BOUNDLESS ENERGY™

Legal Department

American Electric Power
1 Riverside Plaza
Columbus, OH 43215-2373
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April 10, 2023

Ms. Tanowa Troupe, Secretary
Ohio Power Siting Board
180 East Broad Street
Columbus, Ohio 43215-3793

Hector Garcia
Senior Counsel –
Regulatory Services
(614) 716-3410 (P)
hgarcia1@aep.com

RE: Proof of Compliance with Condition
Case No. 22-0695-EL-BLN
Bokes Creek Station Project

Dear Ms. Troupe:

In satisfaction of Condition (2) of the Staff Report for this Project, AEP Ohio Transmission Company, Inc. submits this notice and attachment to inform you that the Ohio Environmental Protection Agency National Pollutant Discharge Elimination System-Construction Site Stormwater General Permit has been approved for the above-referenced Project.

If you have any questions regarding this information, please do not hesitate to contact me.

Respectfully submitted,

/s/ *Hector Garcia*
Hector Garcia (0084517), Counsel of Record
Counsel for AEP Ohio Transmission Company, Inc.

cc: John Jones, Counsel OPSB Staff
Jon Pawley, OPSB Staff

Bokes Creek IPP Switching Station

Union County, Ohio

LAT/LONG: 40.43874, -83.48368

STORM WATER POLLUTION PREVENTION PLAN (SWP3)

Site Contact: Scott Weaver
Phone: 612-477-3101
E-mail: sweaver@myrgroup.com

Prepared for:

MYRE Energy Services, Inc.
12800 Whitewater Drive, Suite 250
Minnetonka, MN 55343

c/o

Sargent & Lundy, L.L.C.
55 East Monroe Street
Chicago, Illinois 60603

Revision 1 – 9/29/22
Revision 2 – 12/12/22

Project Start Date: December 2022
Project End Date: September 2023

Bokes Creek IPP Switching Station

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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, 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.”

Name: Nick Bergren

Title: EPC Project Manager

Signature: ____________________

Date: ____________________

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APPENDIX 6 – Long-term Maintenance Plan

I. Site Description

A. Description of Construction Activity

The Bokes Creek IPP Switching Station Project will consist of the construction of a new 345 kV three breaker ring bus station (Bokes Creek Station) located in Union County, Ohio. The Project consists of constructing a 3.49-acre substation site with a permanent access road (0.42 acres). Construction activities will include grading, gravel placement, and storm water management. A new station fence will be installed and access to the Project will be provided by a new permanent drive off Treaty Line Road (CR-311).

The Project will also involve the construction of two new structures (151 A and 151B) to connect the proposed Bokes Creek Station to the existing Central – East Lima 345 kV transmission line and a tie conductor to the Union Solar collector. The 27.5-acre Project is located in Washington and York Townships, Union County, Ohio. Construction of the Project will require access from existing structure 150 to 154 to install the new structures and new optical ground wire (OPGW) to connect from OPGW splice boxes. The Project will construct approximately 0.7 miles of proposed temporary access roads and will include a laydown yard that is 0.67 acres in size. The total Project area is estimated at 27.5 acres and the maximum area of disturbed soil is approximately 18.34 acres.

B. Disturbed Area

Total Area of the Site – 27.5

Total Disturbed Area – 18.34 acres

Table 1: Disturbed Area

County	Township/Village/City	Disturbance Acreage
Union	Washington Township	4.68
	York Township	13.66

C. Impervious Area

The Bokes Creek Station will result in 3.91 acres of impervious surface. As a result of the change in impervious area, post-construction best management practices (BMPs) are warranted (i.e., a detention basin). See Section II.D.5 of this SWP3 for post-construction storm water management requirements.

Table 2: Impervious Area

	Impervious Acreage	% Imperviousness
Existing	0.0	0%
New	3.91	60%
Total	3.91	60%

D. Storm Water Calculations

Pre- and post-development runoff coefficients have been calculated based on the pre- and post-estimates for impervious surfaces within the Project area. A measure of the impervious areas and percent imperviousness created by the construction activity can be found in the water quality calculations included in Appendix 5. The resulting increase in overall impermeability due to the new station is 60%, producing an increase in runoff volume, as indicated in the water quality calculations in Appendix 5. Therefore, post-construction best management practices (BMPs) are warranted. A detention basin is proposed for the new station.

Drainage Area:
Pre-development runoff coefficient – 0.23
Post-development runoff coefficient – 0.70

E. Existing Soil Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey was used to determine soil types within the Project area. A copy of the web-based soil map is included in Appendix 2. Soils in the Project area are shown in Table 3.

Table 3: Soil Types

Map Unit Symbol	Map Unit Description	Drainage Class	Hydric Soil?
Ble1A1	Blount silt loam, end moraine, 0 to 2 percent slopes	Somewhat poorly drained	No[1]
Ble1B1	Blount silt loam, end moraine, 2 to 4 percent slopes	Somewhat poorly drained	No[1]
Gwe1B1	Glynnwood silt loam, end moraine, 2 to 6 percent slopes	Moderately well drained	No[1]
Gwe1B2	Glynwood silt loam, end moraine, 2 to 6 percent slopes, eroded	Moderately well drained	No[1]
Pk	Pewamo silty clay loam, 0 to 1 percent slopes	Very poorly drained	Yes
We	Wetzel silty clay loam	Poorly drained	Yes

[1] Contains hydric inclusions.

F. Prior Land Uses

The Project is located in a rural area in unincorporated Union County. Prior land use for the Bokes Creek Station site is agricultural land. The associated transmission line contains the 345 kV transmission line right-of-way (ROW) which consists primarily of agricultural lands with some residential and commercial land use.

G. On-site Streams and Receiving Streams and Surface Waters

1. On-Site Waterbodies

There are no on-site jurisdictional waterbodies that were identified during the wetlands and waterways delineation. However, four (4) non-jurisdictional ditches were identified and will be protected with BMPs.

2. Receiving Waters

The Project is located in the Headwaters Bokes Creek and Brush Run-Bokes Creek Watersheds (HUC-12: 050600010702 and 050600010701) which ultimately drain into Bokes Creek. Although there are no receiving streams within the Project Area, nearby receiving streams may include Bokes Creek and Brush Run. The Project Area is not located in a regulated MS4.

H. Implementation Schedule

A construction log will be kept at the Project site to record major dates of grading and stabilization. The general order of construction is provided in Table 6 below and will begin in December 2022 and is estimated to end in Spring 2024.

Table 6: Implementation Schedule

Task	Date
Ohio utilities protection service (Ohio 811 Call)	December 2022
Access road installation	December 2022
Install erosion controls/BMPs	December 2022
Containment pond	December 2022
Pad rough grading and slab foundations for station	December 2022
Station - install cable trench, drilled piers, and below grade conduit	December 2022
Station - install below grade grounding	January 2023
Station - install DICM and station steel	March 2023
Outage 1 - Gunn Road – Marysville 345 kV Circuit Outage	April 2023
Outage 2 - Marysville – Southwest Lima 345 kV Circuit Outage	April 2023
Transmission - ground line and clear for drill rig; drill, place, reinforcing & form; place concrete; remove grounds; setup wire pull locations; and stage material	April 2023
Station - install DE steel, insulators, surge arresters, shield wire, circuit breakers, line switches, and metering CTs	April 2023
Outage 3 - Gunn Road – Marysville 345 kV Circuit Outage	May 2023
Outage 4 - Marysville – Southwest Lima 345 kV Circuit Outage	May 2023
Station - install bus switches	May 2023
Transmission – ground line; erect new structures; deadend existing conductor; pull spans to substation; OPGW into blocks; cut OPGW, swing into south bay, and prep for pulling; pull new OPGW; tension & sag OPGW	May 2023
Outage 5 - Bokes Creek 345kV CBs A and C	May 2023
Transmission –OPGW downleads and prep for splicing; OPGW splicing; existing tower modifications	May 2023
Station - install rigid bus and above grade conduit, pull cable	May 2023
Station - install CCVTs, SSVTs, line turner, terminate control cable, install bus jumpers, test & commissioning	June 2023
SWPPP BMP adjustments	December 2023
Install Treaty Line Road entrance	December 2023
Install culverts and ditches	December 2023
Install permanent access roads	December 2023
Remove environmental controls and temporary access roads	December 2023 – Spring 2024

Repair all remaining disturbed areas	December 2023 – Spring 2024
Seed and mulch all remaining disturbed areas	December 2023 – Spring 2024
Construction demobilization	Spring 2024
Inspection with AEP and SWP3 contractor	Spring 2024

*Actual dates subject to final project schedule.

I. Subdivided Development Drawing

Not applicable.

J. Dedicated Asphalt and Concrete Plant Discharges

Not applicable.

K. Log of Grading and Stabilization Activities

A log for documenting grading and stabilization activities and amendments to the SWP3 is included in Appendix 3.

L. Site Map

A vicinity of the Project area is included in Appendix 2, along with the Soil Erosion Sediment and Sediment Control Plan and details. The Soil Erosion and Sediment Control Plan shows the Project boundaries and contours, the limits of construction, and the locations of the erosion and sediment control features.

M. Permit Requirements

The permit requirements can be reviewed in the Ohio EPA General Permit No. OHC000005 which has been included as Appendix 1.

II. Storm Water Pollution Prevention Plan

The SWP3 was developed to meet the objectives in Part II. Non-numeric Effluent Limitations and Part III. Storm Water Pollution Prevention Plan (SWP3) of Ohio EPA General Permit No. OHC000005.

A. SWP3 Availability

This Plan, a copy of the Notice of Intent (NOI), and the Ohio EPA authorization shall be made available on-site immediately upon request of the director or an authorized representative during working hours. Per Ohio EPA, an electronic copy is an acceptable format for on-site availability and review.

B. Amendments

The SWP3 is a living document that will be updated as needed. The SWP3 shall be amended whenever there is a change in design, construction, operation or maintenance, or if the SWP3 proves to be ineffective in controlling pollutants in storm water discharges associated with construction activity. A log for documenting amendments is included in Appendix 3.

The Environmental Permitting Lead shall be notified prior to any significant modifications to the SWP3, such as changes to the access roads, disturbance acreage, culvert installations, etc., to ensure the Project remains in compliance with Ohio EPA General Permit No. OHC000005.

C. Duty to Inform Contractors

All contractors and subcontractors who will be involved in implementation of the SWP3 shall review and understand the conditions and responsibilities of the SWP3 and document their acknowledgement by signing the form included in Appendix 4.

D. Controls

Timing: Temporary erosion and sediment control measures shall be installed prior to earth-disturbing activity. Temporary control measures will not be removed until final site stabilization, in the form of permanent gravel cover or perennial vegetative cover with a density of at least 70%, is achieved.

The locations of the control methods are shown on the Soil Erosion and Sediment Control Plans in Appendix 2. Maintenance and inspections requirements for these controls can be found in Section II.D.6 of this SWP3. The control measures for this Project include the following:

1. Preservation Methods

Existing natural conditions shall be preserved as much as feasible. Such practices may include: preserving existing vegetation, vegetative buffer strips, and existing soil profile and topsoil; minimizing soil compaction; minimizing disturbance of steep slopes; phasing of construction operations to minimize the amount of disturbed land at any one time; and protective clearing or grubbing practices. For all construction activity adjacent to surface waters of the state, if feasible a 50-foot undisturbed natural buffer will be maintained as measured from the ordinary high-water mark (OHWM). If it is infeasible to provide and maintain a 50-foot undisturbed natural buffer, the stabilization requirements in Table 7 of Section II.D.2 of this SWP3 shall be met.

2. Erosion, Sediment, and Runoff Controls

a. *Stabilization and Seeding*

Disturbed areas will be stabilized as specified in Tables 7 and 8 below per the Soil Erosion and Sediment Control Plan and BMP detail sheets in Appendix 2. A layer of straw mulch shall be applied to all exposed soil that has been seeded in an effort to facilitate seed germination and development.

Table 7: Permanent Stabilization

Area Requiring Permanent Stabilization	Time Frame to Apply Erosion Controls
Any areas that will lie dormant for one year or more.	Within seven calendar days of the most recent disturbance.
Any areas within 50 feet of a surface water of the state and at final grade.	Within two calendar days of reaching final grade.
Other areas at final grade.	Within seven calendar days of reaching final grade within that area.

Table 8: Temporary Stabilization

Area Requiring Temporary Stabilization	Time Frame to Apply Erosion Controls
Any disturbed areas within 50 feet of a surface water of the state and not at final grade.	Within two calendar days of the most recent disturbance if the area will remain idle for more than 14 calendar days.
Any disturbed areas that will be dormant for more than 14 calendar days but less than one year, and not within 50 feet of a surface water of the state.	Within seven calendar days of the most recent disturbance within the area. For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter.	Prior to the onset of winter weather.

b. *Sediment Barriers and Diversions*

For the Bokes Creek Station, silt fence will be installed to encompass the site at appropriate locations to filter sediment from site runoff. Riprap will be used for inlet/outlet protection. Refer to the Soil Erosion and Sediment Control Plan for Bokes Creek Station in Appendix 2 for further details.

For the transmission line work, filter sock or silt fence will be installed as shown on the plans in Appendix 2. Orange barrier fencing will be used as needed. After Project completion, the posts, fencing, and ties shall be removed from the Project site and transported to an appropriate off-site disposal facility.

c. *Wetland and Stream Crossings*

The Project does not cross any streams or wetlands. However, four (4) non-jurisdictional ditches were identified and will be protected with BMPs.

d. *Temporary Construction Entrances*

Construction entrances consisting of a stabilized pad of aggregate will be installed where construction vehicles leave active construction areas and enter public roadways to reduce the amount of sediment tracked offsite. Temporary construction entrance locations and details are provided in Appendix 2.

e. *Sediment Settling Ponds / Sediment Basins*

Sediment basins shall be implemented prior to grading and within seven calendar days from the start of grubbing. A temporary sediment basin will be used during construction as shown on the Soil Erosion and Sediment Control Plan for Bokes Creek Station in Appendix 2. Post-construction, a detention basin will be used to handle post-construction runoff as discussed in Section II.D.5 and shown on the Station Grading Plans for Bokes Creek Station in Appendix 2.

3. <u>Surface Water Protection</u>

No direct discharge to surface waters is proposed for this Project. Surface waters will be protected through the erosion and sediment controls outlined in the sections above.

4. <u>Other Controls</u>

a. *Non-sediment Pollutant Controls*

Waste disposal containers shall be provided for proper collection of all waste material including sanitary garbage, petroleum products and any materials to be used onsite (excluding inert waste/materials such as construction debris that would not be expected to contribute pollution to storm water). Containers shall be covered and not leaking. No construction waste materials shall be buried on-site. All waste materials shall be disposed of in the manner specified by local or state regulations or by the manufacturer. No solid or liquid wastes will be discharged in storm water runoff.

b. *Off-site Traffic and Dust Control*

Any paved roads adjacent to the site entrance shall be swept to remove any excess mud, dirt, or rock tracked from the site, as necessary. Dump trucks hauling materials to or from the site shall be covered with a tarpaulin. Dust control shall be observed both on and off the site for the duration of the Project. Dust and sedimentation will be minimized by limiting earth-moving activities, site traffic, and soil and vegetation disturbances throughout the site. Chemical stabilizers and adhesives will not be used unless written permission is received from AEP Environmental Specialist. Dust control details can be found in Appendix 2.

c. *Concrete Washouts*

Concrete washouts will be located in upland areas outside of wetlands or flood zones. Under no circumstances will concrete trucks wash out into a drainage channel, storm sewer or surface water.

d. *Wash Water*

Water from vehicle washing, wheel washing, and other wash waters will be treated appropriately prior to discharge to minimize pollutants. Spills and leaks will be prevented and responded to as necessary.

e. *Compliance with Other Requirements*

This SWP3 is consistent with state and/or local waste disposal, sanitary sewer or septic system regulations including provisions prohibiting waste disposal by open burning. Spill response, disposal of suspect contaminated soils and clean-up activities are initiated by calling the AEP Land Environment & Remediation Services (LERS) Representative.

f. *Trench and Groundwater Control and Dewatering*

Trench dewatering and groundwater control is not likely for the overhead transmission line but may be required for the substation work. Dewatering may be needed if surface or subsurface water creates conditions where pole or foundation placement is being prevented or hindered and removing the water has the potential to contribute sediment to surface waters. If dewatering is needed, water shall be pumped directly into a dewatering device such as a tube or bag that has been sized according to the flow rate of the dewatering pump and the predominant sediment size (woven for sand, non-woven for silt and clay). Upon construction completion, accumulated sediment shall be removed from the dewatering device and either placed in an upland part of the site where it shall then be seeded and mulched or shall be removed to an appropriate off-site disposal facility.

g. *Contaminated Sediment*

Contaminated soils are not expected to be encountered on this Project. However, if they should exist within the limits of construction, they will be disposed of properly per direction of the AEP LERS Representative.

5. Post-Construction Storm Water Management Requirements

There will be a 3.91 acre increase in impervious surfaces as a result of the construction of the Bokes Creek 345kV three breaker ring bus station. Therefore, there will be a change from pre- to post-construction runoff, and post-construction storm water management is required per Part III.G.2.e of Ohio EPA General Permit No. OHC000005. A detention basin is proposed for the new station as shown on the Station Grading Plans in Appendix 2 and also discussed in the Long-term Maintenance Plan in Appendix 6.

6. Maintenance and Inspections Requirements

*All temporary and permanent control practices shall be maintained and repaired as needed to ensure continued performance of their intended function. All erosion and sediment control measures shall be inspected:

- Once every seven calendar days; and,
- After any storm event greater than one-half inch of rain per 24-hour period by the end of the next calendar day, excluding weekends and holidays unless work is scheduled.

An inspection report shall be made after each inspection. The SWP3 Inspection Form is included in Appendix 3.

*The EPC Project Manager shall select at least two qualified individuals responsible for inspections, maintenance, and repair activities, and filling out the SWP3 Inspection Form and SWP3 Amendments, Grading, and Stabilization Log in Appendix 3. Personnel selected for these responsibilities shall be knowledgeable and experienced in all inspection and maintenance practices necessary for keeping the erosion and sediment controls in good working order.

*If an inspection reveals that a control is in need of repair or maintenance, with the exception of a sediment settling pond, it shall be repaired or maintained within three calendar days of the inspection. Sediment ponds will be repaired or maintained within 10 calendar days of the inspection. If an inspection reveals that a control fails to perform its intended function and that another, more appropriate control is required, the SWP3 shall be amended and the new control shall be installed within 10 calendar days of the inspection. If an inspection reveals a control has been installed inappropriately or incorrectly, the control will be replaced or modified for site conditions.

*When controls are modified, the erosion control drawings associated with the SWP3 will be updated to reflect the modifications, and the changes will be reflected using the SWP3 Amendments, Grading, and Stabilization Log in Appendix 3.

- Silt fence and/or Filter sock shall be inspected for depth of sediment, tears, and to ensure the anchor posts are firmly in the ground. Silt fence and/or filter sock shall also be inspected to ensure they are maintained in the appropriate positions per the plans in Appendix 2. Built up sediment shall be removed from the silt fence when it has reached one-half the height of the fence. Built up sediment shall be removed from the filter sock when it has reached one-third the height of the sock.

- Orange barrier fence shall be inspected to ensure the fence is erect and functioning as intended per the plans in Appendix 2.
- Temporary and permanent seeding shall be inspected for bare spots, washouts, and healthy growth. If seed does not germinate in an area on which it was placed, the area will either be re-seeded or an alternate erosion control method will be employed.
- Locations where vehicles and equipment enter or exit the site shall be inspected for evidence of off-site tracking of sediment. Sediment being tracked onto off-site roadways shall be cleaned up promptly.
- Detention basins shall be cleaned out when the site is stabilized to ensure the design elevation is restored.
- Excess concrete should be removed when the washout system reaches 50 percent of the design capacity. Use of the system should be discontinued until appropriate measures can be initiated to clean out the structure. Prefabricated systems should also utilize this criterion unless the manufacturer has alternative specifications.

*The permittee shall maintain the SWP3 Inspection Forms for three years following the submittal of a notice of termination (NOT) form. The Inspection Forms shall be signed in accordance with Part V.G of Ohio EPA General Permit OHC000005.

III. Approved State or Local Plans

The erosion and sediment control plans were prepared in accordance with Ohio EPA Permit No. OHC000005.

IV. Exceptions

There are no exceptions to the erosion and sediment control practices contained in the Ohio EPA General Permit No. OHC000005.

APPENDIX 1

Ohio EPA General Permit No. OHC000005

Issuance Date: April 23, 2018
Effective Date: April 23, 2018
Expiration Date: April 22, 2023

OHIO ENVIRONMENTAL PROTECTION AGENCY

GENERAL PERMIT AUTHORIZATION FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et. seq. hereafter referred to as "the Act") and the Ohio Water Pollution Control Act [Ohio Revised Code ("ORC") Chapter 6111], dischargers of storm water from sites where construction activity is being conducted, as defined in Part I.B of this permit, are authorized by the Ohio Environmental Protection Agency, hereafter referred to as "Ohio EPA," to discharge from the outfalls at the sites and to the receiving surface waters of the state identified in their Notice of Intent ("NOI") application form on file with Ohio EPA in accordance with the conditions specified in Parts I through VII of this permit.

It has been determined that a lowering of water quality of various waters of the state associated with granting coverage under this permit is necessary to accommodate important social and economic development in the state of Ohio. In accordance with OAC 3745-1-05, this decision was reached only after examining a series of technical alternatives, reviewing social and economic issues related to the degradation, and considering all public and intergovernmental comments received concerning the proposal.

This permit is conditioned upon payment of applicable fees, submittal of a complete NOI application form, development (and submittal, if applicable) of a complete Storm Water Pollution Prevention Plan (SWP3) and written approval of coverage from the director of Ohio EPA in accordance with Ohio Administrative Code ("OAC") Rule 3745-38-02.

Craig W. Butler
Director

Total Pages: 60

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PART I. COVERAGE UNDER THIS PERMIT

A. Permit Area.

This permit covers the entire State of Ohio. Appendices A and B of this permit contain additional watershed specific requirements for construction activities located partially or fully within the Big Darby Creek Watershed and portions of the Olentangy River Watershed. Projects within portions of the Olentangy River watershed shall seek coverage under this permit following the expiration of OHCO00002 (May 31, 2019).

B. Eligibility.

1. Construction activities covered. Except for storm water discharges identified under Part I.B.2, this permit may cover all new and existing discharges composed entirely of storm water discharges associated with construction activity that enter surface waters of the state or a storm drain leading to surface waters of the state.

   For the purposes of this permit, construction activities include any clearing, grading, excavating, grubbing and/or filling activities that disturb one or more acres. Discharges from trench dewatering are also covered by this permit as long as the dewatering activity is carried out in accordance with the practices outlined in Part III.G.2.g.iv of this permit.

   Construction activities disturbing one or more acres of total land or will disturb less than one acre of land but are part of a larger common plan of development or sale that will ultimately disturb one or more acres of land are eligible for coverage under this permit. The threshold acreage includes the entire area disturbed in the larger common plan of development or sale.

   This permit also authorizes storm water discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided:

   a. The support activity is directly related to a construction site that is required to have NPDES permit coverage for discharges of storm water associated with construction activity;

   b. The support activity is not a commercial operation serving multiple unrelated construction projects and does not operate beyond the completion of the construction activity at the site it supports;

   c. Appropriate controls and measures are identified in a storm water pollution prevention plan (SWP3) covering the discharges from the support activity; and

   d. The support activity is on or contiguous with the property defined in the NOI (offsite borrow pits and soil disposal areas, which serve only one project, do not have to be contiguous with the construction site).

