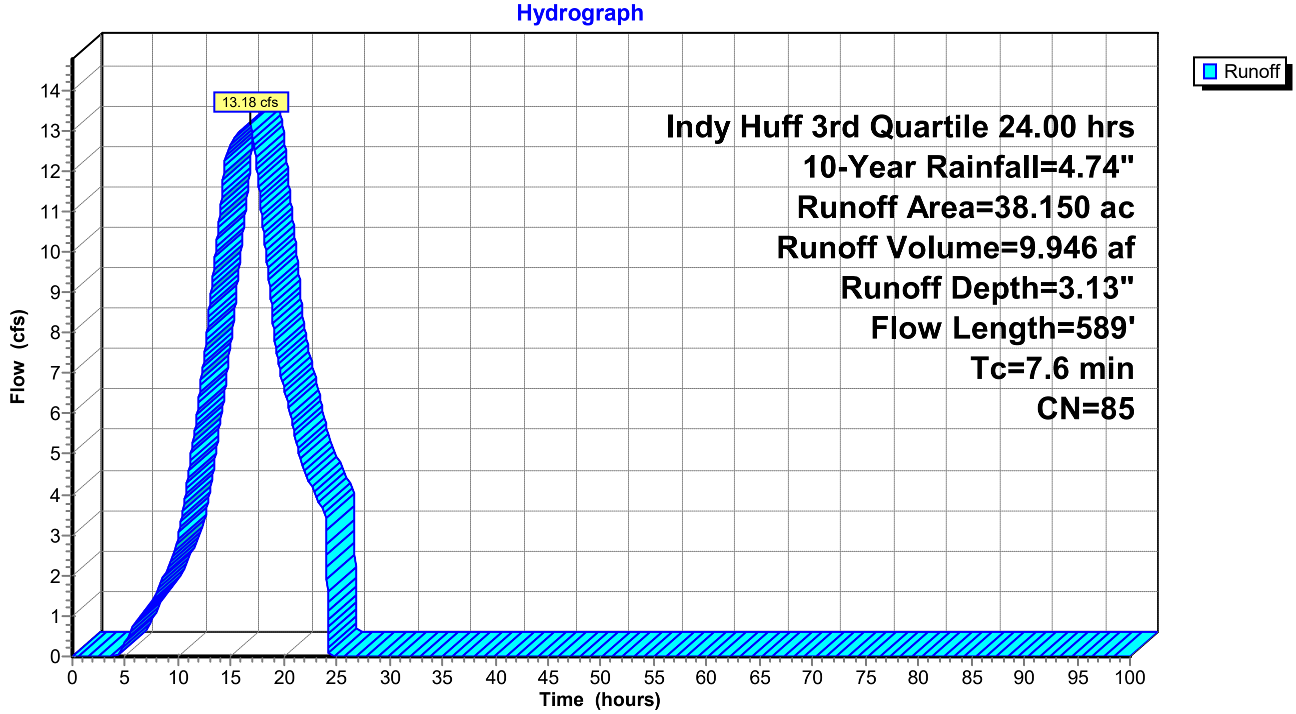
Runoff = 13.18 cfs @ 16.83 hrs, Volume= 9.946 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	21.850	79	50-75% Grass cover, Fair, HSG C
*	1.930	98	Water Surface (Pools C1)
*	9.170	98	Ash from dewatering
*	5.200	79	50-75% Grass cover, Fair, HSG C
	38.150	85	Weighted Average
	27.050		70.90% Pervious Area
	11.100		29.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.4	289	0.0540	3.49		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
7.6	589	Total			

Subcatchment 10S: Phase 1 Drainage Area



Summary for Subcatchment 11S: Phase 1 Drainage Area

Late Phase 2 Drainage Area includes Limits of Ash Pond including the water area of the Pools (A, B, C1, C2). Vegetation is reduced due to construction and grass cover is assumed to be minimal (poor). Remaining drainage area is ash. This subcatchment includes Dry Pool B and its associated drainage.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Ash and water are assumed to have same CNs. If parts of the subcatchment are dewatered and converted to an ash surface, due to the same CNs flow shouldn't be affected.

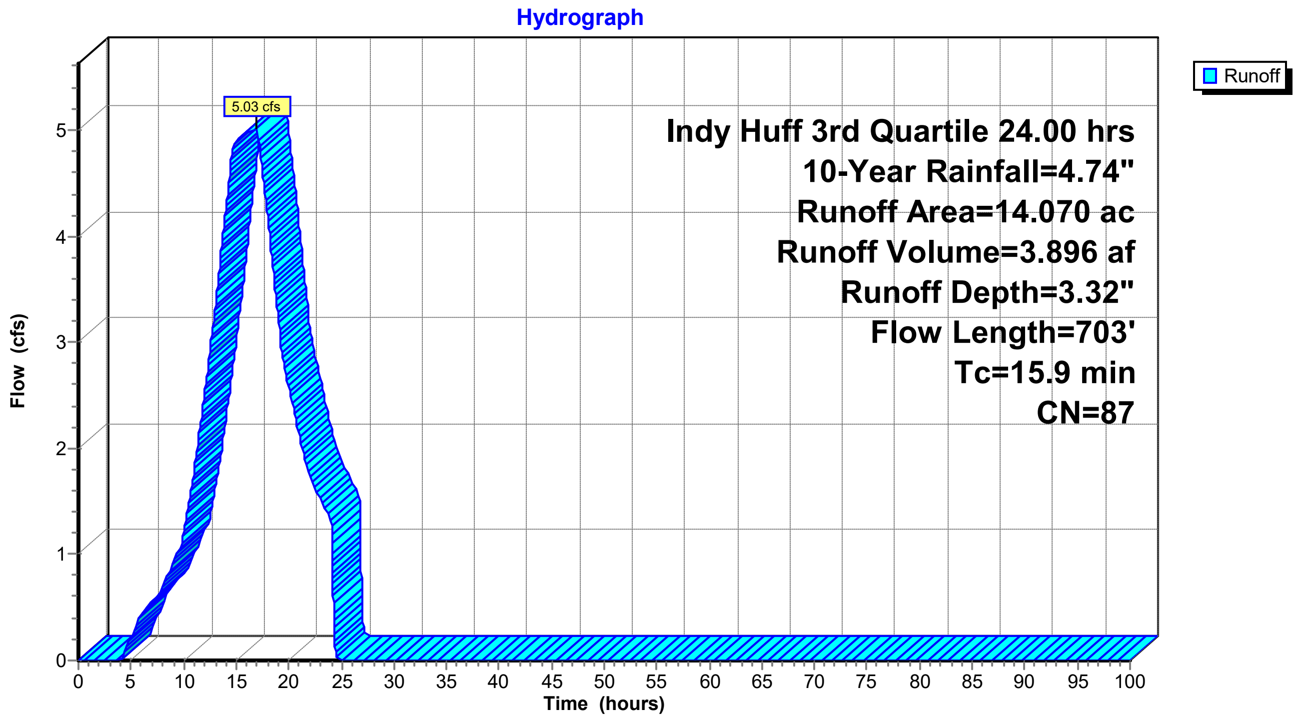
Runoff = 5.03 cfs @ 16.87 hrs, Volume= 3.896 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	8.480	79	50-75% Grass cover, Fair, HSG C
*	5.590	98	Ash from dewatering
	14.070	87	Weighted Average
	8.480		60.27% Pervious Area
	5.590		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	225	0.0850	0.87		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
0.1	53	0.4680	10.26		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.5	425	0.0017	0.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
15.9	703	Total			

Subcatchment 11S: Phase 1 Drainage Area



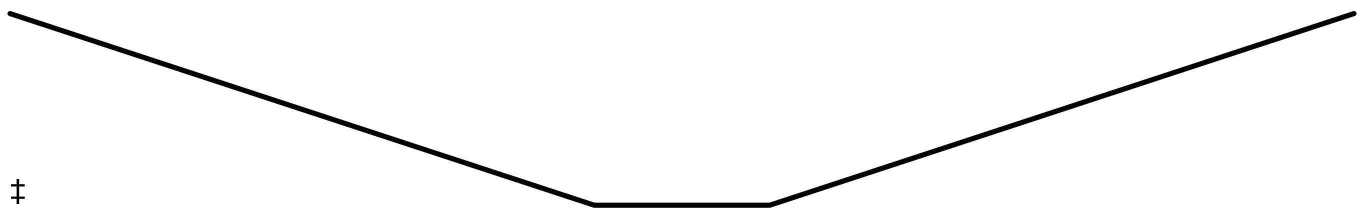
Summary for Reach 2R: Spillway - Lower Reach

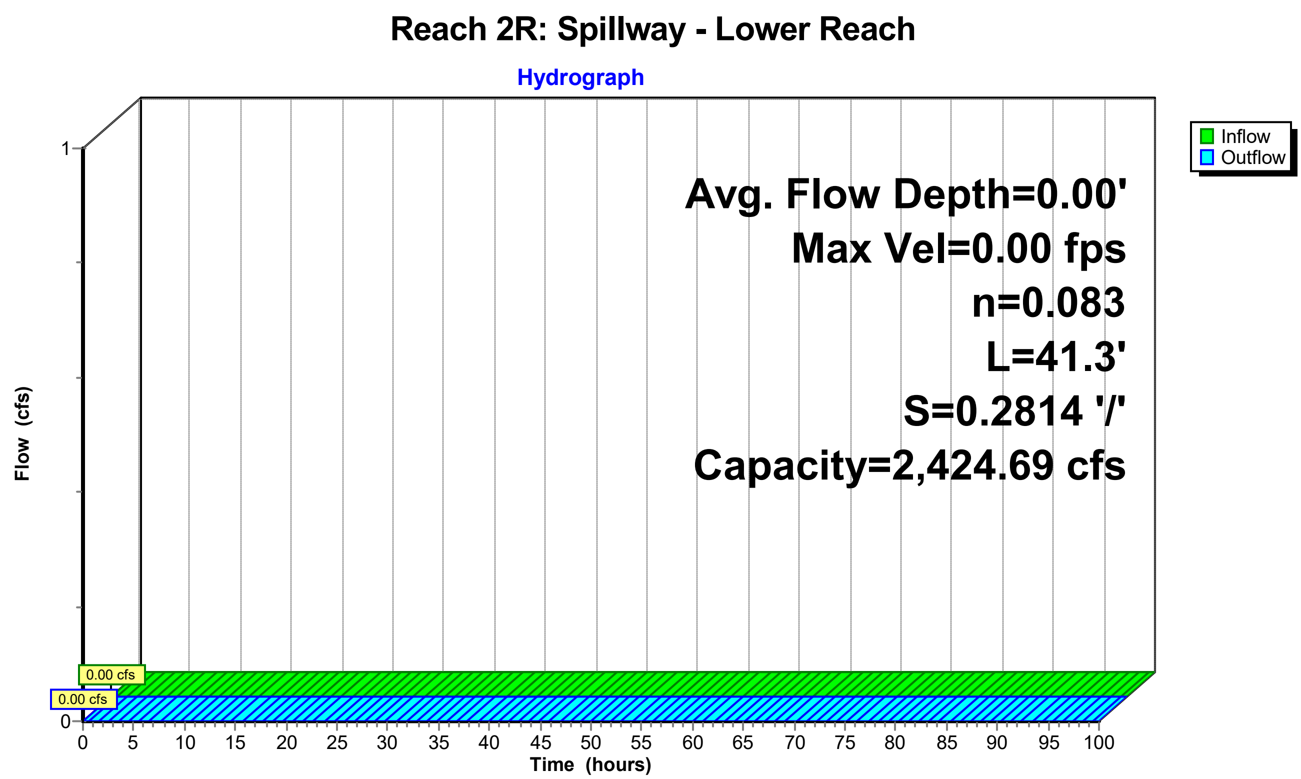
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'





Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

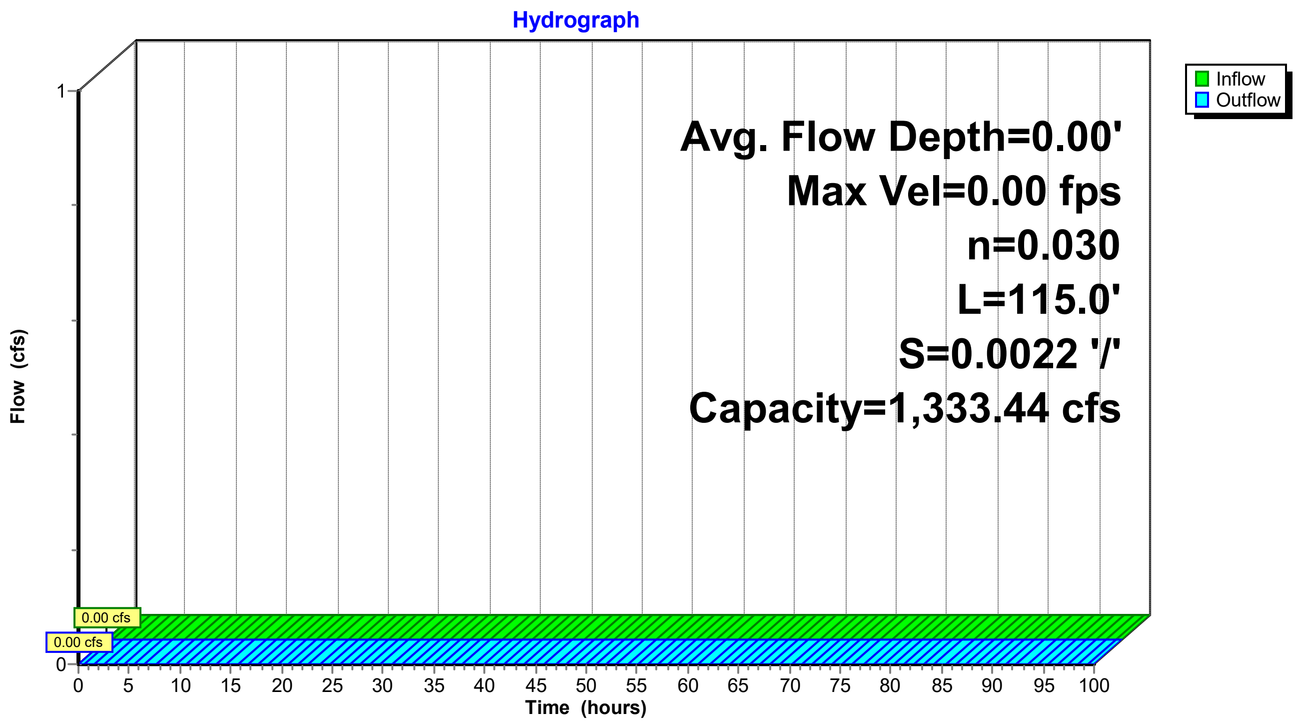
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 4R: Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

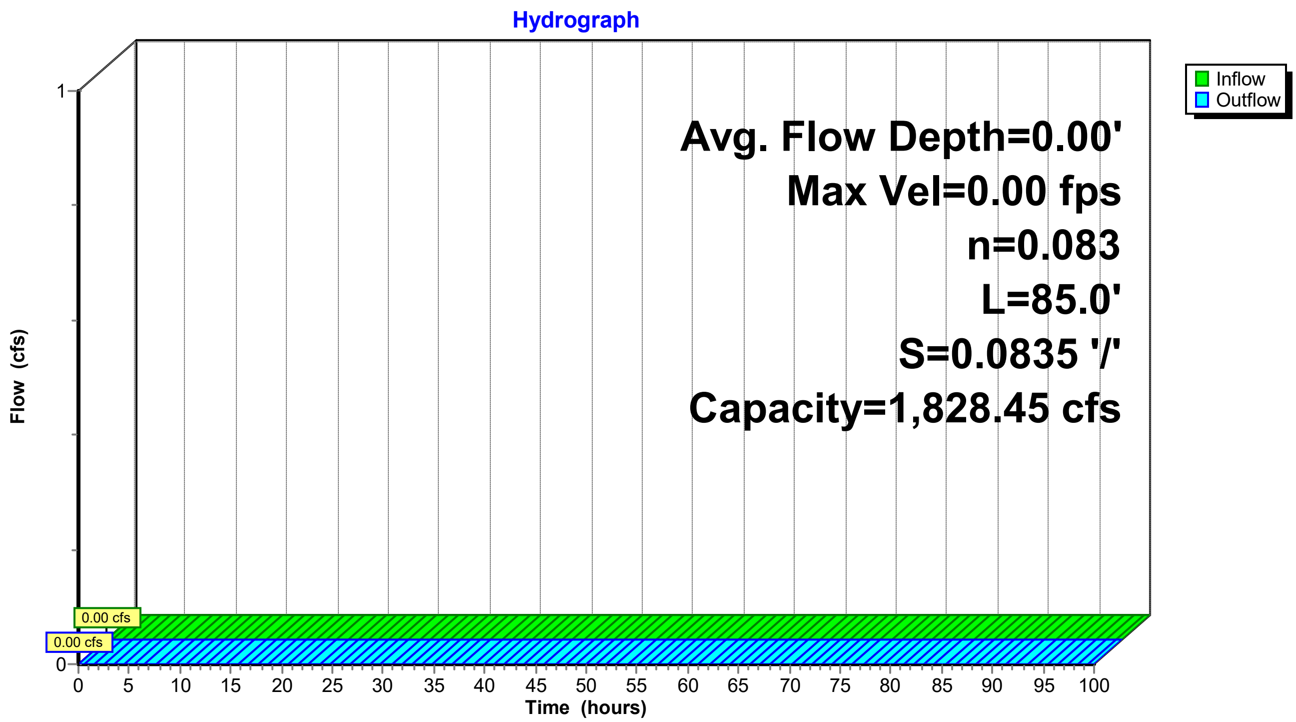
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 1,828.45 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0835 '/'
Inlet Invert= 451.10', Outlet Invert= 444.00'

‡

Reach 4R: Lower Reach



Summary for Reach 5R: Discharge Creek

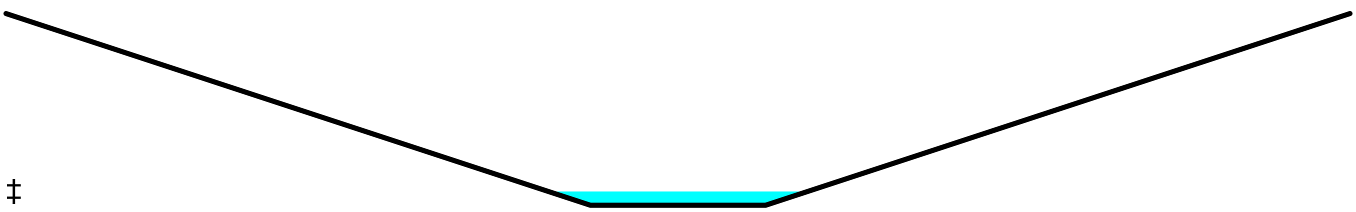
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.62' @ 33.02 hrs

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth > 4.18" for 10-Year event
Inflow = 10.38 cfs @ 33.00 hrs, Volume= 85.792 af
Outflow = 10.38 cfs @ 33.02 hrs, Volume= 85.743 af, Atten= 0%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 3.89 fps, Avg. Travel Time= 3.4 min

Peak Storage= 2,135 cf @ 33.02 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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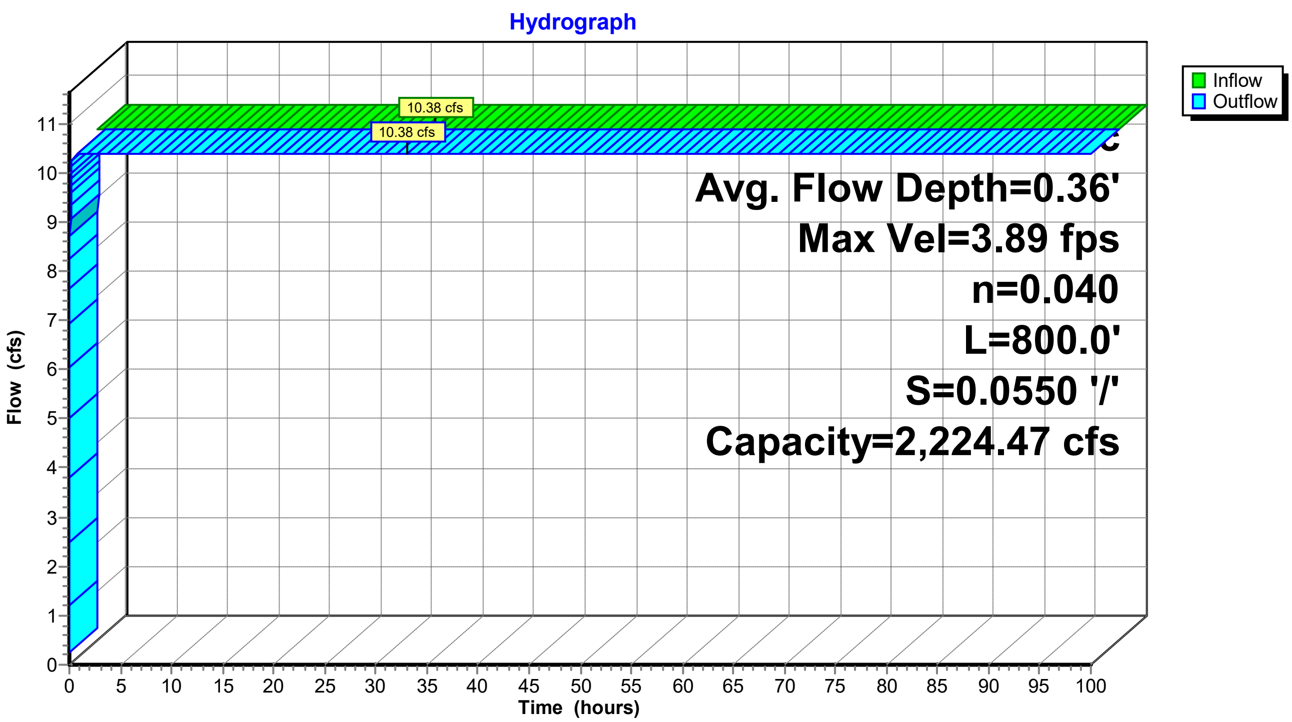
Reach 5R: Discharge Creek



Summary for Reach 6R: Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

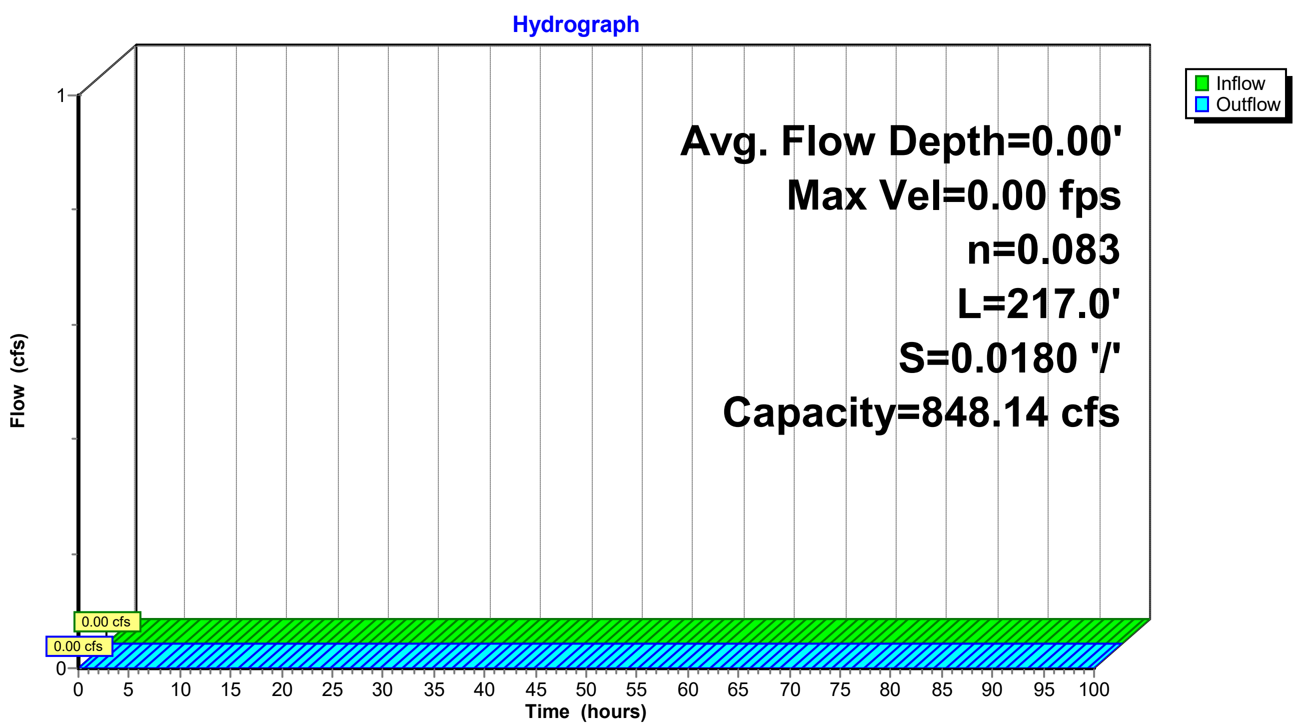
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 175.0 sf, Capacity= 848.14 cfs

10.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 5.0 '/' Top Width= 60.00'
Length= 217.0' Slope= 0.0180 '/'
Inlet Invert= 455.00', Outlet Invert= 451.10'

‡

Reach 6R: Upper Reach



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

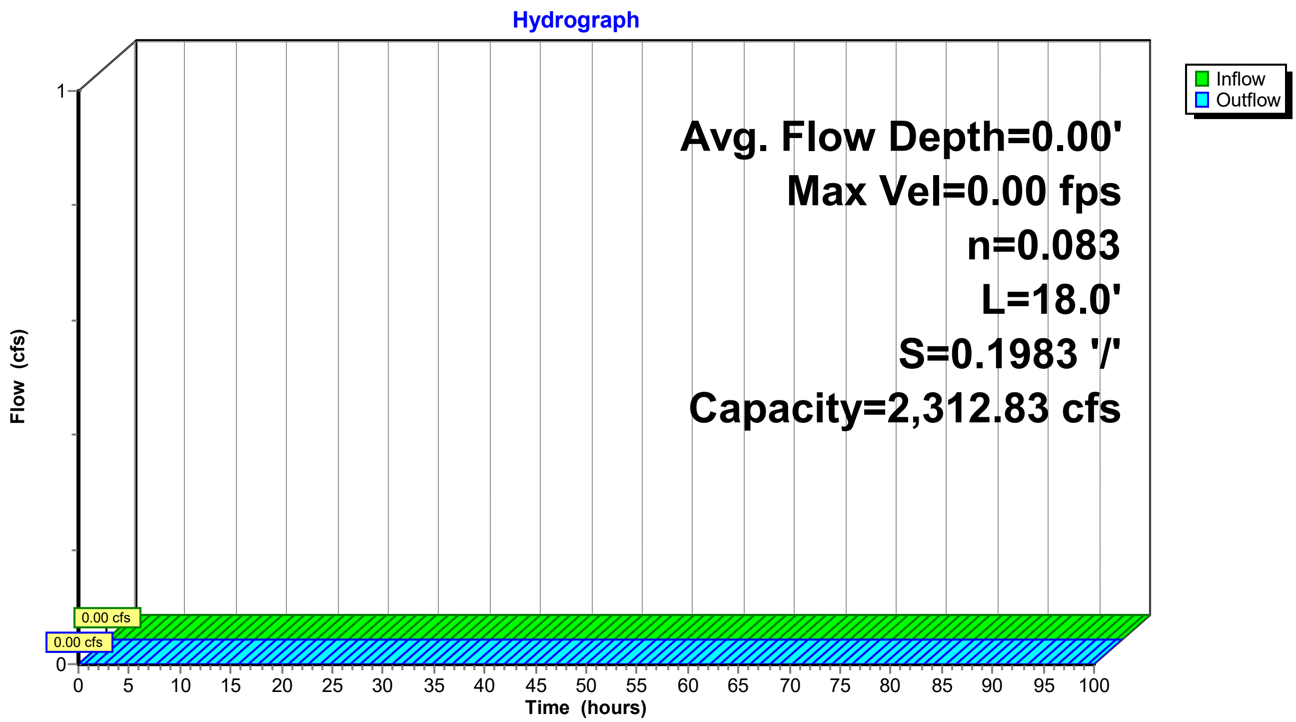
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



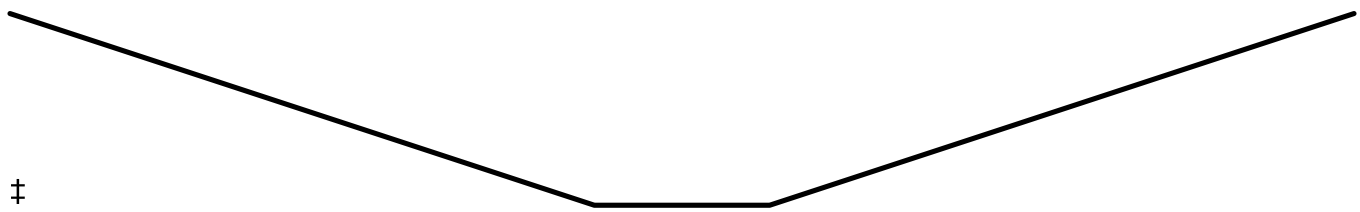
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

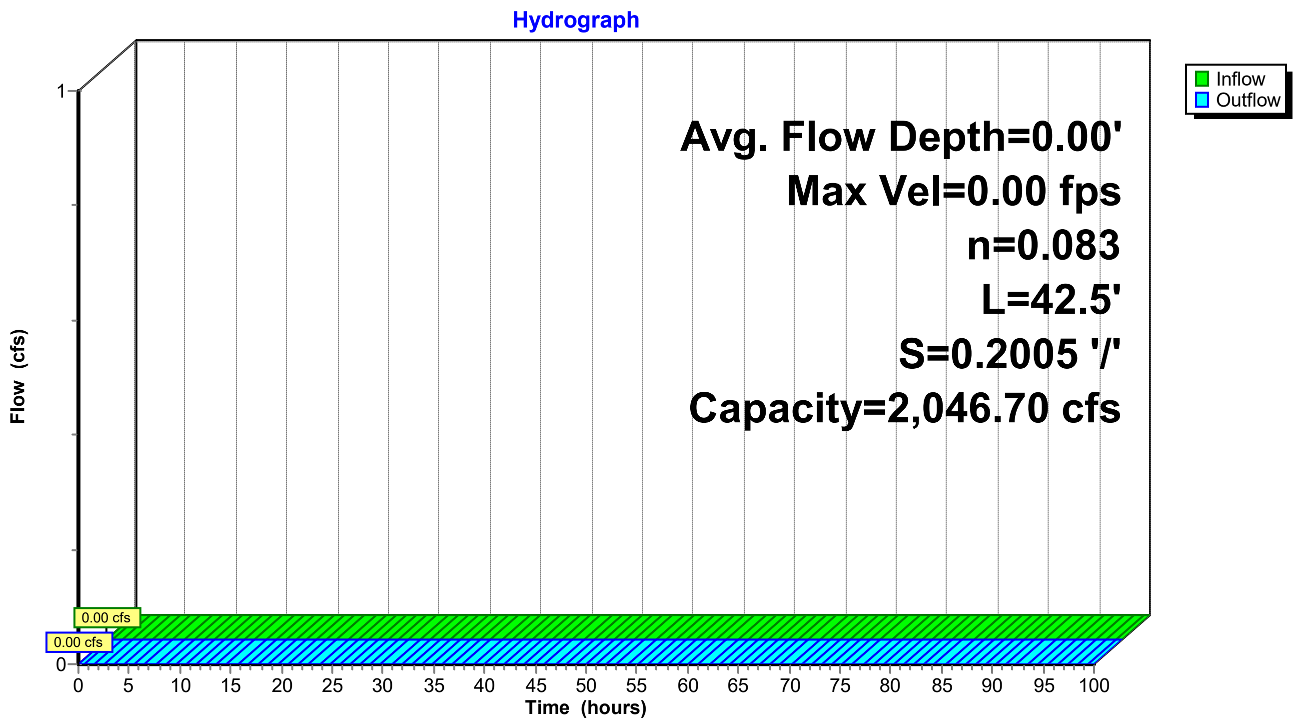
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



Reach 8R: Discharge Ditch



Summary for Reach 9R: Ditch C2 to C1

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C2 with Pool C1.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

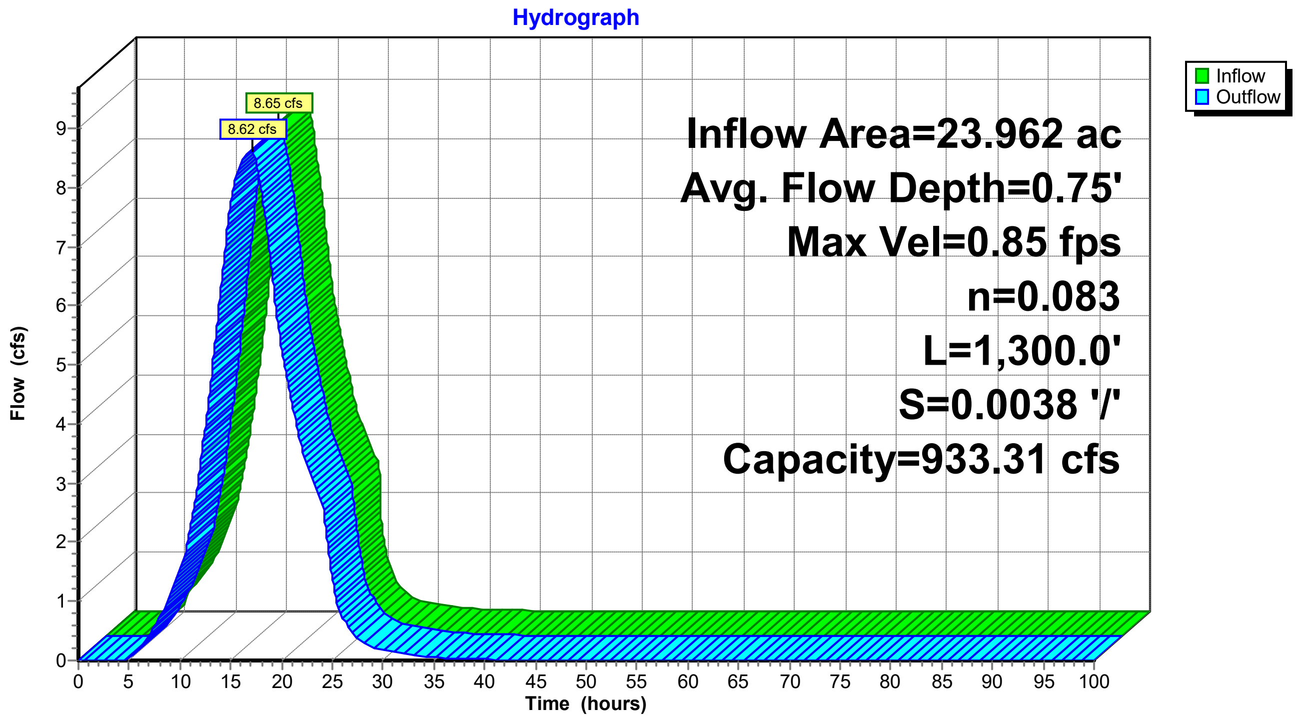
Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 8.65 cfs @ 16.91 hrs, Volume= 6.834 af
Outflow = 8.62 cfs @ 17.03 hrs, Volume= 6.834 af, Atten= 0%, Lag= 7.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.85 fps, Min. Travel Time= 25.4 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 67.2 min

Peak Storage= 13,146 cf @ 17.03 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 933.31 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 1,300.0' Slope= 0.0038 '/'
Inlet Invert= 440.00', Outlet Invert= 435.00'

Reach 9R: Ditch C2 to C1



Summary for Reach 10R: Ditch C1 to B

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool C1 with Pool B.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

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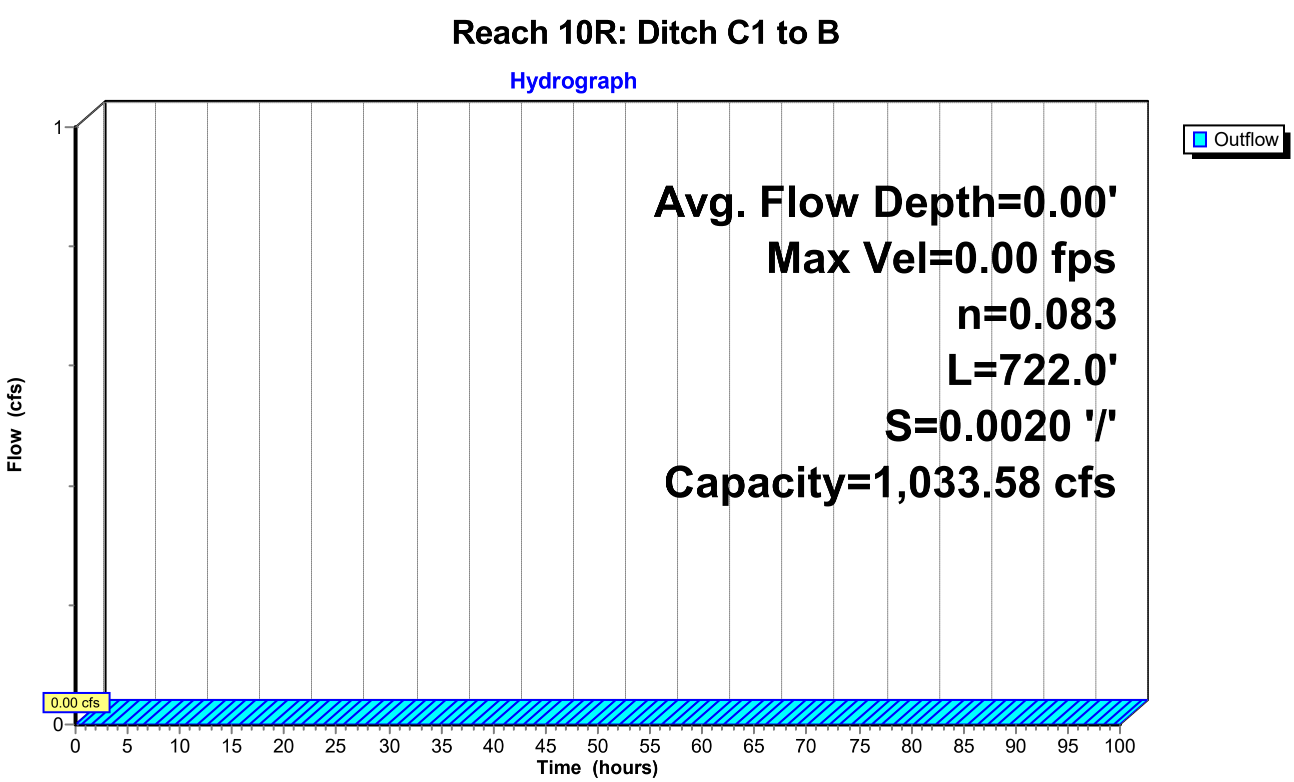
[43] Hint: Has no inflow (Outflow=Zero)

Bank-Full Depth= 10.00' Flow Area= 400.0 sf, Capacity= 1,033.58 cfs

15.00' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 2.5 '/' Top Width= 65.00'
Length= 722.0' Slope= 0.0020 '/'
Inlet Invert= 445.00', Outlet Invert= 443.56'



Summary for Reach 11R: Ditch B to A

Reach is intended to represent the excavated (cut) ditch that hydraulically connects Pool B with Pool A. - REV to include ditch from C1 to B and ditch cut through pool B area - assuming contractor will not excavate out a pool here.

Accounting for the sluggish, ash filled surface of the excavated ditch (that is also possible filled with weeds/vegetation) a Manning's N value of 0.083 is assumed.

See dwg file Drainage Area - Storage Volumes.dwg for side slopes and other geometric features of the reach.

---

[62] Hint: Exceeded Reach 9R OUTLET depth by 0.45' @ 16.92 hrs

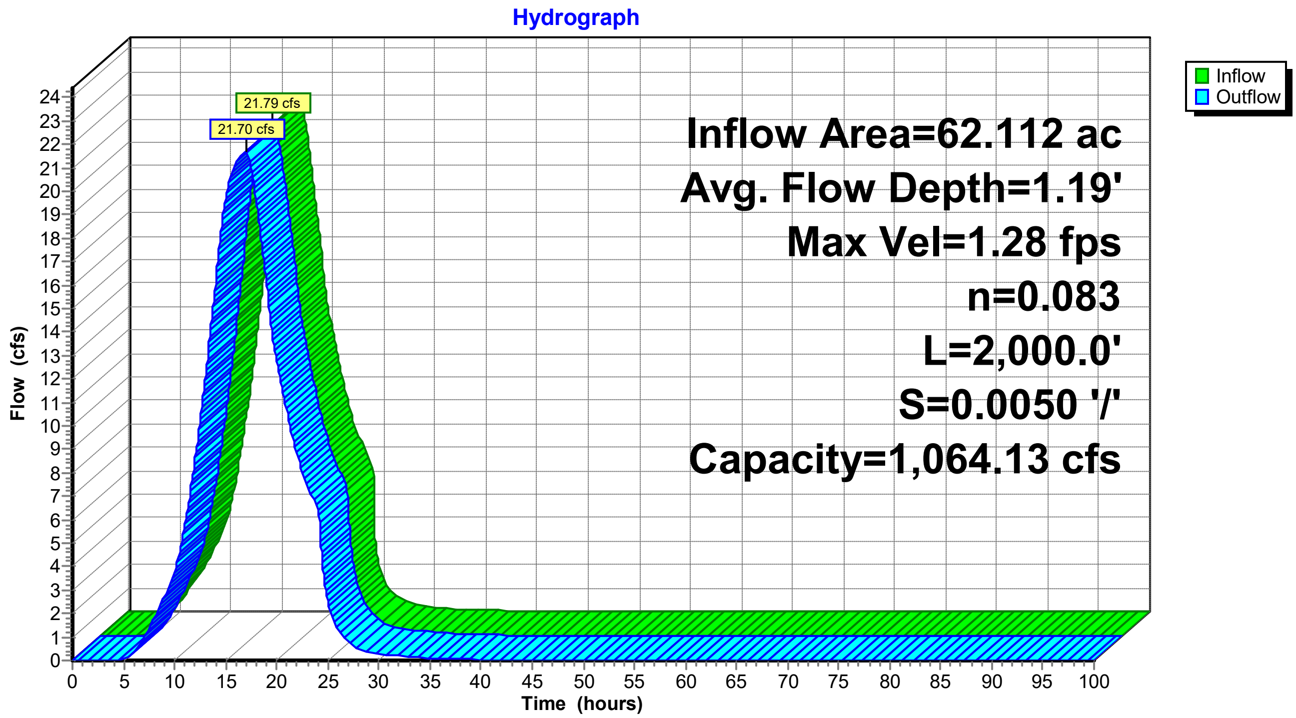
Inflow Area = 62.112 ac, 36.44% Impervious, Inflow Depth = 3.24" for 10-Year event
Inflow = 21.79 cfs @ 16.86 hrs, Volume= 16.781 af
Outflow = 21.70 cfs @ 16.96 hrs, Volume= 16.781 af, Atten= 0%, Lag= 5.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.28 fps, Min. Travel Time= 26.0 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 80.1 min

Peak Storage= 33,851 cf @ 16.96 hrs
Average Depth at Peak Storage= 1.19'
Bank-Full Depth= 10.00' Flow Area= 265.0 sf, Capacity= 1,064.13 cfs

12.50' x 10.00' deep channel, n= 0.083
Side Slope Z-value= 1.4 '/' Top Width= 40.50'
Length= 2,000.0' Slope= 0.0050 '/'
Inlet Invert= 435.00', Outlet Invert= 425.00'

Reach 11R: Ditch B to A



Summary for Pond 3P: Pool C1

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af, Atten= 0%, Lag= 0.0 min
Primary	=	40.05 cfs @	0.00 hrs, Volume=	2.886 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 446.00' Surf.Area= 0.000 ac Storage= 7.570 af
Peak Elev= 446.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 7.570 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

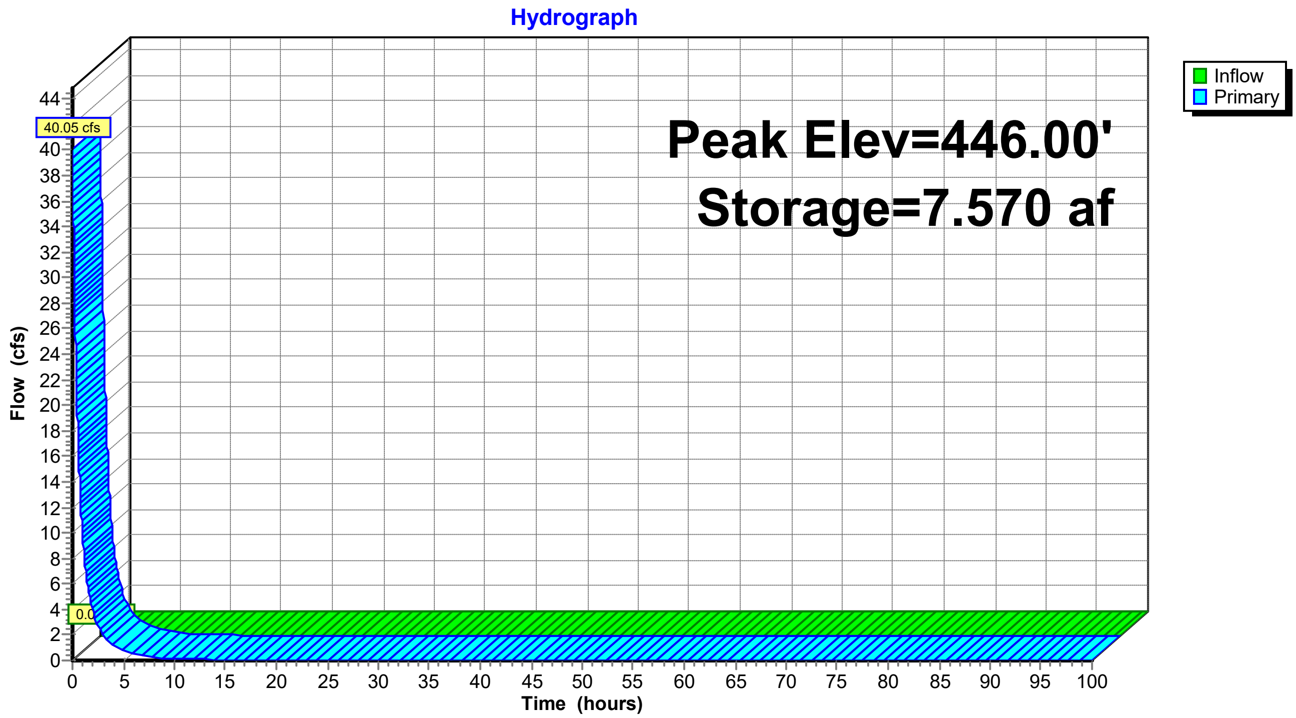
Volume	Invert	Avail.Storage	Storage Description
#1	441.00'	110.990 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
441.00	0.000
443.00	1.430
445.00	4.700
447.00	10.440
449.00	20.010
451.00	33.870
453.00	43.520
454.00	57.010
455.00	70.500
456.00	83.990
457.00	97.490
458.00	110.990

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=40.05 cfs @ 0.00 hrs HW=446.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 40.05 cfs @ 2.67 fps)

Pond 3P: Pool C1



Summary for Pond 4P: Pool C2

Inflow Area = 23.962 ac, 48.13% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 8.70 cfs @ 16.85 hrs, Volume= 6.834 af
Outflow = 8.65 cfs @ 16.91 hrs, Volume= 6.834 af, Atten= 1%, Lag= 3.7 min
Primary = 8.65 cfs @ 16.91 hrs, Volume= 6.834 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 1.995 af
Peak Elev= 440.77' @ 17.01 hrs Surf.Area= 0.000 ac Storage= 2.509 af (0.514 af above start)

Plug-Flow detention time= 292.3 min calculated for 4.839 af (71% of inflow)
Center-of-Mass det. time= 57.6 min (1,007.6 - 950.0)

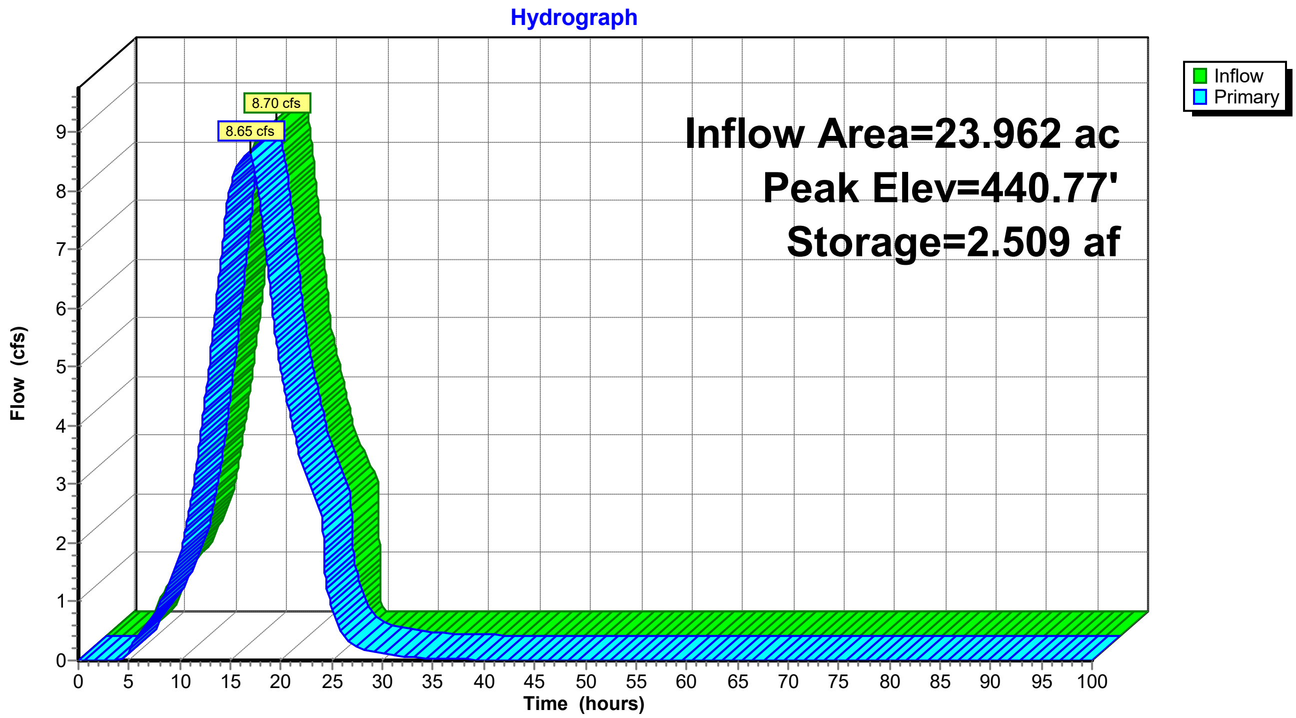
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	61.600 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
441.00	2.660
443.00	4.970
445.00	8.440
447.00	13.290
449.00	19.180
451.00	26.090
453.00	28.800
454.00	35.350
455.00	41.910
456.00	48.470
457.00	55.020
458.00	61.600

Device	Routing	Invert	Outlet Devices
#1	Primary	440.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=8.64 cfs @ 16.91 hrs HW=440.77' TW=440.75' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 8.64 cfs @ 0.75 fps)

Pond 4P: Pool C2



Summary for Pond 5P: Pool B

Pool B is currenty dry. A storage has been assigned with the assumption that some ash will be removed to create necessary storage.

[61] Hint: Exceeded Reach 10R outlet invert by 1.44' @ 0.00 hrs

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min
Primary	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 445.00' Surf.Area= 0.000 ac Storage= 24.000 af
Peak Elev= 445.00' @ 0.00 hrs Surf.Area= 0.000 ac Storage= 24.000 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

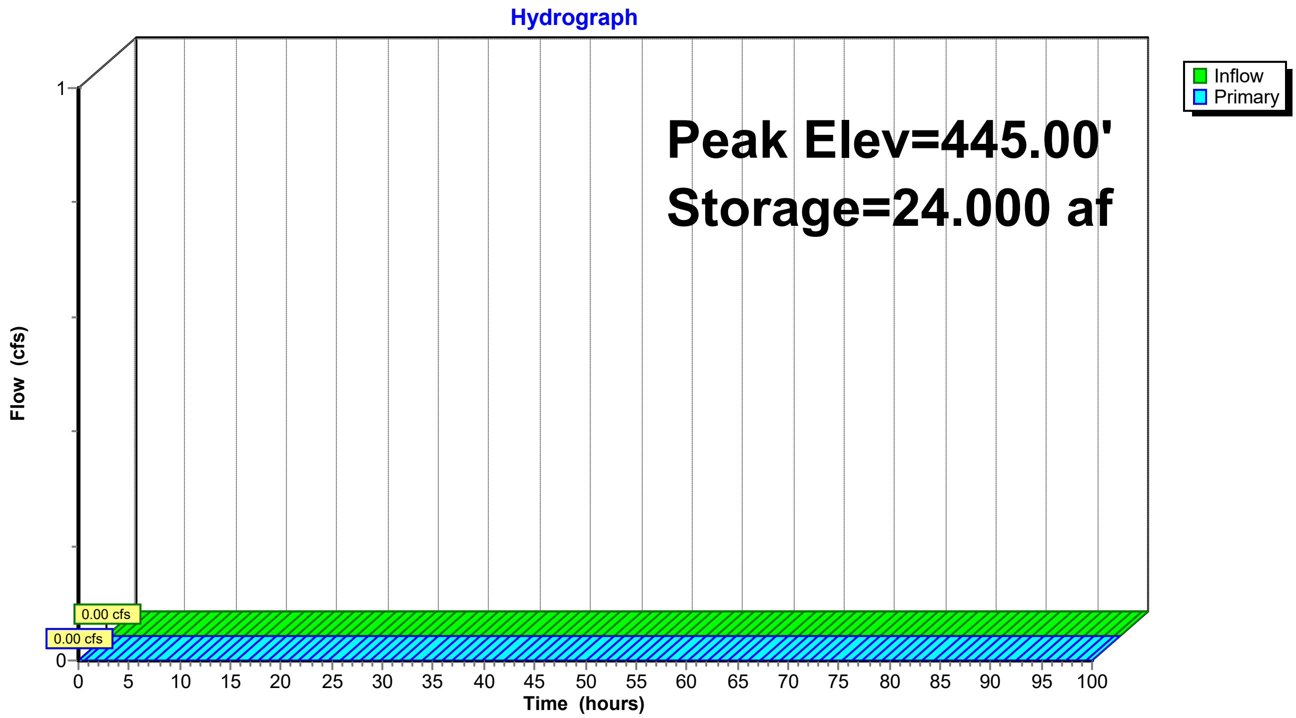
Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	40.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
438.00	0.000
439.00	0.550
440.00	1.480
441.00	3.480
442.00	8.920
443.00	12.160
444.00	18.000
445.00	24.000
446.00	32.000
447.00	40.000

Device	Routing	Invert	Outlet Devices
#1	Primary	445.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=445.00' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: Pool B



Summary for Pond 6P: Pool A

Excavation of the Ash Pond is assumed to be occur concentrically, moving inwards towards a low point that will drain eventually to Pool A.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

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[63] Warning: Exceeded Reach 11R INLET depth by 9.66' @ 24.98 hrs

Inflow Area = 106.882 ac, 31.95% Impervious, Inflow Depth = 3.17" for 10-Year event
Inflow = 36.88 cfs @ 16.95 hrs, Volume= 28.198 af
Outflow = 14.52 cfs @ 21.90 hrs, Volume= 28.173 af, Atten= 61%, Lag= 297.3 min
Primary = 14.52 cfs @ 21.90 hrs, Volume= 28.173 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 440.00' Surf.Area= 0.000 ac Storage= 98.790 af
Peak Elev= 445.17' @ 21.90 hrs Surf.Area= 0.000 ac Storage= 109.041 af (10.251 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 262.0 min (1,272.9 - 1,011.0)

Volume	Invert	Avail.Storage	Storage Description
#1	425.00'	120.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
425.00	0.000
426.00	0.010
427.00	5.580
428.00	14.560
429.00	22.630
430.00	32.150
431.00	40.000
432.00	45.000
433.00	54.690
434.00	67.810
435.00	82.530
436.00	90.470
440.00	98.790
443.00	106.960
445.00	108.000
447.00	120.000

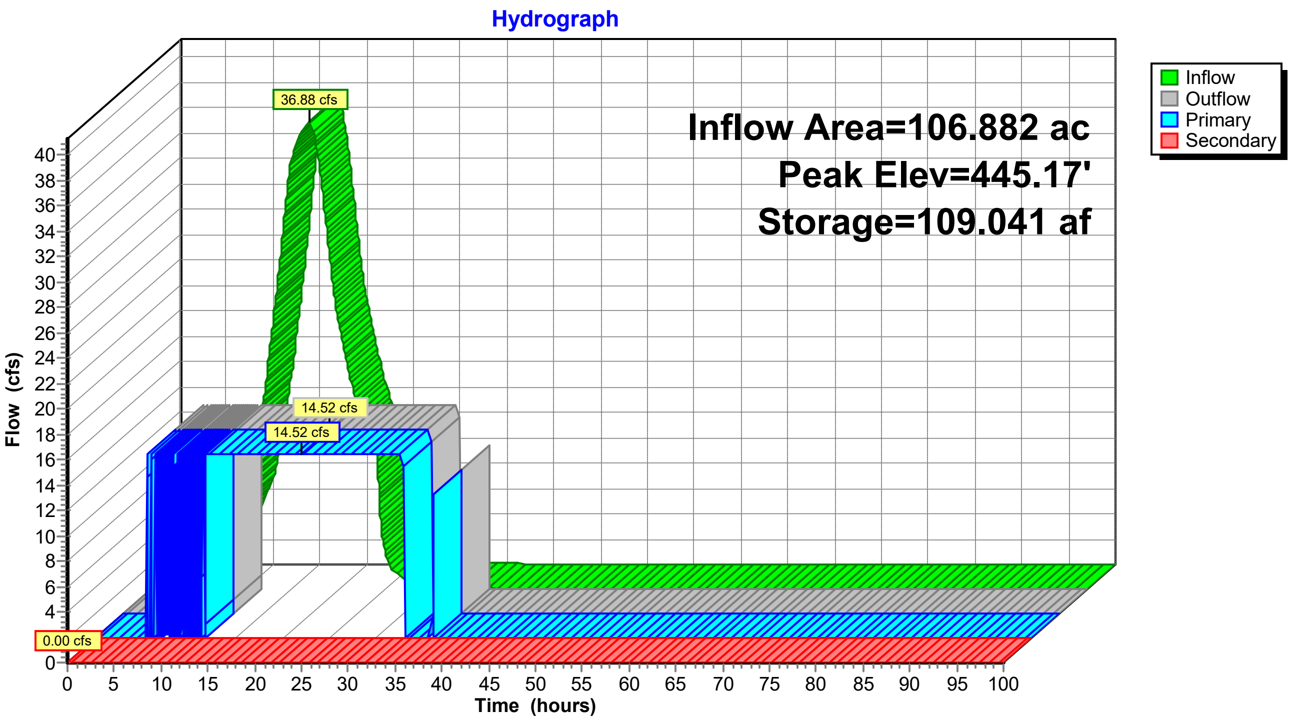
Device	Routing	Invert	Outlet Devices
#1	Primary	440.01'	**Pump** Discharges@455.00' Turns Off@440.00' 12.0" Diam. x 1,000.0' Long Discharge, Hazen-Williams C= 130 Flow (gpm)= 6,516.0 6,516.1

			Head (feet)= 500.00 0.00
			-Loss (feet)= 81.57 81.57
			=Lift (feet)= 418.43 -81.57
#2	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=14.52 cfs @ 21.90 hrs HW=445.17' TW=438.38' (Dynamic Tailwater)
└—**1=Pump** (Pump Controls 14.52 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=440.00' TW=455.00' (Dynamic Tailwater)
└—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Pool A



Summary for Pond 7P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 246.462 ac, 57.38% Impervious, Inflow Depth = 3.65" for 10-Year event
Inflow = 68.54 cfs @ 15.71 hrs, Volume= 74.949 af
Outflow = 10.38 cfs @ 33.00 hrs, Volume= 85.792 af, Atten= 85%, Lag= 1,037.7 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 10.38 cfs @ 33.00 hrs, Volume= 85.792 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 435.00' Surf.Area= 0.000 ac Storage= 80.240 af
Peak Elev= 439.00' @ 33.00 hrs Surf.Area= 0.000 ac Storage= 126.840 af (46.600 af above start)

Plug-Flow detention time= 5,426.9 min calculated for 5.552 af (7% of inflow)
Center-of-Mass det. time= 1,950.5 min (3,000.0 - 1,049.5)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

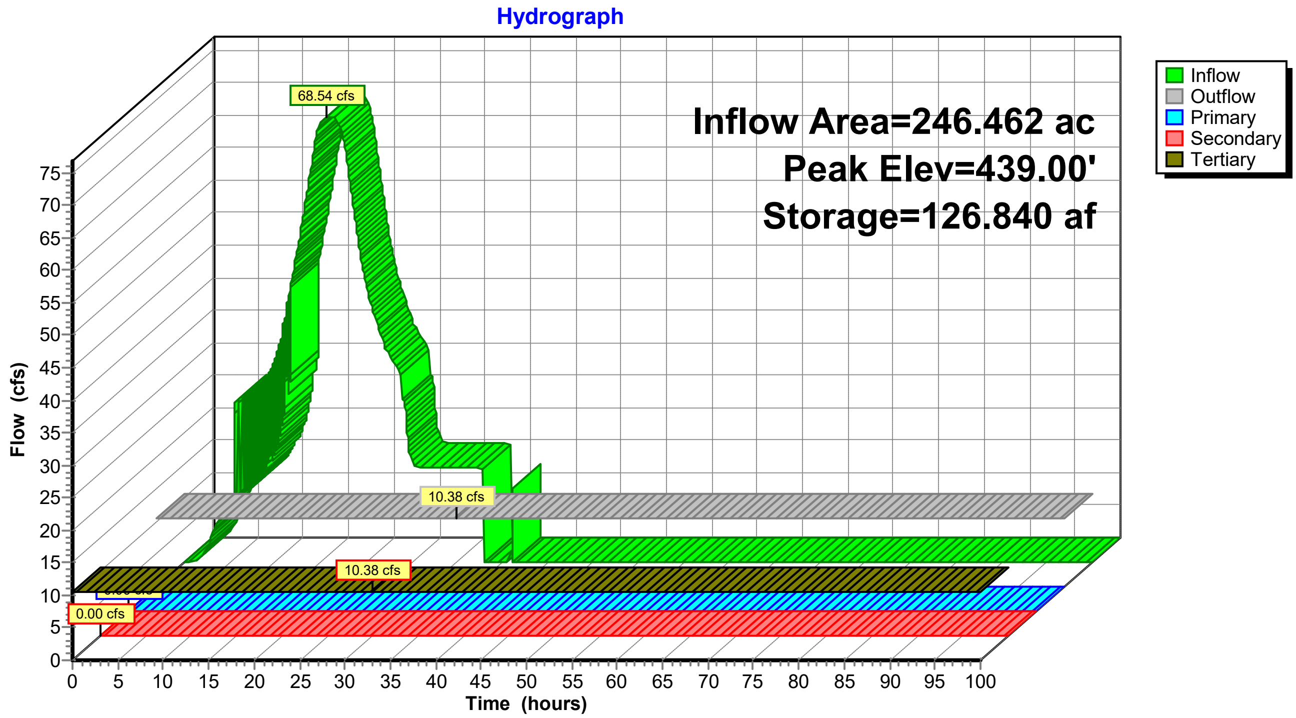
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	430.50'	**Pump** Discharges@450.90' Turns Off@430.01' Flow (gpm)= 4,659.0 4,659.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=428.04' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 84.28 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)

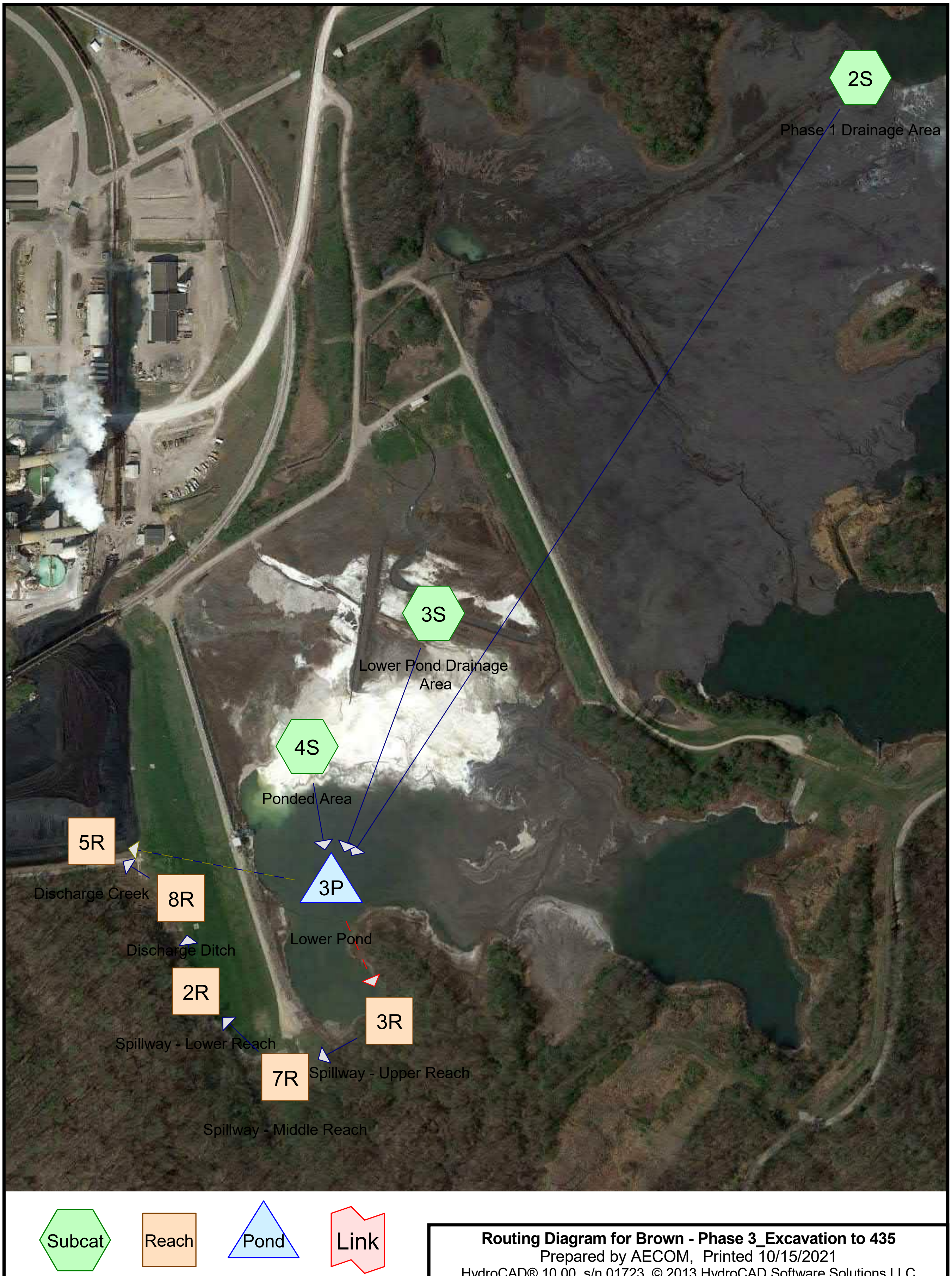
Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=435.00' TW=447.00' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Tertiary OutFlow Max=10.38 cfs @ 33.00 hrs HW=439.00' TW=428.36' (Dynamic Tailwater)
4=Pump (Pump Controls 10.38 cfs)

Pond 7P: Lower Pond



MILESTONE 4



Routing Diagram for Brown - Phase 3_Excavation to 435
Prepared by AECOM, Printed 10/15/2021
HydroCAD® 10.00 s/n 01723 © 2013 HydroCAD Software Solutions LLC

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subca Numb
0.000	0.000	99.830	0.000	0.000	99.830	50-75% Grass cover, Fair	
0.000	0.000	0.000	0.000	71.720	71.720	Ash	
0.000	0.000	0.000	0.000	34.150	34.150	Ash (Formerly Water Surface in Phase 1)	
0.000	0.000	35.560	0.000	0.000	35.560	Water Surface	
0.000	**0.000**	**135.390**	**0.000**	**105.870**	**241.260**	**TOTAL AREA**	

Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

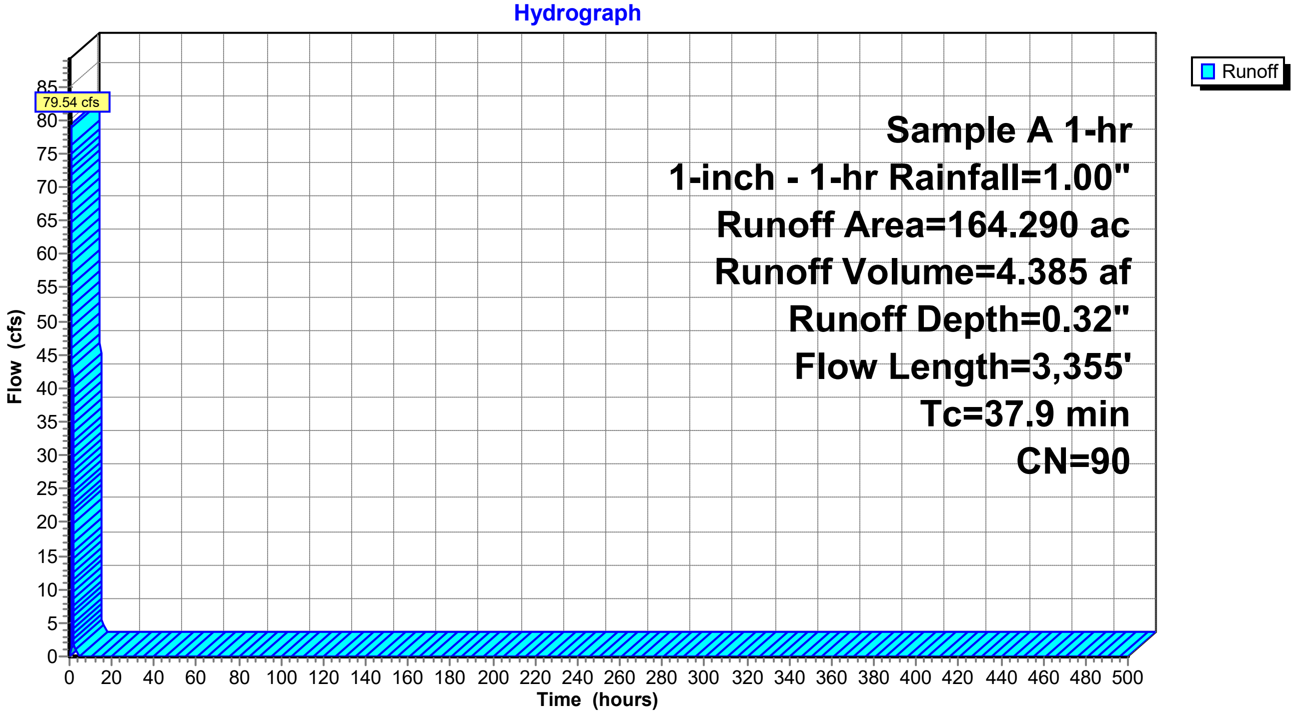
Runoff = 79.54 cfs @ 1.10 hrs, Volume= 4.385 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	34.150	98	Ash (Formerly Water Surface in Phase 1)
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

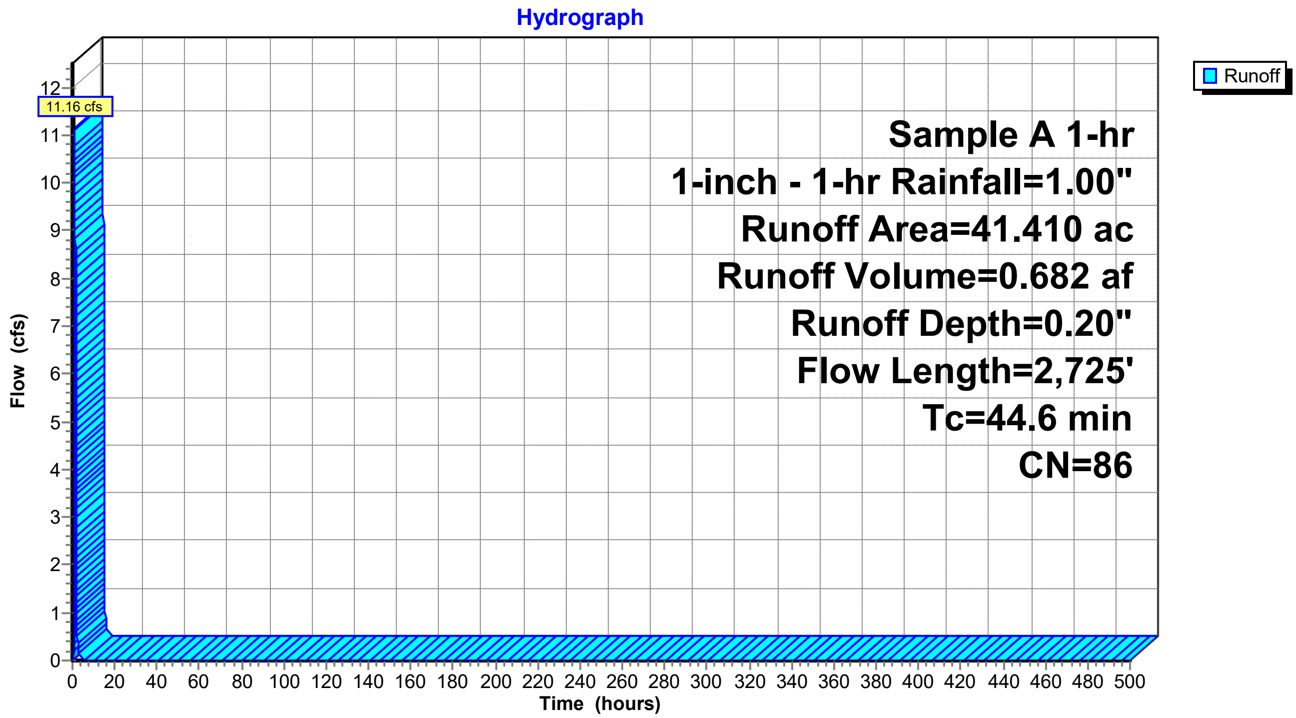
Runoff = 11.16 cfs @ 1.23 hrs, Volume= 0.682 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

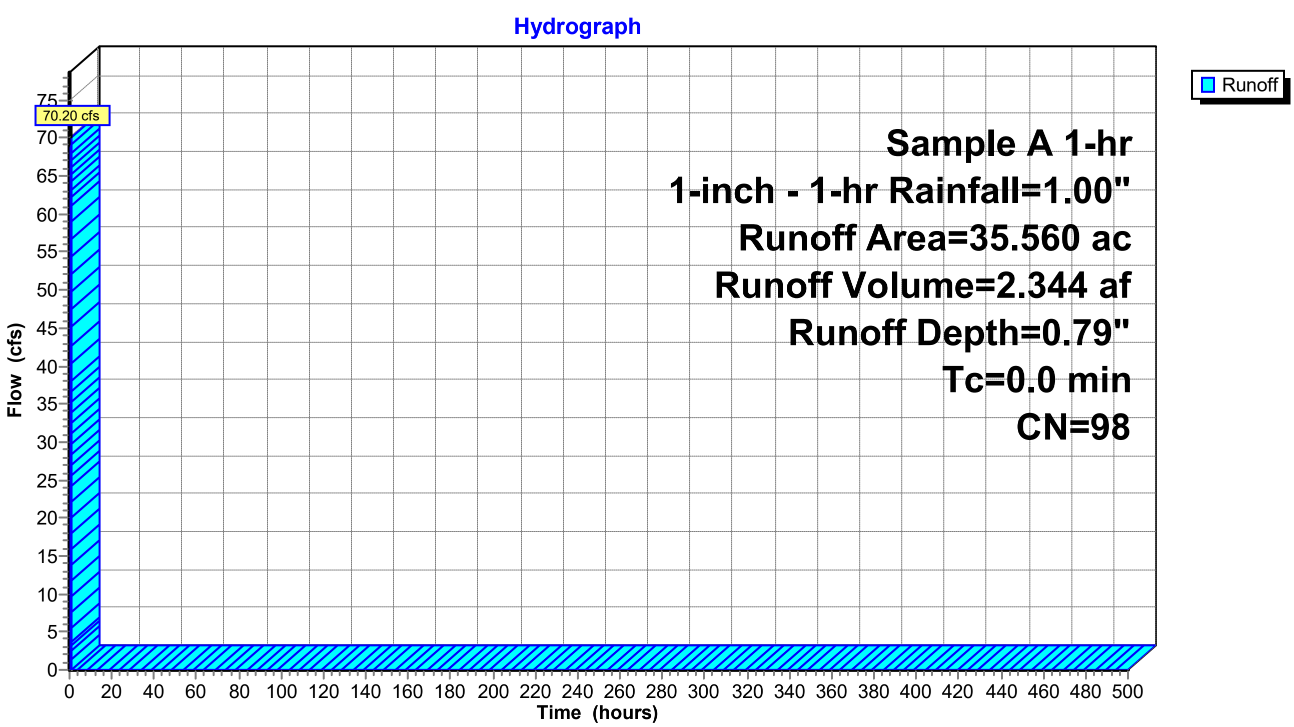
Runoff = 70.20 cfs @ 0.50 hrs, Volume= 2.344 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



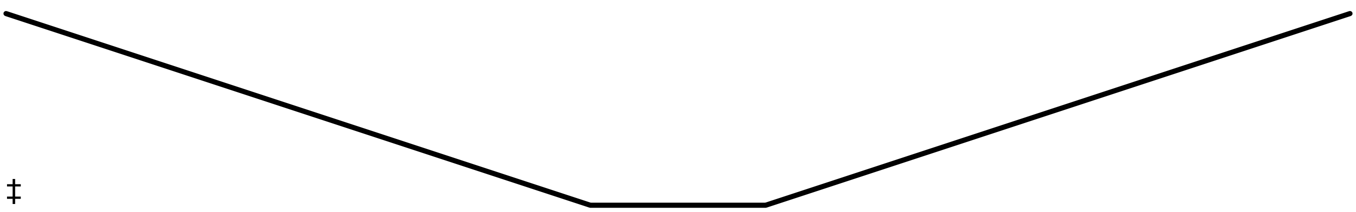
Summary for Reach 2R: Spillway - Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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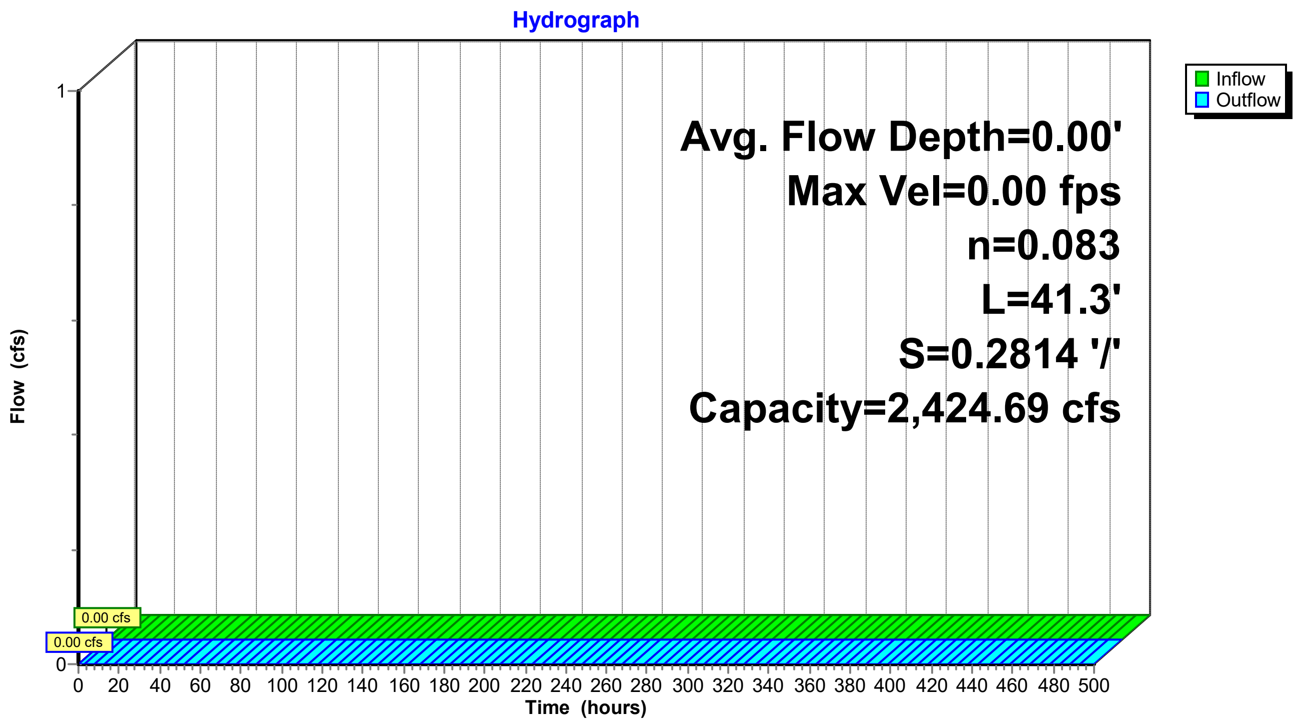
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

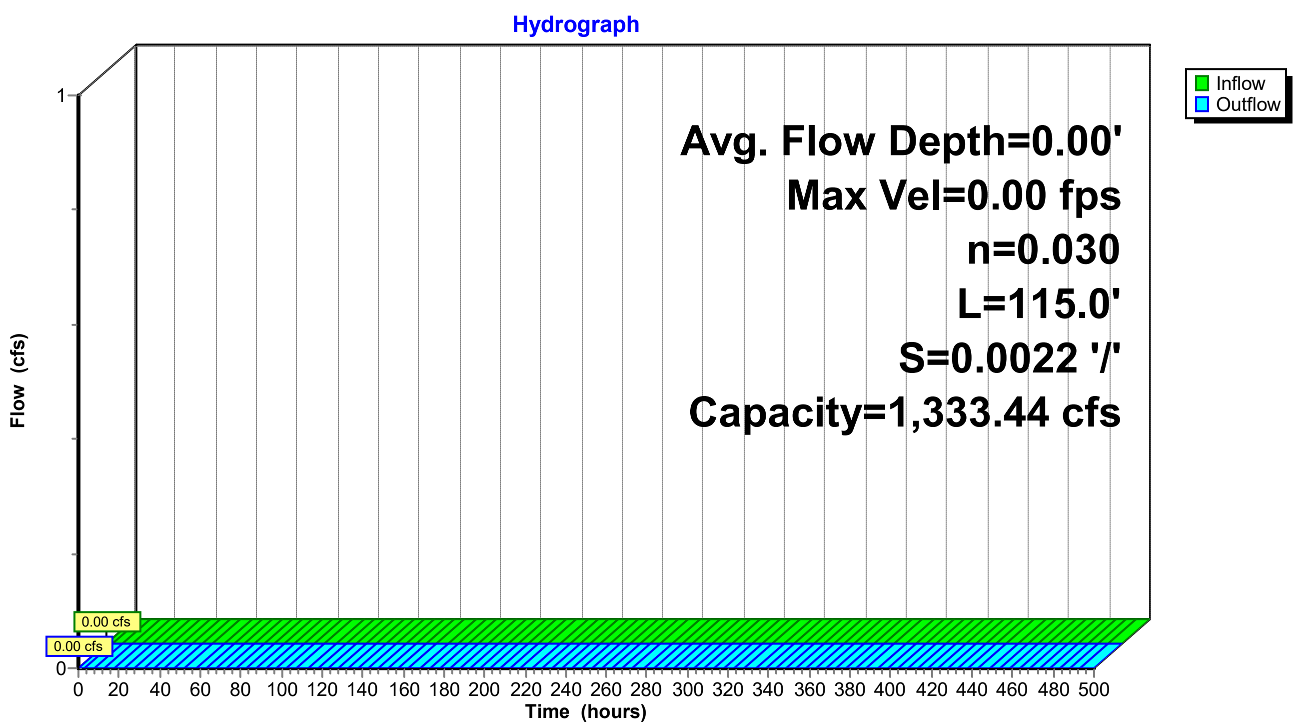
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