2. Limitations on coverage. The following storm water discharges associated with construction activity are not covered by this permit:

a. Storm water discharges that originate from the site after construction activities have ceased, including any temporary support activity, and the site has achieved final stabilization. Industrial post-construction storm water discharges may need to be covered by an NPDES permit;

b. Storm water discharges associated with construction activity that the director has shown to be or may reasonably expect to be contributing to a violation of a water quality standard; and

c. Storm water discharges authorized by an individual NPDES permit or another NPDES general permit.

3. Waivers. After March 10, 2003, sites whose larger common plan of development or sale have at least one, but less than five acres of land disturbance, which would otherwise require permit coverage for storm water discharges associated with construction activities, may request that the director waive their permit requirement. Entities wishing to request such a waiver must certify in writing that the construction activity meets one of the two waiver conditions:

a. Rainfall Erosivity Waiver. For a construction site to qualify for the rainfall erosivity waiver, the cumulative rainfall erosivity over the project duration must be five or less and the site must be stabilized with a least a 70 percent vegetative cover or other permanent, non-erosive cover. The rainfall erosivity must be calculated according to the method in U.S. EPA Fact Sheet 3.1 Construction Rainfall Erosivity Waiver dated January 2001 and be found at: http://epa.ohio.gov/portals/35/permits/USEPAfact3-1_s.pdf. If it is determined that a construction activity will take place during a time period where the rainfall erosivity factor is less than five, a written waiver certification must be submitted to Ohio EPA at least 21 days before construction activity is scheduled to begin. If the construction activity will extend beyond the dates specified in the waiver certification, the operator must either: (a) recalculate the waiver using the original start date with the new ending date (if the R factor is still less than five, a new waiver certification must be submitted) or (b) submit an NOI application form and fee for coverage under this general permit at least seven days prior to the end of the waiver period; or

b. TMDL (Total Maximum Daily Load) Waiver. Storm water controls are not needed based on a TMDL approved or established by U.S. EPA that addresses the pollutant(s) of concern or, for non-impaired waters that do not require TMDLs, and equivalent analysis that determines allocations for small construction sites for the pollutant(s) of concern or that determines that such allocations are not needed to protect water quality based on consideration of existing in-stream concentrations, expected growth in pollutant contributions from all sources, and a margin of safety. The pollutant(s) of concern include sediment or a parameter that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the construction activity. The operator must certify to the director of Ohio EPA that the construction activity will take place, and storm water discharges will occur, within the drainage area addressed by the TMDL or equivalent analysis. A written waiver certification must be submitted to Ohio EPA at least 21 days before the construction activity is scheduled to begin.

4. Prohibition on non-storm water discharges. All discharges covered by this permit must be composed entirely of storm water with the exception of the following: discharges from firefighting activities; fire hydrant flushings; potable water sources including waterline flushings; irrigation drainage; lawn watering; routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated ground water from trench or well point dewatering and foundation or footing drains where flows are not contaminated with process materials such as solvents. Dewatering activities must be done in compliance with Part II.C and Part III.G.2.g.iv of this permit. Discharges of material other than storm water or the authorized non-storm water discharges listed above must comply with an individual NPDES permit or an alternative NPDES general permit issued for the discharge.

   Except for flows from firefighting activities, sources of non-storm water listed above that are combined with storm water discharges associated with construction activity must be identified in the SWP3. The SWP3 must identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

5. Spills and unintended releases (Releases in excess of Reportable Quantities). This permit does not relieve the permittee of the reporting requirements of Title 40 of the Code of Federal Regulations ("CFR") Part 117 and 40 CFR Part 302. In the event of a spill or other unintended release, the discharge of hazardous substances in the storm water discharge(s) from a construction site must be minimized in accordance with the applicable storm water pollution prevention plan for the construction activity and in no case, during any 24-hour period, may the discharge(s) contain a hazardous substance equal to or in excess of reportable quantities.

   40 CFR Part 117 sets forth a determination of the reportable quantity for each substance designated as hazardous in 40 CFR Part 116. The regulation applies to quantities of designated substances equal to or greater than the reportable quantities, when discharged to surface waters of the state. 40 CFR Part 302 designates under section 102(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, those substances in the statutes referred to in section 101(14), identifies reportable quantities for these substances and sets forth the notification requirements for releases of these substances. This regulation also sets forth reportable quantities for hazardous substances designated under section 311(b)(2)(A) of the Clean Water Act (CWA).

C. Requiring an individual NPDES permit or an alternative NPDES general permit.

1. The director may require an alternative permit. The director may require any operator eligible for this permit to apply for and obtain either an individual NPDES permit or coverage under an alternative NPDES general permit in accordance with OAC Rule 3745-38-02. Any interested person may petition the director to take action under this paragraph.

The director will send written notification that an alternative NPDES permit is required. This notice shall include a brief statement of the reasons for this decision, an application form and a statement setting a deadline for the operator to file the application. If an operator fails to submit an application in a timely manner as required by the director under this paragraph, then coverage, if in effect, under this permit is automatically terminated at the end of the day specified for application submittal.

2. Operators may request an individual NPDES permit. Any owner or operator eligible for this permit may request to be excluded from the coverage of this permit by applying for an individual permit. The owner or operator shall submit an individual application with reasons supporting the request to the director in accordance with the requirements of 40 CFR 122.26. If the reasons adequately support the request, the director shall grant it by issuing an individual NPDES permit.

3. When an individual NPDES permit is issued to an owner or operator otherwise subject to this permit or the owner or operator is approved for coverage under an alternative NPDES general permit, the applicability of this permit to the individual NPDES permittee is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the alternative general permit, whichever the case may be.

D. Permit requirements when portions of a site are sold

If an operator obtains a permit for a development, and then the operator (permittee) sells off lots or parcels within that development, permit coverage must be continued on those lots until a Notice of Termination (NOT) in accordance with Part IV.B is submitted. For developments which require the use of centralized sediment and erosion controls (i.e., controls that address storm water runoff from one or more lots) for which the current permittee intends to terminate responsibilities under this permit for a lot after sale of the lot to a new owner and such termination will either prevent or impair the implementation of the controls and therefore jeopardize compliance with the terms and conditions of this permit, the permittee will be required to maintain responsibility for the implementation of those controls. For developments where this is not the case, it is the permittee's responsibility to temporarily stabilize all lots sold to individual lot owners unless an exception is approved in accordance with Part III.G.4. In cases where permit responsibilities for individual lot(s) will be terminated after sale of the lot, the permittee shall inform the individual lot owner of the obligations under this permit and ensure that the Individual Lot NOI application is submitted to Ohio EPA.

E. Authorization

1. Obtaining authorization to discharge. Operators that discharge storm water associated with construction activity must submit an NOI application form and Storm Water Pollution Prevention Plan (SWP3) if located within the Big Darby Creek watershed or portions of the Olentangy watershed in accordance with the requirements of Part I.F of this permit to obtain authorization to discharge under this general permit. As required under OAC Rule 3745-38-06(E), the director, in response to the NOI submission, will notify the applicant in writing that he/she has or has not been granted general permit coverage to discharge storm water associated with construction activity under the terms and conditions of this permit or that the applicant must apply for an individual NPDES permit or coverage under an alternate general NPDES permit as described in Part I.C.1.

2. <u>No release from other requirements</u>. No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations. Other permit requirements commonly associated with construction activities include, but are not limited to, section 401 water quality certifications, isolated wetland permits, permits to install sanitary sewers or other devices that discharge or convey polluted water, permits to install drinking water lines, single lot sanitary system permits and disturbance of land which was used to operate a solid or hazardous waste facility (i.e., coverage under this NPDES general permit does not satisfy the requirements of OAC Rule 3745-27-13 or ORC Section 3734.02(H)). The issuance of this permit is subject to resolution of an antidegradation review. This permit does not relieve the permittee of other responsibilities associated with construction activities such as contacting the Ohio Department of Natural Resources, Division of Water, to ensure proper well installation and abandonment of wells.

F. Notice of Intent Requirements

1. Deadlines for notification.

   a. <u>Initial coverage</u>: Operators who intend to obtain initial coverage for a storm water discharge associated with construction activity under this general permit must submit a complete and accurate NOI application form, a completed Storm Water Pollution Prevention Plan (SWP3) for projects within the Big Darby Creek and portions of the Olentangy river watersheds and appropriate fee at least 21 days (or 45 days in the Big Darby Creek watershed and portions of the Olentangy watershed) prior to the commencement of construction activity. If more than one operator, as defined in Part VII of this general permit, will be engaged at a site, each operator shall seek coverage under this general permit prior to engaging in construction activities. Coverage under this permit is not effective until an approval letter granting coverage from the director of Ohio EPA is received by the applicant. Where one operator has already submitted an NOI prior to other operator(s) being identified, the additional operator shall request modification of coverage to become a co-permittee. In such instances, the co-permittees shall be covered under the same facility permit number. No additional permit fee is required.

   b. <u>Individual lot transfer of coverage</u>: Operators must each submit an individual lot notice of intent (Individual Lot NOI) application form (no fee required) to Ohio EPA at least seven days prior to the date that they intend to accept responsibility for permit requirements for their portion of the original permitted development from the previous permittee. Transfer of permit coverage is not granted until an approval letter from the director of Ohio EPA is received by the applicant.

2. <u>Failure to notify</u>. Operators who fail to notify the director of their intent to be covered and who discharge pollutants to surface waters of the state without an NPDES permit are in violation of ORC Chapter 6111. In such instances, Ohio EPA may bring an enforcement action for any discharges of storm water associated with construction activity.

3. <u>How to submit an NOI</u>. Operators seeking coverage under this permit must submit a complete and accurate Notice of Intent (NOI) application using Ohio EPA's electronic application form which is available through the Ohio EPA eBusiness Center at: **<u>https://ebiz.epa.ohio.gov/</u>**. Submission through the Ohio EPA eBusiness Center will

require establishing an Ohio EPA eBusiness Center account and obtaining a unique Personal Identification Number (PIN) for final submission of the NOI. Existing eBusiness Center account holders can access the NOI form through their existing account and submit using their existing PIN. Please see the following link for guidance: **http://epa.ohio.gov/dsw/ebs.aspx#170669803-streams-guidance**. Alternatively, if you are unable to access the NOI form through the agency eBusiness Center due to a demonstrated hardship, the NOI may be submitted on a paper NOI form provided by Ohio EPA. NOI information shall be typed on the form. Please contact Ohio EPA, Division of Surface Water at (614) 644-2001 if you wish to receive a paper NOI form.

4. Additional notification. NOIs and SWP3s are considered public documents and shall be made available to the public in accordance with Part III.C.2. The permittee shall make NOIs and SWP3s available upon request of the director of Ohio EPA, local agencies approving sediment and erosion control plans, grading plans or storm water management plans, local governmental officials, or operators of municipal separate storm sewer systems (MS4s) receiving drainage from the permitted site. Each operator that discharges to an NPDES permitted MS4 shall provide a copy of its Ohio EPA NOI submission to the MS4 in accordance with the MS4's requirements, if applicable.

5. Re-notification. Existing permittees having coverage under the previous generations of this general permit shall have continuing coverage under OHC000005 with the submittal of a timely renewal application. Within 180 days from the effective date of this permit, existing permittees shall submit the completed renewal application expressing their intent for continued coverage. In accordance with Ohio Administrative Code (OAC) 3745-38-02(E)(2)(a)(i), a renewal application fee will only apply to existing permittees having general permit coverage for 5 or more years as of the effective date of this general permit. Permit coverage will be terminated if Ohio EPA does not receive the renewal application within this 180-day period.

Part II. NON-NUMERIC EFFLUENT LIMITATIONS

You shall comply with the following non-numeric effluent limitations for discharges from your site and/or from construction support activities. Part III of this permit contains the specific design criteria to meet the objectives of the following non-numeric effluent limitations. You shall develop and implement the SWP3 in accordance with Part III of this permit to satisfy these non-numeric effluent limitations.

A. **Erosion and Sediment Controls**. You shall design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, such controls shall be designed, installed and maintained to:

1. Control storm water volume and velocity within the site to minimize soil and stream erosion;

2. Control storm water discharges, including both peak flowrates and total storm water volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion;

3. Minimize the amount of soil exposed during construction activity;

4. Minimize the disturbance of steep slopes;

5. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls shall address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting storm water runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site;

6. If feasible, provide and maintain a 50-foot undisturbed natural buffer around surface waters of the state, direct storm water to vegetated areas to increase sediment removal and maximize storm water infiltration. If it is infeasible to provide and maintain an undisturbed 50-foot natural buffer, you shall comply with the stabilization requirements found in Part II.B for areas within 50 feet of a surface water; and

7. Minimize soil compaction and, unless infeasible, preserve topsoil.

B. **Soil Stabilization**. Stabilization of disturbed areas shall, at a minimum, be initiated in accordance with the time frames specified in the following tables.

Table 1: Permanent Stabilization

Area requiring permanent stabilization	**Time frame to apply erosion controls**
Any areas that will lie dormant for one year or more	Within seven days of the most recent disturbance
Any areas within 50 feet of a surface water of the state and at final grade	Within two days of reaching final grade
Other areas at final grade	Within seven days of reaching final grade within that area

Table 2: Temporary Stabilization

Area requiring temporary stabilization	**Time frame to apply erosion controls**
Any disturbed areas within 50 feet of a surface water of the state and not at final grade	Within two days of the most recent disturbance if the area will remain idle for more than 14 days
Any disturbed areas that will be dormant for more than 14 days but less than one year, and not within 50 feet of a surface water of the state	Within seven days of the most recent disturbance within the area For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed. Permanent and temporary stabilization are defined in Part VII.

C. **Dewatering.** Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, are prohibited unless managed by appropriate controls.

D. **Pollution Prevention Measures.** Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, such measures must be designed, installed, implemented and maintained to:

1. Minimize the discharge of pollutants from equipment and vehicle washing, wheel washwater, and other washwaters. Washwaters shall be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;

2. Minimize the exposure of construction materials, products, and wastes; landscape materials, fertilizers, pesticides, and herbicides; detergents, sanitary waste and other materials present on the site to precipitation and to storm water; and

3. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.

E. **Prohibited Discharges.** The following discharges are prohibited:

1. Wastewater from washout of concrete, unless managed by an appropriate control;

2. Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;

3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and

4. Soaps or solvents used in vehicle and equipment washing or all other waste water streams which could be subject to an individual NPDES permit (Part III.G.2.g).

F. **Surface Outlets**. When discharging from sediment basins utilize outlet structures that withdraw water from the surface, unless infeasible. (Note: Ohio EPA believes that the circumstances in which it is infeasible to design outlet structures in this manner are rare. Exceptions may include time periods with extended cold weather during winter months. If you have determined that it is infeasible to meet this requirement, you shall provide documentation in your SWP3 to support your determination.)

G. **Post-Construction Storm Water Management Controls**. So that receiving stream's physical, chemical and biological characteristics are protected, and stream functions are maintained, post-construction storm water practices shall provide long-term management of runoff quality and quantity.

PART III. STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Storm Water Pollution Prevention Plans.

A SWP3 shall be developed for each site covered by this permit. For a multi-phase construction project, a separate NOI shall be submitted when a separate SWP3 will be prepared for subsequent phases. SWP3s shall be prepared in accordance with sound engineering and/or conservation practices by a professional experienced in the design and implementation of standard erosion and sediment controls and storm water management practices addressing all phases of construction. The SWP3 shall clearly identify all activities which are required to be authorized under Section 401 and subject to an antidegradation review. The SWP3 shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges associated with construction activities. The SWP3 shall be a comprehensive, stand-alone document, which is not complete unless it contains the information required by Part III.G of this permit. In addition, the SWP3 shall describe and ensure the implementation of best management practices (BMPs) that reduce the pollutants and impact of storm water discharges during construction and pollutants associated with the post-construction land use to ensure compliance with ORC Section 6111.04, OAC Chapter 3745-1 and the terms and conditions of this permit.

B. Timing.

An acceptable SWP3 shall be completed and submitted to the applicable regulated MS4 entity (for projects constructed entirely within a regulated MS4 area) prior to the timely submittal of an NOI. Projects within the Big Darby Creek and portions of the Olentangy watersheds must submit a SWP3 with the NOI. The SWP3 shall be updated in accordance with Part III.D. Submission of a SWP3 does not constitute review and approval on the part of Ohio EPA. Upon request and good cause shown, the director may waive the requirement to have a SWP3 completed at the time of NOI submission. If a waiver has been granted, the SWP3 must be completed prior to the initiation of construction activities. The SWP3 must be implemented upon initiation of construction activities.

In order to continue coverage from the previous generations of this permit, the permittee shall review and update the SWP3 to ensure that this permit's requirements are addressed within 180 days after the effective date of this permit. If it is infeasible for you to comply with a specific requirement in this permit because (1) the provision was not part of the permit you were previously covered under, and (2) because you are prevented from compliance due to the nature or location of earth disturbances that commenced prior to the effective date of this permit, you shall include documentation within your SWP3 of the reasons why it is infeasible for you to meet the specific requirement.

Examples of OHC000005 permit conditions that would be infeasible for permittees renewing coverage to comply with include:

- OHC000005 post-construction requirements, for projects that obtained NPDES construction storm water coverage and started construction activities prior to the effective date of this permit;

- OHC000005 post-construction requirements, for multi-phase development projects with an existing regional post-construction BMP issued under previous NPDES post-construction requirements. This only applies to construction sites authorized under Ohio EPA's Construction Storm Water Permits issued after April 20, 2003;

- OHC000005 post-construction requirements, for renewing or initial coverage and you have a SWP3 approved locally and you will start construction within 180 days of the effective date of this permit;

- Sediment settling pond design requirements, if the general permit coverage was obtained prior to April 21, 2013 and the sediment settling pond has been installed; or

- Case-by-case situations approved by the Director.

C. SWP3 Signature and Review.

1. Plan Signature and Retention On-Site. The SWP3 shall include the certification in Part V.H, be signed in accordance with Part V.G., and be retained on site during working hours.

2. Plan Availability

   a. On-site: The plan shall be made available immediately upon request of the director or his authorized representative and MS4 operators or their authorized representative during working hours. A copy of the NOI and letter granting permit coverage under this general permit also shall be made available at the site.

   b. By written request: The permittee must provide the most recent copy of the SWP3 within 7 days upon written request by any of the following:

      i. The director or the director's authorized representative;

      ii. A local agency approving sediment and erosion plans, grading plans or storm water management plans; or

      iii. In the case of a storm water discharge associated with construction activity which discharges through a municipal separate storm sewer system with an NPDES permit, to the operator of the system.

   c. To the public: All NOIs, general permit approval for coverage letters, and SWP3s are considered reports that shall be available to the public in accordance with the Ohio Public Records law. The permittee shall make documents available to the public upon request or provide a copy at public expense, at cost, in a timely manner. However, the permittee may claim to Ohio EPA any portion of an SWP3 as confidential in accordance with Ohio law.

3. Plan Revision. The director or authorized representative may notify the permittee at any time that the SWP3 does not meet one or more of the minimum requirements of this part. Within 10 days after such notification from the director or authorized representative (or as otherwise provided in the notification), the permittee shall make the required changes to the SWP3 and shall submit to Ohio EPA the revised SWP3 or a written certification that the requested changes have been made.

D. Amendments.

The permittee shall amend the SWP3 whenever there is a change in design, construction, operation or maintenance, which has a significant effect on the potential for the discharge of pollutants to surface waters of the state or if the SWP3 proves to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity. Amendments to the SWP3 may be reviewed by Ohio EPA in the same manner as Part III.C.

E. Duty to inform contractors and subcontractors.

The permittee shall inform all contractors and subcontractors not otherwise defined as "operators" in Part VII of this general permit who will be involved in the implementation of the SWP3 of the terms and conditions of this general permit. The permittee shall maintain a written document containing the signatures of all contractors and subcontractors involved in the implementation of the SWP3 as proof acknowledging that they reviewed and understand the conditions and responsibilities of the SWP3. The written document shall be created, and signatures shall be obtained prior to commencement of earth disturbing activity on the construction site.

F. Total Maximum Daily Load (TMDL) allocations.

If a TMDL is approved for any waterbody into which the permittee's site discharges and requires specific BMPs for construction sites, the director may require the permittee to revise his/her SWP3. Specific conditions have been provided in Appendix A (for the Big Darby Creek Watershed) and Appendix B (for portions of the Olentangy river watershed).

G. SWP3 Requirements.

Operations that discharge storm water from construction activities are subject to the following requirements and the SWP3 shall include the following items:

1. Site description. Each SWP3 shall provide:

    a. A description of the nature and type of the construction activity (e.g., low density residential, shopping mall, highway, etc.);

    b. Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas);

    c. A measure of the impervious area and percent imperviousness created by the construction activity (existing, new and total impervious area after construction);

    d. Storm water calculations, including the volumetric runoff coefficients for both the pre-construction and post- construction site conditions, and resulting water quality volume; design details for post-construction storm water facilities and pretreatment practices such as contributing drainage areas, capacities, elevations, outlet details and drain times shall be included in the SWP3; and if applicable, explanation of the use of existing post-construction facilities. Ohio EPA recommends the use of data sheets (see Ohio's Rainwater and Land Development manual and Ohio EPA resources for examples);

    e. Existing data describing the soil and, if available, the quality of any discharge from the site;

f. A description of prior land uses at the site;

g. A description of the condition of any on-site streams (e.g. prior channelization, bed instability or headcuts, channels on public maintenance, or natural channels);

h. An implementation schedule which describes the sequence of major construction operations (i.e., designation of vegetative preservation areas, grubbing, excavating, grading, utilities, infrastructure installation and others) and the implementation of erosion, sediment and storm water management practices or facilities to be employed during each operation of the sequence;

i. The name and/or location of the immediate receiving stream or surface water(s) and the first subsequent named receiving water(s) and the areal extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed, or which will receive discharges from disturbed areas of the project. For discharges to an MS4, the point of discharge to the MS4 and the location where the MS4 ultimately discharges to a stream or surface water of the state shall be indicated;

j. For subdivided developments, a detail drawing of individual parcels with their erosion, sediment or storm water control practices and/or a typical individual lot showing standard individual lot erosion and sediment control practices.

   A typical individual lot drawing does not remove the responsibility to designate specific erosion and sediment control practices in the SWP3 for critical areas such as steep slopes, stream banks, drainage ways and riparian zones;

k. Location and description of any storm water discharges associated with dedicated asphalt and dedicated concrete plants covered by this permit and the best management practices to address pollutants in these storm water discharges;

l. A cover page or title identifying the name and location of the site, the name and contact information of all construction site operators, the name and contact information for the person responsible for authorizing and amending the SWP3, preparation date, and the estimated dates that construction will start and be complete;

m. A log documenting grading and stabilization activities as well as amendments to the SWP3, which occur after construction activities commence; and

n. Site map showing:

   i. Limits of earth-disturbing activity of the site including associated off-site borrow or spoil areas that are not addressed by a separate NOI and associated SWP3;

   ii. Soils types for all areas of the site, including locations of unstable or highly erodible and/or known contaminated soils;

iii. Existing and proposed contours. A delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed, in acres;

iv. The location of any delineated boundary for required riparian setbacks;

v. Conservation easements or areas designated as open space, preserved vegetation or otherwise protected from earth disturbing activities. A description of any associated temporary or permanent fencing or signage;

vi. Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the permittee intends to fill or relocate for which the permittee is seeking approval from the Army Corps of Engineers and/or Ohio EPA;

vii. Existing and planned locations of buildings, roads, parking facilities and utilities;

viii. The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during site development;

ix. Sediment traps and basins noting their sediment storage and dewatering (detention) volume and contributing drainage area. Ohio EPA recommends the use of data sheets (see Ohio EPA's Rainwater and Land Development manual and website for examples) to provide data for all sediment traps and basins noting important inputs to design and resulting parameters such as their contributing drainage area, disturbed area, detention volume, sediment storage volume, practice surface area, dewatering time, outlet type and dimensions;

x. The location of permanent storm water management practices (new and existing) including pretreatment practices to be used to control pollutants in storm water after construction operations have been completed along with the location of existing and planned drainage features including catch basins, culverts, ditches, swales, surface inlets and outlet structures;

xi. Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including dumpster areas, areas designated for cement truck washout, and vehicle fueling;

xii. The location of designated construction entrances where the vehicles will access the construction site; and

xiii. The location of any areas of proposed floodplain fill, floodplain excavation, stream restoration or known temporary or permanent stream crossings.