Reach 3R: Spillway - Upper Reach



Summary for Reach 5R: Discharge Creek

[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 1.79 hrs

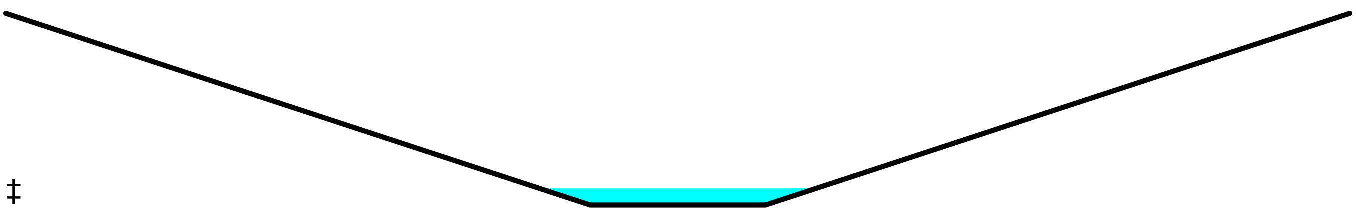
Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 1.91" for 1-inch - 1-hr event
Inflow = 14.52 cfs @ 1.76 hrs, Volume= 38.463 af
Outflow = 14.52 cfs @ 1.80 hrs, Volume= 38.463 af, Atten= 0%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 4.17 fps, Avg. Travel Time= 3.2 min

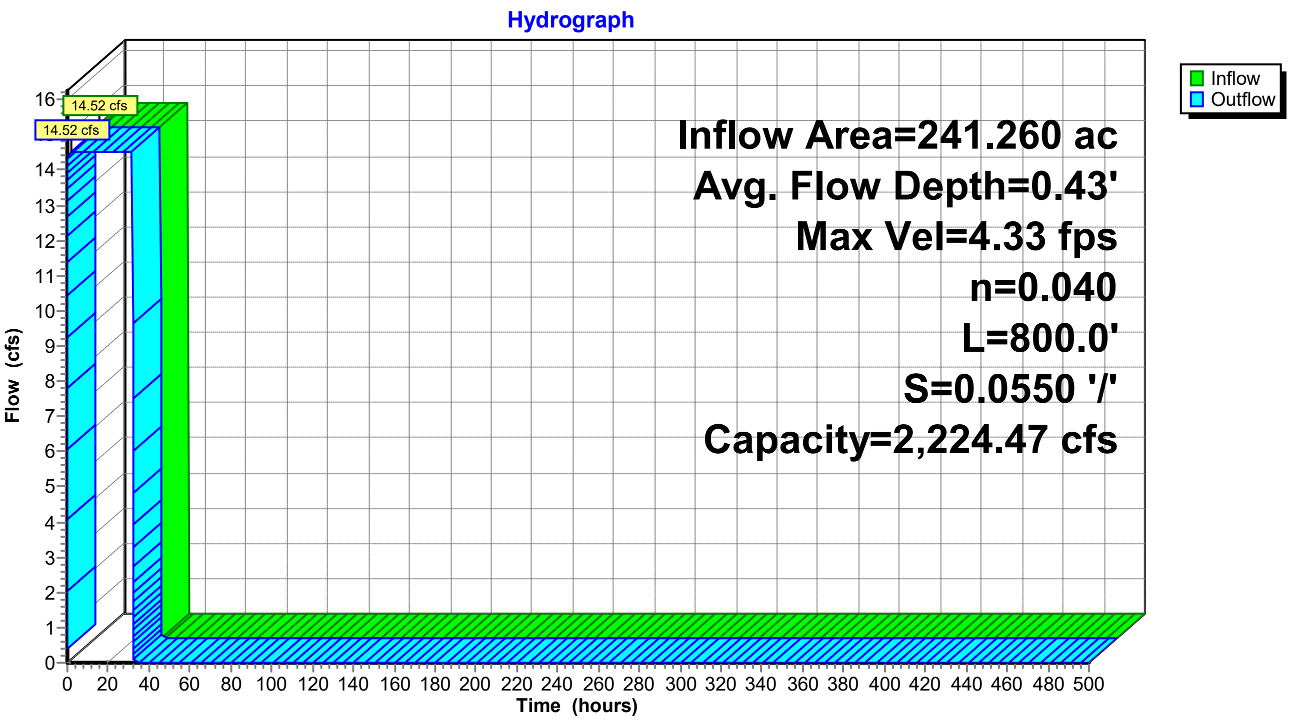
Peak Storage= 2,680 cf @ 1.80 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'

‡



Reach 5R: Discharge Creek



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

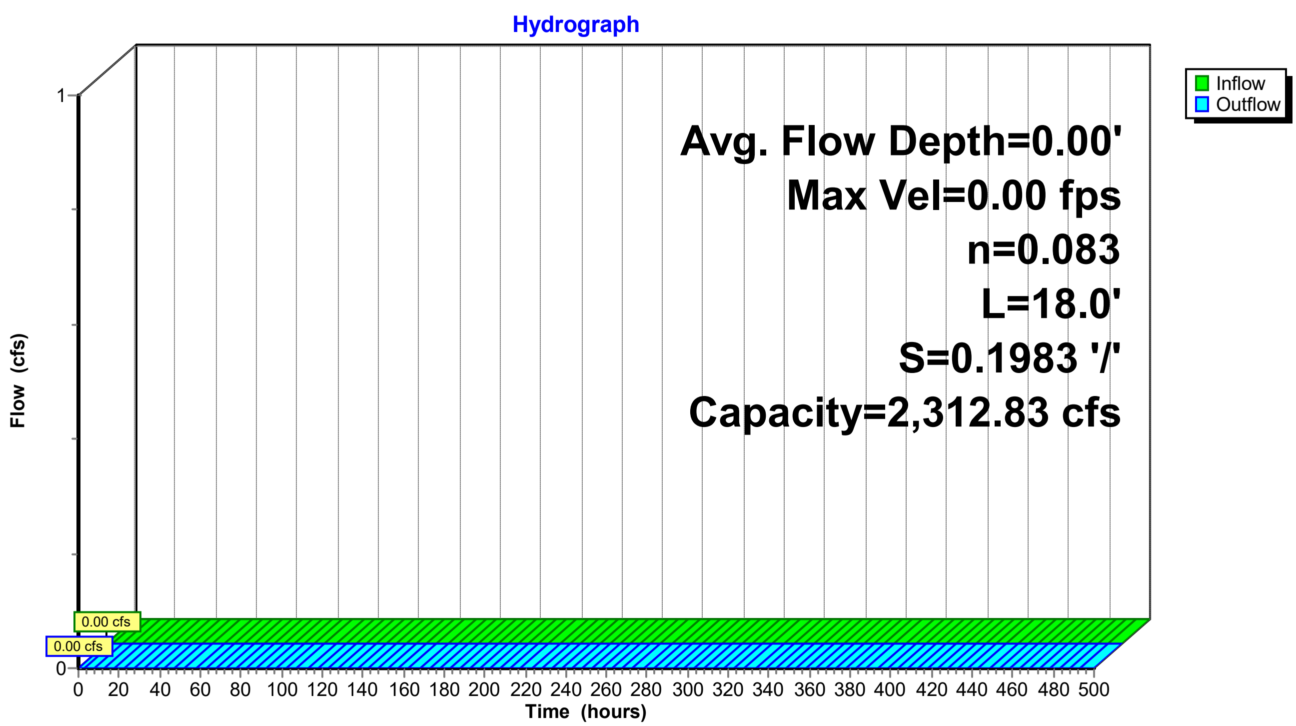
Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



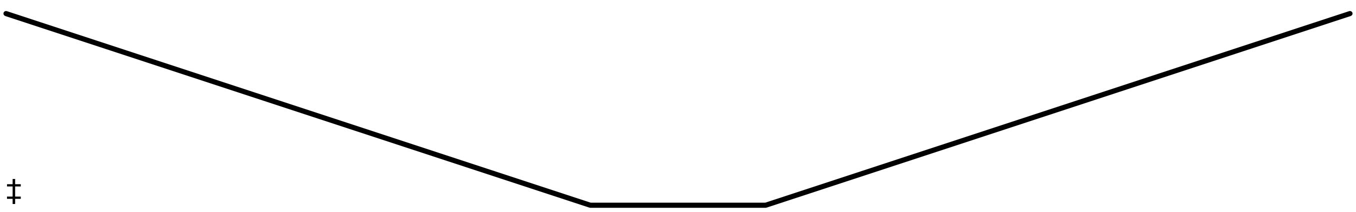
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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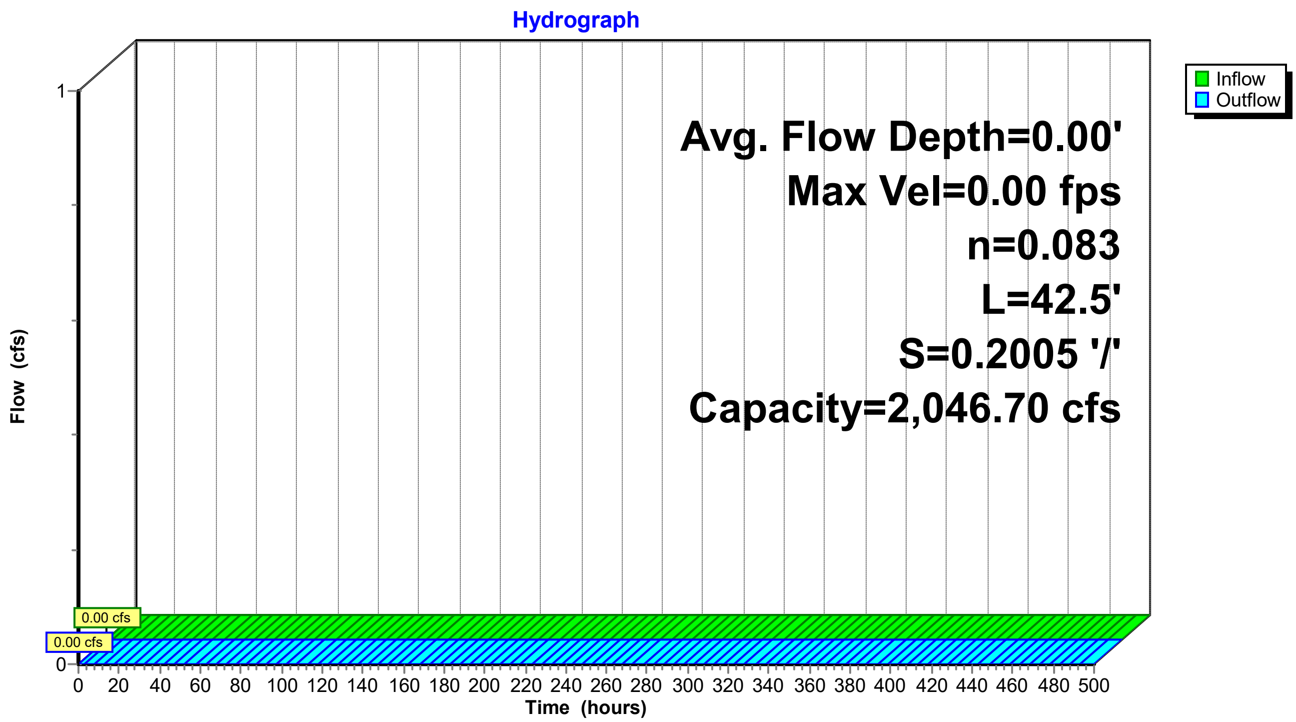
Reach 8R: Discharge Ditch



Summary for Pond 3P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.37" for 1-inch - 1-hr event
Inflow = 89.91 cfs @ 1.13 hrs, Volume= 7.410 af
Outflow = 14.52 cfs @ 1.76 hrs, Volume= 38.463 af, Atten= 84%, Lag= 37.8 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 1.76 hrs, Volume= 38.463 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Starting Elev= 430.00' Surf.Area= 0.000 ac Storage= 42.320 af
Peak Elev= 430.66' @ 1.76 hrs Surf.Area= 0.000 ac Storage= 47.306 af (4.986 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 901.0 min (961.5 - 60.5)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

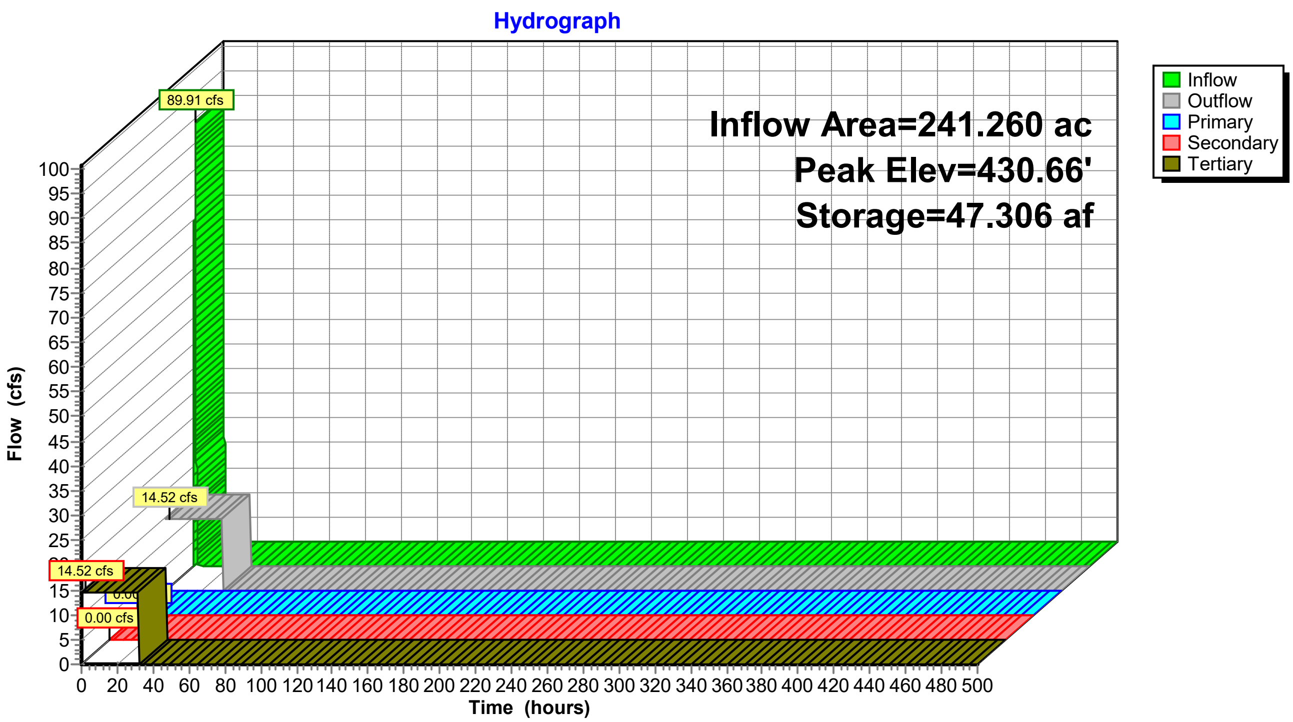
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=428.05' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 44.59 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 1.76 hrs HW=430.66' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 3P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

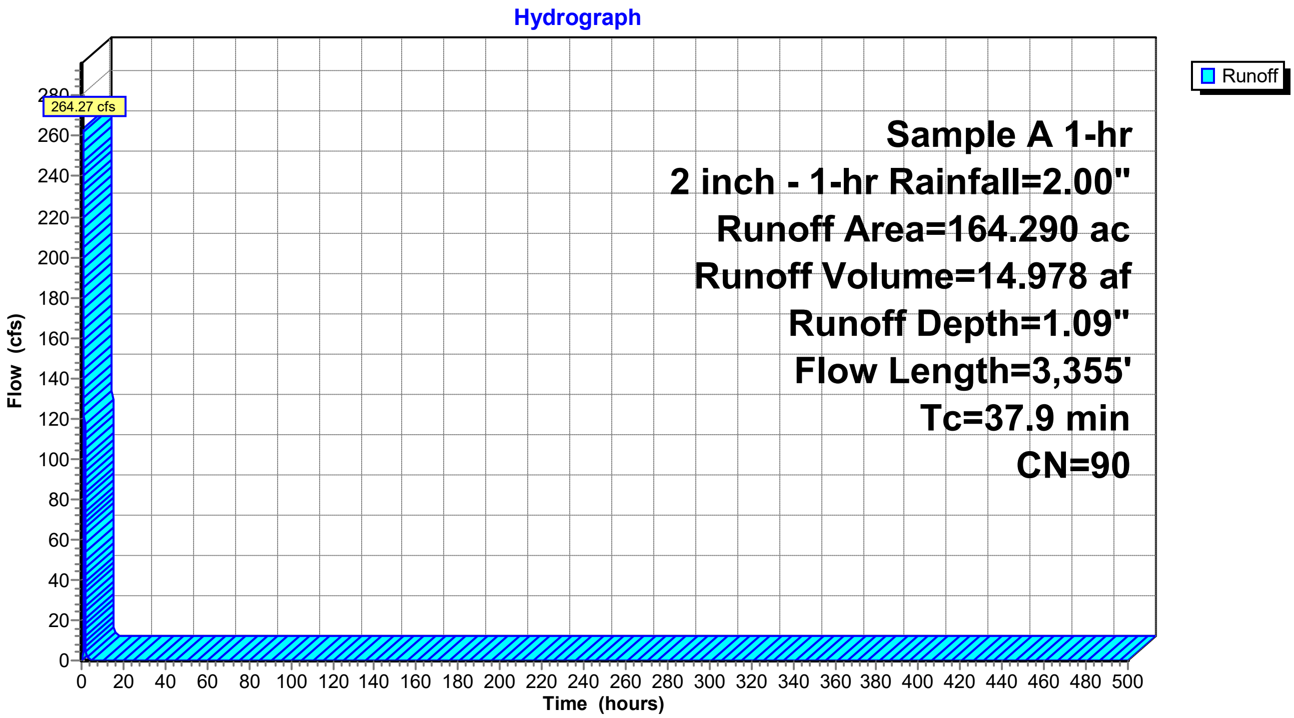
Runoff = 264.27 cfs @ 1.06 hrs, Volume= 14.978 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	34.150	98	Ash (Formerly Water Surface in Phase 1)
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

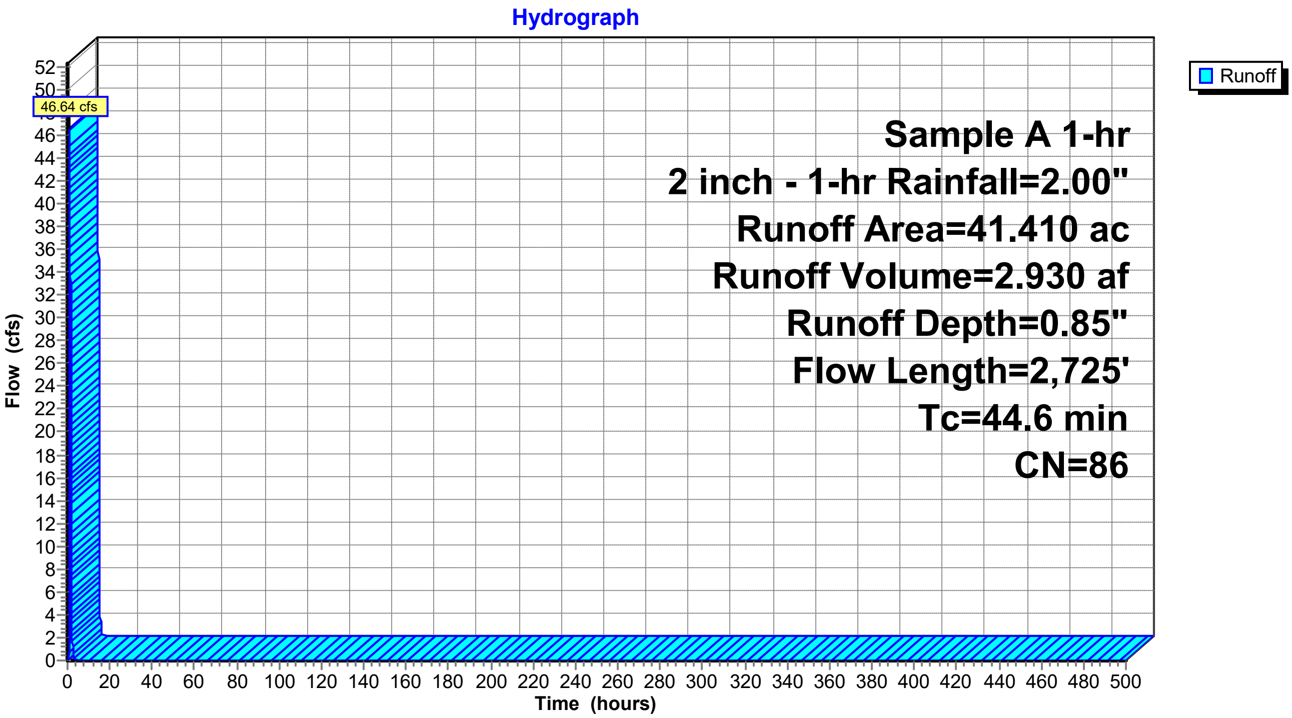
Runoff = 46.64 cfs @ 1.15 hrs, Volume= 2.930 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

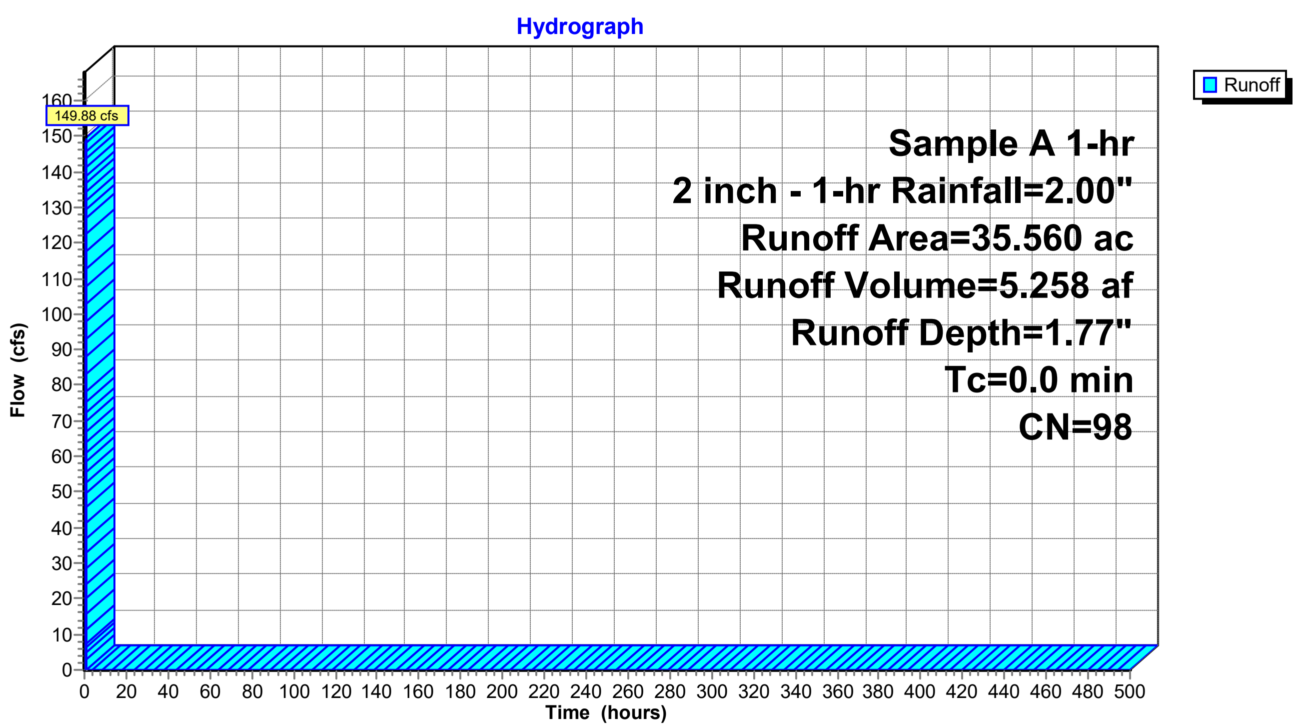
Runoff = 149.88 cfs @ 0.50 hrs, Volume= 5.258 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



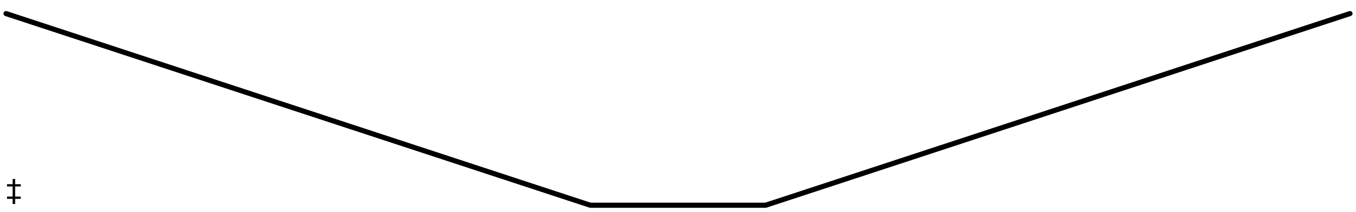
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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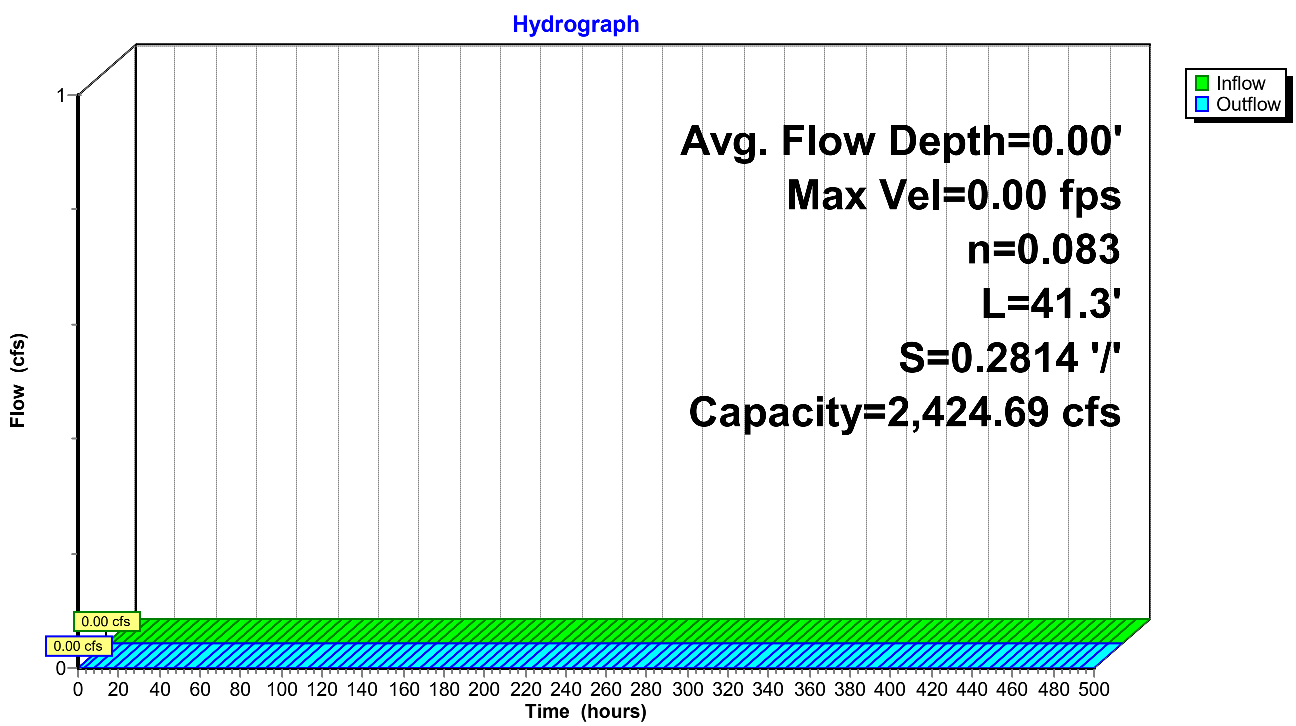
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

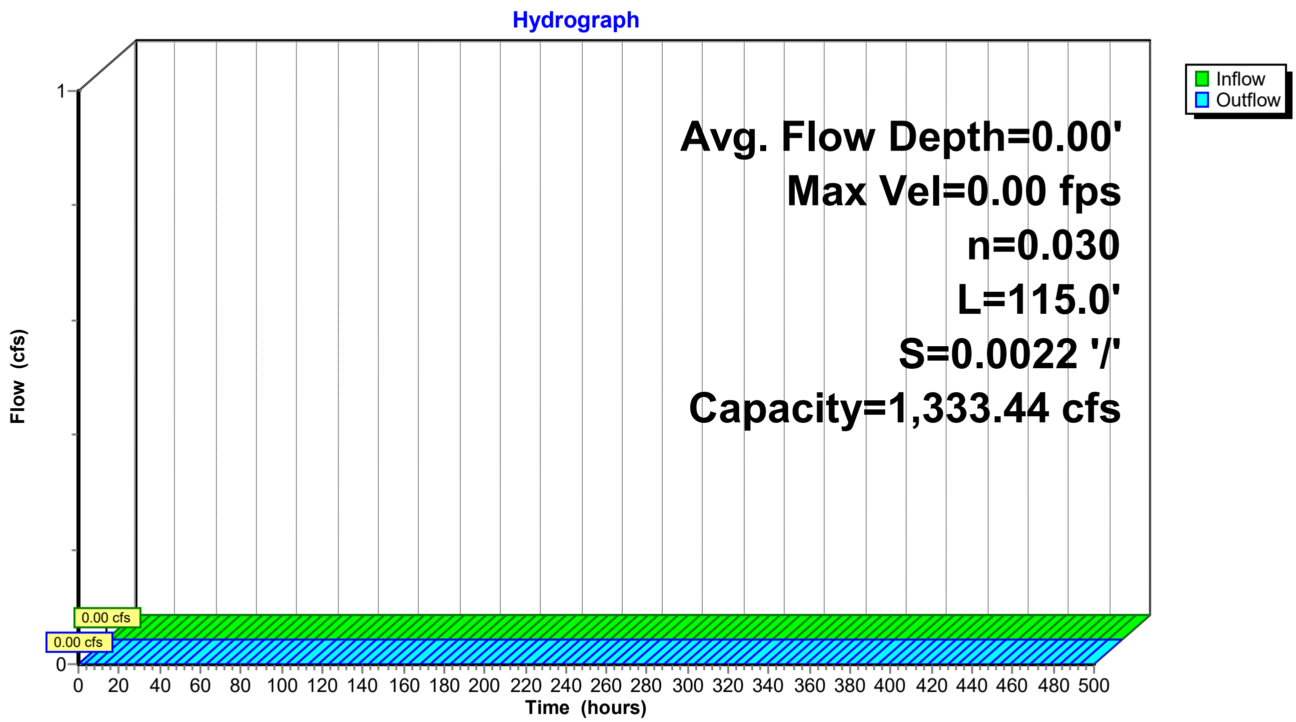
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

Reach 3R: Spillway - Upper Reach



Summary for Reach 5R: Discharge Creek

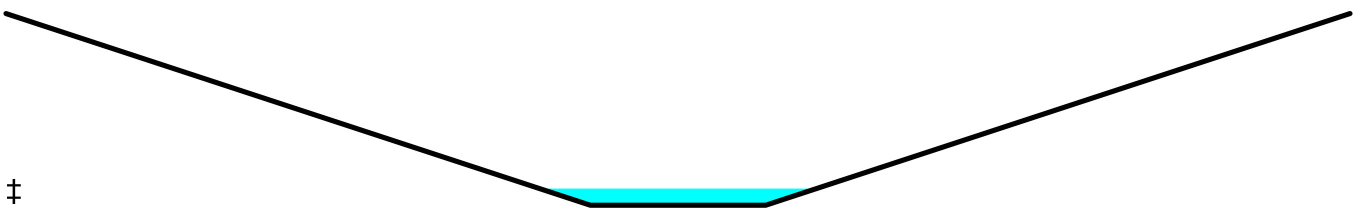
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 2.11 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 2.70" for 2 inch - 1-hr event
Inflow = 14.52 cfs @ 2.07 hrs, Volume= 54.217 af
Outflow = 14.52 cfs @ 2.11 hrs, Volume= 54.217 af, Atten= 0%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 4.21 fps, Avg. Travel Time= 3.2 min

Peak Storage= 2,680 cf @ 2.11 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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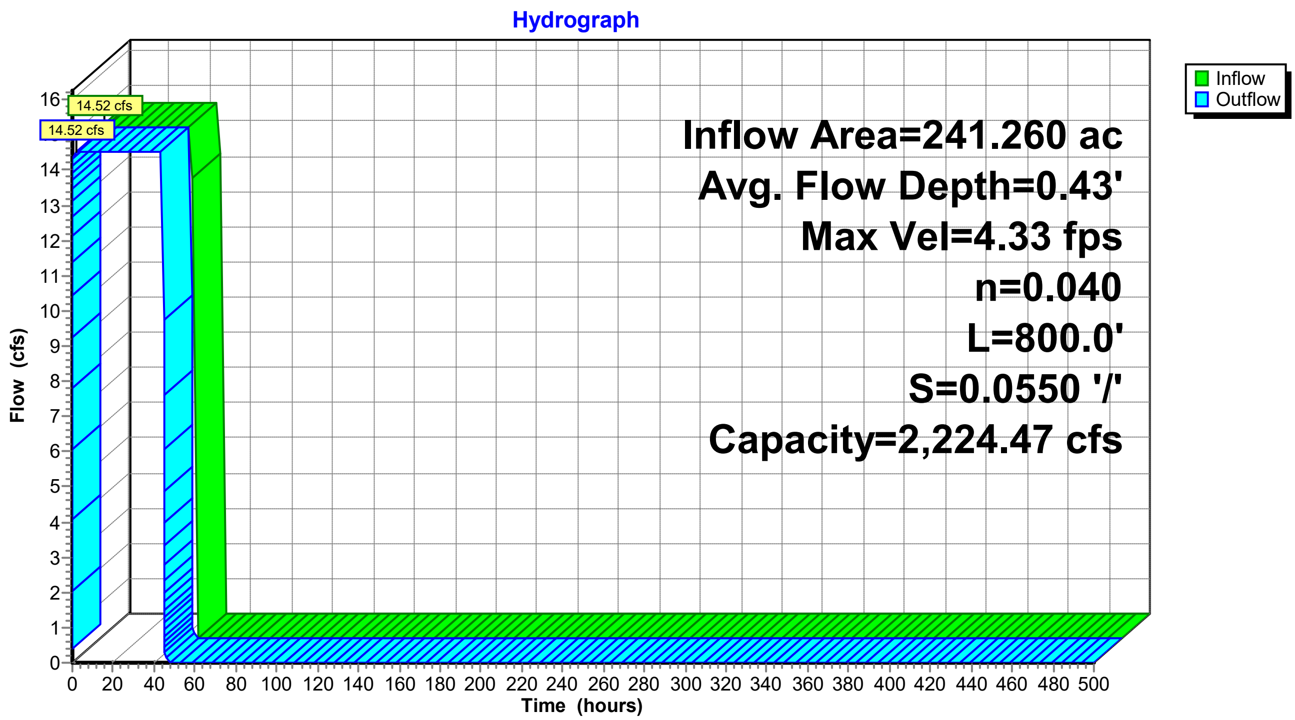
Reach 5R: Discharge Creek



Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

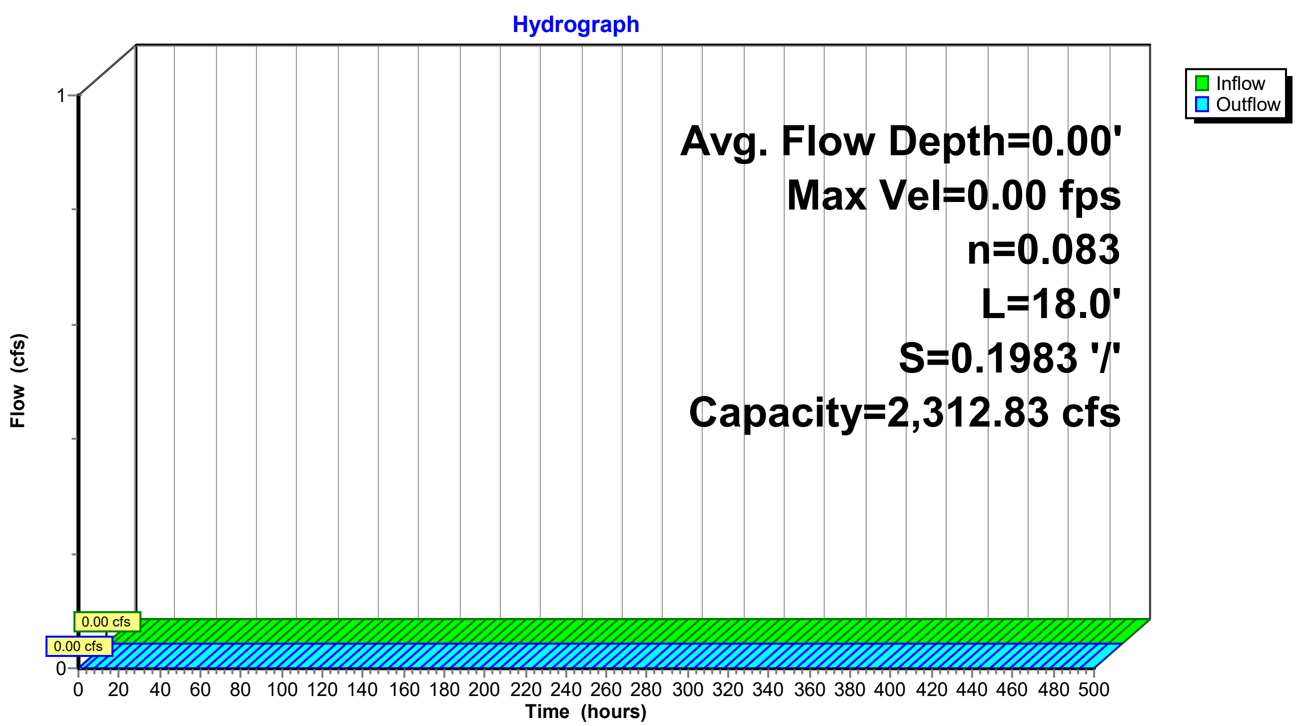
Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



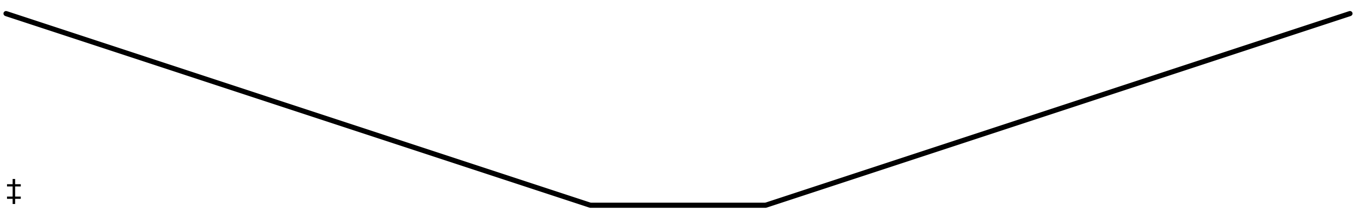
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

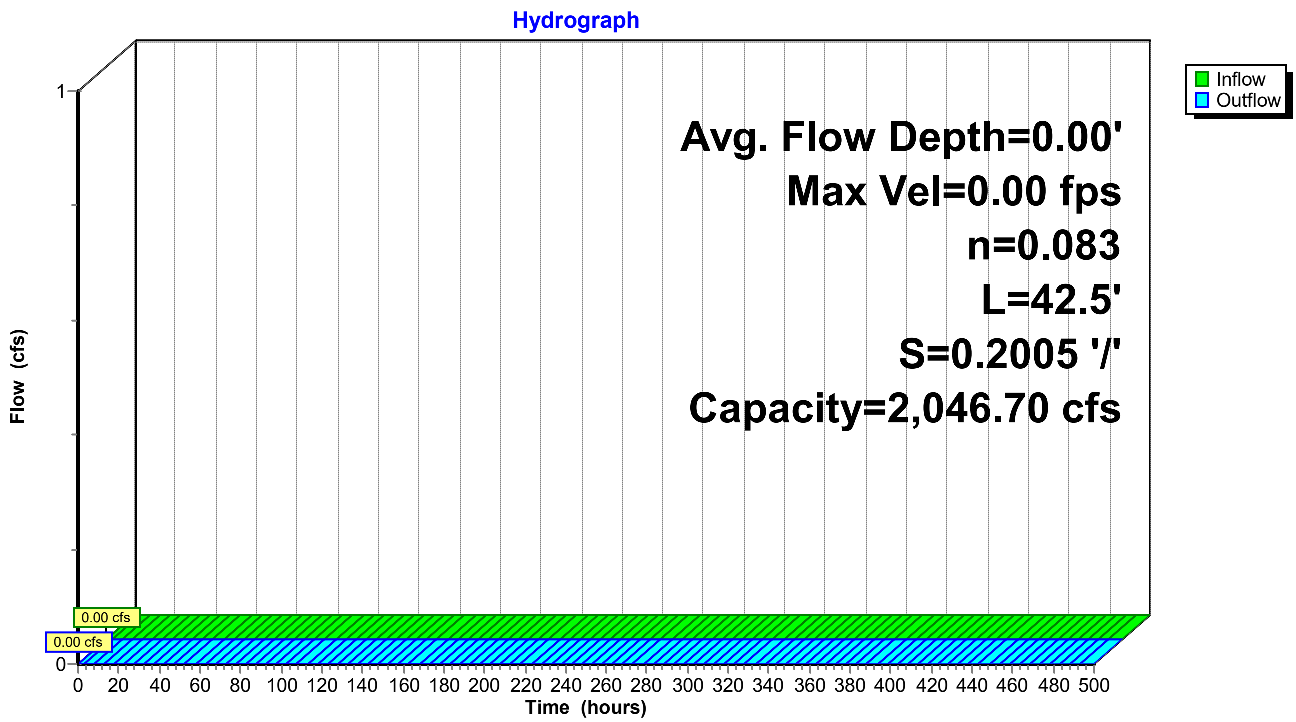
Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



Reach 8R: Discharge Ditch



Summary for Pond 3P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 1.15" for 2 inch - 1-hr event
Inflow = 307.60 cfs @ 1.09 hrs, Volume= 23.166 af
Outflow = 14.52 cfs @ 2.07 hrs, Volume= 54.217 af, Atten= 95%, Lag= 58.7 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 2.07 hrs, Volume= 54.217 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Starting Elev= 430.00' Surf.Area= 0.000 ac Storage= 42.320 af
Peak Elev= 432.69' @ 2.07 hrs Surf.Area= 0.000 ac Storage= 62.700 af (20.380 af above start)

Plug-Flow detention time= 2,370.0 min calculated for 11.897 af (51% of inflow)
Center-of-Mass det. time= 1,293.2 min (1,355.4 - 62.2)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

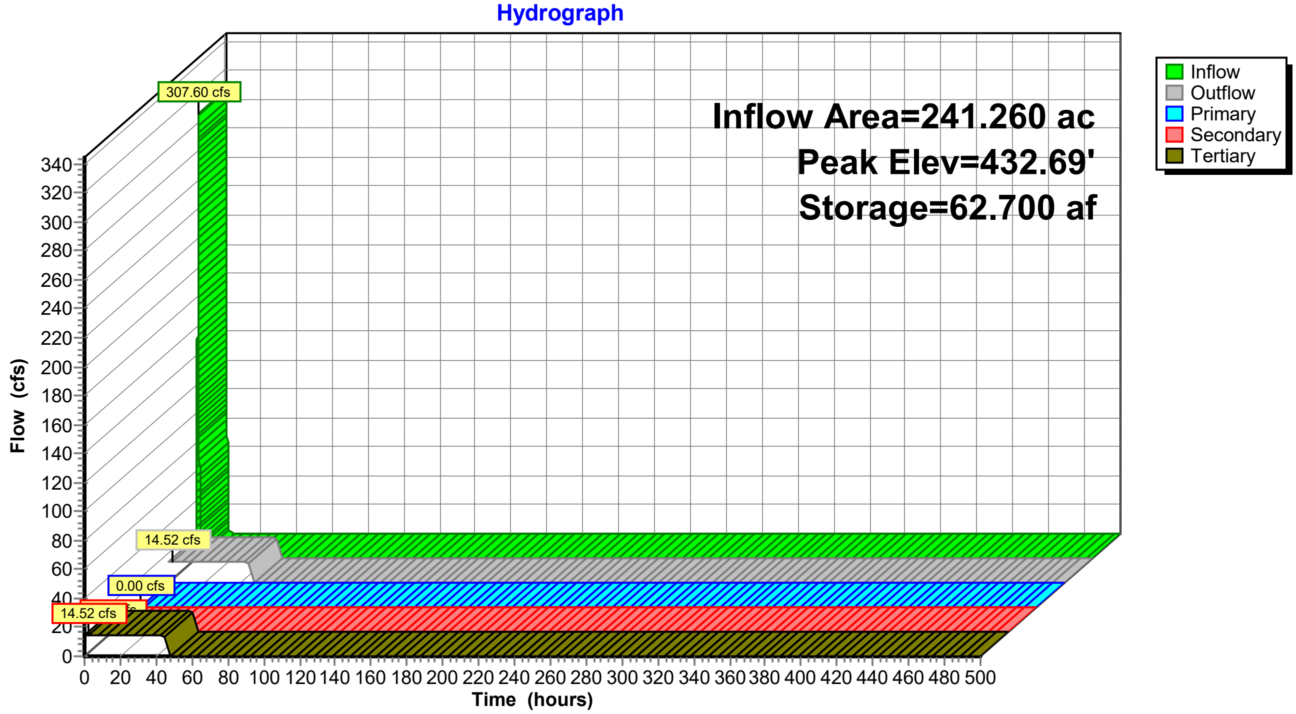
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=428.05' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 44.59 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 2.07 hrs HW=432.69' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 3P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) is removed. Hence, Phase 2 Drainage Area includes Limits of Ash Pond with no ponded water in the pools.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: All flows are routed to Pool A and flow lengths are based on flow to Pool A from respective drainage catchments.

Surface within the Limits of Upper Ash Pond is now 100% Ash.

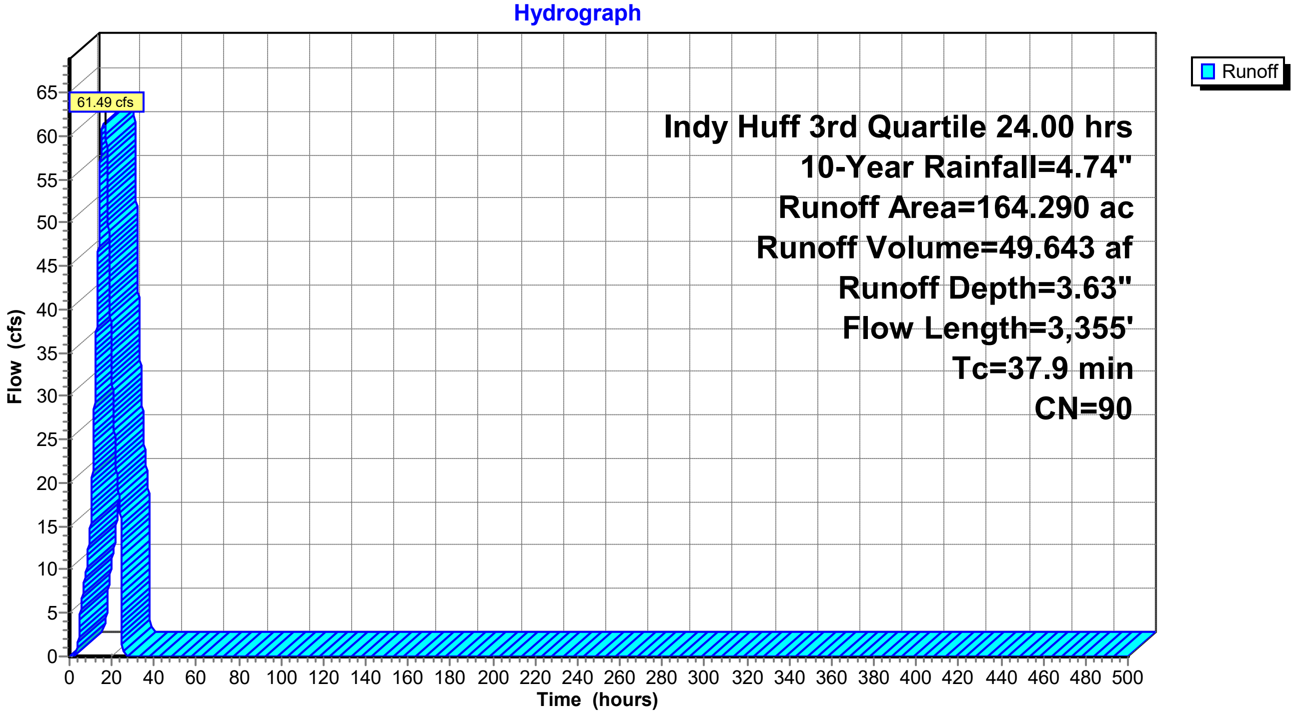
Runoff = 61.49 cfs @ 16.72 hrs, Volume= 49.643 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	57.410	98	Ash
*	34.150	98	Ash (Formerly Water Surface in Phase 1)
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

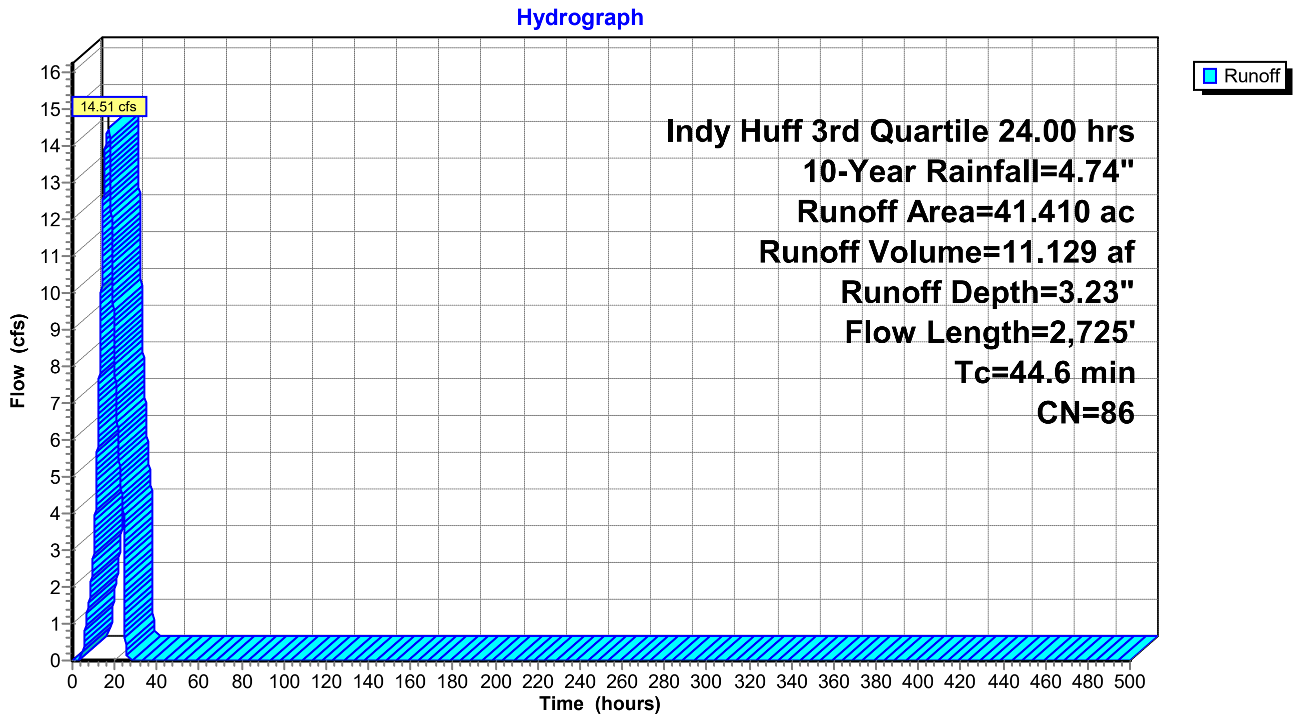
Runoff = 14.51 cfs @ 17.10 hrs, Volume= 11.129 af, Depth= 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	27.100	79	50-75% Grass cover, Fair, HSG C
*	14.310	98	Ash
	41.410	86	Weighted Average
	27.100		65.44% Pervious Area
	14.310		34.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Ponded Area

Phase 2 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

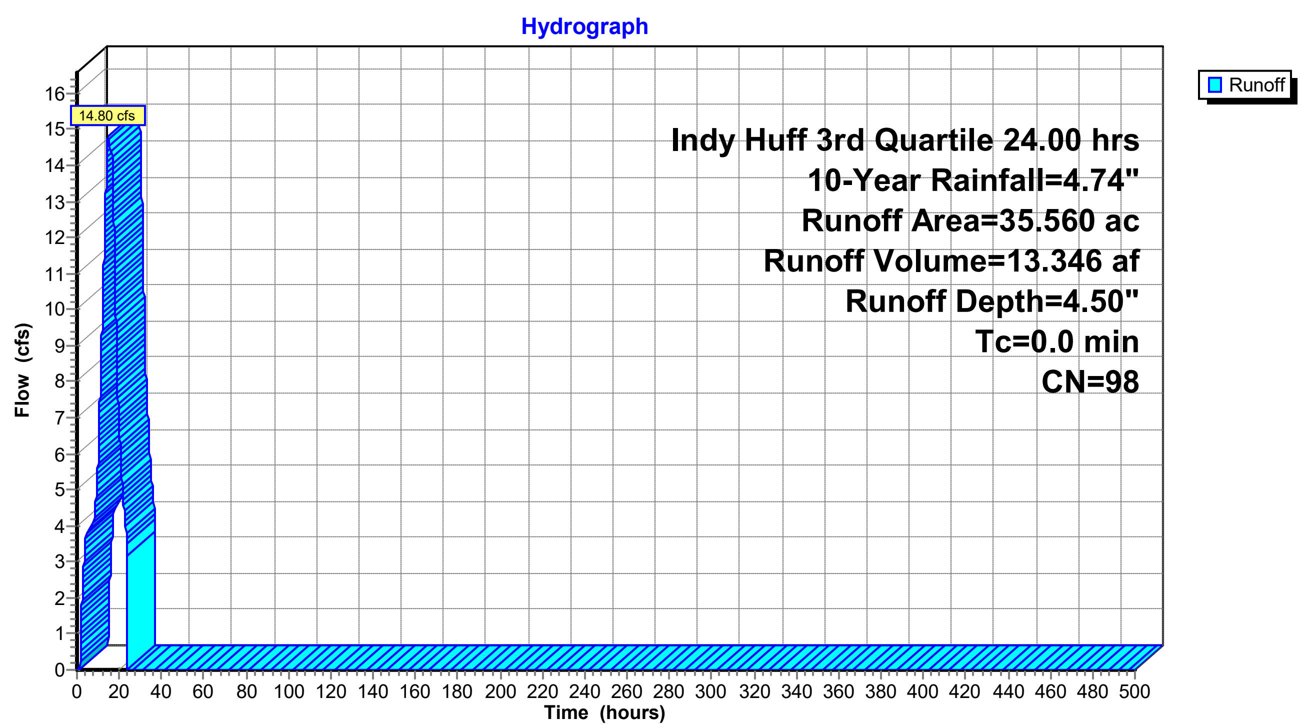
Runoff = 14.80 cfs @ 14.41 hrs, Volume= 13.346 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
35.560	98	Water Surface, HSG C
35.560		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Ponded Area



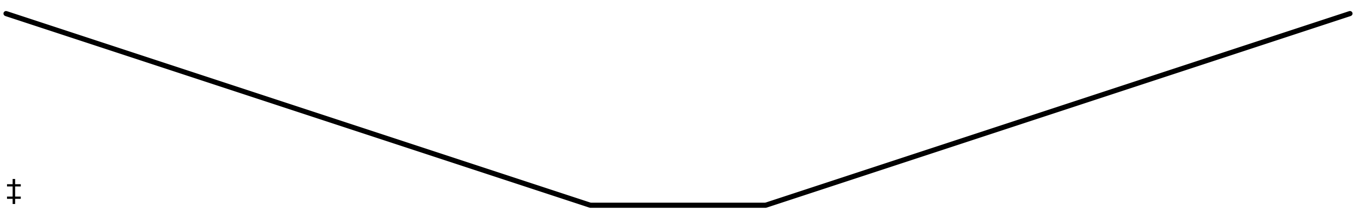
Summary for Reach 2R: Spillway - Lower Reach

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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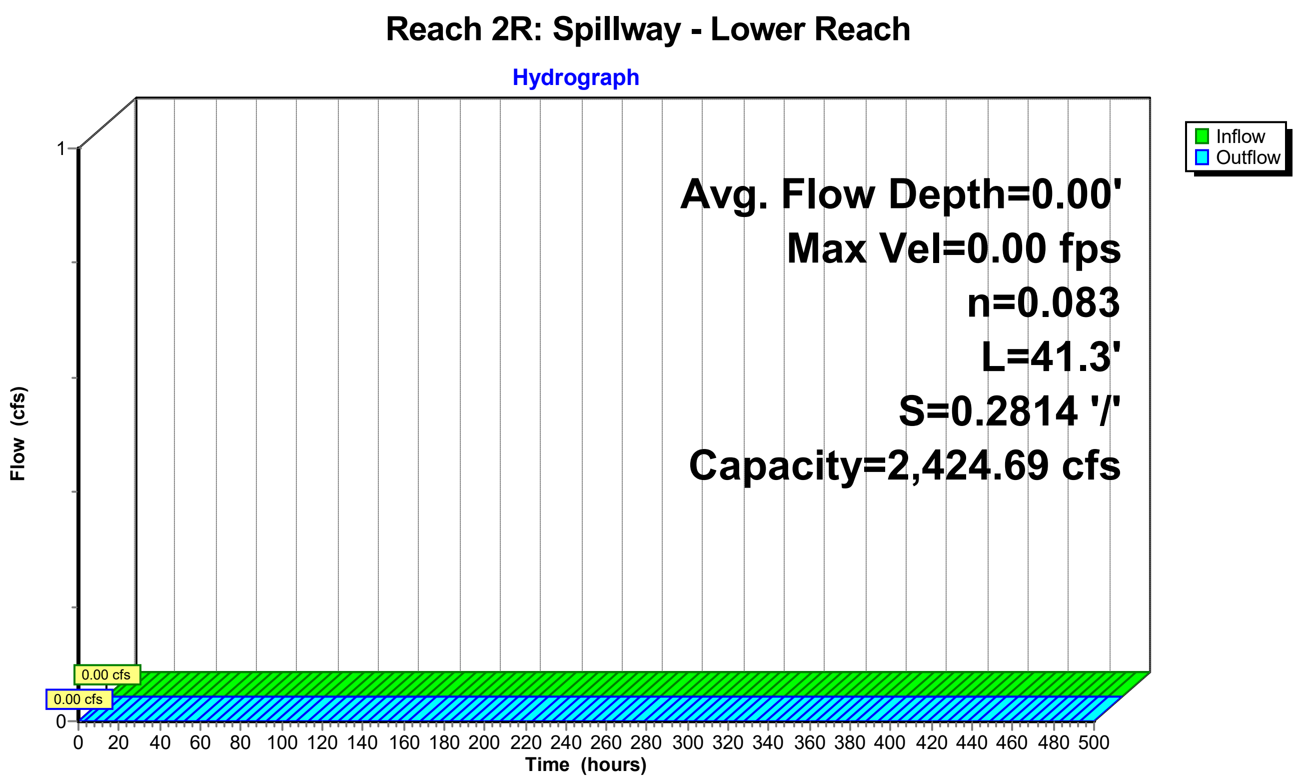


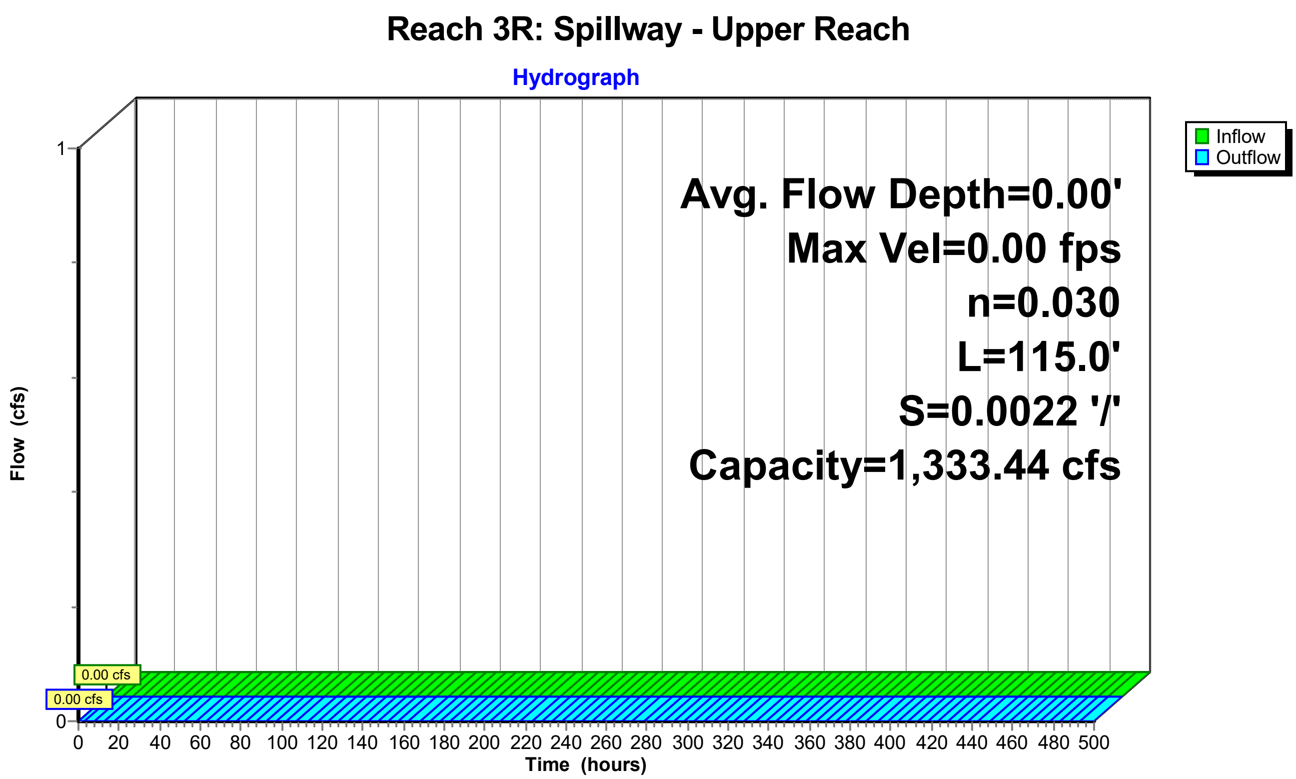
Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'



Summary for Reach 5R: Discharge Creek

[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 24.45 hrs

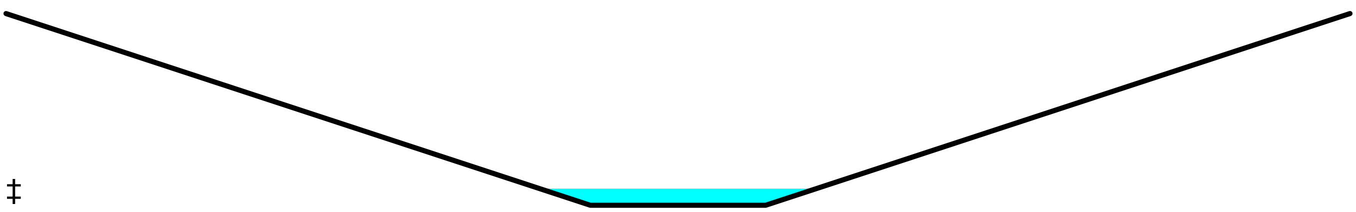
Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 5.23" for 10-Year event
Inflow = 14.52 cfs @ 24.41 hrs, Volume= 105.170 af
Outflow = 14.52 cfs @ 24.45 hrs, Volume= 105.170 af, Atten= 0%, Lag= 2.1 min

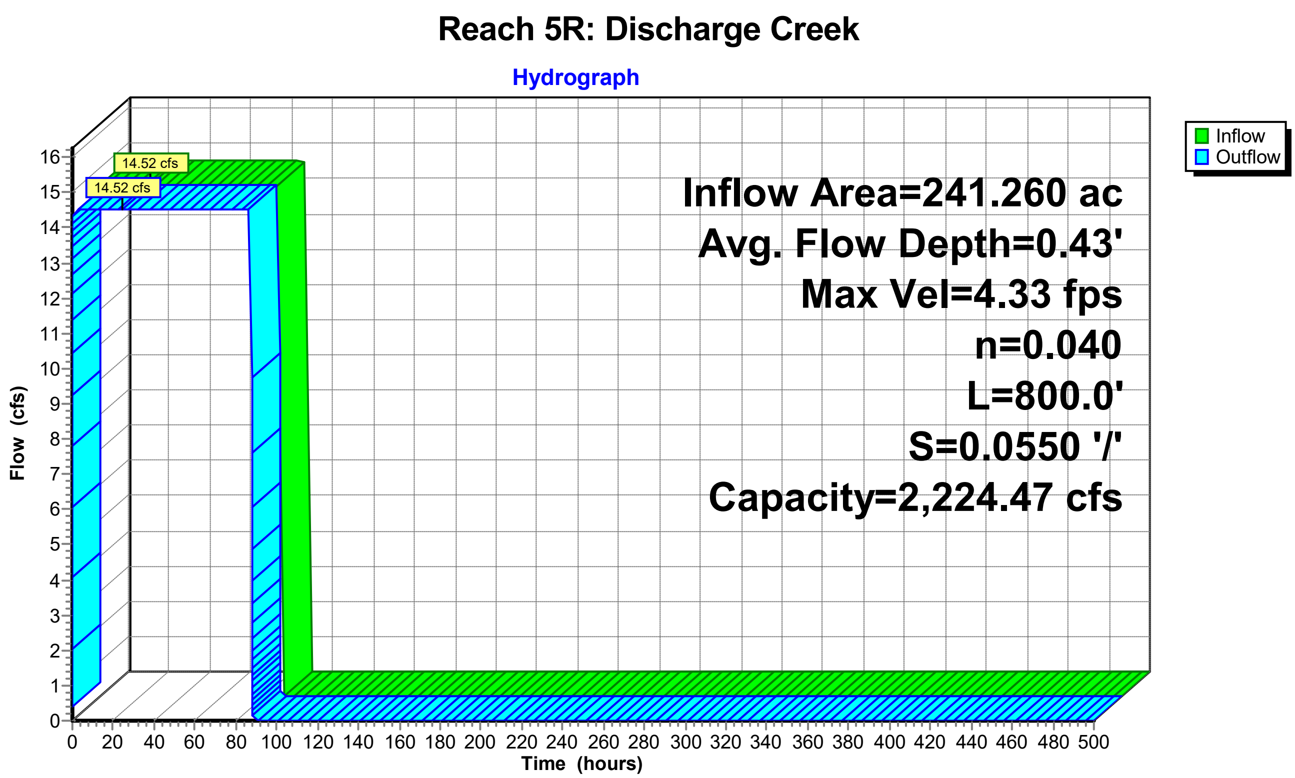
Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 4.27 fps, Avg. Travel Time= 3.1 min

Peak Storage= 2,680 cf @ 24.45 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'

‡





Summary for Reach 7R: Spillway - Middle Reach

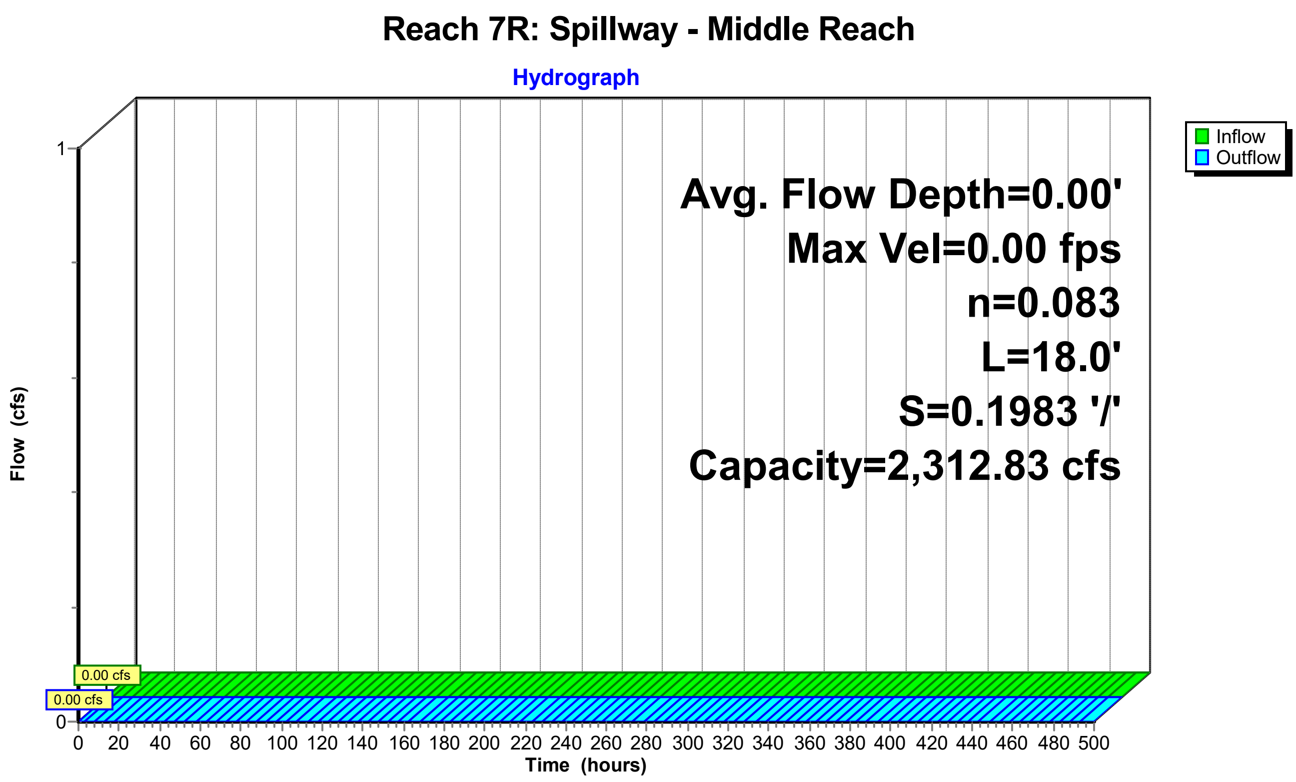
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡



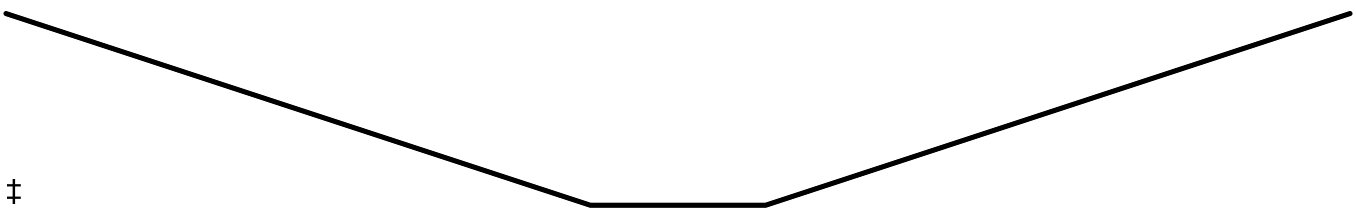
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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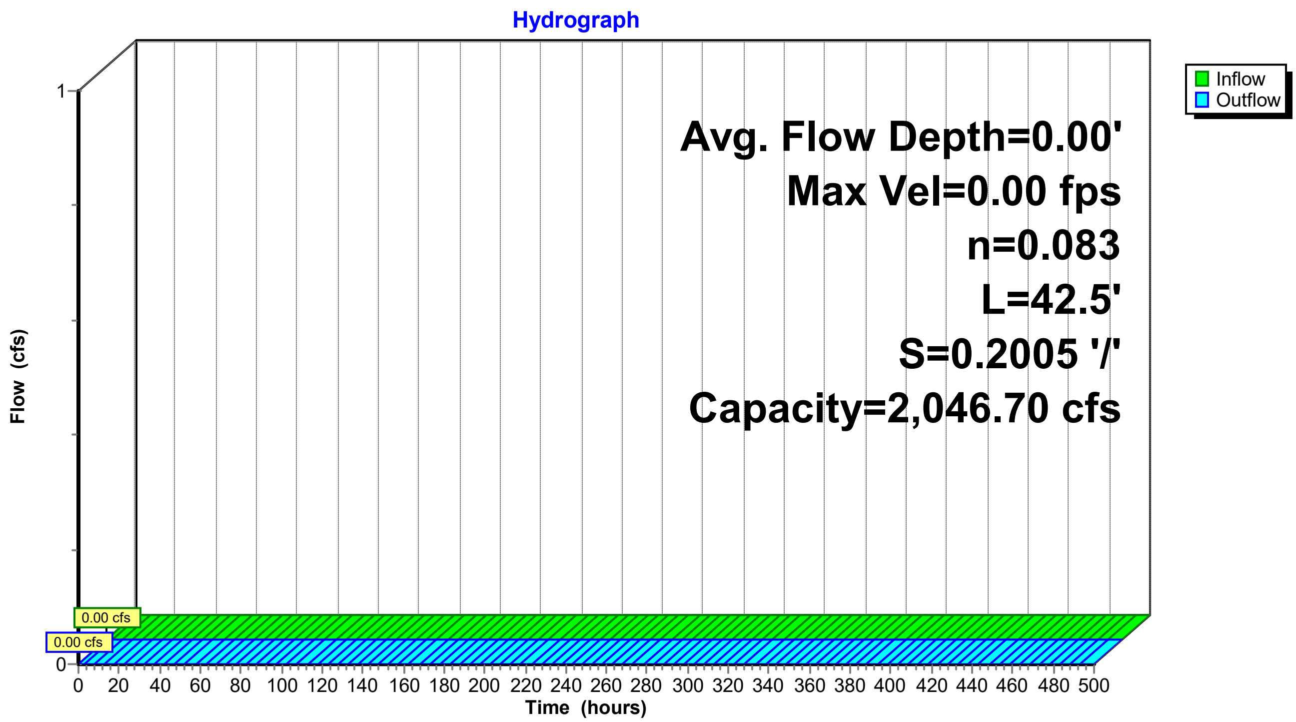
Reach 8R: Discharge Ditch



Summary for Pond 3P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area =	241.260 ac,	58.62% Impervious,	Inflow Depth = 3.69"	for 10-Year event	
Inflow =	90.20 cfs @	16.80 hrs,	Volume=	74.118 af	
Outflow =	14.52 cfs @	24.41 hrs,	Volume=	105.170 af,	Atten= 84%, Lag= 456.9 min
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Tertiary =	14.52 cfs @	24.41 hrs,	Volume=	105.170 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-500.00 hrs, dt= 0.01 hrs
Starting Elev= 430.00' Surf.Area= 0.000 ac Storage= 42.320 af
Peak Elev= 435.56' @ 24.41 hrs Surf.Area= 0.000 ac Storage= 86.789 af (44.469 af above start)

Plug-Flow detention time= 2,809.7 min calculated for 62.850 af (85% of inflow)
Center-of-Mass det. time= 1,683.0 min (2,629.5 - 946.5)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

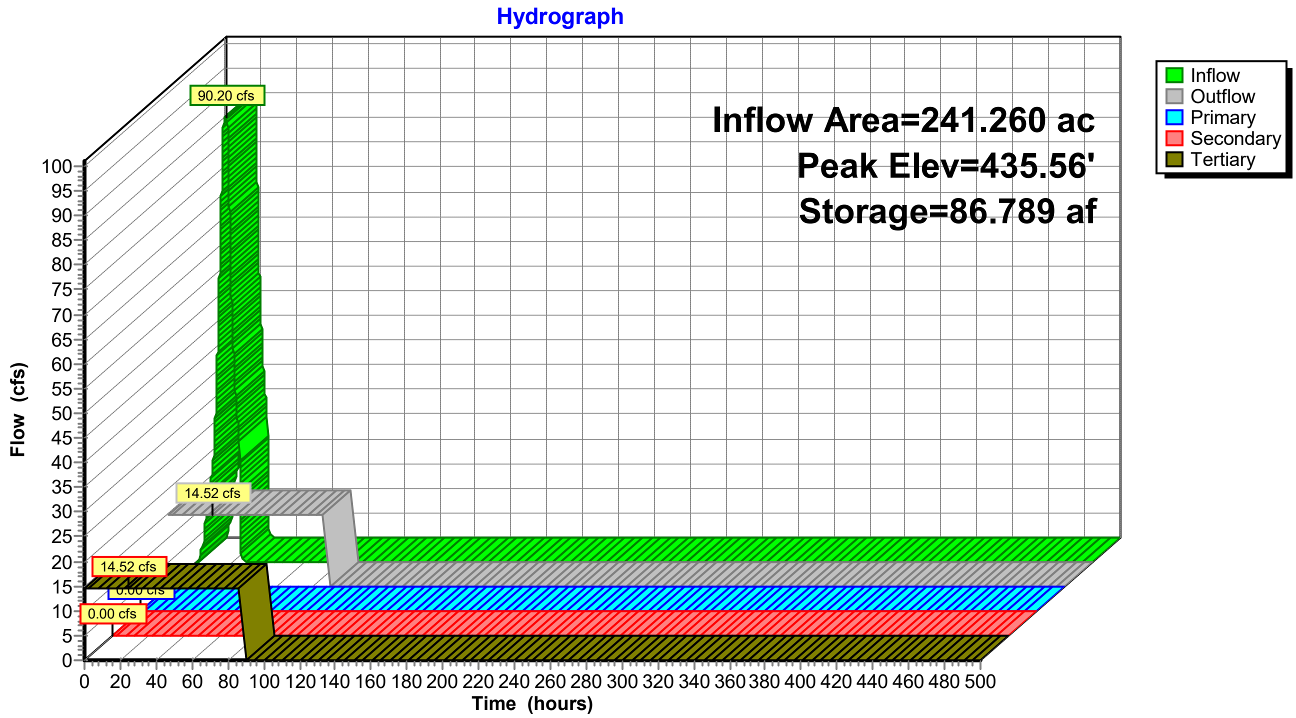
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=428.05' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.00 cfs of 44.59 cfs potential flow)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=430.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 24.41 hrs HW=435.56' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 3P: Lower Pond



MILESTONE 5

Routing Diagram for Brown - Phase 4_Excavation to 425
Prepared by AECOM, Printed 10/15/2021
HydroCAD® 10.00 s/n 01723 © 2013 HydroCAD Software Solutions LLC

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subca Numb
0.000	0.000	99.830	0.000	0.000	99.830	50-75% Grass cover, Fair	
0.000	0.000	0.000	0.000	105.870	105.870	Ash	
0.000	0.000	0.000	0.000	17.780	17.780	Ash - Former Water Surface (Dewatered)	
0.000	0.000	17.780	0.000	0.000	17.780	Water Surface	
0.000	**0.000**	**117.610**	**0.000**	**123.650**	**241.260**	**TOTAL AREA**	

Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 4 Drainage Area includes Limits of Upper Ash Pond all of which is now an ash surface with no pools or vegetation. Excavation Elevation is 430-425 at the Upper Pond area.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: In the absence of any pond storage in the Upper Pond Area, all flows are directly routed to the Lower Pond.

Ash CN = 98.

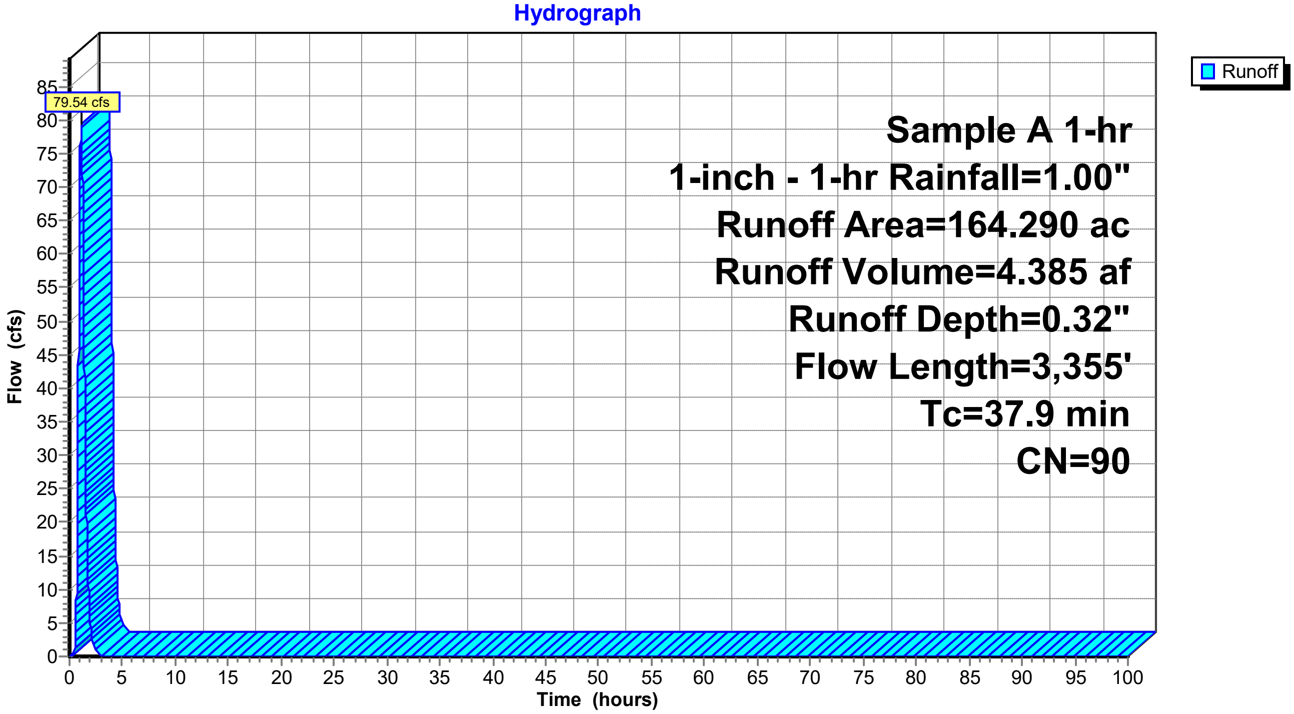
Runoff = 79.54 cfs @ 1.10 hrs, Volume= 4.385 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	91.560	98	Ash
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

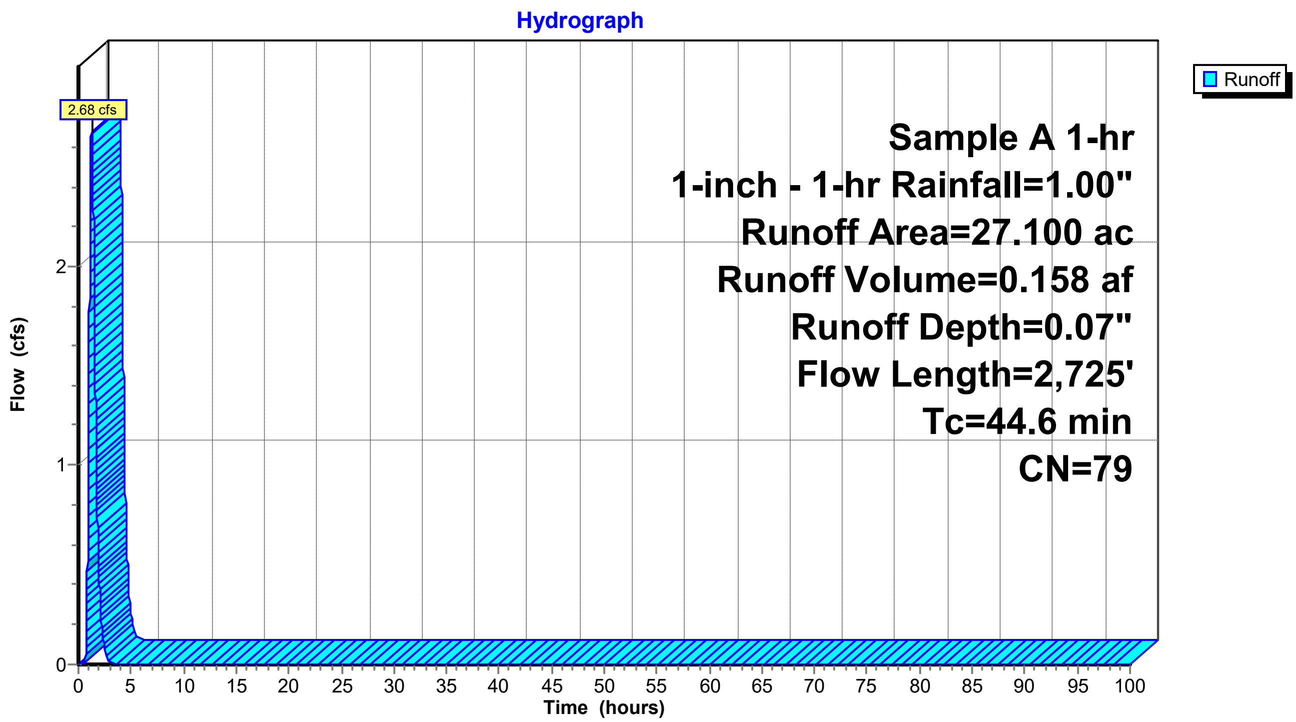
Runoff = 2.68 cfs @ 1.24 hrs, Volume= 0.158 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

Area (ac)	CN	Description
27.100	79	50-75% Grass cover, Fair, HSG C
27.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Lower Pond Excavation Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond. Footprint of ponded area has been halved to 17.78 Acres.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

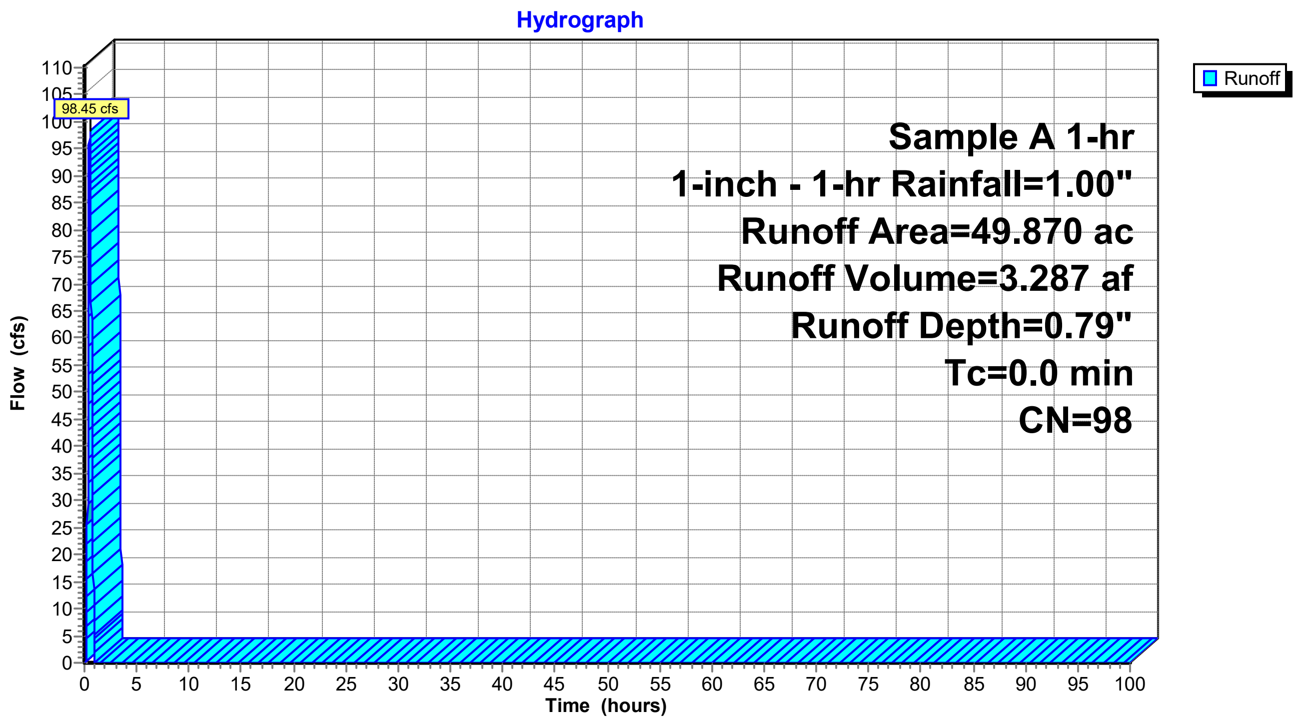
Runoff = 98.45 cfs @ 0.50 hrs, Volume= 3.287 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 1-inch - 1-hr Rainfall=1.00"

	Area (ac)	CN	Description
	17.780	98	Water Surface, HSG C
*	17.780	98	Ash - Former Water Surface (Dewatered)
*	14.310	98	Ash
	49.870	98	Weighted Average
	49.870		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Lower Pond Excavation Area



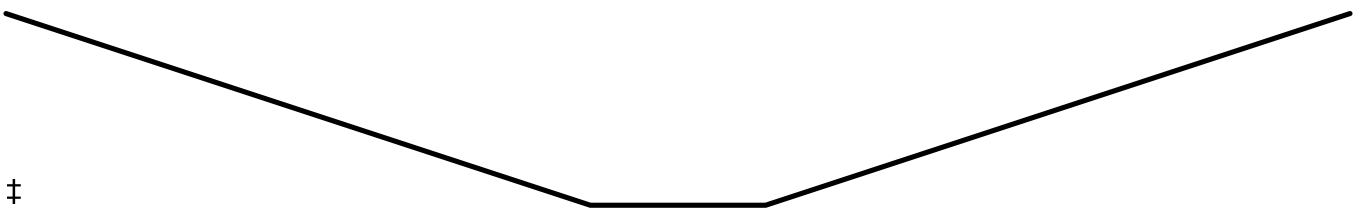
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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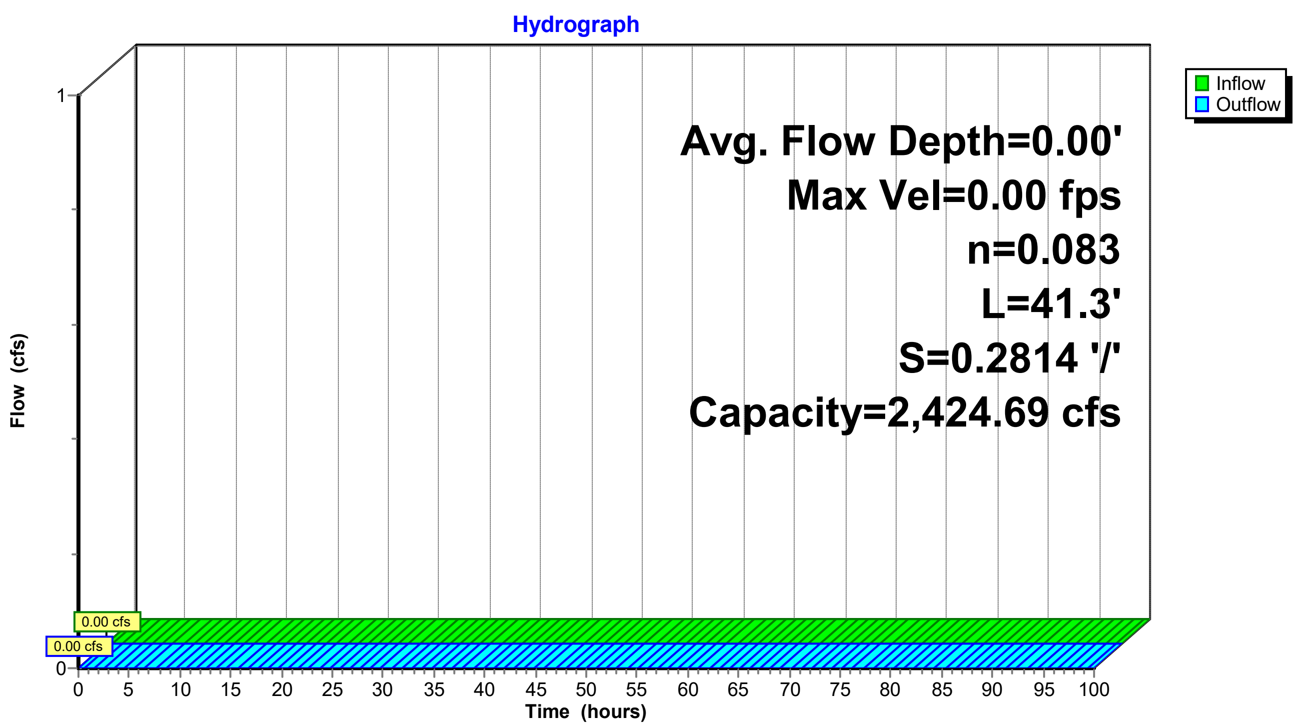
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

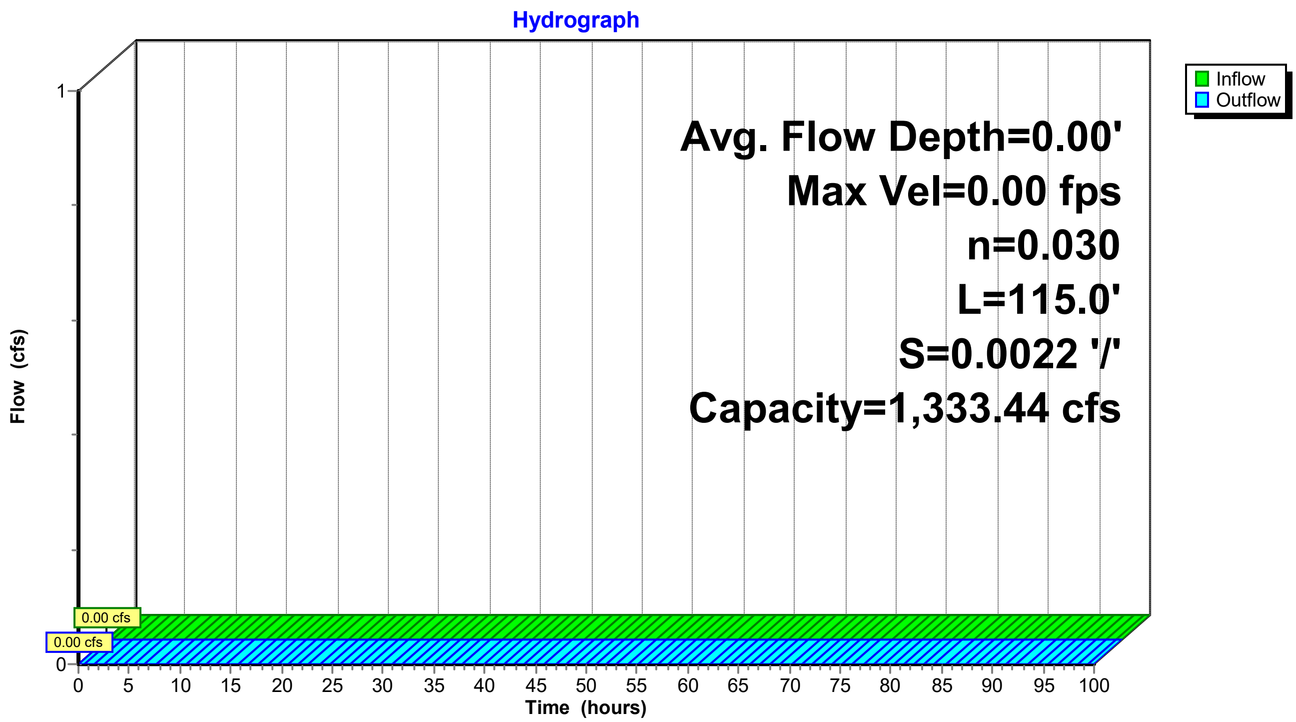
Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

Reach 3R: Spillway - Upper Reach



Summary for Reach 5R: Discharge Creek

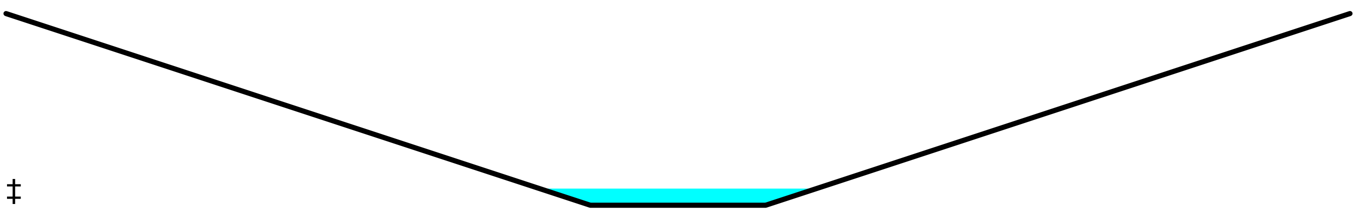
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 1.75 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.39" for 1-inch - 1-hr event
Inflow = 14.52 cfs @ 1.71 hrs, Volume= 7.813 af
Outflow = 14.52 cfs @ 1.75 hrs, Volume= 7.813 af, Atten= 0%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 3.67 fps, Avg. Travel Time= 3.6 min

Peak Storage= 2,680 cf @ 1.75 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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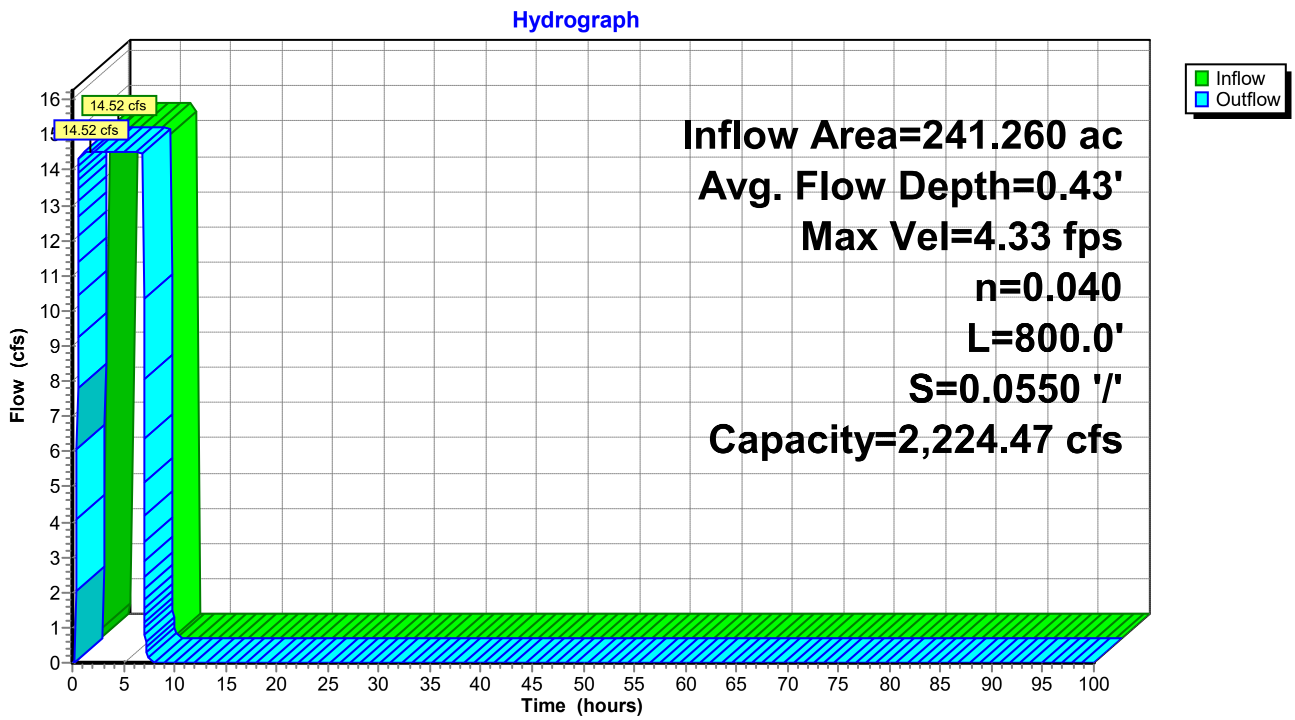
Reach 5R: Discharge Creek



Summary for Reach 7R: Spillway - Middle Reach

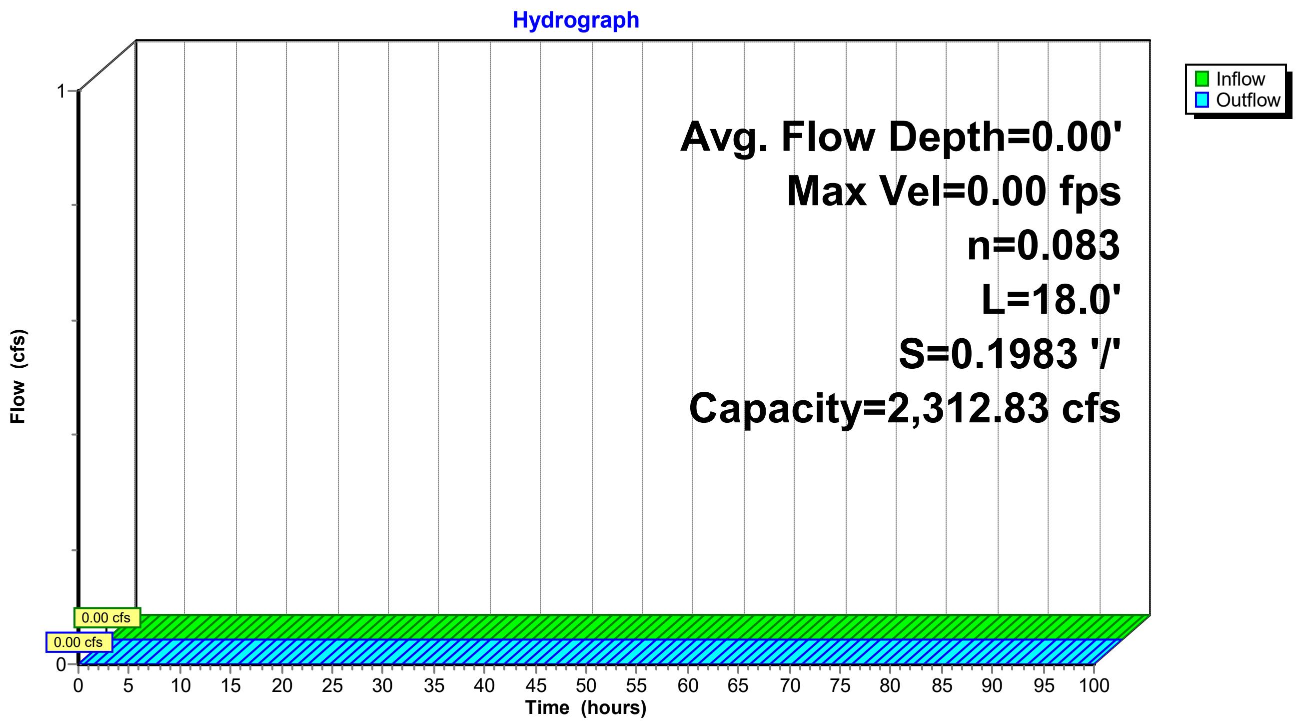
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

Reach 7R: Spillway - Middle Reach



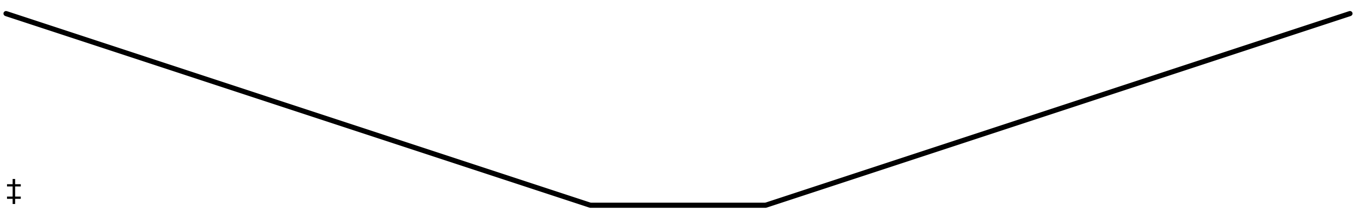
Summary for Reach 8R: Discharge Ditch

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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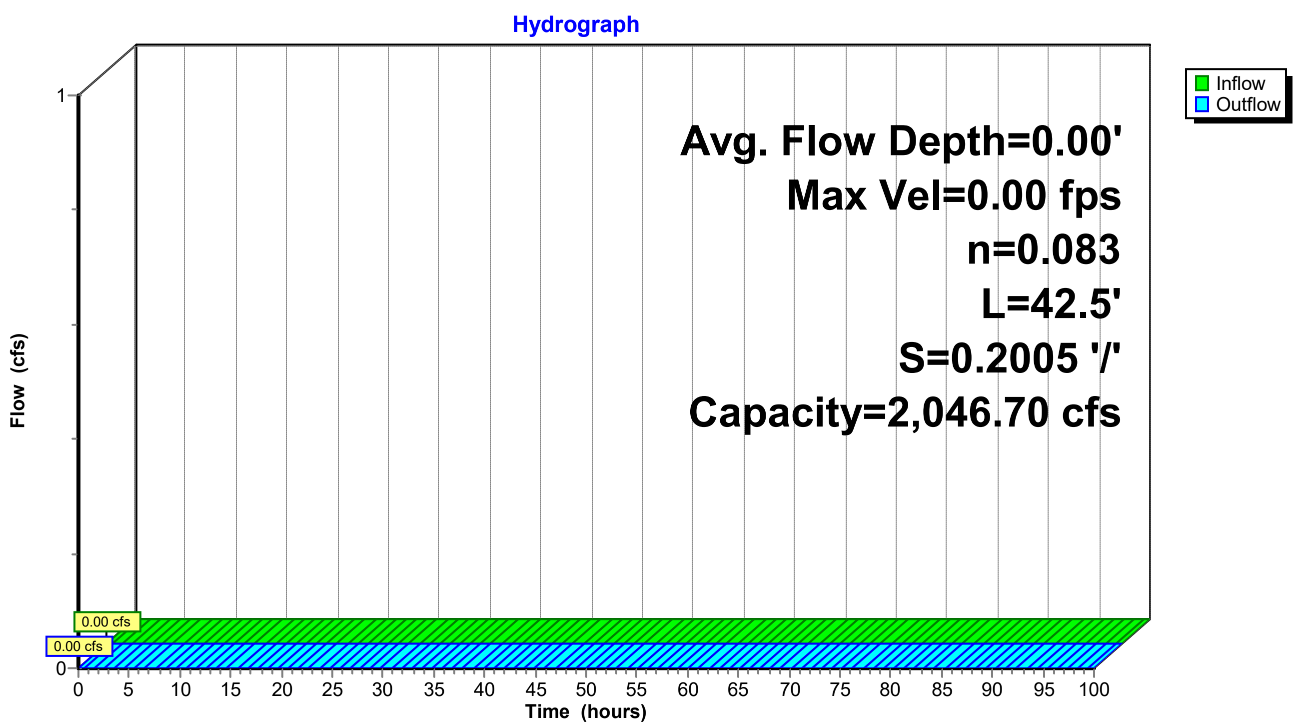
Reach 8R: Discharge Ditch



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow =	13.58 cfs @ 0.00 hrs,	Volume=	112.243 af,	Incl. 13.58 cfs Base Flow
Outflow =	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af,	Atten= 0%, Lag= 6,000.0 min
Primary =	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af	
Secondary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

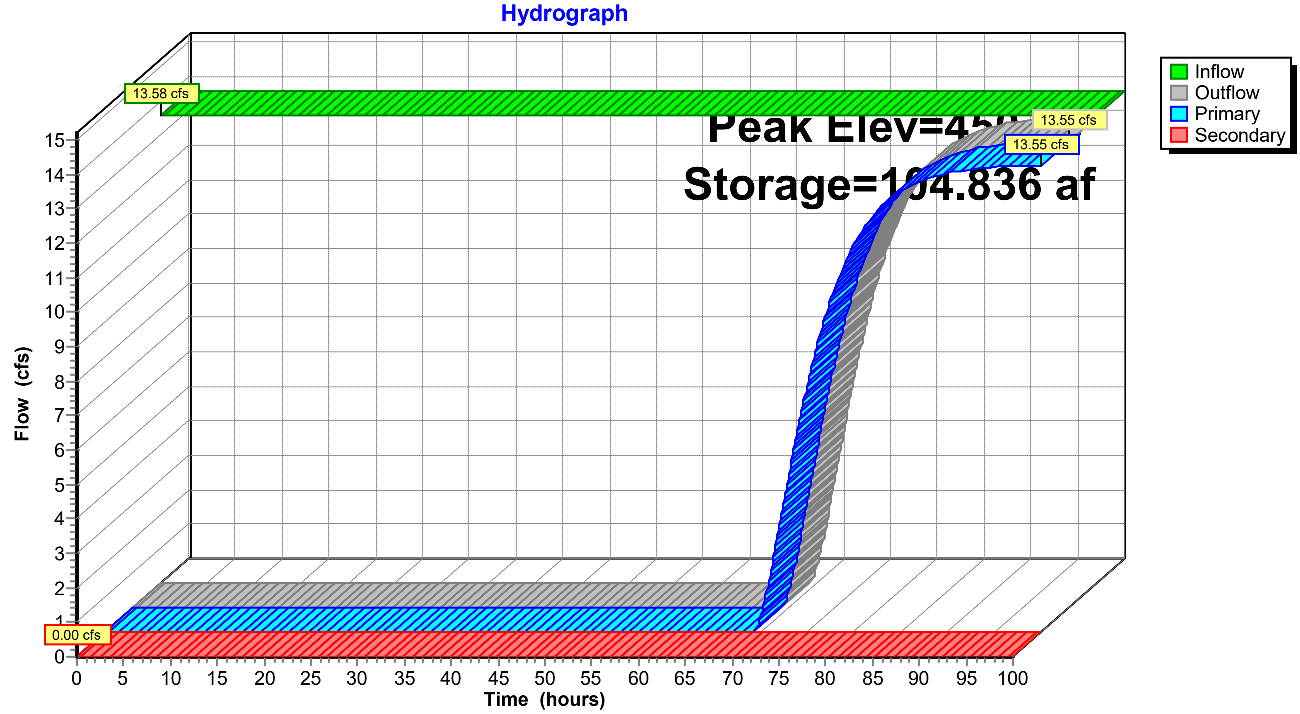
Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
└─**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: Upper Pond



Summary for Pond 7P: Working Area

This pond node shall be used only if there is a pumping scenario

[43] Hint: Has no inflow (Outflow=Zero)

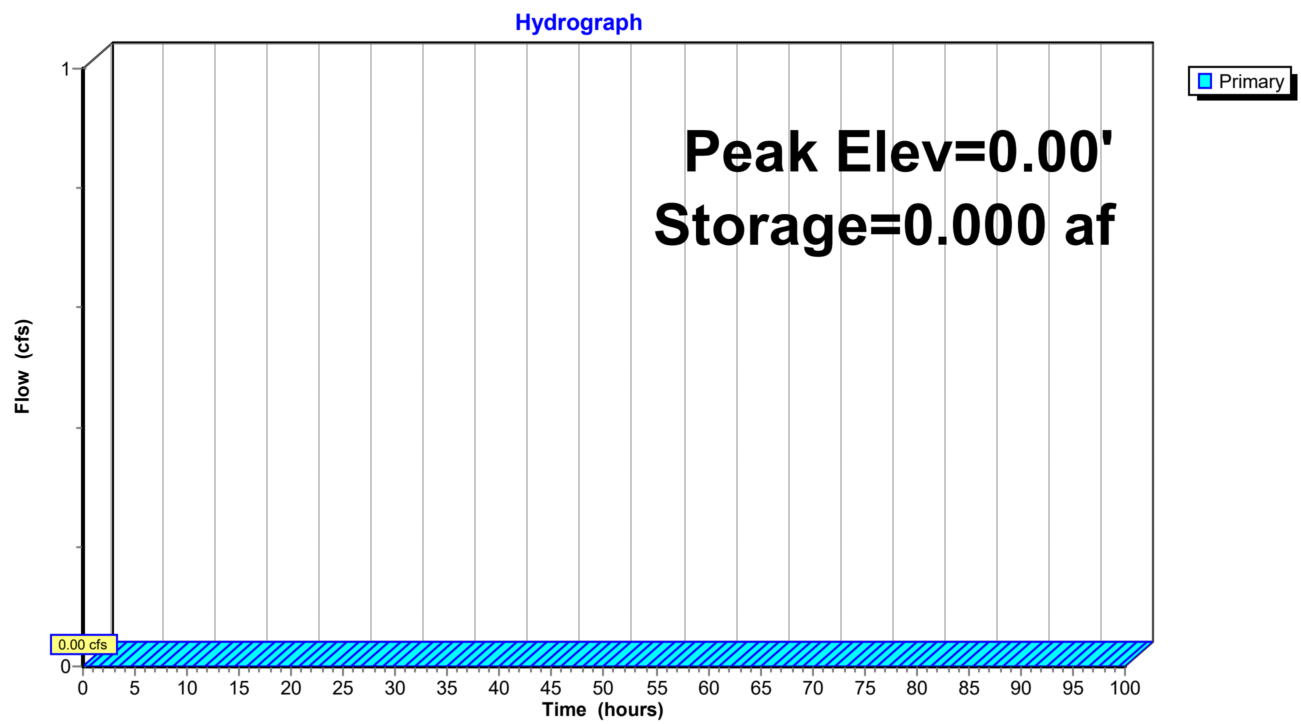
Volume	Invert	Avail.Storage	Storage Description
#1	440.00'	20.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
440.00	0.000
450.00	20.000

Device	Routing	Invert	Outlet Devices
#1	Primary	442.00'	**Pump** Discharges@440.00' Turns Off@440.50' Flow (gpm)= 1.0 100.0 250.0 500.0 1,000.0 Head (feet)= 100.00 90.00 80.00 25.00 10.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
↑—**1=Pump** (Controls 0.00 cfs)

Pond 7P: Working Area



Summary for Pond 8P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 0.39" for 1-inch - 1-hr event
Inflow = 98.80 cfs @ 0.50 hrs, Volume= 7.830 af
Outflow = 14.52 cfs @ 1.71 hrs, Volume= 7.813 af, Atten= 85%, Lag= 72.8 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 1.71 hrs, Volume= 7.813 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 420.00' Surf.Area= 0.000 ac Storage= 11.260 af
Peak Elev= 423.06' @ 1.71 hrs Surf.Area= 0.000 ac Storage= 17.260 af (6.000 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 166.2 min (222.1 - 55.8)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

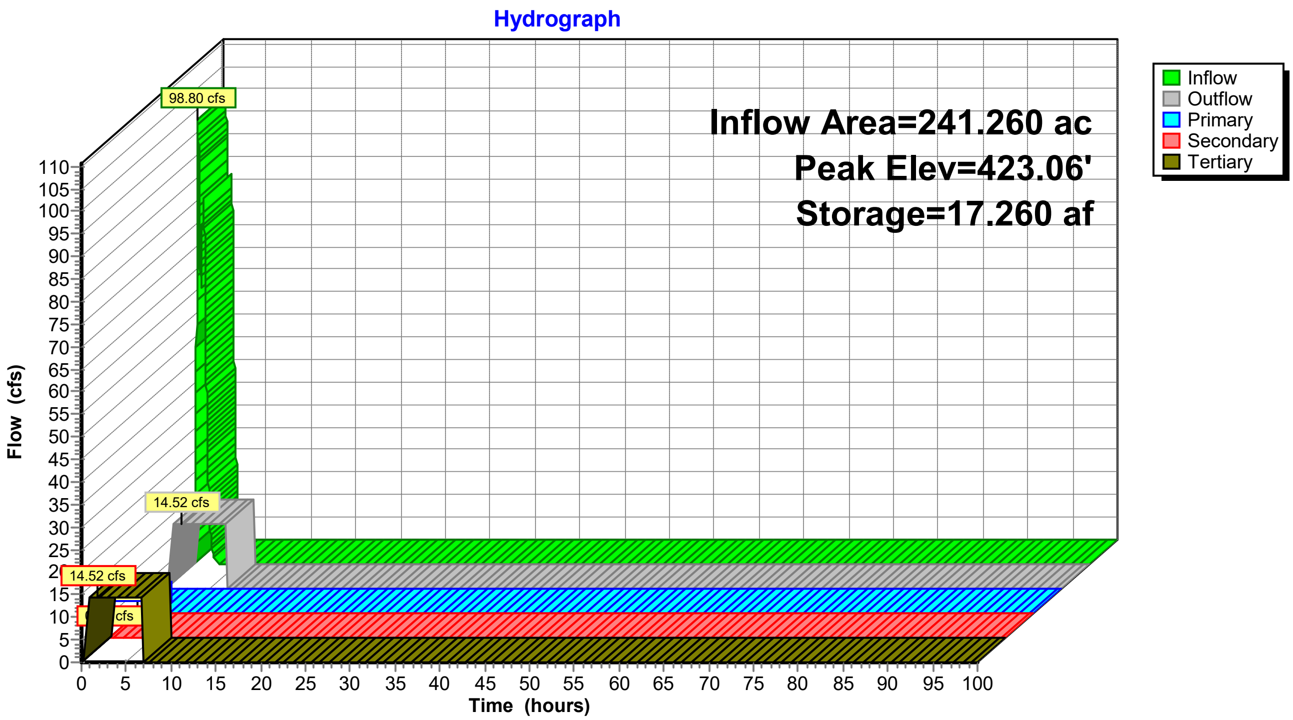
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 1.71 hrs HW=423.06' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 8P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 4 Drainage Area includes Limits of Upper Ash Pond all of which is now an ash surface with no pools or vegetation. Excavation Elevation is 430-425 at the Upper Pond area.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: In the absence of any pond storage in the Upper Pond Area, all flows are directly routed to the Lower Pond.

Ash CN = 98.

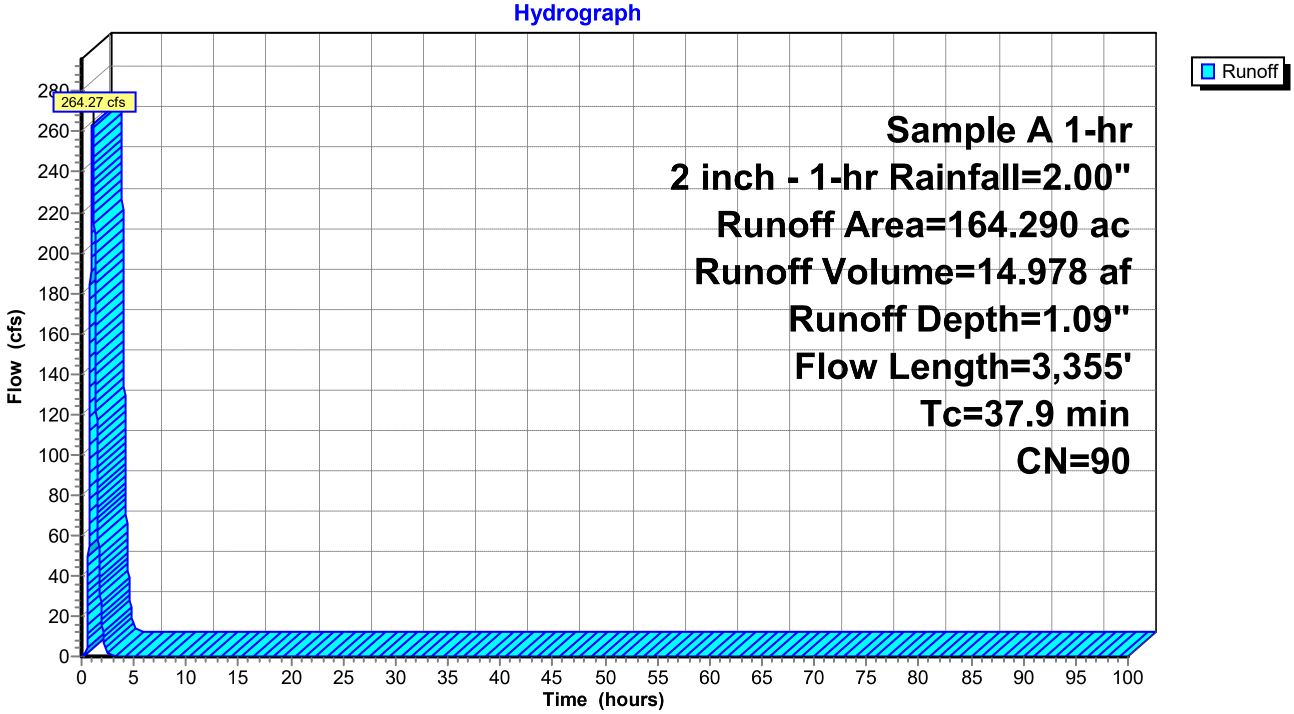
Runoff = 264.27 cfs @ 1.06 hrs, Volume= 14.978 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	91.560	98	Ash
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

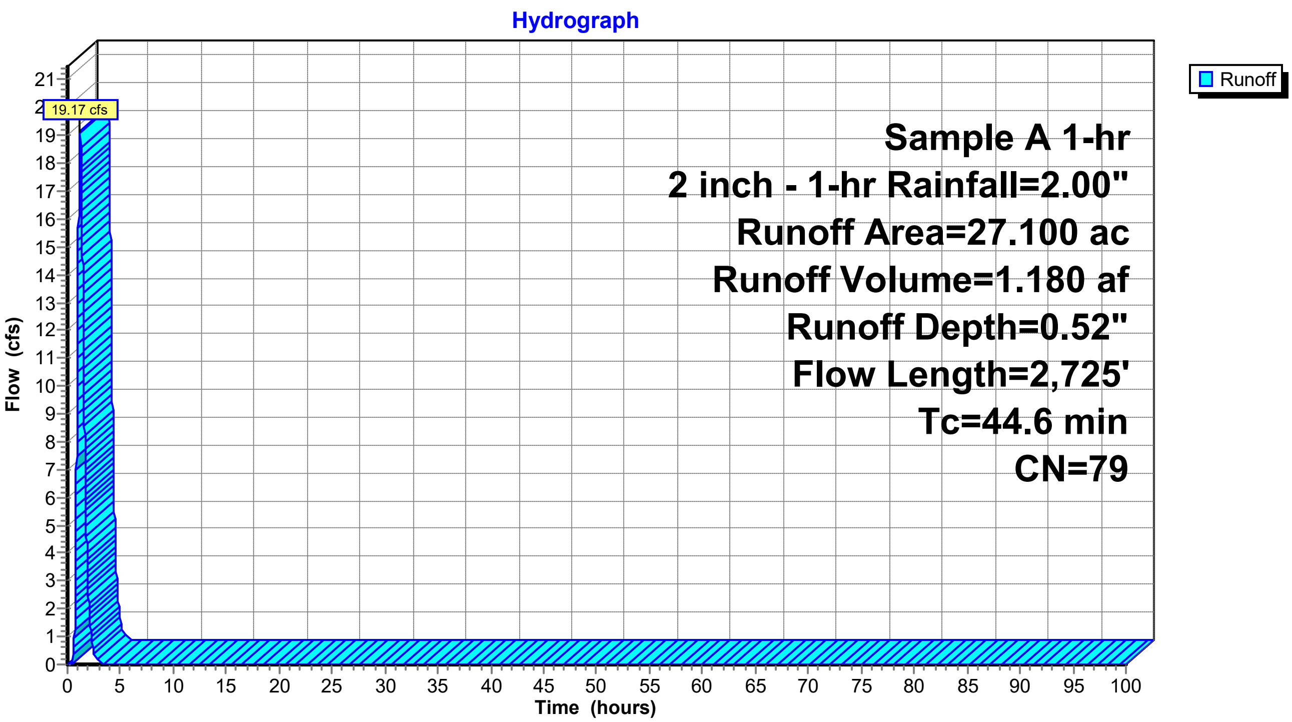
Runoff = 19.17 cfs @ 1.19 hrs, Volume= 1.180 af, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

Area (ac)	CN	Description
27.100	79	50-75% Grass cover, Fair, HSG C
27.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Lower Pond Excavation Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond. Footprint of ponded area has been halved to 17.78 Acres.

See dwg file Drainage Area - Storage Volumes.dwg

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

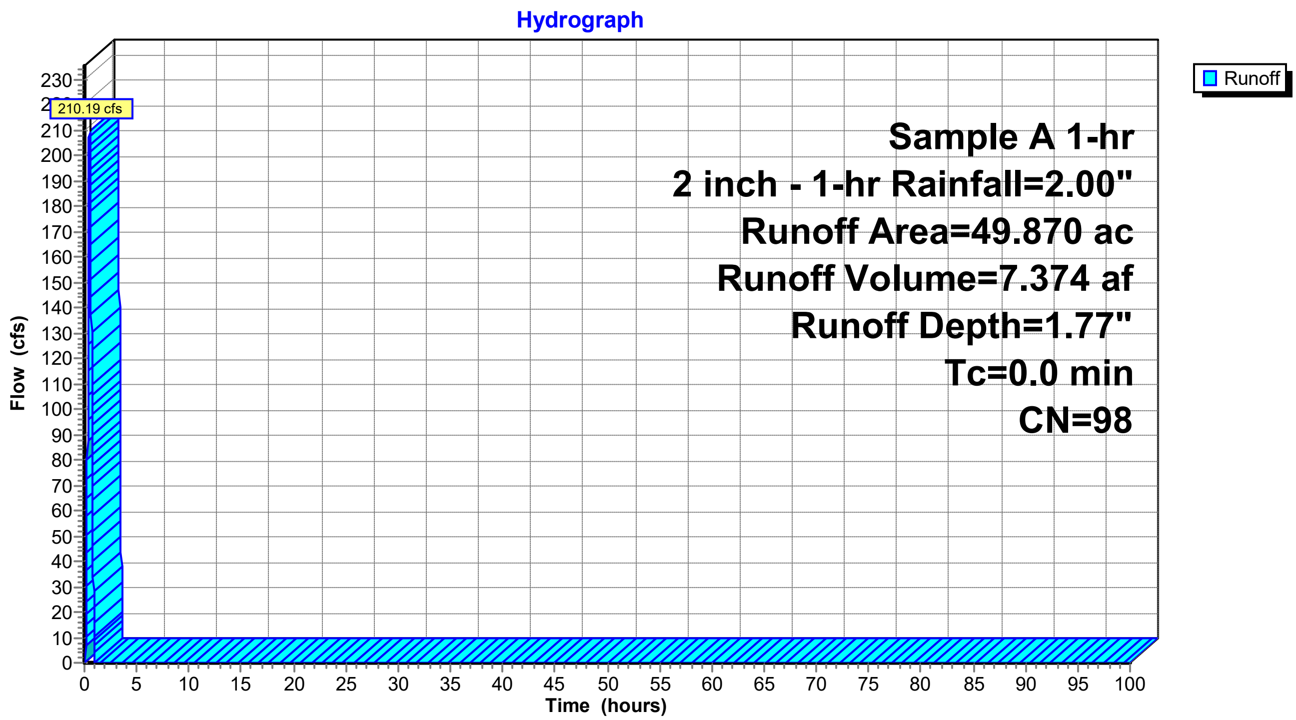
Runoff = 210.19 cfs @ 0.50 hrs, Volume= 7.374 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Sample A 1-hr 2 inch - 1-hr Rainfall=2.00"

	Area (ac)	CN	Description
	17.780	98	Water Surface, HSG C
*	17.780	98	Ash - Former Water Surface (Dewatered)
*	14.310	98	Ash
	49.870	98	Weighted Average
	49.870		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Lower Pond Excavation Area



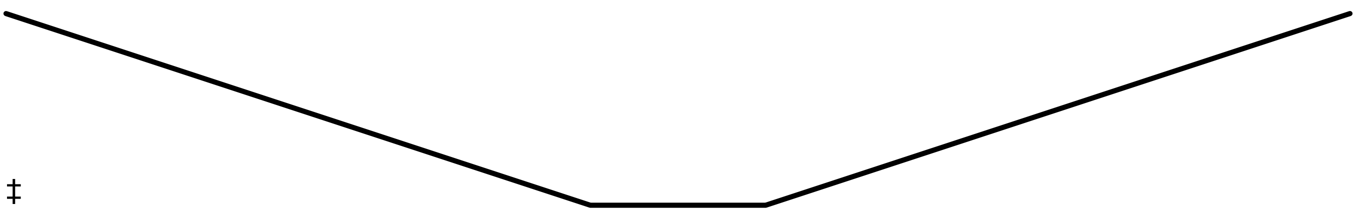
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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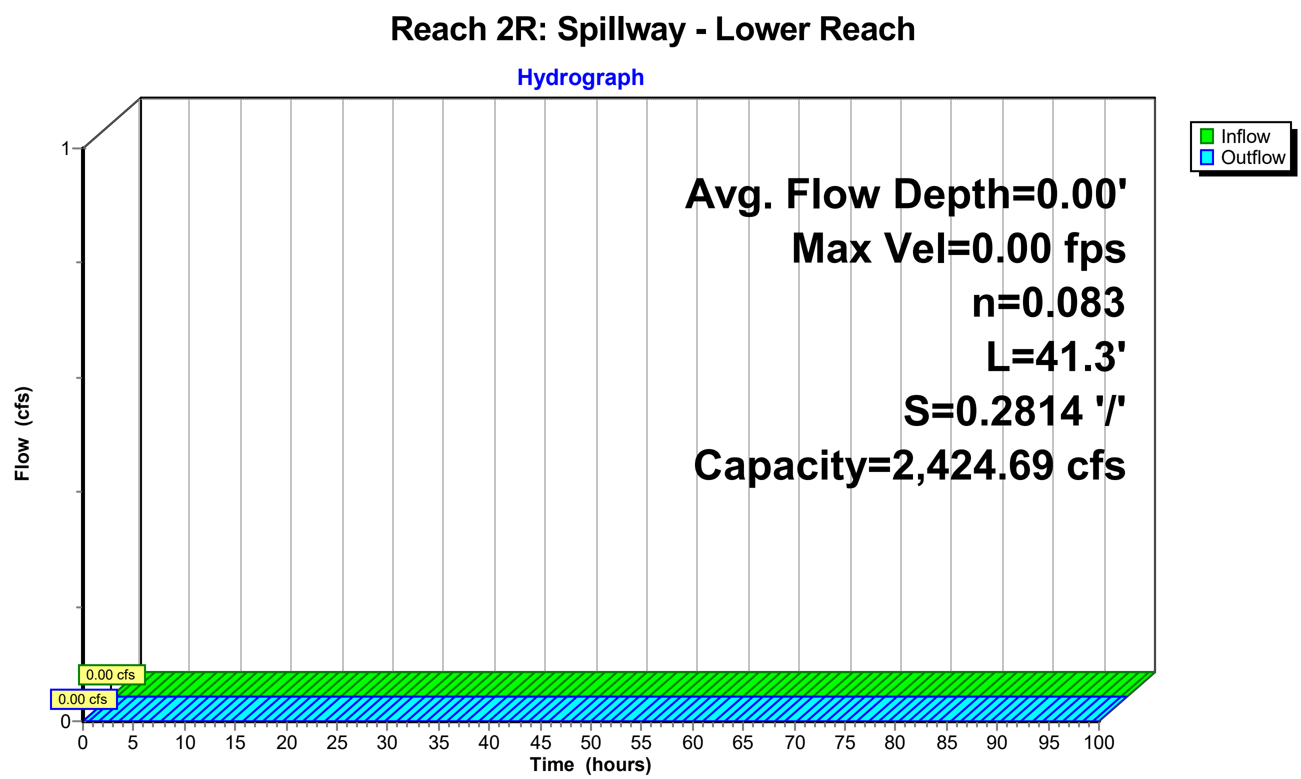


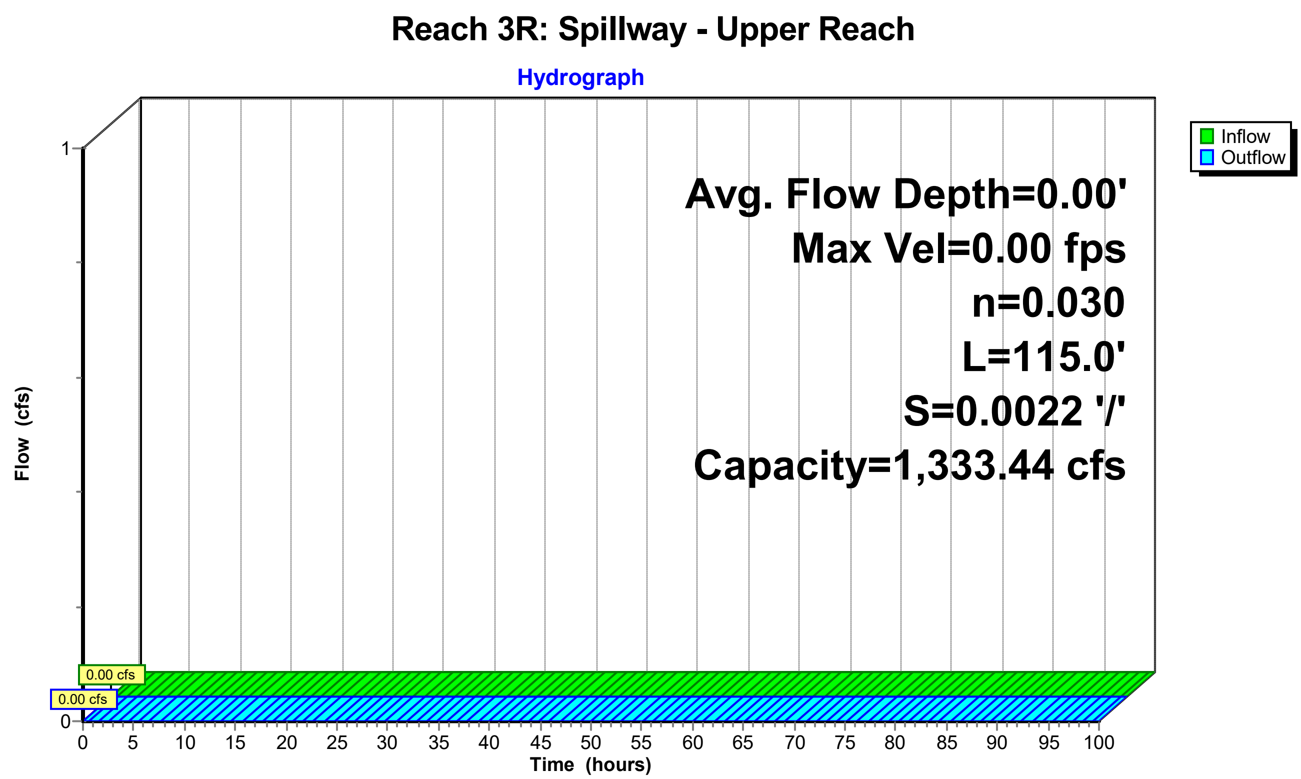
Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'



Summary for Reach 5R: Discharge Creek

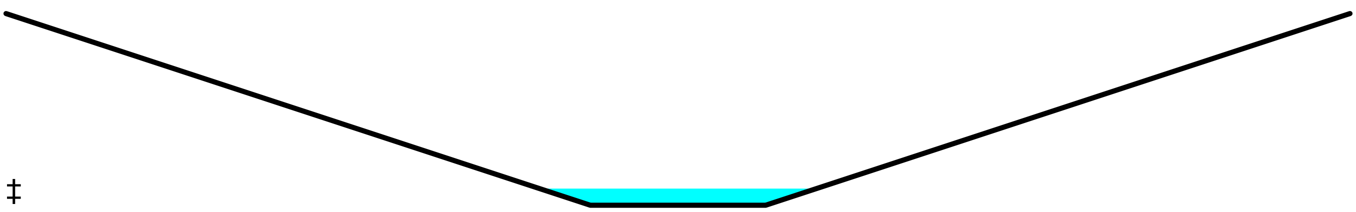
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 2.06 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 1.17" for 2 inch - 1-hr event
Inflow = 14.52 cfs @ 2.02 hrs, Volume= 23.519 af
Outflow = 14.52 cfs @ 2.06 hrs, Volume= 23.519 af, Atten= 0%, Lag= 2.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 4.07 fps, Avg. Travel Time= 3.3 min

Peak Storage= 2,680 cf @ 2.06 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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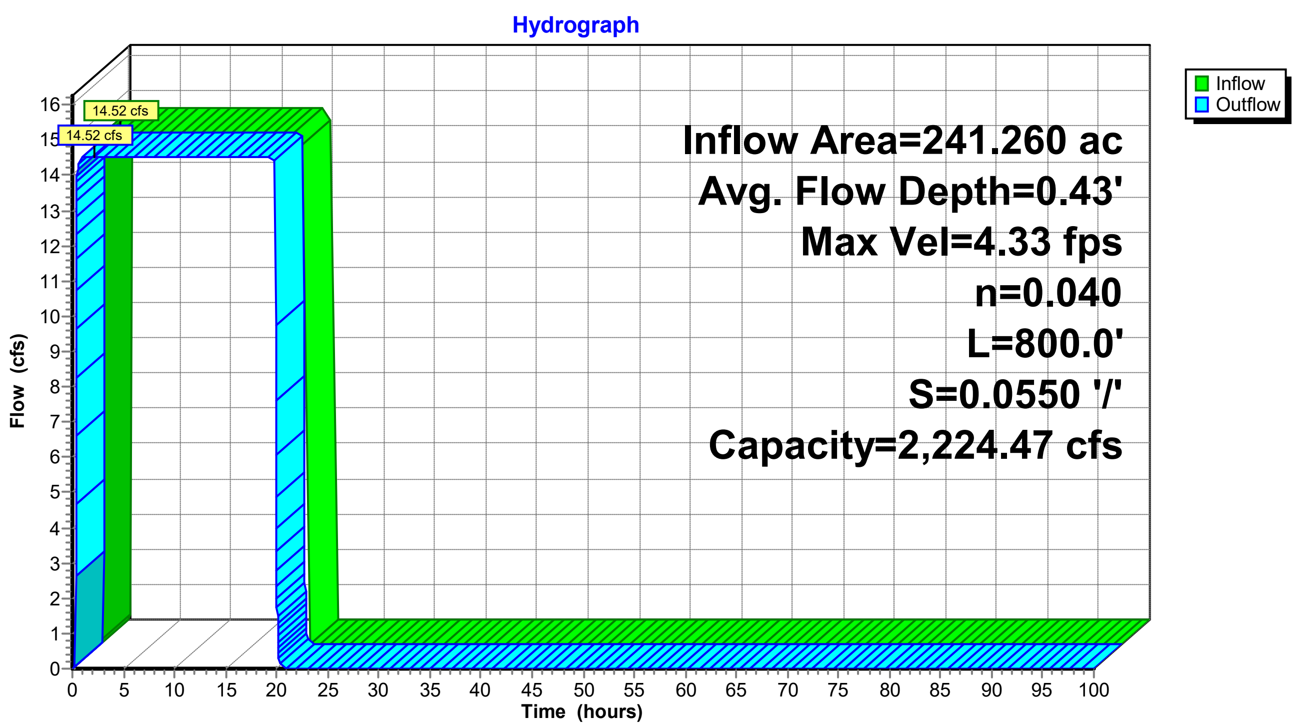
Reach 5R: Discharge Creek



Summary for Reach 7R: Spillway - Middle Reach

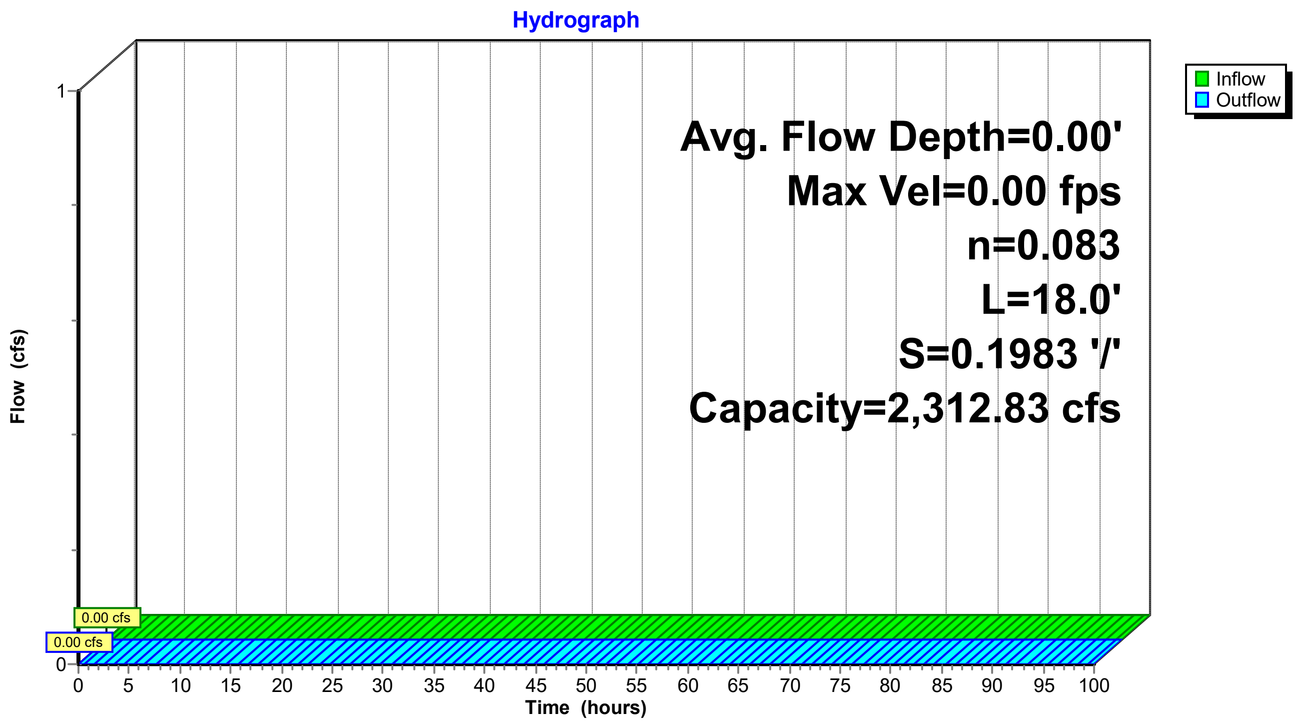
Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

Reach 7R: Spillway - Middle Reach



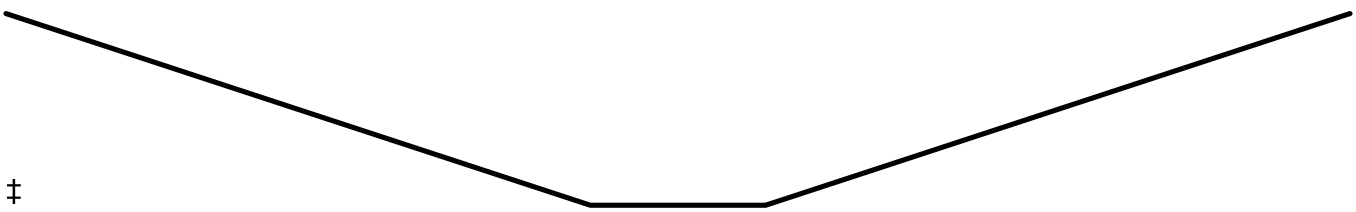
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



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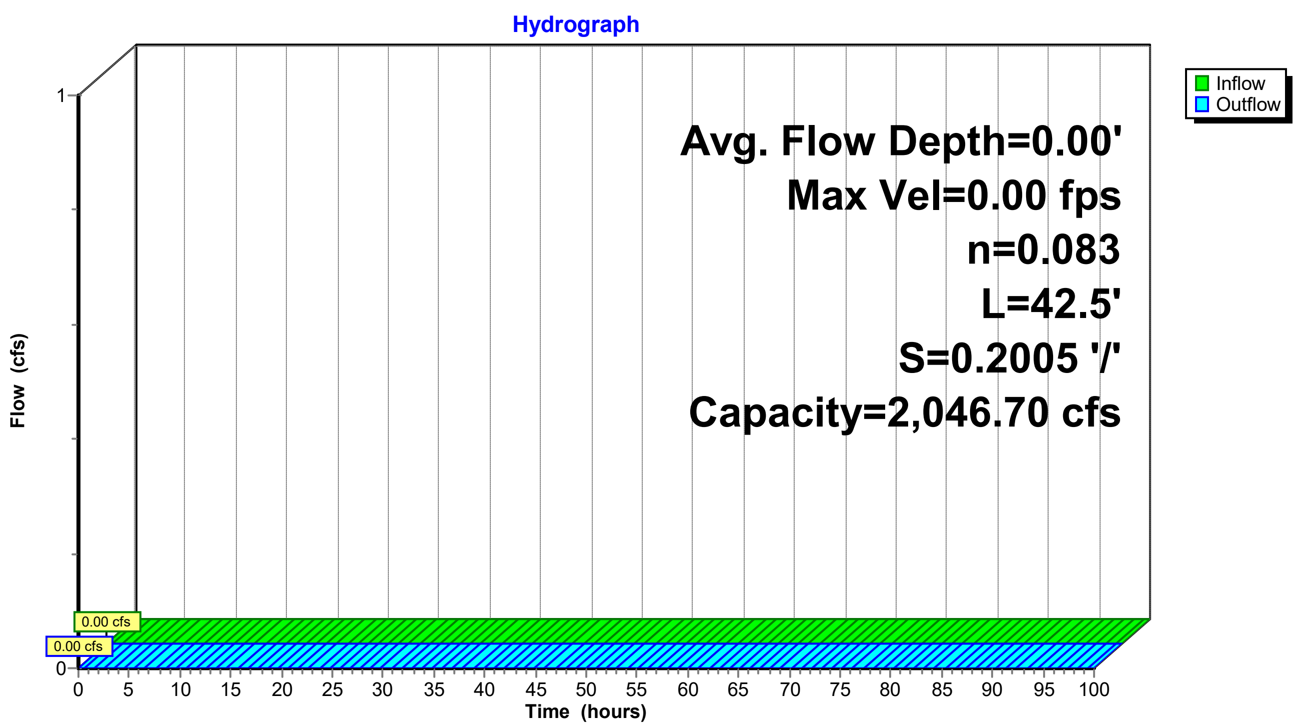
Reach 8R: Discharge Ditch



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow	=	13.58 cfs @ 0.00 hrs,	Volume=	112.243 af,	Incl. 13.58 cfs Base Flow
Outflow	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af,	Atten= 0%, Lag= 6,000.0 min
Primary	=	13.55 cfs @ 100.00 hrs,	Volume=	27.036 af	
Secondary	=	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

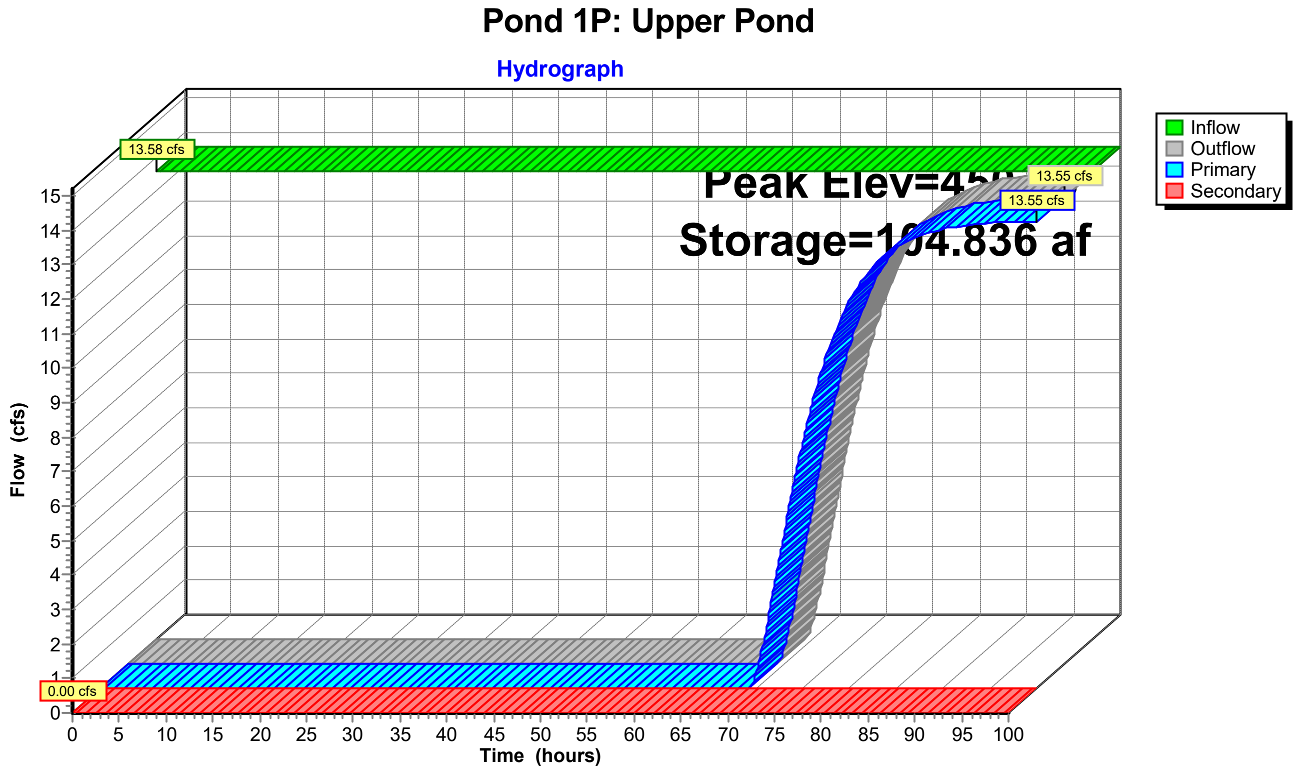
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
└─**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Summary for Pond 7P: Working Area

This pond node shall be used only if there is a pumping scenario

[43] Hint: Has no inflow (Outflow=Zero)

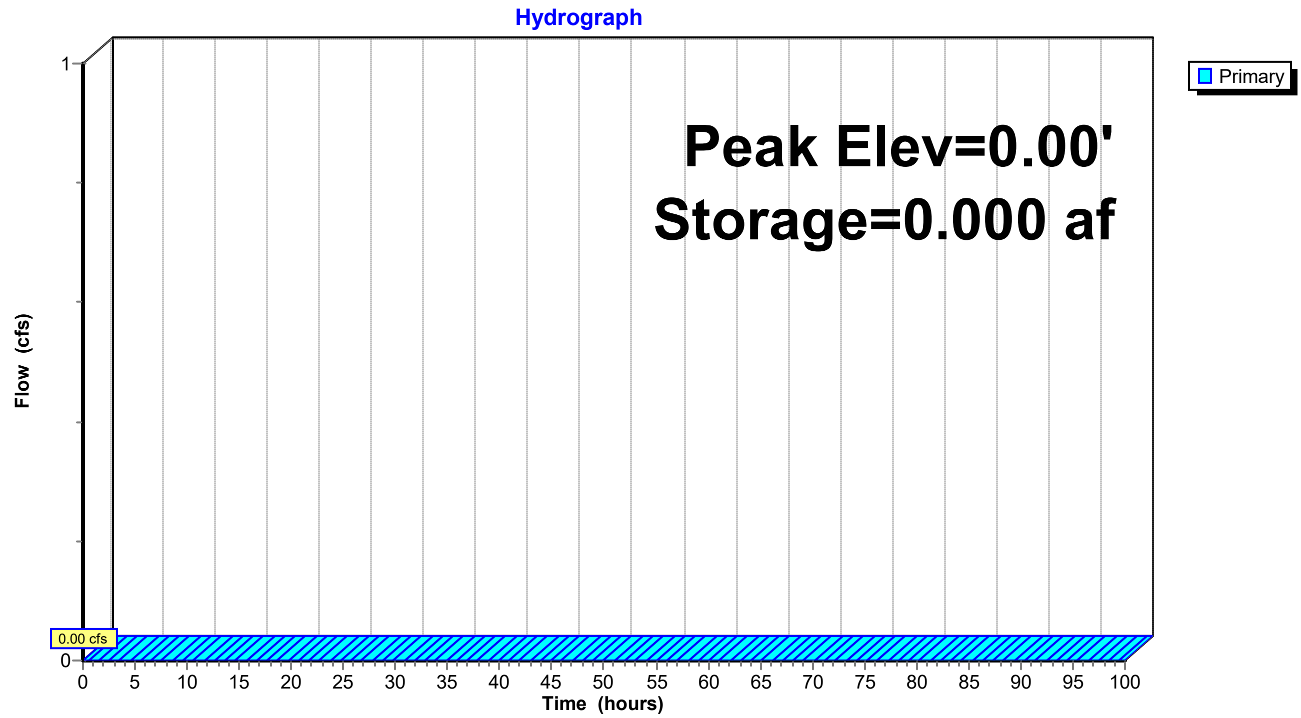
Volume	Invert	Avail.Storage	Storage Description
#1	440.00'	20.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
440.00	0.000
450.00	20.000

Device	Routing	Invert	Outlet Devices
#1	Primary	442.00'	**Pump** Discharges@440.00' Turns Off@440.50' Flow (gpm)= 1.0 100.0 250.0 500.0 1,000.0 Head (feet)= 100.00 90.00 80.00 25.00 10.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Pump** (Controls 0.00 cfs)

Pond 7P: Working Area



Summary for Pond 8P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 1.17" for 2 inch - 1-hr event
Inflow = 281.02 cfs @ 1.06 hrs, Volume= 23.532 af
Outflow = 14.52 cfs @ 2.02 hrs, Volume= 23.519 af, Atten= 95%, Lag= 57.6 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 2.02 hrs, Volume= 23.519 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 420.00' Surf.Area= 0.000 ac Storage= 11.260 af
Peak Elev= 428.01' @ 2.02 hrs Surf.Area= 0.000 ac Storage= 32.477 af (21.217 af above start)

Plug-Flow detention time= 850.9 min calculated for 12.258 af (52% of inflow)
Center-of-Mass det. time= 550.2 min (608.6 - 58.4)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

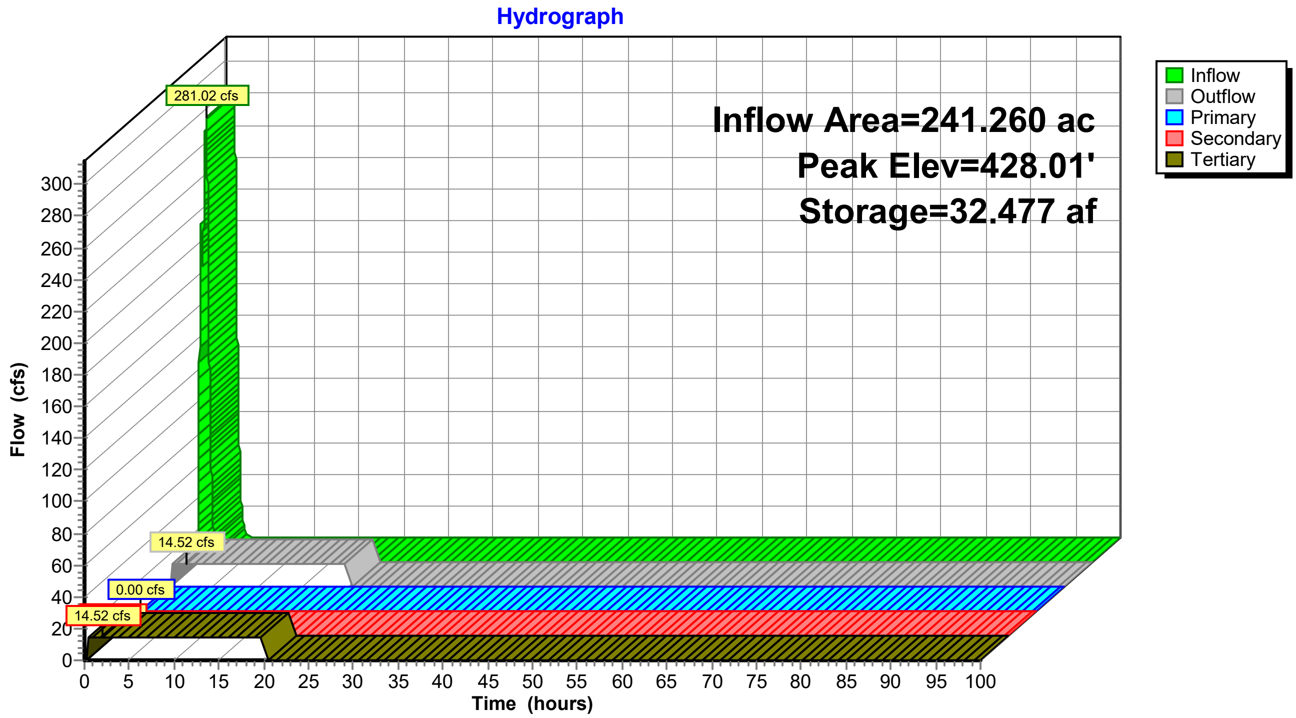
Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.00 cfs)
 └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Tertiary OutFlow Max=14.52 cfs @ 2.02 hrs HW=428.01' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)

Pond 8P: Lower Pond



Summary for Subcatchment 2S: Phase 1 Drainage Area

Phase 4 Drainage Area includes Limits of Upper Ash Pond all of which is now an ash surface with no pools or vegetation. Excavation Elevation is 430-425 at the Upper Pond area.

See dwg file Drainage Area - Storage Volumes.dwg

Time of concentration Assumptions: In the absence of any pond storage in the Upper Pond Area, all flows are directly routed to the Lower Pond.

Ash CN = 98.

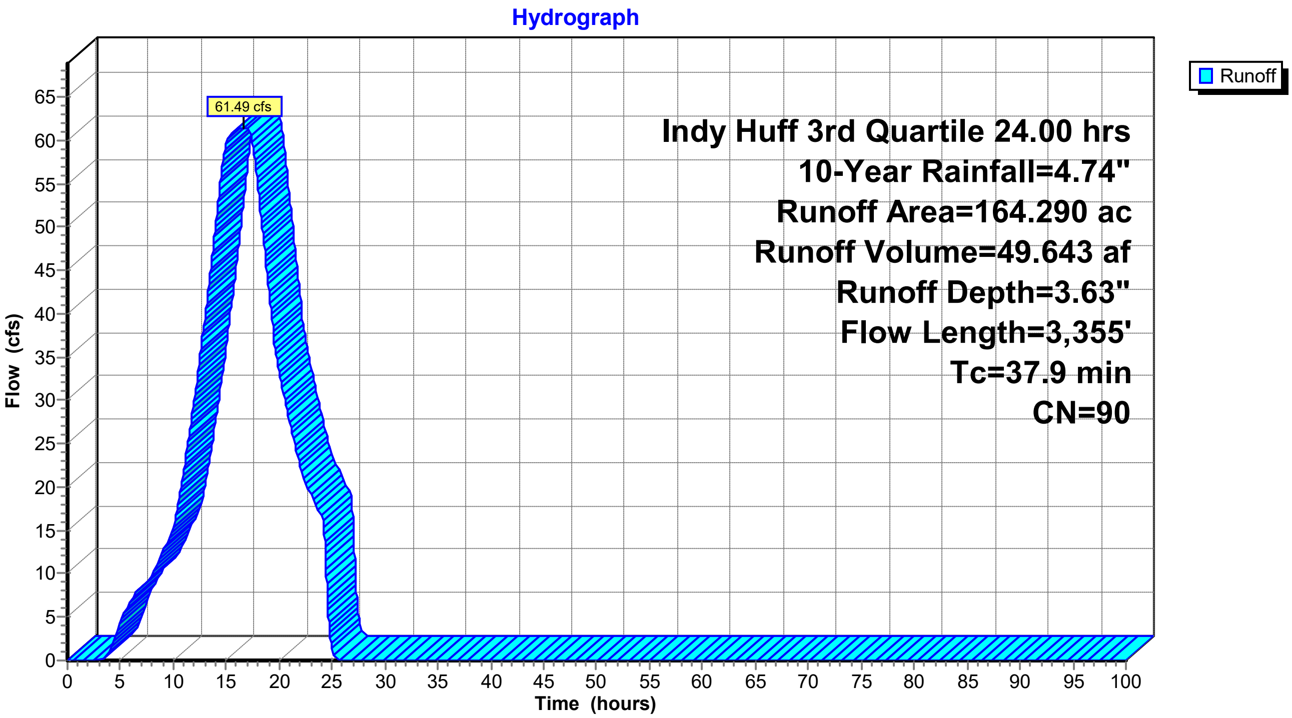
Runoff = 61.49 cfs @ 16.72 hrs, Volume= 49.643 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	67.530	79	50-75% Grass cover, Fair, HSG C
*	91.560	98	Ash
*	5.200	79	50-75% Grass cover, Fair, HSG C
	164.290	90	Weighted Average
	72.730		44.27% Pervious Area
	91.560		55.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	300	0.0600	0.80		**Sheet Flow,** Fallow n= 0.050 P2= 3.29"
1.1	305	0.1000	4.74		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
30.6	2,750	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
37.9	3,355	Total			

Subcatchment 2S: Phase 1 Drainage Area



Summary for Subcatchment 3S: Lower Pond Drainage Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond.

See dwg file Drainage Area - Storage Volumes.dwg

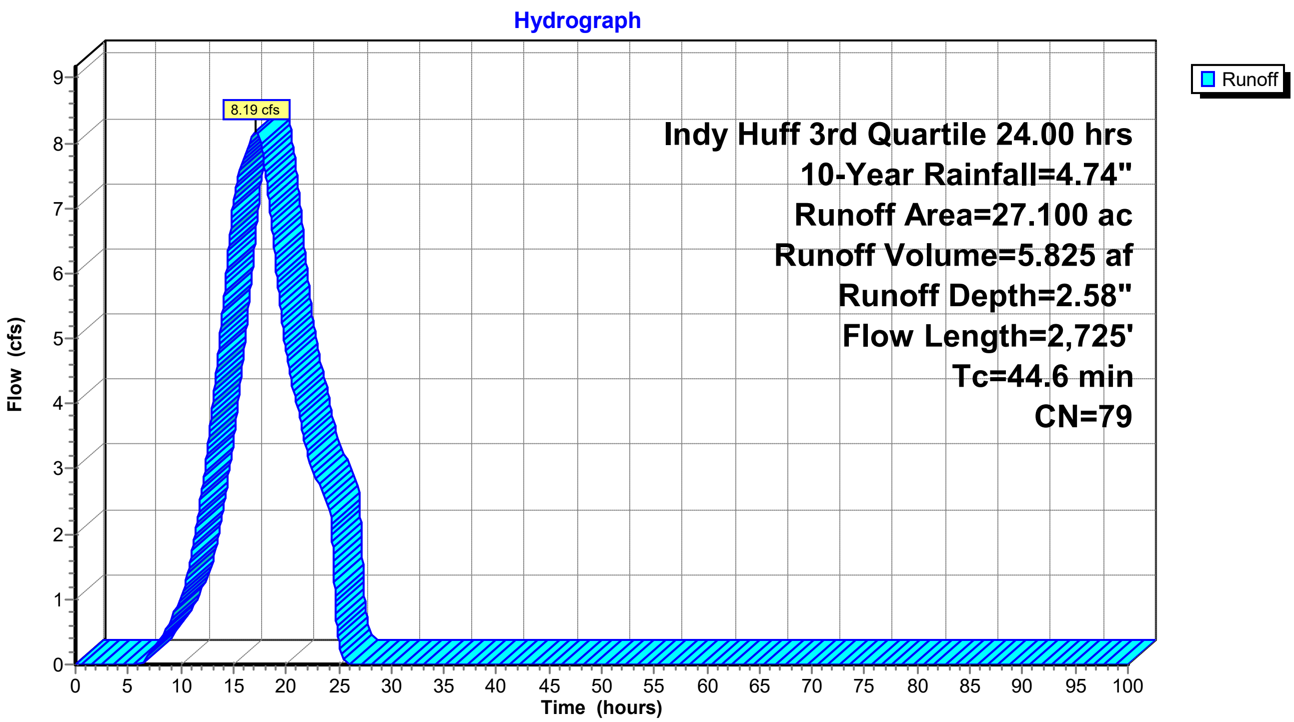
Runoff = 8.19 cfs @ 17.20 hrs, Volume= 5.825 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

Area (ac)	CN	Description
27.100	79	50-75% Grass cover, Fair, HSG C
27.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.8	300	0.0300	0.25		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.29"
1.7	350	0.0500	3.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.1	2,075	0.0100	1.50		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
44.6	2,725	Total			

Subcatchment 3S: Lower Pond Drainage Area



Summary for Subcatchment 4S: Lower Pond Excavation Area

Phase 4 Drainage Area for Lower Ash Pond includes Limits of Ash Pond and drainage subcatchments draining into the pond from outside the limits of the pond. Footprint of ponded area has been halved to 17.78 Acres.