2. Controls. In accordance with Part II.A, the SWP3 shall contain a description of the controls appropriate for each construction operation covered by this permit and the operator(s) shall implement such controls. The SWP3 shall clearly describe for each major construction activity identified in Part III.G.1.h: (a) appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented; and (b) which contractor is responsible for implementation (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization). The SWP3 shall identify the subcontractors engaged in activities that could impact storm water runoff. The SWP3 shall contain signatures from all of the identified subcontractors indicating that they have been informed and understand their roles and responsibilities in complying with the SWP3. Ohio EPA recommends that the primary site operator review the SWP3 with the primary contractor prior to commencement of construction activities and keep a SWP3 training log to demonstrate that this review has occurred.

   Ohio EPA recommends that the erosion, sediment, and storm water management practices used to satisfy the conditions of this permit should meet the standards and specifications in the most current edition of Ohio's Rainwater and Land Development (see definitions) manual or other standards acceptable to Ohio EPA. The controls shall include the following minimum components:

   a. Preservation Methods. The SWP3 shall make use of practices which preserve the existing natural condition as much as feasible. Such practices may include: preserving existing vegetation, vegetative buffer strips, and existing soil profile and topsoil; phasing of construction operations to minimize the amount of disturbed land at any one time; and designation of tree preservation areas or other protective clearing or grubbing practices. For all construction activities immediately adjacent to surface waters of the state, the permittee shall comply with the buffer non-numeric effluent limitation in Part II.A.6, as measured from the ordinary high water mark of the surface water.

   b. Erosion Control Practices. The SWP3 shall make use of erosion controls that provide cover over disturbed soils unless an exception is approved in accordance with Part III.G.4. A description of control practices designed to re-establish vegetation or suitable cover on disturbed areas after grading shall be included in the SWP3. The SWP3 shall provide specifications for stabilization of all disturbed areas of the site and provide guidance as to which method of stabilization will be employed for any time of the year. Such practices may include: temporary seeding, permanent seeding, mulching, matting, sod stabilization, vegetative buffer strips, phasing of construction operations, use of construction entrances and the use of alternative ground cover.

      i. **Stabilization.** Disturbed areas shall be stabilized in accordance with Table 1 (Permanent Stabilization) and Table 2 (Temporary Stabilization) in Part II.B of this permit.

      ii. **Permanent stabilization of conveyance channels**. Operators shall undertake special measures to stabilize channels and outfalls and prevent erosive flows. Measures may include seeding, dormant seeding (as defined in the most current edition of the Rainwater and Land

Development manual), mulching, erosion control matting, sodding, riprap, natural channel design with bioengineering techniques or rock check dams.

c. Runoff Control Practices. The SWP3 shall incorporate measures which control the flow of runoff from disturbed areas so as to prevent erosion from occurring. Such practices may include rock check dams, pipe slope drains, diversions to direct flow away from exposed soils and protective grading practices. These practices shall divert runoff away from disturbed areas and steep slopes where practicable. Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel to provide non-erosive flow velocity from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

d. Sediment Control Practices. The plan shall include a description of structural practices that shall store runoff allowing sediments to settle and/or divert flows away from exposed soils or otherwise limit runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, sediment barriers, earth diversion dikes or channels which direct runoff to a sediment settling pond and storm drain inlet protection. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless those are used in conjunction with a sediment settling pond.

The SWP3 shall contain detail drawings for all structural practices.

i. **Timing.** Sediment control structures shall be functional throughout the course of earth disturbing activity. Sediment basins and perimeter sediment barriers shall be implemented prior to grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is stabilized with permanent cover. As construction progresses and the topography is altered, appropriate controls shall be constructed, or existing controls altered to address the changing drainage patterns.

ii. **Sediment settling ponds.** A sediment settling pond is required for any one of the following conditions:

- Concentrated or collected storm water runoff (e.g., storm sewer or ditch);
- Runoff from drainage areas, which exceed the design capacity of silt fence or other sediment barriers; or
- Runoff from drainage areas that exceed the design capacity of inlet protection.

The permittee may request approval from Ohio EPA to use alternative controls if the permittee can demonstrate the alternative controls are equivalent in effectiveness to a sediment settling pond.

In accordance with Part II.F, if feasible, sediment settling ponds shall be dewatered at the pond surface using a skimmer or equivalent device. The sediment settling pond volume consists of both a dewatering zone and a sediment storage zone. The volume of the dewatering zone shall be a minimum of 1800 cubic feet (ft^3) per acre of drainage (67 yd^3/acre) with a minimum 48-hour drain time. The volume of the sediment storage zone shall be calculated by one of the following methods:

Method 1: The volume of the sediment storage zone shall be 1000 ft^3 per disturbed acre within the watershed of the basin. OR

Method 2: The volume of the sediment storage zone shall be the volume necessary to store the sediment as calculated with RUSLE or a similar generally accepted erosion prediction model.

Accumulated sediment shall be removed from the sediment storage zone once it exceeds 50 percent of the minimum required sediment storage design capacity and prior to the conversion to the post-construction practice unless suitable storage is demonstrated based upon over-design. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity shall be included unless runoff from these areas is diverted away from the sediment settling pond and is not co-mingled with sediment-laden runoff. The depth of the dewatering zone shall be less than or equal to five feet. The configuration between inlets and the outlet of the basin shall provide at least two units of length for each one unit of width (≥ 2:1 length:width ratio); however, a length to width ratio of 4:1 is recommended. When designing sediment settling ponds, the permittee shall consider public safety, especially as it relates to children, as a design factor for the sediment basin and alternative sediment controls shall be used where site limitations would preclude a safe design. Combining multiple sediment and erosion control measures in order to maximize pollutant removal is encouraged.

iii. **Sediment Barriers and Diversions.** Sheet flow runoff from denuded areas shall be intercepted by sediment barriers or diversions to protect adjacent properties and water resources from sediment transported via sheet flow. Where intended to provide sediment control, silt fence shall be placed on a level contour downslope of the disturbed area. For most applications, standard silt fence may be substituted with a 12-inch diameter sediment barrier. The relationship between the maximum drainage area to sediment barrier for a particular slope range is shown in the following table:

Table 3 Sediment Barrier Maximum Drainage Area Based on Slope

Maximum drainage area (in acres) to 100 linear feet of sediment barrier	**Range of slope for a particular drainage area (in percent)**
0.5	< 2%
0.25	≥ 2% but < 20%
0.125	≥ 20% but < 50%

Placing sediment barriers in a parallel series does not extend the size of the drainage area. Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes where practicable. Diversion practices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres.

iv. **Inlet Protection.** Other erosion and sediment control practices shall minimize sediment laden water entering active storm drain systems. All inlets receiving runoff from drainage areas of one or more acres will require a sediment settling pond.

v. **Surface Waters of the State Protection.** If construction activities disturb areas adjacent to surface waters of the state, structural practices shall be designed and implemented on site to protect all adjacent surface waters of the state from the impacts of sediment runoff. No structural sediment controls (e.g., the installation of silt fence or a sediment settling pond) shall be used in a surface water of the state. For all construction activities immediately adjacent to surface waters of the state, the permittee shall comply with the buffer non-numeric effluent limitation in Part II.A.6, as measured from the ordinary high water mark of the surface water. Where impacts within this buffer area are unavoidable, due to the nature of the construction (e.g., stream crossings for roads or utilities), the project shall be designed such that the number of stream crossings and the width of the disturbance within the buffer area are minimized.

vi. **Modifying Controls**. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the permittee shall replace or modify the control for site conditions.

e. <u>Post-Construction Storm Water Management Requirements.</u> So that receiving stream's physical, chemical and biological characteristics are protected, and stream functions are maintained, post-construction storm water practices shall provide long-term management of runoff quality and quantity. To meet the post-construction requirements of this permit, the SWP3 shall contain a description of the post-construction BMPs that will be installed during construction for the site and the rationale for their selection. The rationale shall address the anticipated impacts on the channel and floodplain morphology, hydrology, and water quality. Post-construction BMPs cannot be installed within a surface water of the state (e.g., wetland or stream) unless it is authorized by a CWA 401 water quality certification, CWA 404 permit, or Ohio EPA non-jurisdictional wetland/stream program approval. Note: local jurisdictions may have more stringent post-construction requirements.

Detail drawings and maintenance plans shall be provided for all post-construction BMPs in the SWP3. Maintenance plans shall be provided by the permittee to the post-construction operator of the site (including homeowner associations) upon completion of construction activities (prior to termination of permit coverage). Maintenance plans shall ensure that pollutants collected within structural post-construction practices are disposed of in accordance with local, state, and federal regulations. To ensure that storm water management systems function as designed and constructed, the post-construction operation and maintenance plan shall be a stand-alone document which contains: (1) a designated entity for storm water inspection and maintenance responsibilities; (2) the routine and non-routine maintenance tasks to be undertaken; (3) a schedule for inspection and maintenance; (4) any necessary legally binding maintenance easements and agreements; (5) construction drawings or excerpts showing the plan view, profile and details of the outlet(s); (6) a map showing all access and maintenance easements; and (7) for table 4a/4b practices, provide relevant elevations and associated volumes that dictate when removal of accumulated sediments must occur. Permittees are responsible for assuring all post-construction practices meet plan specifications and intended post-construction conditions have been met (e.g., sediment removed from, and sediment storage restored to, permanent pools, sediment control outlets removed and replaced with permanent post-construction discharge structures, and all slopes and drainageways permanently stabilized), but are not responsible under this permit for operation and maintenance of post-construction practices once coverage under this permit is terminated.

Post-construction storm water BMPs that discharge pollutants from point sources once construction is completed may in themselves need authorization under a separate NPDES permit (one example is storm water discharges from regulated industrial sites).

Construction activities that do not include the installation of any impervious surface (e.g., park lands), abandoned mine land reclamation activities regulated by the Ohio Department of Natural Resources, stream and wetland restoration activities, and wetland mitigation activities are not required to comply with the conditions of Part III.G.2.e of this permit. Linear construction projects (e.g., pipeline or utility line installation) which do not result in the installation of additional impervious surface are not required to comply with the conditions of Part III.G.2.e of this permit. However, linear construction projects shall be designed to minimize the number of stream crossings and the width of disturbance, and to achieve final stabilization of the disturbed area as defined in Part VII.M.1.

For all construction activities that will disturb two or more acres of land or will disturb less than two acres that are part of a larger common plan of development or sale which will disturb two or more acres of land, the post construction BMP(s) chosen shall be able to manage storm water runoff for protection of stream channels, stream stability, and water quality. The BMP(s) chosen must be compatible with site and soil conditions. Structural post-construction storm water treatment practices shall be incorporated into the permanent drainage system for the site. The BMP(s) chosen must be sized to treat the water quality volume (WQ_v) and ensure compliance with Ohio's Water Quality Standards in OAC Chapter 3745-1. The WQ_v shall be equivalent to the volume of runoff from a 0.90-inch rainfall and shall be determined using the following equations:

$$WQ_v = Rv * P * A / 12 \qquad \text{(Equation 1)}$$

where:
WQ_v = water quality volume in acre-feet
Rv = the volumetric runoff coefficient calculated using equation 2
P = 0.90 inch precipitation depth
A = area draining into the BMP in acres

$$Rv = 0.05 + 0.9i \qquad \text{(Equation 2)}$$

where i = fraction of post-construction impervious surface

An additional volume equal to 20 percent of the WQ_v shall be incorporated into the BMP for sediment storage. Ohio EPA recommends BMPs be designed according to the methodology described in the most current edition of the Rainwater and Land Development manual or in another design manual acceptable for use by Ohio EPA.

The BMPs listed in Tables 4a and 4b below are considered standard BMPs approved for general use. However, communities with a regulated MS4 may limit the use of some of these BMPs. BMPs shall be designed such that the drain time is long enough to provide treatment but short enough to provide storage for successive rainfall events and avoid the creation of nuisance conditions. The outlet structure for the post-construction BMP shall not discharge more than the first half of the WQv in less than one-third of the drain time. The WQv is the volume of storm water runoff that must be detained by a post-construction practice as specified by the most recent edition of the Rainwater and Land Development manual.

Post-construction practices shall be sized to treat 100% of the WQv associated with their contributing drainage area. If there is an existing post-construction BMP that treats runoff from the disturbed area and the BMP meets the post-construction requirements of this permit, no additional post-construction BMP will be required. A regional storm water BMP may be used to meet the post-construction requirement if: (1) the BMP meets the design requirements for treating the WQv; and (2) a legal agreement is established through which the regional BMP owner or operator agrees to provide this service in the long term. Design information for such facilities such as contributing drainage areas, capacities, elevations, outlet details and drain times shall be included in the SWP3.

Table 4a Extended Detention Post-Construction Practices with Minimum Drain Times

Extended Detention Practices	**Minimum Drain Time of WQv**
Wet Extended Detention Basin[1,2]	24 hours
Constructed Extended Detention Wetland[1,2]	24 hours
Dry Extended Detention Basin[1,3]	48 hours
Permeable Pavement – Extended Detention[1]	24 hours
Underground Storage – Extended Detention[1,4]	24 hours
Sand & Other Media Filtration - Extended Detention[1, 5]	24 hours

Notes:

1. The outlet structure shall not discharge more than the first half of the WQv in less than one-third of the drain time.
2. Provide a permanent pool with a minimum volume equal to the WQv and an extended detention volume above the permanent pool equal to 1.0 x WQv.
3. Dry basins must include a forebay and a micropool each sized at a minimum of 0.1 x WQv and a protected outlet, or include acceptable pretreatment and a protected outlet.
4. Underground storage must have pretreatment for removal of suspended sediments included in the design and documented in the SWP3. This pretreatment shall concentrate sediment in a location where it can be readily removed. For non-infiltrating, underground extended detention systems, pretreatment shall be 50% effective at capturing total suspended solids according to the testing protocol established in the Alternative Post-Construction BMP Testing Protocol.
5. The WQv ponding area shall completely empty between 24 and 72 hours.

Table 4b Infiltration Post-Construction Practices with Maximum Drain Times

Infiltration Practices	**Maximum Drain Time of WQv**
Bioretention Area/Cell[1,2]	24 hours
Infiltration Basin[2]	24 hours
Infiltration Trench[3]	48 hours
Permeable Pavement – Infiltration[3]	48 hours
Underground Storage – Infiltration[3,4]	48 hours

Notes:
1. Bioretention soil media shall have a permeability of approximately 1 – 4 in/hr. Meeting the soil media specifications in the Rainwater and Land Development manual is considered compliant with this requirement. Bioretention cells must have underdrains unless in-situ conditions allow for the WQv (surface ponding) plus the bioretention soil (to a depth of 24 inches) to drain completely within 48 hours.
2. Infiltrating practices with the WQv stored aboveground (bioretention, infiltration basin) shall fully drain the WQv within 24 hours to minimize nuisance effects of standing water and to promote vigorous communities of appropriate vegetation.
3. Subsurface practices designed to fully infiltrate the WQv (infiltration trench, permeable pavement with infiltration, underground storage with infiltration) shall empty within 48 hours to recover storage for subsequent storm events.
4. Underground storage systems with infiltration must have adequate pretreatment of suspended sediments included in the design and documented in the SWP3 in order to minimize clogging of the infiltrating surface. Pretreatment shall concentrate sediment in a location where it can be readily removed. Examples include media filters situated upstream of the storage or other suitable alternative approved by Ohio EPA. For infiltrating underground systems, pretreatment shall be 80% effective at capturing total suspended solids according to the testing protocol established in the Alternative Post-Construction BMP Testing Protocol.

Small Construction Activities. For all construction activities authorized under this permit which result in a disturbance less than 2 acres, a post-construction practice shall be used to treat storm water runoff for pollutants and to reduce adverse impacts on receiving waters. The applicant must provide a justification in the SWP3 why the use of table 4a and 4b practices are not feasible. The justification must address limiting factors which would prohibit the project going forward should table 4a and 4b practices be required. Please note that additional practices selected will require approval from the regulated MS4. The use of green infrastructure BMPs such as runoff reducing practices is also encouraged.

Transportation Projects. The construction of new roads and roadway improvement projects by public entities (i.e., the state, counties, townships, cities, or villages) may implement post-construction BMPs in compliance with the current version (as of the effective date of this permit) of the Ohio Department of Transportation's "Location and Design Manual, Volume Two Drainage Design" that has been accepted by Ohio EPA as an alternative to the conditions of this permit.

Offsite Mitigation of Post-Construction. Ohio EPA may authorize the offsite mitigation of the post-construction requirements of Part III.G.2.e of this permit on a case by case basis provided the permittee clearly demonstrates the BMPs listed in Tables 4a and 4b are not feasible and the following criteria are met: (1) a maintenance agreement or policy is established to ensure operations and treatment long-term; (2) the offsite location discharges to the same HUC-12 watershed unit; and (3) the mitigation ratio of the WQv is 1.5 to 1 or the WQv at the point of retrofit, whichever is greater. Requests for offsite mitigation must be received prior to receipt of the NOI application.

Previously Developed Areas - Ohio EPA encourages the redevelopment of previously graded, paved or built upon sites through a reduction of the WQv treatment requirement. For a previously developed area, one or a combination of the following two conditions shall be met:

- A 20 percent net reduction of the site's volumetric runoff coefficient through impervious area reduction with soil restoration or replacing impervious roof area with green roof area (for these purposes green roofs shall be considered pervious surface) or
- Treatment of 20 percent of the WQv for the previously developed area using a practice meeting Table 4a/4b criteria.

Where there is a combination of redeveloped areas and new development, a weighted approached shall be used with the following equation:

$$WQv = P * A * [(Rv_1*0.2) + (Rv_2 - Rv_1)] / 12 \qquad \text{(Equation 3)}$$

where

P = 0.90 inches
A = area draining into the BMP in acres
Rv_1 = volumetric runoff coefficient for existing conditions (current site impervious area)
Rv_2 = volumetric runoff coefficient for proposed conditions (post-construction site impervious area)

Post-construction practices shall be located to treat impervious areas most likely to generate the highest pollutant load, such as parking lots or roadways, rather than areas predicted to be cleaner such as rooftops.

Runoff Reduction Practices. The size of structural post-construction practices used to capture and treat the WQv can be reduced by incorporating runoff reducing practices into the design of the site's drainage system. The approach to calculate and document runoff reduction is detailed in the Rainwater and Land Development Manual. BMP-specific runoff reduction volumes are set by specifications in the Rainwater and Land Development Manual for the following practices:

- Impervious surface disconnection
- Rainwater harvesting
- Bioretention
- Infiltration basin
- Infiltration trench
- Permeable pavement with infiltration
- Underground storage with infiltration
- Grass swale
- Sheet flow to filter strip
- Sheet flow to conservation area

A runoff reduction approach may be used to meet the groundwater recharge requirements in the Big Darby Creek Watershed. The runoff reduction practices used for groundwater recharge may be used to reduce the WQv requirement, see appendix A for details on groundwater recharge requirements.

In order to promote the implementation of green infrastructure, the Director may consider the use of runoff reducing practices to demonstrate compliance with Part III.G.2.e of this permit for areas of the site not draining into a common drainage system of the site, e.g., sheet flow from perimeter areas such as the rear yards of residential lots, low density development scenarios, or where the permittee can demonstrate that the intent of pollutant removal and stream protection, as required in Part III.G.2.e of this permit is being addressed through non-structural post-construction BMPs based upon review and approval by Ohio EPA.

<u>Use of Alternative Post-Construction BMPs.</u> This permit does not preclude the use of innovative or experimental post-construction storm water management technologies. Alternative post-construction BMPs shall previously have been tested to confirm storm water treatment efficacy equivalent to those BMPs listed in Tables 4a and 4b using the protocol described in this section. BMP testing may include laboratory testing, field testing, or both.

Permittees shall request approval from Ohio EPA to use alternative post-construction BMPs on a case-by-case basis. To use an alternative post-construction BMP, the permittee must demonstrate that use of a BMP listed in Tables 4a and 4b is not feasible and the proposed alternative post-construction BMP meets the minimum treatment criteria as described in this section. The permittee shall submit an application to Ohio EPA for any proposed alternative post-construction BMP. Where the development project is located within a regulated municipal separate storm sewer system (MS4) community, the use of an alternative practice requires pre-approval by the MS4 before submittal of the

Ohio EPA permit application. Ohio EPA requires that approvals for alternative post-construction BMPs are finalized before permittees submit an NOI for permit coverage.

In addition to meeting sediment removal criteria, the discharge rate from the proposed alternative practice shall be reduced to prevent stream bed erosion and protect the physical and biological stream integrity unless there will be negligible hydrological impact to the receiving surface water of the state. Discharge rate is considered to have a negligible impact if the permittee can demonstrate that one of the following three conditions exist:

i. The entire WQv is recharged to groundwater;
ii. The larger common plan of development or sale will create less than one acre of impervious surface;
iii. The storm water drainage system of the development discharges directly into a large river with drainage area equal to 100 square miles or larger upstream of the development site or to a lake where the development area is less than 5 percent of the watershed area, unless a TMDL has identified water quality problems into the receiving surface waters of the state.

If the conditions above that minimize the potential for hydrological impact to the receiving surface water of the state do not exist, then the alternative post-construction BMP must prevent stream erosion by reducing the flow rate from the WQ_V. In such cases, discharge of the WQ_V must be controlled. A second storm water BMP that provides extended detention of the WQv may be needed to meet the post-construction criteria.

<u>Alternative Post-Construction BMP Testing Protocol.</u> For laboratory testing, the alternative BMP shall be tested using sediment with a specific gravity of 2.65, a particle size distribution closely matching the distribution shown in Table 5, and total suspended sediment (TSS) concentrations within 10% of 200 mg/L (180 mg/L – 220 mg/L TSS). For an alternative BMP to be acceptable, the test results must demonstrate that the minimum treatment rate is 80% TSS removal at the design flow rate for the tested BMP.

Table 5 Particle Size Distribution for Testing Alternative Post-Construction BMPs

Particle Size (microns)	**Percent Finer (%)**
1,000	100
500	95
250	90
150	75
100	60
75	50
50	45
20	35
8	20
5	10
2	5

- For field testing, the alternative BMP shall be tested using storm water runoff from the field, not altered by adding aggregate or subjecting to unusually high sediment loads such as those from unstabilized construction disturbance. The storm water runoff used for field testing shall be representative of runoff from the proposed installation site for the alternative BMP after all construction activities have ceased and the ground has been stabilized. The influent and effluent TSS concentrations of storm water runoff must be collected in the field. For an alternative BMP to be acceptable, the test results must demonstrate the minimum treatment rate is 80% TSS removal for influent concentrations equal to or greater than 100 mg/L TSS. If the influent concentration to the proposed alternative BMP is less than 100 mg/L TSS in the field, then the BMP must achieve an average effluent concentration less than or equal to 20 mg/L TSS.