See dwg file Drainage Area - Storage Volumes.dwg

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[46] Hint: Tc=0 (Instant runoff peak depends on dt)

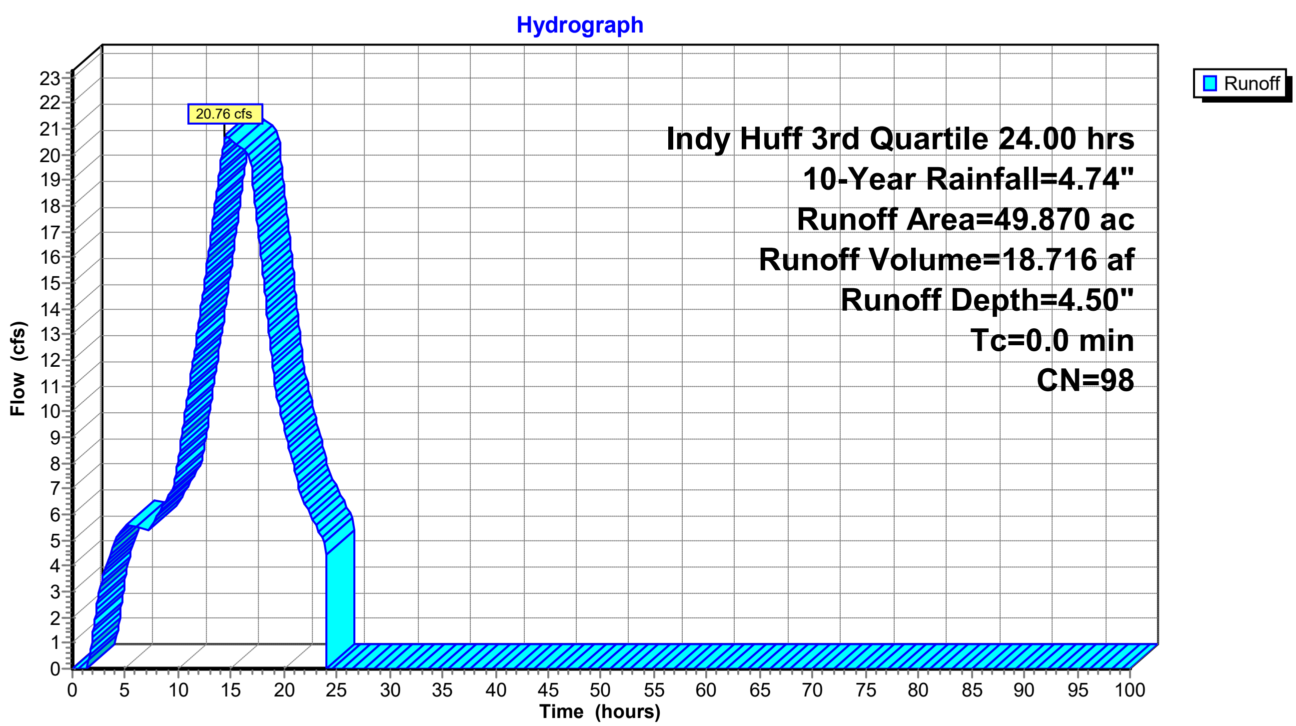
Runoff = 20.76 cfs @ 14.41 hrs, Volume= 18.716 af, Depth= 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Indy Huff 3rd Quartile 24.00 hrs 10-Year Rainfall=4.74"

	Area (ac)	CN	Description
	17.780	98	Water Surface, HSG C
*	17.780	98	Ash - Former Water Surface (Dewatered)
*	14.310	98	Ash
	49.870	98	Weighted Average
	49.870		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 4S: Lower Pond Excavation Area



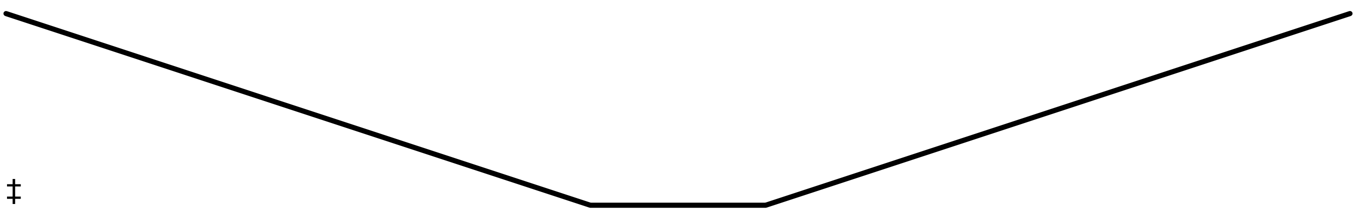
Summary for Reach 2R: Spillway - Lower Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,424.69 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 41.3' Slope= 0.2814 '/'
Inlet Invert= 442.88', Outlet Invert= 431.26'



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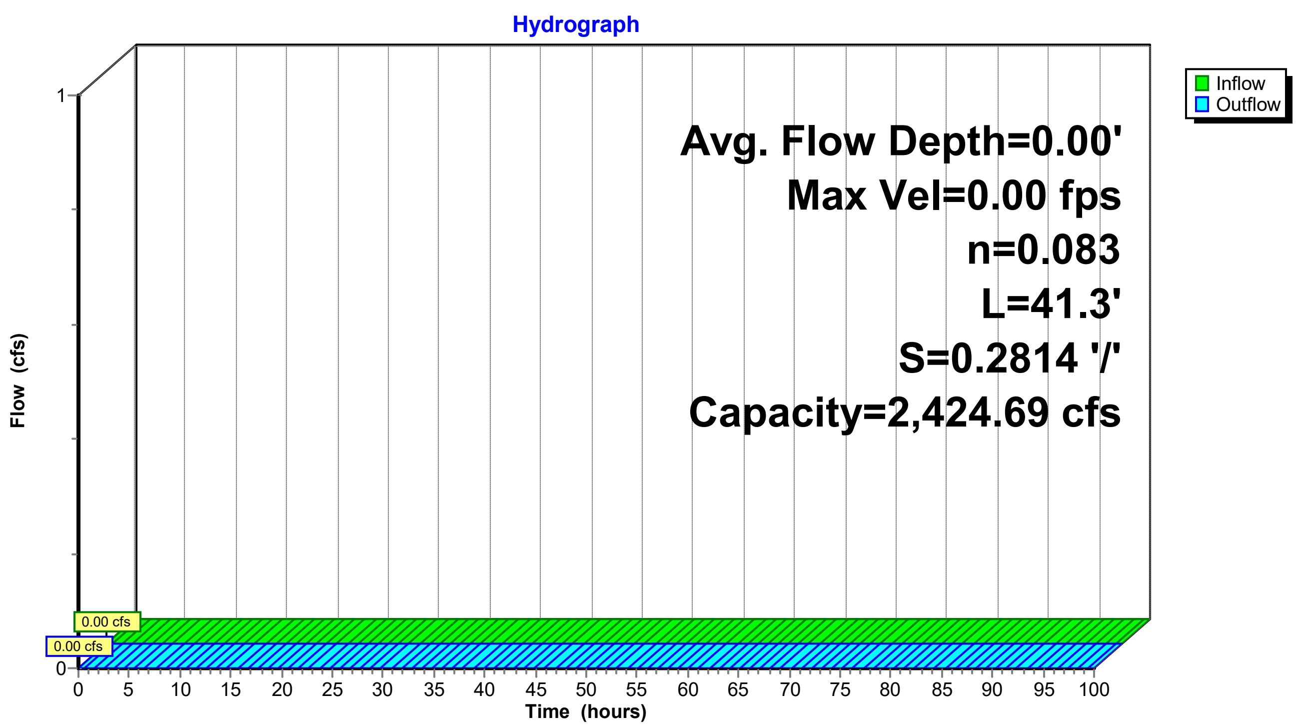
Reach 2R: Spillway - Lower Reach



Summary for Reach 3R: Spillway - Upper Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

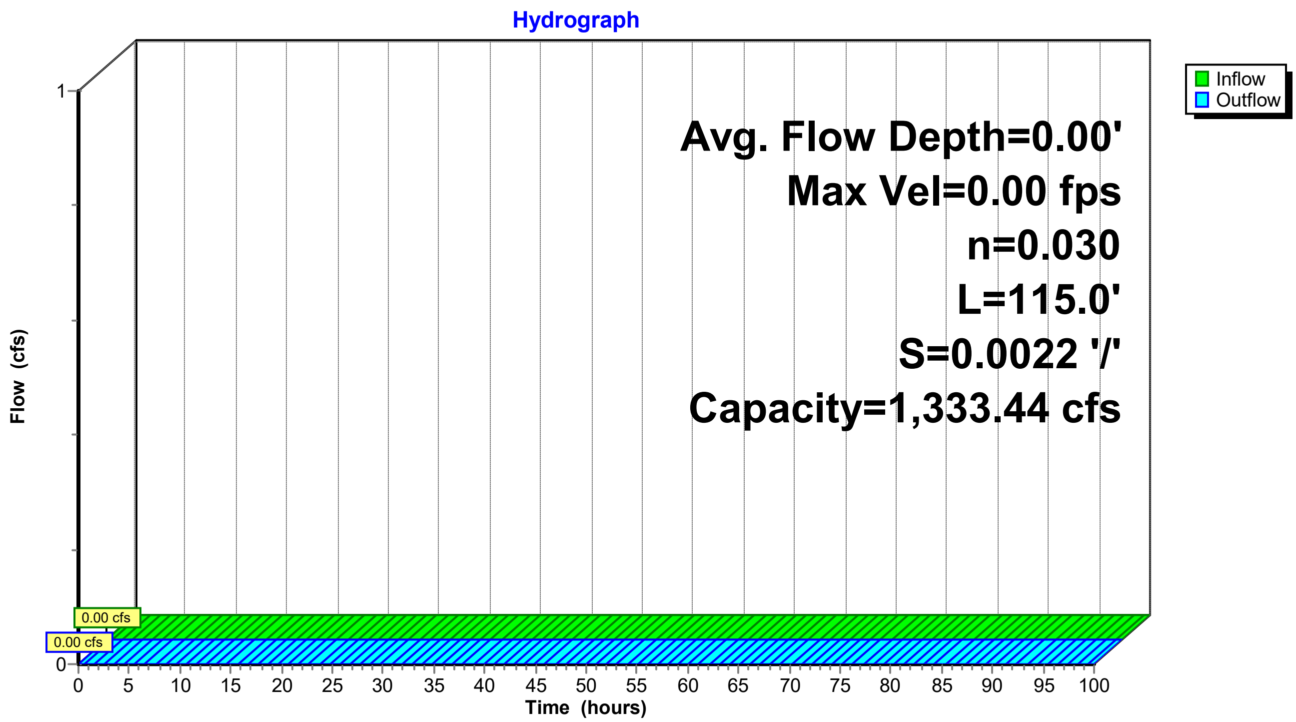
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 250.0 sf, Capacity= 1,333.44 cfs

30.00' x 5.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 4.0 '/' Top Width= 70.00'
Length= 115.0' Slope= 0.0022 '/'
Inlet Invert= 447.00', Outlet Invert= 446.75'

‡

Reach 3R: Spillway - Upper Reach



Summary for Reach 5R: Discharge Creek

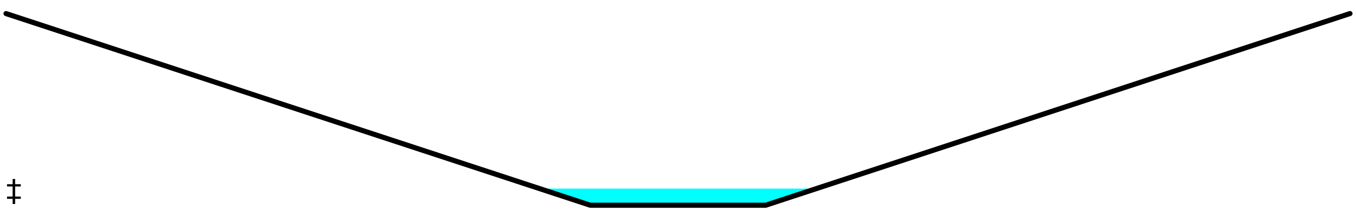
[62] Hint: Exceeded Reach 8R OUTLET depth by 5.69' @ 24.40 hrs

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 3.69" for 10-Year event
Inflow = 14.52 cfs @ 24.37 hrs, Volume= 74.166 af
Outflow = 14.52 cfs @ 24.41 hrs, Volume= 74.166 af, Atten= 0%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.33 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 4.25 fps, Avg. Travel Time= 3.1 min

Peak Storage= 2,680 cf @ 24.41 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,224.47 cfs

6.00' x 5.00' deep channel, n= 0.040 Winding stream, pools & shoals
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 800.0' Slope= 0.0550 '/'
Inlet Invert= 428.00', Outlet Invert= 384.00'



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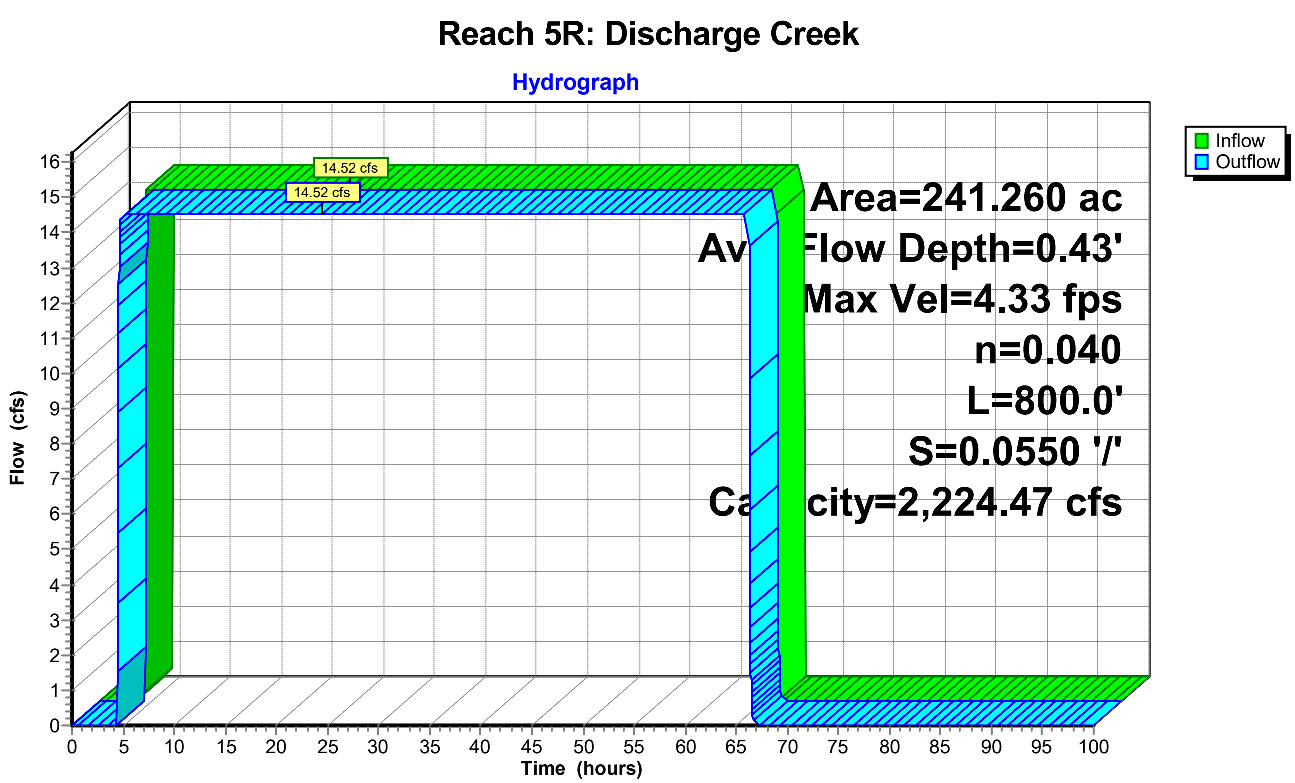


Summary for Reach 7R: Spillway - Middle Reach

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

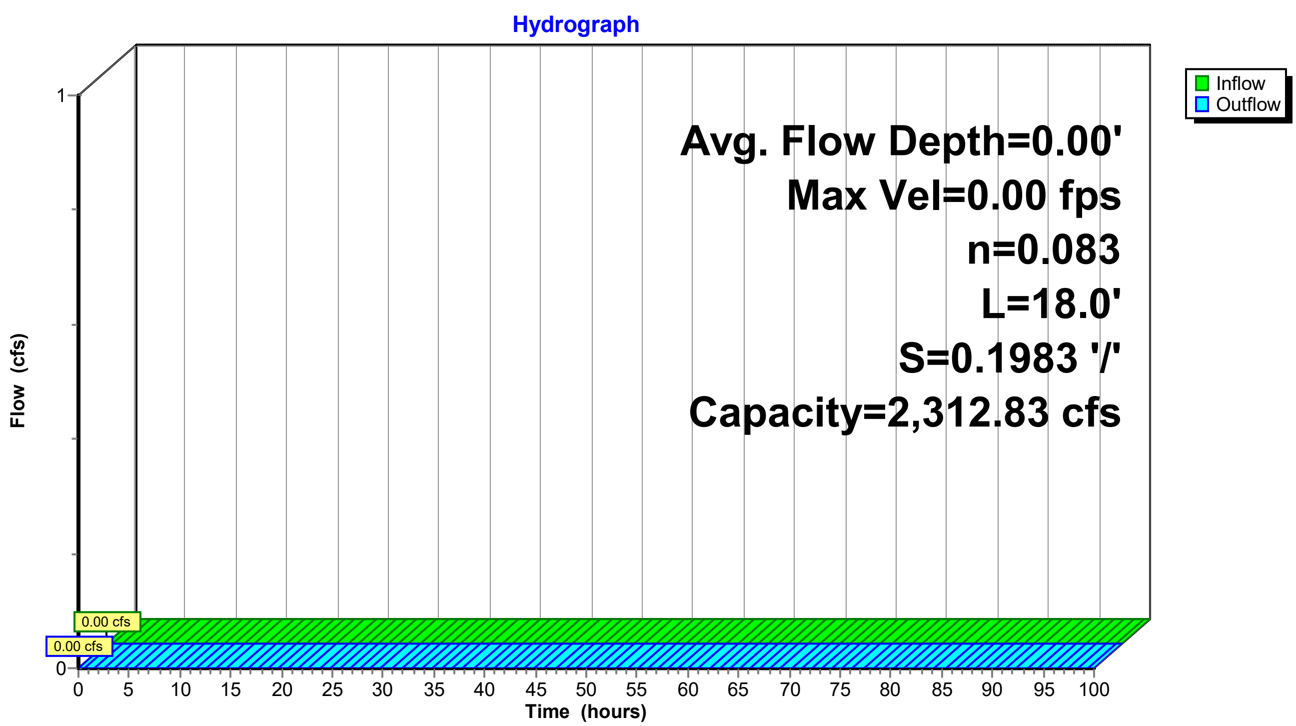
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 143.5 sf, Capacity= 2,312.83 cfs

8.70' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 48.70'
Length= 18.0' Slope= 0.1983 '/'
Inlet Invert= 446.45', Outlet Invert= 442.88'

‡

Reach 7R: Spillway - Middle Reach



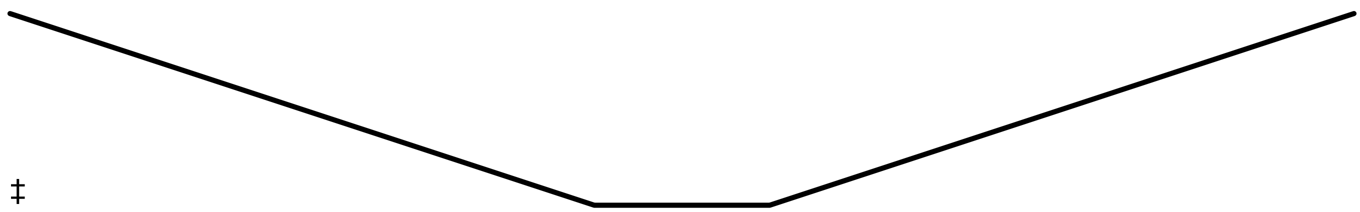
Summary for Reach 8R: Discharge Ditch

Inflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af
Outflow	=	0.00 cfs @	0.00 hrs, Volume=	0.000 af, Atten= 0%, Lag= 0.0 min

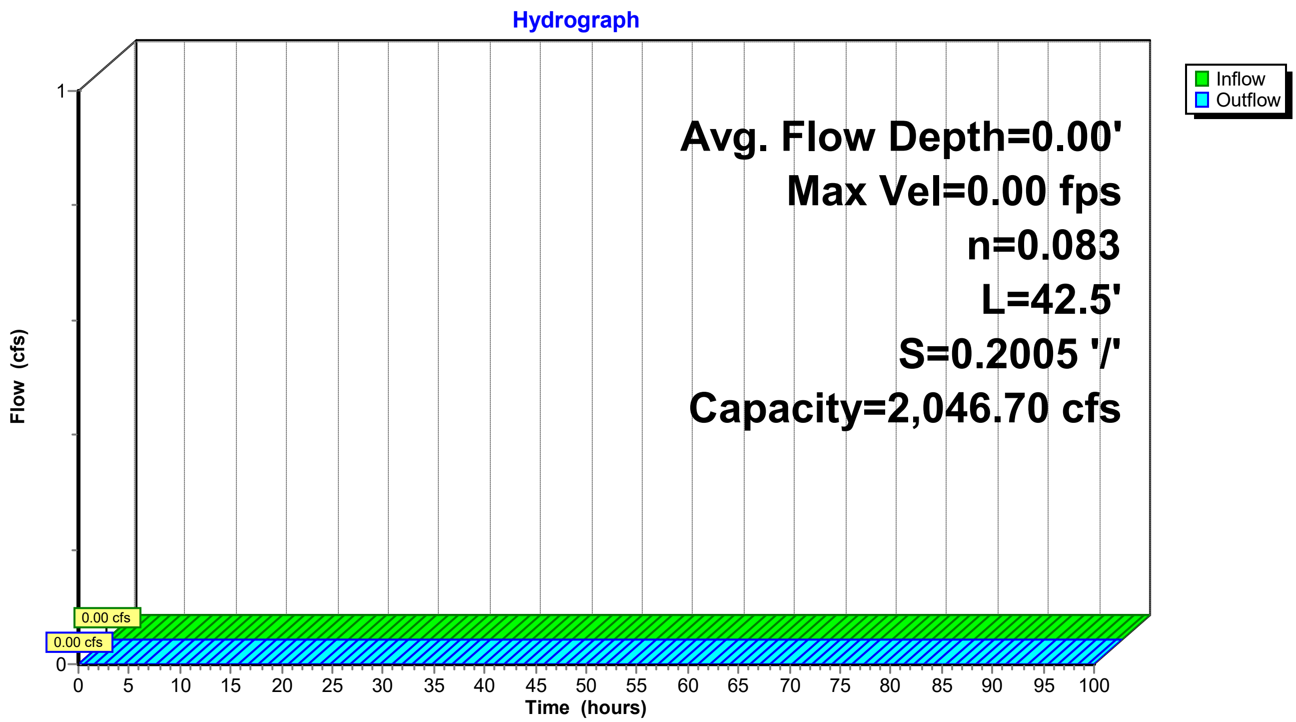
Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 5.00' Flow Area= 130.0 sf, Capacity= 2,046.70 cfs

6.00' x 5.00' deep channel, n= 0.083
Side Slope Z-value= 4.0 '/' Top Width= 46.00'
Length= 42.5' Slope= 0.2005 '/'
Inlet Invert= 431.26', Outlet Invert= 422.74'



Reach 8R: Discharge Ditch



Summary for Pond 1P: Upper Pond

Elevations of outlet taken from ATC Hydraulic analyses and decommising report dated Feb 17, 2016

Outlet sizes from ATC Report are shown in Outside Diameter. Inside diameter for 63" HDPE DR 21pipe is 56.6". Inside Diameter for 26" HDPE DR 17 pipe is 22.8".

Inflow = 13.58 cfs @ 0.00 hrs, Volume= 112.243 af, Incl. 13.58 cfs Base Flow
Outflow = 13.55 cfs @ 100.00 hrs, Volume= 27.036 af, Atten= 0%, Lag= 6,000.0 min
Primary = 13.55 cfs @ 100.00 hrs, Volume= 27.036 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 442.76' Surf.Area= 0.000 ac Storage= 19.628 af
Peak Elev= 450.43' @ 100.00 hrs Surf.Area= 0.000 ac Storage= 104.836 af (85.207 af above start)

Plug-Flow detention time= 5,604.2 min calculated for 7.401 af (7% of inflow)
Center-of-Mass det. time= 2,247.2 min (5,247.2 - 3,000.0)

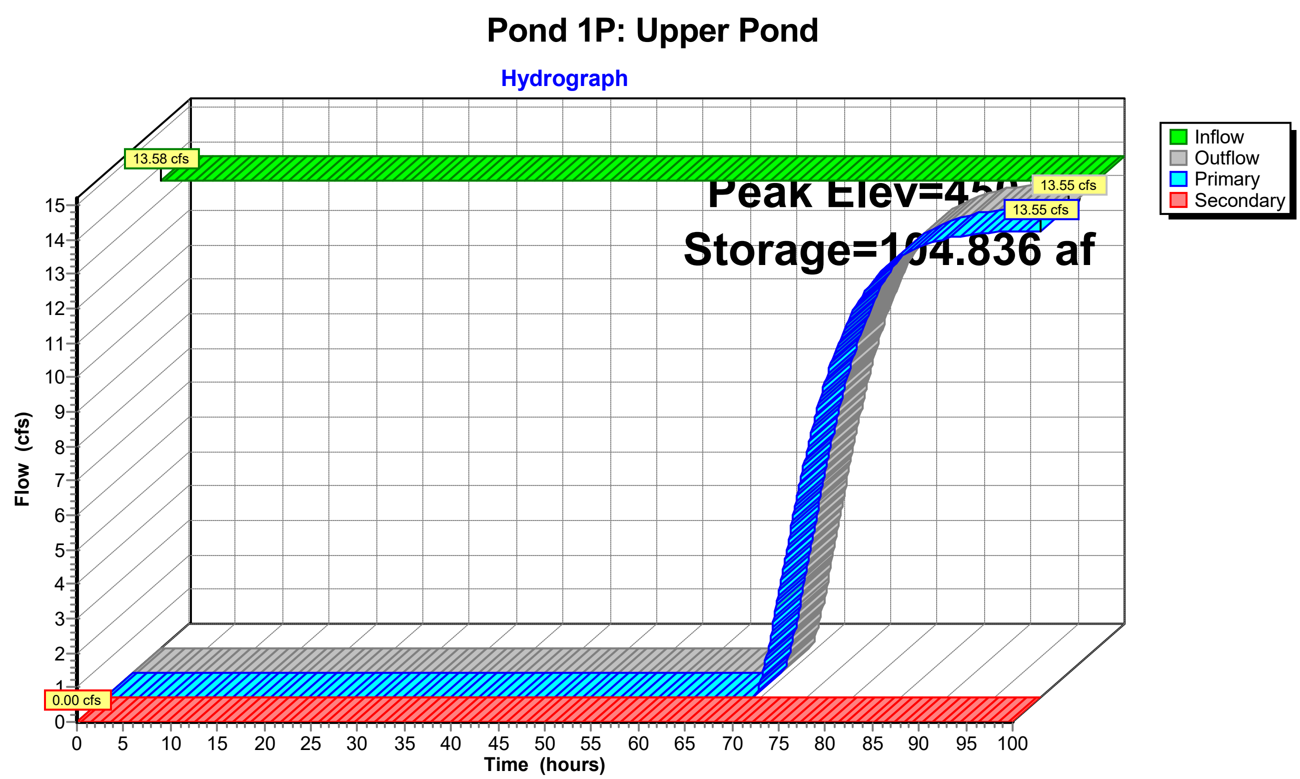
Volume	Invert	Avail.Storage	Storage Description
#1	437.00'	133.420 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
437.00	0.000
438.00	2.190
440.00	7.410
441.00	10.860
442.00	15.380
443.00	20.970
444.00	27.640
445.00	35.770
446.00	45.130
447.00	55.880
448.00	68.230
449.00	82.050
450.00	97.500
451.00	114.650
452.00	133.420

Device	Routing	Invert	Outlet Devices
#1	Primary	446.00'	**22.8" Round Culvert** L= 300.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.00' / 444.50' S= 0.0050 '/' Cc= 0.900 n= 0.011, Flow Area= 2.84 sf
#2	Device 1	450.00'	**56.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	455.00'	**10.0' long x 217.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=13.55 cfs @ 100.00 hrs HW=450.43' (Free Discharge)
└─**1=Culvert** (Passes 13.55 cfs of 20.10 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 13.55 cfs @ 2.14 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=442.76' (Free Discharge)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Summary for Pond 7P: Working Area

This pond node shall be used only if there is a pumping scenario

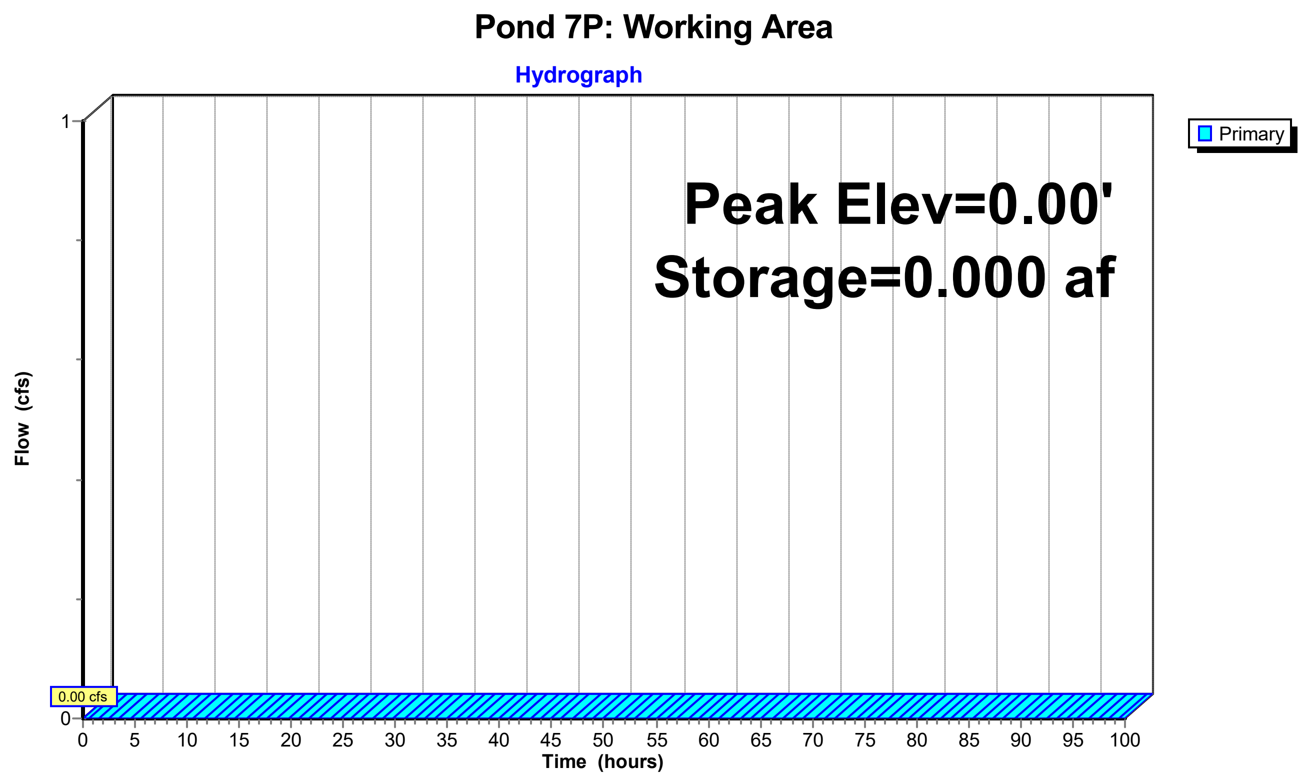
[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	440.00'	20.000 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
440.00	0.000
450.00	20.000

Device	Routing	Invert	Outlet Devices
#1	Primary	442.00'	**Pump** Discharges@440.00' Turns Off@440.50' Flow (gpm)= 1.0 100.0 250.0 500.0 1,000.0 Head (feet)= 100.00 90.00 80.00 25.00 10.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)
└─**1=Pump** (Controls 0.00 cfs)



Summary for Pond 8P: Lower Pond

Phase 2 refers to excavations beyond elevation 450 and upto elevation 445. During this phase the center dike separating the Upper Ash Pond (undergoing Phase 2) and the Lower Ash Pond is expected to be breached. As a result, the only storage within the Limits of the Ash Pond is provided by the Lower Ash Pond. This is expected to be 3 years after Phase 1 when all base flows and existing flows to the Lower Ash Pond have ceased.

Water Surface Elevation from Three-I survey dated 2-18-18 (G:\Cleveland\DCS\Projects\V\Vectren Corporation\60442676_ABBClosure\900-CAD-GIS\910-CAD\10-REFERENCE\Three-I Aerial Topography 2018)

Inflow Area = 241.260 ac, 58.62% Impervious, Inflow Depth = 3.69" for 10-Year event
Inflow = 89.55 cfs @ 16.72 hrs, Volume= 74.184 af
Outflow = 14.52 cfs @ 24.37 hrs, Volume= 74.166 af, Atten= 84%, Lag= 459.3 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 14.52 cfs @ 24.37 hrs, Volume= 74.166 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
Starting Elev= 420.00' Surf.Area= 0.000 ac Storage= 11.260 af
Peak Elev= 432.49' @ 24.37 hrs Surf.Area= 0.000 ac Storage= 61.231 af (49.971 af above start)

Plug-Flow detention time= 1,535.6 min calculated for 62.906 af (85% of inflow)
Center-of-Mass det. time= 1,184.9 min (2,124.4 - 939.5)

Volume	Invert	Avail.Storage	Storage Description
#1	410.00'	603.580 af	**Custom Stage Data** Listed below

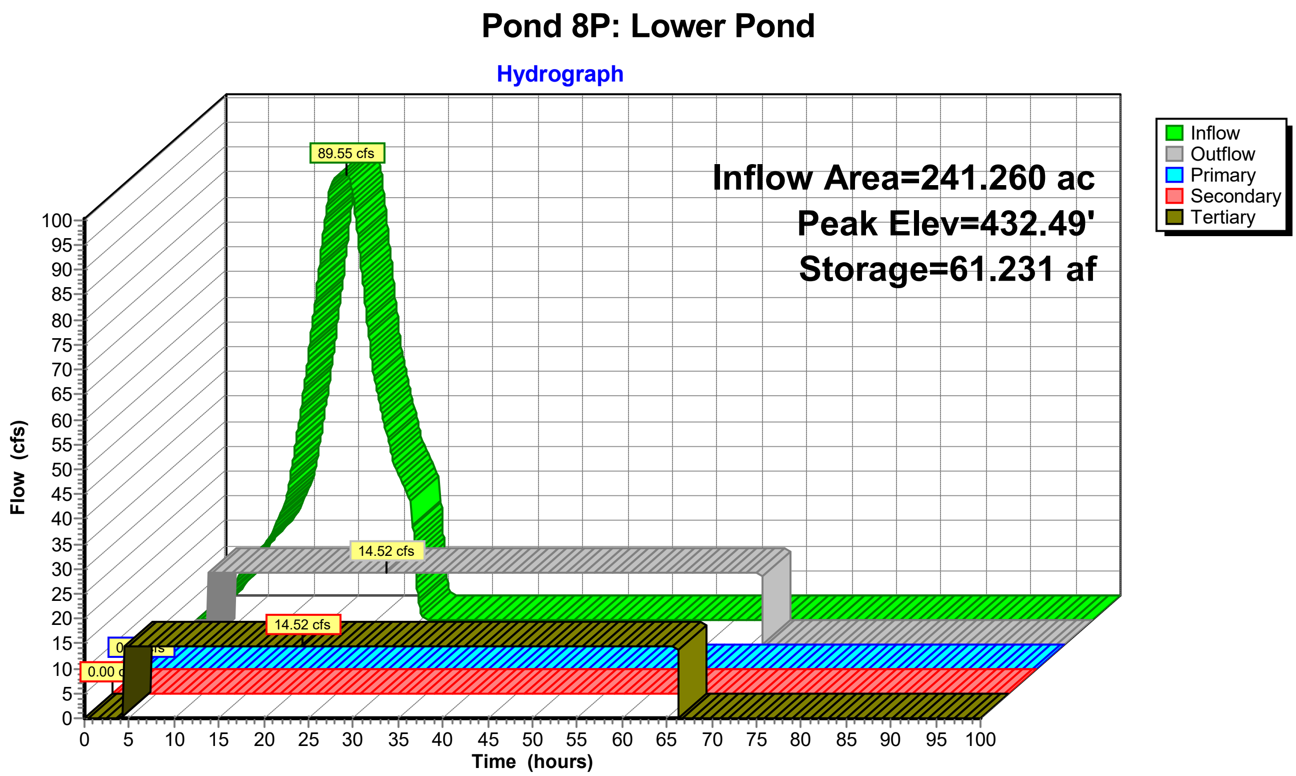
Elevation (feet)	Cum.Store (acre-feet)
410.00	0.000
412.00	1.330
414.00	3.080
416.00	6.620
418.00	8.020
420.00	11.260
421.00	13.100
422.00	15.060
423.00	17.120
424.00	19.280
425.00	21.730
426.00	24.700
427.00	28.260
428.00	32.410
429.00	37.090
430.00	42.320
435.00	80.240
440.00	138.500
441.00	152.440
442.00	167.800
443.00	188.760
444.00	218.970
445.00	258.580
446.00	299.210
447.00	342.320
448.00	387.020
449.00	437.130
450.00	464.600
451.00	545.710
452.00	603.580

Device	Routing	Invert	Outlet Devices
#1	Primary	388.00'	**36.0" Round Culvert** L= 376.0' RCP, groove end w/headwall, Ke= 0.200 Inlet / Outlet Invert= 388.00' / 384.00' S= 0.0106 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	444.00'	**36.0" Vert. Orifice/Grate** C= 0.600
#3	Secondary	447.00'	**30.0' long x 115.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#4	Tertiary	420.50'	**Pump** Discharges@450.90' Turns Off@420.01' Flow (gpm)= 6,516.0 6,516.1 Head (feet)= 500.00 0.00

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=428.00' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=420.00' TW=447.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

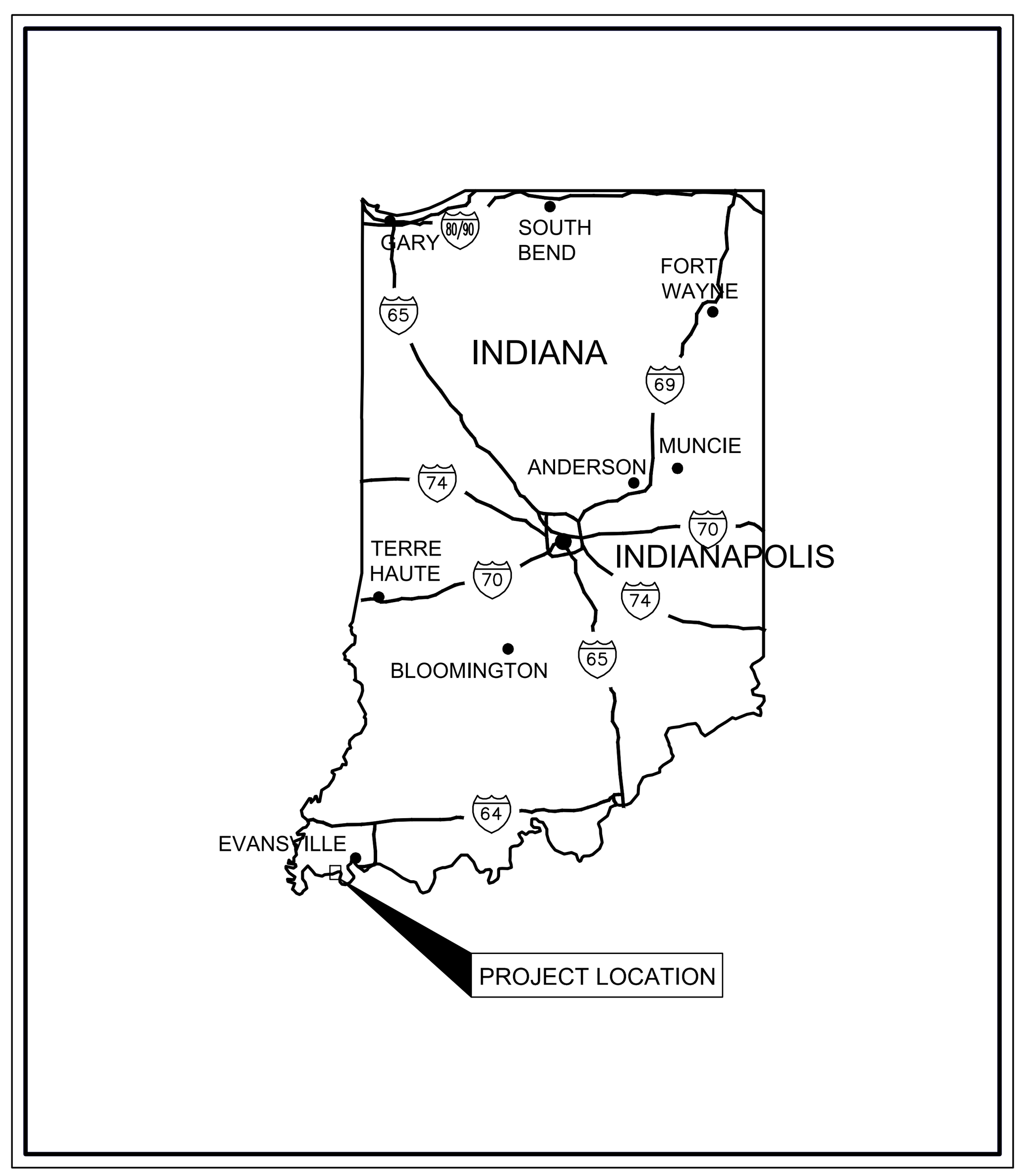
Tertiary OutFlow Max=14.52 cfs @ 24.37 hrs HW=432.49' TW=428.43' (Dynamic Tailwater)
└─**4=Pump** (Pump Controls 14.52 cfs)



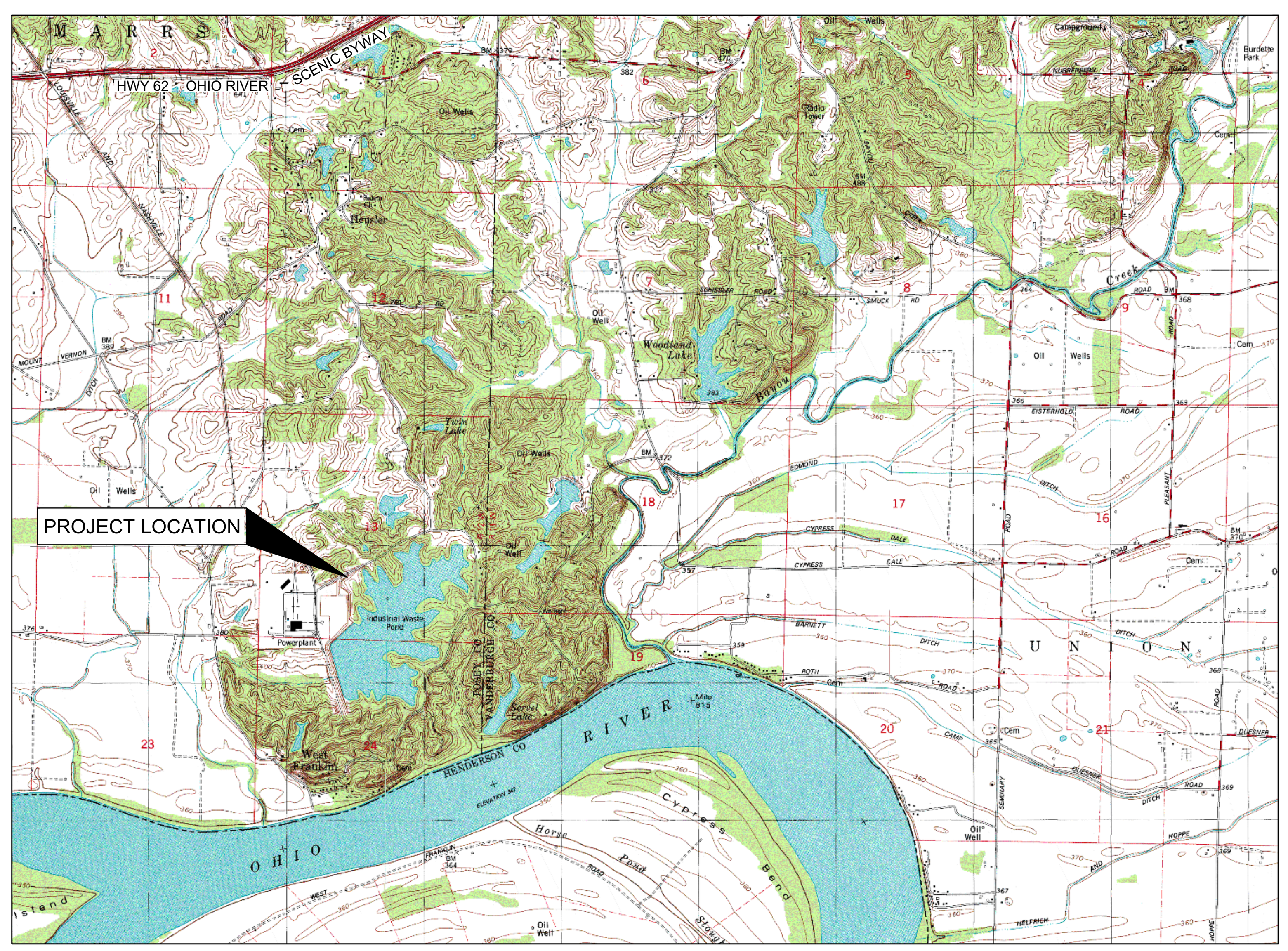
APPENDIX D

Engineering Plan Set

A.B. BROWN GENERATING STATION
ASH POND CLOSURE BY REMOVAL
ISSUED FOR CONSTRUCTION (IFC) DRAWINGS
MT. VERNON, POSEY COUNTY, IN



STATE MAP
NOT TO SCALE



LOCATION MAP
SCALE: 1"= 3000'
USGS TOPOGRAPHIC MAP
7.5 MINUTE SERIES
WEST FRANKLIN QUADRANGLE
INDIANA

DRAWING LIST	
SHEET NO.	DRAWING TITLE
C-00	COVER SHEET
C-01	GENERAL NOTES I
C-02	GENERAL NOTES II
C-03	EXISTING CONDITION PLAN WITH AERIAL PHOTOGRAPHY
C-04	EXISTING CONDITIONS AND DEMOLITION PLAN
C-05	BORING LOCATION PLAN
C-06	ACCESS AND STAGING PRIOR TO ASH EXCAVATION PLAN
C-07	GRADING PROGRESSION PRIOR TO PLANT SHUTDOWN
C-08	SITE PLAN AT 100% ASH REMOVAL
C-09	STORMWATER INFORMATION AND CONCEPT PLAN I
C-10	STORMWATER INFORMATION AND CONCEPT PLAN II
C-11	PASSIVE DEWATERING CONCEPT PLAN
C-12	POSITIVE DEWATERING CONCEPT PLAN
C-13	OVERALL FINAL GRADING PLAN
C-14	FINAL GRADING PLAN I
C-15	FINAL GRADING PLAN II
C-16	FINAL GRADING PLAN III
C-17	PROFILES I
C-18	POST-EXCAVATION TYPICAL REGRADING
C-19	EROSION AND SEDIMENT CONTROL PLAN
C-20	DETAILS I
C-21	DETAILS II

Project Management Initials: Designer:___ Checked:___ Approved:___ ARCH D 24" x 36"

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AECOM

PROJECT

Ash Pond
Closure-by-Removal
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No. 11400808
STATE OF INDIANA
PROFESSIONAL ENGINEER
9-21-21

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

COVER SHEET

SHEET NUMBER

C-00

GENERAL NOTES

1. PURPOSE

THIS POND CLOSURE DESIGN HAS BEEN PREPARED TO MEET THE REQUIREMENTS OF THE FEDERAL CCR RULE (40 CODE OF FEDERAL REGULATIONS (CFR) 257.102(B)(I-VII)) AND THE APPLICABLE PORTIONS OF THE IDEM (INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT) REGULATIONS PROVIDED IN THE 329 IAC 10 DOCUMENT.

THIS PLAN HAS BEEN PREPARED TO PROVIDE ENGINEERING GUIDANCE AND DESIGN FOR THE CLOSURE OF THE ASH POND AT VECTREN'S A.B. BROWN STATION. THE CLOSURE OF THE ASH POND WILL INVOLVE THE FOLLOWING WORK:

A. CLOSURE BY REMOVAL OF THE ASH POND BY MEANS OF EXCAVATION OF ALL IMPOUNDED CCR MATERIAL.
B. COORDINATION WITH OWNER, CONTRACTOR AND ENGINEER TO MAXIMIZE THE QUANTITY OF CCR MATERIALS THAT CAN BE BENEFICIALLY REUSED (BY OTHERS) BY STRATEGICALLY EXCAVATING AND PROCESSING CCR MATERIALS (DRYING, SCREENING, BLENDING, ETC.) TO MEET THE MATERIAL QUALITY SPECIFICATIONS.
C. RESTORATION OF THE EXISTING VALLEY WHERE THE ASH POND WAS CONSTRUCTED TO ITS PRE-DEVELOPMENT CONDITION.

2. DEFINITIONS

2.1. THE OWNER IS VECTREN/SOUTHERN INDIANA GAS AND ELECTRIC CORPORATION (SIGECO).

2.2. THE ENGINEER AND CONTRACTOR IS AECOM. AECOM HAS PREPARED THE PLANS AND NOTES HEREIN, AND IS TO ASSIST THE OWNER IN MONITORING THE PERFORMANCE OF THE WORK.

2.3. THE SUBCONTRACTOR IS THE ENTITY WITH WHOM AECOM HAS AN AGREEMENT TO PERFORM THE PROJECT CONSTRUCTION.

3. SURVEY CONTROL AND EXISTING TOPOGRAPHIC/SITE INFORMATION

3.1. THE EXISTING SURVEY INFORMATION (TOPOGRAPHY, PLANIMETRICS, ETC.) IS BASED ON THE AERIAL TOPOGRAPHIC SURVEY AND NORTH DAM SURVEY PERFORMED BY THREE-I ENGINEERING IN 2016. IT WAS FURTHER SUPPLEMENTED BY THE AS-BUILT BUTTRESS SURVEY AND AS-BUILT STREAM RELOCATION SURVEY PERFORMED BY BLANKENBERGER BROTHERS, INC., DATED OCTOBER 3, 2016. THE BASEMAP WAS UPDATED WITH ADDITIONAL INFORMATION PROVIDED BY THREE-I ENGINEERING DATED FEBRUARY 2, 2020.

3.2. CONTOURS DEPICTED BENEATH THE WATER SURFACE ARE BASED ON THE BATHYMETRIC SURVEY PERFORMED BY AFFILIATED RESEARCHERS, DATED AUGUST 17, 2015. IT WAS FURTHER SUPPLEMENTED BY A OVERALL BATHYMETRIC SURVEY PERFORMED BY THREE-I ENGINEERING IN FEBRUARY 2, 2020 AND A SUPPLEMENTAL BATHYMETRIC SURVEY IN THE LOWER POND DATED FEBRUARY 7, 2020.

3.3. THE ASH POND WASTE BOUNDARY IS APPROXIMATE AND IS BASED ON VISUAL INTERPRETATION OF THE AERIAL IMAGERY AND TOPOGRAPHY.

3.4. HISTORICAL GRADES (BOTTOM OF CCR MATERIAL) ARE BASED ON THE AERIAL SURVEY CONTOURS PROVIDED BY PARK AERIAL SURVEYS, INC DATED MARCH 18, 1973. THESE GRADES REPRESENT PRE-DEVELOPMENT GRADES OF THE VALLEY PRIOR TO THE DEVELOPMENT AND CONSTRUCTION OF THE AB BROWN ASH POND.

3.5. THE AERIAL IMAGE PRESENTED IN THESE DRAWINGS WAS OBTAINED FROM THREE-I ENGINEERING (AERIAL PHOTOGRAPHY DATED FEBRUARY 26, 2020).

3.6. SUBCONTRACTOR SHALL MAKE HIS OWN INVESTIGATIONS AS TO THE LOCATION OF UTILITIES PRIOR TO COMMENCEMENT OF ANY WORK. EXISTING UTILITIES AND STRUCTURES (SUBSURFACE, SURFACE, AND OVERHEAD) ARE INDICATED ONLY TO THE EXTENT THAT SUCH INFORMATION WAS KNOWN, MADE AVAILABLE, OR DISCOVERED BY THE ENGINEER IN PREPARING THE PLANS. THE LOCATIONS, CONFIGURATIONS, AND ELEVATIONS OR SUBSURFACE FACILITIES AND UTILITIES ARE APPROXIMATE, AND NOT ALL UTILITIES AND FACILITIES MAY BE INDICATED. THE EXISTING CONDITIONS SHOWN ON THESE DRAWINGS ARE BELIEVED TO REPRESENT THE BEST KNOWN DATA AVAILABLE FROM HISTORIC DRAWINGS PROVIDED BY OWNER. ALTHOUGH THIS INFORMATION HAS BEEN INCLUDED IN THE CONSTRUCTION PLANS BY AECOM, THEY ARE NOT NECESSARILY THE WORK PRODUCT OF AECOM AND HAVE BEEN INCORPORATED IN RESPONSE TO CERTAIN ASSUMED CONDITIONS. AECOM HAS NOT SURVEYED OR FIELD VERIFIED ANY OF THE EXISTING CONDITIONS INFORMATION AND CANNOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THIS DATA.

3.7. TOPOGRAPHIC MAPPING IS BASED UPON THE FOLLOWING DATUM AND PROJECTION:

HORIZONTAL PROJECTION	:	NAD 83 - INDIANA STATE PLANE WEST Z0NE
VERTICAL DATUM	:	NAVD 88
UNITS	:	US SURVEY FOOT

3.8. BENCHMARK/MONUMENT INFORMATION IS BASED ON THE "RESOLVE PLANT COORDINATE SYSTEMS, INDIANA STATE PLANE, MONUMENT LOCATION PLAN" CREATED BY THREE-I ENGINEERING, DATED JUNE 2, 2005.

3.9. THE SUBCONTRACTOR IS RESPONSIBLE FOR VERIFYING THE ACCURACY OF THE BENCHMARKS. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR ALL SURVEYING AND STAKING NECESSARY FOR LAYOUT AND CONSTRUCTION OF THE PROJECT.

4. GENERAL REQUIREMENTS

4.1. THE PROCEDURES SPECIFIED IN THESE PLANS SHALL BE FOLLOWED, PROVIDED THEY ARE CONSISTENT WITH BEST PRACTICES FOR CONSTRUCTION AND EARTHWORK OPERATIONS. IF PROCEDURES ARE NOT CONSISTENT WITH THESE BEST PRACTICES, ALTERNATE PROCEDURES SHALL BE SUBMITTED TO THE OWNER AND ENGINEER FOR APPROVAL PRIOR TO THE START OF WORK.

4.2. MANAGE STORMWATER AND PROVIDE POSITIVE SURFACE DRAINAGE UTILIZING BEST MANAGEMENT PRACTICES (BMPS), INCLUDING A COMBINATION OF SWALES, BERMS, AND EROSION CONTROL MATERIALS (E.G., WATTLES AND EROSION CONTROL BLANKETS) TO REDUCE THE EFFECTS OF LONG SLOPES AND HELP SLOW, FILTER, AND SPREAD OVERLAND FLOWS. BMPS ARE TO BE INSTALLED BY THE CONTRACTOR TO LIMIT EROSION AND RILL AND GULLY DEVELOPMENT, WHICH WILL REDUCE SEDIMENT LOADS TO THE RECEIVING STORM WATER MANAGEMENT SYSTEM.

4.3. THE CONTRACTOR SHALL HAVE THE RIGHT TO REVIEW FOR ACCEPTANCE WORK BEING PERFORMED BY THE SUBCONTRACTOR. THIS REVIEW BY THE CONTRACTOR DOES NOT ALLEVIATE ANY RESPONSIBILITY OF THE SUBCONTRACTOR TO PROVIDE COMPLETE, ACCURATE, AND CORRECT DATA.

4.4. ACCESS INTO THE WORK AREA ("SITE") FOR DELIVERY OF EQUIPMENT, MATERIALS AND WORKFORCE MUST BE REVIEWED DAILY BY THE SUBCONTRACTOR, AND CONTROLLED AS NEEDED TO PREVENT ANY DAMAGE TO OWNER'S FACILITY INFRASTRUCTURE, EQUIPMENT, OR MATERIALS. IF EQUIPMENT OR MATERIAL HAULING CAUSES DAMAGE, THE DAMAGE MUST BE IMMEDIATELY REPAIRED BY THE SUBCONTRACTOR, AND THE METHODS FOR HAULING MUST BE ALTERED TO PREVENT FURTHER DAMAGE. THE SUBCONTRACTOR SHALL NOT MAKE ANY UNPLANNED EXCAVATIONS WITHOUT THE APPROVAL OF THE OWNER. DURING CONSTRUCTION, THE SUBCONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING PRECAUTIONS REQUIRED TO PROTECT THE INTEGRITY OF EXISTING PAVEMENT, UTILITIES, OR OTHER SITE FEATURES.

4.5. THE SUBCONTRACTOR SHALL TAKE EVERY PRECAUTION TO AVOID OIL OR FUEL SPILLS DURING CONSTRUCTION. THE CONTRACTOR SHALL HAVE OIL/FUEL CONTROL EQUIPMENT (ABSORBENT BOOMS, ETC.) ON SITE AT ALL TIMES. IF OIL OR FUEL IS RELEASED OR OBSERVED DURING CONSTRUCTION, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND DEPLOY OIL/FUEL CONTROL EQUIPMENT. THE SUBCONTRACTOR SHALL COORDINATE WITH THE ENGINEER AND THE OWNER ON OIL/FUEL CLEANUP, AS NECESSARY.

4.6. DESIGNATED STAGING AREAS ARE NOT SHOWN ON THESE PLANS. IF NEEDED, THE SUBCONTRACTOR SHALL COORDINATE WITH THE OWNER TO DETERMINE THE LOCATION OF A STAGING OR PARKING AREAS FOR REQUIRED EQUIPMENT OR MATERIAL STORAGE AND FOR OTHER CONSTRUCTION LAY DOWN ACTIVITY, INCLUDING STOCKPILING. STAGING AND STOCKPILING AREAS SHALL BE PROVIDED WITH EROSION AND SEDIMENT PERIMETER CONTROLS. THE SUBCONTRACTOR SHALL CONSULT WITH OWNER BEFORE SETTING UP STAGING AND STOCKPILING AREAS.

4.7. THE SUBCONTRACTOR SHALL EXERCISE EVERY REASONABLE PRECAUTION AT ALL TIMES TO PREVENT WATER POLLUTION. THE OUTLET OF THE LOWER ASH POND SPILLWAY IS AN INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (IDEM) PERMITTED DISCHARGE THAT IS ROUTED THROUGH THE SECOND STAGE MERCURY TREATMENT SYSTEM, AND SUBSEQUENTLY THROUGH PERMITTED OUTFALL 001. OUTFALL 004, THE ASH POND EMERGENCY SPILLWAY, IS AN EMERGENCY NPDES PERMITTED DISCHARGE LOCATED AT THE SOUTHWEST CORNER OF THE ASH POND. DURING CONSTRUCTION, THE PROPOSED WORK MAY CAUSE CHANGES IN PERMITTED EFFLUENT CHARACTERISTICS. THE SUBCONTRACTOR MAY NEED TO ADJUST CONSTRUCTION PRACTICES IF WATER QUALITY ISSUES ARISE. THE SUBCONTRACTOR SHALL COORDINATE WITH THE OWNER REGARDING THE NEED FOR CHANGES IN CONSTRUCTION PRACTICES BASED ON WATER QUALITY OBSERVATIONS.

4.8. WHENEVER REFERENCE IS MADE TO INDIANA DEPARTMENT OF TRANSPORTATION (INDOT) STANDARD SPECIFICATIONS, AMERICAN CONCRETE INSTITUTE (ACI), AMERICAN WATER WORKS ASSOCIATION (AWWA), AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM) AND OTHER PUBLISHED STANDARDS OR SPECIFICATIONS, IT SHALL MEAN THE LATEST VERSION IN ITS ENTIRETY.

4.9. THE SUBCONTRACTOR SHALL MAKE NO DEVIATIONS FROM THE PLANS, ASSOCIATED SPECIFICATIONS, OR SHOP DRAWINGS WITHOUT PRIOR APPROVAL FROM THE OWNER. THE CONTRACTOR SHALL KEEP A RECORD PLAN SET NOTING ALL DEVIATIONS IN LOCATION OR ELEVATION OF ANY INSTALLATION FROM THAT SHOWN ON THE PLANS (INCLUDING TEMPORARY EROSION AND SEDIMENTATION CONTROL PLANS), AND ANY DEVIATIONS IN INSTALLATIONS FROM APPROVED SHOP DRAWINGS.

4.10. ALL EXISTING PIEZOMETERS, MONITORING WELLS AND ASSOCIATED INSTRUMENTATION SHALL BE PROTECTED BY THE SUBCONTRACTOR DURING CONSTRUCTION ACTIVITIES.

4.11. THE SUBCONTRACTOR IS RESPONSIBLE FOR CONTROL OF FUGITIVE DUST GENERATED DURING CONSTRUCTION AND WILL ADHERE TO THE FUGITIVE DUST CONTROL PLAN TO BE PROVIDED BY AECOM.

4.12. ALL MATERIALS, LABOR, AND EQUIPMENT ARE TO BE PROVIDED BY THE SUBCONTRACTOR UNLESS STATED OTHERWISE HEREIN.

4.13. UNLESS SPECIFIED HEREIN, ALL MATERIALS AND CONSTRUCTION REQUIREMENTS SHALL BE IN ACCORDANCE WITH INDOT STANDARD SPECIFICATIONS AND ALL CONSTRUCTION INSTALLATIONS AND PRACTICES SHALL MEET REQUIREMENTS OF THE INDIANA (DNR) DRAINAGE HANDBOOK, AND THE INDIANA STORM WATER QUALITY MANUAL.

5. SAFETY REQUIREMENTS

5.1. ALL WORK SHALL BE COMPLIANT WITH OSHA REGULATION 29 CFR 1926 AND WITH SIGECO-SPECIFIC SAFETY PROCEDURES.

5.2. SUBCONTRACTOR SHALL SUBMIT A HEALTH AND SAFETY PLAN IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS PRIOR TO BEGINNING CONSTRUCTION.

6. ENVIRONMENTAL PROTECTION

6.1. THE CONTROL OF ENVIRONMENTAL POLLUTION, WHICH COULD RESULT FROM CONSTRUCTION OPERATIONS UNDER THIS CONTRACT, REQUIRES CONSIDERATION OF LAND, WATER, AND AIR QUALITY AT THE SITE. THE SUBCONTRACTOR SHALL COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS CONCERNING ENVIRONMENTAL POLLUTION CONTROL OR ABATEMENT. THE SUBCONTRACTOR SHALL MAKE SURE THAT NECESSARY PERMITS HAVE BEEN OBTAINED AND THAT THIS WORK IS IN COMPLIANCE WITH SUCH PERMITS CONCERNING ENVIRONMENTAL PROTECTION.

6.2. THE OWNER AND THE CONTRACTOR SHALL ESTABLISH THE CRITERIA FOR SUBCONTRACTOR'S COMPLIANCE AND ADMINISTRATION OF THE ENVIRONMENTAL POLLUTION CONTROL PROGRAM PRIOR TO COMMENCEMENT OF WORK.

6.3. THE OWNER WILL NOTIFY THE SUBCONTRACTOR IN WRITING OF ANY NONCOMPLIANCE WITH THESE PLANS AND THE ACTION TO BE TAKEN. THE SUBCONTRACTOR SHALL IMMEDIATELY TAKE CORRECTIVE ACTION.

6.4. PROTECTION OF LAND RESOURCES

6.4.1. LAND RESOURCES ADJACENT TO THE PROJECT BOUNDARIES SHALL BE PRESERVED IN THEIR PRESENT CONDITION OR RESTORED TO A NATURAL APPEARANCE IF INADVERTENTLY DISTURBED AS A RESULT OF THE PROPOSED IMPROVEMENTS.

6.4.2. THE SUBCONTRACTOR SHALL EXERCISE CARE IN CONDUCTING ALL OPERATIONS ON PRIVATE PROPERTY TO MINIMIZE THE AMOUNT OF DISTURBANCE AND DAMAGE RELATED TO GAINING ACCESS TO, AND WORKING AT THE PLANNED LOCATION(S). THE SUBCONTRACTOR SHALL NOT INJURE OR DESTROY TREES OR SHRUBS ADJACENT TO THE PROJECT SITE THAT ARE NOT SHOWN ON THESE PLANS TO BE REMOVED. AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE CONFINED TO THE MAXIMUM EXTENT POSSIBLE.

6.4.3. THE SUBCONTRACTOR SHALL MAINTAIN A STABLE, CLEAN, WORKABLE SURFACE IN THE CONSTRUCTION AREA. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR PURCHASING, HAULING, AND PLACEMENT OF STONE, IF NEEDED. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR PREVENTION OF LITTERING, REMOVAL OF ALL TRASH AND MATERIAL FROM THE SITE, AND ALL REASONABLE PREVENTIVE MEASURES TO MAINTAIN ALL PRIVATE PROPERTY IN A CONDITION ACCEPTABLE TO THE OWNER.

6.4.4. THE SUBCONTRACTOR SHALL PERFORM THE FINAL RESTORATION OF THE CONSTRUCTION AREA (E.G. PLANT GRASS). REPAIRS WHICH ARE, IN THE OPINION OF THE OWNER, REQUIRED TO RESTORE ANY LAND, STRUCTURES, OR APPURTENANCES DAMAGED THROUGH CARELESSNESS, NEGLIGENCE, OR IRRESPONSIBLE ACTS ON THE PART OF THE CONTRACTOR, OR ANY OF THEIR EMPLOYEES, SHALL BE THE SOLE RESPONSIBILITY OF THE SUBCONTRACTOR AND WILL NOT BE PAID FOR BY THE OWNER. SUCH REPAIRS SHALL BE CARRIED OUT IN A TIMELY MANNER AT THE DIRECTION OF, AND TO THE SATISFACTION OF THE OWNER IN ACCORDANCE WITH THE STATION SPECIFIC VEGETATION MAINTENANCE IMPLEMENTATION PLAN.

6.5. PROTECTION OF WATER RESOURCES

6.5.1. THE SUBCONTRACTOR SHALL NOT ADVERSELY AFFECT THE EXISTING WATER QUALITY WITHIN OR ADJACENT TO THE PROJECT SITE. NO CONSTRUCTION WASTES OR OTHER HARMFUL MATERIALS SHALL BE PERMITTED TO ENTER THESE WATER RESOURCES.

6.5.2. JURISDICTIONAL WETLANDS AND STREAMS HAVE BEEN IDENTIFIED IN THE VICINITY OF WORK. THESE FEATURES HAVE BEEN IDENTIFIED ON THE DRAWINGS. THE SUBCONTRACTOR SHALL BE AWARE OF THESE FEATURES AND SHOULD CONDUCT ITS ACTIVITIES TO AVOID ANY DISTURBANCE OR IMPACT TO THESE FEATURES.

6.5.3. SURFACE DRAINAGE FROM WORK ACTIVITIES SHALL BE MANAGED BY USING EFFECTIVE EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES OR THE WORK AREAS SHALL BE GRADED TO CONTROL EROSION WITHIN ACCEPTABLE LIMITS IN ACCORDANCE WITH THE INDIANA STORMWATER QUALITY MANUAL, LATEST EDITION. THESE MEASURES SHALL BE MAINTAINED UNTIL ALL WORK HAS BEEN COMPLETED AND PERMANENT VEGETATION IS ESTABLISHED. REFER TO THE EROSION AND SEDIMENT CONTROL PLAN AND DETAILS.

7. VEGETATION REMOVAL

7.1. VEGETATION REMOVAL WORK MUST BE CONDUCTED IN ACCORDANCE WITH FEMA 534, CHAPTER 6, AND WITH THE ADDITIONAL NOTES PROVIDED HEREIN.

7.2. THE AREA SURROUNDING EACH TREE ALONG EMBANKMENTS SHALL BE OBSERVED FOR ANY SETTLEMENT OR ACTIVE SEEPAGE. TREES/STUMPS LOCATED IN AREAS OF OBSERVABLE SEEPAGE SHALL NOT BE REMOVED WITHOUT PRIOR APPROVAL FROM THE OWNER.

7.3. VEGETATION REMOVAL ACTIVITIES SHALL NOT COMMENCE UNTIL NECESSARY SURVEYOR EROSION AND SEDIMENTATION CONTROL MEASURES ARE IN PLACE AND APPROVED BY THE OWNER.

7.4. CLEARING LIMITS SHALL BE ESTABLISHED BY THE SUBCONTRACTOR'S SURVEYOR. ONCE ESTABLISHED, THE CLEARING LIMITS SHALL BE INSPECTED AND ACCEPTED BY THE OWNER PRIOR TO BEGINNING ANY VEGETATION REMOVAL OR OTHER CLEARING ACTIVITIES.

7.5. CLEARING AND GRUBBING SHALL BE COMPLETED BEFORE START OF EARTHWORK OPERATIONS.

7.6. CLEARING SHALL CONSIST OF CUTTING, REMOVAL, AND SATISFACTORY DISPOSAL OF TREES, ROOT MASSES AND TOPS, FALLEN TIMBER, BRUSH, SHRUBS, WOODY VEGETATION, RUBBISH, AND OTHER PERISHABLE AND OBJECTIONABLE MATERIAL WITHIN THE CLEARING LIMITS.

7.7. EXCAVATION/VOID SPACES RESULTING FROM THE REMOVAL OF TREES, ROOTS, AND SIMILAR SHALL BE FILLED WITH SUITABLE MATERIAL, AS ACCEPTED BY THE OWNER, AND THOROUGHLY COMPACTED PER THE REQUIREMENTS CONTAINED HEREIN.

7.8. CLEARING SHALL INCLUDE GRUBBING TO COMPLETELY REMOVE STUMPS, ROOTS, LOGS, STICKS, AND OTHER PERISHABLE MATERIALS FROM SLOPE SURFACES. LARGE STUMPS MAY BE REMOVED DURING THE WORK BY AN EXCAVATOR EQUIPPED WITH A HYDRAULIC MECHANICAL "THUMB" AS LONG AS THE VOID SPACE (STUMP HOLE) IS PROPERLY BACKFILLED AND COMPACTED IN ACCORDANCE WITH FEMA 534.

7.9. CLEARED MATERIALS SHALL BE DISPOSED OF ALONG WITH OTHER REFUSE MATERIALS BY HAULING OFF-SITE UNLESS AN ON-SITE DISPOSAL AREA IS APPROVED BY THE OWNER. THE SUBCONTRACTOR IS RESPONSIBLE FOR ALL DISPOSAL COSTS, INCLUDING LOADING, HAULING, DUMPING, TIPPING, AND FINAL DISPOSAL WITHIN A LANDFILL PERMITTED TO RECEIVE VEGETATIVE WASTE. THE SUBCONTRACTOR SHALL PROVIDE THE CONTRACTOR COPIES OF ALL TIPPING/DISPOSAL RECEIPTS FOR RECORD OF PROPER DISPOSAL.

7.10. ANY TOPSOIL STOCKPILED ON THE SITE SHALL BE REUSED TO SURFACE SLOPES IN CONJUNCTION WITH THE SLOPE EARTHWORK ACTIVITIES.

7.11. TOPSOIL AND FINISHED SLOPE SURFACES SHALL BE FREE OF STONES, ROOTS, BRUSH, OR OTHER UNSUITABLE MATERIALS.

8. EARTHWORK

8.1. DEWATERING:

8.1.1. DEWATERING REFERS TO THE REMOVAL OF SURFACE WATER, SUBSURFACE WATER, PORE WATER FROM WITHIN EXISTING CCR MATERIALS, AND/OR GROUNDWATER FROM FLOWING INTO WORK ZONES OR EXCAVATIONS AND FROM FLOODING THE PROJECT SITE AND SURROUNDING AREAS.

8.1.2. THE SUBCONTRACTOR IS RESPONSIBLE FOR PROVIDING DRAINAGE WAYS, SUMP PITS AND PUMPS, OR OTHER METHODS AND PRACTICES TO KEEP EXCAVATIONS IN A DRAINED CONDITION AT ALL TIMES. SURFACES ABOVE EXCAVATIONS MUST BE GRADED OR PROTECTED SUCH THAT SURFACE RUNOFF IS DIRECTED AWAY FROM OPEN EXCAVATIONS.

8.1.3. DO NOT ALLOW WATER TO ACCUMULATE IN EXCAVATIONS. REMOVE WATER FROM EXCAVATIONS TO PREVENT SOFTENING OF SUBGRADES OR BEARING SURFACES, UNDERCUTTING, AND SOIL CHANGES DETRIMENTAL TO THE STABILITY OF SUBGRADES AND BEARING SURFACES. PROVIDE AND MAINTAIN PUMPS, SUMPS, SUCTION AND DISCHARGE LINES, AND OTHER DEWATERING SYSTEM COMPONENTS NECESSARY TO CONVEY THE WATER AWAY FROM EXCAVATIONS.

8.1.4. CONVEY WATER REMOVED FROM EXCAVATIONS AND RAIN WATER TO THE AREAS INDICATED ON THESE PLANS AND/OR AS DIRECTED BY THE OWNER. PROVIDE AND MAINTAIN TEMPORARY DRAINAGE DITCHES AND OTHER DIVERSIONS OUTSIDE EXCAVATION LIMITS. DO NOT USE TRENCH EXCAVATIONS OR SITE UTILITIES AS TEMPORARY DRAINAGE DITCHES.

8.1.5. ALL EXCAVATION, CONSTRUCTION AND BACKFILLING SHALL BE PERFORMED UNDER WORKABLE DRY CONDITIONS. THE SUBCONTRACTOR SHALL EMPLOY DEVICES TO CONTROL GROUNDWATER OR WATER INFILTRATION INTO EXCAVATIONS AS NECESSARY TO ADEQUATELY COMPLETE THE WORK.

8.1.6. IF DEWATERING DEVICES ARE REQUIRED FOR EXCAVATIONS, THEY SHALL BE ADEQUATELY FILTERED TO PREVENT THE REMOVAL OF FINES FROM THE SOIL. DEWATERING ACTIVITIES SHALL COMPLY WITH EROSION AND SEDIMENT CONTROL REQUIREMENTS AND REGULATIONS.

8.2. GENERAL EXCAVATION/FILLING/GRADING:

8.2.1. EXCAVATE/FILL/GRADE TO THE LINES AND GRADES SHOWN ON THESE PLANS MAINTAINING EXISTING GRADES/SLOPES WHERE SHOWN. THE CONTRACTOR SHALL PERFORM SURVEYS NECESSARY TO ESTABLISH AND VERIFY LINES AND GRADES FOR ALL EARTHWORK.

8.2.2. REMOVE EXISTING CCR MATERIALS AND UNDERLYING SOILS TO THE LINES AND GRADES DEPICTED ON THE PLANS. CCR WITHIN THE AREAS TO BE EXCAVATED MAY BE SOFT AND/OR WET. EXERCISE CARE IN REMOVING THESE MATERIALS, LEAVING SUFFICIENT DRY MATERIALS ABOVE, OR CONSTRUCT BRIDGE LIFTS OVER, SO THAT CONSTRUCTION EQUIPMENT IS ADEQUATELY SUPPORTED. WORK BELOW THE WATER ELEVATION OR ADJACENT TO THE EXISTING CCR PONDS SHOULD PROCEED WITH EXTREME CAUTION, USING APPROPRIATE MEANS OF ESTABLISHING THE SUITABILITY OF IN-PLACE MATERIALS TO SUPPORT THE PROPOSED CONSTRUCTION.

8.2.3. THE SUBCONTRACTOR SHALL PLACE AND/OR STACK THE EXCAVATED MATERIALS IN LOCATIONS APPROVED BY OWNER. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR THE STABILITY OF THE SLOPES OF THE PLACED AND/OR STACKED EXCAVATED MATERIALS FROM WORK AREA.

8.2.4. PROTECT ALL ON-SITE FACILITIES AND STRUCTURES. SURFACE RUNOFF SHALL BE INTERCEPTED AND COLLECTED AT THE TOP AND BOTTOM OF SLOPES. INTERCEPTING BERMS OR DITCHES SHALL BE CONSTRUCTED AT LOCATIONS SHOWN ON THESE PLANS. DIRECT SURFACE WATER DRAINAGE DURING CONSTRUCTION TO APPROVED AREAS GENERALLY AWAY FROM OPEN EXCAVATIONS.

8.2.5. COMPLETE EARTHWORK TO AVOID SLOUGHS, SLIDES, OR WASHOUTS THAT WILL CAUSE DISTURBANCE OF THE SUBGRADE OR SLOPES OR DAMAGE TO EXISTING AREAS. ANY SLIDES OR OVERBREAKS SHALL BE REPORTED TO THE OWNER, AND REPAIRED IMMEDIATELY BY THE CONTRACTOR.

8.2.6. EMBANKMENT THAT BECOMES EXCESSIVELY ERODED, SOFT, OR OTHERWISE UNSUITABLE SHALL BE REMOVED OR REPAIRED BY THE CONTRACTOR AS DIRECTED BY THE OWNER AND ENGINEER AT NO COST TO THE OWNER.

8.2.7. WORK SHALL BE PERFORMED IN COMPLIANCE WITH ALL CURRENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND ANY STATE OR LOCAL REQUIREMENTS AND STANDARDS. ALL EXCAVATIONS MUST BE SLOPED, BENCHED, OR SHORED TO PERMIT SAFE WORKING CONDITIONS PER OSHA REQUIREMENTS FOR PROTECTIVE SYSTEMS (29 CFR 1926.652). ALL EXCAVATED MATERIALS MUST BE CONSIDERED OSHA TYPE C MATERIALS UNLESS OTHERWISE DETERMINED BY AN EXCAVATION COMPETENT PERSON.

8.2.8. MASS EXCAVATIONS:

8.2.8.1. THE SUBCONTRACTOR SHALL ENSURE MASS EXCAVATIONS IN SATURATED, LOOSE, AND/OR SOFT CCR MATERIALS OF UP TO 10 FT DEEP HAVE TEMPORARY SLOPES NO STEEPER THAN 5H:1V, UNLESS OTHERWISE APPROVED BY THE ENGINEER OR OWNER. THE SUBCONTRACTOR SHALL USE FLATTER SLOPES AS NECESSARY TO PREVENT CAVE-INS, SLOPE AND BEARING INSTABILITY, AND EROSION, ESPECIALLY DURING WET CONDITIONS. THE SUBCONTRACTOR SHALL MITIGATE THESE POTENTIAL HAZARDS.

8.2.8.2. AT NO POINT DURING MASS EXCAVATION WITHIN THE ASH POND SHALL ANY EXCAVATION CREST BE HIGHER THAN 10 FT ABOVE THE EXCAVATION TOE OR LOWEST SURROUNDING GRADE. THE SUBCONTRACTOR SHALL CONTINUOUSLY VERIFY THIS REQUIREMENT DURING THE COURSE OF CONSTRUCTION THROUGH GRADE SURVEYS OR OTHER SUITABLE MEANS.

8.2.8.3. FOR EXISTING UNDERWATER SLOPES INCLINED STEEPER THAN 5H:1V AND/OR EXTENDING DEEPER THAN 10 FT, THE SUBCONTRACTOR SHALL REGRADE/FLATTEN THESE SLOPES PRIOR TO REMOVAL OF FREE WATER TO MAINTAIN STABILITY OF SLOPES AND GROUND SURFACE OF ADJACENT AREAS.

8.2.9. THE SUBCONTRACTOR SHALL PROTECT FINISHED LINES AND GRADES AGAINST EROSION, DAMAGE FROM TRAFFIC, OR OTHER CAUSES AND SHALL REPAIR ANY DAMAGE AT NO ADDITIONAL COST.

8.2.10. THE INTERSECTION OF SLOPES WITH NATURAL GROUND SURFACES, INCLUDING THE BEGINNING AND ENDING OF CUT SLOPES, SHALL BE UNIFORMLY ROUNDED. ALL PROTRUDING ROOTS AND OTHER VEGETATION SHALL BE REMOVED FROM SLOPES. ALL SLOPES SHALL BE FINISHED TO REASONABLY UNIFORM SURFACES ACCEPTABLE FOR SEEDING OPERATIONS.

8.2.11. PRIOR TO PLACING FILL AGAINST THE INSIDE AND OUTSIDE SLOPES OF ANY DIKE, THE BOTTOM MUST BE BENCHED LEVEL TO PROVIDE A LEVEL SURFACE TO BEGIN THE FILLING ACTIVITIES. SLOPING SURFACES AGAINST WHICH FILL MATERIAL WILL BE PLACED MUST BE DISCED, BENCHED OR SCARIFIED, TO ENHANCE BONDING OF THE FILL TO THE EXCAVATION FACE.

8.2.12. THE SUBCONTRACTOR SHALL PLACE NO MATERIAL IN ANY SECTION OF ANY EMBANKMENT UNTIL THE FOUNDATION FOR THAT SECTION HAS BEEN APPROVED BY THE OWNER. THE SUBCONTRACTOR SHALL KEEP THE FOUNDATION AND SUBGRADE FREE FROM WATER OR UNACCEPTABLE MATERIALS AFTER FILL OPERATIONS HAVE STARTED.

8.2.13. NEW FILL MUST NOT BE PLACED ON SUBGRADES OF EXISTING OR FROZEN SOILS OR PREVIOUSLY PLACED FILL LAYERS, IF IN THE OPINION OF THE OWNER THE SUBGRADE IS UNSUITABLE. SUBGRADE MUST BE REWORKED OR REPLACED TO THE SATISFACTION OF THE OWNER, PRIOR TO PLACEMENT OF ADDITIONAL FILL.

8.2.14. SOIL MATERIALS TO BE PLACED FOR GENERAL FILL PURPOSES MUST CONSIST OF SOILS THAT EXHIBIT A CLASSIFICATION OF SC, SM, CL, ML, OR CL-ML IN ACCORDANCE WITH ASTM D-2487. THE MATERIAL MUST HAVE A FINES CONTENT OF 25% OR MORE, LIQUID LIMIT LESS THAN OR EQUAL TO 50, AND PLASTICITY INDEX LESS THAN OR EQUAL TO 25. THE MATERIAL MUST BE FREE OF FROZEN MATERIAL, ORGANIC MATTER, TOPSOIL, RUBBISH, DEBRIS, WASTE MATERIALS, AND ROCK PIECES GREATER THAN 3 INCHES (MAXIMUM DIMENSION) IN SIZE, AND MUST BE AT A MOISTURE CONTENT THAT IS SUITABLE FOR ACCEPTABLE COMPACTION, AS REQUIRED HEREIN. EXISTING SOILS REMOVED FROM THE EXCAVATIONS MAY BE REUSED AS FILL, TO THE EXTENT THAT THEY MEET THE REQUIREMENTS GIVEN HEREIN.

8.3. STOCKPILING:

8.3.1. THE SUBCONTRACTOR MAY TEMPORARILY STOCKPILE MATERIALS IN AREAS APPROVED BY THE OWNER. NO STOCKPILING ALONG SLOPES OR EMBANKMENTS WILL BE ALLOWED.

8.3.2. THE SUBCONTRACTOR SHALL USE EQUIPMENT AND METHODS AS NECESSARY TO MAINTAIN THE MOISTURE CONTENTS OF SOILS STOCKPILED (EXCLUDING TOPSOIL) AT OR NEAR THEIR OPTIMUM MOISTURE CONTENTS.

8.3.3. STOCKPILES SHALL BE PROPERLY SLOPED AND THE SURFACES SEALED BY THE SUBCONTRACTOR AT THE END OF EACH WORKING DAY, OR DURING THE DAY IN THE EVENT OF HEAVY RAIN, TO THE SATISFACTION OF THE OWNER.

8.4. COMPACTION:

8.4.1. SURFACES TO RECEIVE EARTH FILL SHALL BE SCARIFIED, STEPPED, OR KEYED TO PERMIT BONDING WITH THE EXISTING SURFACE. EARTH FILL MAY BE OVERBUILT TO ACCOMMODATE PLACEMENT, SPREADING, AND COMPACTION OF HORIZONTAL LIFTS AND THEN TRIMMED TO THE FINISH LINES AND GRADES SHOWN ON THE PLANS. REMOVE ALL SOFT AND YIELDING MATERIAL, AND ANY OTHER PORTIONS OF THE SUBGRADE WHICH WILL NOT COMPACT READILY, AND REPLACE IT WITH SUITABLE MATERIAL SO THAT THE WHOLE SUBGRADE IS BROUGHT TO LINE AND GRADE SHOWN IN THE PLANS, WITH PROPER ALLOWANCE FOR SUBSEQUENT COMPACTION.

8.4.2. EARTH FILL MATERIALS MUST BE UNIFORMLY PLACED AND SPREAD IN SUCCESSIVE, APPROXIMATELY HORIZONTAL LAYERS OF NOT MORE THAN 8 INCHES DEPTH, LOOSE MEASUREMENT WHEN COMPACTING WITH FULL SIZE EQUIPMENT, AND 4 INCHES WHEN COMPACTING WITH LIGHTWEIGHT OR MANUALLY OPERATED EQUIPMENT. EACH LIFT MUST BE THOROUGHLY COMPACTED TO ACHIEVE A UNIFORM, DENSE SOIL LAYER FREE FROM EXCESSIVE MOISTURE. UNIFORMLY BOND ALL LAYERS TO PRECEDING LAYERS. COMPACT ALL SURFACES ON SLOPES USING TRACKED EQUIPMENT SUCH THAT ALL AREAS OF EACH LIFT RECEIVE AT LEAST THREE PASSES FROM THE CONSTRUCTION EQUIPMENT, OR OTHER METHODS APPROVED BY THE OWNER AND ENGINEER.

9. SEEDING AND STABILIZATION

9.1. USE STABILIZING MEASURES, SUCH AS SEEDING TEMPORARY OR PERMANENT VEGETATION, SODDING, MULCHING, SEDIMENT BASINS, EROSION CONTROL BLANKETS, OR OTHER PROTECTIVE PRACTICES WITHIN SEVEN DAYS AFTER THE LAND HAS BEEN DISTURBED. CONSIDER POSSIBLE FUTURE REPAIR AND MAINTENANCE NEEDS OF THE MEASURES SELECTED.

9.2. IMMEDIATELY AFTER GRADING, APPLY SURFACE STABILIZATION PRACTICES ON ALL GRADED AREAS, USING PERMANENT MEASURES IN ACCORDANCE WITH THE EROSION/SEDIMENT CONTROL PLAN. IF WEATHER DELAYS PERMANENT STABILIZATION, TEMPORARY SEEDING AND/OR MULCHING MAY BE NECESSARY AS AN INTERIM MEASURE. STABILIZE (USING TEMPORARY SEEDING/MULCHING OR OTHER SUITABLE MEANS) ANY DISTURBED AREA WHERE ACTIVE CONSTRUCTION WILL NOT TAKE PLACE FOR 30 WORKING DAYS.

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

GENERAL NOTES I

SHEET NUMBER

C-01

ARCH D 24" x 36"
Approved:___ Checked:___ Designer:___ Project Management Initials:

Last saved by: WADSON.PHANORD(2021-09-21) Last Plotted: 2021-09-22
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9.3. ANY AREAS WHICH WILL NOT BE FURTHER GRADED WITHIN A 14-DAY PERIOD, OR WHICH HAVE NOT BEEN GRADED WITHIN 14 DAYS, SHALL BE SEEDED IN ACCORDANCE WITH THE FOLLOWING:

9.4. TEMPORARY SEEDING:

9.4.1. TEMPORARY SEEDING SHALL BE COMPLETED IN AREAS WHERE FINAL GRADE WILL NOT BE COMPLETED WITHIN 30 CALENDAR DAYS AND SHALL COMPLY WITH THE INDIANA STORMWATER QUALITY MANUAL, AND/OR INDOT STANDARDS AND SPECIFICATIONS.

9.4.2. TEMPORARY SEEDING SHALL ADHERE TO THE FOLLOWING SPECIES AND APPLICATION RATES:

TEMPORARY SEEDING SPECIFICATIONS			
SEED SPECIES[1]	RATE PER ACRE	PLANTING DEPTH	OPTIMUM DATES[2]
WHEAT OR RYE	150 LBS	1 TO 1.5 INCHES	SEPT. 15-OCT. 30
SPRING OATS	100 LBS	1 INCH	MARCH 1- APRIL 15
ANNUAL RYEGRASS	40 LBS	0.25 INCH	MARCH 1 - MAY 1 AUG. 1 - SEPT 1
GERMAN MILLET	40 LBS	1 TO 2 INCHES	MAY 1 - JUNE 1
SUDANGRASS	35 LBS	1 TO 2 INCHES	MAY 1 - JULY 30
BUCKWHEAT	60 LBS	1 TO 2 INCHES	APRIL 15 - JUNE 1
CORN (BROADCAST)	300 LBS	1 TO 2 INCHES	MAY 11 - AUG. 10
SORGHUM	35 LBS	1 TO 2 INCHES	MAY 1 - JULY 15

1. FOR BEST RESULTS: (A) LEGUME SEED SHOULD BE INOCULATED; (B) SEEDING MIXTURES CONTAINING LEGUMES SHOULD PREFERABLY BE SPRING-SEEDED, ALTHOUGH THE GRASS MAY BE FALL-SEEDED AND THE LEGUME FROST-SEEDED; AND IF LEGUMES ARE FALL-SEEDED, DO SO IN EARLY FALL.

2. TALL FESCUE PROVIDES LITTLE COVER FOR AND MAY BE TOXIC TO SOME SPECIES OF WILDLIFE. IDNR RESOURCES RECOGNIZE THE NEED FOR ADDITIONAL RESEARCH ON ALTERNATIVES SUCH AS BUFFALOGRASS, ORCHARDGRASS, SMOOTH BROMEGRASS, AND SWITCHGRASS. THIS RESEARCH, IN CONJUNCTION WITH DEMONSTRATION AREAS, SHOULD FOCUS ON EROSION CONTROL CHARACTERISTICS, WILDLIFE TOXICITY, TURF DURABILITY, AND DROUGHT RESISTANCE.