- Testing of alternative post-construction BMPs shall be performed or overseen by a qualified independent, third-party testing organization;

- Testing shall demonstrate the maximum flow rate at which the alternative post-construction BMP can achieve the necessary treatment efficacy, including consideration for the potential of sediment resuspension;

- Testing shall demonstrate the maximum volume of sediment and floatables that can be collected in the alternative post-construction BMP before pollutants must be removed to maintain 80% treatment efficacy;

- Testing shall indicate the recommended maintenance frequency and maintenance protocol to ensure ongoing performance of the alternative post-construction BMP.

The alternative post-construction BMP testing protocol described in this section is similar to testing requirements specified by the New Jersey Department of Environmental Protection (NJDEP) for storm water Manufactured Treatment Devices (MTD) and therefore testing results certified by NJDEP shall be accepted by Ohio EPA. For examples of BMPs that have been tested using New Jersey Department of Environmental Protection's procedures, see the website: www.njstormwater.org.

Another nationally recognized storm water product testing procedure is the Technology Assessment Protocol – Ecology (TAPE) administered by the State of Washington, Department of Ecology. The TAPE testing procedure describes testing to achieve 80% TSS removal using a sediment mix with a particle size distribution with approximately 75% of the mass of the aggregate with particle diameters less than 45 microns. Overall, this particle size distribution is finer than the distribution in Table 5. Therefore, if TAPE testing results are available for a proposed alternative post-construction BMP, those results shall be accepted by Ohio EPA. The State of Washington, Department of Ecology website is https://ecology.wa.gov/.

Alternative BMPs that utilize treatment processes such as filtering or centrifugal separation, rather than a detention and settling volume, must be designed to ensure treatment of 90 percent of the average annual runoff volume. For the design of these BMPs, the water quality flow rate (WQF) considered equivalent to the Water Quality Volume (WQv) shall be determined utilizing the Rational Method (Equation 4) with an intensity (i) appropriate for the water quality precipitation event. This intensity shall be calculated using the table given in Appendix C.

$$WQF = C * i * A \qquad \text{(Equation 4)}$$

Where

WQF = water quality flow rate in cubic feet per second (cfs)
C = rational method runoff coefficient
i = intensity (in/hr)
A = area draining to the BMP (acres)

Alternative post-construction BMPs may include, but are not limited to: vegetated swales, vegetated filter strips, hydrodynamic separators, high-flow media filters, cartridge filters, membrane filters, subsurface flow wetlands, multi-chamber treatment trains, road shoulder media filter drains, wetland channels, rain barrels, green roofs, and rain gardens. The Director may also consider non-structural post-construction approaches.

f. Surface Water Protection. If the project site contains any streams, rivers, lakes, wetlands or other surface waters, certain construction activities at the site may be regulated under the CWA and/or state isolated wetland permit requirements. Sections 404 and 401 of the Act regulate the discharge of dredged or fill material into surface waters and the impacts of such activities on water quality, respectively. Construction activities in surface waters which may be subject to CWA regulation and/or state isolated wetland permit requirements include, but are not limited to: sewer line crossings, grading, backfilling or culverting streams, filling wetlands, road and utility line construction, bridge installation and installation of flow control structures. If the project contains streams, rivers, lakes or wetlands or possible wetlands, the permittee shall contact the appropriate U.S. Army Corps of Engineers District Office. (CAUTION: Any area of seasonally wet hydric soil is a potential wetland - please consult the Soil Survey and list of hydric soils for your County, available at your county's Soil and Water Conservation District. If you have any questions about Section 401 water quality certification, please contact the Ohio Environmental Protection Agency, Section 401 Coordinator.)

U.S. Army Corps of Engineers (Section 404 regulation):

- Huntington, WV District (304) 399-5210 (Muskingum River, Hocking River, Scioto River, Little Miami River, and Great Miami River Basins)
- Buffalo, NY District (716) 879-4330 (Lake Erie Basin)
- Pittsburgh, PA District (412) 395-7155 (Mahoning River Basin)
- Louisville, KY District (502) 315-6686 (Ohio River)

Ohio EPA 401/404 and non-jurisdictional stream/wetland coordinator can be contacted at (614) 644-2001 (all of Ohio)

Concentrated storm water runoff from BMPs to natural wetlands shall be converted to diffuse flow before the runoff enters the wetlands. The flow should be released such that no erosion occurs downslope. Level spreaders may need to be placed in series, particularly on steep sloped sites, to ensure non-erosive velocities. Other structural BMPs may be used between storm water features and natural wetlands, in order to protect the natural hydrology, hydroperiod, and wetland flora. If the applicant proposes to discharge to natural wetlands, a hydrologic analysis shall be performed. The applicant shall attempt to match the pre-development hydroperiods and hydrodynamics that support the wetland. The applicant shall assess whether their construction activity will adversely impact the hydrologic flora and fauna of the wetland. Practices such as vegetative buffers, infiltration basins, conservation of forest cover, and the preservation of intermittent streams, depressions, and drainage corridors may be used to maintain wetland hydrology.

g. <u>Other controls.</u>

i. **Non-Sediment Pollutant Controls.** In accordance with Part II.E, no solid (other than sediment) or liquid waste, including building materials, shall be discharged in storm water runoff. The permittee must implement all necessary BMPs to prevent the discharge of non-sediment pollutants to the drainage system of the site or surface waters of the state or an MS4. Under no circumstance shall wastewater from the washout of concrete trucks, stucco, paint, form release oils, curing compounds, and other construction materials be discharged directly into a drainage channel, storm sewer or surface waters of the state. Also, no pollutants from vehicle fuel, oils, or other vehicle fluids can be discharged to surface waters of the state. No exposure of storm water to waste materials is recommended. The SWP3 must include methods to minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, and sanitary waste to precipitation, storm water runoff, and snow melt. In accordance with Part II.D.3, the SWP3 shall include measures to prevent and respond to chemical spills and leaks. You may also reference the existence of other plans (i.e., Spill Prevention Control and Countermeasure (SPCC) plans, spill control programs, Safety Response Plans, etc.) provided that such plan addresses conditions of this permit condition and a copy of such plan is maintained on site.

ii. **Off-site traffic.** Off-site vehicle tracking of sediments and dust generation shall be minimized. In accordance with Part II.D.1, the SWP3 shall include methods to minimize the discharge of pollutants from equipment and vehicle washing, wheel washwater, and other washwaters. No detergents may be used to wash vehicles. Washwaters shall be treated in a sediment basin or alternative control that provides equivalent treatment prior to discharge.

iii. **Compliance with other requirements.** The SWP3 shall be consistent with applicable State and/or local waste disposal, sanitary sewer or septic system regulations, including provisions prohibiting waste disposal by open burning and shall provide for the proper disposal of contaminated soils to the extent these are located within the permitted area.

iv. **Trench and ground water control**. In accordance with Part II.C, there shall be no turbid discharges to surface waters of the state resulting from dewatering activities. If trench or ground water contains sediment, it shall pass through a sediment settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

v. **Contaminated Sediment.** Where construction activities are to occur on sites with contamination from previous activities, operators shall be aware that concentrations of materials that meet other criteria (is not considered a Hazardous Waste, meeting VAP standards, etc.) may still result in storm water discharges in excess of Ohio Water Quality Standards. Such discharges are not authorized by this permit. Appropriate BMPs include, but are not limited to:

- The use of berms, trenches, and pits to collect contaminated runoff and prevent discharges;
- Pumping runoff into a sanitary sewer (with prior approval of the sanitary sewer operator) or into a container for transport to an appropriate treatment/disposal facility; and
- Covering areas of contamination with tarps or other methods that prevent storm water from coming into contact with the material.

Operators should consult with Ohio EPA Division of Surface Water prior to seeking permit coverage.

h. Maintenance. All temporary and permanent control practices shall be maintained and repaired as needed to ensure continued performance of their intended function. All sediment control practices must be maintained in a functional condition until all up-slope areas they control are permanently stabilized. The SWP3 shall be designed to minimize maintenance requirements. The applicant shall provide a description of maintenance procedures needed to ensure the continued performance of control practices.

i. Inspections. The permittee shall assign “qualified inspection personnel” to conduct inspections to ensure that the control practices are functional and to evaluate whether the SWP3 is adequate and properly implemented in accordance with the schedule proposed in Part III.G.1.h of this permit or whether additional control measures are required. At a minimum, procedures in a SWP3 shall provide that all controls on the site are inspected:

- after any storm event greater than one-half inch of rain per 24-hour period by the end of the next calendar day, excluding weekends and holidays unless work is scheduled; and
- once every seven calendar days.

The inspection frequency may be reduced to at least once every month for dormant sites if:

- the entire site is temporarily stabilized or
- runoff is unlikely due to weather conditions for extended periods of time (e.g., site is covered with snow, ice, or the ground is frozen).

The beginning and ending dates of any reduced inspection frequency shall be documented in the SWP3.
Once a definable area has achieved final stabilization, the area may be marked on the SWP3 and no further inspection requirements shall apply to that portion of the site.

Following each inspection, a checklist must be completed and signed by the qualified inspection personnel representative. At a minimum, the inspection report shall include:

i. the inspection date;
ii. names, titles, and qualifications of personnel making the inspection;
iii. weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred;
iv. weather information and a description of any discharges occurring at the time of the inspection;
v. location(s) of discharges of sediment or other pollutants from the site;
vi. location(s) of BMPs that need to be maintained;
vii. location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
viii. location(s) where additional BMPs are needed that did not exist at the time of inspection; and
ix. corrective action required including any changes to the SWP3 necessary and implementation dates.

Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for pollutants entering the drainage system. Erosion and sediment control measures identified in the SWP3 shall be observed to ensure that those are operating correctly. Discharge locations shall be inspected to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to the receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking.

The permittee shall maintain for three years following the submittal of a notice of termination form, a record summarizing the results of the inspection, names(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWP3 and a certification as to whether the facility is in compliance with the SWP3 and the permit and identify any incidents of non-compliance. The record and certification shall be signed in accordance with Part V.G. of this permit.

i. **When practices require repair or maintenance.** If the inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment settling pond, it shall be repaired or maintained within 3 days of the inspection. Sediment settling ponds shall be repaired or maintained within 10 days of the inspection.

ii. **When practices fail to provide their intended function.** If the inspection reveals that a control practice fails to perform its intended function and that another, more appropriate control practice is required, the SWP3 shall be amended and the new control practice shall be installed within 10 days of the inspection.

iii. **When practices depicted on the SWP3 are not installed.** If the inspection reveals that a control practice has not been implemented in accordance with the schedule contained in Part III.G.1.h of this permit, the control practice shall be implemented within 10 days from the date of the inspection. If the inspection reveals that the planned control practice is not needed, the record shall contain a statement of explanation as to why the control practice is not needed.

3. Approved State or local plans. All dischargers regulated under this general permit must comply, except those exempted under state law, with the lawful requirements of municipalities, counties and other local agencies regarding discharges of storm water from construction activities. All erosion and sediment control plans and storm water management plans approved by local officials shall be retained with the SWP3 prepared in accordance with this permit. Applicable requirements for erosion and sediment control and storm water management approved by local officials are, upon submittal of a NOI form, incorporated by reference and enforceable under this permit even if they are not specifically included in an SWP3 required under this permit. When the project is located within the jurisdiction of a regulated municipal separate storm sewer system (MS4), the permittee shall certify that the SWP3 complies with the requirements of the storm water management program of the MS4 operator.

4. Exceptions. If specific site conditions prohibit the implementation of any of the erosion and sediment control practices contained in this permit or site-specific conditions are such that implementation of any erosion and sediment control practices contained in this permit will result in no environmental benefit, then the permittee shall provide justification for rejecting each practice based on site conditions. Exceptions from implementing the erosion and sediment control standards contained in this permit will be approved or denied on a case-by-case basis.

The permittee may request approval from Ohio EPA to use alternative methods to satisfy conditions in this permit if the permittee can demonstrate that the alternative methods are sufficient to protect the overall integrity of receiving streams and the watershed. Alternative methods will be approved or denied on a case-by-case basis.

PART IV. NOTICE OF TERMINATION REQUIREMENTS

A. Failure to notify.

The terms and conditions of this permit shall remain in effect until a signed Notice of Termination (NOT) form is submitted. Failure to submit an NOT constitutes a violation of this permit and may affect the ability of the permittee to obtain general permit coverage in the future.

B. When to submit an NOT.

1. Permittees wishing to terminate coverage under this permit shall submit an NOT form in accordance with Part V.G. of this permit. Compliance with this permit is required until an NOT form is submitted. The permittee's authorization to discharge under this permit terminates at midnight of the day the NOT form is submitted. Prior to submitting the NOT form, the permittee shall conduct a site inspection in accordance with Part III.G.2.i of this permit and have a maintenance plan in place to ensure all post-construction BMPs will be maintained in perpetuity.

2. All permittees shall submit an NOT form within 45 days of completing all permit requirements. Enforcement actions may be taken if a permittee submits an NOT form without meeting one or more of the following conditions:

   a. Final stabilization (see definition in Part VII) has been achieved on all portions of the site for which the permittee is responsible (including, if applicable, returning agricultural land to its pre-construction agricultural use);

   b. Another operator(s) has assumed control over all areas of the site that have not been finally stabilized;

   c. A maintenance plan is in place to ensure all post construction BMPs are adequately maintained in the long-term;

   d. For non-residential developments, all elements of the storm water pollution prevention plan have been completed, the disturbed soil at the identified facility have been stabilized and temporary erosion and sediment control measures have been removed at the appropriate time, or all storm water discharges associated with construction activity from the identified facility that are authorized by the above referenced NPDES general permit have otherwise been eliminated. (i)For residential developments only, temporary stabilization has been completed and the lot, which includes a home, has been transferred to the homeowner; (ii) final stabilization has been completed and the lot, which does not include a home, has been transferred to the property owner; (iii) no stabilization has been implemented on a lot, which includes a home, and the lot has been transferred to the homeowner; or

e. An exception has been granted under Part III.G.4.

C. How to submit an NOT.

To terminate permit coverage, the permitee shall submit a complete and accurate Notice of Termination (NOT) form using Ohio EPA's electronic application form which is available through the Ohio EPA eBusiness Center at: https://ebiz.epa.ohio.gov/. Submission through the Ohio EPA eBusiness Center will require establishing an Ohio EPA eBusiness Center account and obtaining a unique Personal Identification Number (PIN) for final submission of the NOT. Existing eBusiness Center account holders can access the NOT form through their existing account and submit using their existing PIN. Please see the following link for guidance: **http://epa.ohio.gov/dsw/ebs.aspx#170669803-streams-guidance**. Alternatively, if you are unable to access the NOT form through the agency eBusiness Center due to a demonstrated hardship, the NOT may be submitted on paper NOT forms provided by Ohio EPA. NOT information shall be typed on the form. Please contact Ohio EPA, Division of Surface Water at (614) 644-2001 if you wish to receive a paper NOT form.

PART V. STANDARD PERMIT CONDITIONS.

A. Duty to comply.

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of ORC Chapter 6111 and is grounds for enforcement action.

Ohio law imposes penalties and fines for persons who knowingly make false statements or knowingly swear or affirm the truth of a false statement previously made.

B. Continuation of an expired general permit.

An expired general permit continues in force and effect until a new general permit is issued.

C. Need to halt or reduce activity not a defense.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to mitigate.

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Duty to provide information.

The permittee shall furnish to the director, within 10 days of written request, any information which the director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the director upon request copies of records required to be kept by this permit.

F. Other information.

When the permittee becomes aware that he or she failed to submit any relevant facts or submitted incorrect information in the NOI, SWP3, NOT or in any other report to the director, he or she shall promptly submit such facts or information.

G. Signatory requirements.

All NOIs, NOTs, SWP3s, reports, certifications or information either submitted to the director or that this permit requires to be maintained by the permittee, shall be signed.

1. These items shall be signed as follows:

    a. For a corporation: By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

        i. A president, secretary, treasurer or vice-president of the corporation in charge of a principal business function or any other person who performs similar policy or decision-making functions for the corporation; or

        ii. The manager of one or more manufacturing, production or operating facilities, provided, the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

    b. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

    c. For a municipality, State, Federal or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes (1) the chief executive officer of the agency or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of U.S. EPA).

2. All reports required by the permits and other information requested by the director shall be signed by a person described in Part V.G.1 of this permit or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Part V.G.1 of this permit and submitted to the director;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of manager, operator of a well or well field, superintendent, position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

c. The written authorization is submitted to the director.

3. Changes to authorization. If an authorization under Part V.G.2 of this permit is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.G.2 of this permit must be submitted to the director prior to or together with any reports, information or applications to be signed by an authorized representative.

H. Certification.

Any person signing documents under this section shall make the following 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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, 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. Oil and hazardous substance liability.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject under section 311 of the CWA or 40 CFR Part 112. 40 CFR Part 112 establishes procedures, methods and equipment and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable surface waters of the state or adjoining shorelines.

J. Property rights.

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

K. Severability.

The provisions of this permit are severable and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

L. Transfers.

Ohio NPDES general permit coverage is transferable. Ohio EPA must be notified in writing sixty days prior to any proposed transfer of coverage under an Ohio NPDES general permit. The transferee must inform Ohio EPA it will assume the responsibilities of the original permittee transferor.

M. Environmental laws.

No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

N. Proper operation and maintenance.

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of SWP3s. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems, installed by a permittee only when necessary to achieve compliance with the conditions of the permit.

O. Inspection and entry.

The permittee shall allow the director or an authorized representative of Ohio EPA, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;

2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment); and

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

P. Duty to Reapply.

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.

Q. Permit Actions.

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

R. Bypass.

The provisions of 40 CFR Section 122.41(m), relating to “Bypass,” are specifically incorporated herein by reference in their entirety. For definition of “Bypass,” see Part VII.C.

S. Upset.

The provisions of 40 CFR Section 122.41(n), relating to “Upset,” are specifically incorporated herein by reference in their entirety. For definition of “Upset,” see Part VII.GG.

T. Monitoring and Records.

The provisions of 40 CFR Section 122.41(j), relating to “Monitoring and Records,” are specifically incorporated herein by reference in their entirety.

U. Reporting Requirements.

The provisions of 40 CFR Section 122.41(l), relating to “Reporting Requirements,” are specifically incorporated herein by reference in their entirety.

PART VI. REOPENER CLAUSE

If there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with construction activity covered by this permit, the permittee of such discharge may be required to obtain coverage under an individual permit or an alternative general permit in accordance with Part I.C of this permit or the permit may be modified to include different limitations and/or requirements.

Permit modification or revocation will be conducted according to ORC Chapter 6111.

PART VII. DEFINITIONS

A. “Act” means Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117 and Pub. L. 100-4, 33 U.S.C. 1251 et. seq.

B. “Bankfull channel” means a channel flowing at channel capacity and conveying the bankfull discharge. Delineated by the highest water level that has been maintained for a sufficient period of time to leave evidence on the landscape, such as the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial or the point at which the clearly scoured substrate of the stream ends and terrestrial vegetation begins.

C. <u>“Bankfull discharge”</u> means the streamflow that fills the main channel and just begins to spill onto the floodplain; it is the discharge most effective at moving sediment and forming the channel.

D. <u>“Best management practices (BMPs)”</u> means schedules of activities, prohibitions of practices, maintenance procedures and other management practices (both structural and non-structural) to prevent or reduce the pollution of surface waters of the state. BMP's also include treatment requirements, operating procedures and practices to control plant and/or construction site runoff, spillage or leaks, sludge or waste disposal or drainage from raw material storage.

E. <u>“Bypass”</u> means the intentional diversion of waste streams from any portion of a treatment facility.

F. <u>“Channelized stream”</u> means the definition set forth in Section 6111.01 (M) of the ORC.

G. <u>“Commencement of construction”</u> means the initial disturbance of soils associated with clearing, grubbing, grading, placement of fill, or excavating activities or other construction activities.

H. <u>“Concentrated storm water runoff”</u> means any storm water runoff which flows through a drainage pipe, ditch, diversion or other discrete conveyance channel.

I. <u>“Director”</u> means the director of the Ohio Environmental Protection Agency.

J. <u>“Discharge”</u> means the addition of any pollutant to the surface waters of the state from a point source.

K. <u>“Disturbance”</u> means any clearing, grading, excavating, filling, or other alteration of land surface where natural or man-made cover is destroyed in a manner that exposes the underlying soils.

L. <u>“Drainage watershed”</u> means for purposes of this permit the total contributing drainage area to a BMP, i.e., the “watershed” directed to the practice. This would also include any off-site drainage.

M. <u>“Final stabilization”</u> means that either:

1. All soil disturbing activities at the site are complete and a uniform perennial vegetative cover (e.g., evenly distributed, without large bare areas) with a density of at least 70 percent cover for the area has been established on all unpaved areas and areas not covered by permanent structures or equivalent stabilization measures (such as the use of mulches, rip-rap, gabions or geotextiles) have been employed. In addition, all temporary erosion and sediment control practices are removed and disposed of and all trapped sediment is permanently stabilized to prevent further erosion; or

2. For individual lots in residential construction by either:

   a. The homebuilder completing final stabilization as specified above or

   b. The homebuilder establishing temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for and benefits of, final stabilization. (Homeowners typically have an incentive to put in the landscaping functionally equivalent to final stabilization as quick as possible to keep mud out of their homes and off sidewalks and driveways.); or

3. For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its pre-construction agricultural use. Areas disturbed that were previously used for agricultural activities, such as buffer strips immediately adjacent to surface waters of the state and which are not being returned to their pre-construction agricultural use, must meet the final stabilization criteria in (1) or (2) above.

N. <u>“General contractor”</u> – for the purposes of this permit, the primary individual or company solely accountable to perform a contract. The general contractor typically supervises activities, coordinates the use of subcontractors, and is authorized to direct workers at a site to carry out activities required by the permit.

O. <u>“Individual lot NOI”</u> means a Notice of Intent for an individual lot to be covered by this permit (see Part I of this permit).

P. <u>“Larger common plan of development or sale”</u>- means a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan.

Q. <u>“MS4"</u> means municipal separate storm sewer system which means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) that are:

1. Owned or operated by the federal government, state, municipality, township, county, district(s) or other public body (created by or pursuant to state or federal law) including special district under state law such as a sewer district, flood control district or drainage districts or similar entity or a designated and approved management agency under section 208 of the act that discharges into surface waters of the state; and
2. Designed or used for collecting or conveying solely storm water,
3. Which is not a combined sewer and
4. Which is not a part of a publicly owned treatment works.

R. <u>“National Pollutant Discharge Elimination System (NPDES)”</u> means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits and enforcing pretreatment requirements, under sections 307, 402, 318 and 405 of the CWA. The term includes an "approved program.”

S. “Natural channel design” means an engineering technique that uses knowledge of the natural process of a stream to create a stable stream that will maintain its form and function over time.

T. “NOI” means notice of intent to be covered by this permit.

U. “NOT” means notice of termination.

V. “Operator” means any party associated with a construction project that meets either of the following two criteria:

1. The party has day-to-day operational control of all activities at a project which are necessary to ensure compliance with a SWP3 for the site and all permit conditions including the ability to authorize modifications to the SWP3, construction plans and site specification to ensure compliance with the General Permit, or

2. Property owner meets the definition of operator should the party which has day to day operational control require additional authorization from the owner for modifications to the SWP3, construction plans, and/or site specification to ensure compliance with the permit or refuses to accept all responsibilities as listed above (Part VII.V.1).

Subcontractors generally are not considered operators for the purposes of this permit. As set forth in Part I.F.1, there can be more than one operator at a site and under these circumstances, the operators shall be co-permittees.

W. “Ordinary high water mark” means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

X. “Owner or operator” means the owner or operator of any “facility or activity” subject to regulation under the NPDES program.