9.4.3. FERTILIZER SHALL BE STANDARD COMMERCIAL FERTILIZER WITH AN ANALYSIS OF 12-12-12.TESTS WILL NOT BE REQUIRED, BUT FERTILIZER STANDARDS SHALL BE GOVERNED BY THE RULINGS OF THE INDIANA STATE SEED COMMISSIONER. FERTILIZER SHALL BE APPLIED AT A RATE OF 800 LBS/ACRE.

9.4.4. INCORPORATE FERTILIZER AND LIME INTO TOP 4 TO 6 INCHES OF SOIL BY DISK HARROWING OR TILLING.

9.4.5. PREPARE SEEDBED TO BE COMPRISED OF WELL-PULVERIZED, LOOSE, AND UNIFORM SOIL. LOOSEN ALL DISTURBED AREAS TO A DEPTH OF 3 TO 6 INCHES. IN AREAS WHERE REPEATED ACCESS BY HEAVY EQUIPMENT OR TRUCKS HAS CAUSED COMPACTION, LOOSEN THE SOIL TO A DEPTH OF 12 INCHES. THE CONTRACTOR MAY USE AGRICULTURAL OR CONSTRUCTION EQUIPMENT TO PERFORM THIS TASK.

9.4.6. EVENLY APPLY SEED BY BROADCASTING OR HYDROSEEDING. COVER BROADCAST SEED BY RAKING OR CHAIN DRAGGING. SEE NOTE 10 BELOW FOR HYDROSEEDING REQUIREMENTS.

9.4.7. PROTECT GENTLE SLOPES (SHALLOWER THAN 3H:1V) BY APPLYING 4000 LBS/ACRE OF STRAW MULCH. WHERE PRACTICAL, SEED SHALL BE APPLIED IN TWO DIRECTIONS PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.

9.4.8. PROTECT STEEPER SLOPES (3H:1V) OR OTHERWISE SENSITIVE AREAS THROUGH HYDROSEEDING OR BY APPLYING EROSION CONTROL MATTING (AS APPROVED BY THE OWNER). SEE NOTE 10 BELOW FOR HYDROSEEDING REQUIREMENTS AND SPECIFICATIONS.

9.4.9. WATER AND MONITOR TEMPORARY SEEDING, BUT DO NOT MOW UNTIL PERMANENT VEGETATION IS ESTABLISHED.

9.5. PERMANENT SEEDNG:

9.5.1. PERMANENT SEEDING SHALL COMPLY WITH THE REQUIREMENTS OF THE INDIANA STORMWATER QUALITY MANUAL, AND/OR INDOT STANDARDS AND SPECIFICATIONS.

9.5.2. PERMANENT SEEDING SHALL ADHERE TO THE FOLLOWING SPECIES AND APPLICATIONS RATES:

PERMANENT SEEDING		
SEED MIXTURES	RATE PER ACRE PURE LIVE SEED	OPTIMUM SOIL PH
1. PERENNIAL RYEGRASS	150 LBS	5.5 TO 7.0
-WHITE[1]	2 LBS	
2. KENTUCKY BLUEGRASS	20 LBS	5.5 TO 7.5
- SMOOTH BLOMEGRASS	10 LBS	
-SWITCHGRASS	3 LBS	
-TIMOTHY	4 LBS	
-PERENNIAL RYEGRASS	10 LBS	
-WHITE CLOVER[2]	2 LBS	
3. TALL FESCUE[1]	150 LBS	5.5 TO 7.5
-WHITE CLOVER[2]	2 LBS	
4. TALL FESCUE[2]	150 LBS	5.5 TO 7.5
-PERENNIAL RYEGRASS	20 LBS	
-KENTUCKY BLUEGRASS	20 LBS	

1. PERENNIAL SPECIES MAY BE USED AS A TEMPORARY COVER, ESPECIALLY IF THE AREA TO BE SEEDED WILL REMAIN IDLE FOR MORE THAN ONE YEAR.

2. SEEDING DONE OUTSIDE THE OPTIMUM SEEDING DATES INCREASES THE CHANCES OF SEEDING FAILURE. DATES MAY BE EXTENDED OR SHORTENED BASED ON THE LOCATION OF THE PROJECT SITE WITHIN THE STATE.

9.5.3. SEEDING WITHOUT MULCH MAY NOT BE DONE BETWEEN MAY 1 AND AUG 15.

9.5.4. FERTILIZER SHALL BE STANDARD COMMERCIAL FERTILIZER WITH AN ANALYSIS OF 12-12-12.TESTS WILL NOT BE REQUIRED, BUT FERTILIZER AND LIME STANDARDS SHALL BE GOVERNED BY THE RULINGS OF THE INDIANA STATE SEED COMMISSIONER.

9.5.5. INCORPORATE FERTILIZER AND LIME INTO TOP 4 TO 6 INCHES OF SOIL BY DISK HARROWING OR TILLING.

9.5.6. PREPARE SEEDBED TO BE COMPRISED OF WELL-PULVERIZED, LOOSE, AND UNIFORM SOIL. LOOSEN ALL DISTURBED AREAS TO A DEPTH OF 3 TO 6 INCHES. IN AREAS WHERE REPEATED ACCESS BY HEAVY EQUIPMENT OR TRUCKS HAS CAUSED COMPACTION, THE CONTRACTOR SHALL LOOSEN THE SOIL TO A DEPTH OF 12 INCHES. THE CONTRACTOR MAY USE AGRICULTURAL OR CONSTRUCTION EQUIPMENT TO PERFORM THIS TASK.

9.5.7. ESTABLISH PERMANENT VEGETATION IN ALL DISTURBED AREAS THROUGH HYDROSEEDING. SEE NOTE 10 BELOW FOR HYDROSEEDING REQUIREMENTS.

10. HYDROSEEDING

10.1. ESTABLISH A SMOOTH, HEALTHY, UNIFORM, CLOSE STAND OF GRASS FROM THE SPECIFIED SEED. PRIOR TO VEGETATION, THE CONTRACTOR SHALL ADEQUATELY TEST THE SOILS TO BE VEGETATED TO ENSURE ADEQUACY OF THE SPECIFIED REQUIREMENTS PROVIDED IN THE PERMANENT STABILIZATION AND SEEDING REQUIREMENTS OF THE INDIANA STORMWATER QUALITY MANUAL.

10.2. PREPARE SOILS TO RECEIVE SEEDING BY LOOSENING SURFACE TO MINIMUM DEPTH OF 4 INCHES. REMOVE STONES, ROOTS, STICKS, RUBBISH, AND OTHER EXTRANEOUS MATTER OVER 3 INCHES IN DIAMETER. SPREAD LIME UNIFORMLY OVER DESIGNATED AREAS AT THE RATE SPECIFIED IN SEEDING TABLE. GRADE SEEDED AREAS TO SMOOTH, EVEN SURFACE WITH LOOSE, UNIFORMLY FINE TEXTURE. TRACK FINISHED SLOPES VERTICALLY PRIOR TO PLANTING. LIMIT PREPARATION TO AREAS WHICH WILL BE PLANTED SOON AFTER PREPARATION.

10.3. MIXED SUSTAINABLE SLOPE SEED SHALL BE OF THE VARIETIES AND APPLIED AT RATES AS SPECIFIED IN THE STABILIZATION AND SEEDING REQUIREMENTS OF THE INDIANA STORMWATER QUALITY MANUAL.

10.4. FLEXTERRA FLEXIBLE HIGH PERFORMANCE - FLEXIBLE GROWTH MEDIUM (HP-FGM) SHALL BE APPLIED AT A MINIMUM RATE OF 3500 LBS/ACRE (80 LBS/1000 SQUARE FEET).

10.5. FERTILIZER AND LIME SHALL BE OF THE TYPE AND APPLIED AT RATES AS SPECIFIED IN THE PERMANENT STABILIZATION AND SEEDING REQUIREMENTS OF THE INDIANA STORMWATER QUALITY MANUAL.

10.6. EQUIPMENT SHALL HAVE A BUILT IN MECHANICAL AGITATION SYSTEM WITH A FAN TYPE NOZZLE AND OPERATING CAPACITY SUFFICIENT TO AGITATE, SUSPEND, AND HOMOGENEOUSLY MIX SLURRY WITH THE REQUIRED AMOUNTS OF SEED, FLEXIBLE GROWTH MEDIUM, FERTILIZER, WATER, AND ANY AMENDMENTS.

10.7. STRICTLY COMPLY WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS AND RECOMMENDATIONS. MANUFACTURER REPRESENTATIVE SHALL BE ONSITE TO TRAIN THE APPLICATORS FOR THE FIRST APPLICATION OF HYDROSEEDING. THERE SHALL BE NO RAIN IN THE FORECAST FOR AT LEAST 24 HOURS AFTER ANTICIPATED APPLICATION.

10.8. MIX THE SEED, SOIL AMENDMENTS, AND COMMERCIAL FERTILIZER WITH A SMALL AMOUNT OF FLEXIBLE GROWTH MEDIUM FOR VISUAL METERING AND APPLY ALONG THE AREAS TO BE VEGETATED BEING SURE TO APPLY SEED AND AMENDMENTS AT THE SPECIFIED RATES.

10.9. MIX AND APPLY THE FLEXIBLE GROWTH MEDIUM AT A RATE OF 50 LBS PER 150 GALLONS OF WATER OVER FRESHLY SEEDED AREAS. HYDROMULCH SHOULD BE APPLIED IN MULTIPLE DIRECTIONS SO THAT SHADOWING DOES NOT OCCUR AND TO ENSURE UNIFORMITY OF THE APPLICATION. CONFIRM THE LOADING RATES WITH EQUIPMENT MANUFACTURERS. DO NOT LEAVE SEEDED SURFACES UNPROTECTED, ESPECIALLY IF PRECIPITATION IS IMMINENT.

10.10. EXERCISE SPECIAL CARE TO PREVENT ANY OF THE SLURRY FROM BEING SPRAYED ONTO ANY HARDSCAPE AREAS INCLUDING CONCRETE WALKS, ROADS, FENCES, WALLS, BUILDINGS, ETC. REMOVE ALL SLURRY SPRAYED ONTO THESE SURFACES IMMEDIATELY.

10.11. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL SEEDED AREAS THROUGH THE END OF THE PROJECT. THE SUBCONTRACTOR SHALL PROVIDE AT HIS EXPENSE PROTECTION OF ALL SEEDED AREAS AGAINST DAMAGE AT ALL TIMES UNTIL ACCEPTANCE OF THE WORK. MAINTENANCE SHALL INCLUDE BUT NOT BE LIMITED TO: FREQUENT LIGHT IRRIGATION SHALL BE APPLIED TO SEEDED AREAS IF NO NATURAL RAIN EVENTS HAVE OCCURRED WITHIN ONE WEEK OF HYDROSEEDING. WATER SHALL BE APPLIED LONG ENOUGH TO MOISTEN THE SOIL THOROUGHLY TO THE DEPTH OF THE SLURRY MULCH, TAKING CARE NOT TO SUPER SATURATE OR WASH AWAY THE SLURRY AND SEED.

10.12. AFTER SEED GERMINATION HAS OCCURRED AND PLANTS ARE VISIBLE THE FREQUENCY OF IRRIGATION SHALL BE CUT BACK WITH HEAVIER APPLICATION RATES STILL MAKING SURE NOT TO SUPER SATURATE OR WCCR AWAY THE SLURRY AND SEED.

10.13. REPAIR ALL SEED WASHINGS AND EROSION.

10.14. FUTURE FERTILIZATION SHALL OCCUR WHENEVER APPLICABLE AT THE RECOMMENDED RATE BASED ON SOIL ANALYSIS.

10.15. REPLANT BARE AREAS USING SAME MATERIALS SPECIFIED.

11. A RECOMMENDED SEQUENCE OF CONSTRUCTION IS PROVIDED BELOW AS A GUIDELINE ONLY, WITH MILESTONES CORRESPONDING TO THE STORMWATER MANAGEMENT MILESTONES PRESENTED ON DRAWINGS C-09 AND C-10. THE SUBCONTRACTOR IS RESPONSIBLE FOR PLANNING, EXECUTION, AND CONTROL OF THEIR CONSTRUCTION MEANS AND METHODS.

11.1. INSTALL EROSION AND SEDIMENT CONTROL MEASURES AS SHOWN ON THE DRAWINGS: STABILIZED CONSTRUCTION ENTRANCE, PERIMETER CONTROL DEVICES, ETC.

11.2. INSTALL AND MAINTAIN CONSTRUCTION ACCESS ROADS AND ESTABLISH A STAGING AND LOADING AREA PRIOR TO COMMENCEMENT OF CONSTRUCTION.

11.3. PRE-EXCAVATION CONSTRUCTION:

11.3.1. CONSTRUCTION BY OTHERS OF THE HOPPER AREA, INCLUDING ASSOCIATED EARTHWORK, TO ENABLE LOADING OF CCR MATERIAL. THE EARTHWORK DIRECTLY AROUND THE HOPPER AND ASSOCIATED INFRASTRUCTURE (SHOWN ON THESE PLANS AS EXISTING) WILL BE CONSTRUCTED BY OTHERS. THE SUBCONTRACTOR IS RESPONSIBLE FOR ESTABLISHING AN ASH STAGING AREA THAT TIES INTO EXISTING GRADES..

11.3.2. DEMOLISH, ABANDON OR RELOCATE UTILITIES AS SHOWN ON THE DRAWINGS. THIS ACTIVITY WILL BE CONDUCTED ACCORDING TO A SEQUENCE RECOMMENDED BY THE SUBCONTRACTOR AND APPROVED BY THE OWNER.

11.4. MILESTONE 0 - PRELIMINARY ACTIVITIES

11.4.1. DURING MILESTONE 0, THE PLANT IS OPERATING AND PLANT INFLOWS TO LOWER POND.

11.4.2. MAINTAIN LOWER POND WATER ELEV. 440'.

11.4.3. CONDUCT EARTHWORK ACTIVITIES TO CONSTRUCT ACCESS, MATERIAL STAGING AREAS AND HOPPER AREA.

11.5. MILESTONE 1 EXCAVATION

11.5.1. DURING MILESTONE 1, THE PLANT IS OPERATING AND PLANT INFLOWS TO LOWER POND.

11.5.2. MAINTAIN LOWER POND WATER ELEV. 440'.

11.5.3. EXCAVATE IN THE UPPER POND TO TARGET EXCAVATION ELEVATION: 450'.

11.6. MILESTONE 2 EXCAVATION

11.6.1. DURING MILESTONE 2 EXCAVATION, THE PLANT IS CLOSED, LOWER POND CEASES RECEIVING PLANT INFLOWS.

11.6.2. MAINTAIN POND ELEVATION 10' BELOW TARGET EXCAVATION ELEVATION.

11.6.3. BEGIN EXCAVATION IN THE LOWER POND AND CONTINUE EXCAVATION IN THE UPPER POND. TARGET EXCAVATION ELEVATION: 450-445'.

11.7. MILESTONE 3 EXCAVATION

11.7.1. REMOVE UPPER POND DAM THEREBY DRAINING UPPER POND DRAINAGE AREA DIRECTLY TO THE LOWER POND.

11.7.2. MAINTAIN STORAGE IN POOL A OF THE UPPER POND.

11.3.2. CONTINUE EXCAVATION IN THE UPPER AND LOWER POND. TARGET EXCAVATION ELEVATION: 445'. EXCAVATE IN THE UPPER POND TO TARGET EXCAVATION ELEVATION: 450'.

11.4. MILESTONE 4 EXCAVATION

11.4.1. MAINTAIN POOL AT LOWER POND. ALL UPPER POND POOLS DEWATERED.

11.4.2. CONTINUE EXCAVATION IN THE UPPER AND LOWER PONDS. TARGET EXCAVATION ELEVATION: 435'.

11.4.3. IT IS ASSUMED THAT AFTER PLANT CLOSURE, ANY GROUNDWATER, FREE WATER, OR STORMWATER THAT ACCUMULATES WITHIN THE POND WILL BE PUMPED FROM THE LOWER POOL TO A DOWNGRADIENT STORMWATER POND PRIOR TO DISCHARGE VIA A PERMITTED NPDES OUTFALL. THE DESIGN OF THIS STORMWATER POND IS ONGOING AND ITS CONSTRUCTION IS NOT INCLUDED IN THIS SCOPE. THE ANTICIPATED LOCATION OF THIS STORMWATER POND IS ADJACENT TO THE EXISTING COAL PILE AREA.

11.5. MILESTONE 5 EXCAVATION

11.5.1. MAINTAIN POOL AT LOWER POND.

11.5.2. CONTINUE EXCAVATION TO FINAL BOTTOM OF ASH ELEVATIONS. TARGET EXCAVATION ELEVATION: VARIES.

11.5.3. BREACH LOWER ASH POND DAM.

11.5. POST-EXCAVATION CLEANUP AND RESTORATION

11.5.1. INSTALL STORMWATER CHANNELS AND FILL TO FINAL GRADES AS NECESSARY TO PROVIDE POSITIVE DRAINAGE UPON RESTORATION OF THE ASH POND FOOTPRINT.

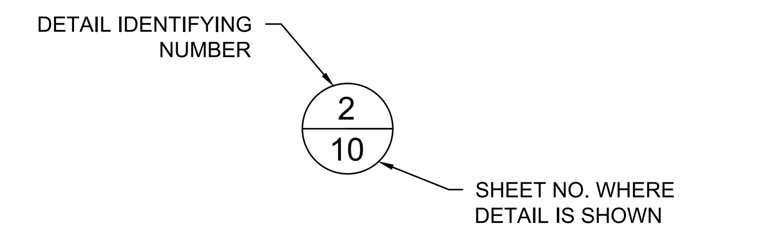
11.5.2. STABILIZE, SEED AND MULCH FORMER ASH POND FOOTPRINT.

SURVEY LEGEND

	EXISTING BRUSH		RAILROAD
	EXISTING CULVERT		SIGN
	DROP INLET DRAIN		JURISDICTIONAL STREAM
EX.	EXISTING		EX. UTILITY POLE
EX. PIPE	EXISTING PIPE		WATER
	FENCE LINE - OTHER	W.E.	WATER ELEVATION (DAY OF SURVEY)
	GRAVEL / UNPAVED SURFACE		ASH BASIN WASTE BOUNDARY (APPROX.)
	GUARD RAIL	460	EXISTING MAJOR TOPOGRAPHIC CONTOUR
	LIGHT POLE		EXISTING MINOR TOPOGRAPHIC CONTOUR
MH	MANHOLE		EXISTING (SURVEY) MONUMENT
MW	MONITOR WELL		EXISTING TREELINE
OE 30	OVERHEAD UTILITIES	UE	UNDERGROUND ELECTRIC
	PAVED SURFACE		DIRECTION OF FLOW
P	POST		
	POLE		

HATCH LEGEND

	WATER		JURISDICTIONAL WETLAND AREA
	MARSHY AREA (AREAS THAT ARE NOT DELINEATED AS JURISDICTIONAL WETLANDS)		RIPRAP



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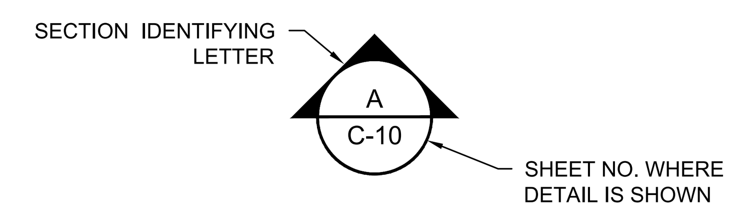

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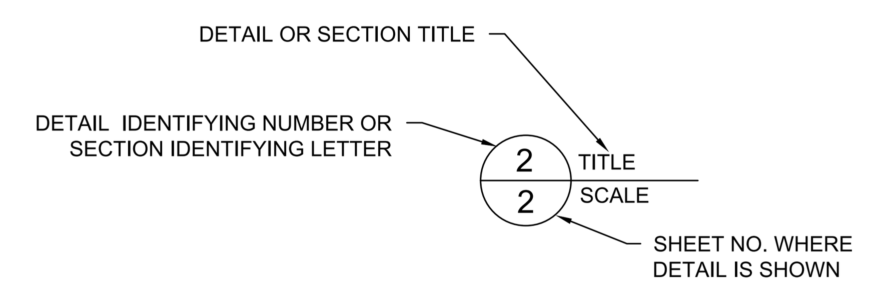

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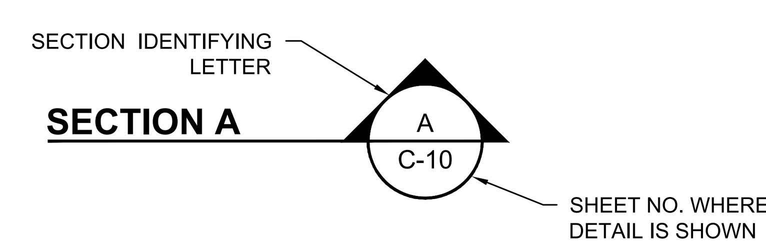

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REGISTRATION

ISSUE/REVISION

0	2021-09-21	Issue for Construction
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

GENERAL NOTES II

SHEET NUMBER

C-02

ARCH D 24" x 36"

Project Management Initials: Designer: ___ Checked: ___ Approved: ___

Last saved by: WADSON.PHANORD(2021-09-21) Last Plotted: 2021-09-22
Filename: C:\USERS\WADSON.PHANORD\DESKTOP\ABB IFC\20-SHEETS\01-02 GENERAL NOTES.DWG

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NOTES

1. SEE SHEET C-001 (SECTION 3.8) FOR DATUM AND PROJECTION OF TOPOGRAPHIC MAPPING.
2. CONVEYOR, HOPPER AND ASSOCIATED INFRASTRUCTURE ARE SHOWING TO BE "EXISTING" AND WILL BE CONSTRUCTED BY OTHERS
3. THE ASH BASIN WASTE BOUNDARY SHOWN ON THIS AND ALL SUBSEQUENT SHEETS IS APPROXIMATE AND IS BASED ON VISUAL INTERPRETATION OF THE AERIAL IMAGERY. THE SUBCONTRACTOR IS RESPONSIBLE FOR THE PHYSICAL VERIFICATION OF THE LIMITS OF ASH AND FOR INFORMING THE ENGINEER IF ANY DIFFERENCES EXIST BETWEEN THE APPROXIMATE WASTE BOUNDARY SHOWN ON THE DRAWINGS AND THE LIMITS OF ASH ENCOUNTERED IN THE FIELD.

REFERENCES

1. SEE SHEET C-001 (SECTION 3: SURVEY CONTROL AND EXISTING TOPOGRAPHIC SITE INFORMATION) FOR DRAWING REFERENCES.

MONUMENT DATA

MONUMENT	NORTHING	EASTING	ELEV
ABB 5	966980.153	2771376.063	450.555
ABB 6	968252.804	2771022.369	450.074
ABB 9	969440.358	2770743.279	414.572
ABB 10	969925.495	2771557.967	474.954

COORDINATE SYSTEM - US STATE PLANE 1983
ZONE - INDIANA WEST 1302
PROJECT DATUM - NAD 1983 (CONUS)
VERTICAL DATUM - NAVD 1988 (CONUS)

N

0 200 400 600
GRAPHIC SCALE (IN FEET)

AECOM

PROJECT

Ash Pond
Closure-by-Removal
IFC Design Drawings

A.B. BROWN GENERATING STATION
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KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

EXISTING CONDITION PLAN WITH AERIAL PHOTOGRAPHY

SHEET NUMBER

C-03

Project Management Initials: Designer:___ Checked:___ Approved:___ ARCH D 24" x 36"

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NOTES

1. SEE SHEET C-001 (SECTION 3.8) FOR DATUM AND PROJECTION OF TOPOGRAPHIC MAPPING.
2. CONVEYOR, HOPPER AND ASSOCIATED INFRASTRUCTURE ARE SHOWN AS "EXISTING" AND WILL BE CONSTRUCTED BY OTHERS.
3. SUBCONTRACTOR SHALL DEMOLISH THE PUMP HOUSE AND ALL ASSOCIATED STRUCTURAL, MECHANICAL AND ELECTRICAL INFRASTRUCTURE. SUBCONTRACTOR SHALL COORDINATE WITH ENGINEER AND OWNER TO DE-ENERGIZE AND ISOLATE FACILITIES AS REQUIRED PRIOR TO COMMENCEMENT OF WORK.
4. SEQUENCING OF ITEMS NOTED FOR DEMOLITION AND ABANDONMENT SHALL BE DETERMINED BASED ON SUBCONTRACTOR'S RECOMMENDATION TO FACILITATE THEIR MEANS AND METHODS, AND SHALL BE COORDINATED WITH AND APPROVED BY OWNER AND ENGINEER.
5. OVERHEAD ELECTRIC LINES ARE PRESENT WITHIN THE SOUTHEASTERN PORTION OF THE ASH POND. THE VOLTAGES OF THE NORTHERN AND SOUTHERN POWER LINES ARE 345KV AND 138KV, RESPECTIVELY. ALL EQUIPMENT SHALL MAINTAIN APPROPRIATE CLEARANCE FROM THE LOWEST SAG ELEVATION OF OVERHEAD ELECTRIC LINES IN ACCORDANCE WITH OSHA 1926.1408 TABLE A.
6. GAS, ELECTRIC, WATER, AND OTHER UNDERGROUND UTILITIES ARE PRESENT WITHIN AND ADJACENT TO THE LIMITS OF THE ASH POND. SUBCONTRACTOR SHALL MAKE HIS OWN INVESTIGATIONS AS TO THE LOCATION OF UTILITIES PRIOR TO COMMENCEMENT OF ANY WORK. EXISTING UTILITIES AND STRUCTURES (SUBSURFACE, SURFACE, AND OVERHEAD) ARE INDICATED ONLY TO THE EXTENT THAT SUCH INFORMATION WAS KNOWN, MADE AVAILABLE, OR DISCOVERED BY THE ENGINEER IN PREPARING THE PLANS. THE LOCATIONS, CONFIGURATIONS, AND ELEVATIONS OR SUBSURFACE FACILITIES AND UTILITIES ARE APPROXIMATE, AND NOT ALL UTILITIES AND FACILITIES MAY BE INDICATED. THE EXISTING CONDITIONS SHOWN ON THESE DRAWINGS ARE BELIEVED TO REPRESENT THE BEST KNOWN DATA AVAILABLE FROM HISTORIC DRAWINGS PROVIDED BY OWNER. ALTHOUGH THIS INFORMATION HAS BEEN INCLUDED IN THE CONSTRUCTION PLANS BY AECOM, THEY ARE NOT NECESSARILY THE WORK PRODUCT OF AECOM AND HAVE BEEN INCORPORATED IN RESPONSE TO CERTAIN ASSIGNED CONDITIONS. AECOM HAS NOT SURVEYED OR FIELD VERIFIED ANY OF THE EXISTING CONDITIONS INFORMATION AND CANNOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF THIS DATA.
7. TWO DRAWINGS (AVENTINELL6859.002, DATED 04/24/2009 AND THREE I DESIGN 07520A DATED 03/19/2020) WERE EXAMINED TO ESTIMATE THE LOCATION OF THE EXISTING GAS LINE. DIFFERENCES EXIST BETWEEN THE DRAWINGS; ACCORDINGLY, BOTH LINES ARE SHOWN.

REFERENCES

1. SEE SHEET C-001 (SECTION 3: SURVEY CONTROL AND EXISTING TOPOGRAPHIC SITE INFORMATION) FOR DRAWING REFERENCES.

MONUMENT DATA

MONUMENT	NORTHING	EASTING	ELEV
ABB 5	966980.153	2771376.063	450.555
ABB 6	968252.804	2771022.369	450.074
ABB 9	969440.358	2770743.279	414.572
ABB 10	969925.495	2771557.967	474.954

COORDINATE SYSTEM - US STATE PLANE 1983
ZONE - INDIANA WEST 1302
PROJECT DATUM - NAD 1983 (CONUS)
VERTICAL DATUM - NAVD 1988 (CONUS)

N

0 200 400 600
GRAPHIC SCALE (IN FEET)

AECOM

PROJECT

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REGISTRATION

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KEY PLAN

PROJECT NUMBER

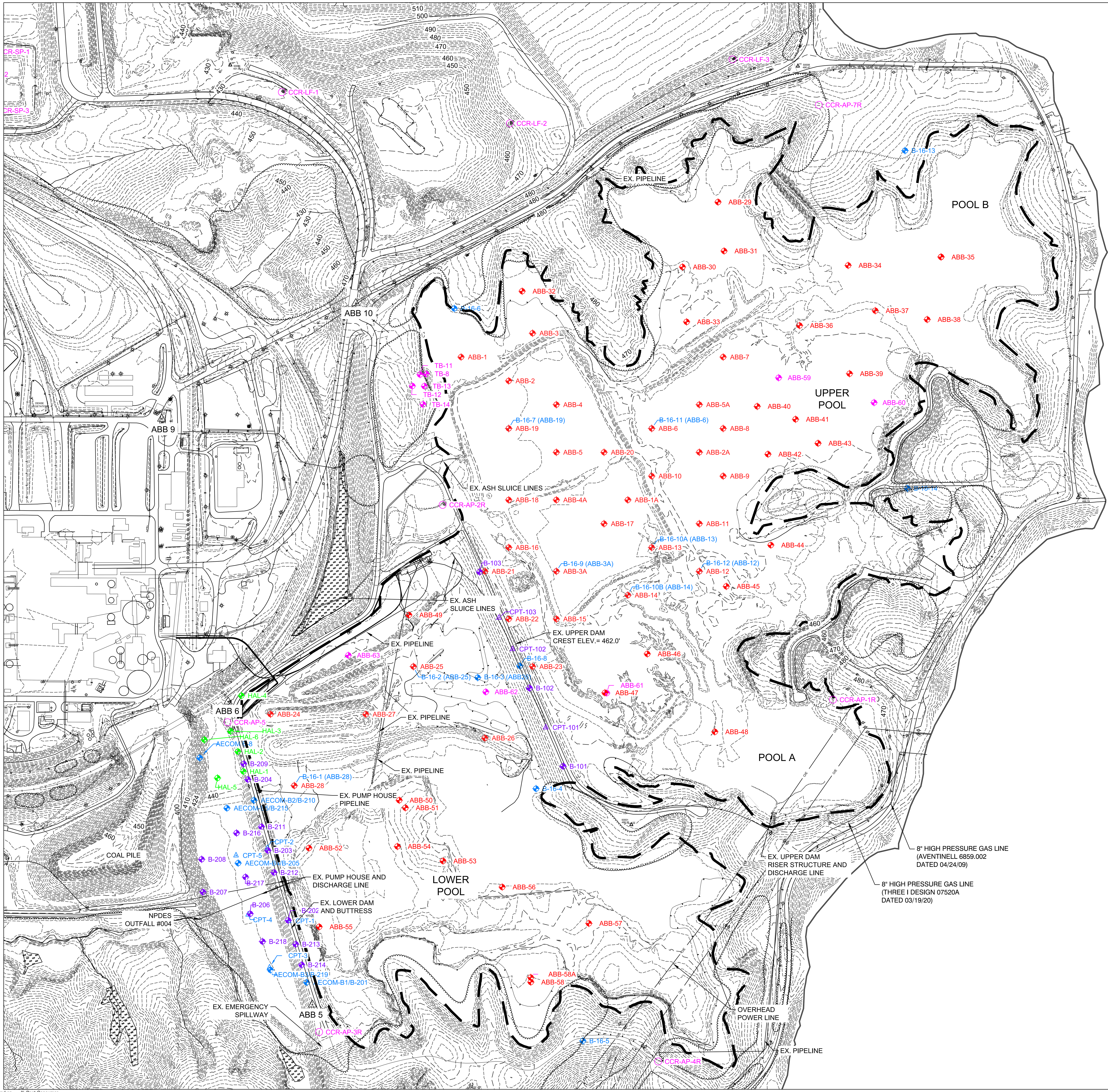
60602575

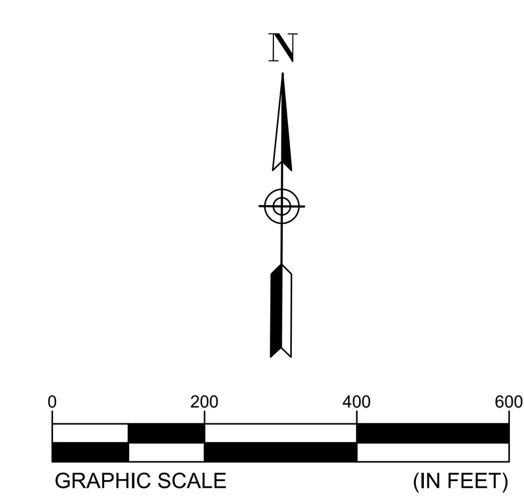
SHEET TITLE

EXISTING CONDITIONS
AND DEMOLITION PLAN

SHEET NUMBER

C-04





LEGEND

- AECOM BORINGS, 2020
- AECOM BORINGS, 2016
- CARDNO ATC BORINGS, 2015
- VECTREN BORINGS, 2016 & 2018
- HLA BORINGS, 1982
- AECOM CPT, 2015
- CARDNO ATC CPT, 2015
- MONITORING WELLS

NOTES

1. SEE SHEET C-001 (SECTION 3.8) FOR DATUM AND PROJECTION OF TOPOGRAPHIC MAPPING.

REFERENCES

1. SEE SHEET C-001 (SECTION 3: SURVEY CONTROL AND EXISTING TOPOGRAPHIC SITE INFORMATION) FOR DRAWING REFERENCES.

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Project Management Initials:

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

PROJECT NUMBER

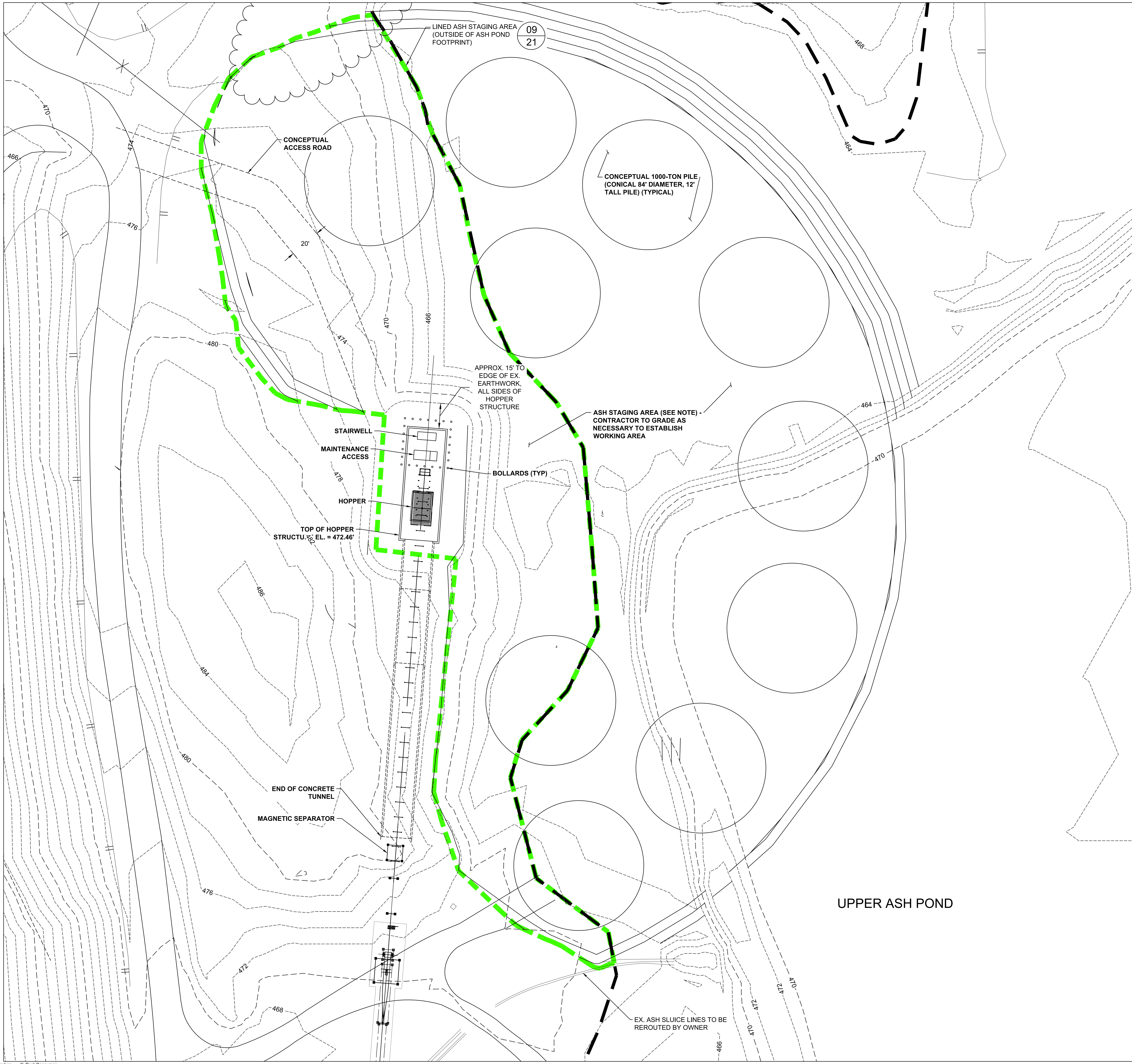
60602575

SHEET TITLE

BORING LOCATION PLAN

SHEET NUMBER

C-05



LEGEND

- LIMIT OF LINED ASH STAGING AREA
- ASH BASIN WASTE BOUNDARY (APPROX.)

NOTES

1. SEE SHEET C-001 (SECTION 3.8) FOR DATUM AND PROJECTION OF TOPOGRAPHIC MAPPING.
2. THE CONFIGURATION SHOWN FOR THE ASH STAGING AREA IS APPROXIMATE AND IS BASED UPON INFORMATION PROVIDED BY THE SUBCONTRACTOR. SPECIFIC LOCATION, DIMENSIONS AND CONFIGURATION OF THE ASH STAGING AREA ARE CONCEPTUAL AND SHALL BE ADJUSTED TO MEET THE SUBCONTRACTOR'S MEANS AND METHODS TO ALLOW THE REQUIRED MATERIAL LOADING RATES TO BE MET.
3. CONVEYOR, HOPPER AND ASSOCIATED INFRASTRUCTURE WILL BE CONSTRUCTED BY OTHERS. THE EARTHWORK DIRECTLY AROUND THE HOPPER AND ASSOCIATED INFRASTRUCTURE (SHOWN ON THESE PLANS AS EXISTING) WILL BE CONSTRUCTED BY OTHERS. THE SUBCONTRACTOR IS RESPONSIBLE FOR ESTABLISHING AN ASH STAGING AREA THAT TIES INTO EXISTING GRADES.
4. SUBCONTRACTOR SHALL DELINEATE EXISTING LIMITS OF ASH POND IN THE FIELD. ALL FILL MATERIALS USED TO BUILD ANY PADS, RAMPS, ETC. INSIDE THE LIMITS OF THE ASH POND MAY BE CONSTRUCTED FROM MATERIALS BASED UPON THE SUBCONTRACTOR'S CHOICE. ALL MATERIALS PLACED OUTSIDE THE LIMITS OF THE ASH POND MUST CONSIST OF CLAY FILL SOILS. THE APPROXIMATE REQUIRED LIMITS OF THE LINED AREA AS SHOWN ARE BASED UPON INFORMATION PROVIDED BY THE SUBCONTRACTOR.
5. SUBCONTRACTOR SHALL FOLLOW CCR MATERIAL HANDLING REQUIREMENTS PRESENTED IN THE CQA PLAN (CCR HANDLING FOR BENEFICIAL USE SECTION).

REFERENCES

1. SEE SHEET C-001 (SECTION 3: SURVEY CONTROL AND EXISTING TOPOGRAPHIC SITE INFORMATION) FOR DRAWING REFERENCES.

N

GRAPHIC SCALE (IN FEET): 0 30 60 90

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9-21-21

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

PROJECT NUMBER

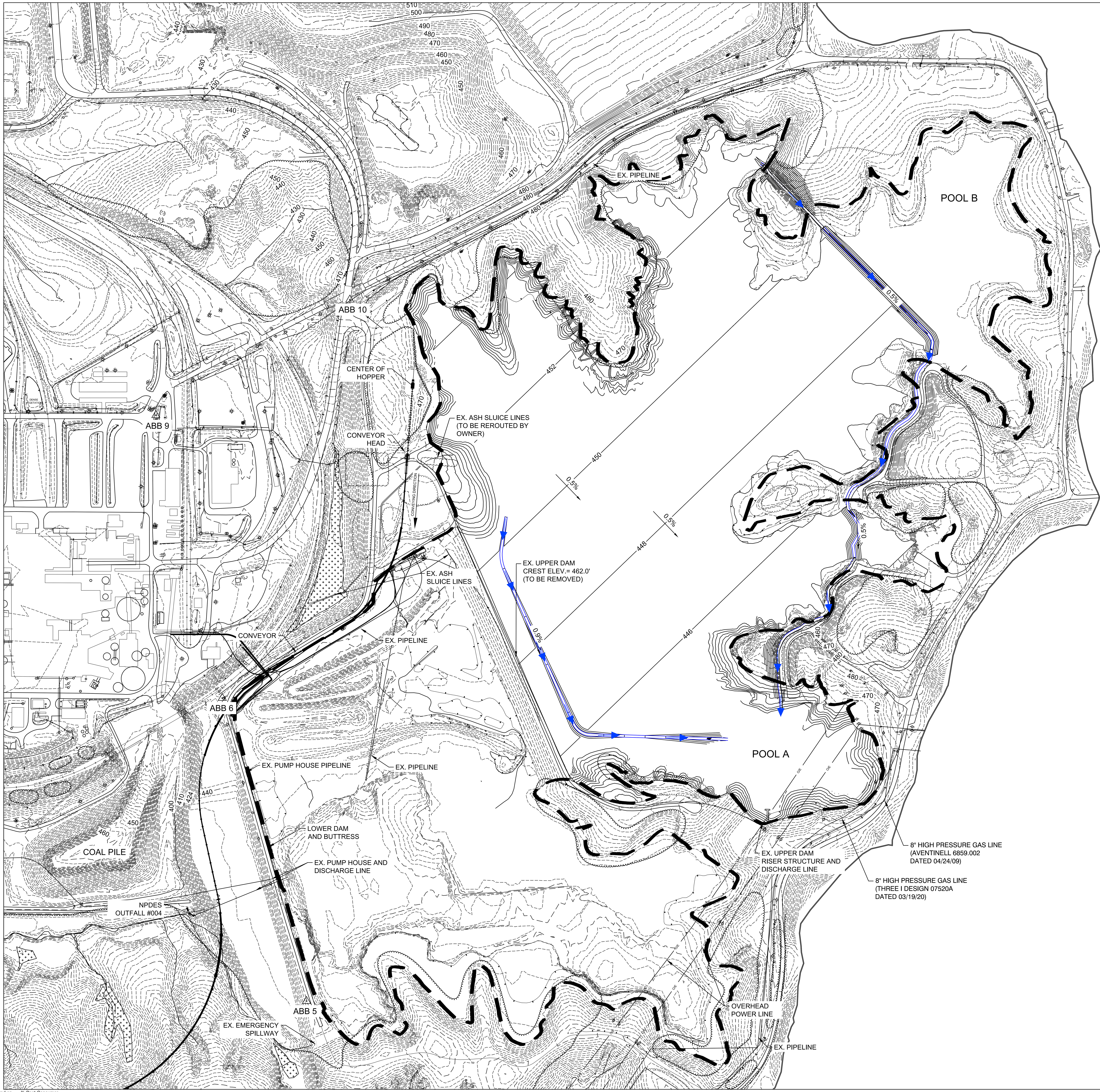
60602575

SHEET TITLE

ACCESS AND STAGING PRIOR TO ASH EXCAVATION PLAN

SHEET NUMBER

C-06



LEGEND

RIM DITCH/STORMWATER FLOW DIRECTION

NOTES:

PURPOSE

THIS PLAN DEPICTS A POTENTIAL CONCEPT FOR GRADING AND STORMWATER MANAGEMENT PRIOR TO PLANT CLOSURE. THE SUBCONTRACTOR IS RESPONSIBLE FOR PLANNING, EXECUTION AND CONTROL OF THEIR CONSTRUCTION MEANS AND METHODS.

EXCAVATION

1. BEGIN EXCAVATION IN THE UPPER POOL. EXCAVATION AND DEWATERING ARE TO BE CONDUCTED IN SUBCONTRACTOR-DEFINED SECTIONS. POOLS A AND B ARE EXISTING AND MAY REMAIN THROUGHOUT THE CONSTRUCTION PROCESS TO COLLECT STORMWATER RUNOFF (SEE STORMWATER INFORMATION AND CONCEPT PLANS I AND II).
2. SUBCONTRACTOR TO CONTINUOUSLY MONITOR THE PHREATIC SURFACE DURING CONSTRUCTION. PHREATIC SURFACE MUST BE A MINIMUM OF 10 FEET BELOW THE WORKING SURFACE DURING ASH REMOVAL OPERATIONS.
3. AS NECESSARY, EXCAVATED CCR MATERIAL MAY BE TEMPORARILY PLACED ADJACENT TO EXCAVATION AREA TO ALLOW FOR INITIAL DECANTING FOLLOWED BY WINDROWING.

STORMWATER

4. STORMWATER IS EXPECTED TO BE REMOVED USING A VARIETY OF DRAINAGE DITCHES AND SUMPS. A COMBINATION OF PUMPING AND GRAVITY FLOW WILL BE REQUIRED TO REMOVE STORMWATER FROM THE SUMPS AND CONVEY IT TO THE LOWER POND. FURTHER INFORMATION IS PRESENTED ON SHEETS STORMWATER INFORMATION AND CONCEPT PLAN I AND STORMWATER INFORMATION AND CONCEPT PLAN II.
5. WHILE PLANT IS OPERATIONAL, ALL STORMWATER IS ROUTED TO THE LOWER POOL AND RECIRCULATED BACK TO THE PLANT.
6. UPON PLANT CLOSURE, ANY GROUNDWATER, FREE WATER, OR STORMWATER THAT ACCUMULATES WITHIN THE ASH POND WILL BE PUMPED FROM THE LOWER POOL TO A DOWNGRADIENT STORMWATER POND. THE DESIGN OF THIS STORMWATER POND IS ONGOING AND ITS CONSTRUCTION IS NOT INCLUDED IN THIS SCOPE. THE ANTICIPATED LOCATION OF THIS STORMWATER POND IS ADJACENT TO THE EXISTING COAL PILE AREA.

GENERAL NOTES:

7. IT IS ASSUMED THAT THE NORMAL OPERATING WATER SURFACE ELEVATION IN THE LOWER POND WILL BE LOWERED TO EL. 440.0 FEET BEFORE COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
8. IT IS ASSUMED THAT SLUICED ASH DISCHARGE LINES OR ANY OTHER PROCESS FLOW LINE WILL BE REROUTED BY OWNER TO THE LOWER POOL BEFORE COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
9. IT IS ASSUMED THAT SLUICED ASH DISCHARGED INTO THE LOWER POOL (PRIOR TO PLANT SHUTDOWN) WILL BE MANAGED AT AN ELEVATION ABOVE EL 445.0 FEET.

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KEY PLAN

PROJECT NUMBER

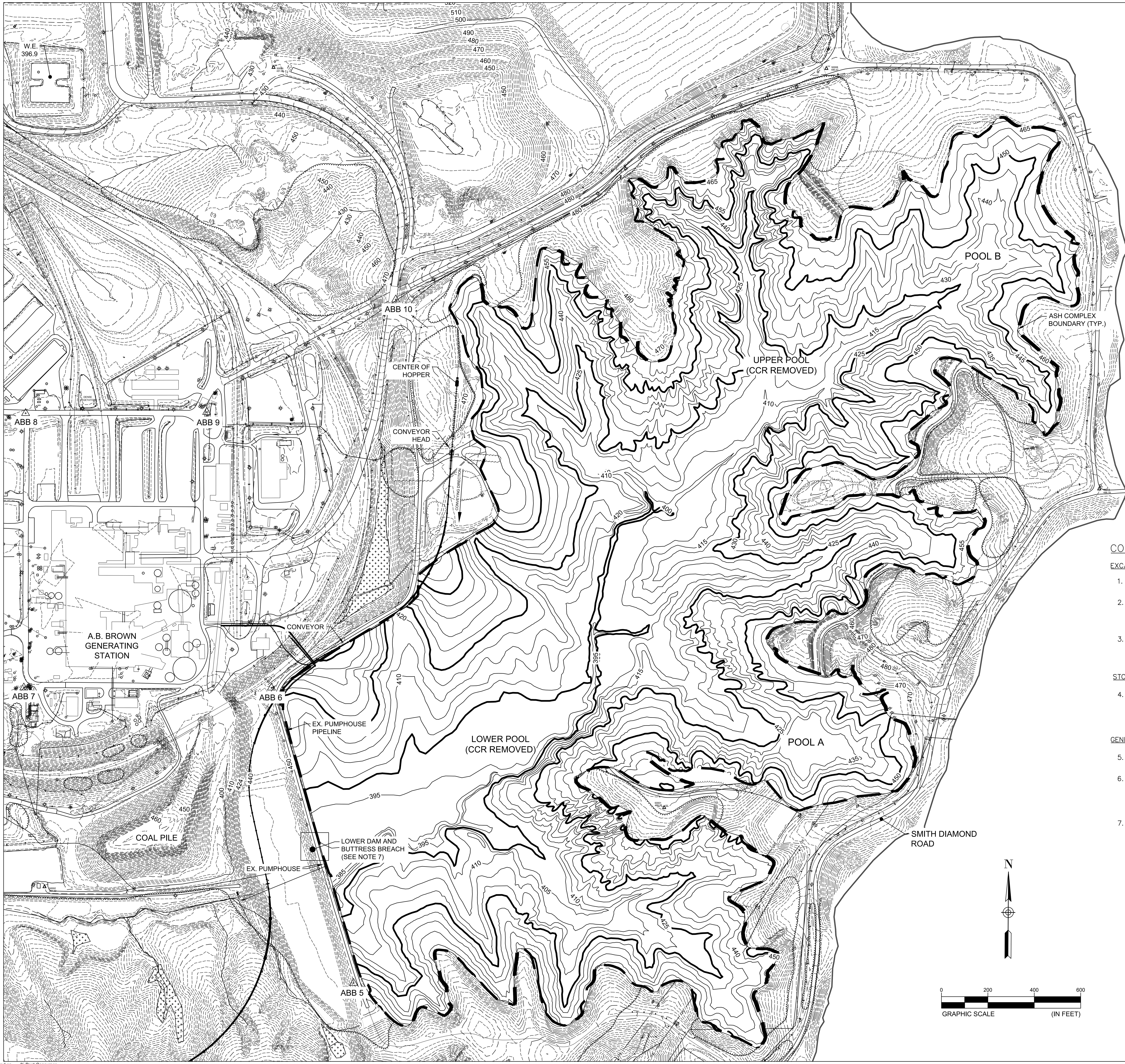
60602575

SHEET TITLE

GRADING PROGRESSION PRIOR TO PLANT SHUTDOWN PLAN

SHEET NUMBER

C-07



CONSTRUCTION NOTES:

EXCAVATION:

1. REMOVE ALL REMAINING CCR MATERIAL IN THE ASH POND.
2. SUBCONTRACTOR TO CONTINUOUSLY MONITOR THE PHREATIC SURFACE DURING CONSTRUCTION. PHREATIC SURFACE MUST BE A MINIMUM OF 10 FEET BELOW THE WORKING SURFACE DURING ASH REMOVAL OPERATIONS.
3. AS NECESSARY, EXCAVATED CCR MATERIAL MAY BE TEMPORARILY PLACED ADJACENT TO EXCAVATION AREA TO ALLOW FOR INITIAL DECANTING FOLLOWED BY WINDROWING.

STORMWATER/DEWATERING

4. DEWATERING FOR ASH REMOVAL WILL REQUIRE A COMBINATION OF PASSIVE METHODS (DITCHES AND SUMPS WITH PUMPING) AND POSITIVE DEWATERING METHODS (E.G., WELLPOINTS) TO LOWER THE PHREATIC SURFACE. FURTHER INFORMATION IS PRESENTED ON SHEETS PASSIVE DEWATERING CONCEPT PLAN AND POSITIVE DEWATERING CONCEPT PLAN.

GENERAL NOTES

5. PROPOSED GRADES ILLUSTRATE THE MINIMUM EXCAVATION GRADES.
6. THE EXCAVATED GRADES SHOWN HEREIN WERE OBTAINED FROM HISTORIC DRAWINGS DATED 1973 THAT DEPICT THE ORIGINAL VALLEY PRIOR TO THE CONSTRUCTION OF THE ASH POND. FIELD CONDITIONS MAY VARY FROM THE PROPOSED GRADES.
7. REFER TO THE FINAL GRADING PLAN FOR FINISHED CLOSURE BY REMOVAL SURFACES INCLUDING LOWER DAM AND BUTTRESS BREACH, AND STORMWATER MANAGEMENT CHANNELS.

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9-21-21

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I/R	DATE	DESCRIPTION
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KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

SITE PLAN AT 100% ASH REMOVAL

SHEET NUMBER

C-08

Project Management Initials: Designer:___ Checked:___ Approved:___ ARCH D 24" x 36"

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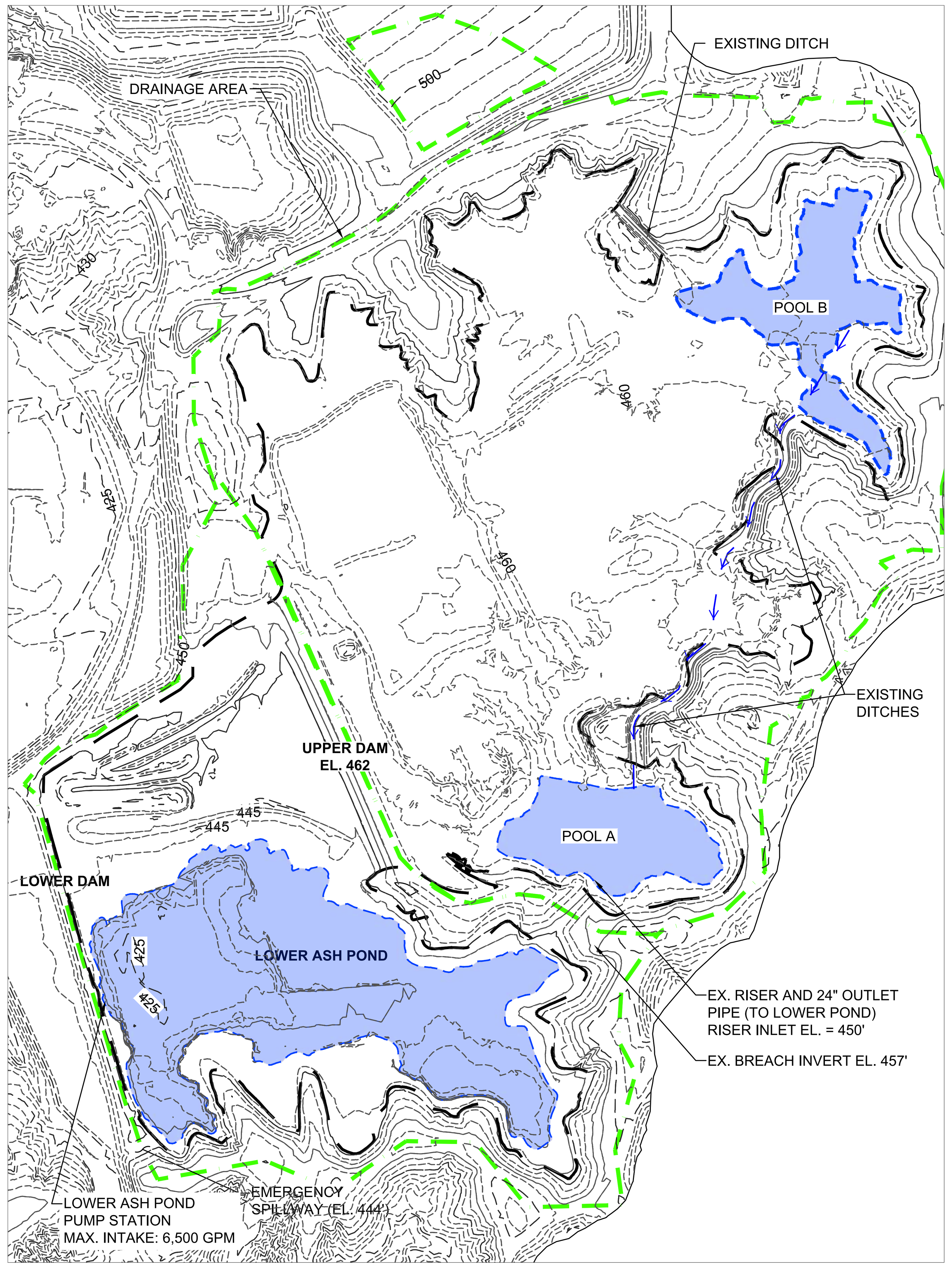
PURPOSE: THE FOLLOWING CONCEPTS ARE PROVIDED AS INFORMATION FOR THE SUBCONTRACTOR TO USE IN PLANNING FOR MANAGEMENT OF STORMWATER THROUGHOUT THE DURATION OF THE PROJECT. SUBCONTRACTOR IS RESPONSIBLE FOR PLANNING, EXECUTION AND CONTROL OF THEIR CONSTRUCTION MEANS AND METHODS.



WATER MANAGEMENT - PRIOR TO CONSTRUCTION (~2021)

UPPER POOL CHARACTERISTICS	
LIMITS OF ASH	125 ACRES
1-INCH 1-HR RAINFALL STORM VOLUME TO POND	1.4 MILLION GAL
2-INCH RAINFALL STORM VOLUME TO POND	4.2 MILLION GAL
4.74 INCH RAINFALL (10-YR 24-HR STORM) VOLUME TO POND	16.2 MILLION GAL
CONTRIBUTING AREA UPSTREAM	193 ACRES
AVAILABLE POOL A VOLUME (FROM EXISTING BOTTOM TO W.S.E. 440')	5.8 MILLION GAL
AVAILABLE POOL A VOLUME (FROM EXISTING BOTTOM TO W.S.E. 445')	14.1 MILLION GAL

LOWER POND CHARACTERISTICS	
LIMITS OF ASH	50 ACRES
1-INCH 1-HR RAINFALL STORM VOLUME TO POND	4.7 MILLION GAL
2-INCH 1-HR RAINFALL STORM VOLUME TO POND	9.8 MILLION GAL
4.74 INCH RAINFALL (10-YR 24-HR STORM) VOLUME TO POND	26.4 MILLION GAL
CONTRIBUTING AREA UPSTREAM	77 ACRES
AVAILABLE POND VOLUME (FROM EXISTING BOTTOM TO W.S.E. 420')	3.7 MILLION GAL
AVAILABLE POND VOLUME (FROM EXISTING BOTTOM TO W.S.E. 430')	13.8 MILLION GAL

NOTES:

1. PLANT IS OPERATIONAL AND WATER FROM LOWER POND IS RECIRCULATED TO PLANT. LOWER POND WATER SURFACE ELEVATION SHALL BE MAINTAINED AT ELEVATION 440' PRIOR TO PLANT CLOSURE.
2. PEAK RATE AT WHICH STORMWATER CAN BE SENT TO LOWER POND IS 6,500 GPM. LARGER VOLUMES MAY RESULT IN DISCHARGE THROUGH THE EMERGENCY SPILLWAY, WHICH SHALL BE AVOIDED.
3. CONCEPT ASSUMES MANAGEMENT OF STORMWATER PER THE EXISTING CONDITIONS THAT INCLUDES A NETWORK OF RIM DITCHES DRAINING TO POOL A AND FLOWING THROUGH THE WEIR OUTLET TO THE LOWER POND.

LEGEND

EXISTING STORMWATER DITCH

DEWATERING DITCH

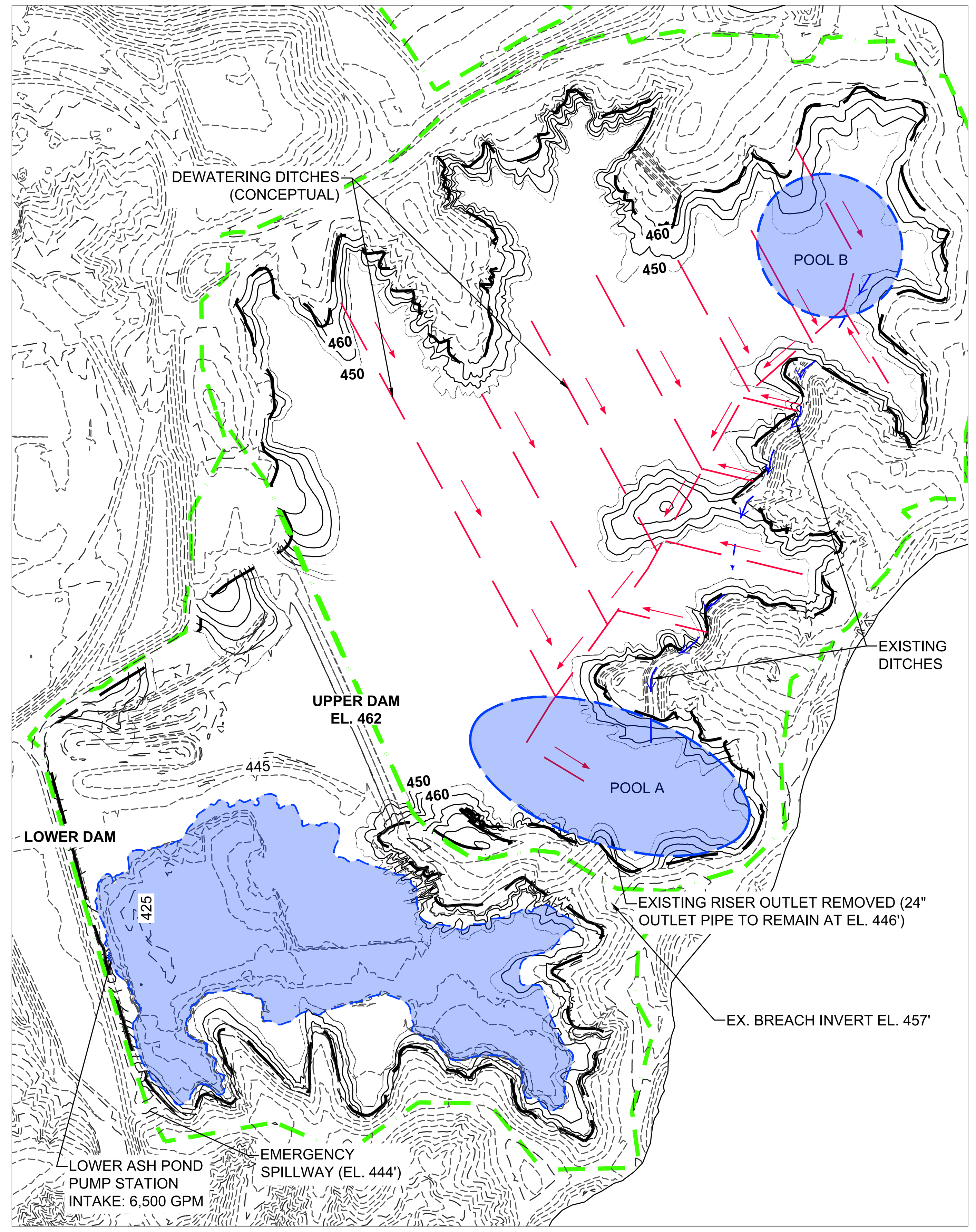
APPROXIMATE LIMITS OF POOL

DRAINAGE AREA

N

0 400 800

HORIZONTAL SCALES (IN FEET)



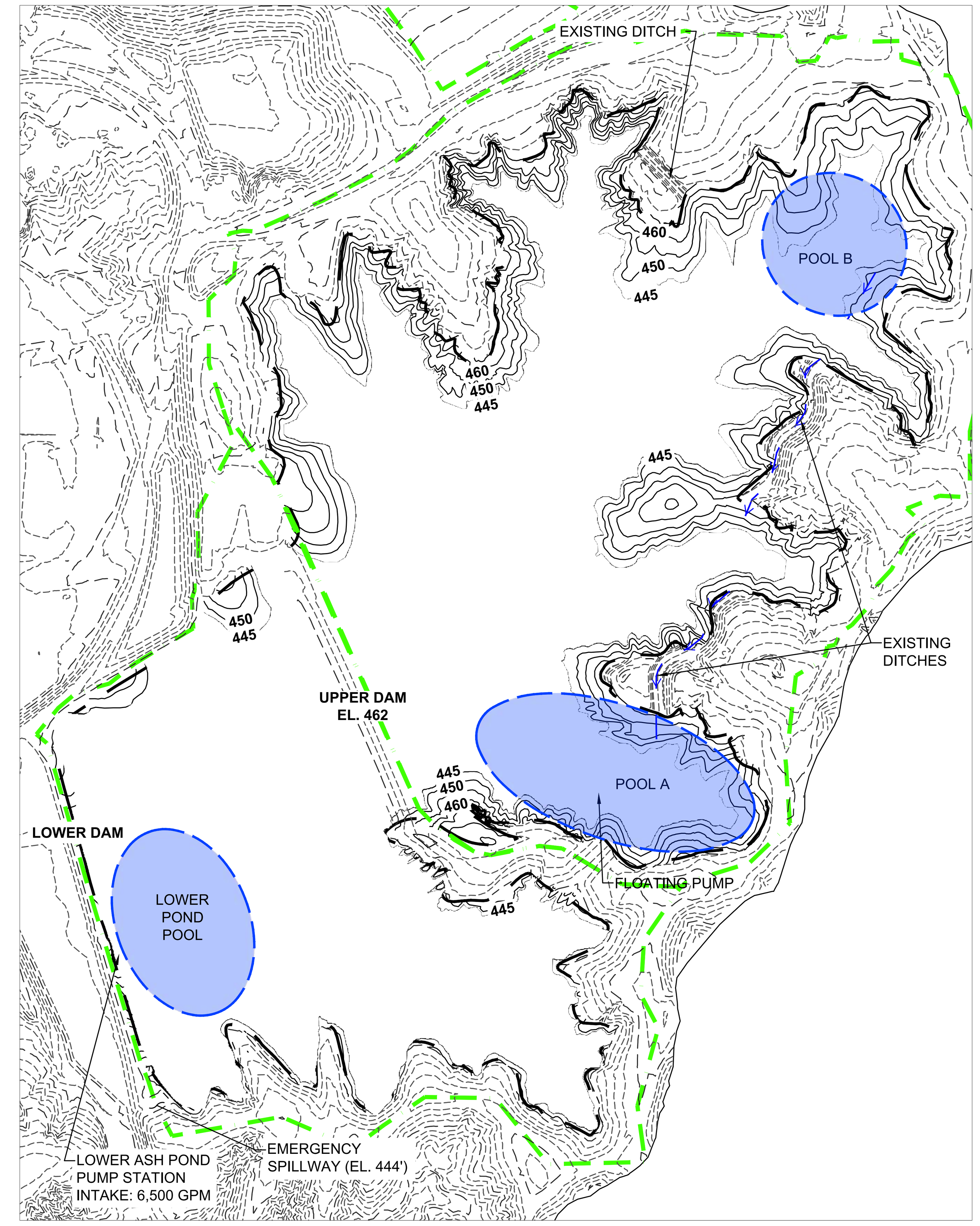
WATER MANAGEMENT - MILESTONE 1 (EXCAVATION TO EL. 450')

UPPER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME - PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	1.4 MILLION GAL	5 HOUR	6,500 GPM	NEGLIGIBLE	N/A
2-INCH 1-HR RAINFALL	4.8 MILLION GAL	5 HOUR	6,500 GPM	2.9 MILLION GAL	7 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	16.0 MILLION GAL	28 HOUR	6,500 GPM	5.1 MILLION GAL	13 HOURS

LOWER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME - PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	3.2 MILLION GAL	5 HOUR	6,500 GPM	1.2 MILLION GAL	3 HOURS
2-INCH 1-HR RAINFALL	8.2 MILLION GAL	5 HOUR	6,500 GPM	6.3 MILLION GAL	16 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	24.6 MILLION GAL	40 HOUR	6,500 GPM	13.7 MILLION GAL	35 HOURS

NOTES:

1. PLANT IS OPERATIONAL AND WATER FROM LOWER POND IS RECIRCULATED TO PLANT. LOWER POND WATER SURFACE ELEVATION SHALL BE MAINTAINED AT ELEVATION 440' PRIOR TO PLANT CLOSURE.
2. UPPER POND W.S.E. = 445', LOWER POND W.S.E 440'.
3. MILESTONE 1 SCENARIO ENVISIONS AND ASSUMES THAT THE CONTRACTOR WILL MAINTAIN THE NETWORK OF RIM DITCHES TO POOL A, AND MAKE NECESSARY MODIFICATIONS TO EXISTING NETWORK OF DITCHES TO ALLOW POSITIVE DRAINAGE FROM POOL B TO POOL A.
4. EXISTING RISER CONNECTED TO OUTLET PIPE REGULATING FLOW BETWEEN POOL A AND THE LOWER ASH POND WILL BE REMOVED. OUTLET PIPE (BARREL) OF THE RISER WILL REMAIN.
5. HYDRAULIC ANALYSIS HAS SHOWN THAT USING THE EXISTING POOL A OUTLET AT ELEVATION 446' SHOULD ALLOW FOR APPROPRIATE STORMWATER MANAGEMENT IN POOL A. HOWEVER, SUBCONTRACTOR MAY CHOOSE TO UTILIZE PUMPS, SIPHONS, OR LOWER THE ELEVATION OF EXISTING EMERGENCY BREACH AT POOL A TO MANAGE STORMWATER.
6. IN ADDITION TO MODIFICATIONS TO EXISTING NETWORK OF DITCHES, SUBCONTRACTOR SHALL MAINTAIN A SYSTEM OF GRAVITY DEWATERING DITCHES IN THE UPPER ASH POND TO DRAIN TO POOL A. THESE DITCHES SHALL MAINTAIN THE PHREATIC LEVEL 10' BELOW THE EXCAVATION LEVEL.



WATER MANAGEMENT - MILESTONE 2 - AFTER PLANT CLOSURE (EXCAVATION EL. FROM 450' TO 445')

UPPER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME - PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	1.4 MILLION GAL	5 HOUR	6,500 GPM	NEGLIGIBLE	N/A
2-INCH 1-HR RAINFALL	4.8 MILLION GAL	5 HOUR	6,500 GPM	2.9 MILLION GAL	7 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	16.0 MILLION GAL	28 HOUR	6,500 GPM	5.1 MILLION GAL	13 HOURS

LOWER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME - PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	3.2 MILLION GAL	3 HOUR	6,500 GPM	2.0 MILLION GAL	5 HOURS
2-INCH 1-HR RAINFALL	8.2 MILLION GAL	3 HOUR	6,500 GPM	7.1 MILLION GAL	18 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	24.6 MILLION GAL	40 HOUR	6,500 GPM	9.1 MILLION GAL	23 HOURS

NOTES:

1. PLANT HAS CEASED OPERATION DURING THIS MILESTONE.
2. UPPER POND W.S.E = 445' TO 440', LOWER POND W.S.E = 435'.
3. AS NOTED IN MILESTONE 1, MILESTONE 2 SCENARIO ALSO ENVISIONS THAT THE SUBCONTRACTOR WILL MAINTAIN THE NETWORK OF RIM DITCHES TO POOL A, AND MAKE NECESSARY MODIFICATIONS TO EXISTING NETWORK OF DITCHES TO ALLOW POSITIVE DRAINAGE FROM POOL B TO POOL A.
4. POOL A OUTLET PIPE BARREL SHALL REMAIN DURING THIS PHASE.
5. AS THE EXCAVATION PROGRESSES TO EL. 445' IN THE UPPER POND, REMOVAL OF THE UPPER DAM IS INITIATED. IT IS ASSUMED THAT THE UPPER DAM REMOVAL WILL BE PERFORMED TOWARDS THE END OF THIS PHASE WHEN EXCAVATION AT THE UPPER POND PROCEEDS LOWER THAN THE NORMAL WATER SURFACE ELEVATIONS AT THE LOWER POND.
6. SUBCONTRACTOR SHOULD BE PREPARED TO PROVIDE 6,500 GPM OUTLET FROM POOL A TO THE LOWER POND TO MANAGE STORMWATER IN THE UPPER POND AND REDUCE WORK DELAYS. SUBCONTRACTOR MAY UTILIZE PUMPS, SIPHONS, OR LOWER THE EXISTING BREACH AT POOL A AT THEIR DISCRETION TO MANAGE STORMWATER.
7. IN ADDITION TO MODIFICATIONS TO EXISTING NETWORK OF DITCHES, SUBCONTRACTOR SHALL MAINTAIN A SYSTEM OF GRAVITY DEWATERING DITCHES IN THE UPPER ASH POND TO DRAIN TO POOL A. THESE DITCHES SHALL MAINTAIN THE PHREATIC LEVEL 10' BELOW THE EXCAVATION LEVEL.
8. SUBCONTRACTOR SHALL MAINTAIN MINIMUM PUMPING RATE OF 6,500 GPM FROM LOWER POOL TO DOWN-GRADIENT STORMWATER POND.

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REGISTRATION

ISSUE/REVISION

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KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

STORMWATER MANAGEMENT - I

SHEET NUMBER

C-09

Project Management Initials: Designer:___ Checked:___ Approved:___ ARCH D 24" x 36"

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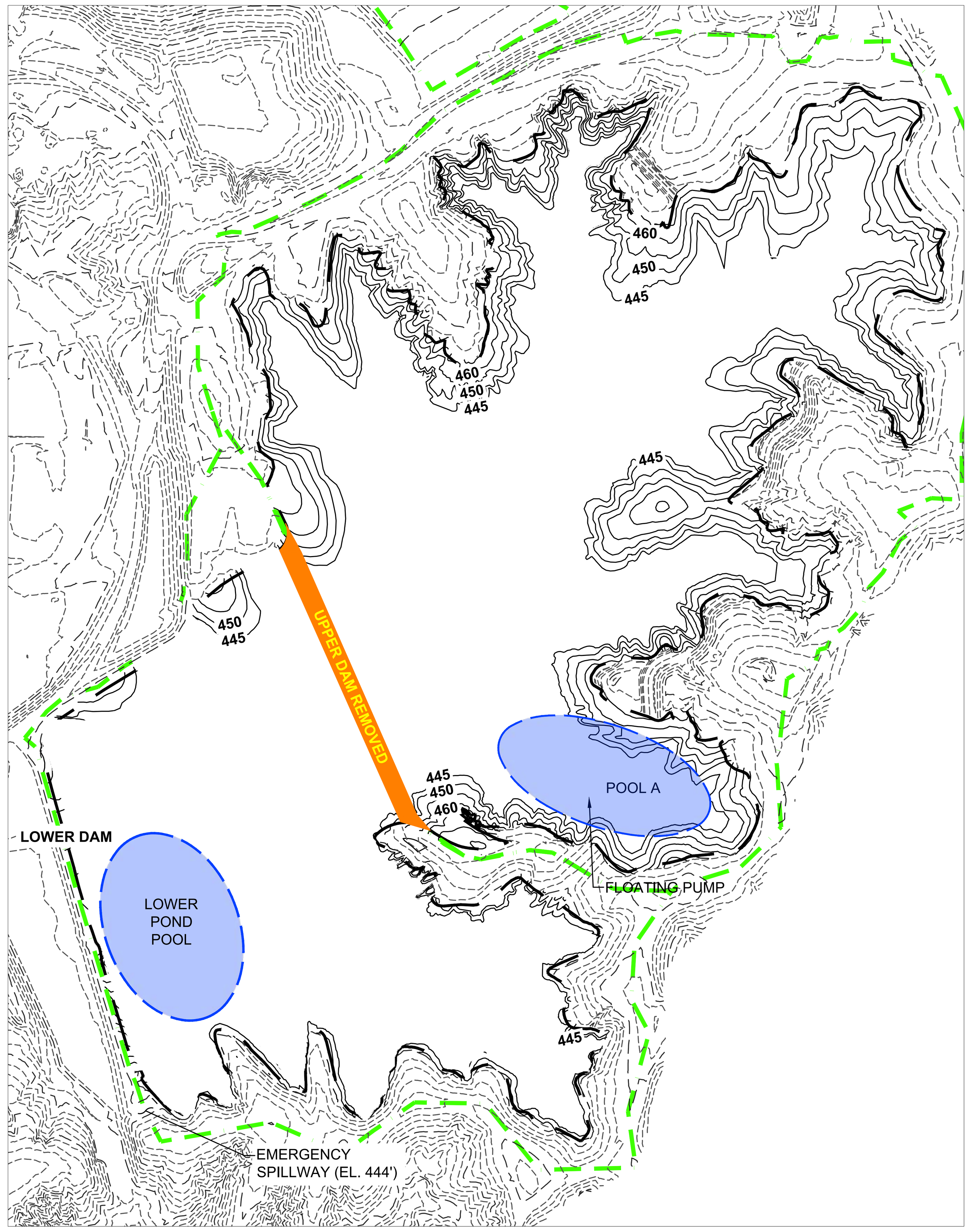
PURPOSE: THE FOLLOWING CONCEPTS ARE PROVIDED AS INFORMATION FOR THE SUBCONTRACTOR TO USE IN PLANNING FOR MANAGEMENT OF STORMWATER THROUGHOUT THE DURATION OF THE PROJECT. SUBCONTRACTOR IS RESPONSIBLE FOR PLANNING, EXECUTION AND CONTROL OF THEIR CONSTRUCTION MEANS AND METHODS.



WATER MANAGEMENT - MILESTONE 3 (EXCAVATION TO EL. 445')

UPPER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME – PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	0.5 MILLION GAL	5 HOUR	6,500 GPM	NEGLIGIBLE	N/A
2-INCH 1-HR RAINFALL	2.4 MILLION GAL	5 HOUR	6,500 GPM	0.4 MILLION GAL	1 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	9.2 MILLION GAL	28 HOUR	6,500 GPM	NEGLIGIBLE	N/A

LOWER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME – PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	2.6 MILLION GAL	3 HOUR	6,500 GPM	1.5 MILLION GAL	4 HOURS
2-INCH 1-HR RAINFALL	7.7 MILLION GAL	3 HOUR	6,500 GPM	6.6 MILLION GAL	17 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	24.4 MILLION GAL	32 HOUR	6,500 GPM	12.0 MILLION GAL	31 HOURS

NOTES:

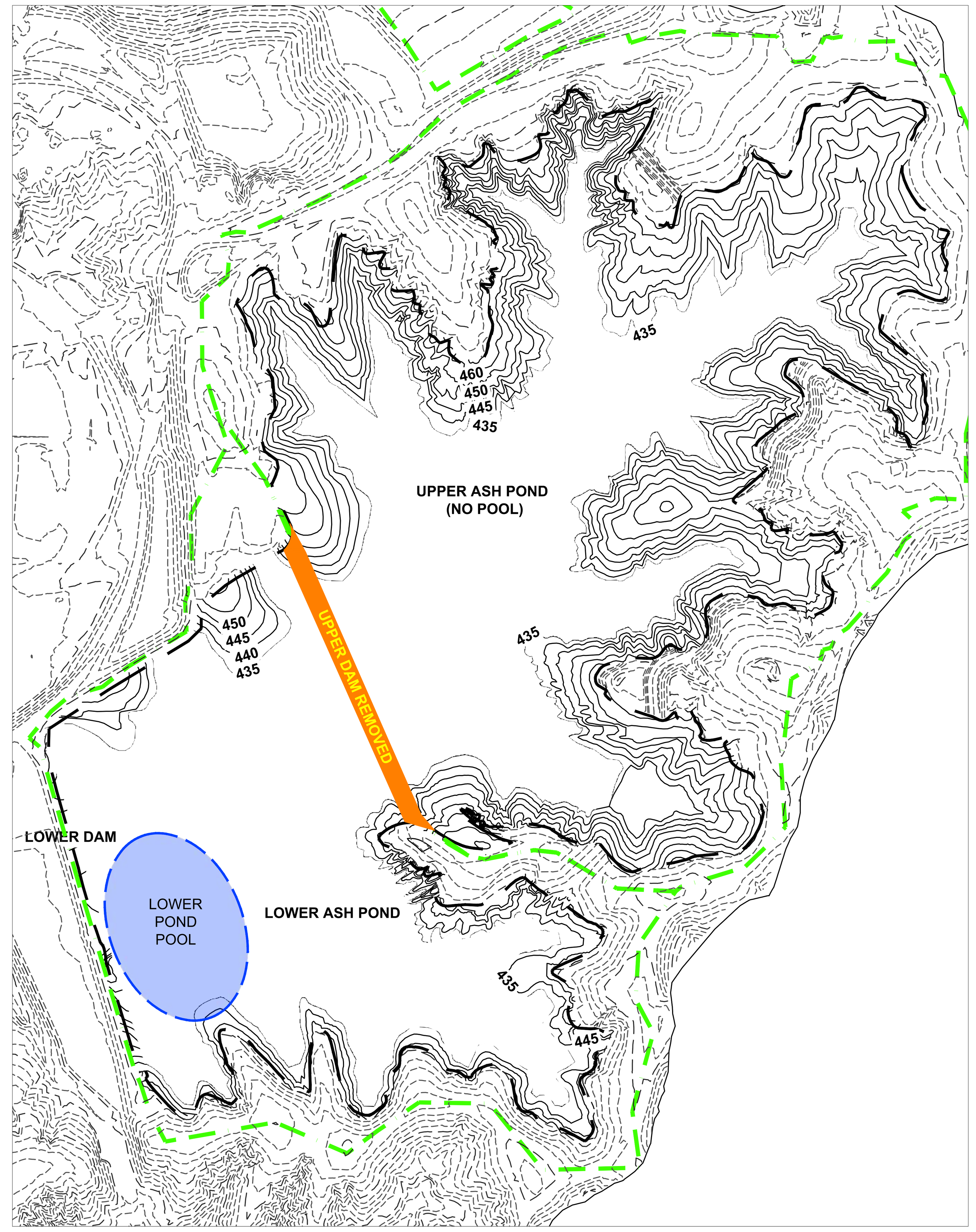
1. UPPER POND W.S.E. = 440', LOWER POND W.S.E. = 435'.
2. SUBCONTRACTOR SHOULD PROVIDE 6,500 GPM OUTLET FROM POOL A TO THE LOWER POND TO MANAGE STORMWATER IN THE UPPER POND AND PREVENT WORK DELAYS. SUBCONTRACTOR CAN UTILIZE PUMPS, SIPHONS, OR LOWER THE EXISTING UPPER POND EMERGENCY SPILLWAY AT THEIR DISCRETION TO MANAGE STORMWATER.
3. IN ADDITION TO MODIFICATIONS TO EXISTING NETWORK OF DITCHES, SUBCONTRACTOR SHALL MAINTAIN A SYSTEM OF GRAVITY DEWATERING DITCHES IN THE UPPER ASH POND TO DRAIN TO POOL A. THESE DITCHES SHALL MAINTAIN THE PHREATIC LEVEL 10' BELOW THE EXCAVATION LEVEL.
4. SUBCONTRACTOR SHALL MAINTAIN MINIMUM PUMPING RATE OF 6,500 GPM FROM LOWER POOL TO DOWN-GRADIENT STORMWATER POND.