Y. “Permanent stabilization” means the establishment of permanent vegetation, decorative landscape mulching, matting, sod, rip rap and landscaping techniques to provide permanent erosion control on areas where construction operations are complete or where no further disturbance is expected for at least one year.

Z. “Percent imperviousness” means the impervious area created divided by the total area of the project site.

AA. “Point source” means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or the floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

BB. "Qualified inspection personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess all conditions at the construction site that could impact storm water quality and to assess the effectiveness of any sediment and erosion control measures selected to control the quality of storm water discharges from the construction activity.

CC. "Rainwater and Land Development" is a manual describing construction and post-construction best management practices and associated specifications. A copy of the manual may be obtained by contacting the Ohio Department of Natural Resources, Division of Soil & Water Conservation.

DD. "Riparian area" means the transition area between flowing water and terrestrial (land) ecosystems composed of trees, shrubs and surrounding vegetation which serve to stabilize erodible soil, improve both surface and ground water quality, increase stream shading and enhance wildlife habitat.

EE. "Runoff coefficient" means the fraction of total rainfall that will appear at the conveyance as runoff.

FF. "Sediment settling pond" means a sediment trap, sediment basin or permanent basin that has been temporarily modified for sediment control, as described in the latest edition of the Rainwater and Land Development manual.

GG. "State isolated wetland permit requirements" means the requirements set forth in Sections 6111.02 through 6111.029 of the ORC.

HH. "Storm water" means storm water runoff, snow melt and surface runoff and drainage.

II. "Steep slopes" means slopes that are 15 percent or greater in grade. Where a local government or industry technical manual has defined what is to be considered a "steep slope," this permit's definition automatically adopts that definition.

JJ. "Stream edge" means the ordinary high water mark.

KK. "Subcontractor" – for the purposes of this permit, an individual or company that takes a portion of a contract from the general contractor or from another subcontractor.

LL. "Surface waters of the state" or "water bodies" means all streams, lakes, reservoirs, ponds, marshes, wetlands or other waterways which are situated wholly or partially within the boundaries of the state, except those private waters which do not combine or effect a junction with natural surface or underground waters. Waters defined as sewerage systems, treatment works or disposal systems in Section 6111.01 of the ORC are not included.

MM. "SWP3" means storm water pollution prevention plan.

NN. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

OO. "Temporary stabilization" means the establishment of temporary vegetation, mulching, geotextiles, sod, preservation of existing vegetation and other techniques capable of quickly establishing cover over disturbed areas to provide erosion control between construction operations.

PP. "Water Quality Volume (WQ_v)" means the volume of storm water runoff which must be captured and treated prior to discharge from the developed site after construction is complete.

Appendix A
Big Darby Creek Watershed

CONTENTS OF THIS APPENDIX

A.1 Permit Area.

This appendix to Permit OHC00005 applies to the entire Big Darby Creek Watershed located within the State of Ohio. Please see Attachment A for permit area boundaries.

A.2 TMDL Conditions.

This general permit requires control measures/BMPs for construction sites that reflect recommendations set forth in the U.S. EPA approved Big Darby Creek TMDL.

A.3 Sediment Settling Ponds and Sampling

Sediment settling ponds additional conditions. The sediment settling pond shall be sized to provide a minimum sediment storage volume of 134 cubic yards of effective sediment storage per acre of drainage and maintain a target discharge performance standard of 45 mg/l Total Suspended Solids (TSS) up to a 0.75-inch rainfall event within a 24-hour period. Unless infeasible, sediment settling ponds must be dewatered at the pond surface using a skimmer or equivalent device. The depth of the sediment settling pond must be less than or equal to five feet. Sediment must be removed from the sediment settling pond when the design capacity has been reduced by 40 percent (This is typically reached when sediment occupies one-half of the basin depth).

<u>Silt Fence and Diversions</u>. For sites five or more acres in size, the use of sediment barriers as a primary sediment control is prohibited. Centralized sediment basins shall be used for sites 5 or more acres in size. Diversions shall direct all storm water runoff from the disturbed areas to the impoundment intended for sediment control. The sediment basins and associated diversions shall be implemented prior to the major earth disturbing activity.

The permittee shall sample in accordance with sampling procedures outlined in 40 CFR 136. Sampling shall occur as follows:

i. Occur at the outfall of each sediment settling pond associated with the site. Each associated outfall shall be identified by a three-digit number (001, 002, etc.);

ii. The applicable rainfall event for sampling to occur shall be a rainfall event of 0.25-inch to a 0.75-inch rainfall event to occur within a 24-hour period. Grab sampling shall be initiated at a site within 14 days, or the first applicable rainfall event thereafter, once upslope disturbance of each sampling location is initiated and shall continue on a quarterly basis. Quarterly periods shall be represented as January - March, April - June, July - September and October - December. Sampling results shall be retained on site and available for inspection.

If any sample is greater than the performance standard of 45 mg/l TSS, the permittee shall modify the SWP3 and install/implement new control practice(s) within 10 days to ensure the TSS performance standard is maintained. Within 3 days of improvement(s), or the first applicable rainfall event thereafter, the permittee shall resample to ensure SWP3 modifications maintain the TSS performance standard target.

For each sample taken, the permittee shall record the following information:

- the outfall and date of sampling;
- the person(s) who performed the sampling;
- the date the analyses were performed on those samples;
- the person(s) who performed the analyses;
- the analytical techniques or methods used; and
- the results of all analyses.

Both quarterly and sampling results following a discharge target exceedance shall be retained on site and available for inspection.

A.4 Riparian Setback Requirements.

The SWP3 shall clearly delineate the boundary of required stream setback distances. No construction activity shall occur, without appropriate mitigation, within the delineated setback boundary except activities associated with restoration or recovery of natural floodplain and channel form characteristics as described in Attachment B, storm water conveyances from permanent treatment practices and approvable utility crossings. Such conveyances must be designed to minimize the width of disturbance. If intrusion within the delineated setback boundary is necessary to accomplish the purposes of a project, then mitigation shall be required in accordance with Appendix A.5 of this permit. Streams requiring protection under this section are defined as perennial, intermittent or ephemeral streams with a defined bed, bank or channel. National Resources Conservation Service (NRCS) soil survey maps should be used as one reference and the presence of a stream requiring protection should also be confirmed in the field. Any required setback distances shall be clearly displayed in the field prior to any construction related activity.

Riparian setbacks distance shall be delineated based upon one of the following two methods:

i. The setback distance shall be sized as the greater of the following:

1. The regulatory 100-year floodplain based on FEMA mapping;

2. A minimum of 100 feet from the top of the streambank on each side; or

3. A distance calculated using the following equation:

   $W = 133DA^{0.43}$ (Equation 1, Appendix A)

   where:
   DA = drainage area (mi^2)
   W = total width of riparian setback (ft)

W shall be centered over the meander pattern of the stream such that a line representing the setback width would evenly intersect equal elevation lines on either side of the stream.

If the DA remains relatively constant throughout the stretch of interest, then the DA of the downstream edge of the stretch should be used. Where there is a significant increase in the DA from the upstream edge to The downstream edge of the area of interest, the setback width shall increase accordingly.

ii. **Stream Restoration with 100 feet (each side) Riparian Setback**. Each stream segment within the proposed site boundaries can be assessed in accordance with Attachment B, Part 1. In the event the stream segment is classified as a "Previously Modified Low Gradient Headwater Stream", the permittee has the option to restore the stream segment in accordance with Attachment B and include a 100-foot water quality setback distance from the top of the streambank on each side. In the event the stream segment exceeds the minimum criteria in Attachment B to be classified as a "Previously Modified Low Gradient Headwater Stream," this Appendix A, Attachment B may be considered on a case-by-case basis.

No structural sediment controls (e.g., the installation of sediment barriers or a sediment settling pond) or structural post-construction controls shall be used in a surface water of the State or the delineated setback corridor.

Previously developed projects (as defined in Part III.G.2.e.) located within the delineated setback boundary are exempt from Riparian Setback Mitigation (A.5) provided the proposed project does not further intrude into the delineated setback boundary.

Linear transportation projects which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities are exempt from Riparian Setback Mitigation (Appendix A, A.5) if less than one acre of total new right-of-way is associated with the project.

A.5 Riparian Setback Mitigation.

The mitigation required for intrusion into the riparian setback shall be determined by the horizontal distance the intrusion is from the stream. Up to three zones will be used in determining the required mitigation. Zone 1 extends from 0 to 25 feet from the stream edge. Zone 2 extends from 25 to 100 feet from the stream edge, and Zone 3 extends from 100 feet to the outer edge of the setback corridor. Intrusion into these zones will require the following mitigation within the same Watershed Assessment Unit (12-digit HUC scale):

i. Four times the total area disturbed in the stream and within Zone 1 of the site being developed shall be mitigated within Zone 1 of the mitigation location.

ii. Three times the area disturbed within Zone 2 of the site being developed shall be mitigated within Zones 1 and/or 2 of the mitigation location.

iii. Two times the area disturbed within Zone 3 of the site being developed shall be mitigated within any zone of the mitigation location.

In lieu of mitigation ratios found within in this section, linear transportation projects which result in total new right-of-way greater than one acre and less than two acres, which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities, shall provide Riparian Setback Mitigation at a ratio of 1.5 to 1.

All mitigation shall, at a minimum, include conserved or restored setback zone and should be designed to maximize the ecological function of the mitigation. Including mitigation at the stream edge along with associated setback areas is one way to maximize ecological function. Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of receiving permit authorization. Granting of binding conservation easements or environmental covenants protected in perpetuity for land outside of disturbed area but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas. Mitigation resulting from State or Federal environmental regulations may be adjusted in recognition of these requirements.

A.6 Groundwater Recharge Requirements.

The SWP3 shall ensure that the overall site post-development groundwater recharge equals or exceeds the pre-development groundwater recharge. The SWP3 shall describe the conservation development strategies, BMPs and other practices deemed necessary by the permittee to maintain or improve pre-development rates of groundwater recharge. Pre-development and post-development groundwater recharge shall be calculated using the following equation:

i. $Vre_x = A_x * Dre_x / 12$ (Equation 2, Appendix A)

where:

X = represents a land use and hydrologic soil group pair

Vre_x = volume of total annual recharge from land use-soil group X (in acre-ft)

Dre_x = depth of total annual recharge associated with land use-soil group X from Tables 1 or 2 (in inches)

A_x = area of land use-soil group X (in acres)

Table A-1 values should be used for land where the underlying geology indicates a potential for downward migration of groundwater. Table A-1 values represent the combined total groundwater recharge potential including groundwater contribution to stream baseflow and to the underlying bedrock aquifer. The potential for downward migration can be determined from a comparison of the potentiometric maps for the glacial and bedrock aquifers. Use Table A-2 when this potential is unlikely to exist. Detailed potentiometric maps for the Franklin county portion of the Darby watershed, and coarse potentiometric maps for the Darby watershed outside of Franklin County and hydrologic soil group data are available at:
http://www.epa.state.oh.us/dsw/permits/GP_ConstructionSiteStormWater_Darby.aspx.

Table A-1 (Appendix A) Annual Average Expected Total Groundwater Recharge[3]

Land Use	Density (DU[1]/acre)	% Impervious	Recharge (inches) by Hydrologic Soil Group2			
			A	B	C	D
Woods / Forest	-	-	17.0	16.6	15.6	14.6
Brush	-	-	17.0	16.6	15.6	14.6
Meadow	-	-	17.0	16.5	15.4	14.4
Managed Wood	-	-	16.9	16.0	14.7	13.4
Pasture	-	-	16.5	15.9	14.4	13.0
Row Crop	-	-	15.8	14.2	11.9	8.1
Urban Grasses	-	-	15.7	15.7	14.2	12.7
Low Density Residential	0.5	12%	15.7	15.7	14.2	12.7
Low Density Residential	1	20%	14.8	14.8	13.7	12.2
Medium Density Residential	2	25%	11.5	11.5	11.5	11.5
Medium Density Residential	3	30%	11.2	11.2	11.2	11.2
Medium Density Residential	4	38%	9.6	9.6	9.6	9.6
High Density Residential	≥5	65%	7.3	7.3	7.3	7.3
Commercial & Road Right-of-Way[4]	-	90%	4.3	4.3	4.3	4.3

[1] DU = Dwelling Units

[2] Hydrologic soil group designations of A/D, B/D, and C/D should be considered as D soils for this application.

[3] These values apply when recharge of the aquifer is expected; recharge to the bedrock aquifer can be expected when the potentiometric head of the glacial aquifer is greater than the bedrock aquifer.

[4] The 4.3 infiltration value may only be used for an area as a whole (includes impervious and pervious areas) which includes a minimum of 10 percent pervious area. If all land uses (pervious and impervious) are tabulated separately, then impervious areas have 0 inches of recharge.

Table A-2 (Appendix A) Annual Average Expected Baseflow Recharge[3]

Land Use	Density (DU[1]/acre)	% Impervious	Recharge (inches) by Hydrologic Soil Group2			
			A	B	C	D
Woods / Forest	-	-	11.8	11.4	10.7	9.9
Brush	-	-	11.7	11.4	10.7	9..9
Meadow	-	-	11.8	11.3	10.6	9.8
Managed Wood	-	-	11.7	11.0	10.0	9.1
Pasture	-	-	11.3	11.0	9.9	8.9
Row Crop	-	-	11.1	10.1	9.0	6.2
Urban Grasses	-	-	11.2	11.2	10.3	9.3
Low Density Residential	0.5	12%	11.2	11.2	10.3	9.3
Low Density Residential	1	20%	9.5	9.5	9.0	8.6
Medium Density Residential	2	25%	7.8	7.8	7.8	7.8
Medium Density Residential	3	30%	7.6	7.6	7.6	7.6
Medium Density Residential	4	38%	6.5	6.5	6.5	6.5
High Density Residential	≥5	65%	5.0	5.0	5.0	5.0
Commercial & Road Right-of-Way[4]	-	90%	2.9	2.9	2.9	2.9

[1] DU = Dwelling Units
[2] Hydrologic soil group designations of A/D, B/D, and C/D should be considered as D soils for this application.
[3] These values apply when no recharge of the aquifer is expected.
[4] The 2.9 infiltration value may only be used for an area as a whole (includes impervious and pervious areas) which includes a minimum of 10 percent pervious area. If all land uses (pervious and impervious) are tabulated separately, then impervious areas have 0 inches of recharge.

Table A-3 (Appendix A) Land Use Definitions

Land Use	Definition
Woods / Forest	Areas dominated by trees. Woods are protected from grazing and litter and brush adequately cover the soil.
Brush	Brush, weeds, grass mixture where brush is the major element and more than 75% of the ground is covered.
Meadow	Continuous grass, protected from grazing, generally mowed for hay.
Managed Wood	Orchards, tree farms, and other areas planted or maintained for the production of fruits, nuts, berries, or ornamentals.
Pasture	Pasture, grassland, or range where at least 50% of the ground is covered and the area is not heavily grazed.
Row Crop	Areas used to produce crops, such as corn, soybeans, vegetables, tobacco, and cotton.
Urban Grasses	Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
Residential	Areas with a mixture of constructed materials and vegetation; the average % imperviousness and number of dwelling units per acre to determine the appropriate density is specified.
Commercial	Includes infrastructure (e.g. roads, railroads, etc.) and all highly developed areas not classified as High Intensity Residential.

ii. The pre-development ground water recharge volume shall be calculated by determining the area of each land use-soil type pairing on the site of interest. The recharge associated with each such pairing multiplied by the area will give the pre-development volume of total groundwater recharge. The same shall be done for the post-development land use-soil type pairings.

Any activity that is expected to produce storm water runoff with elevated concentrations of carcinogens, hydrocarbons, metals, or toxics is prohibited from infiltrating untreated storm water from the area affected by the activity. The groundwater recharge mitigation requirement for areas affected by such activities must be met by methods which do not present a risk of groundwater contamination. The following land uses and activities are typically deemed storm water hotspots:

Vehicle salvage yards and recycling facilities

- vehicle service and maintenance facilities (i.e. truck stops, gas stations)
- fleet storage areas (i.e. bus, truck)
- industrial sites subject to industrial storm water permitting requirements
- bulk terminals
- marinas
- facilities that generate or store hazardous materials
- other land uses and activities as designated by individual review

The following land uses and activities are not normally considered hotspots:

- residential streets and rural highways
- residential development
- institutional development
- commercial and office developments
- non-industrial rooftops
- pervious areas, except golf courses and nurseries

The applicant may use structural BMPs within drinking water source protection areas for community public water systems only to the extent that the structural BMP(s) does not cause contaminants in the recharge waters to impact the ground water quality at levels that would cause an exceedance of the drinking water Maximum Contaminant Levels (OAC Section 3745-81 and 3745-82). To obtain a map of drinking water source protection areas for community public water systems contact Ohio EPA's Division of Drinking and Ground Waters at (614) 644-2752.

Linear transportation projects which are caused solely by correcting safety related issues, mandates of modern design requirements and/or resulting from other mitigation activities are exempt from Groundwater Recharge Mitigation (Appendix B, A.7) if less than one acre of total new right-of-way is associated with the project.

Protection of open space (infiltration areas) shall be by binding conservation easements that identify a third-party management agency, such as a homeowners' association/condominium association, political jurisdiction or third-party land trust.

A.7 Groundwater Recharge Mitigation.

If the post-development recharge volume is less than the pre-development recharge volume, then mitigation will be required. Two options are available for most applications:

i. The preferred method is to convert additional land to land use with higher recharge potential. The difference in groundwater recharge between the existing and converted land use recharge is the amount which can be used as recharge credit. Off-site Groundwater Recharge Mitigation shall occur within the same Watershed Assessment Unit (12-digit HUC scale) as the permitted site and preferably up-gradient and within a 2-mile radius.

Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of receiving permit authorization. Granting of binding conservation easements or environmental covenants protected in perpetuity for land outside of the disturbed area, but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas.

ii. On-site structural and non-structural practices may also be used to achieve groundwater mitigation requirements by retaining and infiltrating on-site a minimum volume of storm water runoff based on the area and hydrologic soil groups of disturbed soils. If these infiltrating practices are incorporated upstream of the water quality volume treatment practice, the volume of groundwater being infiltrated may be subtracted from the water quality volume for the purpose of meeting post-construction requirements. The on-site retention requirement is determined by the following formula:

$$V_{retention} = A_{HSG\text{-}A}*0.90 \text{ in} + A_{HSG\text{-}B}*0.75 \text{ in} + A_{HSG\text{-}C}*0.50 \text{ in} + A_{HSG\text{-}D}*0.25 \text{ in}$$

(Equation 3, Appendix A)

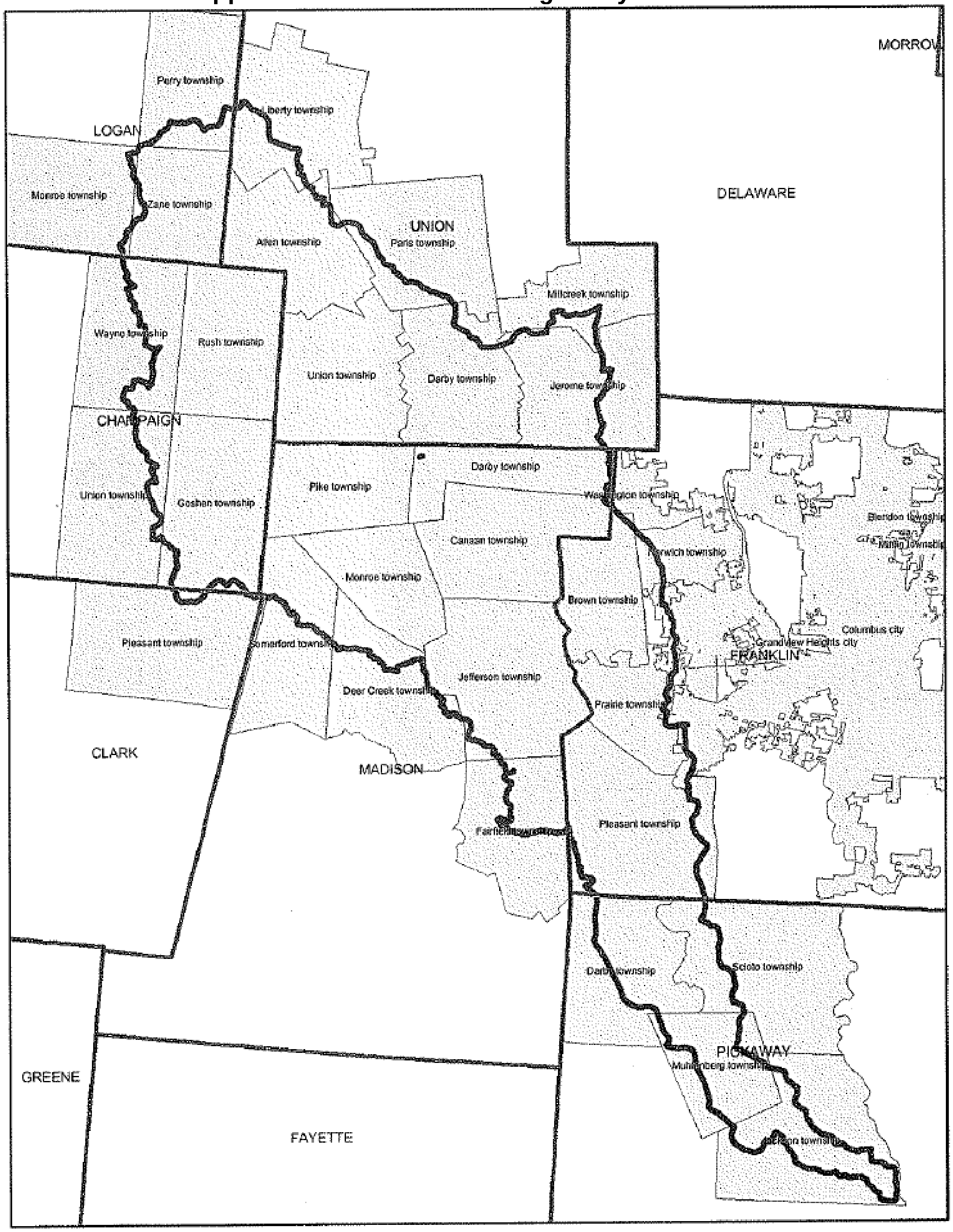
Where,
$V_{retention}$ = volume of runoff retained onsite using an approved infiltration practice
$A_{HSG\text{-}x}$ = area of each hydrologic soil group within the disturbed area

Table A-4: Hydrologic Soil Groups and On-site Retention Depth per Acre

Hydrologic Soil Group	HSG A	HSG B	HSG C	HSG D
Retention Depth (inches)	0.90	0.75	0.50	0.25

Retention volume ($V_{retention}$) provided by selected practices shall be determined using the runoff reduction method criteria as outlined in Part III.G.2.e, Ohio EPA's Runoff Reduction spreadsheet and supporting documentation in the Rainwater and Land Development manual. Hydrologic soil group (HSG) areas are to be determined by using the current version of SURRGO or Web Soil Survey soils information.

Appendix A Attachment A: Big Darby Creek Watershed



A more detailed map can be viewed at:
http://www.epa.state.oh.us/dsw/permits/GP_ConstructionSiteStormWater_Darby.aspx

Appendix A Attachment B

Part 1 Stream Assessment

This assessment will determine if a stream is considered a previously channelized, low-gradient headwater stream (a drainage ditch) which would be applicable for stream restoration in lieu of protecting a setback as per Appendix A. A.4.i and ii.

In the event the assessment of the stream, meets all the criteria listed below, restoration (provided 401/404 permits are authorized) as depicted in Part 2 of this attachment, may be a means of reducing the setback distance required by A.4.i. (Appendix A).

Previously Channelized Low-Gradient Headwater Streams (drainage ditches) shall for the purposes of this permit be defined as having all of the following characteristics:

- Less than 10 square miles of drainage area
- Low gradient and low stream power such that despite their straightened and entrenched condition incision (down-cutting) is not evident
- Entrenched, entrenchment ratio < 2.2
- Straight, sinuosity of the bankfull channel < 1.02

Part 2 Restoration

Restoration shall be accomplished by any natural channel design approach that will lead to a self-maintaining reach able to provide both local habitat and watershed services (e.g. self-purification and valley floodwater storage).

a. Construction of a floodplain, channel and habitat via natural channel design;
b. Floodplain excavation necessary to promote interaction between stream and floodplain;
c. Include a water quality setback of 100 feet from top of the streambank on each side.

The primary target regardless of design approach shall be the frequently flooded width, which shall be maximized, at 10 times the channel's self-forming width. Five times the self-forming channel width may still be acceptable particularly on portions of the site if greater widths are achieved elsewhere.

Appendix B
Olentangy River Watershed

CONTENTS OF THIS APPENDIX

B.1 Permit Area.

This appendix to Permit OHC00005 applies to specific portions of the Olentangy River Watershed located within the State of Ohio. The permit area includes the following 12-digit Hydrologic Unit Codes (HUC-12) within the Olentangy River Watershed:

12-Digit Hydrologic Unit Codes

12-Digit Hydrologic Unit Codes (HUC)	Narrative Description of Sub-Watershed
05060001 09 01	Shaw Creek
05060001 09 02	Headwaters Whetstone Creek
05060001 09 03	Claypool Run-Whetstone Creek
05060001 10 07	Delaware Run-Olentangy River
05060001 11 01	Deep Run-Olentangy River
05060001 11 02 (Only portion as depicted in Attachment A)	Rush Run-Olentangy River

Please see Attachment A (Appendix B) for permit area boundaries. An electronic version of Attachment A can be viewed at
http://epa.ohio.gov/dsw/permits/GP_ConstructionSiteStormWater_Olentangy.aspx

B.2 TMDL Conditions.

This general permit requires control measures/BMPs for construction sites that reflect recommendations set forth in the U.S. EPA approved Olentangy TMDL.

B.3 Riparian Setback Requirements.

The permittee shall comply with the riparian setback requirements of this permit or alternative riparian setback requirements established by a regulated MS4 and approved by Ohio EPA. The SWP3 shall clearly delineate the boundary of required stream setback distances. The stream setback shall consist of a streamside buffer and an outer buffer. No construction activity shall occur, without appropriate mitigation, within the streamside buffer except activities associated with storm water conveyances from permanent treatment practices, approvable utility crossings and restoration or recovery of floodplain and channel form characteristics as described in Attachment B. Storm water conveyances must be designed to minimize the width of disturbance.

Construction activities requiring mitigation for intrusions within the outer buffer for the Olentangy River mainstem and perennial streams are described in Appendix B.4.

If intrusion within the delineated setback boundary is necessary to accomplish the purposes of a project, then mitigation shall be required in accordance with Appendix B.3. of this permit. Streams requiring protection under this section have a defined bed and bank or channel and are defined as follows:

- The Olentangy River mainstem;
- Perennial streams have continuous flow on either the surface of the stream bed or under the surface of the stream bed;
- Intermittent streams flow for extended periods of time seasonally of a typical climate year; and
- Ephemeral streams are normally dry and only flow during and after precipitation runoff (episodic flow).

National Resources Conservation Service (NRCS) soil survey maps should be used as one reference and the presence of a stream requiring protection should also be confirmed in the field. Any required setback distances shall be clearly displayed in the field prior to any construction related activity.

Riparian setbacks shall be delineated based upon one of the following two methods:

i. The required setback distances shall vary with stream type as follows:

a. The setback distances associated with the mainstem of the Olentangy River shall consist of:

(1) A streamside buffer width of 100 feet as measured horizontally from the ordinary high water mark per side; and

(2) An outer buffer width sized to the regulatory 100-year floodplain based on FEMA mapping. No impervious surfaces shall be constructed without appropriate mitigation and moderate to substantial fill activities with no impervious surface may require appropriate mitigation pending an individual approval by Ohio EPA.

b. The setback distance associated with perennial streams, other than the Olentangy mainstem, shall consist of:

(1) A streamside buffer width of 80 feet per side measured horizontally from the ordinary high water mark; and

(2) An outer buffer width sized to the regulatory 100-year floodplain based on FEMA mapping. In the event the regulatory 100-year floodplain is not established, the outer buffer width shall be calculated using the following equation and measured horizontally from the ordinary high water mark. No impervious surfaces, structure, fill, or activity that would impair the floodplain or stream stabilizing ability of the outer buffer shall occur without appropriate mitigation:

$$W = 143DA^{0.41} \qquad \text{(Equation 1 Appendix B)}$$

where:
DA = drainage area (mi^2)
W = total width of riparian setback (ft)

W shall be centered over the meander pattern of the stream such that a line representing the setback width would evenly intersect equal elevation lines on either side of the stream.

If the DA remains relatively constant throughout the stretch of interest, then the DA of the downstream edge of the stretch should be used. Where there is a significant increase in the DA from the upstream edge to the downstream edge of the area of interest, the setback width shall increase accordingly.

c. The setback distance associated with intermittent streams and ephemeral streams shall be a streamside buffer width of 30 feet per side measured horizontally from the centerline of the stream. No outer buffer is required for intermittent and ephemeral streams.

ii. Stream Restoration with 100 feet (each side) Riparian Setback. Each stream segment within the proposed site boundaries can be assessed in accordance with Attachment B. In the event the stream segment is classified as a “Previously Modified Low Gradient Headwater Stream”, the permittee has the option to restore the stream segment in accordance with Attachment B and include a 100 feet water quality setback distance from the top of the streambank on each side. In the event the stream segment exceeds the minimum criteria in Attachment B to be classified as a “Previously Modified Low Gradient Headwater Stream”, this may be considered on a case-by-case basis.

No structural sediment controls (e.g., the installation of sediment barriers or a sediment settling pond) or structural post-construction controls shall be used in a stream or the streamside buffer. Activities and controls that would not impair the floodplain or stream stabilizing ability of the outer buffer can be considered.

Redevelopment projects (i.e., developments on previously developed property) located within the delineated setback boundary is exempt from Riparian Setback Mitigation (B.3) provided the proposed project does not further intrude the delineated setback boundary.

B.4 Riparian Setback Mitigation.

The mitigation required for intrusion into the riparian setback of the **Olentangy River mainstem or perennial streams** shall be determined by the horizontal distance the intrusion is from the stream. Up to three zones will be used in determining the required mitigation. Zone 1 extends from 0 to 30 feet from the stream edge. Zone 2 extends from 30 feet to the outer edge of the streamside buffer. Zone 3 extends from the outer edge of the streamside buffer to the outer edge of the outer buffer. Intrusion into these zones will require the following mitigation within the same Watershed Assessment Unit (12-digit HUC scale). Alternative mitigation, within the permit area, may be considered on a case-by-case basis:

1. Four (4) times the total area disturbed in the stream within Zone 1 of the site being developed shall be mitigated; or, two (2) times the total area disturbed in the stream within Zone 1 shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected by binding conservation easements or environmental covenants.

2. Three (3) times the area disturbed within Zone 2 of the site being developed shall be mitigated within Zones 1 and/or 2 of the mitigation location; or, one and one-half (1.5) times the total area disturbed within Zone 2 shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

3. Two (2) times the area to be mitigated within Zone 3 of the site being developed shall be mitigated within any Zone of the mitigation location; or, one (1) times the total area to be mitigated within any zone shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

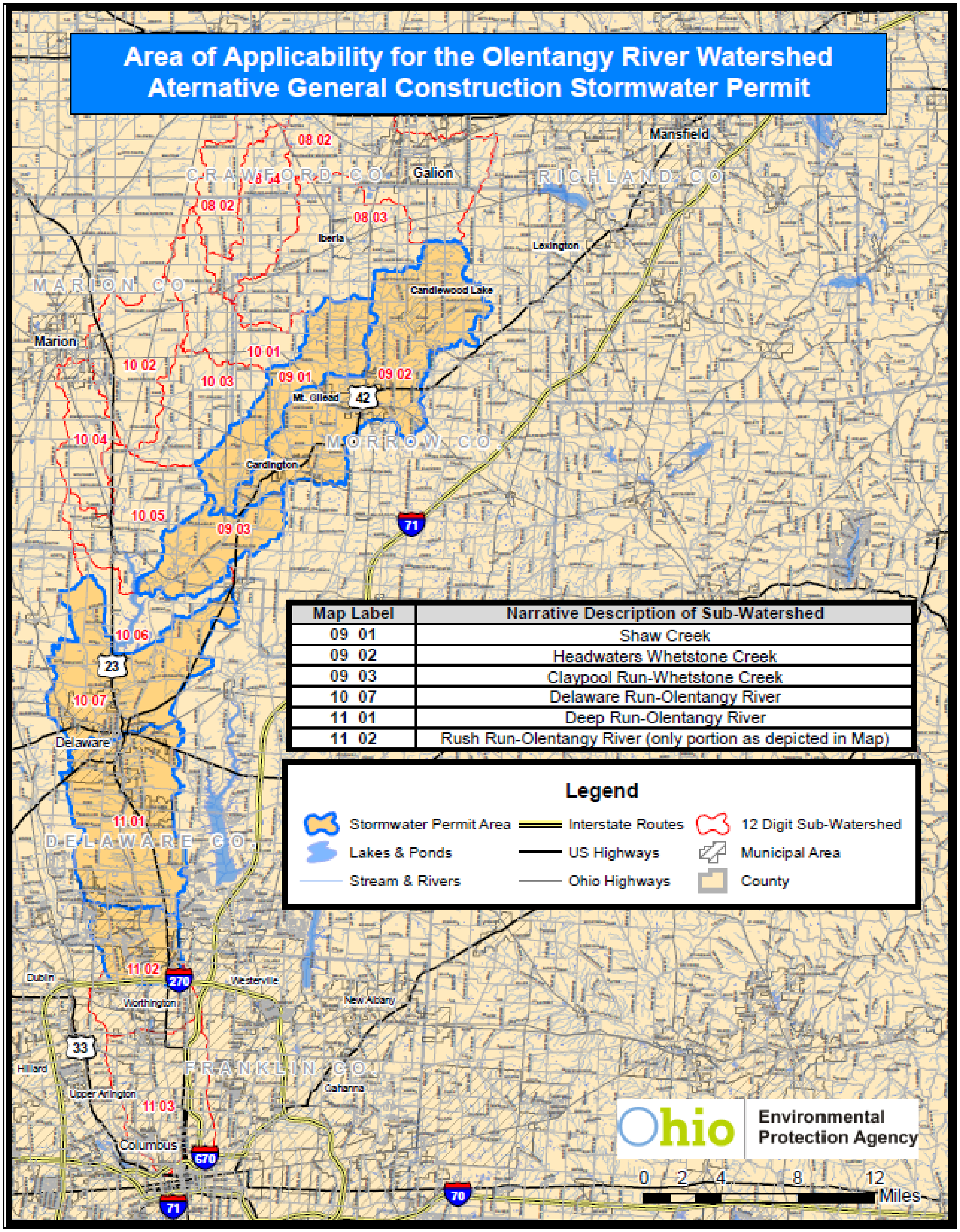
The mitigation required for intrusion into the riparian setback of an **intermittent stream** shall be four (4) times the total area disturbed within the riparian setback of the site being developed shall be mitigated; or two (2) times the total area disturbed within the riparian setback shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

The mitigation required for intrusion into the streamside buffer of an **ephemeral stream** shall be two (2) times the total area disturbed within the riparian setback of the site being developed shall be mitigated; or one (1) times the total area disturbed within the riparian setback shall be mitigated within the watershed of the immediate receiving stream, and the entire required setback of the site shall be protected in perpetuity by binding conservation easements or environmental covenants.

All mitigation shall, at a minimum, include conserved or restored setback zone, and should be designed to maximize the ecological function of the mitigation. Including mitigation at the stream edge along with associated setback areas is one way to maximize ecological function. Mitigation shall be protected in perpetuity by binding conservation easements or environmental covenants which must be recorded within 6 months of permit authorization. Granting of binding conservation easements or environmental covenants protected for land outside of disturbed area, but within a required riparian setback counts towards required mitigation.

Mitigation may also be satisfied by approved pooled mitigation areas and in-lieu fee sponsored mitigation areas. Mitigation resulting from State or Federal environmental regulations may be adjusted in recognition of these requirements.

Appendix B Attachment A Applicable Portions of the Olentangy Watershed



Map Label	Narrative Description of Sub-Watershed
09 01	Shaw Creek
09 02	Headwaters Whetstone Creek
09 03	Claypool Run-Whetstone Creek
10 07	Delaware Run-Olentangy River
11 01	Deep Run-Olentangy River
11 02	Rush Run-Olentangy River (only portion as depicted in Map)

A more detailed map can be viewed at:
http://epa.ohio.gov/dsw/permits/GP_ConstructionSiteStormWater_Olentangy.aspx

Appendix B Attachment B

Part 1 Stream Assessment

This assessment will determine if a stream is considered a previously channelized, low-gradient headwater stream (a drainage ditch) which would be applicable for stream restoration in lieu of protecting an outer ‘no build’ setback as per Appendix B B.2i. and ii.

In the event the assessment of the stream meets all the criteria listed below, restoration as depicted in Part 2 of this attachment or natural channel design could be performed, provided 401/404 permits are authorized, and may be a means of reducing the setback distance required by B.2.i. (Appendix B).

Previously Modified, Low-Gradient Headwater Streams shall, for the purposes of this permit, be defined as having all of the following characteristics:

- Less than 10 square miles of drainage area;
- Low gradient and low stream power such that incision (down-cutting) is not evident;
- Entrenched such that the ratio of the frequently flooded width to the bankfull width is less than 2.2; and
- Straight with little or no sinuosity present such that the ratio of the bankfull channel length to the straight-line distance between two points is less than 1.02.

Part 2 Restoration

Restoration shall be accomplished by any natural channel design approach that will lead to a self-maintaining reach able to provide both local habitat and watershed services (e.g. self-purification and valley floodwater storage).

a. Construction of a floodplain, channel and habitat via natural channel design;
b. Floodplain excavation necessary to promote interaction between stream and floodplain;
c. Include a water quality setback of 100 feet from top of the streambank on each side.

The primary target shall be a frequently flooded width of 10 times the channel’s self-forming width. Five times the self-forming channel width may be acceptable if sufficient elements of natural channel design are included in the restoration project.

Appendix C Rainfall Intensity for Calculation of Water Quality Flow (WQF)

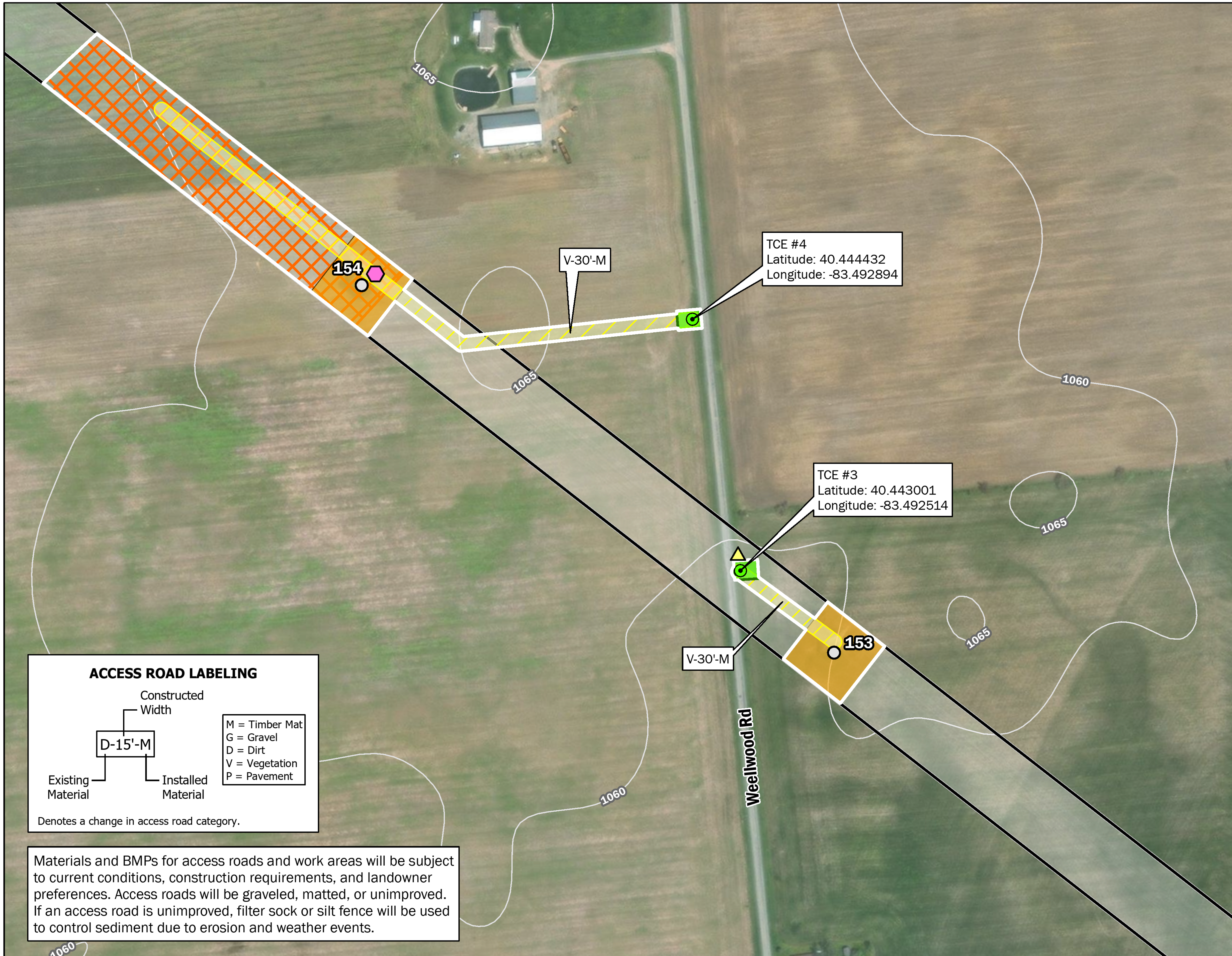
DURATION t_c (minutes)	WATER QUALITY INTENSITY [i_{wq}] (inches/hour)
5	2.37
6	2.26
7	2.15
8	2.04
9	1.94
10	1.85
11	1.76
12	1.68
13	1.62
14	1.56
15	1.51
16	1.46
17	1.41
18	1.37
19	1.33
20	1.29
21	1.26
22	1.22
23	1.19
24	1.16
25	1.13
26	1.10
27	1.07
28	1.05
29	1.03
30	1.01
31	0.99
32	0.97

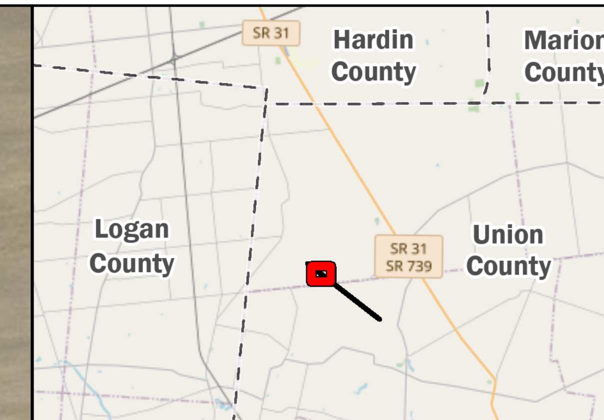
DURATION t_c (minutes)	WATER QUALITY INTENSITY [i_{wq}] (inches/hour)
33	0.95
34	0.93
35	0.92
36	0.90
37	0.88
38	0.86
39	0.85
40	0.83
41	0.82
42	0.80
43	0.78
44	0.77
45	0.76
46	0.75
47	0.74
48	0.73
49	0.72
50	0.71
51	0.69
52	0.68
53	0.67
54	0.66
55	0.66
56	0.65
57	0.64
58	0.64
59	0.63
60	0.62

Note: For t_c < 5 minutes, use i = 2.37 in/hr; for t_c > 60 minutes, use i = 0.62 in/hr. For all other t_c, use the appropriate value from this table.

APPENDIX 2

Project Location Map, Soil Erosion and Sediment Control Plan, USDA Soils Map, Watershed (HUC-12) Map, and ODNR Rainwater and Land Development Manual Details





Bokes Creek IPP Switching Station

SWPPP Map

- Existing Transmission Structure
- Install New Transmission Structure
- OPGW Splice Location
- Culvert Identified in Field
- Silt Fence or Filter Sock
- Barricade Fence
- Elevation Contour (5' Interval)
- Non-Jurisdictional Ditch
- Sensitive Areas – Keep Out
- Access Point
- Temporary Construction Entrance
- Matting
- Access Road (30 ft Width)
- Pulling and Tensioning Area
- Construction Pad
- Laydown Yard
- Bokes Creek Station LOD
- Transmission LOD
- Transmission Right of Way (150 ft Width)

N

1 inch equals 200 feet*

0 100 200 400 Feet

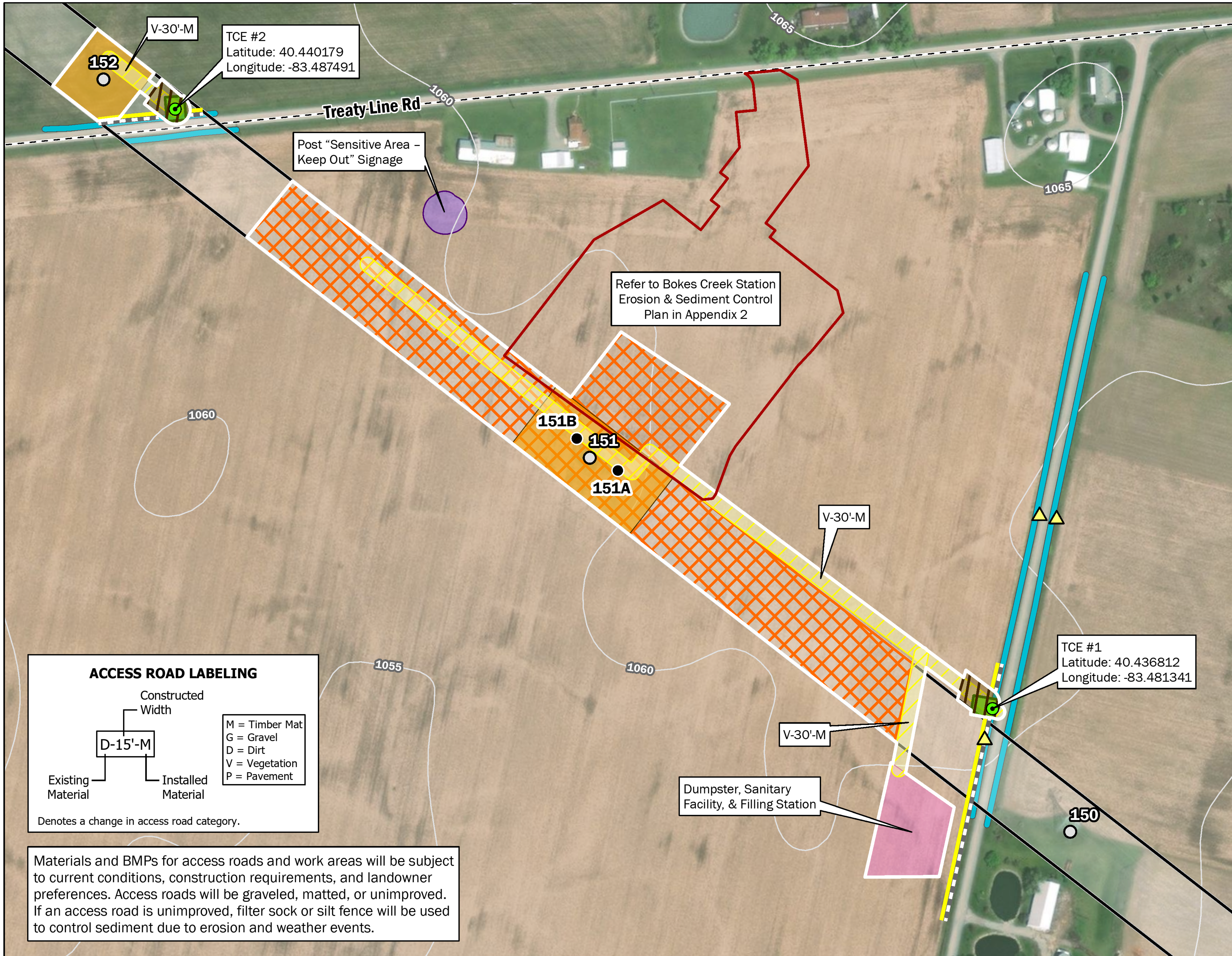
*When printed on 11" x 17" page

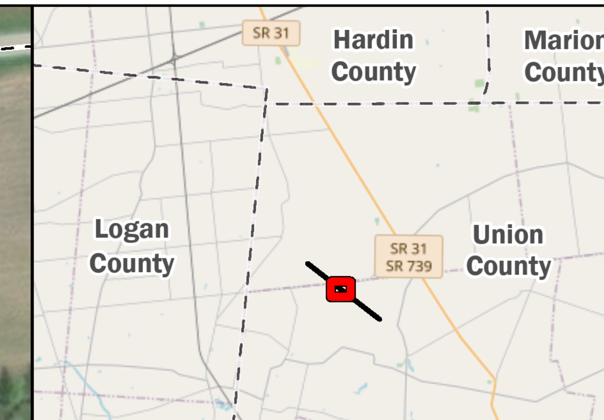
Disclaimer: Maps are not intended to provide survey grade data.