LEGEND

POST-CLOSURE STORMWATER CHANNEL(S)

APPROXIMATE LIMITS OF POOL

DRAINAGE AREA



WATER MANAGEMENT - MILESTONE 4 (EXCAVATION EL. 435')

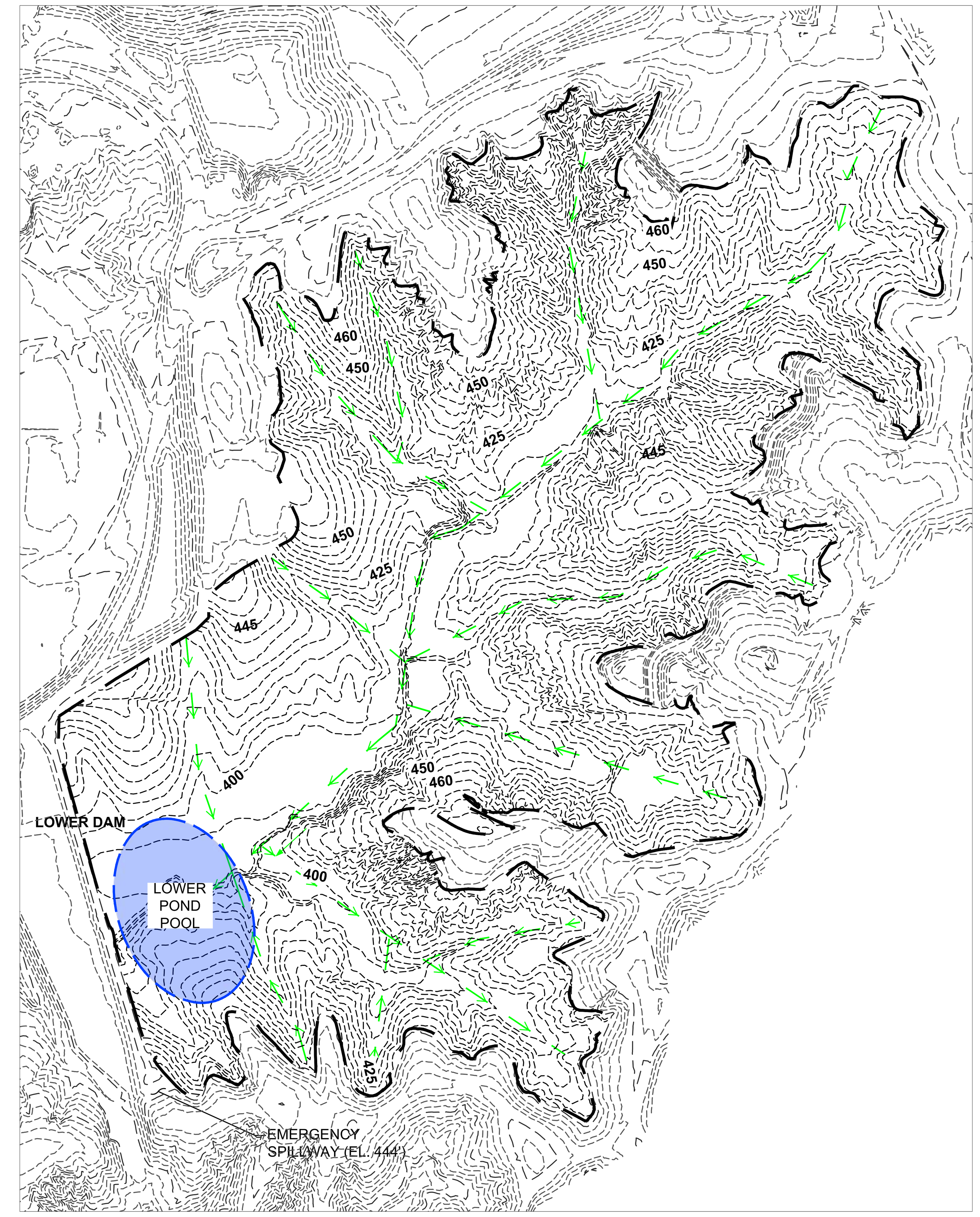
LOWER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME – PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	2.4 MILLION GAL	3 HOUR	6,500 GPM	1.3 MILLION GAL	3 HOURS
2-INCH 1-HR RAINFALL	7.5 MILLION GAL	3 HOUR	6,500 GPM	6.4 MILLION GAL	16 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	24.2 MILLION GAL	26 HOUR	6,500 GPM	14.0 MILLION GAL	36 HOURS

NOTES:

1. LOWER POND W.S.E. = 430'.
2. IT IS EXPECTED THAT ALL STORMWATER FLOWS IN THE UPPER POND ARE ROUTED TO THE LOWER POND.
3. LOWER POND FOOTPRINT SHOWN IS FOR REPRESENTATION ONLY. SUBCONTRACTOR MAY UTILIZE A LARGER FOOTPRINT AS NECESSARY FOR THEIR MEANS AND METHODS.
4. UPPER ASH POND OUTLET PIPE SHOULD BE ABANDONED.
5. IN ADDITION TO MODIFICATIONS TO EXISTING NETWORK OF DITCHES, SUBCONTRACTOR SHALL MAINTAIN A SYSTEM OF GRAVITY DEWATERING DITCHES IN THE UPPER ASH POND TO DRAIN TO POOL A. THESE DITCHES SHALL MAINTAIN THE PHREATIC LEVEL 10' BELOW THE EXCAVATION LEVEL.
6. SUBCONTRACTOR SHALL MAINTAIN MINIMUM PUMPING RATE OF 6,500 GPM FROM LOWER POOL TO DOWN-GRADIENT STORMWATER POND.

WATER MANAGEMENT - GENERAL NOTES

1. 10-YEAR DESIGN STORM ANALYZES A RAINFALL OF 4.74" APPLIED WITH INDY HUFF 3RD QUARTILE DISTRIBUTION OVER A 24 HOUR PERIOD.
2. 1-INCH AND 2-INCH STORMS WERE ANALYZED ASSUMING A ONE HOUR DURATION.
3. CONTRIBUTING UPSTREAM DRAINAGE AREA TO UPPER POND IS 193 ACRES.
4. CONTRIBUTING UPSTREAM DRAINAGE AREA TO LOWER POND IS 77 ACRES.
5. IT IS ASSUMED THAT AFTER PLANT CLOSURE, ANY GROUNDWATER, FREE WATER, OR STORMWATER THAT ACCUMULATES WITHIN THE POND WILL BE PUMPED FROM THE LOWER POOL TO A DOWNGRADIENT STORMWATER POND PRIOR TO DISCHARGE VIA A PERMITTED NPDES OUTFALL. THE DESIGN OF THIS STORMWATER POND IS ONGOING AND ITS CONSTRUCTION IS NOT INCLUDED IN THIS SCOPE. THE ANTICIPATED LOCATION OF THIS STORMWATER POND IS ADJACENT TO THE EXISTING COAL PILE AREA.



WATER MANAGEMENT - MILESTONE 5 (EXCAVATION TO FINAL CLOSURE GRADES)

LOWER POND CHARACTERISTICS					
STORM EVENT DESCRIPTION	TOTAL RAINFALL VOLUME TO STORAGE POND	STORMWATER INFLOW TO POND DURATION	ASSUMED PUMP RATE OUT DURING STORM	REQUIRED STORAGE VOLUME (TOTAL RAINFALL VOLUME – PUMP RATE OUT X DURATION)	TIME TO LOWER POND AT ASSUMED PUMP RATE
1-INCH 1-HR RAINFALL	2.6 MILLION GAL	3 HOUR	6,500 GPM	1.3 MILLION GAL	4 HOURS
2-INCH 1-HR RAINFALL	7.7 MILLION GAL	3 HOUR	6,500 GPM	6.4 MILLION GAL	17 HOURS
4.74 INCH RAINFALL (10-YR 24-HR STORM)	24.2 MILLION GAL	26 HOUR	6,500 GPM	14.0 MILLION GAL	36 HOURS

NOTES:

1. LOWER POND W.S.E. = 420'.
2. LOWER POND FOOTPRINT SHOWN IS FOR REPRESENTATION ONLY. SUBCONTRACTOR MAY UTILIZE A LARGER FOOTPRINT AS NECESSARY FOR THEIR MEANS AND METHODS.
3. SUBCONTRACTOR SHALL MAINTAIN MINIMUM PUMPING RATE OF 6,500 GPM FROM LOWER POOL TO DOWN-GRADIENT STORMWATER POND.

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HORIZONTAL SCALES (IN FEET)

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REGISTRATION

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STORMWATER MANAGEMENT II

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ARCH D 24" x 36"

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GRAPHIC SCALE (IN FEET)

LEGEND

DIRECTION OF FLOW

GRAVITY DEWATERING DITCH

S SUMP

PASSIVE DEWATERING CONCEPT NOTES:

RELATED DOCUMENTS:

REFER TO SPECIFICATIONS SECTION 312319 – DEWATERING AND FREE WATER REMOVAL FOR ADDITIONAL DETAILS AND SPECIFIC REQUIREMENTS OF THE DEWATERING SYSTEM DESIGN.

GENERAL DEWATERING REQUIREMENTS

A. DEWATERING: DESIGN, FURNISH, INSTALL, TEST, OPERATE, MONITOR, AND MAINTAIN DEWATERING SYSTEM OF SUFFICIENT SCOPE, SIZE, AND CAPACITY TO CONTROL SUBSURFACE HYDROSTATIC PRESSURES TO PREVENT INTERFERENCE WITH PERFORMANCE OF THE WORK IN ACCORDANCE WITH THE CONTRACT. THE SYSTEM WILL BE IMPLEMENTED TO LOWER, CONTROL, REMOVE, AND DISPOSE OF SURFACE WATER OR GROUNDWATER TO ALLOW REGRADING AND CONSTRUCTION TO PROCEED ON DRY, STABLE SUBGRADES. THE SYSTEM IS TO BE IMPLEMENTED AS FOLLOWS:

1.1. DESIGN: DESIGN DEWATERING SYSTEM, INCLUDING COMPREHENSIVE ENGINEERING ANALYSIS BY A QUALIFIED PROFESSIONAL ENGINEER, USING PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA INDICATED IN PROJECT SPECIFICATIONS.
1.2. CONTINUOUSLY MONITOR AND MAINTAIN DEWATERING OPERATIONS TO ENSURE EROSION CONTROL, STABILITY OF EXCAVATIONS AND CONSTRUCTED SLOPES, PREVENTION OF FLOODING IN THE EXCAVATED AREAS AND PREVENTION OF DAMAGE TO SUBGRADES AND PERMANENT STRUCTURES.
1.3. PREVENT SURFACE WATER FROM ENTERING EXCAVATIONS BY GRADING, DIKES, OR OTHER MEANS.
1.4. ACCOMPLISH DEWATERING WITHOUT DAMAGING EXISTING STRUCTURES, EMBANKMENTS, DIKES, AND SITE IMPROVEMENTS ADJACENT TO EXCAVATION.
1.5. REMOVE DEWATERING SYSTEM WHEN NO LONGER REQUIRED FOR CONSTRUCTION.

B. FREE WATER REMOVAL:

DESIGN, FURNISH, INSTALL, TEST, OPERATE, MONITOR, AND MAINTAIN FREE WATER REMOVAL SYSTEM OF SUFFICIENT SCOPE, SIZE, AND CAPACITY TO CONTROL SUBSURFACE HYDROSTATIC PRESSURES TO PREVENT INTERFERENCE WITH PERFORMANCE OF THE WORK IN ACCORDANCE WITH THE CONTRACT. THE SYSTEM WILL BE IMPLEMENTED TO LOWER, CONTROL, REMOVE, AND DISPOSE OF FREE WATER TO ALLOW REGRADING AND CONSTRUCTION TO PROCEED ON DRY, STABLE SUBGRADES. THE SYSTEM IS TO BE IMPLEMENTED AS FOLLOWS:

1.1. DESIGN: DESIGN FREE WATER REMOVAL SYSTEM, INCLUDING COMPREHENSIVE ENGINEERING ANALYSIS BY A QUALIFIED PROFESSIONAL ENGINEER, USING PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA INDICATED IN PROJECT SPECIFICATIONS.
1.2. CONTINUOUSLY MONITOR AND MAINTAIN FREE WATER REMOVAL OPERATIONS TO ENSURE EROSION CONTROL, STABILITY OF EXCAVATIONS AND CONSTRUCTED SLOPES, PREVENTION OF FLOODING IN THE EXCAVATED AREAS AND PREVENTION OF DAMAGE TO SUBGRADES AND PERMANENT STRUCTURES.
1.3. PREVENT SURFACE WATER FROM ENTERING EXCAVATIONS BY GRADING, DIKES, OR OTHER MEANS.
1.4. ACCOMPLISH FREE WATER REMOVAL WITHOUT DAMAGING EXISTING STRUCTURES, EMBANKMENTS, DIKES, AND SITE IMPROVEMENTS ADJACENT TO EXCAVATION.
1.5. REMOVE FREE WATER REMOVAL SYSTEM WHEN NO LONGER REQUIRED FOR CONSTRUCTION.

CONCEPTUAL DEWATERING SYSTEM

A CONCEPTUAL DEWATERING SYSTEM WAS DEVELOPED BY AECOM FOR THIS PROJECT BASED ON ITS KNOWLEDGE OF THE SITE'S SUBSURFACE CONDITIONS AND FINDINGS OF FIELD TESTING CONDUCTED BY VECTREN/AECOM TO EVALUATE THE POTENTIAL FOR GRAVITY DEWATERING AND OTHER DEWATERING TECHNIQUES. PER THE PROJECT SPECIFICATIONS, THE SUBCONTRACTOR SHALL SUBMIT A COMPLETE DEWATERING PLAN FOR APPROVAL. THE DEWATERING SYSTEM PRESENTED HEREIN CAN ONLY BE CONSIDERED BY THE SUBCONTRACTOR AS A CONCEPTUAL DESIGN SCHEME FOR A POTENTIAL DEWATERING SYSTEM. THE CONCEPTUAL CONFIGURATIONS OF THE DEWATERING SYSTEM ARE PRESENTED ON PLAN SHEETS C–11 AND C–12.

1.6. THE CONCEPTUAL DEWATERING SYSTEM IS COMPOSED OF TWO SYSTEM TYPES: 1) A PASSIVE, GRAVITY SYSTEM CONSISTING OF EXCAVATED DITCHES AND SUMPS IN CONJUNCTION WITH PUMPING (SEE THIS SHEET); 2) A POSITIVE SYSTEM, CONSISTING OF CLOSELY SPACED WELL POINTS AND/OR DEEP WELLS INSTALLED IN LINES, CONNECTED VIA A SYSTEM OF HEADER PIPES (SEE PLAN SHEET C–12).
1.7. THE PURPOSE OF THE DEWATERING SYSTEM IS TO LOWER AND MAINTAIN THE POND PHREATIC SURFACE AT ANY WORK AREA TO APPROXIMATELY 10 FT BELOW THE CURRENT SURFACE GRADE IN ANY AREA OF WORK, AT ANY TIME. THE INTENT IS TO ACHIEVE A STABLE SUBGRADE, ON WHICH EXCAVATION EQUIPMENT CAN WORK.
1.8. THE PASSIVE, GRAVITY SYSTEM (SEE THIS SHEET) IS INTENDED TO BE CONFIGURED TO LOWER AND MAINTAIN THE PHREATIC SURFACE WITHIN WORK AREAS TO APPROXIMATE EL. 440, AND WILL ALLOW FOR MASS EXCAVATIONS OF CCR MATERIAL UP TO A SURFACE ELEVATION OF APPROXIMATELY 445.
1.9. THE POSITIVE SYSTEM WILL NEED TO BE IN PLACE AND OPERATIONAL PRIOR TO EXTENDING EXCAVATIONS BELOW EL. 445 AT ANY AREA.

CONCEPTUAL GRAVITY DEWATERING SYSTEM NOTES

1.10. THE CONCEPTUAL GRAVITY SYSTEM SHALL CONSIST OF A NETWORK OF DEWATERING DITCHES, SPACED AT MAXIMUM 300 FT ON–CENTER (CENTERLINE OF ONE DITCH TO THE NEXT) ACROSS THE FOOTPRINT OF THE POND. THE DEWATERING DITCHES SHALL BE CONFIGURED TO DRAIN FROM NORTH TO SOUTH AND DISCHARGE TO A PERIMETER RIM DITCH, INSTALLED ALONG THE SOUTHERN/SOUTHEASTERN EDGE OF THE ASH POND. THE RIM DITCH WILL COLLECT THE DEWATERING DITCHES AS WELL AS STORMWATER RUN–OFF FLOWS ENTERING THE POND, AND WILL FLOW FROM NORTH TO SOUTH, TERMINATING AT POOL A.
1.11. A SUMP SHALL BE CONSTRUCTED WITHIN POOL A AND THE POOL SHALL BE CONTINUOUSLY MAINTAINED IN A DRY CONDITION BY PUMPING OR USE OF SIPHON PIPING. WATER REMOVED FROM THE SUMP IN POOL A WILL BE DISCHARGED TO THE LOWER POOL. THE WATER WILL ULTIMATELY BE PUMPED FROM THE LOWER POOL TO THE EXISTING PLANT FOR RECIRCULATION (PRIOR TO EXISTING PLANT CLOSURE) OR FROM THE LOWER POOL TO THE FUTURE DOWN–GRADIENT STORMWATER POND (FOLLOWING PLANT SHUTDOWN).
1.12. ACCESS FOR CONSTRUCTION EQUIPMENT PERFORMING MASS EXCAVATIONS SHALL BE FROM THE NORTH SIDE OF THE POND. EXCAVATIONS SHALL BE PERFORMED IN BAYS, IN BETWEEN THE DEWATERING DITCHES.
1.13. THE GRAVITY DEWATERING SYSTEM SHALL BE EXCAVATED AND PUT INTO SERVICE WELL AHEAD OF THE START OF EXCAVATION ACTIVITIES. IT IS ESTIMATED THAT, ONCE THE SYSTEM IS OPERATIONAL, APPROXIMATELY 6 MONTHS WILL BE REQUIRED TO LOWER THE POND PHREATIC SURFACE FROM ITS EXISTING LEVEL (APPROX. EL. 452) TO A LEVEL OF EL. 442–443.
1.14. THE DEWATERING DITCHES SHALL BE APPROPRIATELY MAINTAINED THROUGHOUT THE CONSTRUCTION DURATION. ANY DEBRIS OR SEDIMENT COLLECTING WITHIN THE DITCHES SHALL BE PROMPTLY REMOVED, AND ANY SLOUGHS SHALL BE PROMPTLY REPAIRED, SUCH THAT THE REQUIRED DIMENSIONS OF THE DITCHES ARE MAINTAINED.

PHREATIC SURFACE MONITORING

A PHREATIC SURFACE MONITORING SYSTEM SHALL BE INSTALLED AND MAINTAINED OPERATIONAL THROUGHOUT ALL EXCAVATION ACTIVITIES. THE MONITORING SYSTEM SHALL CONSIST OF A NUMBER OF VIBRATING WIRE PIEZOMETERS OR CONVENTIONAL STANDPIPE PIEZOMETERS (OR A COMBINATION OF BOTH), INSTALLED ON A REGULAR GRID THROUGHOUT THE EXCAVATION FOOTPRINT. PIEZOMETERS SHALL BE CONFIGURED AND MONITORED TO:

1.15. BE INSTALLED AT SPACINGS/LOCATIONS SUCH THAT THERE IS NOT LESS THAN 1 PIEZOMETER PER 3 ACRES OF FOOTPRINT, AND SUCH THAT PIEZOMETERS ARE LOCATED UNIFORMLY ACROSS THE FOOTPRINT.
1.16. BE LOCATED IN THE BAYS THAT ARE IN BETWEEN THE DEWATERING DITCHES.
1.17. BE CONFIGURED/ADJUSTED TO BE CAPABLE OF DETECTING THE DEPTH OF THE STATIC PHREATIC SURFACE AT THE LOCATION OF THE PIEZOMETER AND SHALL BE ADJUSTED AS NECESSARY AS THE EXCAVATION PROCEEDS.
1.18. SHALL BE MONITORED ON A REGULAR BASIS TO CONFIRM THAT THE PHREATIC SURFACE IS LOCATED NOT LESS THAN 10 FT BELOW THE SURFACE ON WHICH EXCAVATION EQUIPMENT WILL WORK AT ANY GIVEN TIME.

SEQUENCE OF CONSTRUCTION FOR CONCEPTUAL GRAVITY SYSTEM

1.19. CONSTRUCT PERIMETER RIM DITCH AND SUMP IN POOL A. SUMP SHALL BE EXCAVATED TO EL. 435.
1.20. DECANT/PUMP/REMOVE ANY FREE WATER IN POOLS A AND B.
1.21. CONSTRUCT COMPLETE NETWORK OF DEWATERING DITCHES ACROSS THE UPPER POOL FOOTPRINT. DITCHES SHALL INITIALLY BE CONSTRUCTED TO EXTEND TO INVERT EL. 450. LOW GROUND PRESSURE EQUIPMENT SHALL BE USED TO IMPLEMENT DITCH EXCAVATIONS.
1.22. INSTALL PHREATIC SURFACE MONITORING SYSTEM CONCURRENTLY WITH DEWATERING DITCH EXCAVATIONS.
1.23. WHEN THE PHREATIC SURFACE HAS DROPPED TO AN ACCEPTABLE LEVEL, BEGIN CCR MATERIAL EXCAVATION WITHIN THE UPPER POOL TO EL. 445.
1.24. MAINTAIN THE SUMP IN POOL A PUMPED DRY AT ALL TIMES, AND APPROPRIATELY CONTROL EXCAVATION OPERATIONS TO MAINTAIN THE WORKING SURFACE AT LEAST 10 FT ABOVE THE PHREATIC SURFACE. SUSPEND EXCAVATIONS WHEN PRECIPITATION EVENTS RAISE THE PHREATIC SURFACE BEYOND THESE LIMITS.
1.25. PRIOR TO THE EXCAVATION ELEVATION REACHING EL. 445 IN UPPER POOL, DEEPEN THE DEWATERING DITCH INVERTS TO EL. 435 AT ALL LOCATIONS.
1.26. PERFORM CCR MATERIAL EXCAVATION IN LOWER POOL TO EL. 445.

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9-21-21

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PASSIVE DEWATERING CONCEPT PLAN

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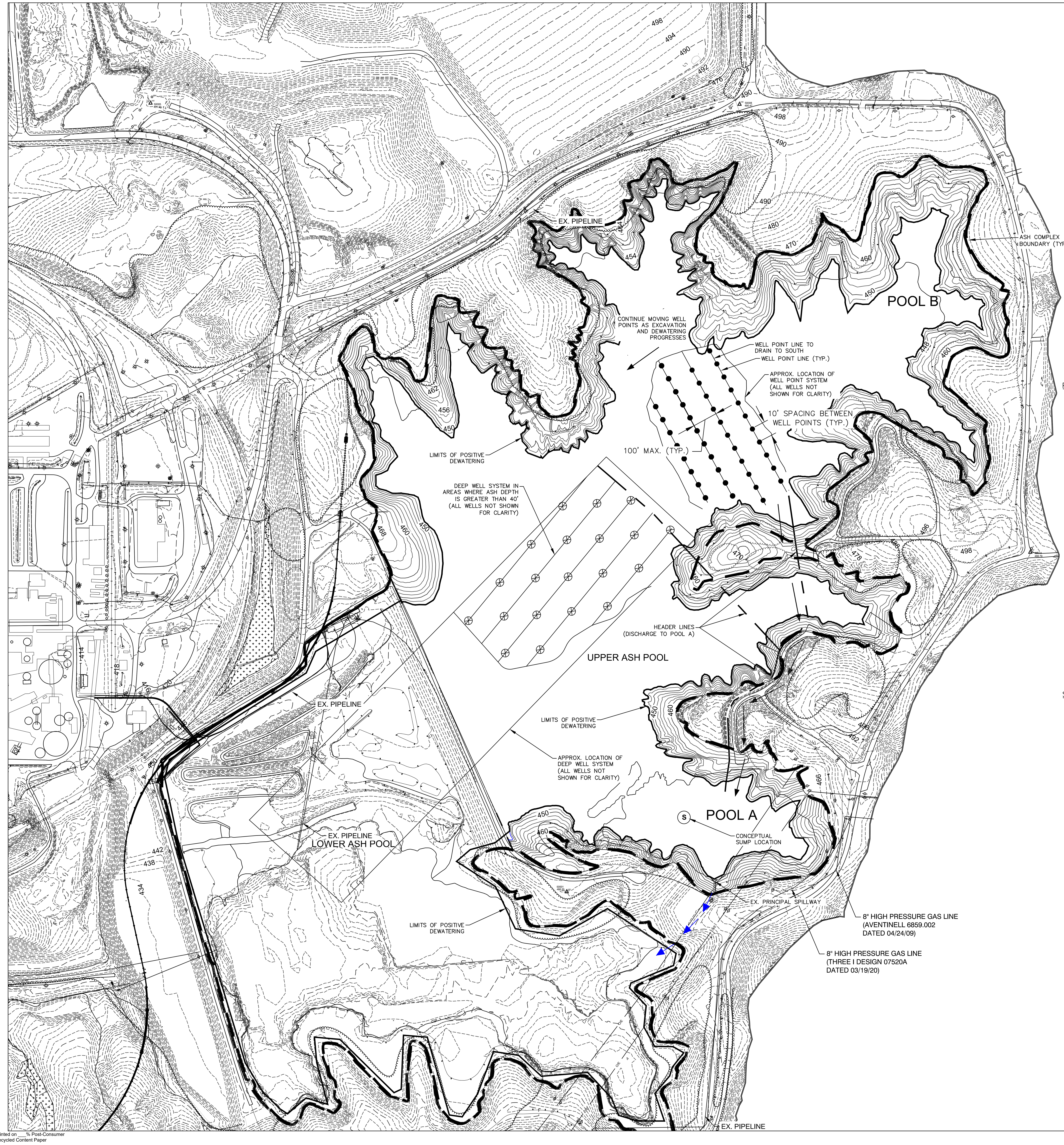

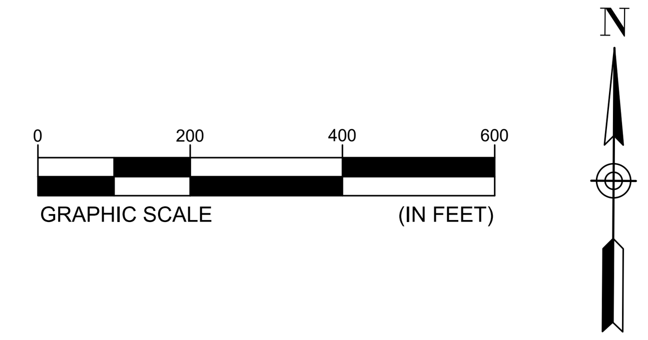

DIRECTION OF FLOW
POSITIVE DEWATERING HEADER LINE
SUMP
DEEP WELL
WELL POINT

POSITIVE DEWATERING CONCEPT NOTES:

POSITIVE DEWATERING SYSTEM NOTES

1. THE CONCEPTUAL POSITIVE DEWATERING SYSTEM WILL CONSIST OF A NETWORK OF CLOSELY SPACED WELL POINTS INSTALLED IN LINES RUNNING NORTH–SOUTH ACROSS THE FOOTPRINT OF THE POND. INDIVIDUAL WELL POINTS WILL BE SPACED AT APPROXIMATELY 10 FT ON CENTER WITHIN EACH LINE, AND THE LINES WILL BE SPACED AT APPROXIMATELY 100 FT FROM EACH OTHER. HEADER PIPES WILL CONNECT THE WELL POINTS IN EACH LINE AND WILL ALSO CONNECT THE LINES. WATER REMOVED BY THE WELL POINTS WILL BE PUMPED VIA THE HEADER PIPES AND DISCHARGED TO THE LOWER POOL. THE WATER WILL ULTIMATELY BE PUMPED FROM THE LOWER POOL TO THE EXISTING PLANT FOR RECIRCULATION (PRIOR TO EXISTING PLANT CLOSURE) OR ULTIMATELY PUMPED TO A TREATMENT SYSTEM AT A FUTURE PLANT (AFTER EXISTING PLANT CLOSURE).
2. SPECIFIC DESIGN OF THE POSITIVE SYSTEM SHALL BE BY AN EXPERIENCED AND QUALIFIED DEWATERING CONTRACTOR. IT IS ANTICIPATED THAT THE DEWATERING SYSTEM'S DESIGN (DEPTH/SPACING OF WELL POINTS, ETC.) WILL BE RELATIVELY CONSTANT FOR MOST OF THE POND, EXCEPT IN THE AREA EAST, WEST, AND BELOW THE CENTRAL AREA OF THE UPPER DAM EMBANKMENT. ASH THICKNESS IS SUBSTANTIALLY GREATER IN THIS AREA THAN ON AVERAGE ACROSS THE POND AND A DEEP WELL SYSTEM WILL LIKELY BE NEEDED IN THIS AREA.
3. THE POSITIVE DEWATERING SYSTEM SHALL BE CAPABLE OF LOWERING THE PHREATIC SURFACE NO LESS THAN 10 FT BELOW THE LOWEST ELEVATION OF THE EXCAVATION IN ANY AREA.
4. ACCESS FOR CONSTRUCTION EQUIPMENT PERFORMING MASS EXCAVATIONS SHALL BE FROM THE NORTH SIDE OF THE POND. EXCAVATIONS SHALL BE PERFORMED IN BAYS, IN BETWEEN THE WELL POINT LINES.
5. THE PHREATIC SURFACE MONITORING SYSTEM (INSTALLED PREVIOUSLY FOR EXCAVATIONS ABOVE EL. 445) SHALL BE MAINTAINED AND/OR APPROPRIATELY MODIFIED DURING OPERATION OF THE POSITIVE DEWATERING SYSTEM. MONITORING OF THE SYSTEM SHALL CONTINUE THROUGHOUT THE COURSE OF ASH EXCAVATION ACTIVITIES.

SPECIFIC REQUIREMENTS FOR POSITIVE DEWATERING SYSTEM

1. THE POSITIVE DEWATERING SYSTEM SHALL BE FIRST PUT INTO SERVICE AHEAD OF THE ASH EXCAVATION REACHING EL. 445. THE SYSTEM WILL BE INITIALLY INSTALLED IN THE NORTHERN AREA OF THE UPPER ASH POOL AND BEGIN OPERATION AHEAD OF THE EXCAVATION REACHING EL. 445. THE SYSTEM SHALL TAKE THE PLACE OF THE GRAVITY SYSTEM ALREADY IN THAT AREA.
2. AS THE ASH EXCAVATION CONTINUES, IT IS ANTICIPATED THAT THE POSITIVE SYSTEM WILL BE MOVED AND REINSTALLED TO CORRESPOND TO THE SPECIFIC AREAS BEING EXCAVATED. SPECIFIC SEQUENCES OF MOVING/INSTALLATION SHALL BE DETERMINED BY THE SUBCONTRACTOR, BUT SHALL BE IMPLEMENTED TO MEET THE FOLLOWING REQUIREMENTS:

A. WHILE EXCAVATIONS CAN PROCEED WHILE THE DEWATERING SYSTEM IS IN ACTIVE OPERATION, THE EXCAVATED SURFACE CAN ONLY BE EXTENDED TO 10 FT ABOVE THE CURRENT POND PHREATIC SURFACE, AT ANY TIME.
B. ONCE THE PHREATIC SURFACE REACHES ITS LOWEST DESIGN LEVEL, IT SHALL BE MAINTAINED AT THAT ELEVATION BY REGULAR PUMPING.
C. INSTALLATION OF THE SYSTEM IN FUTURE AREAS OF EXCAVATION SHALL BE PERFORMED IN A TIMELY MANNER/SEQUENCE, SUCH THAT WHEN EXCAVATIONS BEGIN, THE PHREATIC SURFACE HAS BEEN LOWERED TO THE REQUIRED LEVEL AND ANY DOWN–TIME OR DELAYS FOR DEWATERING ARE KEPT TO A MINIMUM.

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9-21-21

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KEY PLAN

PROJECT NUMBER
60602575

SHEET TITLE
POSITIVE DEWATERING CONCEPT PLAN

SHEET NUMBER
C-12

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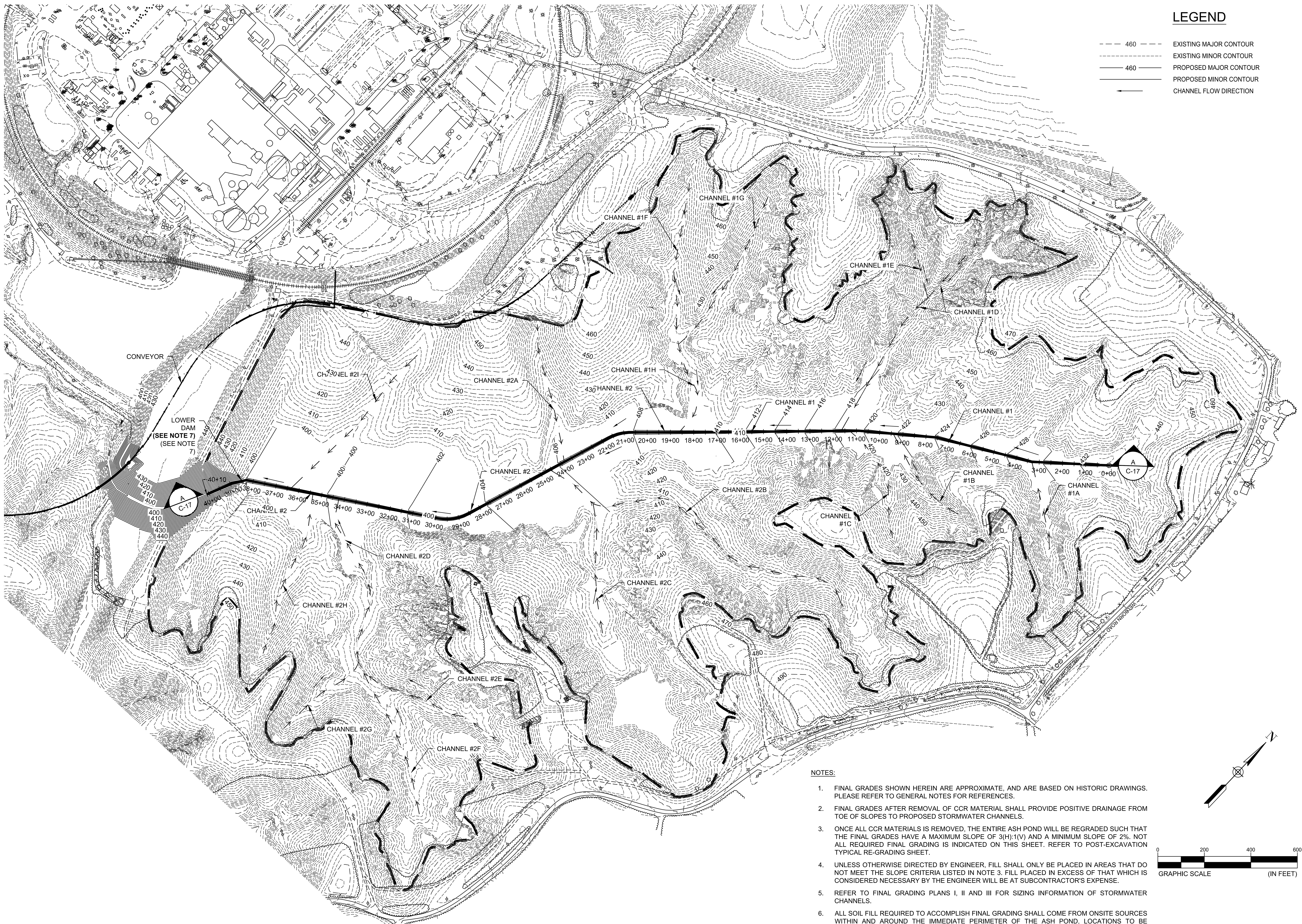

LEGEND

— — 460 — —	EXISTING MAJOR CONTOUR
- - - - -	EXISTING MINOR CONTOUR
—— 460 ——	PROPOSED MAJOR CONTOUR
————	PROPOSED MINOR CONTOUR
←	CHANNEL FLOW DIRECTION

NOTES:

1. FINAL GRADES SHOWN HEREIN ARE APPROXIMATE, AND ARE BASED ON HISTORIC DRAWINGS. PLEASE REFER TO GENERAL NOTES FOR REFERENCES.
2. FINAL GRADES AFTER REMOVAL OF CCR MATERIAL SHALL PROVIDE POSITIVE DRAINAGE FROM TOE OF SLOPES TO PROPOSED STORMWATER CHANNELS.
3. ONCE ALL CCR MATERIALS IS REMOVED, THE ENTIRE ASH POND WILL BE REGRADED SUCH THAT THE FINAL GRADES HAVE A MAXIMUM SLOPE OF 3(H):1(V) AND A MINIMUM SLOPE OF 2%. NOT ALL REQUIRED FINAL GRADING IS INDICATED ON THIS SHEET. REFER TO POST-EXCAVATION TYPICAL RE-GRADING SHEET.
4. UNLESS OTHERWISE DIRECTED BY ENGINEER, FILL SHALL ONLY BE PLACED IN AREAS THAT DO NOT MEET THE SLOPE CRITERIA LISTED IN NOTE 3. FILL PLACED IN EXCESS OF THAT WHICH IS CONSIDERED NECESSARY BY THE ENGINEER WILL BE AT SUBCONTRACTOR'S EXPENSE.
5. REFER TO FINAL GRADING PLANS I, II AND III FOR SIZING INFORMATION OF STORMWATER CHANNELS.
6. ALL SOIL FILL REQUIRED TO ACCOMPLISH FINAL GRADING SHALL COME FROM ONSITE SOURCES WITHIN AND AROUND THE IMMEDIATE PERIMETER OF THE ASH POND. LOCATIONS TO BE APPROVED BY OWNER.
7. A PERMIT IS REQUIRED FROM IDNR PRIOR TO MODIFICATION OF THE DAM. INITIATION OF THE PERMITTING/PLANNING PROCESS FOR DAM REMOVAL WILL BEGIN 3 YEARS PRIOR TO ANTICIPATED BREACHING OF THE LOWER DAM. PERMIT TO BE OBTAINED BY OWNER.

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KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

OVERALL FINAL GRADING PLAN

SHEET NUMBER

C-13

CHANNEL#	LENGTH (FT)	BOTTOM WIDTH B (FT)	MIN. DEPTH D (FT)	LONGTUDINAL SLOPE S	RIGHT SIDE SLOPE Z1	LEFT SIDE SLOPE Z2	CHANNEL LINING
1	1662	3	3	0.0138	2	2	GRASS
1A	385	0	3	0.0151	2	2	GRASS
1B	454	0	2	0.0358	2	2	GRASS
1C	520	0	3	0.0390	2	2	GRASS
1D	1024	0	3	0.0288	2	2	GRASS
1E	286	0	2	0.0011	2	2	GRASS

NOTES:

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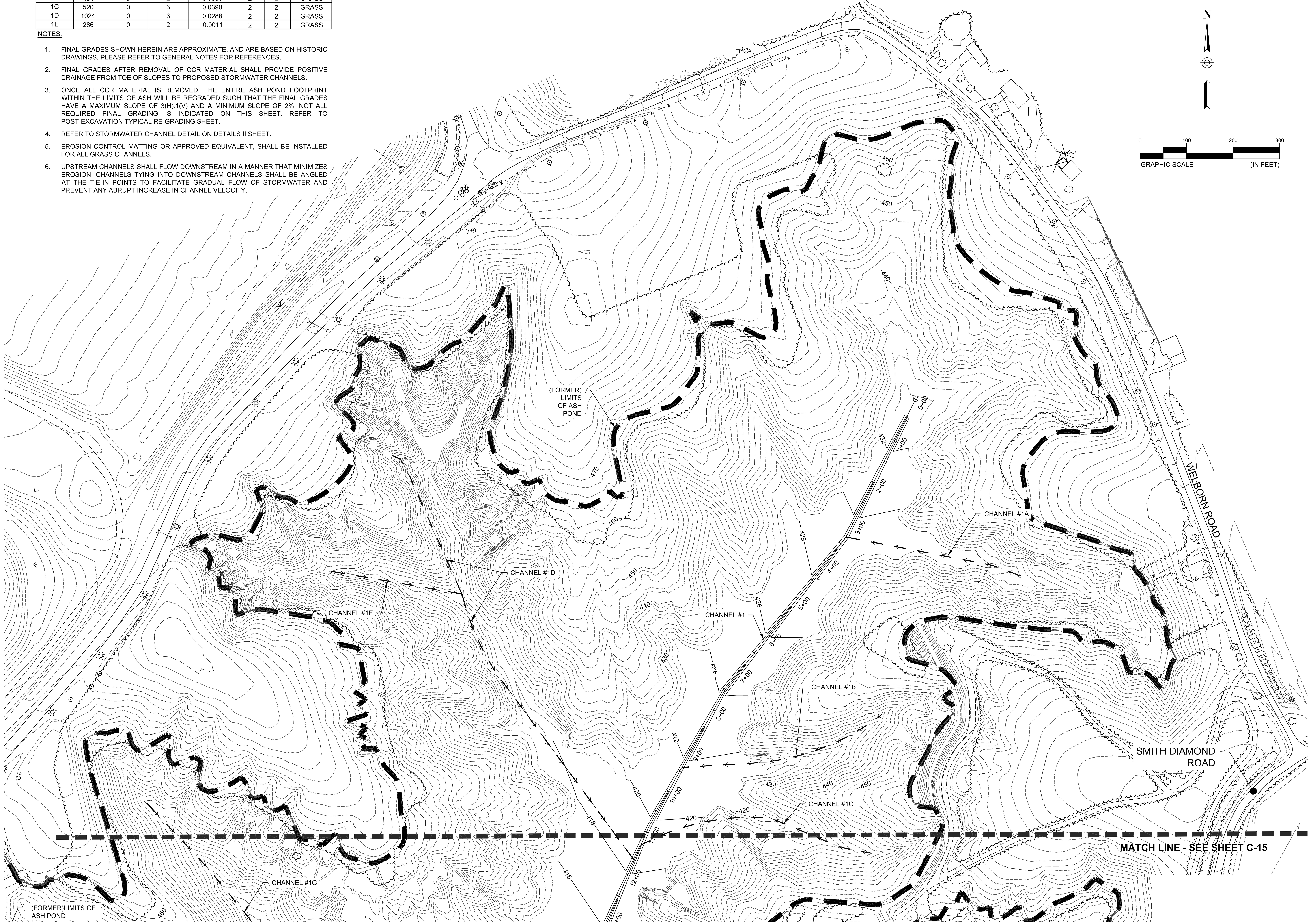
2. FINAL GRADES AFTER REMOVAL OF CCR MATERIAL SHALL PROVIDE POSITIVE DRAINAGE FROM TOE OF SLOPES TO PROPOSED STORMWATER CHANNELS.
3. ONCE ALL CCR MATERIAL IS REMOVED, THE ENTIRE ASH POND FOOTPRINT WITHIN THE LIMITS OF ASH WILL BE REGRADED SUCH THAT THE FINAL GRADES HAVE A MAXIMUM SLOPE OF 3(H):1(V) AND A MINIMUM SLOPE OF 2%. NOT ALL REQUIRED FINAL GRADING IS INDICATED ON THIS SHEET. REFER TO POST-EXCAVATION TYPICAL RE-GRADING SHEET.
4. REFER TO STORMWATER CHANNEL DETAIL ON DETAILS II SHEET.
5. EROSION CONTROL MATTING OR APPROVED EQUIVALENT, SHALL BE INSTALLED FOR ALL GRASS CHANNELS.
6. UPSTREAM CHANNELS SHALL FLOW DOWNSTREAM IN A MANNER THAT MINIMIZES EROSION. CHANNELS TYING INTO DOWNSTREAM CHANNELS SHALL BE ANGLED AT THE TIE-IN POINTS TO FACILITATE GRADUAL FLOW OF STORMWATER AND PREVENT ANY ABRUPT INCREASE IN CHANNEL VELOCITY.



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KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

FINAL GRADING PLAN I

SHEET NUMBER

C-14

CHANNEL #	LENGTH (FT)	BOTTOM WIDTH B (FT)	MIN DEPTH D (FT)	LONGTUDINAL SLOPE S	RIGHT SIDE SLOPE Z1	LEFT SIDE SLOPE Z2	CHANNEL LINING
1F	699	0	2	0.0255	2	2	GRASS
1G	749	0	2	0.0297	2	2	GRASS
1H	386	0	3	0.0291	2	2	GRASS
2	3049	6	3	0.0052	2	2	GRASS
2A	634	0	3	0.0345	2	2	GRASS
2B	1447	0	3	0.0195	2	2	GRASS
2C	558	0	2	0.0152	2	2	GRASS

NOTES:

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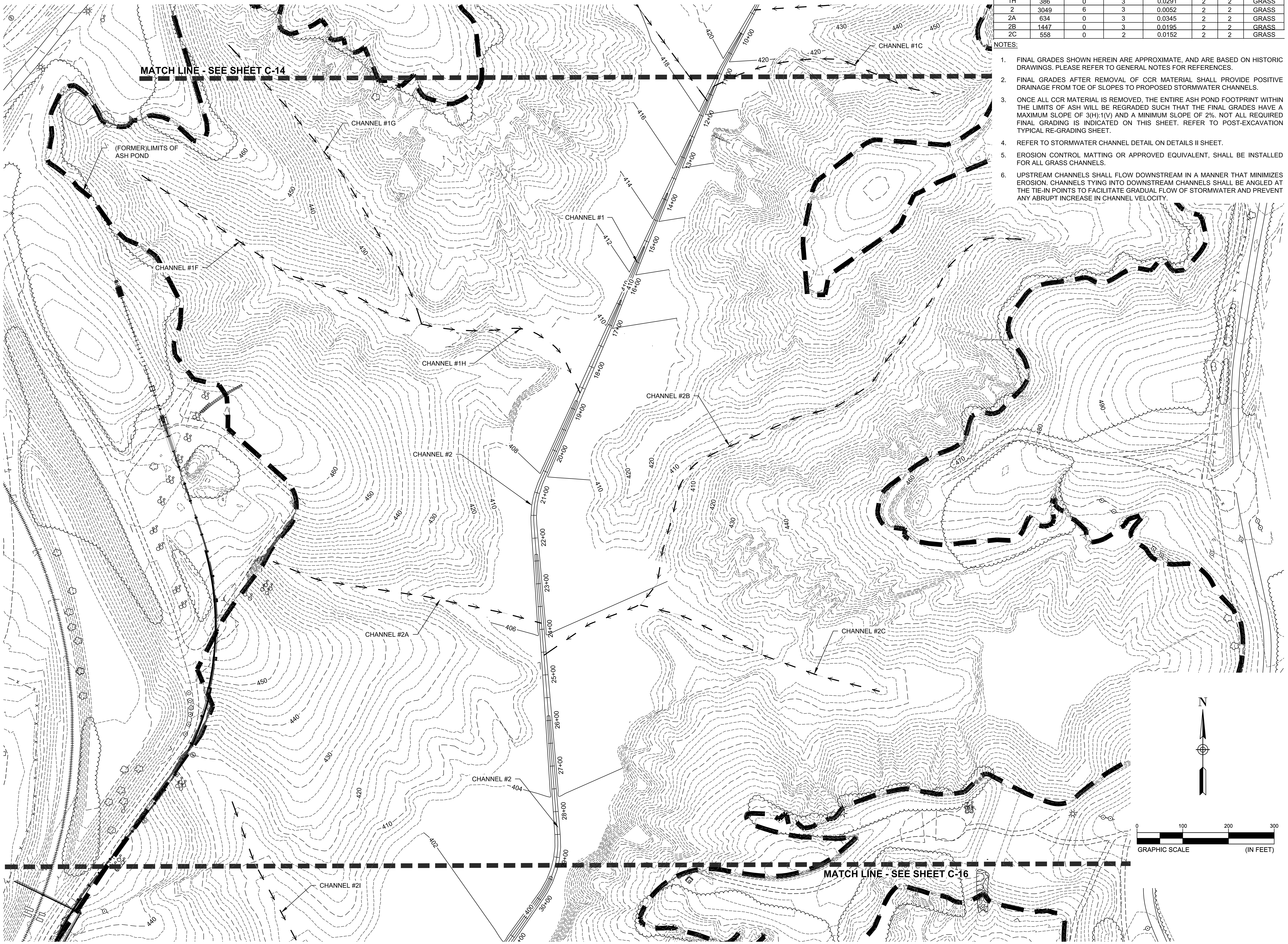
3. ONCE ALL CCR MATERIAL IS REMOVED, THE ENTIRE ASH POND FOOTPRINT WITHIN THE LIMITS OF ASH WILL BE REGRADED SUCH THAT THE FINAL GRADES HAVE A MAXIMUM SLOPE OF 3(H):1(V) AND A MINIMUM SLOPE OF 2%. NOT ALL REQUIRED FINAL GRADING IS INDICATED ON THIS SHEET. REFER TO POST-EXCAVATION TYPICAL RE-GRADING SHEET.
4. REFER TO STORMWATER CHANNEL DETAIL ON DETAILS II SHEET.
5. EROSION CONTROL MATTING OR APPROVED EQUIVALENT, SHALL BE INSTALLED FOR ALL GRASS CHANNELS.
6. UPSTREAM CHANNELS SHALL FLOW DOWNSTREAM IN A MANNER THAT MINIMIZES EROSION. CHANNELS TYING INTO DOWNSTREAM CHANNELS SHALL BE ANGLED AT THE TIE-IN POINTS TO FACILITATE GRADUAL FLOW OF STORMWATER AND PREVENT ANY ABRUPT INCREASE IN CHANNEL VELOCITY.



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KEY PLAN

PROJECT NUMBER

60602575

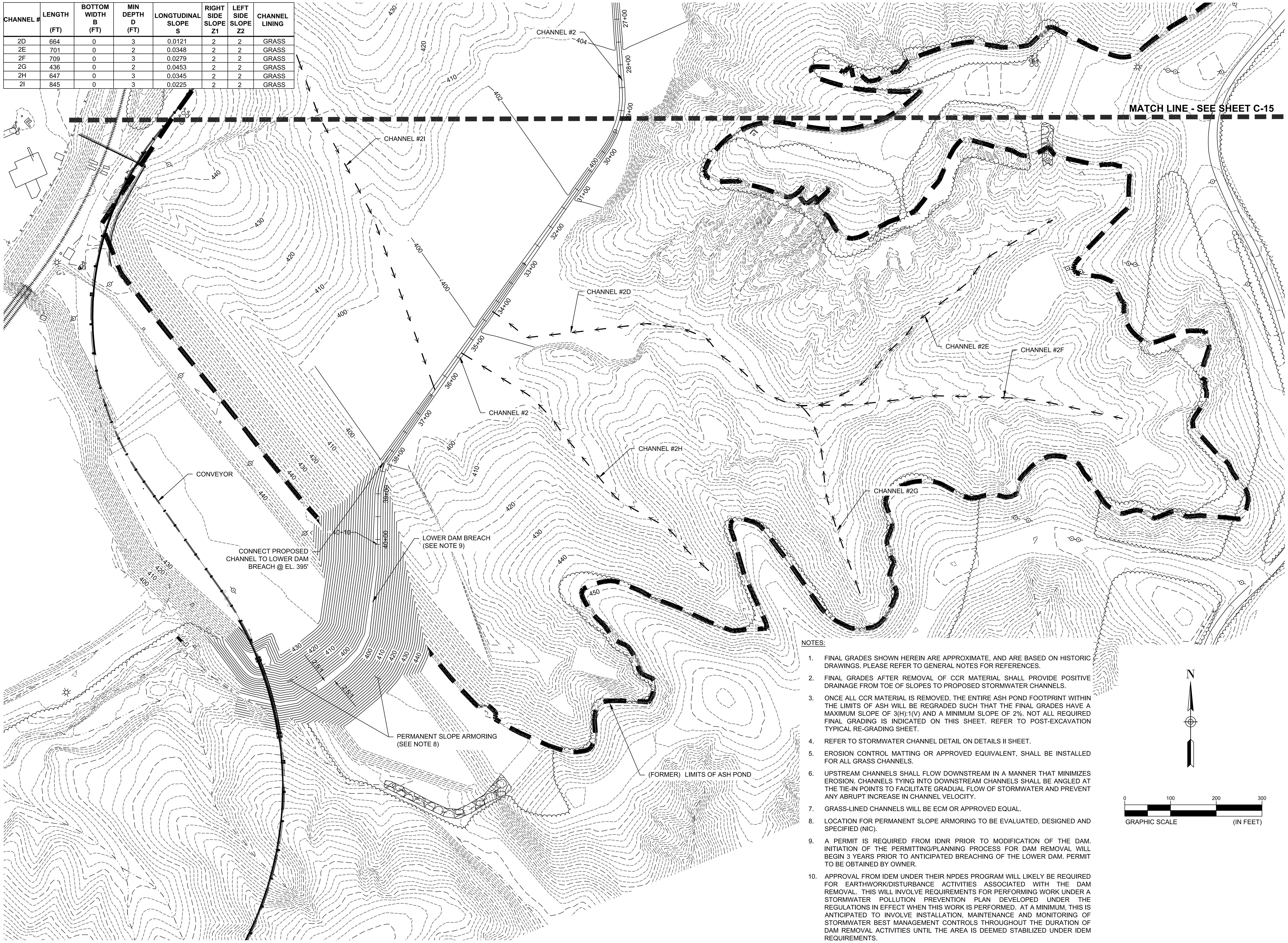
SHEET TITLE

FINAL GRADING PLAN II

SHEET NUMBER

C-15

CHANNEL #	LENGTH (FT)	BOTTOM WIDTH B (FT)	MIN DEPTH D (FT)	LONGTUDINAL SLOPE S	RIGHT SIDE SLOPE Z1	LEFT SIDE SLOPE Z2	CHANNEL LINING
2D	664	0	3	0.0121	2	2	GRASS
2E	701	0	2	0.0348	2	2	GRASS
2F	709	0	3	0.0279	2	2	GRASS
2G	436	0	2	0.0453	2	2	GRASS
2H	647	0	3	0.0345	2	2	GRASS
2I	845	0	3	0.0225	2	2	GRASS



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2. FINAL GRADES AFTER REMOVAL OF CCR MATERIAL SHALL PROVIDE POSITIVE DRAINAGE FROM TOE OF SLOPES TO PROPOSED STORMWATER CHANNELS.
3. ONCE ALL CCR MATERIAL IS REMOVED, THE ENTIRE ASH POND FOOTPRINT WITHIN THE LIMITS OF ASH WILL BE REGRADED SUCH THAT THE FINAL GRADES HAVE A MAXIMUM SLOPE OF 3(H):1(V) AND A MINIMUM SLOPE OF 2%. NOT ALL REQUIRED FINAL GRADING IS INDICATED ON THIS SHEET. REFER TO POST-EXCAVATION TYPICAL RE-GRADING SHEET.
4. REFER TO STORMWATER CHANNEL DETAIL ON DETAILS II SHEET.
5. EROSION CONTROL MATTING OR APPROVED EQUIVALENT, SHALL BE INSTALLED FOR ALL GRASS CHANNELS.
6. UPSTREAM CHANNELS SHALL FLOW DOWNSTREAM IN A MANNER THAT MINIMIZES EROSION. CHANNELS TYING INTO DOWNSTREAM CHANNELS SHALL BE ANGLED AT THE TIE-IN POINTS TO FACILITATE GRADUAL FLOW OF STORMWATER AND PREVENT ANY ABRUPT INCREASE IN CHANNEL VELOCITY.
7. GRASS-LINED CHANNELS WILL BE ECM OR APPROVED EQUAL.
8. LOCATION FOR PERMANENT SLOPE ARMORING TO BE EVALUATED, DESIGNED AND SPECIFIED (NIC).
9. A PERMIT IS REQUIRED FROM IDNR PRIOR TO MODIFICATION OF THE DAM. INITIATION OF THE PERMITTING/PLANNING PROCESS FOR DAM REMOVAL WILL BEGIN 3 YEARS PRIOR TO ANTICIPATED BREACHING OF THE LOWER DAM. PERMIT TO BE OBTAINED BY OWNER.
10. APPROVAL FROM IDEM UNDER THEIR NPDES PROGRAM WILL LIKELY BE REQUIRED FOR EARTHWORK/DISTURBANCE ACTIVITIES ASSOCIATED WITH THE DAM REMOVAL. THIS WILL INVOLVE REQUIREMENTS FOR PERFORMING WORK UNDER A STORMWATER POLLUTION PREVENTION PLAN DEVELOPED UNDER THE REGULATIONS IN EFFECT WHEN THIS WORK IS PERFORMED. AT A MINIMUM, THIS IS ANTICIPATED TO INVOLVE INSTALLATION, MAINTENANCE AND MONITORING OF STORMWATER BEST MANAGEMENT CONTROLS THROUGHOUT THE DURATION OF DAM REMOVAL ACTIVITIES UNTIL THE AREA IS DEEMED STABILIZED UNDER IDEM REQUIREMENTS.

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SHEET TITLE

FINAL GRADING PLAN III

SHEET NUMBER

C-16

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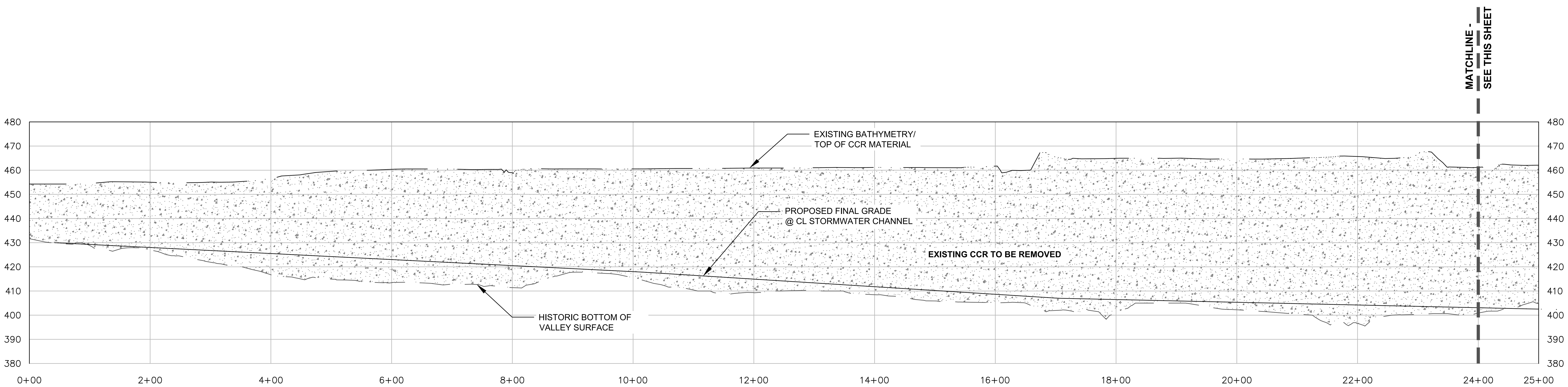
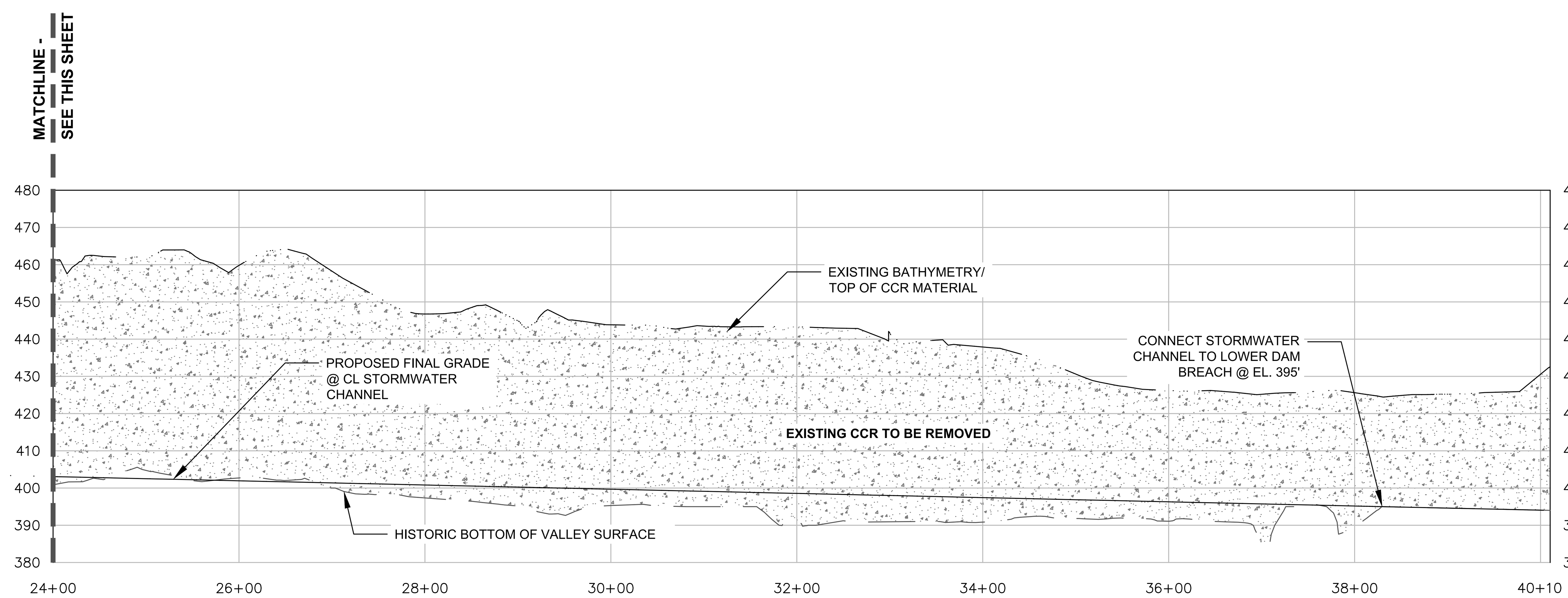


PROFILE A A C-17



PROFILE A (CONTINUED) A C-17

0 25 50 75
VERTICAL SCALE (IN FEET)

0 100 200 300
HORIZONTAL SCALE (IN FEET)

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9-21-21

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SHEET TITLE

PROFILES I

SHEET NUMBER

C-17

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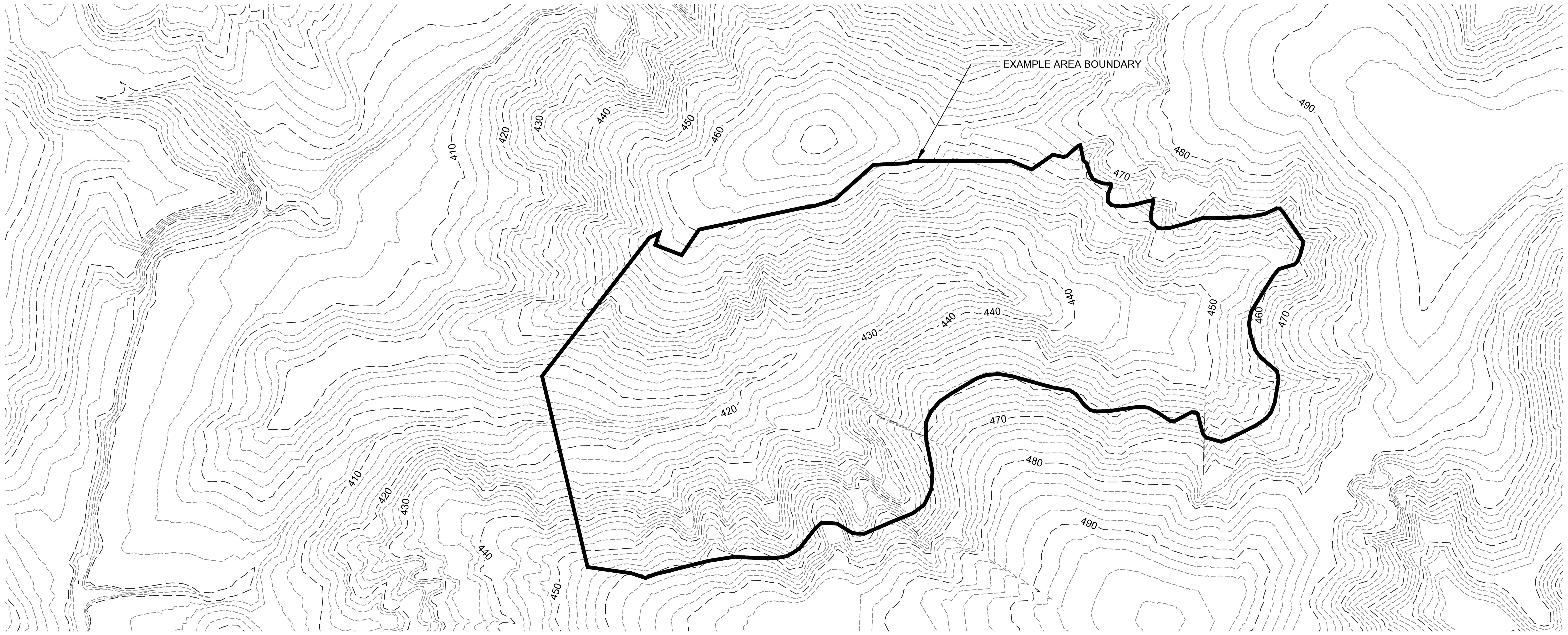
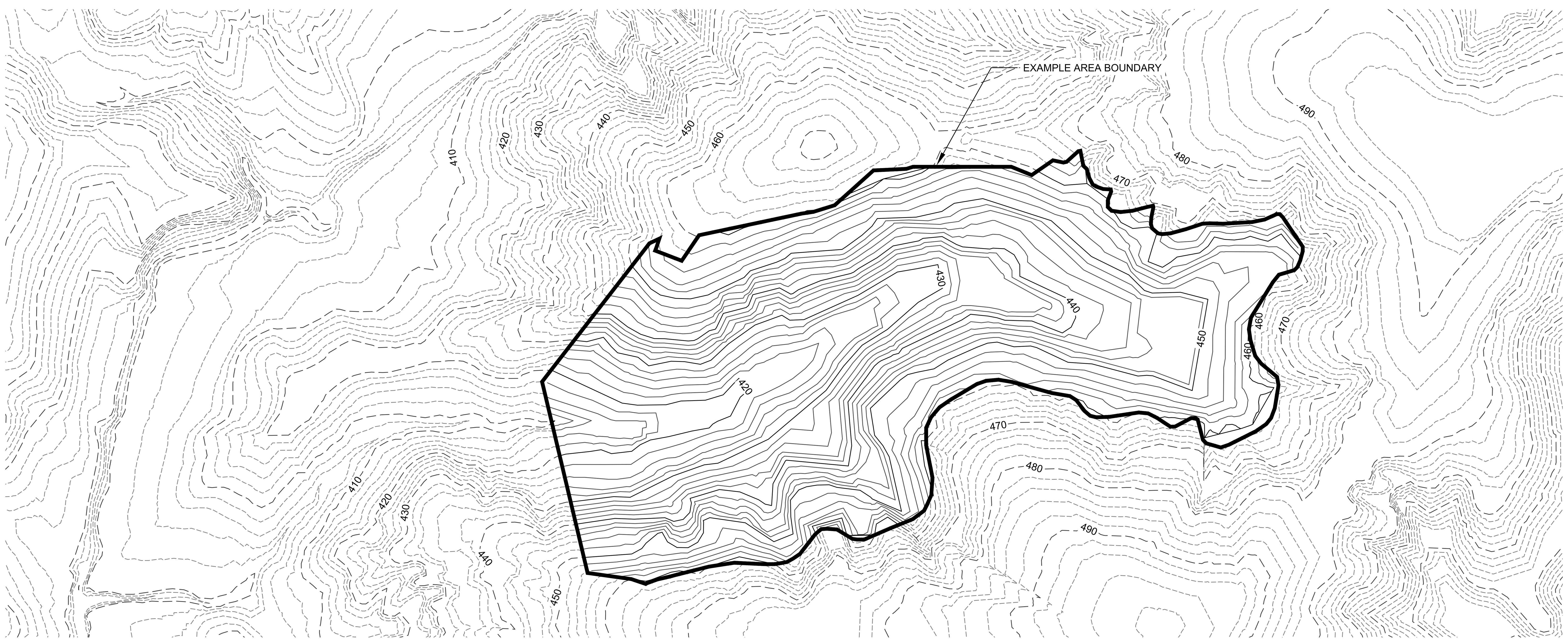


ANTICIPATED FINAL
EXCAVATION GRADES



POST-EXCAVATION
TYPICAL FINAL GRADING

NOTES

1. THE ANTICIPATED FINAL EXCAVATION GRADES SHOWN ON THIS SHEET ARE THE SAME AS THOSE SHOWN ON THE 'SITE PLAN AT 100% ASH REMOVAL" (SHEET C-008). THE EXAMPLE AREA SHOWN IS PROVIDED FOR REPRESENTATION ONLY AND IS INTENDED TO BE INDICATIVE OF MULTIPLE AREAS WITHIN THE ASH POND ONCE FINAL EXCAVATION GRADES HAVE BEEN ACCEPTED.

2. THE ANTICIPATED FINAL EXCAVATION GRADES SHOWN ARE BASED ON THE HISTORICAL DRAWINGS DATED 1973 THAT DEPICT THE ORIGINAL VALLEY PRIOR TO THE CONSTRUCTION OF THE ASH POND (BOTTOM OF CCR). SEE SHEET C-001 FOR DRAWING REFERENCES.

3. ONCE FINAL EXCAVATION IS COMPLETE, IT IS EXPECTED THAT THE EXCAVATION TOPOGRAPHY WILL APPROXIMATELY RESEMBLE THE HISTORICAL GRADES/ORIGINAL VALLEY SURFACE. THE EXACT FINAL GRADES AND ELEVATIONS WILL BE DEPENDENT ON THE ELEVATIONS AT WHICH THE EXCAVATION IS TERMINATED BASED ON THE ENGINEER'S WRITTEN APPROVAL OF THE FINAL EXCAVATION SURFACE.

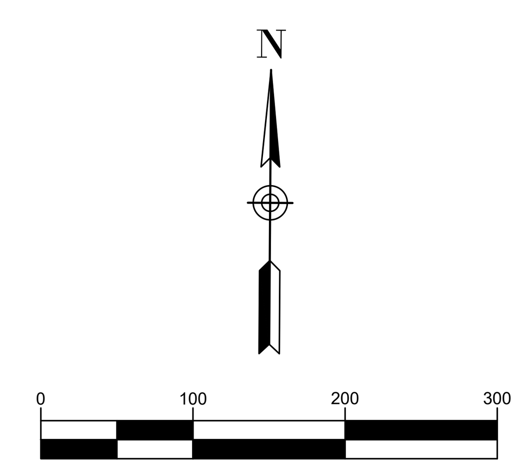
4. ONCE THE FINAL EXCAVATION SURFACE HAS BEEN APPROVED BY THE ENGINEER, EITHER IN PART OR WHOLE, THE SUBCONTRACTOR SHALL COMPLETE A MILESTONE SURVEY OF THE APPROVED AREA(S) AND SUBMIT IT TO THE ENGINEER FOR APPROVAL.

5. SUBCONTRACTOR SHALL REGRADE THE APPROVED FINAL EXCAVATION SURFACE USING CUT-TO-FILL METHODS TO PROVIDE UNIFORM GRADES THAT GENTLY SLOPE INTO THE CENTER OF THE VALLEY AND PROPOSED NETWORK OF STORMWATER DITCHES AT SLOPES NO GREATER THAN 3:1 (H:V) AND NO LESS THAN 2 PERCENT UNLESS OTHERWISE DIRECTED BY ENGINEER.

6. FILL MATERIAL CUT FROM ONSITE SOURCES WITHIN AND AROUND THE IMMEDIATE PERIMETER OF THE ASH POND WILL BE COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS AND KEYED-INTO THE FINAL EXCAVATION GRADES TO PREVENT UNEVEN SETTLING AND/OR SLOPE INSTABILITY. THE REGRADED SURFACE, UPON APPROVAL BY THE ENGINEER, IS REFERRED TO HEREIN AS "POST-EXCAVATION" GRADES.

7. TO ACHIEVE THE POST-EXCAVATION GRADES, SIMILAR TO THOSE ILLUSTRATED WITHIN THE EXAMPLE AREA SHOWN ON THIS SHEEET, SUBCONTRACTOR SHALL MINIMIZE THE QUANTITY OF FILL UTILIZED. SUBCONTRACTOR SHALL ONLY UTILIZE FILL IN AREAS THAT HAVE SLOPES GREATER THAN 3:1 (H:V) OR LESS THAN 2 PERCENT UNLESS A MINIMUM DEPTH OF FILL IS MANDATED IN CERTAIN AREAS BY THE ENGINEER. AT A MINIMUM, ANY IRREGULARITIES IN THE FORM OF DEPRESSIONS, RUTS, RILLS OR MOUNDS OBSERVED IN THE FINAL EXCAVATION GRADES SHALL BE REGRADED TO PROVIDE POSITIVE DRAINAGE TOWARDS THE NETWORK OF STORMWATER DITCHES SHOWN IN THE FINAL GRADING PLAN SHEETS.

8. ONCE UNIFORM POST-EXCAVATION GRADES HAVE BEEN APPROVED BY THE ENGINEER, SUBCONTRACTOR SHALL PLACE A MINIMUM 3 INCH TOPSOIL LAYER ACROSS THE APPROVED POST-EXCAVATION AREA(S) AND ESTABLISH VEGETATIVE COVER TO RESTORE THE HISTORICAL VALLEY. REFER TO DETAILS II SHEET FOR THE FINAL RESTORATION SURFACE DETAIL.



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PROJECT

Ash Pond
Closure-by-Removal
IFC DESIGN DRAWINGS

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REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

PROJECT NUMBER

60602575

SHEET TITLE

POST-EXCAVATION
TYPICAL REGRADING

SHEET NUMBER

C-18

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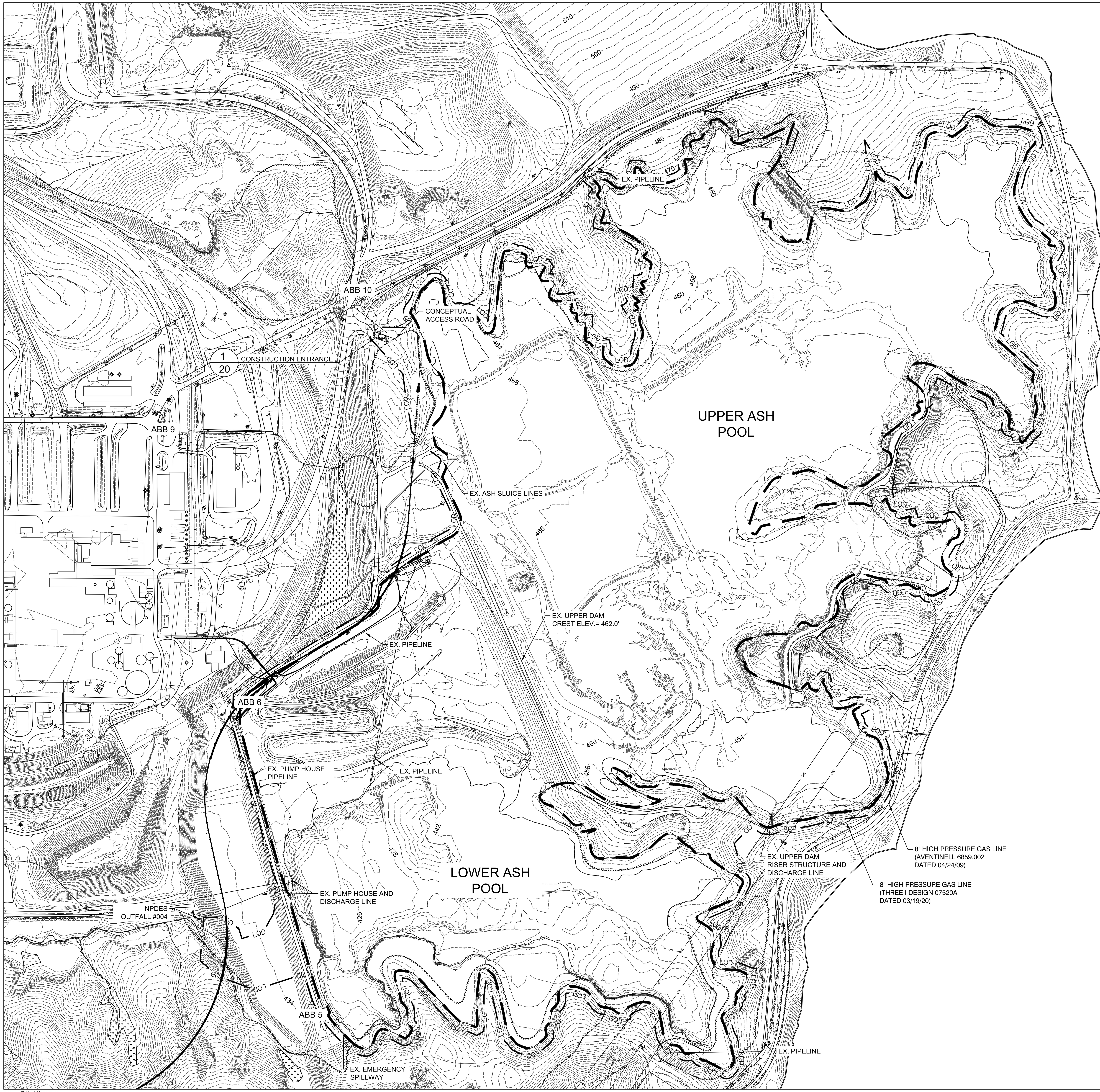

LEGEND

(dashed heavy line)	ASH POND WASTE BOUNDARY (APPROX.)
— LOD —	LIMITS OF DISTURBANCE
(hatched box)	CONSTRUCTION ENTRANCE LOCATION

NOTES

1. SURFACE DRAINAGE FROM WORK ACTIVITIES SHALL BE MANAGED USING EFFECTIVE EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (E&S BMPs) OR THE WORK AREAS SHALL BE GRADED TO CONTROL EROSION WITHIN ACCEPTABLE LIMITS IN ACCORDANCE WITH THE INDIANA STORMWATER QUALITY MANUAL, LATEST EDITION. THESE E&S BMPs MAY INCLUDE SILT FENCE, COMPOST FILTER SOCK, CHECK DAMS, SUMP PITS, SEDIMENT BAGS, ROCK CONSTRUCTION ENTRANCES, ETC. E&S BMPs SHALL BE MAINTAINED UNTIL ALL WORK HAS BEEN COMPLETED AND PERMANENT VEGETATION IS ESTABLISHED. REFER TO THE EROSION AND SEDIMENT CONTROL DETAILS PROVIDED ON DETAILS SHEET I AND II.
2. SUBCONTRACTOR SHALL INSTALL APPROPRIATE E&S BMPs TO THE SATISFACTION OF THE ENGINEER IN ADVANCE OF DISTURBING ANY AREAS WHERE THERE IS POTENTIAL THAT SEDIMENT-LADEN WATER MAY BE DISCHARGED OUTSIDE THE LIMITS OF THE ASH POND.

REFERENCES

1. SEE SHEET C-001 (SECTION 3: SURVEY CONTROL AND EXISTING TOPOGRAPHIC SITE INFORMATION) FOR DRAWING REFERENCES.

N

0 200 400 600
GRAPHIC SCALE (IN FEET)

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No. 11400808
STATE OF INDIANA
PROFESSIONAL ENGINEER
9-21-21

ISSUE/REVISION

I/R	DATE	DESCRIPTION
0	2021-09-21	Issue for Construction

KEY PLAN

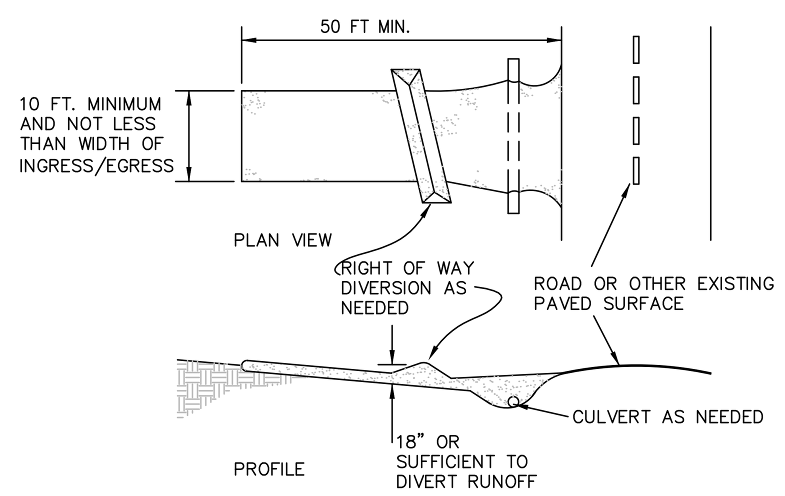
PROJECT NUMBER
60602575

SHEET TITLE
EROSION AND SEDIMENT CONTROL PLAN

SHEET NUMBER
C-19

Project Management Initials: Designer: Checked: Approved: ARCH D 24" x 36"

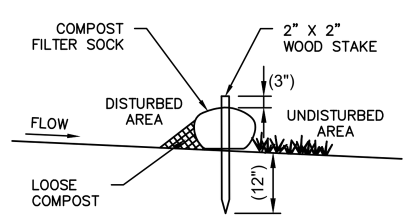
Last saved by: WADSON.PHANORD(2021-09-22) Last Plotted: 2021-09-22
Filename: C:\USERS\WADSON.PHANORD\DESKTOP\ABB IFC\20-SHEETS\19-E&S CONTROL PLAN.DWG



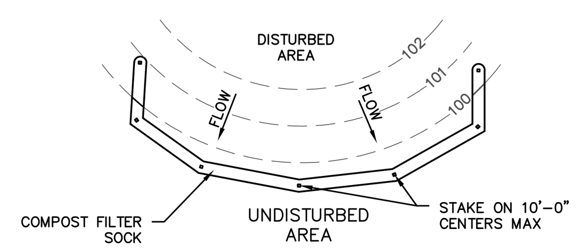
SPECIFICATIONS FOR CONSTRUCTION ENTRANCE

1. A CONSTRUCTION ENTRANCE IS A STABILIZED PAD OF AGGREGATE OVER A GEOTEXTILE BASE AND IS USED TO REDUCE THE AMOUNT OF MUD TRACKED OFF-SITE WITH CONSTRUCTION TRAFFIC.
2. STONE SIZE – TWO-INCH WASHED STONE MUST BE USED, OR RECYCLED CONCRETE EQUIVALENT.
3. LENGTH – THE CONSTRUCTION ENTRANCE MUST BE AS LONG AS REQUIRED TO STABILIZE HIGH TRAFFIC AREAS BUT NOT LESS THAN 50 FEET.
4. THICKNESS – THE STONE LAYER MUST BE AT LEAST 6 INCHES THICK.
5. WIDTH – THE ENTRANCE MUST BE AT LEAST 10 FEET WIDE, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
6. BEDDING – A NON-WOVEN 10 OZ. GEOTEXTILE MUST BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE. IT MUST HAVE A GRAB TENSILE STRENGTH OF AT LEAST 200 LB. AND A MULLEN BURST STRENGTH OF AT LEAST 190 LB.
7. CULVERT – A PIPE OR CULVERT MUST BE CONSTRUCTED UNDER THE ENTRANCE IF NEEDED TO PREVENT SURFACE WATER FLOWING ACROSS THE ENTRANCE FROM BEING DIRECTED OUT ONTO PAVED SURFACES.
8. WATER BAR – A WATER BAR MUST BE CONSTRUCTED AS PART OF THE CONSTRUCTION ENTRANCE IF NEEDED TO PREVENT SURFACE RUNOFF FROM FLOWING THE LENGTH OF THE CONSTRUCTION ENTRANCE AND OUT ONTO PAVED SURFACES.
9. MAINTENANCE – TOP DRESSING OF ADDITIONAL STONE MUST BE APPLIED AS CONDITIONS DEMAND. MUD SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC ROADS, OR ANY SURFACE WHERE RUNOFF IS NOT CHECKED BY SEDIMENT CONTROLS, MUST BE REMOVED IMMEDIATELY. REMOVAL MUST BE ACCOMPLISHED BY SCRAPING OR SWEEPING.
10. CONSTRUCTION ENTRANCES MUST NOT BE RELIED UPON TO REMOVE MUD FROM VEHICLES AND PREVENT OFF-SITE TRACKING. VEHICLES THAT ENTER AND LEAVE THE CONSTRUCTION SITE MUST BE RESTRICTED FROM MUDDY AREAS.
11. AT A MINIMUM, TEMPORARY CONSTRUCTION ENTRANCES MUST BE INSTALLED AT EACH CONSTRUCTION TRAFFIC ENTRANCE/EXIT TO A PUBLIC ROAD. THE LOCATIONS OF CONSTRUCTION ENTRANCES MUST BE COORDINATED WITH THE OWNER.
12. CONTRACTOR TO WASH OFF WHEELS IN GRAVEL CONSTRUCTION ENTRANCE PRIOR TO ENTERING LOCAL STREETS. IF MUD ACCUMULATES IN STREETS, THEN THE CONTRACTOR MUST BE RESPONSIBLE TO CLEAN STREETS AS REQUESTED.
13. ROCK CONSTRUCTION ENTRANCE SHALL BE INSTALLED ONLY AS NECESSARY OR AS DIRECTED BY THE ENGINEER.

01/20 ROCK CONSTRUCTION ENTRANCE
N.T.S.



SECTION VIEW



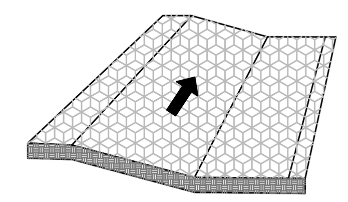
PLAN VIEW

NOTES:

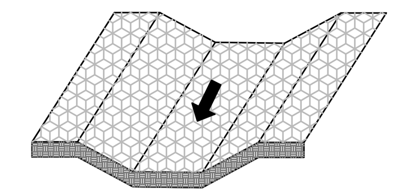
1. COMPOST FILTER SOCK SHALL BE PLACED AT EXISTING LEVEL GRADE. BOTH ENDS OF THE SOCK SHALL BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN SOCK ALIGNMENT (SEE ABOVE).
2. TRAFFIC SHALL NOT BE PERMITTED TO CROSS FILTER SOCKS.
3. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT REACHES ½ THE ABOVE GROUND HEIGHT OF THE SOCK AND DISPOSED IN THE MANNER DESCRIBED ELSEWHERE IN THE PLAN.
4. SOCKS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT. DAMAGED SOCKS SHALL BE REPAIRED ACCORDING TO MANUFACTURER'S SPECIFICATIONS OR REPLACED WITHIN 24 HOURS OF INSPECTION.
5. BIODEGRADABLE FILTER SOCK SHALL BE REPLACED AFTER 6 MONTHS; PHOTODEGRADABLE SOCKS AFTER 1 YEAR. POLYPROPYLENE SOCKS SHALL BE REPLACED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
6. UPON STABILIZATION OF THE AREA TRIBUTARY TO THE SOCK, STAKES SHALL BE REMOVED. THE SOCK MAY BE LEFT IN PLACE AND VEGETATED OR REMOVED. IN THE LATTER CASE, THE MESH SHALL BE CUT OPEN AND THE MULCH SPREAD AS A SOIL SUPPLEMENT.

02/20 COMPOST FILTER SOCK DETAIL (TYP.)
N.T.S.

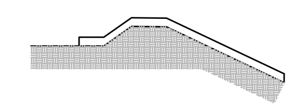
EROSION CONTROL BLANKET - ORIENTATION
N.T.S



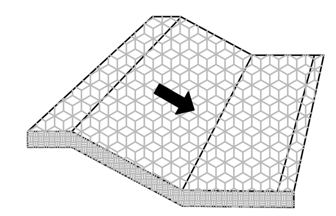
SLOPES FLATTER THAN 1H:1V
ON SHALLOW SLOPES STRIPS OF BLANKET/MAT MAY BE APPLIED ACROSS THE SLOPE.



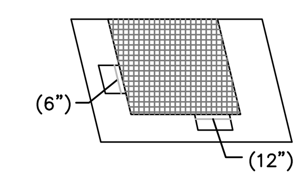
SWALE/DITCH
IN SWALES, APPLY BLANKET/MAT PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS EVERY 15 ft. DO NOT JOIN STRIPS IN THE CENTER OF THE DITCH.



WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE BLANKET/MAT OVER THE BERM AND ANCHOR IT BEHIND THE BERM.

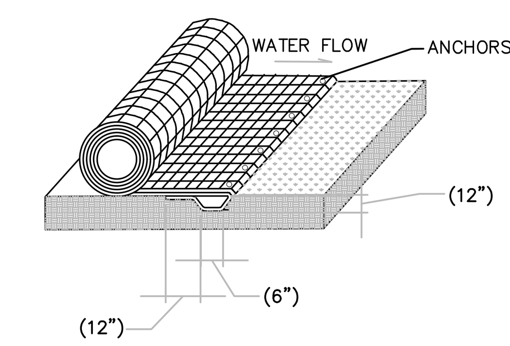


SLOPES STEEPER THAN 1H:1V
ON STEEP SLOPES, APPLY STRIPS IF BLANKET/MAT PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

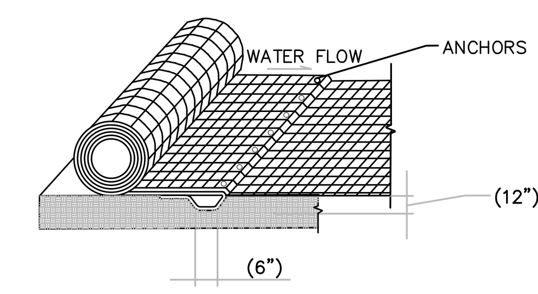


BRING THE BLANKET/MAT TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 16" AND STAPLE AT 12" INTERVALS.

EROSION CONTROL BLANKET - ANCHOR SLOT
N.T.S

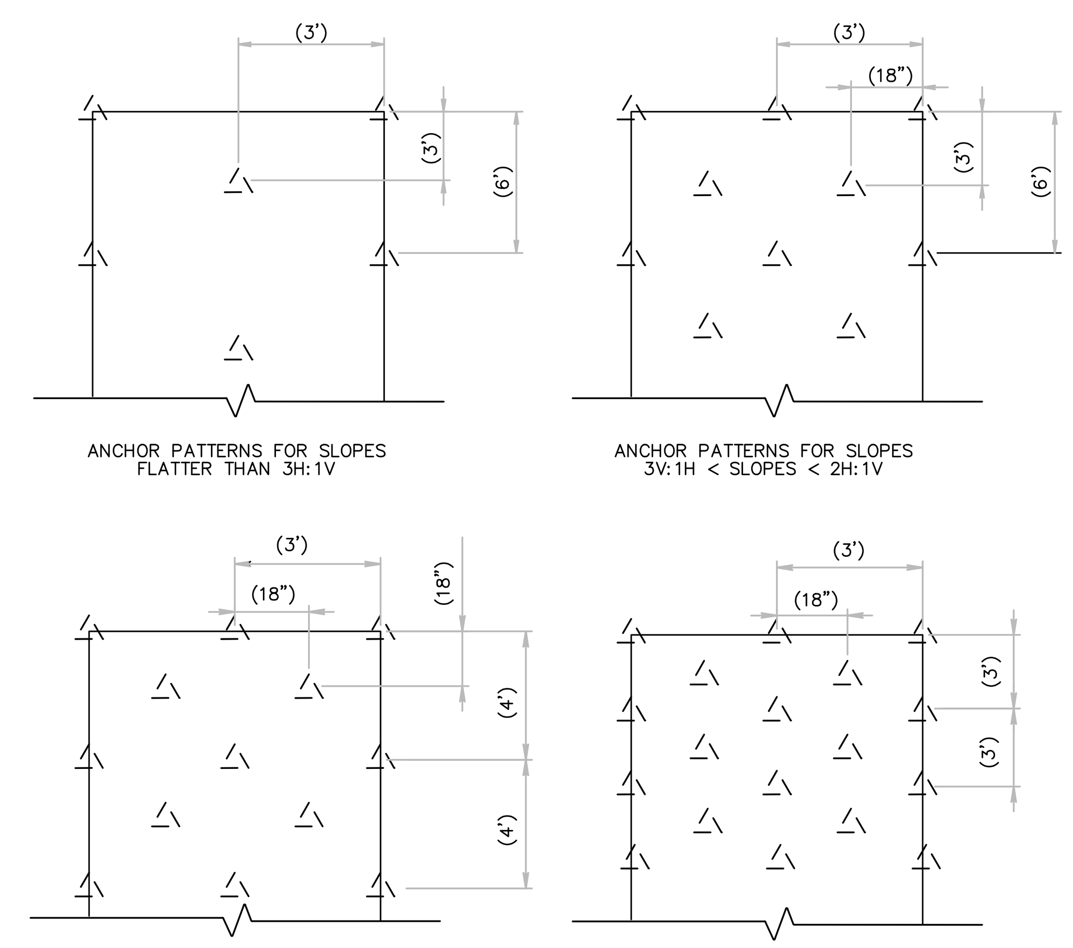


EROSION CONTROL BLANKET - CHECK SLOT
N.T.S.



EROSION CONTROL MATTING / BLANKET NOTES

1. USE INDOT APPROVED ROLLED EROSION CONTROL PRODUCTS ONLY. THIS DETAIL PROVIDES GENERAL GUIDELINES REGARDING INSTALLATION AND ANCHORING OF EROSION CONTROL BLANKET. INSTALLATION AND ANCHORING OF THE EROSION CONTROL BLANKET SHALL BE COMPLETED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. SEED AND SOIL AMENDMENTS SHALL BE APPLIED ACCORDING TO THE RATES IN THE PLAN DRAWINGS PRIOR TO INSTALLING THE BLANKET.
3. PROVIDE ANCHOR TRENCH AT TOE OF SLOPE IN SIMILAR FASHION AS AT TOP OF SLOPE.
4. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS.
5. BLANKET SHALL HAVE GOOD CONTINUOUS CONTACT WITH UNDERLYING SOIL THROUGHOUT ENTIRE LENGTH. LAY BLANKET LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH SOIL. DO NOT STRETCH BLANKET.
6. STAPLING OF THE BLANKET SHALL BE DONE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. WOOD OR DEGRADABLE PLASTIC STAPLES ARE PREFERRED OVER WIRE.
7. BLANKETED AREAS SHALL BE INSPECTED WEEKLY AND AFTER EACH RUNOFF EVENT UNTIL PERENNIAL VEGETATION IS ESTABLISHED TO A MINIMUM UNIFORM 90% COVERAGE THROUGHOUT THE BLANKETED AREA. DAMAGED OR DISPLACED BLANKETS SHALL BE RESTORED OR REPLACED WITHIN 5 CALENDAR DAYS.
8. EROSION CONTROL MATTING SHALL BE INSTALLED ON ALL FINAL SURFACES WITH SLOPES 3H:1V OR STEEPER.



03/20 EROSION CONTROL MATTING/BLANKET – ANCHOR PATTERN
N.T.S.

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REGISTERED
No. 11400808
STATE OF INDIANA
PROFESSIONAL ENGINEER
9-21-21

ISSUE/REVISION

I/R	DATE	DESCRIPTION
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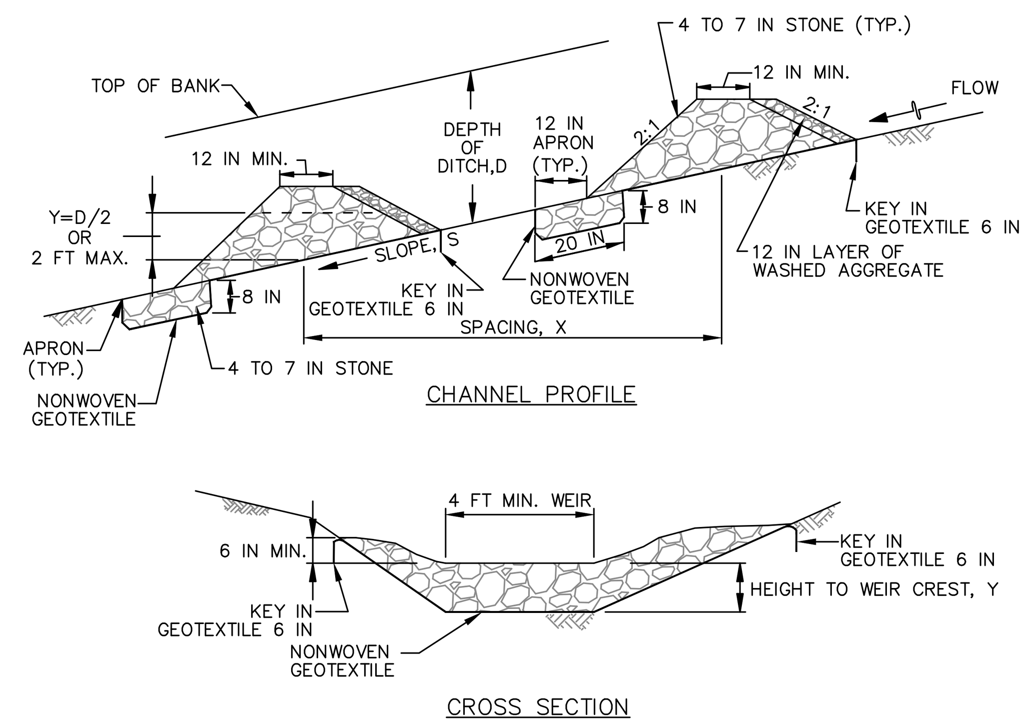
KEY PLAN

PROJECT NUMBER
60602575

SHEET TITLE
DETAILS I

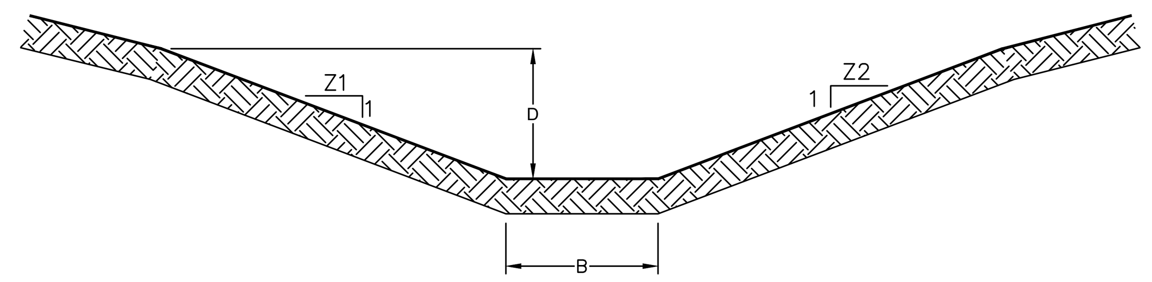
SHEET NUMBER
C-20



CONSTRUCTION SPECIFICATIONS

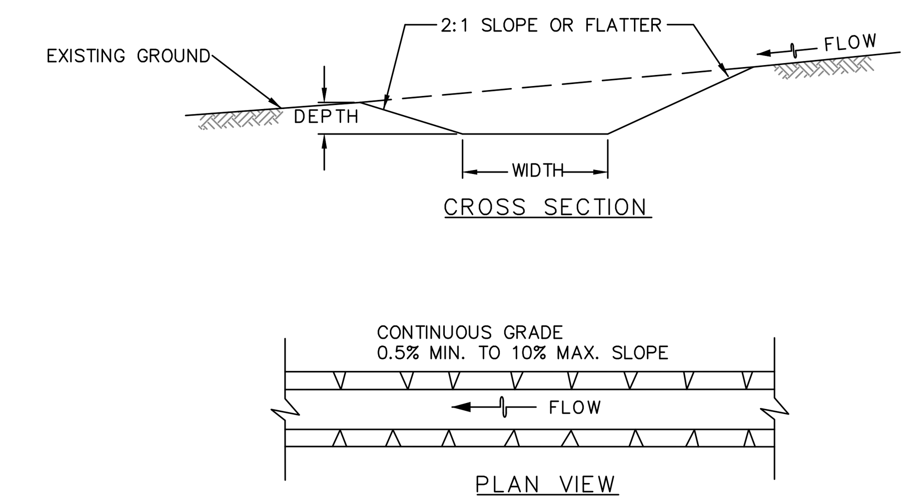
1. PREPARE SWALES AS SPECIFIED ON THE PLAN DRAWINGS.
2. PLACE NONWOVEN GEOTEXTILE UNDER THE BOTTOM AND SIDES OF THE CHECK DAM PRIOR TO PLACEMENT OF STONE. CONSTRUCT THE CHECK DAM WITH WASHED 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) WITH SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM TOP WIDTH OF 12 INCHES. PLACE THE STONE SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL AND CHANNEL BANKS. FORM THE WEIR SO THAT TOP OF THE OUTLET CREST IS APPROXIMATELY 6 INCHES LOWER THAN THE OUTER EDGES. LINE THE UPSTREAM FACE OF THE CHECK DAM WITH A 1 FOOT THICK LAYER OF WASHED AGGREGATE (¾ TO 1 ½ INCH).
3. SET THE HEIGHT FOR THE WEIR CREST EQUAL TO ONE-HALF THE DEPTH OF THE CHANNEL OR DITCH. TO AVOID SCOUR THE MAXIMUM HEIGHT OF THE WEIR CREST MUST NOT EXCEED 2.0 FEET.
4. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE-HALF OF THE HEIGHT OF THE WEIR CREST. MAINTAIN LINE, GRADE, AND CROSS SECTION.
5. ROCK CHECK DAMS SHALL BE INSTALLED ONLY AS NECESSARY OR AS DIRECTED BY THE ENGINEER..

04 / 21 ROCK CHECK DAM
N.T.S.



NOTES

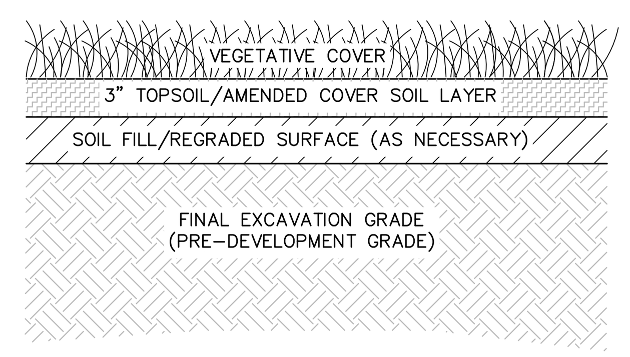
1. THE LINING TYPES OF THE STORMWATER CHANNELS ARE SHOWING IN THE SUMMARY TABLES ON THE FINAL GRADING PLANS I, II AND III PROVIDED ON SHEETS C-14 THROUGH C-16.



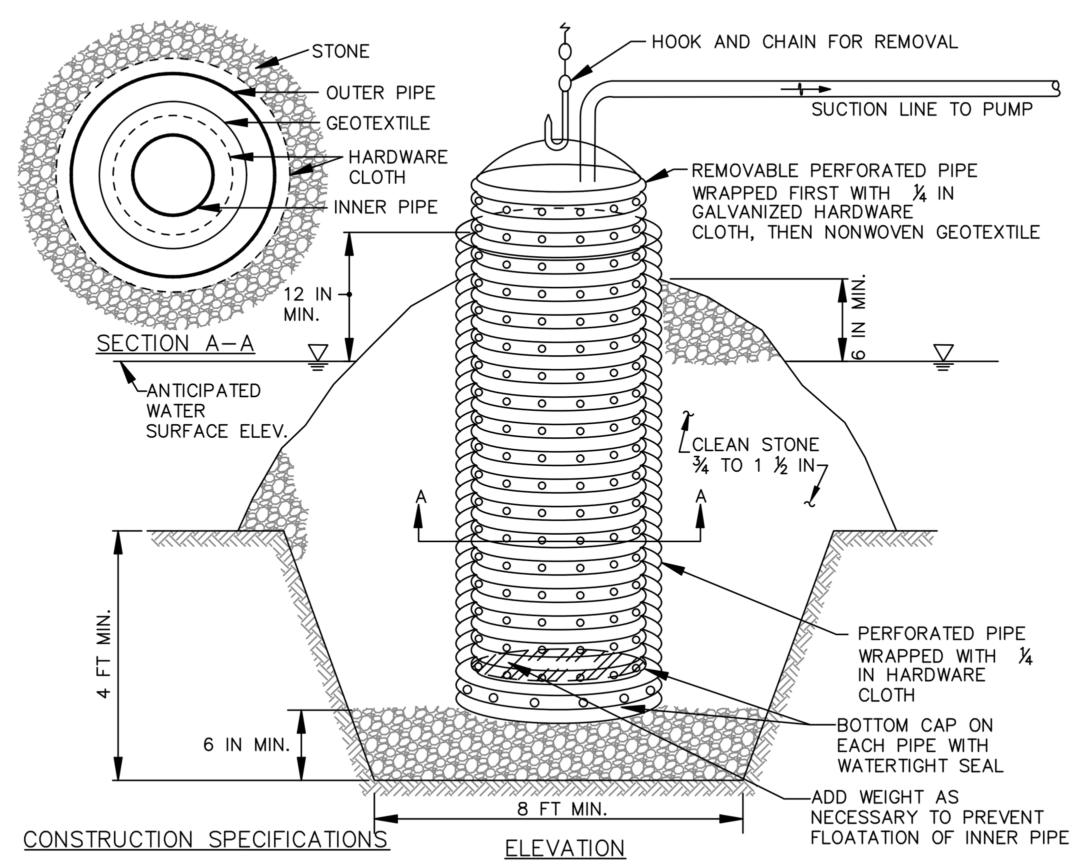
CONSTRUCTION SPECIFICATIONS

1. REMOVE AND DISPOSE OF ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SO AS NOT TO INTERFERE WITH PROPER FUNCTION OF THE CHANNEL.
2. EXCAVATE OR SHAPE THE CHANNEL TO LINE, GRADE, AND CROSS SECTION AS SPECIFIED. BANK PROJECTIONS OR OTHER IRREGULARITIES ARE NOT ALLOWED.
3. STABILIZE THE CHANNEL WITHIN 24 HOURS OF INSTALLATION WITH SEEDING AND EROSION CONTROL MATTING, OR WITH THE SPECIFIED RIPRAP MATERIAL.
4. CONSTRUCT FLOW CHANNEL ON AN UNINTERRUPTED, CONTINUOUS GRADE, ADJUSTING THE LOCATION DUE TO FIELD CONDITIONS AS NECESSARY TO MAINTAIN POSITIVE DRAINAGE.
5. PROVIDE OUTLET PROTECTION AS REQUIRED ON APPROVED PLAN.
6. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS, AND MAINTAIN POSITIVE DRAINAGE. KEEP THE CHANNEL AND POINT OF DISCHARGE FREE OF EROSION, AND CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT.

05 / 21 STORMWATER CHANNEL
N.T.S.



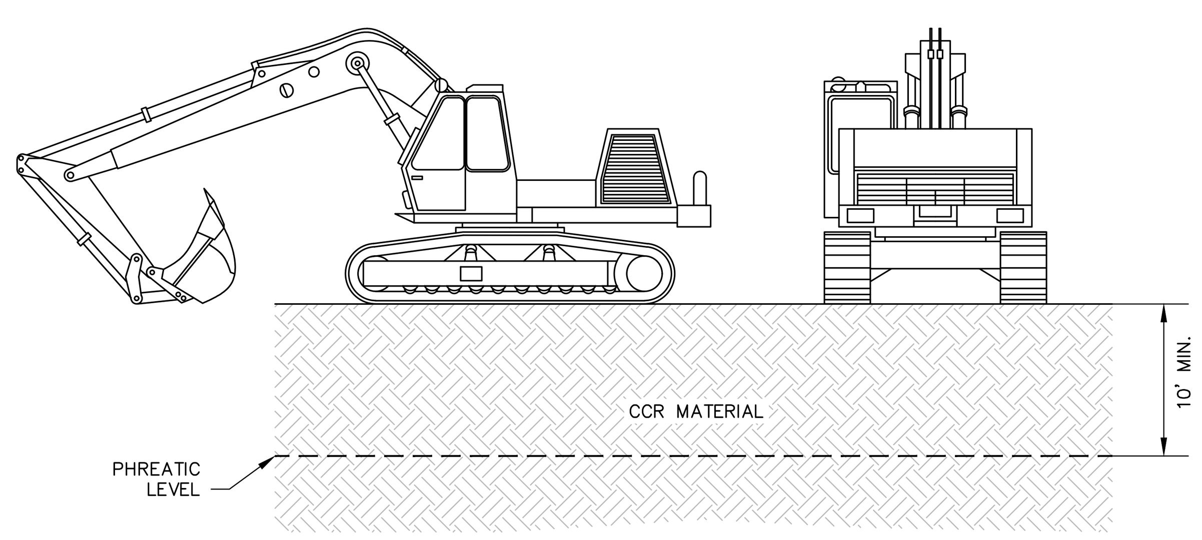
07 / 21 FINAL RESTORATION SURFACE DETAIL
N.T.S.



CONSTRUCTION SPECIFICATIONS

1. USE CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS 6 INCHES ON CENTER.
2. USE A MINIMUM 12 INCH DIAMETER INNER PIPE WITH AN OUTER PIPE A MINIMUM 6 INCHES LARGER IN DIAMETER. BOTTOM OF EACH PIPE MUST BE CAPPED WITH WATERTIGHT SEAL.
3. WRAP EACH PIPE WITH ¼ INCH GALVANIZED HARDWARE CLOTH. ON INNER PIPE WRAP NONWOVEN GEOTEXTILE OVER THE HARDWARE CLOTH.
4. EXCAVATE 8 FEET X 8 FEET X 4 FEET DEEP PIT FOR PIPE PLACEMENT. PLACE CLEAN ¾ TO 1 ½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE, 6 INCHES IN DEPTH PRIOR TO PIPE PLACEMENT.
5. SET TOP OF INNER AND OUTER PIPES MINIMUM 12 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION (OR RISER CREST ELEVATION WHEN DEWATERING A BASIN).
6. BACKFILL PIT AROUND THE OUTER PIPE WITH ¾ TO 1 ½ INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE AND EXTEND STONE A MINIMUM OF 6 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
7. DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A REMOVABLE PUMPING STATION REQUIRES FREQUENT MAINTENANCE. IF SYSTEM CLOGS, PULL OUT INNER PIPE AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

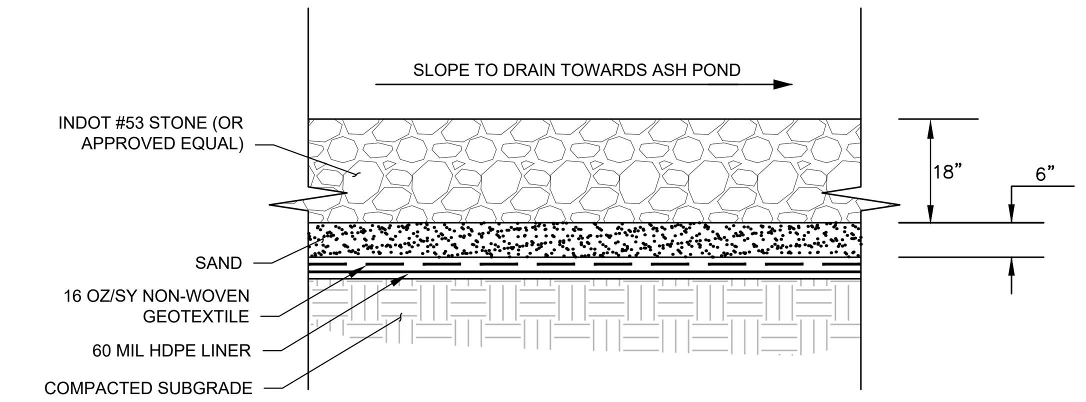
06 / 21 SUMP PIT
N.T.S.



CONSTRUCTION SPECIFICATIONS

1. CONTRACTOR TO CONTINUOUSLY MONITOR THE PHREATIC SURFACE DURING CONSTRUCTION. PHREATIC SURFACE MUST BE MAINTAINED AT LEAST 10 FEET BELOW THE WORKING SURFACE DURING CCR MATERIAL EXCAVATION OPERATIONS. REFER TO PASSIVE AND POSITIVE CONCEPT DEWATERING PLANS.
2. REFER TO SPECIFICATIONS SECTION 312319 - DEWATERING AND FREE WATER REMOVAL FOR ADDITIONAL DETAILS AND SPECIFIC REQUIREMENTS OF THE DEAWATERING SYSTEM DESIGN.

08 / 21 PHREATIC LEVEL DETAIL
N.T.S.



NOTES

1. THE LINED PORTION OF THE ASH STAGING AREA IS LOCATED ADJACENT BUT OUTSIDE THE LIMITS OF THE ASH POND FOOTPRINT. ALL ASH MATERIALS THAT MAY BE TEMPORARILY STOCKPILED AND MANAGED OUTSIDE THE FOOTPRINT OF THE ASH POND SHALL BE PLACED OVERTOP THE LINER SYSTEM AS SHOWN. THE LINED AREA SHALL BE SLOPED TO DRAIN SURFACE WATER BACK TO THE ASH POND.

09 / 21 LINED ASH STAGING AREA (OUTSIDE OF ASH POND FOOTPRINT)
N.T.S.

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PROJECT

Ash Pond Closure-by-Removal IFC Design Drawings

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KEY PLAN

PROJECT NUMBER
60602575

SHEET TITLE
DETAILS II

SHEET NUMBER
C-21

ARCH D 24" x 36"
Approved:___ Checked:___ Designer:___ Project Management Initials:

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APPENDIX E

Construction Quality Assurance Plan

ASH POND CLOSURE

A.B. BROWN GENERATING STATION
POSEY COUNTY, INDIANA

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
IFC DESIGN

ASH POND CLOSURE

Prepared for

Vectren Corporation
P.O. Box 209
Evansville, IN 47702

September 2021

Prepared by

AECOM

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AECOM Project No. 60602575

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ATTACHMENTS

LIST OF ACRONYMS

Owner	Vectren Corporation/Southern Indiana Gas and Electric Corporation (SIGECO)
AECOM	AECOM
CQA	Construction Quality Assurance
QA/QC Plan	Quality Assurance/Quality Control Plan
NPDES	National Pollutant Discharge Elimination System
CM	Construction Manager
CQC	Construction Quality Control
RFI	Request(s) For Information
USCS	Unified Soil Classification System

1. Introduction

The purpose of the Construction Quality Assurance Plan (CQA Plan) is to describe observations and tests that assist in evaluating whether the construction has been performed in accordance with the approved plans and appropriately documented. This CQA Plan details material requirements, sampling and testing procedures, testing frequency, test parameters and sampling locations, surveying, required documentation. In addition, it also lists the procedures to follow in the case of a test failure.

The following section addresses CQA activities associated with various construction components of the project. These components will include some, but not necessarily all, of the following:

- Structural Fill
- Surface Water Controls Structures
- Ponded CCR Materials that will be Beneficially Reused
- Forfeited or other materials identified by the CQA Inspector requiring disposal at the onsite FGD Landfill

The Contract Documents (Drawings, Specifications, and CQA Plan) are the official documents governing the CQA requirements. If compliance with two or more standards is specified in the Contract Documents and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Project Manager, Resident Engineer, and Construction Manager for a decision before proceeding.

2. PROJECT DESCRIPTION

Vectren proposes to carry out the following activities at the Ash Pond located at the A.B. Brown Generation Station (AB Brown Station).

- Excavate all CCR (Coal Combustion Residual) materials located within the Ash Pond footprint.
- Haul, stockpile, manage and load "Conforming" CCR materials into Ash Reclaim Hopper for beneficial reuse (recycling). Prior to loading the hopper, CCR materials will be tested at an on-site lab for conformance with recycler's (third party cement manufacturer's) requirements.
- Haul and dispose "Forfeited" or other materials identified by the CQA Inspector requiring disposal at the onsite FGD Landfill.
- Once removal of all CCR materials from within the Ash Pond footprint has been confirmed, regrade post-excavation surface using onsite soil materials to meet minimum and maximum slope requirements and construct stormwater drainage channels.
- Stabilize disturbed surfaces with topsoil and vegetative cover.
- Breach Ash Pond dam to enable stormwater to flow to downgradient stream.

All work described above will be accomplished under one construction contract.

3. CQA Program

3.1 Quality Assurance

Construction Quality Assurance (CQA) starts at the beginning of the project during preparation of the engineering plans and specifications. At this stage, the CQA plan outlines means and actions to be employed by the Owner through the CQA team to evaluate and measure conformity with the design, production (manufacture and fabrication), and installation of equipment and materials in accordance with this CQA plan as well as with the design plans and specifications.

3.2 Quality Control

Quality Control (QC) includes actions taken by all parties including the Engineer, Subcontractor, manufacturer, fabricator, and installer, to document that their methods, materials, and workmanship are accurate, correct, meet regulatory requirements, and are in accordance with the approved plans and specifications. QC is provided by each party individually for the work, product, or service provided.

3.3 Roles and Responsibilities

3.3.1 Owner and Operator

The plant and its ancillary functions are owned and operated by Vectren Corporation (Owner). The Owner will be responsible for monitoring the overall performance of work, contracting and administration.

3.3.2 Engineer

AECOM will serve the role as Engineer for this project and is under contract with the Owner. As the Engineer, AECOM has prepared the regulatory permitting documents, Contract Documents (Drawings and Specifications), this CQA Plan and instructions pertaining to performing the work.

3.3.3 Contractor

AECOM will serve the role as Contractor for this project and is under contract with the Owner. As the Contractor, AECOM will be responsible for monitoring the overall performance of work, management of construction activities including subcontracting and administration. The Contractor will designate an on-site representative to serve as the Construction Manager (CM).

3.3.4 Construction Manager

AECOM will serve the role as Construction Manager for this project. The construction manager will provide a wide range of services and will be involved in both the design and construction phases of a project. In general, the Construction Manager provides leadership to the construction team and coordinates between the Owner and the Subcontractor to plan and oversee the completion of a project. Responsibilities of the Construction Manager include managing the budget, tracking the construction progress, and overseeing the schedule of construction.

3.3.5 SUBCONTRACTOR

The Subcontractor for this project will be selected by the Contractor and the Owner and will be contracted directly to the Contractor. The Subcontractor shall be responsible for construction activities associated with this project, including meeting all the requirements for project quality as defined in the construction plans and specifications for his work as well as that of their Subcontractors.

3.3.6 CQA CONSULTANT

AECOM will serve the role as the CQA Consultant for this project. The CQA Consultant is responsible for making observations and performing field tests to provide written documentation that a facility is constructed in accordance with the applicable plans, specifications, and CQA Plan. This includes the results and performance of on-site and laboratory testing, as necessary. AECOM will be the CQA consultant for this project.

The following section provides a description of a typical AECOM CQA Consultant team led by the Construction Manager, including each member's roles and responsibilities.

3.3.6.1 CQA Certifying Engineer

The CQA Certifying Engineer (Certifying Engineer) is responsible for certifying to the Owner and the permitting agency that, to the best of his knowledge based on the data provided, the construction activities observed, and the testing performed, the facility has been constructed in accordance with the plans, drawings, and the approved CQA Plan. The Certifying Engineer serves as the Professional Engineer for the project and certifies the construction record documents, or the construction certification report.

3.3.6.2 CQA Project Engineer

The CQA Project Engineer (Project Engineer) is responsible for providing engineering and technical support to the field CQA team throughout the construction process. The Project Engineer works closely with the Construction Manager to assist with calculations and complete take-offs in support of as-built quantities for payment. The Project Engineer also reviews submittals and responds to RFIs from the Subcontractor; reviews and maintains CQA data, and coordinates all supplementary laboratory testing of CCR materials and soils. The Project Engineer will provide the following QA personnel as needed and as directed by the Construction Manager:

- CQA Inspector;
- Third party CQA testing firm; and
- Third party laboratory.

3.3.6.3 CQA Inspector

The CQA Inspector will perform a visual observation of construction activities and document them for compliance with the contract documents. Specific duties of the CQA inspector include:

- Observe and document all construction-related activities.
- Coordinate and monitor testing with CQA Subcontractor.
- Monitor delivery, handling, and on-site storage of construction materials.
- Evaluate conformance of all CCR and soil materials.
- Observe CCR material excavation and testing.
- Coordinate material sampling and laboratory testing.

Other duties and responsibilities of the CQA inspector will be determined by the Project Engineer and Owner as the work progresses.

3.3.6.4 CQA Subcontractors

The CQA Consultant will subcontract with a construction materials testing and inspection firm for field and laboratory testing as needed. The CQA subcontractor will provide field technicians for on-site testing and observance, including:

- Moisture and compaction testing of soils; and
- Surveying services.

Anticipated laboratory testing includes (but will not be limited to):

- Soil testing

3.3.7 STOP WORK AUTHORITY

The CQA Consultant will advise the Owner that the Subcontractor should stop work in situations of perceivable safety hazards, recognizable stability issues, deviations from design, and significant cost or schedule impacts. In situations where personnel safety is a concern, the CQA Consultant will advise the Subcontractor to stop work and notify the Owner as soon as possible of that action.

3.4 PROJECT MEETINGS

To achieve a high degree of quality during installation, clear, open channels of communication are essential. The following meetings should be held when appropriate.

3.4.1 PRE-CONSTRUCTION MEETINGS

A Pre-Construction Meeting will be held prior to the beginning of construction activities. At a minimum, the meeting should be attended by the Owner, the Subcontractor, the CQA Consultant's Certifying Engineer or Project Engineer, the Construction Manager, the CQA

Inspector, the Earthwork Subcontractor's Superintendent, the Permitting Agency and other involved parties as deemed necessary by the Owner. Additional pre-Construction Meetings may be held prior to earth moving operations, if deemed necessary by the CQA Consultant as discussed in Section 3.4.6.

3.4.2 Daily Meetings

A daily meeting will be held, as necessary, between the Construction Manager, the CQA Inspector, the Subcontractor, and other involved parties. Those attending will discuss, plan, and coordinate the work and CQA activities to be completed that day.

3.4.3 Progress Meetings

Progress meetings will be held weekly, or as determined to be necessary by the CQA Consultant and Construction Manager. Attendees should include the Construction Manager, the CQA Engineer, the Subcontractor, and other involved parties. Those attending will discuss current progress, planned activities for the following week, submittals, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting.

3.4.4 Problem or Work Deficiency Meeting

A special meeting may be held when and if a problem or work deficiency, which would impact the construction schedule or other project requirements, is present or is likely to occur. At a minimum, the meeting should be attended by the affected Subcontractors, the CQA Consultant's Certifying Engineer or Project Engineer, the Construction Manager and the CQA Inspector, as appropriate. The purpose of the meeting is to define and resolve the problem or work deficiency.

3.4.5 Safety Meetings

The Subcontractor will hold safety meetings in accordance with the Subcontractor’s Site Health and Safety Plan. The Subcontractor’s Site Health and Safety Plan must be submitted to the Contractor and the Owner for approval prior to commencing construction activities. Meetings will be held at the start of construction and then periodically as prevailing conditions change or as determined by the Construction Manager.

3.5 Documentation

An effective CQA plan depends largely on recognition of construction activities that should be monitored, and assigning monitoring responsibilities. This is most effectively accomplished and verified through quality assurance activities. The CQA Consultant will document that quality assurance requirements have been met satisfactorily.

The CQA Consultant will prepare and provide to the Construction Manager periodic signed reports which summarize construction activities and the results of observations and tests including descriptive remarks, data sheets, and logs to verify that all quality assurance and monitoring activities have been carried out.

3.5.1 REPORTS

Progress reports will be prepared at regular time intervals to document the status of the construction work by the CQA Consultant. Certifications will be prepared upon completion of major construction activities. Upon completion of the work in its entirety, final documentation will be prepared and will include a professional engineer's seal along with supporting field and laboratory test results.

3.5.1.1 Daily Summary Report

Standard reporting procedures must include preparation of a daily report which, at a minimum, will consist of:

- An identifying sheet number for cross referencing and document control
- Date, project name/number, location, and other identification
- A summary report including memoranda of meetings and/or relevant discussions with the Owner, Construction Manager, and/or site subcontractors, observation logs, test data sheets, decisions reached, activities planned and their schedule
- Other forms of daily recordkeeping to be used as appropriate including construction problem and solution data sheets and photographic reporting data sheets

The daily summary report will also include the following information as needed:

- Weather conditions
- A reduced-scale site plan showing all proposed work areas and test locations
- Descriptions and locations of ongoing construction
- Deviations from the design plans and specifications
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets
- Calibrations or recalibration of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets
- Off-site materials received, including quality verification documentation
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality

- The signature of the CQA Consultant's representative

This information must be regularly submitted to and reviewed by the Construction Manager.

3.5.1.2 Observation Logs and Test Data Sheets

Observations of construction and QA-related activities will be recorded on project-specific logs and data sheets by the CQA Consultant. At a minimum, the logs and data sheets will include the following information:

- An identifying sheet numbered for cross referencing and document control
- Date, project name, location, and other identification; Description or title of activity monitored
- Location of activity and locations of samples collected
- Locations of field tests performed and their results
- Results of laboratory tests received
- Results of monitoring activity in comparison to specifications
- The signature of the CQA Consultant's representative

This information will be submitted with the Daily Summary Report during construction projects.

3.5.1.3 Construction Certification Report

Upon completion of the work, a signed Construction Certification Report will be prepared by the Certifying Engineer and will be prepared in accordance with the project requirements and applicable regulations.

The Construction Certification Report will be prepared and signed and sealed by a professional engineer skilled in the appropriate discipline(s) and registered in the State of Indiana.

At a minimum, the Construction Certification Report will include:

1. A narrative section that identifies the engineered components that were constructed that includes the following:
    - A summary of the design and construction specifications and a comparison with the components that were constructed during the construction event
    - A summary of how construction was impacted by weather and equipment limitations and other difficulties encountered
2. All alterations and other changes that relate to the installation of any of the components to be certified and presented as follows:
    - A listing of all applicable alteration requests/changes that were previously concurred with

- All alteration requests/changes and supporting documentation which are proposed for concurrence
- A list of any other changes made by the owner or operator which do not require regulatory concurrence but which affect construction or the record drawings

The alteration request will be of equivalent or higher standard than the applicable regulation or authorizing document.

3. Results of all tests and QA/QC data including manufacturers' certifications in accordance with the project specifications.
4. Results of all surveys in accordance with the project specifications. Additional points will be established at grade breaks and other critical locations.
5. Record drawings of the constructed facility components showing the following:
   - The location of all survey control points.
   - Plan views with topographic representation of all engineered components depicted along with critical elevations such as ditch flow lines, tops and toes of berms, etc.
   - The location and as-built detail drawings of all components to be certified.
   - If the Certification Report is submitted for establishment of facility survey marks, the following information summarizing the activities performed to construct and establish the facility survey marks:
     - An identification and description of the known control point(s) used to establish the horizontal and vertical coordinate(s) of the facility survey marks.
     - The horizontal and vertical coordinates of the known control point(s) and facility survey marks.
     - A summary of surveying activities performed in determining the coordinates of the facility survey marks.
     - A detailed drawing(s) illustrating the design of the facility survey marks, as constructed.
6. Qualifications of testing personnel that provided construction oversight and conducted all the testing on the engineered components for which the Certification Report is submitted including a description of the experience, training, responsibilities in decision making, and other relevant qualifications.
7. A notarized statement, signed by the Certifying Engineer and the Owner, that, to the best of their knowledge, the Certification Report is true, accurate, and contains all information required by the applicable regulations, contract documents and this CQA plan.

3.5.1.4 Progress Reports

Progress reports at timely intervals established at the Pre-Construction Meeting will be completed and submitted to the Construction Manager and Owner by the CQA Consultant. At a minimum, this report will include the following information:

- A unique identifying sheet number for cross-referencing and document control
- The date, project name, location, and other information
- A summary of work activities during the progress reporting period
- A summary of construction situations, work deficiencies, and/or defects occurring during the progress reporting period
- The signature of the CQA Consultant's representative

Copies of progress reports will be distributed as decided at the Progress Meetings and as deemed necessary by the Construction Manager.

3.5.1.5 Photographic Logs

Photographic logs will be used to assist in documenting general construction progress and other specific items of work. The photographic log will include a brief summary description of the photograph, the orientation and perspective from which the photograph was taken, the date the photograph was taken and the identity of the photographer. The photographic log will be used in conjunction with the Daily Summary Report and will be included with the Construction Certification Report.

3.5.2 Design and/or Specification Changes

Design and/or specification changes may be required during construction. In such cases, the Subcontractor will notify the Construction Manager and Project Engineer. The Construction Manager will then investigate the situation and confirm that it warrants the need for a modification from the design/specifications and recommend appropriate changes in procedures or specifications to the Owner. These changes will be submitted to the Project Engineer for approval and if necessary, the Permitting Agency.

When this type of evaluation is made, the results will be documented with a description of the changes by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports must include the following information:

- An identifying sheet number for cross-referencing and document control
- A detailed description of the situation or deficiency
- The location and probable cause of the situation or deficiency
- How and when the situation or deficiency was identified or located

- Documentation of the corrective action taken to address the situation or deficiency
- Any precautionary measures taken to prevent a similar situation from occurring in the future
- The signature of the Construction Manager, Project Engineer, and Certifying Engineer indicating concurrence

Design and/or specifications changes will be made only with the written agreement of the Owner and the Project Engineer, and will take the form of an addendum to the construction plans or specifications.

3.5.3 DOCUMENTATION MANAGEMENT

The Subcontractor and CQA Inspector will submit project documentation to the CQA Consultant on a weekly basis or at an alternate frequency established by the project requirements.

Complete project CQA documentation must be collected and maintained on-site by the CQA Consultant in a safe repository. This includes (but is not limited to):

- A complete set of construction drawings and specifications
- The CQA Plan
- Project checklists, test procedures, and standards
- Project test procedures, Daily Summary Reports and their attachments, pertinent regulatory documents, and other necessary documents.

3.5.4 STORAGE OF RECORDS AND RECORDS RETENTION

All data sheet originals related to the CQA and Certification process, test results, Daily Summary Reports, memorandums, etc., will be stored by the CQA Consultant in a safe repository on-site during the construction project.

Upon completion of the construction project, records will either be retained at the facility or alternately stored at the CQA Consultants or Certifying Engineer's office and be readily accessible by the facility upon request. Records will be maintained for a minimum period of three years from the time of project completion.

3.6 FAILED TEST PROCEDURES AND ALTERATIONS

A "failed test" occurs when a test performed on an engineered component yields a result that does not meet the specifications outlined in the applicable plans or specifications. Testing performed on an engineered component which does not meet the specifications is not considered a failed test if the construction or installation of the engineered component has not achieved completion at the time of testing. In this case, the testing is performed for the purpose of gauging the effectiveness or completeness of construction.

An “alteration” or “field change” is a change in construction materials, specifications, or CQA procedures from the project requirements that is necessary to perform the work or meet project requirements.

3.6.1 Failed Test Prior To Submittal Of Certification Report

If, prior to submission of the Construction Certification Report for the engineered component, the CQA Consultant determines that there is a "failed test," the CQA Consultant will do all of the following:

- Retest or otherwise assess the engineered component or portion of the facility to determine if construction is in compliance with the construction plans and specifications or other project requirements and include the final results in the Certification Report.
- Implement measures to attain compliance with the construction plans and specifications or other project requirements. An area with a verified failure must be reconstructed or components reinstalled. Reconstructed areas must be retested at a frequency acceptable to the CQA Consultant and at a frequency and location(s) sufficient to demonstrate that compliance has been achieved.

3.6.2 Alteration Prior to Submittal of Certification Report

If, prior to submission of the Construction Certification Report the CQA Consultant and/or Construction Manager determines that an alteration or field change is necessary to the plans or specifications, the CQA Consultant will do all of the following:

- Include the applicable testing results and an assessment and justification for the necessary change(s) in an appropriate section of the Certification Report where the change is clearly identified.
- Provide a demonstration in the Certification Report that the changes are at a minimum equivalent to the project requirements, the construction plans and specifications, and are at least as protective to human health and the environment as they were prior to the changes.
- Submit the Certification Report as required by the Construction Manager.

3.6.3 Detection of the Change after Submittal of Certification Report

If, after submission of the Construction Certification Report the CQA Consultant and/or Construction Manager determine that the Certification Report is in error due to improper documentation of an alteration or field change of the plans or specifications, the CQA Consultant will do all of the following:

- Notify the Owner and/or Construction Manager as determined by the Certifying Engineer of the change within twenty-four hours after discovery, by phone and within seven days after discovery in writing.

- Within 14 days of submitting the written notification required above, do either of the following:
  - **a.** Implement the failed test procedures outlined above (3.6.1) and amend and resubmit the Construction Certification Report to explain the circumstances and how compliance was achieved.
  - **b.** Submit the Alteration information outlined above (Section 3.6.2).

3.7 CQA Consultant Documentation

This CQA Plan includes examples of Construction Documentation Forms that will be generated by the CQA Consultant. These forms may be modified as deemed appropriate based on the requirements of the Construction Manager or the Subcontractor.

3.8 Surveying

The Subcontractor is responsible for subcontracting a Professional Land Surveyor licensed in the State of Indiana to complete construction surveying and as-built surveys for this project. Surveying of lines and grades will be conducted on an ongoing basis during construction of soil layers and other engineered components. Surveying will be performed to provide documentation for record plans, verifying quantities, and to assist the Subcontractor in complying with the required grades. The purpose of the survey is to verify that the actual thickness and grades of the construction components are in accordance with the plans and specifications. Surveying of lines and grades will be conducted during construction of the soil layers. Review of the surveys conducted at the site will be part of the CQA program. The existing permanent benchmarks at the facility will be used for survey control. Surveying will be performed under the supervision of a qualified, Professional Land Surveyor licensed in the State of Indiana.

Based on the control points (permanent benchmarks) provided by the Owner, the Subcontractor is to provide all temporary and permanent benchmarks, monuments, and increments needed to control work. If during the work, control points set by the Owner are disturbed by the Subcontractor, the Subcontractor will replace the control points in kind.

3.8.1 Survey Control

The permanent benchmarks at the facility will be used for survey control. One or more temporary benchmarks will be established for the site at a location convenient for daily tie-in. Temporary benchmarks are to be considered as accurate as third order benchmarks. The vertical and horizontal controls for this benchmark will be established within normal land surveying standards.

3.8.2 Precision and Accuracy

The survey instruments used for this work will be precise and accurate to meet the needs of the project. Survey instruments will be capable of reading to a precision of 0.01 of a foot (3.05 mm) and with a setting accuracy of 10 seconds.

A vertical tolerance of ±0.10 feet will apply to each of the following components as they are constructed:

- Surface of excavation – Final Cleanup Grade
- Top of Structural Fill
- Top of topsoil
- Stormwater ditches/channels

These tolerances are meant to assure that the required material dimensions and design intent can be met upon final certification. A Professional Surveyor registered in Indiana will certify the results of the survey. Results will be included in the Certification Report provided to the Owner.

3.8.3 FREQUENCY AND SPACING

Surveying will be performed as soon as possible after completion of a given installation to facilitate construction-progress and avoid delaying the next installation. In addition, spot checks during construction will be necessary to assist the Subcontractor in complying with the required grades.

The as-built thickness of various components of the construction (topsoil and compacted clay layers) will be determined by non-destructive methods, i.e., comparison of the survey data for the underlying materials with that of the component of interest. As-built survey data will be obtained at locations having a typical on-center spacing of 100-feet maximum at all toe, midpoint, and top of slope locations as well as grade breaks. Locations will be, to the maximum extent possible, at the same coordinates as the survey data for the underlying materials. A list of all required survey milestones is provided in Section 017123 - Construction Surveying of the Specifications.

3.8.4 LINES AND GRADES

When required, the extent of the following components will be surveyed to determine the lines and grades achieved during construction:

- Original ground surface/Existing conditions
- Extents of excavation
- Structural fill
- Topsoil layer
- Surface water structure details including profiles, cross sections, and inverts for ditches, culverts, catch basins, swales, benches, ditches.

3.8.5 SURVEYING PERSONNEL

Surveying for construction certification and record documentation purposes will be performed under the supervision of a qualified, licensed Professional Land Surveyor registered in the State of Indiana. The survey crew will consist of a Senior Surveyor and as many Surveying Assistants as required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, including detailed, accurate documentation.

3.8.6 CERTIFICATION

Survey results will be certified by a licensed Professional Land Surveyor licensed in the State of Indiana and submitted to the CQA Consultant for review.

3.8.7 SURVEYS BY OWNER OR ENGINEER

The Owner or Project Engineer may request additional surveys to monitor, verify, or document the work.

3.9 SUBMITTALS

3.9.1 SUBMITTAL PROCEDURE

Submittals will include shop drawings, material data, and samples. Product data submittals, samples, and shop drawings are required to verify that the correct products will be installed on the project. The shop drawing submittal is a drawing or set of drawings produced by the Subcontractor, Supplier, Installer, Manufacturer, or Fabricator typically for pre-fabricated components or construction procedures. The product data submittal usually consists of the manufacturer’s product information. The sample submittal is a physical portion of a specified product, often required when several products are acceptable, to confirm the quality and aesthetic level of the material. The size or unit of sample material is usually specified.

Submittals shall be submitted electronically and will be initially submitted to the CQA Inspector for review. After review by the CQA Inspector, each submittal will be submitted following the procedures described in the Specifications.

Shop drawings will be submitted well in advance of the need for the material or equipment for construction by the Subcontractor and with ample allowance for the time required for the CQA Consultant’s review and to accept delivery of material or equipment afterward in accordance with the project schedule.

3.9.2 SUBMITTAL REVIEW

After the CQA Inspector and Project Engineer complete their review, submittals will be returned to the Subcontractor indicating whether or not the materials meet the project requirements along with further instructions.

3.10 REQUESTS FOR INFORMATION (RFI)

The purpose of this procedure is to formalize and detail requests for clarification, additional information relative to the design drawings, construction specifications, or other construction related issues. RFIs are to be processed expeditiously in order to avoid the possibility of delay to the project. RFIs cannot be used as a substitute for items specifically requiring a submittal from the Subcontractor or to change the design. If a change in the design is needed (i.e., based on an RFI response), then a change order must be issued. Responses to RFIs are not authorizations for such change orders or payments.

RFI submittals will be submitted by the Subcontractor on forms specified by the Construction Manager. The form must be completed using sequential numbers and submitted by the Subcontractor to the Construction Manager and CQA Consultant for review.

The Project Engineer will review and respond to the RFI. If the RFI leads to a Change Order, the Project Engineer will submit to the Construction Manager for review. If the RFI does not lead to a Change Order, the Project Engineer will sign and return the RFI with the response to the Subcontractor.

3.11 PROJECT SCHEDULE

A detailed project schedule is required to be provided by the Subcontractor to the Construction Manager for review and approval prior to the preconstruction meeting. The schedule must be generated using Primavera P6 software, or other similar program(s), and composed of detailed activities logically tied together. The Subcontractor will formulate the schedule to have the following attributes at a minimum:

- Schedule narrative describing the logic for the work planned
- Clearly defined starting point
- Clearly defined completion date
- Project Milestones
- Mobilization and demobilization activities
- Critical paths identified
- Tasks that represent the performance of the work, including tangible deliverables or products
- Specifies the resources required to perform the work (This will include labor, equipment, and materials)
- Easily measurable during the performance of the detailed activity relating to the work

All details in the project schedule will be logically tied to other activities. As a general guideline for generating schedules, the duration of an activity should be limited to 20 calendar days or less. In no case should an individual work activity be scheduled for a duration longer than 20 calendar days without approval from the Construction Manager or Project Engineer. If any portion of the project is to be accomplished during a plant outage, those scheduled activities should be incorporated into a separate hourly schedule. The work should be broken down into sufficient detail to allow the maximum use of finish-to-start relationships. In addition, start-to-start, finish-to-finish, or start-to-finish relationships will be used at a minimum. In no case will negative lag values be allowed for any relationships. In all cases, any exceptions to the above criteria must have the Construction Manager's approval.

Individual activities in the project schedule requiring identifiable labor to complete the project will be resource loaded with all the necessary engineering labor hours, project support labor hours and/or craft labor hours consistent with the Subcontractor's estimate, scope of work and work assignments. Progress for scheduled tasks will be tracked using physical percent complete. All significant reductions in physical percent complete will be reported in the weekly report along with an explanation.

4. Prequalification Testing

4.1 Summary

The following section discusses the specific QA/QC requirements for prequalification conformance testing of the engineered components for the Ash Pond.

4.2 Prequalification Conformance Testing

Prequalification testing is necessary to establish that the materials used for the engineered components conform to the minimum specifications contained in this document for each component. Some prequalification testing is generally necessary for any engineered component comprised in whole or in part of excavated CCR materials and structural fill soils. Conformance testing is performed on representative materials obtained from the location of origin with results submitted prior to arrival on site unless otherwise directed by the CQA Inspector.

In this CQA Plan, prequalification conformance testing for soil are located in **Table 1A and 1B**. Minimum testing requirements and frequencies for soils are located in **Table 2**. **Table 3** contains calibration requirements for testing equipment to be utilized.

4.3 Engineered Components Requiring Prequalification Conformance Testing

Engineered components that require some measure of prequalification are noted in the individual specifications under submittals. These materials are summarized as follows:

- Structural Fill
- Topsoil Layer

4.4 Submittals

Submit the results of all required prequalification testing including interface friction testing, to the CQA Consultant for review and verification that the reported test results meet with project specifications at least 14 calendar days prior to use of the material at the job site unless otherwise directed by the CQA Consultant.

5. Structural Fill

5.1 General

5.1.1 Summary

The following section discusses the specific QA/QC requirements for the testing and construction of this material. Structural fill will be used to establish base elevations in areas where undercuts are made in the subgrade, to raise site grades, and to construct buttresses, berms and roads.

5.1.2 DESCRIPTION

Structural fill typically serves as support and as a foundation for other engineered components or as replacement for unsuitable earth materials in discrete areas.

5.1.3 SUBMITTALS

Submit the results of all required prequalification testing as required in Section 4 of this CQA Plan to the CQA Consultant for review and verification that the reported test results meet with project specifications at least 14 days prior to use of the material at the job site.

5.2 PRODUCTS

5.2.1 MATERIALS/DESIGN REQUIREMENTS

Obtain soil or other acceptable material for construction of the structural fill from on-site and/or off-site borrow sources as contained in the construction plans and/or as directed by the CQA Inspector or Construction Manager. Remove excess or unsatisfactory material to designated on-site stockpiles as directed by the CQA Inspector. Soil material removed from excavations may be reused as structural fill provided it meets the prequalification requirements listed herein.

Material utilized for structural fill shall exhibit the following characteristics:

- Consists of well-graded natural earth material that is not excessively dry or saturated.
- Free of cobbles, stones, rock, gravel or boulders greater than 4-inches in diameter.
- Free of CCR Material, organic materials, debris, waste, frozen materials, vegetation, roots, and any other deleterious materials and any materials that could damage or puncture overlying materials.
- Meets one of the following USCS soil classifications: SC, CL, CH, CL-ML, MH, ML, or SM.

Additional requirements are contained in **Table 2**.

5.2.2 SOURCE QUALITY CONTROL

Perform additional field or laboratory tests as often as is necessary to document that the material continues to meet the prequalification specifications contained in the Materials/Design Requirements section above.

5.3 EXECUTION

5.3.1 PREPARATION

Over-excavate and remove all unsuitable soil located below the structural fill layer or in-situ foundation elevations until a competent, stable surface at a lower elevation is reached.

5.3.2 CONSTRUCTION AND INSTALLATION

Place structural fill to the lines and grades shown on the construction drawings.

Prepare and process the material as necessary to achieve the required minimum compaction requirements as determined by ASTM D698 and/or ASTM D1557 in accordance with the requirements contained in **Table 2**. It must be noted that the compaction and moisture requirements may change to achieve the required density due to changes in soil and field conditions.

Place the material in loose lifts compacted by a minimum of four passes (up and back over same area, move over half a drum, then up and back over the same area again) of a compactor. Overlap the passes so the entire area where material is placed receives the required minimum number of one-way passes of the compaction equipment.

Remove any unsuitable materials encountered (e.g. organics, soft/loose soil, protruding cobbles and boulders, etc.) and fill the resulting voids with additional structural fill appropriately compacted.

Key in the structural fill into existing and/or constructed slopes with 2 horizontal to 1 vertical minimum benches.

Prepare the final surface to be relatively smooth such that the surface is suitable to support the overlying engineered component(s).

5.3.3 FIELD QUALITY ASSURANCE

Quality assurance of the placement of structural fill will be by in-place density testing or by proofrolling in accordance with **Table 2** and will be performed by the CQA Consultant in general accordance with ASTM D698 (standard Proctor) or D1557 (modified Proctor). The locations of the individual tests must be adequately spaced to appropriately represent the constructed area. Source verification will be visually observed and confirmed by the CQA Consultant.

6. TOPSOIL

6.1 GENERAL

6.1.1 SUMMARY

The following section discusses the specific QA/QC requirements for the testing and construction of this material. Topsoil, or amended soil meeting the requirements of topsoil, will be used to establish final elevations within the limits of waste (CCR) and provide erosion protection for the underlying material.

6.1.2 DESCRIPTION AND DESIGN REQUIREMENTS

A topsoil layer will be placed over native soils or structural fill. This layer serves to provide adequate soil for the establishment of vegetation upon final closure of the Ash Pond and restoration of the footprint. The topsoil layer will be planted with vegetation to prevent erosion and to enhance aesthetics of the footprint.

6.1.3 SUBMITTALS

Submit the results of the required prequalification testing to the CQA representative and Construction Manager as summarized in **Table 2** for approval prior to excavation and/or stockpiling of the material for use.

6.2 PRODUCTS

6.2.1 MATERIAL REQUIREMENTS

Obtain soil for placement of the topsoil layer from on-site and/or off-site borrow sources as contained in the construction plans and/or as directed by the Project Engineer and Construction Manager. Remove excess or unsatisfactory material to designated on-site stockpiles as directed by the CQA Inspector or Construction Manager.

Material utilized for the topsoil layer will exhibit the following characteristics:

- Has sufficient fertility or can be amended to support vegetation in the top 6-inches of material.
- Shall not have particle sizes greater than four inches in diameter in any direction.

6.2.1.1 Vegetation

Vegetation will be established on the topsoil layer in accordance with the seeding, mulching, and fertilization specifications provided in construction specifications.

6.2.2 SOURCE QUALITY CONTROL

Perform additional field or laboratory tests as often as is necessary to document that the material continues to meet the prequalification specifications contained in the Material Requirements section above.

6.3 EXECUTION

6.3.1 CONSTRUCTION AND INSTALLATION

Place the topsoil layer to the lines and grades shown on the construction drawings. Place the topsoil layer only after the infiltration soil layer has been accepted in writing by the CQA Inspector or Construction Manager. Deposit and spread the topsoil layer in a single uniform 6-inch lift using low ground pressure equipment. Complete topsoil layer such that it is well draining and exhibits a smooth uniform surface free from ruts, depressions, and debris.

Seeding of the topsoil layer may begin after the area to be covered has been properly prepared and fertilized. Uniformly distribute seed to meet the application rate provided in the project specifications. Perform seeding only during periods of acceptable weather conditions.

Protect seeded areas with temporary erosion control matting (ECM) as shown in the construction drawings, or as necessary to prevent loss of seed and fertilizer. Complete all ECM field installation in accordance with the manufacturer's recommended installation procedures and the construction specifications. Ensure that matting overlaps are shingled in the direction of flow.

6.3.2 QUALITY ASSURANCE

Lift thickness and source verification will be visually observed and confirmed by the CQA Consultant. Total thickness will be verified by as-built survey on a 100-ft maximum grid.

The CQA Consultant will verify that the seed, application method, and application rates meet the construction specifications, and that seed has been uniformly distributed over the required footprint.

7. Surface Water Controls Structures

7.1 General

7.1.1 Summary

The following section discusses the specific QA/QC requirements for the construction of surface water control structures. Surface water control structures will be constructed to manage surface water runoff from the Ash Pond and surrounding drainage areas.

7.1.2 Description and Design Requirements

Surface water control structures will include channels, benches, ditches, letdowns, culverts, and catch basins. These structures are designed to manage surface water at the site. Precast concrete surface water control structures may also be designed to meet specified traffic loading requirements if deemed necessary upon final cleanup.

7.1.3 Submittals

Submit the results of the manufacturer's quality control testing to the CQA Consultant for review and verification that the reported test results meet the project specifications at least 14 days prior to delivery of the erosion control matting/turf reinforcement matting (ECM/TRM) to the job site.

7.1.4 Delivery Storage and Handling

Handle the ECM/TRM and other construction materials in accordance with manufacturer's recommendations and utilize handling equipment on-site that poses minimal risk of damage to the material.

7.2 Products

7.2.1 Material Requirements

Riprap materials will conform to the requirements of the Indiana Storm Water Quality Manual, Appendix D: Coarse Aggregate Size Specifications, for riprap material classifications specified in the project specifications or construction drawings.

7.2.2 Source Quality Control

Perform additional field or laboratory tests as often as is necessary to document the riprap material continues to meet the prequalification specifications contained in the Material Requirements section above.

7.3 EXECUTION

7.3.1 CONSTRUCTION AND INSTALLATION

Excavate channels and ditches to the lines and grades shown on the construction drawings. Install ECM/TRM in accordance with the manufacturer's recommended installation procedures and the construction specifications.

7.3.2 FIELD QUALITY ASSURANCE

In addition to reviews of QC documentation, the CQA Inspector will visually inspect installed surface water control structures to ensure conformance with the specifications and to check for damage.

8. CCR Material Handling for Beneficial Use

8.1 Division of Responsibility

8.1.1 Responsibilities of the Subcontractor

In addition to the general construction activities pertinent to the excavation and closure of the AB Brown Ash Pond, the Subcontractor will carry out the following material handling activities to both facilitate beneficial reuse of the CCR material from the Ash Pond and to maximize the quantity of material that can be beneficially reused.

- Haul excavated CCR material to Ash Staging Area.
- Dry CCR material to meet moisture specification.
- Stockpile CCR material for sampling (by Engineer) and chemical analysis (by Owner).
- Identify and segregate material based on laboratory results indicating classification as: Conforming, Non-Conforming or Forfeited CCR material.
- Continually maintain a stockpile of at least 10,000 tons of Conforming CCR material to provide available material for mixing with Non-Conforming CCR material.
- Mechanically screen material to meet size specification.
- Load conforming material into Ash Reclaim Hopper. Loading of the Ash Reclaim Hopper will serve to combine CCR material, according to laboratory results and Engineer's mathematical determination of mixing ratios, to maximize quantity of conforming material.

In order to execute the above activities, the Subcontractor shall stockpile, identify, track and manage excavated materials in multiple stockpiles to allow for material sampling (by AECOM) and analysis (by Owner at onsite laboratory). It is anticipated that this will take place after the excavated CCR materials have been decanted, dried as necessary and mechanically screened prior to loading into the Ash Reclaim Hopper. The excavated CCR materials will be sufficiently dewatered using the proposed passive and positive dewatering systems (as described in the contract technical documents) to place the material into stockpiles and decant water within a 24-hour time period. The Subcontractor may also use other means it deems necessary to further dry the CCR materials to meet the moisture specification. The dewatering operations should be effective such that the excavated CCR materials meet the specified moisture content within 7 to 10 days after excavation. Laboratory analysis of the CCR materials will be performed according to the analytical test methods agreed upon by the Owner and the third-party material recycler. In addition to meeting the requirements and specifications included in this CQA Plan, the Subcontractor shall study the **Subsurface Data Report** (provided under separate cover) and make its own determinations as required for the sequencing, phasing and efficiency of their beneficial reuse operations.

8.1.2 RESPONSIBILITIES OF THE ENGINEER AND OWNER

Sampling of CCR materials will be performed by the Engineer in accordance with the methodology discussed in this Section. Chemical analysis of the CCR materials will be performed at the Owner's onsite laboratory. The Engineer will coordinate material sampling activities with the Owner and provide results to the Subcontractor. The sampling methods and analysis by the Owner's on-site laboratory will be conducted in accordance with the contractual agreements between the Engineer and the Owner and between the Owner and the third-party recycler.

8.2 CCR MATERIAL SAMPLING

The material sampling process will require a composite sample for every 1,000 tons of material, after the material has been dewatered and dried to meet the moisture specification. A composite sample will consist of 10 grab samples of about 8 ounces each that are composited using the coning and quartering method or other agreed upon method. Materials will be sampled in accordance with ASTM D6009 (Standard Guide for Sampling Waste Piles) and ASTM D4687 (Standard Guide for General Planning of Waste Sampling) guidance and standard practices. Composite samples will be tested at the Owner's on-site laboratory.

8.3 CCR MATERIAL CLASSIFICATION

8.3.1 BASIS FOR MATERIAL CLASSIFICATION

Environmental visualization system (EVS) modeling was conducted using analytical data from CCR materials collected from the AB Brown Ash Pond in 2016, 2017 and 2020. The EVS modeling showed that 3,136,900 CY of the ponded CCR materials meet the specification *as is* and unaltered. The modeling further indicated that 1,694,000 CY of the ponded CCR material does not meet the specification *as is* but could be potentially blended with other ponded materials to meet the specification. In addition, the modeling indicated that 1,253,800 CY of the ponded CCR materials both do not meet the specifications *as is* and cannot be blended to meet the specification due to high concentrations of FGD filter cake or sulfite (SO_3^{2-}). Based on mass balance calculations conducted by AECOM and described in the **Subsurface Data Report,** CCR materials with a level of SO_3^{2-} greater than 12% will be forfeited and disposed in the onsite FGD Landfill. **Table 5** shows the laboratory analytical test methods to be used for the testing of the CCR materials and comparison against the material specification provided in **Table 4**.

8.3.2 MATERIAL CLASSIFICATION DEFINITIONS

CCR materials excavated from the Ash Pond will be classified according to the following general definitions:

Conforming Materials: CCR materials that meet the specification listed in **Table 4** based on laboratory analysis will be classified as Conforming Materials. The entire stockpile of which the composite sample is representative will be considered a conforming stockpile and may be mechanically screened and loaded in the Ash Reclaim Hopper. A stockpile that exceedingly meets the specification listed in **Table 4** will be considered a highly conforming stockpile.

Non-Conforming Materials: CCR materials that do not meet the specification listed in **Table 4** based laboratory analysis will be classified as Non-Conforming Materials. The entire stockpile of which the composite sample is representative will be considered a non-conforming stockpile and will be marked for combination or blending with a conforming stockpile. Materials initially classified as non-conforming materials that eventually meet the specification through blending of materials, as described later in this Section, will then be considered Conforming Materials.

Forfeited Materials: CCR materials that contain greater than 12% SO_3^{2-} will automatically be classified as Forfeited Material. All Forfeited Material will be hauled by the Subcontractor for disposal in the onsite FGD Landfill. CCR materials may be classified as "Forfeited Material" in one of two ways:

- CQA Inspector visually identifies material that they highly suspect will not meet material requirements due to presence of white coloration indicative of high SO_3^{2-} concentration. These materials will be identified as "Forfeited Material" and hauled directly by the Subcontractor for disposal in the onsite FGD Landfill.

  Or:

- CQA Inspector does not initially visually identify material as "Forfeited Material", therefore the material is stockpiled and tested; however, laboratory results indicate that the material contains greater than 12% SO_3^{2} or the CQA Inspector otherwise determines that the material cannot be effectively combined with Conforming Material to meet the material specifications.

Existing organic materials (vegetation, trees, stumps, grass, cattails, etc.), construction debris and other non-CCR materials that cannot be salvaged shall not be disposed at the FGD Landfill; such materials shall be disposed by the Subcontractor at a licensed offsite solid waste facility.

8.4 CCR MATERIAL BLENDING METHODOLOGY

When CCR materials in a particular 1,000-ton pile are deemed Non-Conforming (do not meet the specification listed in **Table 4)**, a combination or blending of different piles will be performed by the Subcontractor. In coordination with the CQA Inspector, the Subcontractor shall combine material from one or multiple other piles, such that the combined material meets the specifications. The Subcontractor shall amend their blending efforts, if directed by the CQA Inspector, to maximize the quantity of material that conforms with the material specifications.

The ratio at which one or multiple piles are combined will be based on the results of the laboratory analysis of the material and the Engineer's mathematical determination with the goal that the combined material on any given barge will meet the material specification on average. Once materials are combined, in accordance with the mathematically determined ratio, the materials will be classified as Conforming Material and no further material sampling and analysis is required.

Combining or blending of CCR materials in the piles will be accomplished by loading the Ash Reclaim Hopper at the defined ratio. Physically combining stockpiles to accomplish material blending prior to loading the Ash Reclaim Hopper is not required; however, may be conducted at the option of the Subcontractor. The Subcontractor may choose to mechanically screen the material at the defined ratio, prior to loading the Ash Reclaim Hopper, as a means to both blend the material and meet the material size specification. The amount of material to be beneficially reused annually is expected to be between a minimum of 400,000 metric tons (440,924 short tons) and a maximum of 500,000 metric tons (551,155 short tons).

The following are two examples of the CCR Material Blending Methodology:

Example 1: Using two piles, Pile A and Pile B: Pile A (1,000 tons) is found to be non-conforming for Hg with a concentration of 100 ppb and Pile B (1,000 tons) is found to be conforming for Hg with a concentration of 50 ppb. Therefore, Pile A and Pile B can be loaded into the Ash Reclaim Hopper at a 1:1 ratio in order to achieve the Hg specification of 75 ppb for the combined material (2,000 tons).

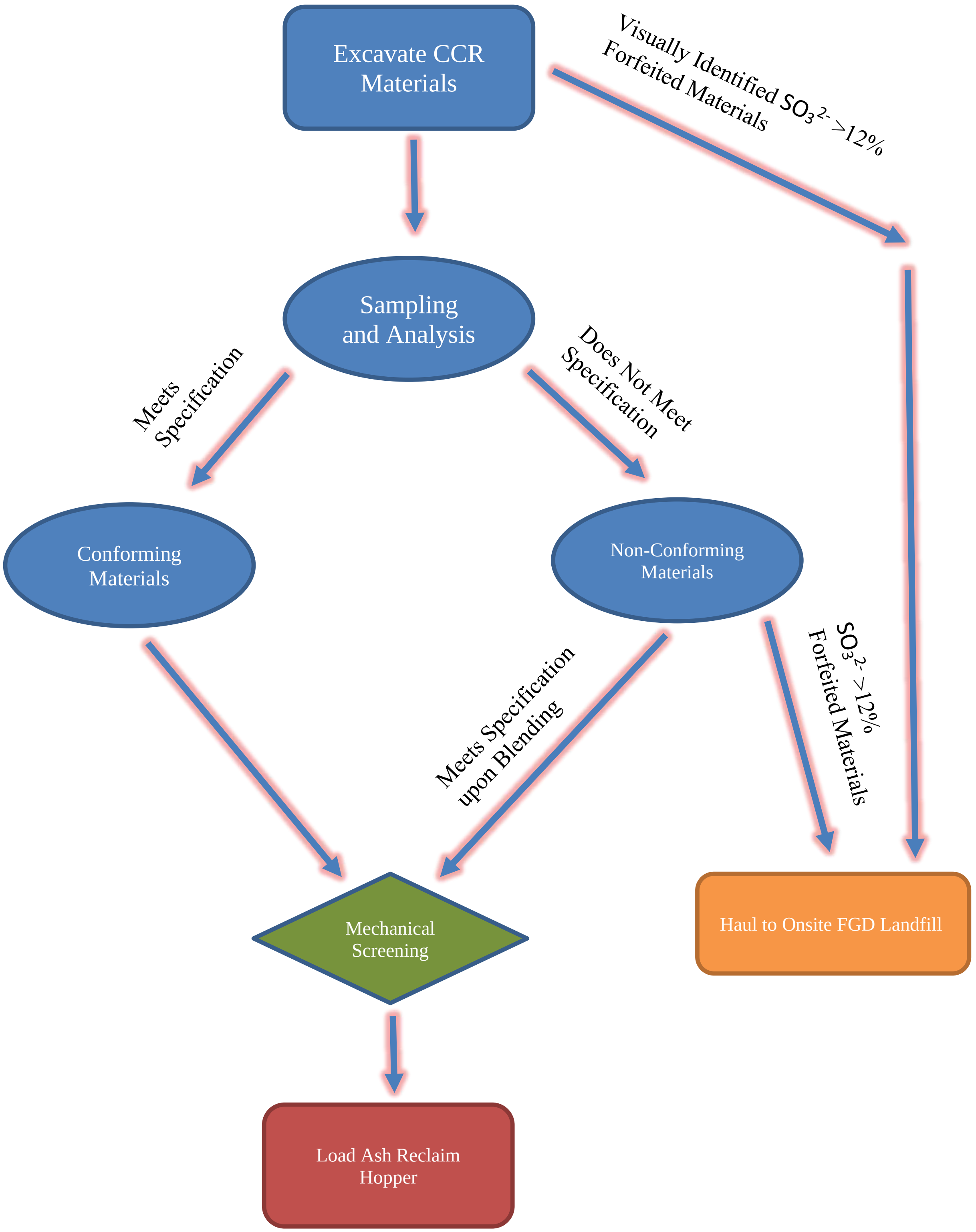
Example 2: Using three piles, Pile A, Pile B and Pile C: Pile A (1,000 tons) is found to be non-conforming for Hg with a concentration of 100 ppb and conforming for SO3 with a concentration of 1%. Pile B (1,000 tons) is found to be conforming for Hg with a concentration of 70 ppb, but non-conforming for SO3 with a concentration of 2%. Pile C is found to be conforming for Hg with a concentration of 50 ppb and conforming for SO3 with a concentration of 0.5%. Loading Pile A to Pile B into the Ash Reclaim Hopper at a ratio of 1:5 would bring the combined material into conformance for Hg but out of conformance for SO3. Conversely, combining Pile A with Pile B at 1:1 ratio would bring the combined material into conformance for SO3 but would not result in conformance for Hg. Therefore, Pile A, Pile B, and Pile C would be loaded into the Ash Reclaim Hopper at a 1:1:1 ratio in order to achieve the Hg specification of 75 ppb and SO3 specification of 1.5% for the combined material (3,000 tons).

8.5 Mechanical Screening

The Subcontractor shall screen the excavated CCR materials using a 1-inch mechanical screen. All excavated CCR material shall pass through the screen such that no material will need to be disposed as non-conforming due to non-conformance with respect to particle size per the material specifications. Offsite disposal of material that does not pass through the screen that cannot be utilized as part of the project for purposes such as structural fill or rock will be handled by Change Order.

Note that during process of screening excavated CCR materials, wetter material may slow down the rate of screening to approximately 1,500 tons per day, which is significantly slower than the optimum estimated rate of 5,000 tons per day possible during dry conditions. As the rate at which the Owner accepts excavated CCR material increases, it may be necessary to use an additional screener to meet the required conveyor-loading rates.

A simplistic flowchart is provided on the following page to generalize the overall process described in this Section.


Excavate CCR Materials
Visually Identified SO_3^{2-} >12% Forfeited Materials
Sampling and Analysis
Meets Specification
Does Not Meet Specification
Conforming Materials
Non-Conforming Materials
Meets Specification upon Blending
SO_3^{2-} >12% Forfeited Materials
Mechanical Screening
Haul to Onsite FGD Landfill
Load Ash Reclaim Hopper

9. CCR Removal Verification (Clean Closure Certification)

CCR removal verifications is anticipated to be conducted using visual verification methods.

9.1 Visual Verification

9.1.1 Procedure

The excavation activities are anticipated to terminate once complete removal of CCR materials has been achieved and clean native soil has been reached. The bottom of excavation will be visually inspected by the CQA Inspector to verify that all CCR materials have been removed. Once this visual inspection has been completed by the CQA Inspector, a topographic survey of the excavated surface will be performed by a third-party licensed surveyor contracted by the Subcontractor. Surveying will be conducted using a grid system with a maximum spacing of 100-ft. x 100-ft. The post-excavation survey will be used to compare to the final excavation grades to the pre-existing grades. Also, photographic documentation of the bottom of excavation will be collected. Lastly, collection of samples for analysis using PLM is proposed to provide additional verification of complete CCR removal. Once excavation of CCR materials is completed as described above, soil samples will be collected from the bottom and side slopes of the pond on an established sampling grid for purposes of performing PLM analysis. PLM is a method whereby a soil sample is viewed under a high magnification microscope coupled with reflected-light illumination which allows for the positive identification of particles of coal combustion products in the soil sample. By examining the internal variation in optical indices within a sample and comparing shape, size, color, transparency, opacity, and other optical properties of the sample, the presence or absence of coal combustion products can be discerned.

Based on the surface area of the pond bottom and side slopes, a proposed sampling grid of 200-ft. X 200-ft. would yield approximately 161 samples for PLM analysis by a qualified laboratory (or approximately one sample per acre). The results of the PLM analysis provide the percent of CCR materials by area within each sample. The percent by area can be directly compared to an equivalent percent by weight (based on a sample being placed on a standard 22mm x 22mm coverslip slide). The proposed pass/fail criteria for PLM analysis is less than or equal to 5% by weight of CCR. Therefore, results indicating less than or equal to 5% by weight of CCR would be considered a passing result and further soil removal would not be required. PLM results indicating greater than 5% by weight of CCR would require additional soil removal up to a maximum of 2-feet below the interface between the originally removed CCR materials and native soils. Upon completion of excavation activities, AECOM will photograph and identify the coordinates of each sample location (based on GPS methodology).

A standard report will be prepared by the CQA Inspector to memorialize the CCR removal verification of each area, including documentation of the supporting visual, photographic, and PLM results.

10. Disposal of CCR Materials

CCR materials that are determined by the CQA Inspector to meet the definition of "Forfeited Material" or otherwise identified by the CQA Inspector to not meet material specifications will be hauled by the Subcontractor to the onsite FGD Landfill or other regulated disposal location.

TABLES

Table 1A. Laboratory Test Methods for the Evaluation of Soil and Aggregate

COMMON TEST NAME	PARAMETER DEFINED	STANDARD METHOD
Unified Soil Classification System	Class of Soil	ASTM D2487
Sieve and Hydrometer Analysis	Particle Size Distribution of Coarse and Fine-Grained Soils	ASTM D422
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
Standard Proctor	Moisture/Density Relationship Using 5.5 lb (2.46 kg) Rammer and 12 in. (305 mm) Drop	ASTM D698
Modified Proctor	Moisture/Density Relationship Using 10 lb (4.54 kg) Rammer and 18 in. (457.2 mm) Drop	ASTM D1557
Moisture Content	Water to Dry Weight Ratio	ASTM D2216
Permeability: Flex Wall Permeameter	Permeability (Hydraulic Conductivity) on Undisturbed or Remolded Samples of Soil	ASTM D5084

Notes:

1) Not all tests are required for this site; refer to Table 2 in the CQA Plan.

2) Latest version of the applicable ASTM International or USDA testing standards will be used when conducting tests.

Table 1B. Field Test Methods for the Evaluation of Soil and Aggregate

COMMON TEST NAME	PARAMETER DEFINED	STANDARD METHOD
Visual Classification	Maximum Particle Size, General Material Characteristics	ASTM D2488
USDA Classification	Classification of Ability to Support Vegetation	USDA Method
Nuclear Methods	In-Place Density and Moisture Content	ASTM D6938
Moisture Content	In-Place Moisture as Check on Nuclear Densometer Measurements	ASTM D2216
Sand Cone Density	In-Place Density as Check on Nuclear Densometer Measurements	ASTM D1556
Drive Tube Sample	In-Place Density as Check on Nuclear Densometer Measurements	ASTM D2937
Lift Depth Check	Thickness of Placed Soils	Visual Confirmation

Notes:

1) Not all tests are required for this site; refer to Table 2 in the CQA Plan.

2) Latest version of the applicable ASTM International or USDA testing standards will be used when conducting tests.

Table 2. Minimum Requirements and Test Frequencies for Structural Fill

Component	Required Test	Minimum Frequency	Sample Size[1]	Acceptance Criteria
Structural Fill Prequalification Conformance Testing [1]	Visual Observation	As required	N/A	Substantially free of debris, large rocks, plant materials, or other deleterious material.
	Sieve Analysis (ASTM C136 or ASTM D422)	1 per source & 1 per 10,000 yd^3	5-10 lb	Max. 4 in. particle size
	Standard Proctor (ASTM D698)	1 per source & 1 per 10,000 yd^3	50-100 lb	Determination of window of acceptable moisture content given required dry density. Maximum dry unit weight greater than 90 lb/ft^3
Structural Fill Performance Testing [2]	Visual Observation	As required	N/A	Final surface: firm, smooth, and uniform
	Lift Depth Check	As required	N/A	6 to 8 in compacted lift
	Nuclear Densometer In-place Density and Moisture Content (ASTM D6938)	1 per 100 ft grid per lift	N/A	≥ 95% Standard Proctor maximum dry density, Moisture content -3% +2% of optimum
	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils - Atterberg Limits (ASTM D4318)	1 per 10,000 yd^3	1 lb	Plasticity Index shall be no less than 7.
	Proofroll	Continuous or as directed by the Engineer	Varies	No excessive pumping or rutting of subgrade

(1) Conformance testing is performed on borrow sources to confirm the minimum required values are met and the material remains consistent.
(2) Performance testing is performed on materials after placement is complete to confirm that the lift or layer meets design requirements.

Table 3. Calibration of Testing Equipment

Equipment	Required Test	Minimum Frequency	Acceptance Criteria
Nuclear Density Gauge	Radioactive Source Wipe Testing and Systems Electronics Check	Annually by Manufacturer or Specialty Testing firm qualified to inspect and calibrate nuclear source equipment	Certificate of Calibration and Safety by Testing Firm
Tensiometer	Tensile strength calibration to standard	Prior to arrival to project site. Tensiometer to be field verified at the discretion of the Engineer	+/- 3 psi
Air Pressure Gauges	Pressure in psi compared to standard	Prior to arrival to project site or documentation that the product is new	+/- 1 psi
Other	As Determined by the Engineer	As Recommended by the Manufacturer, or Required by State Auditor of Measurement Devices	As Guaranteed by the Manufacturer

Table 4. Material Specification for Beneficial Reuse

Parameter	Minimum Content (wt.%) *	Maximum Content (wt.%, if expressed as a percentage) *
SiO2	37	54
Al2O3	16	no limit
Fe2O3	15	33
Na equivalent (Na2O + 0.658 K2O)	no limit	2.5
SO_3^{2-}	no limit	1.5
MgO	no limit	2
P2O5	no limit	0.3
TiO2	no limit	1.3
Loss-on-Ignition (LOI)	no limit	10
Hg	no limit	75 ppb
Moisture	no limit	20%
Size	no limit	Screened to less than ¾" – 1"
Material must not be hazardous waste and/or radioactive and should be free of foreign debris.	None allowed	

**All percentages are calculated on a dry basis prior to any ignition loss.*

Table 5. Analytical Test Methods

Materials		
	Method	**Method Description**
Metal Oxides	ASTM C114 (XRF)	"Standard Test Methods for Chemical Analysis of Hydraulic Cement" using the X-Ray Fluorescence (XRF) Rapid Test Method
Mercury (Hg)	EPA Method 7471B (SW-846)	Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)
Loss on Ignition (LOI)	ASTM C114	Section 18 Test Method
Moisture Content	ASTM D2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

FORMS

Example Construction Documentation Forms

AECOM

Date: Click here to enter a date.

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: A.B.Brown	Project: AB Brown Ash Pond Closure	Project Phase: N/A
Job No. : 60602575		Consecutive Report No.: ###

Summary of Construction/Operation Activities (Include Additional Sheets as Necessary):

Click here to enter text.

Summary of Daily Observations (Include any Problems and Resolutions):

Click here to enter text.

Stormwater Management, Erosion & Sediment Controls Observations (Include Sketches and Additional Sheet as Necessary):

Click here to enter text.

Summary of Incidents, Accidents, or Health and Safety Issues:

Click here to enter text.

Directives Given / Approvals Provided:	**Material Description**	**Today's Quantity:**	**Cumulative Quantity:**
	Click here to enter text.		