Sargent & Lundy

Title: SWPPP Map	Prepared: M Krajewski
Site: Bokes Creek IPP Switching Station	Reviewed: C Kwiatkowski
Location: Union County	Date: 12/6/2022
Sheet: 1 of 2	Revision: 1

Sources: © OpenStreetMap (and) contributors, CC-BY-SA, Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community





Bokes Creek IPP Switching Station

SWPPP Map

- Existing Transmission Structure
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- Laydown Yard
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- Transmission Right of Way (150 ft Width)

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0 100 200 400 Feet

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Disclaimer: Maps are not intended to provide survey grade data.

Title: SWPPP Map	Prepared: M Krajewski
Site: Bokes Creek IPP Switching Station	Reviewed: C Kwiatkowski
Location: Union County	Date: 12/6/2022
Sheet: 2 of 2	Revision: 1

GENERAL NOTES:

Transmission Construction Representative (TCR) is **Brandon Morrison, (614) 307-9196**
Environmental Specialist is **Shannon Hemmerly, (740) 350-6240**
Environmental Advisor, SMG is **Sam Schau, (614) 318-3757**
Regional Environmental Coordinator (REC), LERS is **Burak Ergezen, (614) 582-1522**

1. Any ground disturbance not shown on this plan must be approved by the TCR and Environmental Specialist prior to implementation. Ground disturbance includes but is not limited to: laydown yards, staging areas, stockpiles, equipment or timber storage areas, access roads, work pads, pulling pads, etc.
2. Any substitution of BMPs must be approved by the TCR, Environmental Advisor, and Environmental Specialist prior to installation.
3. If any human or unidentified artifacts are unearthed or otherwise discovered, construction must cease and the TCR and Environmental Specialist must be notified.
4. Access through wetlands is not allowed unless on a permitted timber mat access road. Parking equipment on timber mats overnight within a wetland is strictly prohibited.
5. If Orange barrier fence (OBF) is installed to avoid a water feature, install warning signs.
6. Do not install culverts without approval from TCR and Environmental Specialist.
7. Contact REC for proper management of material (such as soil, wood pole, etc.) disposal or giveaway.

BOKES CREEK STATION

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY℠

STATION ADDRESS:
GPS: LAT. = 40.438611, LONG. = -83.483611

DRAWING STATUS ISSUE: Issued for Construction

ISSUE TYPE: SITE PREPARATION

W.O. #T10404234002
BPID #P20263001

NOTES:
PROJECTS THAT ARE ENGINEERED BY AN OEC:
1) FOR PHYSICAL DETAILED DESIGN ISSUES, CONTACT THE OEC STATION LEAD, COPY THE AEP SE LEAD.

2) FOR P&C DETAILED DESIGN ISSUES, CONTACT THE OEC P&C LEAD, COPY THE AEP PCE & SE LEADS.

3) FOR OTHER ISSUES THAT IMPACT COST OR SCHEDULE, CONTACT THE AEP PROJECT MANAGER, COPY THE AEP SE LEAD.

	OUTSOURCE ENGINEERING COMPANY (OEC) NAME	NAME	WORK PHONE	CELL PHONE	EMAIL
OEC PROJECT MANAGER	POWER ENGINEERS, INC.	JUSTIN SHIPLEY	(224) 277-2998	(224) 277-2998	Justin.Shipley@powereng.com
OEC STATION LEAD	POWER ENGINEERS, INC.				
OEC STATION BACKUP CONTACT	POWER ENGINEERS, INC.				
OEC P&C LEAD	POWER ENGINEERS, INC.				
OEC P&C BACKUP CONTACT	POWER ENGINEERS, INC.				
OEC CIVIL LEAD	POWER ENGINEERS, INC.	A.J. WEHR	(513) 326-1561	N/A	AJ.Wehr@powereng.com
OEC CIVIL BACKUP CONTACT	POWER ENGINEERS, INC.	TOM GILL	(513) 326-1510	N/A	Tom.Gill@powereng.com
OEC STATION DESIGNER	POWER ENGINEERS, INC.				
OEC P&C DESIGNER	POWER ENGINEERS, INC.				

	COMPANY NAME	NAME	WORK PHONE	CELL PHONE	EMAIL
PROJECT MANAGER	AEP	KEVIN LONG	(380) 205-5151	N/A	kalong@aep.com
STATION ENGINEERING (SE) LEAD	AEP				
PROTECTION & CONTROL ENGINEERING (PCE) LEAD	AEP				
CIVIL LEAD	AEP	TIERRA SHEPHERD	(380) 205-5151	N/A	tlshepherd@aep.com
STATION DESIGNER	AEP				
PROTECTION & CONTROL DESIGNER	AEP				
TELECOM LEAD	AEP				
TCR	AEP				

CONTACT SHEET

DWG. NO. E-1301

AMERICAN ELECTRIC POWER
OHIO POWER COMPANY
BOKES CREEK STATION
30651 HOOVER MOFFITT ROAD
YORK TOWNSHIP, UNION COUNTY, OHIO 43358
LATITUDE: 40° 26' 19" LONGITUDE: -83° 29' 01"

DRAWING INDEX

REFERENCE DRAWINGS:

SIGN STANDARD	1LPX002U SH A, SH B, SH E, SH G
FENCE STANDARD	1LPX001U SH A
AEP STATION CONSTRUCTION STANDARD	SS-160102
AEP SITE PREPARATION STANDARD	SS-710000
AEP FENCE STANDARD	SS-250500
AEP CABLE TRENCH STANDARD	6DEX008U SH. A

OWNER/APPLICANT:

AMERICAN ELECTRIC POWER
OHIO POWER COMPANY
1 RIVERSIDE PLZ.
COLUMBUS, OHIO 43215

PROJECT MANAGER: KEVIN LONG
PHONE: (380) 205-5151
EMAIL: KALONG@AEP.COM

911 ADDRESS:

30651 HOOVER MOFFITT ROAD
YORK TOWNSHIP, OHIO 43358

SURVEY:

BOUNDARY LINES AND DEED RECORDS SHOWN HEREON WERE TAKEN FROM A SURVEY PERFORMED BY CENTRAL SURVEYING CO., LTD., 7563 EAST MAIN STREET, REYONDSBURG, OHIO 43068, (614) 864-1100 DATED 04/12/2022.

BEARINGS ARE ORIENTED TO THE STATE PLANE COORDINATE SYSTEM: OHIO NORTH ZONE HORIZONTAL DATUM NAD83 (2011), US SURVEY FEET; VERTICAL DATUM NAVD88.

GEOTECHNICAL REPORT:

INTERTEK-PSI
4960 VULCAN AVENUE
COLUMBUS, OH 43228

"GEOTECHNICAL EXPLORATION REPORT
BOKES CREEK STATION
YORK TOWNSHIP, UNION COUNTY, OHIO."
APRIL 11, 2022
PSI PROJECT NO. 01022066

FLOOD INFORMATION:

ACCORDING TO FEMA FLOOD INSURANCE RATE MAP : UNION COUNTY, OHIO PANEL 130 OF 500 MAP NUMBER 39159C0130D; EFFECTIVE DATE: DECEMBER 16, 2008 THE PROPERTY SHOWN HEREON IS LOCATED IN ZONE X .

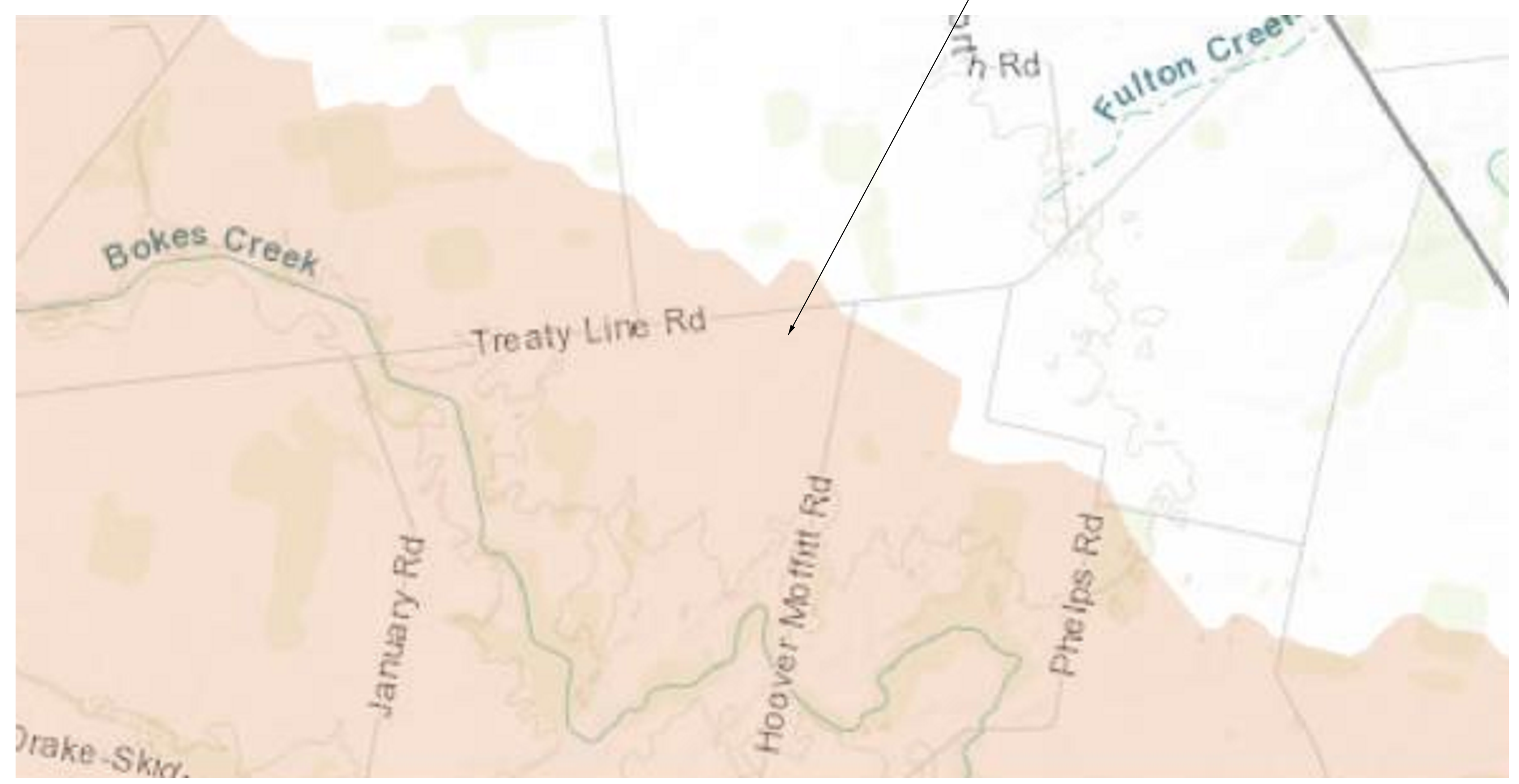
THERE ARE NO WETLANDS IDENTIFIED WITHIN THE PROJECT AREA.

NOTIFY UTILITY COMPANIES BEFORE YOU DIG

THE LOCATIONS OF UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON ABOVE-GROUND STRUCTURES. LOCATIONS OF UNDERGROUND UTILITIES/STRUCTURES MAY VARY FROM LOCATIONS SHOWN HEREON. ADDITIONAL BURIED UTILITIES/STRUCTURES MAY BE ENCOUNTERED. NO EXCAVATIONS WERE MADE DURING THE PROGRESS OF THIS SURVEY TO LOCATE BURIED UTILITIES/STRUCTURES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ACTUAL LOCATION AND DEPTH OF ALL EXISTING UTILITIES. THE OWNER AND THE SURVEYOR SHALL NOT BE RESPONSIBLE FOR ANY OMISSION OR VARIATION FROM THE LOCATION SHOWN. THE CONTRACTOR SHALL NOTIFY OHIO811 AT (800)-362-2764 TWO (2) WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.

OHIO811 Before You Dig

PROJECT LOCATION



N

LOCATION MAP
N.T.S.

ESTIMATED QUANTITIES	
CONTRACTOR SHALL VERIFY ALL QUANTITIES DURING BID PHASE	
SITE DEVELOPMENT QUANTITIES	
LIMITS OF DISTURBANCE	6.48 AC.
TOPSOIL STRIPPING (12" THICK)	10,783 CY
RE-USE TOPSOIL (4" THICK)	1,580 CY
TOPSOIL HAUL-OFF	9,203 CY
EARTHWORK	33,306 CY
EARTHWORK: IMPORT FILL (BASED ON COMPLETE SITE GRADING)	21,229 CY
CRUSHED LIMESTONE STABILIZATION	17,250 TONS
4" STATION STONE - AASHTO #57 - (NOT BY GRADING CONTRACTOR)	2,817 TONS
6" SUBBASE AGGREGATE - ODOT ITEM 304	5,633 TONS
9" ACCESS DRIVE TOP STONE - ODOT ITEM 304	1,016 TONS
MIRAFI 600X WOVEN GEOTEXTILE FABRIC	2,032 SY
STATION CHAIN LINK FENCE & APPURTENANCES (NOT BY GRADING CONTRACTOR)	1,448 LF
24' WIDE DBL. ACCESS GATE W/FND (NOT BY GRADING CONTRACTOR)	3 EA.
12" CONCRETE PIPE (RCP CLASS III) CULVERT	62 LF
12" CONCRETE PIPE (RCP CLASS IV) CULVERT	38 LF
18" CONCRETE PIPE (RCP CLASS III) CULVERT	42 LF
4" SOLID PVC PIPE	340 LF
MODIFIED PRECAST ODOT CATCH BASIN 2-4	1 EA.
EROSION AND SEDIMENT CONTROL QUANTITIES	
TEMPORARY CONSTRUCTION ENTRANCE	1 EA.
CONCRETE WASHOUT	1 EA.
RIPRAP INLET/OUTLET PROTECTION (ODOT TYPE C ROCK)	14 TONS
RIPRAP INLET/OUTLET PROTECTION (ODOT TYPE D ROCK)	19 TONS
SILT FENCE	1,320 LF
TEMPORARY SEEDING	14,200 SY
PERMANENT SEEDING	14,200 SY

LIMITS OF DISTURBANCE: 6.52 AC. (284,246.23 SQ FT.)
STATION PAD AREA: 3.49 AC. (152,100.00 SQ FT.)
ACCESS ROAD AREA: 0.42 AC. (18,287.03 SQ FT.)

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER

12/06/2022

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
2	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C3
1	11/07/22	QUANTITIES REVISION TO INCLUDE CABLE TRENCH DRAIN PIPE BY POWER ENGINEERS, INC.	AJW	AJW	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

OLD DWG #: STD DWG #:

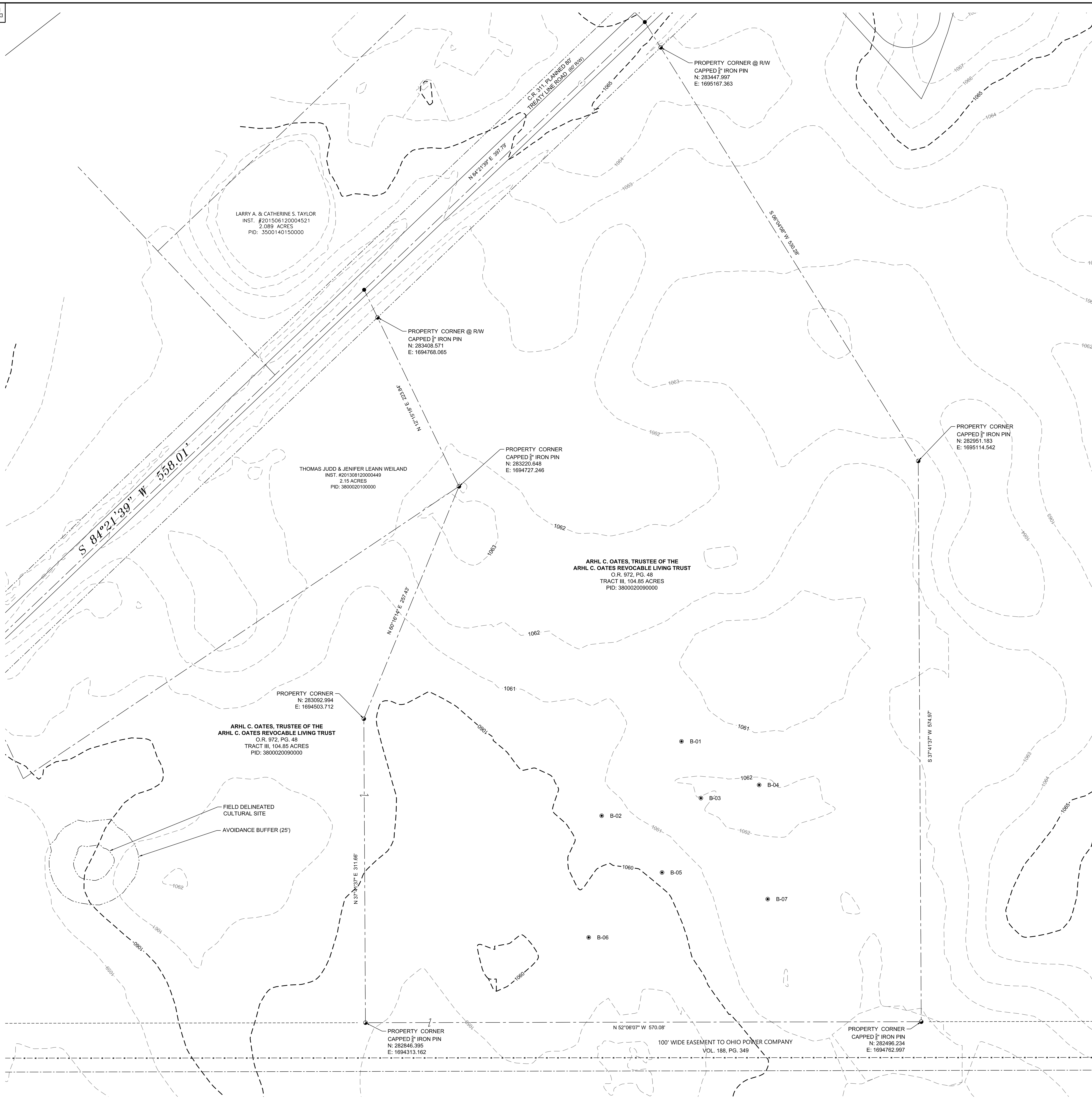
OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY
BOKES CREEK STATION
YORK TOWNSHIP OHIO
345kV
COVER SHEET

SCALE: NONE	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C3	APPD: AJW/PEI	DATE: 08/05/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1301	REV 2

CADFILEPATH

STATION ENGINEERING
PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM
AEP G (30 X 46)

CM 1 2 3 4 5 6 7 | 1/16 INCH 4 8 12 16 | TENTHS 10 20 30 | INCHES 1 2 3



EXISTING CONDITIONS PLAN

SCALE 1" = 40'

CM 1 2 3 4 5 6 7
1/16 INCH 4 8 12 16
TENTHS 10 20 30
INCHES 1 2 3

LEGEND

(heavy dashed line)	EXISTING MAJOR CONTOUR
(light dashed line)	EXISTING MINOR CONTOUR
(long dash–short dash line)	PROPERTY LINE
(dash–double dot line)	RIGHT-OF-WAY
(solid line)	EDGE OF PAVEMENT
(dashed line with marks)	EXISTING ELECTRICAL TRANSMISSION LINES
B-07	SOIL BORING
	MAG NAIL SET
	5/8" IRON PIN SET CAP STAMPED "CENTRAL SURV. CO., LTD"

DRAWING INDEX:

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER

12/06/2022

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
2	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C3
1	08/22/22	ADDED CULTURAL RESOURCE AREA	AJW	AJW	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