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**

Weather:	AM: Weather	PM: Weather	Contractor Started Work: Time	Field Representative Started Work: Time
Temperature:	AM: Temp °F	PM: Temp °F	Contractor Stopped Work: Time	Field Representative Stopped Work: Time
Field Representative: Click here to enter text.			Field Representative's Signature:	Date: Click here to enter a date.
Reviewed by: Jay Mokotoff, PE			Reviewer's Signature:	Date: Click here to enter a date.

**** Attach sketches of observed features on a location map. Also attach other pertinent information on separate sheets, as necessary.***

Date: Click here to enter a date.

DAILY ACTIVITY AND OBSERVATION REPORT

Additional Observations
Click here to enter text.

**** Attach sketches of observed features on a location map. Also attach other pertinent information on separate sheets, as necessary.***

AECOM

Date: Click here to enter a date.

DAILY ACTIVITY AND OBSERVATION REPORT

Photography Log	
Location: Click here to enter text. **Description:** Click here to enter text.	**Location:** Click here to enter text. **Description:** Click here to enter text.
Location: Click here to enter text. **Description:** Click here to enter text.	**Location:** Click here to enter text. **Description:** Click here to enter text.

**** Attach sketches of observed features on a location map. Also attach other pertinent information on separate sheets, as necessary.***

1300 E 9th Street, Suite 500
Cleveland, OH 44114
216-622-2300

REQUEST FOR INFORMATION

TO: **DATE:**

PROJECT: **VECTREN – A.B. BROWN GENERATING STATION ASH POND CLOSURE PROJECT**

BY: **RFI NO. :**

RE:

COPIES:

REQUEST:

SIGNED: ______________________________

RESPONSE:

SIGNED: ______________________________

DATE: ______________________________

COMPANY: ______________________________

Note: Responses contained herein DO NOT constitute changes to the contract documentation. THIS IS NOT AN AUTHORIZATION TO PROCEED WITH WORK INVOLVING ADDITIONAL COST OR TIME.

Submittal Log
Owner: Vectren
Project: AB Brown Ash Pond Closure
Owner Project No: TBD
AECOM Project No: 60602575 Date:
December 22, 2017

No.	Spec. Section	Submittal Name	Date Received	Date Returned	Total Days	Total Work Days	Reviewed By	Action	Resubmittal Required?	Notes

AECOM

NON-CONFORMANCE FORM

Section A: Report (to be completed by the Resident or Project Engineer observing the non-conformance)	
Project Location/Location on Site of Non-conformance:	Date:
Details of observed Non-conformance:	
Probable causes of Non-conformity:	
Name:	Signature:
Section B: Proposed Plan of Action (To be completed by designated AECOM Personnel)	
Name:	Signature:
Section C: Resolution (To be completed by designated AECOM Personnel)	
Result:	
Is Non-compliance issue resolved? ☐ Yes ☐ No	
Name:	Signature:

APPENDIX F

Ground Water Monitoring Program

www.haleyaldrich.com

REPORT ON

POST-CLOSURE GROUNDWATER MONITORING PROGRAM
A.B. BROWN GENERATING STATION
ASH POND
MOUNT VERNON, INDIANA

by
Haley & Aldrich, Inc.
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for
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1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Southern Indiana Gas and Electric Company (SIGECO) to perform technical services associated with development of a Post-Closure Groundwater Monitoring Program (GMP) for the Coal Ash Pond (Ash Pond) that complies with the April 17, 2015 Coal Combustion Residuals (CCR) Rule (Rule) published by the U.S. Environmental Protection Agency (USEPA). Haley & Aldrich has prepared this GMP on behalf of SIGECO for the Ash Pond at the A.B. Brown Generating Station (ABB) located in Posey County near the community of West Franklin, Indiana. The groundwater monitoring requirements of the CCR Rule are provided in Appendix A of this document, as outlined in 40 Code of Federal Regulations (CFR) §257.90 through §257.98.

The CCR Rule was written to be "self-implementing" because the USEPA was not authorized under federal law to enforce the program. This changed with Congress' passage of the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016, which authorizes the USEPA or a particular state to implement a permit program to enforce the CCR Rule. Indiana Department of Environmental Management (IDEM) is currently working to develop and gain approval for a CCR permit program.

Prior to the CCR Rule, IDEM regulated landfills and surface impoundments that ceased operation and initiated closure in accordance with the Solid Waste Land Disposal Facility Rules under 329 Indiana Administrative Code (IAC) 10. This regulatory structure is still in place while IDEM is currently updating these regulations to include the CCR Rule; further, they have adopted an emergency rule incorporating certain elements of the CCR Rule for CCR surface impoundments into 329 IAC 10. As such, this GMP specifically addresses the requirements of the CCR Rule.

There are three groundwater monitoring components referenced in the CCR Rule that together describe the groundwater monitoring activities being undertaken. One component is the GMP which provides a summary of relevant background information and Site geology and hydrogeology along with a detailed description of the groundwater monitoring network and sampling program. The second component is the Quality Assurance Project Plan (QAP_jP) which is based on the CCR Rule specifications in 40 CFR §257.93 and contains the sampling and chemical analysis procedures and processes that are followed to obtain representative and technically defensible groundwater monitoring results. The third component describes the methods for the statistical analysis of the collected groundwater quality data as required by the CCR Rule to determine whether a Statistically Significance Increase (SSI) of Appendix III constituents in the downgradient wells, compared to upgradient/background well(s), has occurred. The "Statistical Evaluation Plan (StEP) – A.B. Brown Generating Station" will be based on the CCR Rule-specified statistical methods outlined in 40 CFR §257.93, paragraphs f(1) through f(5).

1.1 SITE SETTING

The Site is located in Posey County near the community of West Franklin, Indiana. The location of the Site is shown on Figure 1. The Site is located approximately one-half mile north of the Ohio River. The Site varies in elevation with natural ground surface elevations varying from 380 to 520 feet above mean sea level (msl). The higher elevations are generally to the north of the Site with surface topography dominated by a series of ridges separated by ravines. In general, surface topography across the Site slopes to the west toward the western property boundary then to the south toward the Ohio River. Surface water runoff occurs via sheet flow to low-lying areas or ravines which eventually lead to the Ohio River.

1.2 SITE BACKGROUND

The Site began operations in 1978 with the construction of a 250-megawatt (MW) generating unit. In 1985, an additional generating unit was added. Both units burn southern Indiana coal. SIGECO currently owns the land and operates the station to supply electric power to industrial, commercial, and residential customers in its service territory. When the Ash Pond was initially charged and put into operation at the Site, groundwater began seeping into the administration building. Subsequently, a French drain was installed to intercept shallow groundwater downgradient of the Ash Pond. The location and construction details of the French drain system were not documented at the time of its construction.

In accordance with the CCR Rule, a monitoring system has been designed and constructed for the Ash Pond CCR management unit. The Ash Pond was constructed and commissioned in 1978 by building an earthen dam across an existing valley. The surface area of the Ash Pond is approximately 159 acres. A Site Index Map is provided as Figure 1. The groundwater sampling area and the associated groundwater monitoring well network is shown in Figure 2. Table 1 presents a summary of well construction information.

2. Site Geology and Hydrogeology

The Site's geology and hydrogeology has been evaluated through review of historical geotechnical drilling logs from the time the plant was constructed and through drilling, soil sampling, and well installation activities conducted to comply with the CCR Rule.

2.1 SITE GEOLOGY

Soil borings drilled at the Site indicate that the uppermost geologic unit consists of unconsolidated alluvial deposits consisting of primarily silts and clays with discontinuous layers of sand. This unit overlies Pennsylvanian age sandstone which is commonly identified as the Inglefield Sandstone. Underlying the Inglefield Sandstone is low-permeability weathered shale and siltstone. Downgradient from the Ash Pond, the Inglefield Sandstone is absent, and the top of bedrock is represented by the low-permeability weathered shale and siltstone. Exploration of the French drain system revealed that it extended across the unconsolidated overburden and into the upper portion of the shale bedrock unit. Groundwater entering the French drain is routed to the Southside runoff pond where it is managed through the facility's National Pollutant Discharge Elimination System (NPDES) permit.

2.2 SITE HYDROGEOLOGY

Hydrogeologic units are defined based on their ability to transmit groundwater or serve as confining units between zones of groundwater saturation. The uppermost aquifer downgradient of the Ash Pond occurs within unconsolidated low-permeability alluvial deposits which consist primarily of silty clay containing discontinuous layers of sand. Groundwater contained within these unconsolidated deposits recharges to the underlying bedrock units. Beneath upland areas, or ridgelines, the uppermost aquifer occurs in weathered sandstone, shale, or siltstone. Downgradient of the Ash Pond, the unconsolidated deposits overlie weathered, or partially decomposed shale bedrock. Recharge to the surficial aquifer occurs through direct surface infiltration.

Piezometric data recorded from the monitoring wells installed at the Site shows that the configuration of the uppermost aquifer is primarily controlled by surface topography with groundwater flowing from the ridges into the ravines where groundwater discharges into small perennial streams. Groundwater flow in the vicinity of the Ash Pond is predominantly to the west with a component of flow to the northwest flowing beneath the Landfill from the northern portion of the Ash Pond (Figure 3). Groundwater elevations vary seasonally; however, the groundwater flow patterns remain consistent.

The French drain evaluation identified a high-conductivity flow zone within the uppermost portion of the weathered shale and siltstone. While limestone was not encountered within the flow zone, the high-conductivity flow zone is interpreted to be the result of differential weathering of limestone. A review of historical geotechnical borings suggests that this flow zone pinches out to the north of monitoring well CCR-AP-2R but extends to the west of the administration building. Groundwater modeling and water level measurements collected during the French drain evaluation demonstrate that shallow groundwater flowing west of the Ash Pond is captured by the French drain.

Groundwater flow velocity in the uppermost aquifer beneath the CCR units was estimated using Site-specific hydraulic conductivity obtained from slug testing and hydraulic gradients, and an assumed effective porosity of 25 percent. Hydraulic conductivity is approximately 2.3 feet per day in the vicinity of the Ash Pond. The hydraulic gradient beneath and downgradient of the Ash Pond is 0.03 feet per foot. Using the Site-specific hydraulic conductivity and hydraulic gradients, and assuming an effective porosity of 25 percent, the groundwater flow velocity in the vicinity of the CCR units is estimated to be 100 feet per year beneath and downgradient of the Ash Pond.

3. Groundwater Monitoring Program

Haley & Aldrich developed the post-closure GMP outlined below after reviewing and evaluating the existing hydrogeologic and groundwater quality data collected to date, the hydrogeological characterization results outlined above, and considering the performance standards provided in the CCR Rule 40 CFR §257.91 through §257.98 (Appendix A). The post-closure GMP includes a sufficient number of wells installed at locations and depths to obtain representative groundwater samples from the uppermost aquifer and French drain feature. Groundwater sampling locations have been established to accurately represent background groundwater quality, not affected by potential releases from the CCR management unit, as well as the quality of groundwater passing the waste boundary downgradient of the CCR management unit. Details of the post-closure GMP for the CCR units at the Site are further described below.

3.1 GROUNDWATER MONITORING NETWORK FOR THE ASH POND

The Ash Pond at the Site is located to the east of the generating station. As shown on Figure 3, groundwater in the uppermost aquifer around the Ash Pond generally flows to the west and northwest with a minor component of flow to the southwest. A substantial portion of groundwater flows into a French drain catchment feature to the west of the Ash Pond. Haley & Aldrich determined monitoring well placement based on interpretations of Site-specific hydrogeology including groundwater flow directions and rates of groundwater movement. The groundwater monitoring well network for the Ash Pond complies with the CCR Rule by monitoring the uppermost aquifer at the boundary of the CCR unit. Based on the groundwater flow pattern in the area of the Ash Pond, the upgradient (unaffected by the CCR unit) background monitoring wells are identified as CCR-BK-1R and CCR-BK-2, located north of the generating station as shown in Figure 2. The two upgradient wells provide spatial variability in the background groundwater quality and increase the statistical power of the data analysis.

Several downgradient wells have been installed along the perimeter of the Ash Pond to adequately monitor the potential release and migration of ash constituents from the unit. Haley & Aldrich concluded that twelve downgradient monitoring wells (CCR-AP-2R, CCR-AP-2I, CCR-AP-2IR, CCR-AP-3R, CCR-AP-3I, CCR-AP-4R, CCR-AP-5, CCR-AP-6, CCR-AP-7R, CCR-AP-9, CCR-AP-10, and CCR-AP-11), along with upgradient wells CCR-BK-1R and CCR-BK-2, are sufficient to comply with the CCR Rule by monitoring the uppermost aquifer at the boundary of the CCR management unit. In addition, the French drain feature that captures much of the shallow groundwater flow from the western portion of the Ash Pond will be monitored through a network of five piezometers (FD PZ-1, FD PZ-2, FD PZ-3S, FD-PZ-3D, and FD PZ-4). A summary of the monitoring network for the Ash Pond along with well construction details is provided in Table 1.

3.2 MONITORING WELL CONSTRUCTION AND DOCUMENTATION

As described above, the monitoring network includes twelve monitoring wells located around the Ash Pond (CCR-AP-2R, CCR-AP-2I, CCR-AP-2IR, CCR-AP-3R, CCR-AP-3I, CCR-AP-4R, CCR-AP-5, CCR-AP-6, CCR-AP-7R, CCR-AP-9, CCR-AP-10, and CCR-AP-11), and five piezometers (FD PZ-1, FD PZ-2, FD PZ-3S, FD PZ-3D, and FD PZ-4) located around the French drain, along with two upgradient/background wells installed on the north side of the facility (CCR-BK-1R and CCR-BK-2).

Groundwater monitoring wells were constructed with 2-inch Inside Diameter (ID) Schedule 40 polyvinyl chloride (PVC) casing; a 10-foot-long, 0.01-inch machine-slotted PVC screen; and a locking, steel, 5-foot-long protective casing. Where possible, the well screen was placed so that the encountered water table was approximately five feet above the top of the well screen. Groundwater samples were collected from the mid-point of the well screen.

At each monitoring well, the top of the PVC well casing was surveyed by a registered Indiana surveyor to within 0.01 foot, and the ground surface was surveyed to 0.1 foot. The surveyed top of the well casing, identified on each well, is used for measuring and recording water levels. Each sample location was surveyed to North American Datum of 1988 (NAD88). A summary of the survey results for the monitoring wells, with horizontal and vertical coordinates, is provided in Table 1.

All downhole drilling equipment was cleaned prior to use at the next well location. Decontamination fluids were contained and placed into the Ash Pond. Well casing and screens were new and were protected by factory packaging. Monitoring wells were installed according to the procedures described below.

Monitoring wells were installed using conventional hollow-stem auger drilling techniques. Soil sampling was performed while advancing the borehole using standard split spoon sampling on five-foot centers to provide samples for soil descriptions and to estimate the depth to groundwater. After the borehole was advanced approximately 15 feet below the water table, well casing and screen were placed through the augers to the bottom of the borehole.

Filter sand was added by gravity to approximately 2 feet above the top of the well screen as the augers were withdrawn from the borehole. The filter pack was surged as the sand was emplaced to promote proper packing and to minimize the potential for settlement of the filter pack following placement of the bentonite seal. Approximately two feet of bentonite pellets were added by gravity above the sand pack to seal the well screen against surface water infiltration. A neat cement grout was emplaced by tremie pipe into the remaining annular space. Risers extend approximately two to three feet above the ground surface. The depth of the filter sand, bentonite seal, and annular space seal was carefully measured to 0.1 foot prior to the installation of the next layer.

A locking steel protective casing or flush-mounted vault was stabilized in place with a 2-foot by 2-foot square concrete pad sloping away from the casing. A weep hole was drilled at the base of the protective casing just above the concrete pad to evacuate rainwater that may enter the casing. One to three steel bollards were installed around each above-grade well to protect it from damage. To protect wells installed in high-traffic areas, the monitoring wells were completed below grade in vaults.

The installed groundwater monitoring wells were developed after construction by surging and purging each well with a pump. The pump was decontaminated by submersing the pump and pumping through a soapy water solution, followed by a distilled water rinse. For wells that could not be purged dry, development was considered complete when a minimum of ten well volumes of groundwater was removed, and purge water was free of turbidity. For wells that purged dry, a minimum of four well volumes of groundwater were removed.

4. Groundwater Sampling Program

This section includes an explanation of activities required to comply with the groundwater monitoring requirements outlined in the CCR Rule.

4.1 POST-CLOSURE GROUNDWATER MONITORING

To comply with the detection and assessment monitoring requirements outlined in 40 CFR §257.94 and §257.95 of the CCR Rule, a network of twelve downgradient monitoring wells (CCR-AP-2R, CCR-AP-2I, CCR-AP-2IR, CCR-AP-3R, CCR-AP-3I, CCR-AP-4R, CCR-AP-5, CCR-AP-6, CCR-AP-7R, CCR-AP-9, CCR-AP-10, and CCR-AP-11), and five piezometers (FD PZ-1, FD PZ-2, FD PZ-3S, FD PZ-3D, and FD PZ-4) located around the French drain, located at the boundary of the unit, and screened in the shallow and deeper portions of the uppermost aquifer were installed. In addition, two upgradient/background wells were installed on the north side of the Site property (CCR-BK-1R and CCR-BK-2). Groundwater monitoring locations are shown on Figure 2. These wells will continue to be relied upon to monitor post-closure groundwater conditions at the Ash Pond.

As stated in 40 CFR §257.98(a)(1)(i), post-closure groundwater monitoring will, at a minimum, meet the requirements of §257.95, document the effectiveness of the corrective action remedy, and demonstrate compliance with the groundwater protection standards (GWPS). Post-closure groundwater monitoring will be considered complete when the constituents listed in Appendix IV of the CCR Rule have not exceeded the GWPS for a period of three consecutive years.

4.1.1 Chemical Analysis

Groundwater samples collected for chemical analysis will continue to be analyzed for constituents listed in Appendix III and Appendix IV of the CCR Rule. Analytical methods are described in the Groundwater Sampling and Analysis Plan (GWSAP) as defined in 40 CFR §257.93 of the Rule. The Appendix III and Appendix IV constituents consist of the following:

Appendix III Constituents	Appendix IV Constituents	
Boron	Antimony	Lead
Calcium	Arsenic	Lithium
Chloride	Barium	Mercury
Fluoride	Beryllium	Molybdenum
pH	Cadmium	Radium 226 and 228 combined
Sulfate	Chromium	Selenium
Total Dissolved Solids	Cobalt	Thallium
	Fluoride	

4.1.2 Sampling and Analysis

The Groundwater Sampling and Analysis Plan (GWSAP) identifies the Site-specific activities and methodologies for groundwater sampling for the groundwater monitoring program. The GWSAP includes field data collection, sample collection, sample preservation and shipment, interpretation, laboratory analytical methods, and reporting for groundwater sampling at the Ash Pond. The administrative procedures and frequency for collection of groundwater elevation measurements, flow direction, and gradient are also provided in the GWSAP.

Laboratory results from each semiannual sampling event at the Ash Pond will continue to be statistically analyzed for each of the Appendix IV constituents following the procedures outlined in the statistical method utilized in the detection and assessment programs. Appropriate statistical analyses being applied to the groundwater quality data are based on the sample population distribution acquired during detection and assessment monitoring at the Ash Pond, consistent with guidance provided by USEPA in the Resource Conservation and Recovery Act (RCRA) Statistical Analysis of Groundwater Monitoring Data Unified Guidance Document (USEPA, 2009).

4.2 GROUNDWATER ELEVATION MEASUREMENT

The depth to groundwater will continue to be measured in each well immediately prior to purging each time groundwater samples are collected. Future groundwater measurements from monitoring wells surrounding the Ash Pond will be recorded within a period short enough to avoid temporal variations in groundwater conditions. The measured groundwater levels will be converted to groundwater elevations for subsequent interpretation of groundwater flow direction and rate.

4.2.1 Procedures for Groundwater Elevation Measurement

The water level in each well will continue to be measured using an electric water level indicator. Water level measurements will be made from a surveyed fixed reference point marked on the well. The fixed reference point is located on the top of the well casing. If a surveyed mark is not present, the reference point will be established and marked on the north side of the well casing. More details for groundwater measurement procedures are provided in the GWSAP.

4.2.2 Frequency

The depth to groundwater, in wells which monitor the Ash Pond, will continue to be measured within a period short enough to avoid temporal variations in groundwater conditions which could preclude accurate determination of groundwater flow rate and direction.

4.3 GROUNDWATER FLOW DIRECTION AND GRADIENT

The groundwater elevations will continue to be used to construct a water table configuration map to interpret the direction of groundwater flow and calculate the hydraulic gradient each time groundwater samples are collected.

4.3.1 Procedures for Calculation

Groundwater flow direction and gradient will continue to be calculated using the following steps:

- Determine the groundwater surface elevation by subtracting the water level measurement (depth to water) from the surveyed measuring point elevation at each well.
- Determine the difference in groundwater surface elevation between each of the wells by subtracting the groundwater elevation of a well with a higher elevation from the groundwater elevation of a well with a lower elevation. The elevation differences are divided up into equal increments. Repeat this step between multiple wells. Groundwater elevation contours can be drawn at corresponding elevation increments between wells.

- Determine groundwater flow direction by drawing a line perpendicular to the groundwater contour lines from higher elevations to lower elevations.
- Determine the hydraulic gradient by dividing the groundwater elevation change in the direction of flow by the horizontal difference between measurement points.

4.3.2 Frequency

The gradient and direction of groundwater flow at the Ash Pond will continue to be calculated upon completion of each groundwater sampling event.

5. Reporting

5.1 DATA MANAGEMENT

A project database that incorporates hydrogeologic and groundwater quality data has been established to allow efficient management of chemical and physical data collected in the field and received from the laboratories. Laboratories conducting groundwater analyses for this program have been supplied with specific formats for electronic data deliverables to ensure compatibility with the project database requirements. Qualified personnel will be assigned to conduct quality assurance/quality control (QA/QC) reviews for each dataset generated. The database has been integrated with a geographical information system to allow for presentation of spatial information and data, such as Site features, ownership boundaries, and sample locations. Each sample location has been surveyed according to NAD88.

5.2 SEMIANNUAL REPORTING

SIGECO, or a designated representative, will continue to prepare a semiannual groundwater monitoring report for the Ash Pond after each groundwater monitoring event. The semiannual groundwater monitoring report will continue to summarize key actions completed for the previous year and describe any problems that may have been encountered, along with the corresponding actions to resolve the problems. At a minimum, the semiannual groundwater monitoring report will continue to include the following:

- A detailed site map showing the CCR units, including all background and downgradient monitoring wells;
- Identification of any monitoring wells installed or decommissioned during the preceding year;
- A summary of all groundwater monitoring activities, including number of samples collected, specific analyses for each groundwater sample, field procedures followed during sample collection activities, and dates of sampling events;
- Laboratory reports and field sampling forms;
- Electronic data files formatted as an ASCII, tab-delimited text file;
- Water level gauging along with an interpretation of groundwater flow direction and rate;
- A statistical evaluation of the Appendix IV constituents, including a discussion of any transition between monitoring programs, including dates of transition, cause for transition, identification of constituents detected at a statistically significant level (SSL) over GWPS; and
- Any other pertinent information regarding the groundwater monitoring system or post-closure GMP.

6. Documentation

6.1 RECORDKEEPING

Per the CCR Rule, SIGECO, or a designated representative, will continue to maintain adequate information in a written operating record at the subject facility, as described in 40 CFR §257.105. The operating record will be retained for at least five years following the date of each occurrence, measurement, sampling event, maintenance activity, corrective action, or report. The operating record may be maintained in a variety of methods, such as saved on a computer, computer storage device, or equivalent system that ensures that adequate information is kept for the required time frame. Documentation will be submitted to the State Director when such documentation is not available on SIGECO's maintained website, as described in Section 6.3, below. The following information pertinent to the groundwater monitoring network and the post-closure groundwater monitoring program will be placed in the operating record:

- The annual groundwater monitoring report, as required by 40 CFR §257.90(e);
- Documentation of the design, installation, development, and decommissioning of any monitoring well, piezometer, and other measurement or sampling device as required under 40 CFR §257.91(e)(1);
- The groundwater monitoring system certification, as required under 40 CFR §257.91(f);
- Selection of the statistical method certification (SDAP), as required under 40 CFR §257.93(f)(6);
- A certified alternate source demonstration in accordance with 40 CFR §257.94 (e)(2) or §257.95(g)(3)(ii), as required by §257.90(e);
- Notification of establishing an Assessment Monitoring program (within 30 days of triggering), as required under 40 CFR §257.94(e)(3);
- Results of Appendix III and IV constituent concentrations, as required under 40 CFR §257.95(d)(1);
- Notification of returning to Detection Monitoring (within 30 days), as required under 40 CFR §257.95(e);
- Notification of detection of one or more Appendix IV constituents at SSLs above the GWPS (within 30 days), as required by 40 CFR §257.95(g). Note - Appendix III constituents are not assessed above the groundwater protection standards but are assessed against the upgradient/background concentrations;
- Notification of initiating the assessment of Corrective Measures (within 30 days), as required under 40 CFR §257.95(g)(5);
- Completed assessment of Corrective Measures, as required under 40 CFR §257.96(d);
- Documents prepared by owner/operator recording the public meeting for Corrective Measures assessment, as required under 40 CFR §257.96(e);
- The semiannual report documenting the progress in selecting and designing the remedy and the selection of remedy report, as required under 40 CFR §257.97(a); and
- Notification of completing the remedy (within 30 days), as required under 40 CFR §257.98(e).

6.2 NOTIFICATION

Notifications will continue to be provided to the relevant State Director before the close of business on the day the notification is required to be completed, as specified under 40 CFR §257.106. The State must be notified when information is added or placed in the operating recorded and on SIGECO's publicly accessible internet site. Notification will be made to the relevant authority of any design or operating criteria modifications, or actions specified under 40 CFR §257.106(f) and §257.106(g) of the CCR Rule. Notification of the availability of the annual groundwater monitoring report is specified under 40 CFR §257.105(h)(1).

6.3 POSTING INFORMATION TO THE INTERNET

A publicly accessible internet website (CCR website), titled "CCR Rule Compliance Data and Information," will continue to be maintained that contains the information specified under 40 CFR §257.107 of the CCR Rule. One CCR website will be kept for the A.B. Brown Generating Station Ash Pond. All information will be made available to the public within 30 days of placing the information in the operating record and for at least five years following the date on which the information was first posted to the CCR website. Notification information provided to the relevant State Director will be posted on the CCR website as specified under 40 CFR §257.106.

References

1. Cardno ATC, 2017, May 2017 Groundwater Quality Data Statistics, July 2017.

2. United States Environmental Protection Agency (USEPA), 2000. Sampling and Analysis Plan Guidance and Template, R9QA/002.1. April 2000.

3. United States Environmental Protection Agency (USEPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance, EPA 530/R-09-007. March 2009.

TABLES

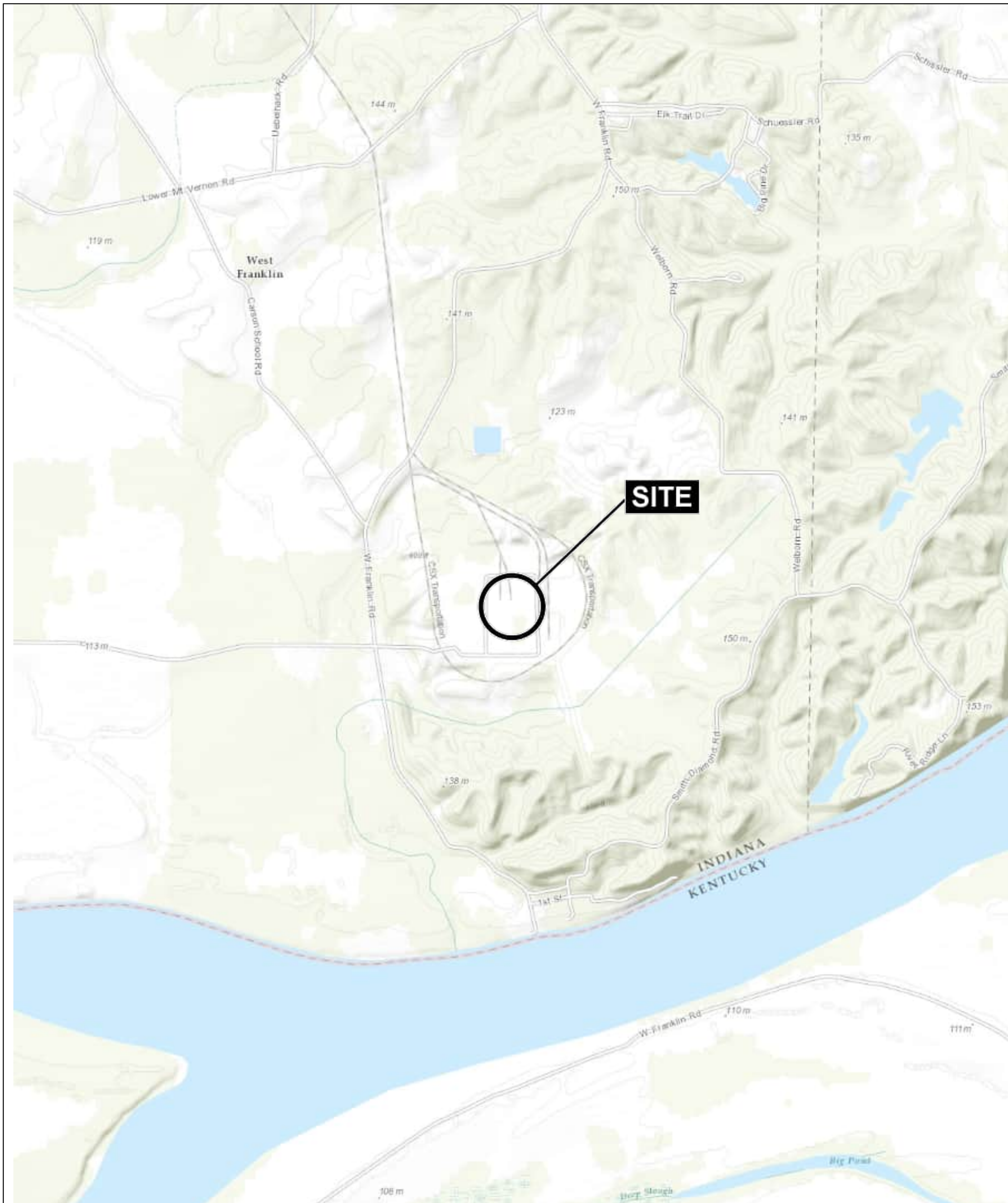
TABLE I
GROUNDWATER MONITORING WELL LOCATION AND CONSTRUCTION DETAILS
A.B. BROWN GENERATING STATION - ASH POND
MOUNT VERNON, INDIANA

Well	CCR Unit	Date Installed	Easting	Northing	Top of Pad Elevation (ft msl)	Top of Riser Elevation (ft msl)	Surface Grout (ft bgs)	Bentonite (ft bgs)	Sand Pack (ft bgs)	Screen Zone (ft bgs)	Screen Length (ft)	Well Radius (in)	Status
CCR-AP-1R	Ash Pond	July 2016	2773560.71	968260.82	464.70	467.57	0.0 - 23.0	23.0 - 25.0	25.0 - 37.0	27.00 - 37.00	10	2	Active
CCR-AP-2R	Ash Pond	July 2016	2771922.52	969079.16	465.40	468.13	0.0 - 39.0	39.0 - 41.0	41.0 - 53.3	43.30 - 53.30	10	2	Active
CCR-AP-2I	Ash Pond	January 2019	**319167.75	**148852.17	465.82	468.88	0.0 - 77.0	77.0 - 79.0	79.0 - 93.3	83.00 - 93.00	10	2	Active
CCR-AP-2IR	Ash Pond	March 2021	2771920	969076.29	465.80	465.79	0.0 - 41.0	42.0 - 49.70	49.70 -51.70	51.70 - 61.70	10	2	Active
CCR-AP-3R	Ash Pond	July 2016	2771404.27	966865.12	450.10	449.13	0.0 - 33.0	33.0 - 35.0	35.0 - 47.0	37.00 - 47.00	10	2	Active
CCR-AP-3I	Ash Pond	January 2019	**318653.79	**146643.51	450.35	450.35	0.0 - 63.5	63.5 - 67.5	67.5 - 77.8	67.50 - 77.50	10	2	Active
CCR-AP-4R	Ash Pond	July 2016	2772827.01	966741.47	472.80	475.38	0.0 - 34.0	34.0 - 36.0	36.0 - 48.0	38.00 - 48.00	10	2	Active
CCR-AP-5R	Ash Pond	March 2016	2771019.65	968165.74	453.20	453.14	0.0 - 31.0	31.0 - 33.0	33.0 - 45.0	35.00 - 45.00	10	2	Active
CCR-AP-6	Ash Pond	March 2016	2771626.75	969932.76	458.90	461.57	0.0 - 25.0	25.0 - 27.0	27.0 - 39.0	29.00 - 39.00	10	2	Active
CCR-AP-7R	Ash Pond	July 2016	2773501.63	970758.70	486.00	488.57	0.0 - 39.5	39.5 - 41.5	41.5 - 53.5	43.50 - 53.50	10	2	Active
CCR-AP-8	Ash Pond	January 2019	**317746.04	**149793.38	413.97	417.17	0.0 - 2.0	2.0 - 4.2	4.2 - 16.5	6.20 - 16.20	10	2	Active
CCR-AP-9	Ash Pond	January 2019	**316940.58	**147282.61	392.51	392.51	0.0 - 19.5	19.5 - 22.5	22.5 - 35.5	25.20 - 35.20	10	2	Active
CCR-AP-10	Ash Pond	January 2019	**319549.96	**146467.58	471.46	474.34	0.0 - 29.2	29.2 - 31.2	31.2 - 43.5	33.20 - 43.20	10	2	Active
CCR-AP-11	Ash Pond	May 2020	2768459.21	967930.60	373.64	376.72	0.0 - 12.0	12.0 - 14.0	14.0 - 26.0	16.00 - 26.00	10	2	Active
CCR-BK-1R	Background	March 2016	2770919.08	974083.40	480.10	483.39	0.0 - 50.0	50.0 - 52.0	52.0 - 64.0	54.00 - 64.00	10	2	Active
CCR-BK-2	Background	March 2016	2769728.14	972854.33	427.50	430.60	0.0 - 11.5	11.5 - 13.5	13.5 - 25.5	15.50 - 25.50	10	2	Active
APPW-1I	Ash Pond	November 2018	-	-	-	-	+	12.0 - 14.0	14.0 - 20.0	15.00 - 20.00	5	2	Destroyed
APPW-1D	Ash Pond	November 2018	-	-	-	-	+	24.0 - 28.0	28.0 - 29.0	29.00 - 34.00	5	2	Destroyed
APPW-2S	Ash Pond	November 2018	-	-	-	-	+	10.0 - 12.0	13.0 - 19.0	14.00 - 19.00	5	2	Destroyed
APPW-2I	Ash Pond	November 2018	-	-	-	-	+	26.0 - 28.0	28.0 - 34.0	29.00 - 34.00	5	2	Destroyed
APPW-2D	Ash Pond	November 2018	-	-	-	-	+	34.0 - 38.0	38.0 - 44.0	39.00 - 44.00	5	2	Destroyed
APPW-3	Ash Pond	November 2018	-	-	-	-	+	16.0 - 18.0	18.0 - 29.0	19.00 - 29.00	10	2	Destroyed
APPW-4S	Ash Pond	November 2018	-	-	-	-	+	12.0 - 14.0	14.0 - 20.0	15.00 - 20.00	5	2	Destroyed
APPW-4I	Ash Pond	November 2018	-	-	-	-	+	34.0 - 36.0	36.0 - 42.0	37.00 - 42.00	5	2	Destroyed
APPW-4D	Ash Pond	November 2018	-	-	-	-	+	42.0 - 47.0	47.0 - 54.0	49.00 - 54.00	5	2	Destroyed
APPW-5I	Ash Pond	November 2018	-	-	-	-	+	10.0 - 12.0	12.0 - 18.0	13.00 - 18.00	5	2	Destroyed
APPW-5D	Ash Pond	November 2018	-	-	-	-	+	17.0 - 23.0	23.0 - 29.0	24.00 - 29.00	5	2	Destroyed
HA-PP-1*	Ash Pond	May 2020	2769934.70	967323.16	381.12	381.82	+	+	+	2.50 - 3.50	1	1	Active
HA-PP-2*	Ash Pond	May 2020	2769922.20	967290.63	380.87	381.51	+	+	+	2.50 - 3.50	1	1	Active
FD-PZ-1	Ash Pond	May 2020	2771101.58	968746.38	418.94	418.94	0.0 - 9.5	9.5 - 11.5	11.5 - 13.5	13.50 - 18.50	5	1	Active
FD-PZ-2	Ash Pond	May 2020	2771272.40	969128.98	423.37	423.34	0.0 - 20.0	20.0 - 22.0	22.0 - 34.0	24.00 - 34.00	10	1	Active
FD-PZ-3S	Ash Pond	March 2021	2771178.58	968663.70	420.45	420.09	0.0 - 6.0	6.0 - 7.6	7.6 - 19.6	9.60 - 19.60	10	2	Active
FD-PZ-3D	Ash Pond	March 2021	2771181.92	968659.62	420.67	420.30	0.0 - 20.0	20.0 - 22.0	22.0 - 34.0	24.00 - 34.00	10	2	Active
FD-PZ-4	Ash Pond	March 2021	2771055.46	968516.03	419.74	419.19	0.0 - 8.0	8.0 - 11.0	11.0 - 23.0	13.00 - 23.00	10	2	Active

Notes and Abbreviations:

bgs = below ground surface
- = not been surveyed
+ = Natural collaspe
ft = feet
in = inches
msl = mean sea level
Datum of Elevations in NAVD 88
**Water levels only*
***Elevation of wells is based on IN State Plane (US Foot) West NAD27*

FIGURES



MAP SOURCE: ESRI

SITE COORDINATES: 37°54'25"N, 87°42'55"W

42796-000_1_LOCUS.PDF

HALEY ALDRICH

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
A.B. BROWN GENERATING STATION
MT. VERNON, INDIANA 47620

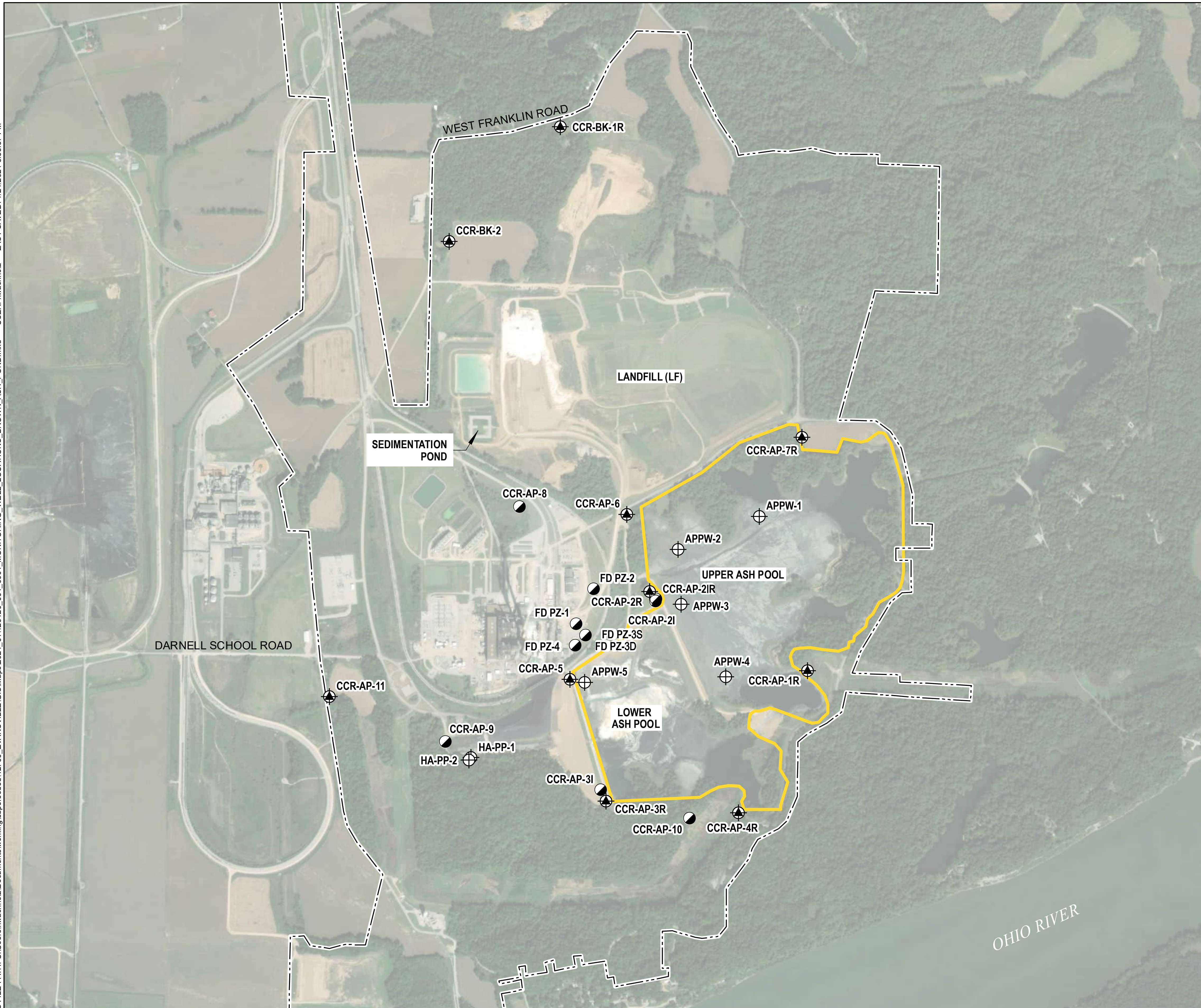
SITE LOCATION MAP

APPROXIMATE SCALE: 1 IN = 2000 FT

SEPTEMBER 2022

FIGURE 1

GIS FILE PATH: C:\Users\hwachholz\Documents\working\superseded\42796_EVANSVILLE\GIS\Maps\2021_01\129420_001_0001_MONITORING_WELL_LOCATIONS_BROWN_ASH_POND.mxd — USER: hwachholz — LAST SAVED: 1/21/2021 3:58:37 PM



LEGEND

- CCR MONITORING WELL
- NATURE AND EXTENT MONITORING WELL
- CCR PIEZOMETER WELL
- APPROXIMATE UNIT BOUNDARY

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

0 1,100 2,200
SCALE IN FEET

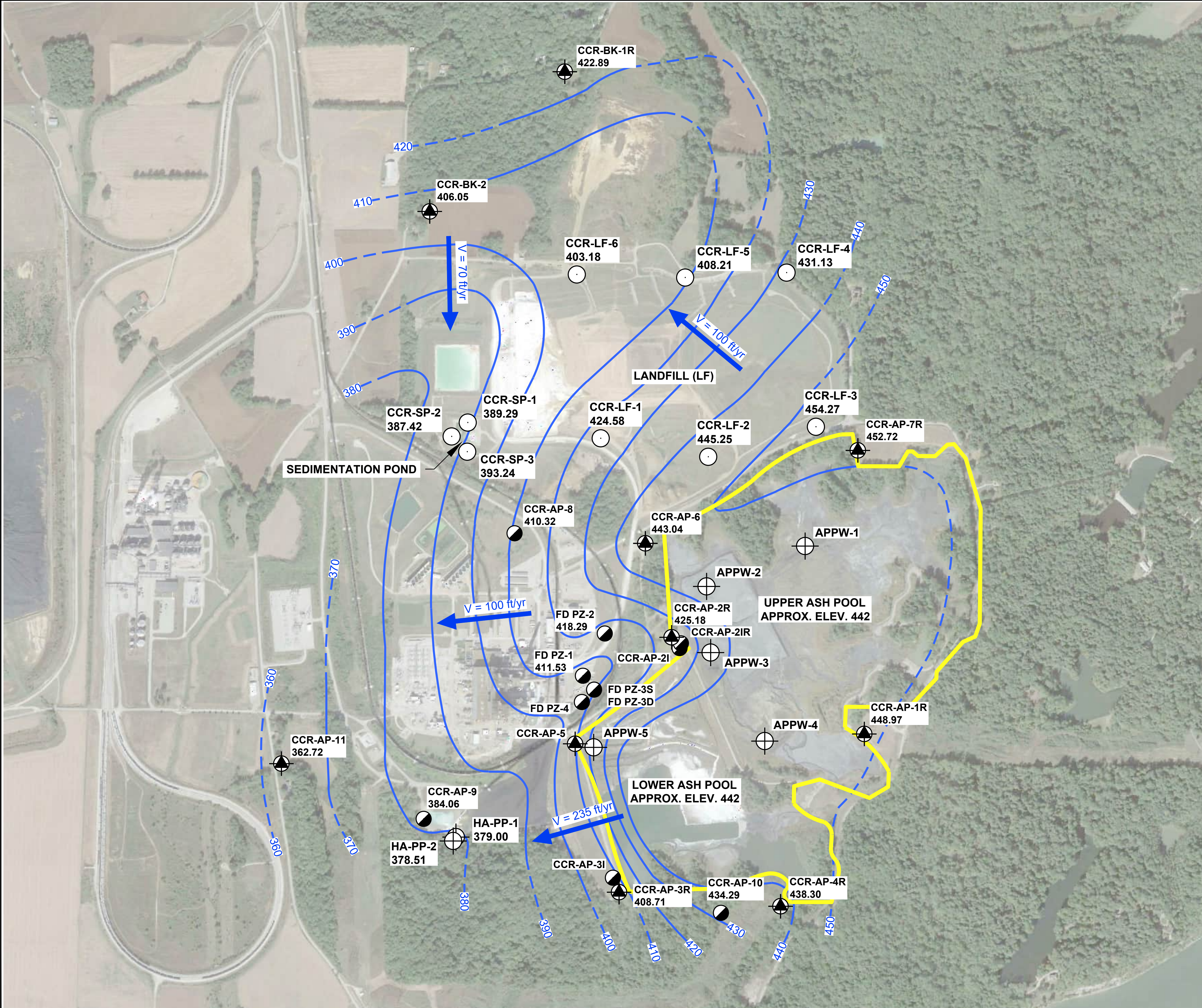
HALEY ALDRICH

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
A.B. BROWN GENERATING STATION
MOUNT VERNON, INDIANA

GROUNDWATER MONITORING
WELL LOCATIONS - ASH POND

SEPTEMBER 2022

FIGURE 2



LEGEND

- CCR MONITORING WELL
- NATURE AND EXTENT MONITORING WELL
- CCR PIEZOMETER WELL
- SEDIMENTATION POND AND LANDFILL CCR MONITORING WELL
- ASH POND UNIT BOUNDARY
- GROUNDWATER ELEVATION CONTOUR, 10-FT INTERVAL DASHED WHERE INFERRED

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. APPROXIMATE GROUNDWATER FLOW RATE CALCULATED USING $V = ki/n_e$ where
   - V = GROUNDWATER FLOW VELOCITY IN FEET PER YEAR
   - k = HORIZONTAL HYDRAULIC CONDUCTIVITY IN FEET PER DAY
   - i = HORIZONTAL GROUNDWATER GRADIENT IN FEET PER FOOT
   - n_e = ASSUMED EFFECTIVE PEROSITY
3. K = 2.3 FEET PER DAY
4. n_e = 0.25
5. CCR = COAL COMBUSTION RESIDUALS
6. AERIAL IMAGERY SOURCE: GOOGLE 2018

N

0 900 1800
SCALE IN FEET

HALEY ALDRICH

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
A.B. BROWN GENERATING STATION
MOUNT VERNON, INDIANA

WATER TABLE CONFIGURATION MAP NOVEMBER 2021

SCALE: AS SHOWN
SEPTEMBER 2022

FIGURE 3

KRAKORA, MATTHEW Printed: 3/1/2022 12:57 PM Layout: 1
\\HALEYALDRICH.COM\SHARE\CF\PROJECTS\129420\CAD\FIGURES\CORRECTIVE MEASURES\BROWN\129420-021_BRO_GW FLOW MAP_NOVEMBER 2021_V2.DWG

APPENDIX A
40 CFR §257.90 through §257.98, revised 2016 August 5, 40 CFR §257, and Appendices III – IV

following the date of initial receipt of CCR in the CCR unit.

(4) *Frequency of inspections.* (i) Except as provided for in paragraph (b)(4)(ii) of this section, the owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(6).

(ii) In any calendar year in which both the periodic inspection by a qualified professional engineer and the quinquennial (occurring every five years) structural stability assessment by a qualified professional engineer required by §§ 257.73(d) and 257.74(d) are required to be completed, the annual inspection is not required, provided the structural stability assessment is completed during the calendar year. If the annual inspection is not conducted in a year as provided by this paragraph (b)(4)(ii), the deadline for completing the next annual inspection is one year from the date of completing the quinquennial structural stability assessment.

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

§ 257.84 Inspection requirements for CCR landfills.

(a) *Inspections by a qualified person.* (1) All CCR landfills and any lateral expansion of a CCR landfill must be examined by a qualified person as follows:

(i) At intervals not exceeding seven days, inspect for any appearances of actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit; and

(ii) The results of the inspection by a qualified person must be recorded in the facility's operating record as required by § 257.105(g)(8).

(2) *Timeframes for inspections by a qualified person*—(i) *Existing CCR landfills.* The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section no later than October 19, 2015.

(ii) *New CCR landfills and any lateral expansion of a CCR landfill.* The owner or operator of the CCR unit must initiate the inspections required under paragraph (a) of this section upon initial receipt of CCR by the CCR unit.

(b) *Annual inspections by a qualified professional engineer.* (1) Existing and new CCR landfills and any lateral expansion of a CCR landfill must be inspected on a periodic basis by a qualified professional engineer to ensure that the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. The inspection must, at a minimum, include:

(i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (*e.g.*, the results of inspections by a qualified person, and results of previous annual inspections); and

(ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

(2) *Inspection report.* The qualified professional engineer must prepare a report following each inspection that addresses the following:

(i) Any changes in geometry of the structure since the previous annual inspection;

(ii) The approximate volume of CCR contained in the unit at the time of the inspection;

(iii) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and

(iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.

(3) *Timeframes for conducting the initial inspection*—(i) *Existing CCR landfills.* The owner or operator of the CCR unit must complete the initial inspection required by paragraphs (b)(1) and (2) of this section no later than January 18, 2016.

(ii) *New CCR landfills and any lateral expansion of a CCR landfill.* The owner or operator of the CCR unit must complete the initial annual inspection required by paragraphs (b)(1) and (2) of this section no later than 14 months following the date of initial receipt of CCR in the CCR unit.

(4) *Frequency of inspections.* The owner or operator of the CCR unit must conduct the inspection required by paragraphs (b)(1) and (2) of this section on an annual basis. The date of completing the initial inspection report is the basis for establishing the deadline to complete the first subsequent inspection. Any required inspection may be conducted prior to the required deadline provided the owner or operator places the completed inspection report into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent inspection reports is based on the date of completing the previous inspection report. For purposes of this section, the owner or operator has completed an inspection when the inspection report has been placed in the facility's operating record as required by § 257.105(g)(9).

(5) If a deficiency or release is identified during an inspection, the owner or operator must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(c) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

Groundwater Monitoring and Corrective Action

§ 257.90 Applicability.

(a) Except as provided for in § 257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §§ 257.90 through 257.98.

(b) *Initial timeframes*—(1) *Existing CCR landfills and existing CCR surface impoundments.* No later than October 17, 2017, the owner or operator of the CCR unit must be in compliance with the following groundwater monitoring requirements:

(i) Install the groundwater monitoring system as required by § 257.91;

(ii) Develop the groundwater sampling and analysis program to include selection of the statistical procedures to be used for evaluating groundwater monitoring data as required by § 257.93;

(iii) Initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background and downgradient well as required by § 257.94(b); and

(iv) Begin evaluating the groundwater monitoring data for statistically significant increases over background levels for the constituents listed in appendix III of this part as required by § 257.94.

(2) *New CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units.* Prior to initial receipt of CCR by the CCR unit, the owner or operator must be in compliance with the groundwater monitoring requirements specified in paragraph (b)(1)(i) and (ii) of this section. In addition, the owner or operator of the CCR unit must initiate the detection monitoring program to include obtaining a minimum of eight independent samples for each background well as required by § 257.94(b).

(c) Once a groundwater monitoring system and groundwater monitoring program has been established at the CCR unit as required by this subpart, the owner or operator must conduct groundwater monitoring and, if necessary, corrective action throughout the active life and post-closure care period of the CCR unit.

(d) In the event of a release from a CCR unit, the owner or operator must immediately take all necessary measures to control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of contaminants into the environment. The owner or operator of the CCR unit must comply with all applicable requirements in §§ 257.96, 257.97, and 257.98.

(e) *Annual groundwater monitoring and corrective action report.* For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by § 257.105(h)(1). At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:

(1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;

(2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;

(3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;

(4) A narrative discussion of any transition between monitoring programs (*e.g.*, the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and

(5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

§ 257.91 Groundwater monitoring systems.

(a) *Performance standard.* The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that:

(1) Accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where:

(i) Hydrogeologic conditions do not allow the owner or operator of the CCR unit to determine what wells are hydraulically upgradient; or

(ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and

(2) Accurately represent the quality of groundwater passing the waste boundary of the CCR unit. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer. All potential contaminant pathways must be monitored.

(b) The number, spacing, and depths of monitoring systems shall be determined based upon site-specific technical information that must include thorough characterization of:

(1) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and

(2) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

(c) The groundwater monitoring system must include the minimum number of monitoring wells necessary to meet the performance standards specified in paragraph (a) of this section, based on the site-specific information specified in paragraph (b) of this section. The groundwater monitoring system must contain:

(1) A minimum of one upgradient and three downgradient monitoring wells; and

(2) Additional monitoring wells as necessary to accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and the quality of groundwater passing the waste boundary of the CCR unit.

(d) The owner or operator of multiple CCR units may install a multiunit groundwater monitoring system instead of separate groundwater monitoring systems for each CCR unit.

(1) The multiunit groundwater monitoring system must be equally as capable of detecting monitored constituents at the waste boundary of

the CCR unit as the individual groundwater monitoring system specified in paragraphs (a) through (c) of this section for each CCR unit based on the following factors:

(i) Number, spacing, and orientation of each CCR unit;

(ii) Hydrogeologic setting;

(iii) Site history; and

(iv) Engineering design of the CCR unit.

(2) If the owner or operator elects to install a multiunit groundwater monitoring system, and if the multiunit system includes at least one existing unlined CCR surface impoundment as determined by § 257.71(a), and if at any time after October 19, 2015 the owner or operator determines in any sampling event that the concentrations of one or more constituents listed in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under § 257.95(h) for the multiunit system, then all unlined CCR surface impoundments comprising the multiunit groundwater monitoring system are subject to the closure requirements under § 257.101(a) to retrofit or close.

(e) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (*i.e.*, the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

(1) The owner or operator of the CCR unit must document and include in the operating record the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices. The qualified professional engineer must be given access to this documentation when completing the groundwater monitoring system certification required under paragraph (f) of this section.

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to the design specifications throughout the life of the monitoring program.

(f) The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of this section. If the groundwater monitoring system includes the minimum number of monitoring wells specified in paragraph (c)(1) of this section, the certification must document the basis supporting this determination.

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

§ 257.92 [Reserved]

§ 257.93 Groundwater sampling and analysis requirements.

(a) The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells required by § 257.91. The owner or operator of the CCR unit must develop a sampling and analysis program that includes procedures and techniques for:

(1) Sample collection;

(2) Sample preservation and shipment;

(3) Analytical procedures;

(4) Chain of custody control; and

(5) Quality assurance and quality control.

(b) The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. For purposes of §§ 257.90 through 257.98, the term *constituent* refers to both hazardous constituents and other monitoring parameters listed in either appendix III or IV of this part.

(c) Groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled. The owner or operator of the CCR unit must determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same CCR management area must be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.

(d) The owner or operator of the CCR unit must establish background groundwater quality in a hydraulically upgradient or background well(s) for each of the constituents required in the particular groundwater monitoring program that applies to the CCR unit as determined under § 257.94(a) or § 257.95(a). Background groundwater quality may be established at wells that are not located hydraulically upgradient from the CCR unit if it meets the requirements of § 257.91(a)(1).

(e) The number of samples collected when conducting detection monitoring and assessment monitoring (for both downgradient and background wells) must be consistent with the statistical procedures chosen under paragraph (f) of this section and the performance standards under paragraph (g) of this section. The sampling procedures shall be those specified under § 257.94(b) through (d) for detection monitoring, § 257.95(b) through (d) for assessment monitoring, and § 257.96(b) for corrective action.

(f) The owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of this section to be used in evaluating groundwater monitoring data for each specified constituent. The statistical test chosen shall be conducted separately for each constituent in each monitoring well.

(1) A parametric analysis of variance followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of paragraph (g) of this section.

(6) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.

(g) Any statistical method chosen under paragraph (f) of this section shall comply with the following performance standards, as appropriate, based on the statistical test method used:

(1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of constituents. Normal distributions of data values shall use parametric methods. Non-normal distributions shall use non-parametric methods. If the distribution of the constituents is shown by the owner or operator of the CCR unit to be inappropriate for a normal theory test, then the data must be transformed or a distribution-free (non-parametric) theory test must be used. If the distributions for the constituents differ, more than one statistical method may be needed.

(2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.

(3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. The parameter values shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any other approach in this section for evaluating groundwater data. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(5) The statistical method must account for data below the limit of detection with one or more statistical procedures that shall at least as effective as any other approach in this section for evaluating groundwater data. Any practical quantitation limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

(6) If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

(h) The owner or operator of the CCR unit must determine whether or not there is a statistically significant increase over background values for each constituent required in the particular groundwater monitoring program that applies to the CCR unit, as determined under § 257.94(a) or § 257.95(a).

(1) In determining whether a statistically significant increase has occurred, the owner or operator must compare the groundwater quality of each constituent at each monitoring well designated pursuant to § 257.91(a)(2) or (d)(1) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs (f) and (g) of this section.

(2) Within 90 days after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for any constituent at each monitoring well.

(i) The owner or operator must measure "total recoverable metals" concentrations in measuring groundwater quality. Measurement of total recoverable metals captures both the particulate fraction and dissolved fraction of metals in natural waters. Groundwater samples shall not be field-filtered prior to analysis.

(j) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.94 Detection monitoring program.

(a) The owner or operator of a CCR unit must conduct detection monitoring at all groundwater monitoring wells consistent with this section. At a minimum, a detection monitoring program must include groundwater monitoring for all constituents listed in appendix III to this part.

(b) Except as provided in paragraph (d) of this section, the monitoring frequency for the constituents listed in appendix III to this part shall be at least semiannual during the active life of the CCR unit and the post-closure period. For existing CCR landfills and existing CCR surface impoundments, a minimum of eight independent samples from each background and downgradient well must be collected and analyzed for the constituents listed in appendix III and IV to this part no later than October 17, 2017. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, a minimum of eight independent samples for each background well must be collected and analyzed for the constituents listed in appendices III and IV to this part during the first six months of sampling.

(c) The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background and downgradient well.

(d) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix III to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (d)(1) and (2) of this section.

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:

(i) Lithology of the aquifer and unsaturated zone;

(ii) Hydraulic conductivity of the aquifer and unsaturated zone; and

(iii) Groundwater flow rates.

(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay establishment of an assessment monitoring program.

(3) The owner or operator must obtain a certification from a qualified

professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(e) If the owner or operator of the CCR unit determines, pursuant to § 257.93(h) that there is a statistically significant increase over background levels for one or more of the constituents listed in appendix III to this part at any monitoring well at the waste boundary specified under § 257.91(a)(2), the owner or operator must:

(1) Except as provided for in paragraph (e)(2) of this section, within 90 days of detecting a statistically significant increase over background levels for any constituent, establish an assessment monitoring program meeting the requirements of § 257.95.

(2) The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(3) The owner or operator of a CCR unit must prepare a notification stating that an assessment monitoring program has been established. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(5).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.95 Assessment monitoring program.

(a) Assessment monitoring is required whenever a statistically significant increase over background levels has been detected for one or more of the constituents listed in appendix III to this part.

(b) Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator of the CCR unit must sample and analyze the groundwater for all constituents listed in appendix IV to this part. The number of samples collected and analyzed for each well during each sampling event must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each well.

(c) The owner or operator of a CCR unit may demonstrate the need for an alternative monitoring frequency for repeated sampling and analysis for constituents listed in appendix IV to this part during the active life and the post-closure care period based on the availability of groundwater. If there is not adequate groundwater flow to sample wells semiannually, the alternative frequency shall be no less than annual. The need to vary monitoring frequency must be evaluated on a site-specific basis. The demonstration must be supported by, at a minimum, the information specified in paragraphs (c)(1) and (2) of this section.

(1) Information documenting that the need for less frequent sampling. The alternative frequency must be based on consideration of the following factors:

(i) Lithology of the aquifer and unsaturated zone;

(ii) Hydraulic conductivity of the aquifer and unsaturated zone; and

(iii) Groundwater flow rates.

(2) Information documenting that the alternative frequency will be no less effective in ensuring that any leakage from the CCR unit will be discovered within a timeframe that will not materially delay the initiation of any necessary remediation measures.

(3) The owner or operator must obtain a certification from a qualified professional engineer stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(d) After obtaining the results from the initial and subsequent sampling events required in paragraph (b) of this section, the owner or operator must:

(1) Within 90 days of obtaining the results, and on at least a semiannual basis thereafter, resample all wells that were installed pursuant to the requirements of § 257.91, conduct analyses for all parameters in appendix III to this part and for those constituents in appendix IV to this part that are detected in response to paragraph (b) of this section, and record their concentrations in the facility operating record. The number of samples collected and analyzed for each background well and downgradient well during subsequent semiannual sampling events must be consistent with § 257.93(e), and must account for any unique characteristics of the site, but must be at least one sample from each background and downgradient well;

(2) Establish groundwater protection standards for all constituents detected pursuant to paragraph (b) or (d) of this section. The groundwater protection standards must be established in accordance with paragraph (h) of this section; and

(3) Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).

(e) If the concentrations of all constituents listed in appendices III and IV to this part are shown to be at or below background values, using the statistical procedures in § 257.93(g), for two consecutive sampling events, the owner or operator may return to detection monitoring of the CCR unit. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(7).

(f) If the concentrations of any constituent in appendices III and IV to this part are above background values, but all concentrations are below the groundwater protection standard established under paragraph (h) of this section, using the statistical procedures in § 257.93(g), the owner or operator must continue assessment monitoring in accordance with this section.

(g) If one or more constituents in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard established under paragraph (h) of this section in any sampling event, the owner or operator must prepare a notification identifying the constituents in appendix IV to this part that have exceeded the groundwater protection standard. The owner or operator has completed the notification when the notification is placed in the facility's operating record as required by § 257.105(h)(8). The owner or operator of the CCR unit also must:

(1) Characterize the nature and extent of the release and any relevant site conditions that may affect the remedy ultimately selected. The characterization must be sufficient to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the CCR unit pursuant to § 257.96. Characterization of the release includes the following minimum measures:

(i) Install additional monitoring wells necessary to define the contaminant plume(s);

(ii) Collect data on the nature and estimated quantity of material released including specific information on the constituents listed in appendix IV of this part and the levels at which they are present in the material released;

(iii) Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (d)(1) of this section; and

(iv) Sample all wells in accordance with paragraph (d)(1) of this section to characterize the nature and extent of the release.

(2) Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells in accordance with paragraph (g)(1) of this section. The owner or operator has completed the notifications when they are placed in the facility's operating record as required by § 257.105(h)(8).

(3) Within 90 days of finding that any of the constituents listed in appendix IV to this part have been detected at a statistically significant level exceeding the groundwater protection standards the owner or operator must either:

(i) Initiate an assessment of corrective measures as required by § 257.96; or

(ii) Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(4) If a successful demonstration has not been made at the end of the 90 day period provided by paragraph (g)(3)(ii) of this section, the owner or operator of the CCR unit must initiate the assessment of corrective measures requirements under § 257.96.

(5) If an assessment of corrective measures is required under § 257.96 by either paragraph (g)(3)(i) or (g)(4) of this section, and if the CCR unit is an existing unlined CCR surface impoundment as determined by § 257.71(a), then the CCR unit is subject to the closure requirements under § 257.101(a) to retrofit or close. In addition, the owner or operator must prepare a notification stating that an assessment of corrective measures has been initiated.

(h) The owner or operator of the CCR unit must establish a groundwater protection standard for each constituent in appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been established under §§ 141.62 and 141.66 of this title, the MCL for that constituent;

(2) For constituents for which an MCL has not been established, the background concentration for the constituent established from wells in accordance with § 257.91; or

(3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

(i) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.96 Assessment of corrective measures.

(a) Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer.

(b) The owner or operator of the CCR unit must continue to monitor groundwater in accordance with the assessment monitoring program as specified in § 257.95.

(c) The assessment under paragraph (a) of this section must include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97 addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

(d) The owner or operator must place the completed assessment of corrective measures in the facility's operating record. The assessment has been completed when it is placed in the facility's operating record as required by § 257.105(h)(10).

(e) The owner or operator must discuss the results of the corrective measures assessment at least 30 days prior to the selection of remedy, in a public meeting with interested and affected parties.

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.97 Selection of remedy.

(a) Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator must, as soon as feasible, select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. This requirement applies to, not in place of, any applicable standards under the Occupational Safety and Health Act. The owner or operator must prepare a semiannual report describing the progress in selecting and designing the remedy. Upon selection of a remedy, the owner or operator must prepare a final report describing the selected remedy and how it meets the standards specified in paragraph (b) of this section. The owner or operator must obtain a certification from a qualified professional engineer that the remedy selected meets the requirements of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(12).

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to § 257.95(h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in appendix IV to this part into the environment;

(4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems;

(5) Comply with standards for management of wastes as specified in § 257.98(d).

(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR unit shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminant;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases; and

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

(d) The owner or operator must specify as part of the selected remedy a schedule(s) for implementing and completing remedial activities. Such a schedule must require the completion of remedial activities within a reasonable period of time taking into consideration the factors set forth in paragraphs (d)(1) through (6) of this section. The owner or operator of the CCR unit must consider the following factors in determining the schedule of remedial activities:

(1) Extent and nature of contamination, as determined by the characterization required under § 257.95(g);

(2) Reasonable probabilities of remedial technologies in achieving compliance with the groundwater protection standards established under § 257.95(h) and other objectives of the remedy;

(3) Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;

(4) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

(5) Resource value of the aquifer including:

(i) Current and future uses;

(ii) Proximity and withdrawal rate of users;

(iii) Groundwater quantity and quality;

(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents;

(v) The hydrogeologic characteristic of the facility and surrounding land; and

(vi) The availability of alternative water supplies; and

(6) Other relevant factors.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the Internet requirements specified in § 257.107(h).

§ 257.98 Implementation of the corrective action program.

(a) Within 90 days of selecting a remedy under § 257.97, the owner or operator must initiate remedial activities. Based on the schedule established under § 257.97(d) for implementation and completion of remedial activities the owner or operator must:

(1) Establish and implement a corrective action groundwater monitoring program that:

(i) At a minimum, meets the requirements of an assessment monitoring program under § 257.95;

(ii) Documents the effectiveness of the corrective action remedy; and

(iii) Demonstrates compliance with the groundwater protection standard pursuant to paragraph (c) of this section.

(2) Implement the corrective action remedy selected under § 257.97; and

(3) Take any interim measures necessary to reduce the contaminants leaching from the CCR unit, and/or potential exposures to human or ecological receptors. Interim measures must, to the greatest extent feasible, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to § 257.97. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:

(i) Time required to develop and implement a final remedy;

(ii) Actual or potential exposure of nearby populations or environmental receptors to any of the constituents listed in appendix IV of this part;

(iii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iv) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

(v) Weather conditions that may cause any of the constituents listed in appendix IV to this part to migrate or be released;

(vi) Potential for exposure to any of the constituents listed in appendix IV to this part as a result of an accident or failure of a container or handling system; and

(vii) Other situations that may pose threats to human health and the environment.

(b) If an owner or operator of the CCR unit, determines, at any time, that compliance with the requirements of § 257.97(b) is not being achieved through the remedy selected, the owner or operator must implement other methods or techniques that could feasibly achieve compliance with the requirements.

(c) Remedies selected pursuant to § 257.97 shall be considered complete when:

(1) The owner or operator of the CCR unit demonstrates compliance with the groundwater protection standards established under § 257.95(h) has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under § 257.91.

(2) Compliance with the groundwater protection standards established under § 257.95(h) has been achieved by demonstrating that concentrations of constituents listed in appendix IV to this part have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in § 257.93(f) and (g).

(3) All actions required to complete the remedy have been satisfied.

(d) All CCR that are managed pursuant to a remedy required under § 257.97, or an interim measure required under paragraph (a)(3) of this section, shall be managed in a manner that complies with all applicable RCRA requirements.

(e) Upon completion of the remedy, the owner or operator must prepare a notification stating that the remedy has been completed. The owner or operator must obtain a certification from a qualified professional engineer attesting that the remedy has been completed in compliance with the requirements of paragraph (c) of this section. The report has been completed when it is placed in the operating record as required by § 257.105(h)(13).

(f) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(h), the notification requirements specified in § 257.106(h), and the internet requirements specified in § 257.107(h).

Closure and Post-Closure Care

§ 257.100 Inactive CCR surface impoundments.

(a) Except as provided by paragraph (b) of this section, inactive CCR surface impoundments are subject to all of the requirements of this subpart applicable to existing CCR surface impoundments.

(b) An owner or operator of an inactive CCR surface impoundment that completes closure of such CCR unit, and meets all of the requirements of either paragraphs (b)(1) through (4) of this section or paragraph (b)(5) of this section no later than April 17, 2018, is exempt from all other requirements of this subpart.

(1) *Closure by leaving CCR in place.* If the owner or operator of the inactive CCR surface impoundment elects to close the CCR surface impoundment by leaving CCR in place, the owner or operator must ensure that, at a minimum, the CCR unit is closed in a manner that will:

(i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;

(ii) Preclude the probability of future impoundment of water, sediment, or slurry;

(iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system; and

(iv) Minimize the need for further maintenance of the CCR unit.

(2) The owner or operator of the inactive CCR surface impoundment must meet the requirements of paragraphs (b)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (b)(3) of this section.

(i) Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.

(ii) Remaining wastes must be stabilized sufficient to support the final cover system.

(3) The owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (b)(3)(i) of this section, or the requirements of an alternative final cover system specified in paragraph (b)(3)(ii) of this section.

(i) The final cover system must be designed and constructed to meet the criteria specified in paragraphs (b)(3)(i)(A) through (D) of this section.

(A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} centimeters/second, whichever is less.

(B) The infiltration of liquids through the CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.

(C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.

(D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

(ii) The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (b)(3)(ii)(A) through (C) of this section.

(A) The design of the final cover system must include an infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (b)(3)(i)(A) and (B) of this section.

(B) The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (b)(3)(i)(C) of this section.

deficiency or release specified under § 257.105(f)(11).

(11) The initial and periodic safety factor assessments specified under § 257.105(f)(12).

(12) The design and construction plans, and any revisions of them, specified under § 257.105(f)(13).

(g) *Operating criteria.* The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The CCR fugitive dust control plan, or any subsequent amendment of the plan, specified under § 257.105(g)(1) except that only the most recent plan must be maintained on the CCR Web site irrespective of the time requirement specified in paragraph (c) of this section.

(2) The annual CCR fugitive dust control report specified under § 257.105(g)(2).

(3) The initial and periodic run-on and run-off control system plans specified under § 257.105(g)(3).

(4) The initial and periodic inflow design flood control system plans specified under § 257.105(g)(4).

(5) The periodic inspection reports specified under § 257.105(g)(6).

(6) The documentation detailing the corrective measures taken to remedy the deficiency or release specified under § 257.105(g)(7).

(7) The periodic inspection reports specified under § 257.105(g)(9).

(h) *Groundwater monitoring and corrective action.* The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The annual groundwater monitoring and corrective action report specified under § 257.105(h)(1).

(2) The groundwater monitoring system certification specified under § 257.105(h)(3).

(3) The selection of a statistical method certification specified under § 257.105(h)(4).

(4) The notification that an assessment monitoring programs has been established specified under § 257.105(h)(5).

(5) The notification that the CCR unit is returning to a detection monitoring program specified under § 257.105(h)(7).

(6) The notification that one or more constituents in appendix IV to this part have been detected at statistically significant levels above the groundwater protection standard and the notifications to land owners specified under § 257.105(h)(8).

(7) The notification that an assessment of corrective measures has been initiated specified under § 257.105(h)(9).

(8) The assessment of corrective measures specified under § 257.105(h)(10).

(9) The semiannual reports describing the progress in selecting and designing remedy and the selection of remedy report specified under § 257.105(h)(12), except that the selection of the remedy report must be maintained until the remedy has been completed.

(10) The notification that the remedy has been completed specified under § 257.105(h)(13).

(i) *Closure and post-closure care.* The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The notification of intent to initiate closure of the CCR unit specified under § 257.105(i)(1).

(2) The annual progress reports of closure implementation specified under § 257.105(i)(2).

(3) The notification of closure completion specified under § 257.105(i)(3).

(4) The written closure plan, and any amendment of the plan, specified under § 257.105(i)(4).

(5) The demonstration(s) for a time extension for initiating closure specified under § 257.105(i)(5).

(6) The demonstration(s) for a time extension for completing closure specified under § 257.105(i)(6).

(7) The notification of intent to close a CCR unit specified under § 257.105(i)(7).

(8) The notification of completion of closure of a CCR unit specified under § 257.105(i)(8).

(9) The notification recording a notation on the deed as required by § 257.105(i)(9).

(10) The notification of intent to comply with the alternative closure requirements as required by § 257.105(i)(10).

(11) The annual progress reports under the alternative closure requirements as required by § 257.105(i)(11).

(12) The written post-closure plan, and any amendment of the plan, specified under § 257.105(i)(12).

(13) The notification of completion of post-closure care specified under § 257.105(i)(13).

(j) *Retrofit criteria.* The owner or operator of a CCR unit subject to this subpart must place the following information on the owner or operator's CCR Web site:

(1) The written retrofit plan, and any amendment of the plan, specified under § 257.105(j)(1).

(2) The notification of intent to comply with the alternative retrofit requirements as required by § 257.105(j)(2).

(3) The annual progress reports under the alternative retrofit requirements as required by § 257.105(j)(3).

(4) The demonstration(s) for a time extension for completing retrofit activities specified under § 257.105(j)(4).

(5) The notification of intent to retrofit a CCR unit specified under § 257.105(j)(5).

(6) The notification of completion of retrofit activities specified under § 257.105(j)(6).

■ 5. Amend part 257 by adding "Appendix III to Part 257" and "Appendix IV to Part 257" to read as follows:

Appendix III to Part 257—Constituents for Detection Monitoring

Common name [1]
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids (TDS)

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common name [1]
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

PART 261—IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

■ 6. The authority citation for part 261 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, 6922, 6924(y) and 6938.

■ 7. Section 261.4 is amended by revising paragraph (b)(4) to read as follows:

APPENDIX G

Closure Cost Estimates

CLOSURE COST ESTIMATE
A.B. Brown Generating Station – Ash Pond

The closure cost estimate provided herein is not intended to be all inclusive of costs associated with closure work completed by SIGECO. The costs reported are intended to capture fundamental closure costs for the Ash Pond at A.B. Brown Generating Station. The costs include excavation and beneficial reuse of ash materials, earthwork to achieve final grades, final stabilization and other key costs. The costs included herein do not include elements such as infrastructure improvements; water management and treatment; engineering costs (other than those listed); owner burdened or indirect costs; risk; or escalation.

I. GENERAL INFORMATION

A. **Facility Name:** A.B. Brown Generating Station: Ash Pond

B. **Facility Location:** Approximately 9 miles southwest of Evansville, Indiana

C. **Facility County:** Posey

D. **Facility Solid Waste Permit No.:** N/A

E. **Total Closure Acreage:** Approximately 161 acres for Closure-by-Removal (CbR) of entire pond area.

II CLOSURE ACTIVITIES (Provide a description of the steps that will be used to partially close, if applicable, and finally close the facility.)

A. Removal of existing free water from the Ash Pond.

B. Dewatering of existing CCR materials to be excavated using a combination of gravity drainage (ditches and sumps) and positive dewatering methods (well points, etc.).

C. Excavation of CCR materials from within the Ash Pond, beginning in the Upper Pool and working from the northeast to the southwest until completion of excavation activities in the Lower Pool. Loading of CCR materials to the conveyor for transport to beneficial reuse site. Subsequent excavation of underlying CCR-impacted soils from these same areas.

D. Disposal of unusable CCR materials within the FGD Landfill.

E. Regrading of the site within minimum and maximum grades to promote drainage as well as limit erosion.

F. Construction of stormwater channels to promote drainage from the final grades. Once the site has been stabilized, clean non-contact stormwater will be routed via these stormwater channels through a breach in the Lower Dam to a new stormwater outfall to the unnamed tributary to the Ohio River.

G. Establish vegetative cover over the site and install erosion control measures, including, but not be limited to erosion control matting, riprap, rock check dams, etc.

H. Following completion of closure activities, a closure certification will be submitted to the Indiana Department of Environmental Management. This certification will be in accordance with the requirements of 329 IAC 10-30-7.

III. LABOR, MATERIALS, & TESTING (Provide a listing of items necessary to close the facility. For items that will vary depending upon the number of acres to be closed, the quantities should be indicated on a per acre basis.)

A. Item	B. Quantity	C. Unit Cost
Dewatering	Lump Sum	$10,340,000
Excavation of CCR	5,370,800 CY	$22,440,000 ($4.18/CY)
Excavation of Soil	77,500 CY	$320,000 ($4.13/CY)
Regrading of Excavated Areas	344,173 CY	$1,046,500 ($6,500/acre)
3-in Topsoil Layer	161 acres	$692,300 ($4,300/acre)
Vegetative Cover	161 acres	$273,700 ($1,700/acre)
Engineering Certification	Lump Sum	$100,000
Additional Items	Lump Sum	$16,130,000 (See Section VI.B.)
TOTAL (contingency not included)		**$51,340,000***

*Total rounded to the nearest $10,000.

IV EXPECTED YEAR OF CLOSURE

A. Expected Year of Closure 2034

B. Total Time Required to Close Facility approximately 11 years

C. Time Required for Intermediate Steps in Closure (Provide a description of intermediate closure activities and time required.)

1. **Excavation:** 123 months
2. **Earthwork:** 6 months
3. **Final Stabilization:** 3 months

V. COST PER ACRE FOR FINAL COVER & VEGETATION

A. What Percent of Final Cover and Topsoil is Available from Areas that are Controlled, and Will be Controlled through Post-Closure, by the Permittee?

1. **% of final cover:** 100%

2. **Describe location of sources:** Soil obtained from on-site excavations and from adjacent borrow area (owned by SIGECO)

3. **% of topsoil** 100%

4. **Describe location of sources** Soil obtained from local Borrow Area (owned by SIGECO)

B. Cost Per Acre for Acquisition and Placement of Soil for Final Grades

1. **Acquisition**

   a. **Quantity of soil needed per acre (cy/acre)** 2,137 CY/acre (344,173 CY total) – includes re-grading of onsite soils within pond footprint

   b. **Excavation unit cost ($/cy) (if obtained on-site)** $3.04/CY

   c. **Purchase unit cost ($/cy) (if obtained off-site)** $0

   d. **Delivery unit cost ($/cy) (if obtained off-site)** $0

   e. **Acquisition cost ($/acre) Line 1a * Line 1b (or) Line 1a * (Line 1c + Line 1d)** $6,500/acre

2. **Placement and Compaction**

   a. **Placement/spreading unit cost ($/cy)** Included in excavation unit cost (Sec. V.B.1.b)

   b. **Compaction unit cost ($/cy)** Included in excavation unit cost (Sec. V.B.1.b)

c. Placement and compaction cost ($/acre)
Line 1a * (Line 2a + Line 2b) — Included in Acquisition cost (Sec. V.B.1.e)

3. Testing

a. Soil classification (if soil source is of variable quality) ($/acre) — Included in Acquisition cost (Sec. V.B.1.e)

b. Survey control for cover thickness and proper slopes ($/acre) — Included in Acquisition cost (Sec. V.B.1.e)

c. Density testing (if planned) ($/acre) — not applicable

d. Testing cost ($/acre)
Line 3a + Line 3b + Line 3c — Included in Acquisition cost (Sec. V.B.1.e)

4. Soil Cover Cost ($/acre)
Line 1e + Line 2c + Line 3d — $6,500/acre

C. Cost Per Acre for Acquisition and Placement of 3" Topsoil Layer

1. Acquisition

a. Quantity of topsoil needed per acre (cy/acre) — 411 cy/acre (66,147 cy total)

b. Excavation unit cost ($/cy) (if obtained on-site) — Included in Purchase cost (Sec. V.C.1.c)

c. Purchase unit cost ($/cy) (if obtained off-site) — $10.45/cy

d. Delivery unit cost ($/cy) (if obtained off-site) — Included in Purchase cost (Sec. V.C.1.c)

e. Acquisition cost ($/acre)
Line 1a * Line 1b (or)
Line 1a * (Line 1c + Line 1d) — $4,300/acre

2. Placement and Compaction

a. Placement/spreading unit cost ($/cy) — Included in Purchase cost (Sec. V.C.1.c)

b. Compaction unit cost ($/cy) — Included in Purchase cost (Sec. V.C.1.c)

c. Placement and compaction cost ($/acre)
Line 1a * (Line 2a + Line 2b) — Included in Acquisition cost (Sec. V.C.1.e)

3. Testing

a. Soil classification (if soil source is of variable quality)($/acre) — Included in Purchase cost (Sec. V.C.1.c)

b. Survey control for cover thickness and proper slopes ($/acre) — Included in Purchase cost (Sec. V.C.1.c)

c. Density testing (if planned) ($/acre) — not applicable

d. Testing cost ($/acre)
Line 3a + Line 3b + Line 3c — Included in Purchase cost (Sec. V.C.1.c)

4. Soil Cover Cost ($/acre)
Line 1e + Line 2c + Line 3d — $4,300/acre

D. Cost Per Acre to Establish Vegetation

1. Vegetation

a. Seeding unit cost ($/acre) — Included in total below (Sec. V.D.1.d)

b. Fertilization unit cost ($/acre) — Included in total below (Sec. V.D.1.d)

c. Mulching unit cost ($/acre) — Included in total below (Sec. V.D.1.d)

d. Vegetation Establishment Cost ($/acre)
Line 1a + Line 1b + Line 1c — $1,700/acre

E. Cost Per Acre to Certify Closure

1. Registered Professional Engineer

a. Initial review of closure plan (hrs)	100
b. Total number of inspections	30
c. Inspection time required (hrs/visit)	16
d. Total inspection time (hrs) **Line 1b * Line 1c**	480
e. Prepare final documentation (hrs)	250
f. Total engineer time (hrs) **Line 1a + Line 1d + Line 1e**	830
g. Engineer unit labor cost ($/hr)	$120.00
h. Professional engineer cost ($) **Line 1f * Line 1g**	$100,000
i. Area of closure area (acres)	161
j. Closure Certification Cost ($/acre) **Line 1h / Line 1i**	$600/acre

F. Other Costs Per Acre for Final Cover and Vegetation

1. **Other Costs ($/acre) (Specify)** $0/acre
   a. No other per acre costs noted.

G. Total of Items B through F

$13,100/acre (Tot. = $2,109,100)

VI OTHER CLOSURE COSTS (Give these on a total facility basis rather than per acre.)

A. Notation of Property Deed $10,000

B. Other Costs

Cost for items such as drainage features, installation of gas vents, etc., should be delineated in this section.

1.

Activity	Cost
Mobilization / Demobilization	$720,000
Dewatering	$10,340,000
Temporary Access Roads/Staging Areas	$50,000
Piezometric Level Monitoring System	$270,000
Demolition	$70,000
Excavation of CCR for Beneficial Reuse	$22,440,000
Excavation of Soil	$320,000
Stormwater Management / E&S	$930,000
Surveying	$280,000
Pond Closure Engineering	$660,000
Project Management	$1,340,000
Construction Management	$8,690,000
Construction Quality Assurance	$3,110,000
Total Other Costs	$49,220,000

C. SubTotal (Add costs from Sections A. and B.) $49,230,000

D. Contingency (10% of Items V.G. and VI.C.) $5,130,000

E. Total (Add costs from Sections C. and D.) $54,360,000

VII CLOSURE COST ESTIMATE (Multiply Item I.E. by Item V.G. and then add Item (VI.E.): **$56,470,000**

VIII ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINANCIAL ASSURANCE ON AN INCREMENTAL BASIS

A. Will Closure Financial Assurance be Provided on an Incremental Basis? (If the answer to this question is no, skip to Item IX.) No

B. Map of Areas of Waste Deposition (Attach a copy of the facility's final contour map which shows the maximum areas of waste deposition on a yearly basis for the remaining life of the facility.) N/A

C. Maximum Areas of Waste Deposition & Closure Costs (Fill in the following table for each remaining year of the facility's life.)

Year	Max. Area of Waste Deposition (cumulative acres) (end of year)	Closure Cost w/o Partial Closure ($)	Area Partially Closed (cumulative acres) (start of year)	Increm. Closure ($)
N/A				

IX ENGINEER CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information.

Signature: Jay D. Mokotoff **Date:** 11/13/23

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