OLD DWG #: STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP OHIO

345kV

EXISTING CONDITIONS PLAN

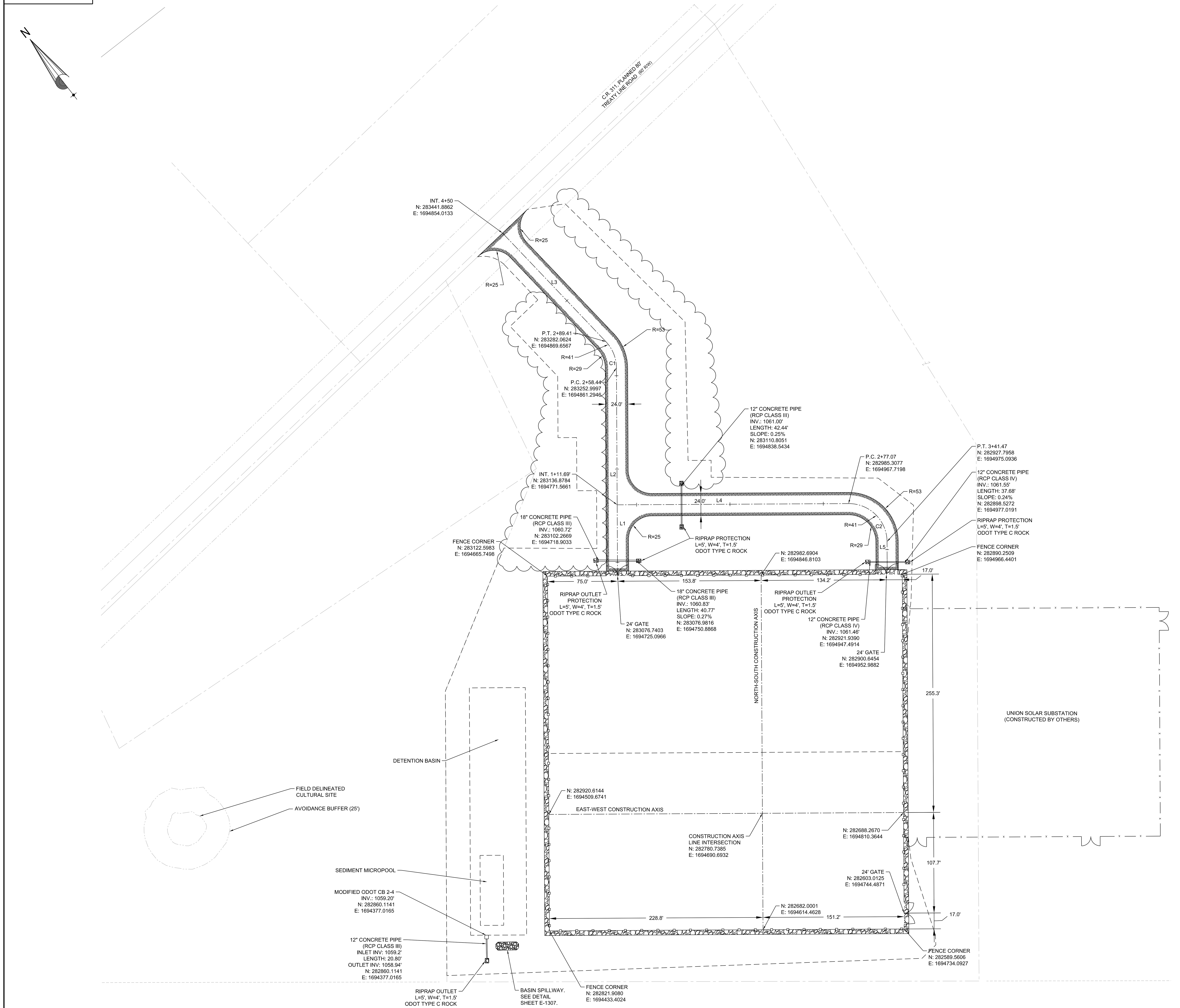
SCALE: 1" = 40'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C3	APPD: AJW/PEI	DATE: 08/05/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1302	REV 2

STATION ENGINEERING

PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM

AEP G (30 X 46)

CADFILEPATH



SITE LAYOUT PLAN

SCALE 1" = 40'

CM 1 2 3 4 5 6 7 | 1/16 INCH 4 8 12 16 | TENTHS 10 20 30 | INCHES 1 2 3

CURVE TABLE					
CURVE NUMBER	LENGTH	RADIUS	DELTA	START COORDINATE (NORTHING,EASTING)	END COORDINATE (NORTHING,EASTING)
C1	30.97	41.00	43.28	(283252.9997,1694861.2946)	(283282.0624,1694869.6567)
C2	64.40	41.00	90.00	(282927.7958,1694975.0936)	(282985.3077,1694967.7198)

LINE TABLE				
LINE NUMBER	LENGTH	DIRECTION	START CORDINATE (NORTHING,EASTING)	END COORDINATE (NORTHING,EASTING)
L1	76.00	N37° 41' 37"E	(283076.7403,1694725.0966)	(283136.8784,1694771.5661)
L2	146.75	S37° 41' 37"W	(283252.9997,1694861.2946)	(283136.8784,1694771.5661)
L3	160.58	N5° 35' 25"W	(283282.0624,1694869.6567)	(283441.8836,1694854.0135)
L4	247.89	S52° 18' 23"E	(283136.8784,1694771.5661)	(282985.3077,1694967.7198)
L5	30.00	S37° 41' 37"W	(282927.7958,1694975.0936)	(282904.0571,1694956.7504)

LEGEND

- PROPERTY LINE
- RIGHT-OF-WAY
- EDGE OF PAVEMENT
- EXISTING ELECTRICAL TRANSMISSION LINES
- B-01 SOIL BORING
- PROPOSED STATION FENCE
- PROPOSED STATION PAD BOUNDARY
- PROPOSED ACCESS ROAD
- PROPOSED RIPRAP
- UNION SOLAR STATION FENCE (BY OTHERS)
- LIMITS OF DISTURBANCE
- CONSTRUCTION AXIS LINE

DRAWING INDEX:

COVER SHEET	E-1301
EXISTING CONDITIONS PLAN	E-1302
SITE LAYOUT PLAN	E-1303
STATION GRADING PLAN	E-1304
STATION GRADING SECTIONS AND DETAILS	E-1305
ACCESS ROAD PROFILES & DETAILS	E-1306
STORMWATER MANAGENT PLAN AND DETAILS	E-1307
EROSION & SEDIMENT CONTROL PLAN	E-1308
EROSION & SEDIMENT CONTROL NOTES & DETAILS	E-1309

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER

12/06/2022

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP OHIO

345kV

SITE LAYOUT PLAN

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
2	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C3
1	08/22/22	ADDED CULTURAL RESOURCE AREA	AJW	TVS	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

SCALE: 1" = 40'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C1	APPD: AJW/PEI	DATE: 08/05/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1303	REV 2

STATION ENGINEERING

PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM

AEP G (30 X 46)

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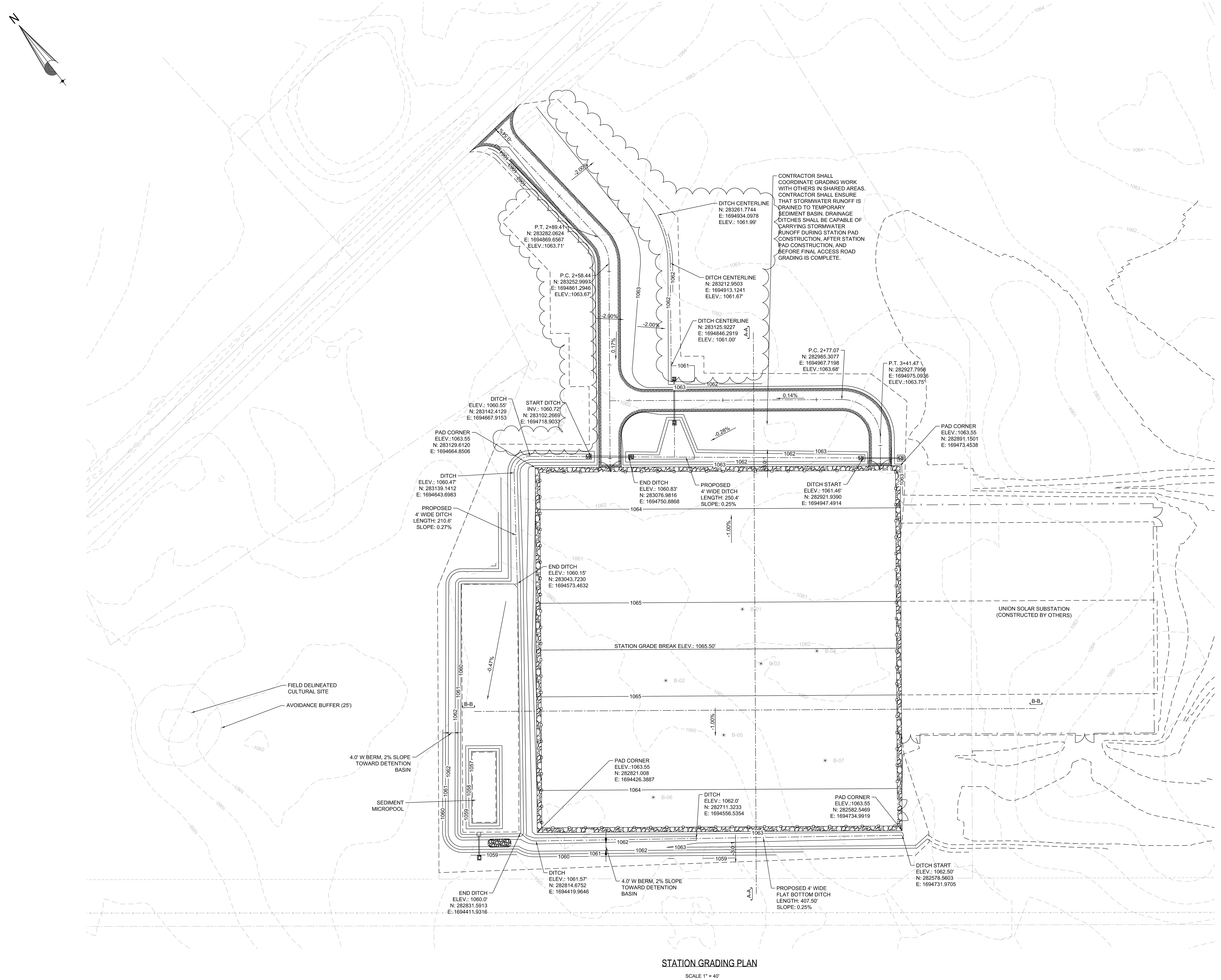

STATION GRADING PLAN

SCALE 1" = 40'

TRENCHING AND EXCAVATION NOTES:

1. IMPORTED SOIL FILL MATERIALS: ASTM D 2487 SOIL CLASSIFICATION GROUPS CL, CL-ML, WHEN USED IN STRICT ACCORDANCE WITH THE PROJECT GEOTECHNICAL REPORT: FREE OF ROCK OR GRAVEL LARGER THAN 3 INCHES IN ANY DIMENSION, DEBRIS, WASTE, FROZEN MATERIALS, VEGETATION & OTHER DELETERIOUS MATTER.
2. BASE MATERIAL: GRANULAR SELECT FILL - NATURALLY OR ARTIFICIALLY GRADED MIXTURE OF NATURAL OR CRUSHED GRAVEL, CRUSHED STONE CONFORMING TO ODOT ITEM 304.
3. STATION PAD MATERIAL 4"-THICK EVENLY GRADED MIXTURE OF CRUSHED STONE AASHTO #57 WASHED LIMESTONE AGGREGATE TO BE PROVIDED BY STATION CONTRACTOR UNDER SEPARATE CONTRACT.
4. PROVIDE EROSION CONTROL MEASURES TO PREVENT EROSION OR DISPLACEMENT OF SOILS & DISCHARGE OF SOIL-BEARING WATER RUNOFF OR AIRBORNE DUST TO ADJACENT PROPERTIES.
5. PREVENT SURFACE WATER & SUBSURFACE OR GROUND WATER FROM ENTERING EXCAVATIONS, FROM PONDING ON PREPARED SUBGRADES & FROM FLOODING PROJECT SITE & SURROUNDING AREA. PROTECT SUBGRADES & FOUNDATION SOILS FROM SOFTENING & DAMAGE BY RAIN OR WATER ACCUMULATION.
6. "UNCLASSIFIED EXCAVATION" EXCAVATION IS UNCLASSIFIED & INCLUDES EXCAVATION TO REQUIRED SUBGRADE ELEVATIONS REGARDLESS OF THE CHARACTER OF MATERIALS & OBSTRUCTIONS ENCOUNTERED.
7. STOCKPILE EXCAVATED MATERIALS ACCEPTABLE FOR BACKFILL AND FILL SOIL MATERIALS, INCLUDING ACCEPTABLE BORROW MATERIALS. STOCKPILE SOIL MATERIALS IN DESIGNATED AREA. PLACE, GRADE & SHAPE STOCKPILES TO DRAIN SURFACE WATER.
8. PLACE AND COMPACT BACKFILL MATERIAL OR SUBBASE MATERIAL, FREE OF PARTICLES LARGER THAN 3 INCHES, TO FINAL SUBGRADE.
9. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 8 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY APPROPRIATE COMPACTION EQUIPMENT AND NOT MORE THAN 4 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HAND-OPERATED TAMPERS.
10. PERFORM FIELD IN PLACE DENSITY TESTS ACCORDING TO ASTM D6938 (NUCLEAR METHOD), 98% STANDARD PROCTOR MAXIMUM DRY DENSITY FOR STRUCTURAL/SUBBASE & BASE BACKFILL, 90% STANDARD PROCTOR MAXIMUM DRY DENSITY FOR NON-STRUCTURAL/ON-SITE FILL MATERIAL BACKFILL WITHIN -1% TO +3% FOR COHESIVE MATERIAL AND WITHIN -2% TO +2% FOR GRANULAR MATERIAL.
11. SUBGRADE SOILS SHALL BE SCARIFIED AND COMPACTED TO AT LEAST 98% OF THE MATERIALS' STANDARD PROCTOR MAXIMUM DRY DENSITY, IN GENERAL ACCORDANCE WITH ASTM PROCEDURES, TO A DEPTH OF AT LEAST 12 INCHES BELOW THE SURFACE.
12. PIPE BACKFILL AND BEDDING SHALL BE ODOT SPECIFICATION ITEM 603 AND 611.
13. DISPOSAL: REMOVE SURPLUS SATISFACTORY SOIL AND WASTE MATERIAL, INCLUDING UNSATISFACTORY SOIL, EXCESS TOPSOIL, TRASH, AND DEBRIS AND DISPOSE OF IT IN ACCORDANCE WITH STATE LAW AND LOCAL ORDINANCE .

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPERTY LINE
- RIGHT-OF-WAY
- EDGE OF PAVEMENT
- EXISTING ELECTRICAL TRANSMISSION LINES
- B-01 SOIL BORING
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED STATION FENCE
- PROPOSED STATION PAD BOUNDARY
- PROPOSED ACCESS ROAD
- PROPOSED RIPRAP
- UNION SOLAR STATION FENCE (BY OTHERS)
- PROPOSED UNION SOLAR MAJOR CONTOUR (BY OTHERS)
- PROPOSED UNION SOLAR MINOR CONTOUR (BY OTHERS)
- LIMITS OF DISTURBANCE

DRAWING INDEX:

STATE OF OHIO ANTHONY WEHR PE 86221 REGISTERED PROFESSIONAL ENGINEER

12/06/2022

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
2	12/06/2022	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C3
1	08/22/22	ADDED CULTURAL RESOURCES AREA	AJW	AJW	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP — UNION COUNTY OHIO

345kV

STATION GRADING PLAN

SCALE: 1" = 40'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C1	APPD: AJW/PEI	DATE: 08/05/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1304	REV 2

DWG. NO. E-1304

STATION ENGINEERING

PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM

AEP G (30 X 46)

CADFILEPATH

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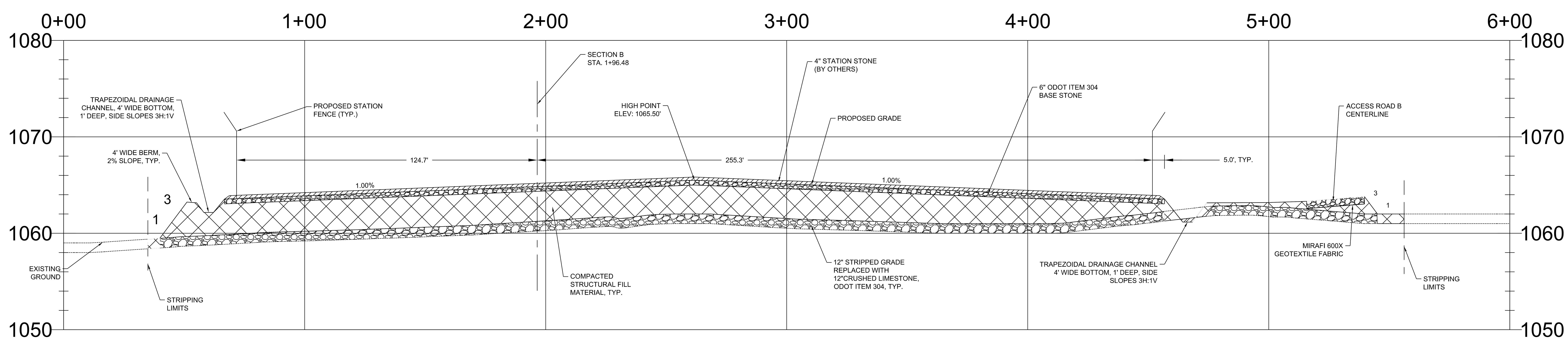
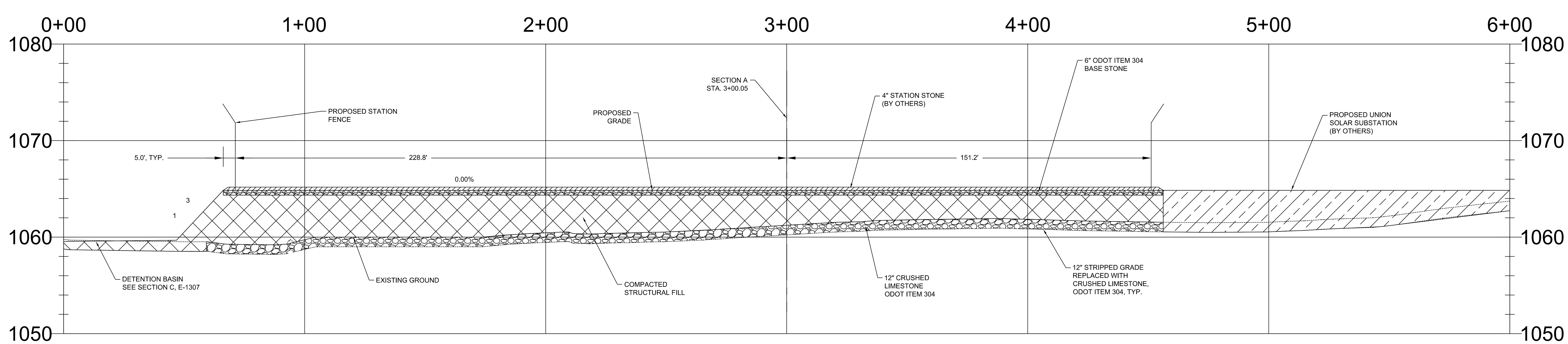


Section B PROFILE



STATION GRADING SECTIONS AND DETAILS

SCALE 1" = 20' HORIZONTAL
1"=10' VERTICAL

DRAWING INDEX:

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER

12/06/2022

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP — UNION COUNTY OHIO

345kV

STATION GRADING SECTIONS AND DETAILS

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
1	12/06/22	SITE GRADING UPDATES AND REVISED LOD B YPOWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	1040423C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

SCALE: 1" = 20'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C1	APPD: /PEI	DATE: 08/05/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1305	REV 1

CADFILEPATH

STATION ENGINEERING PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM

AEP G (30 X 46)

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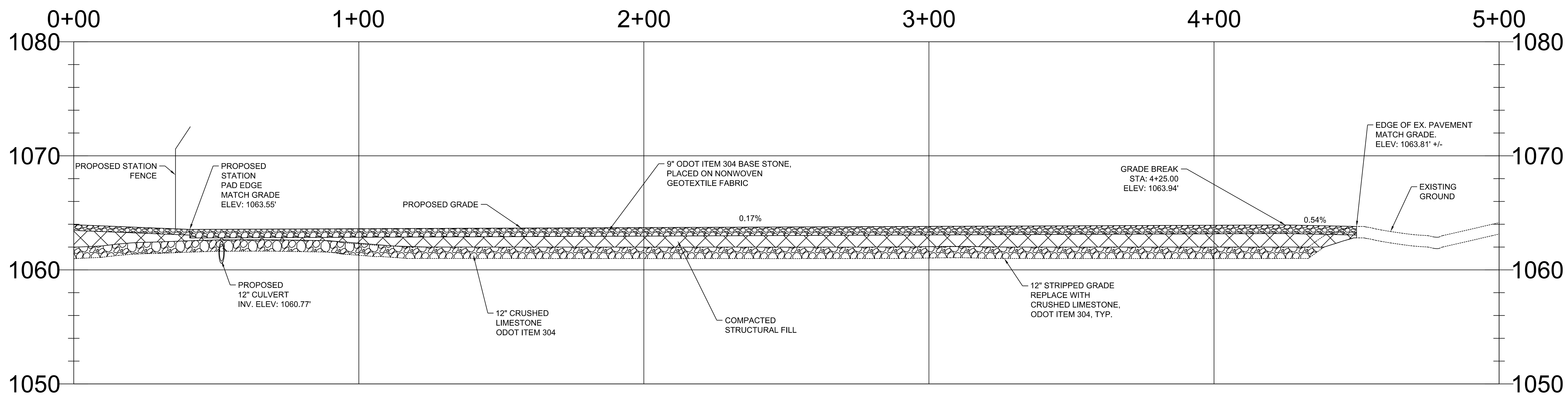
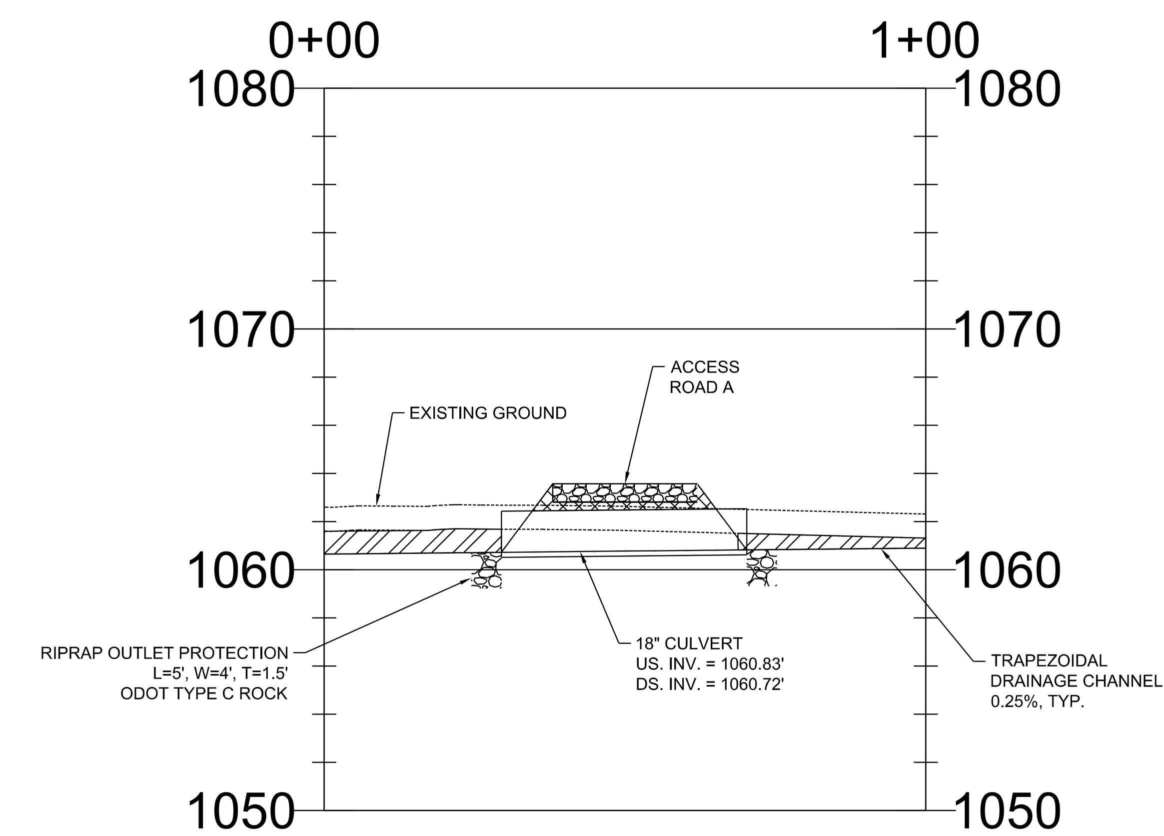
DWG. NO. E-1306

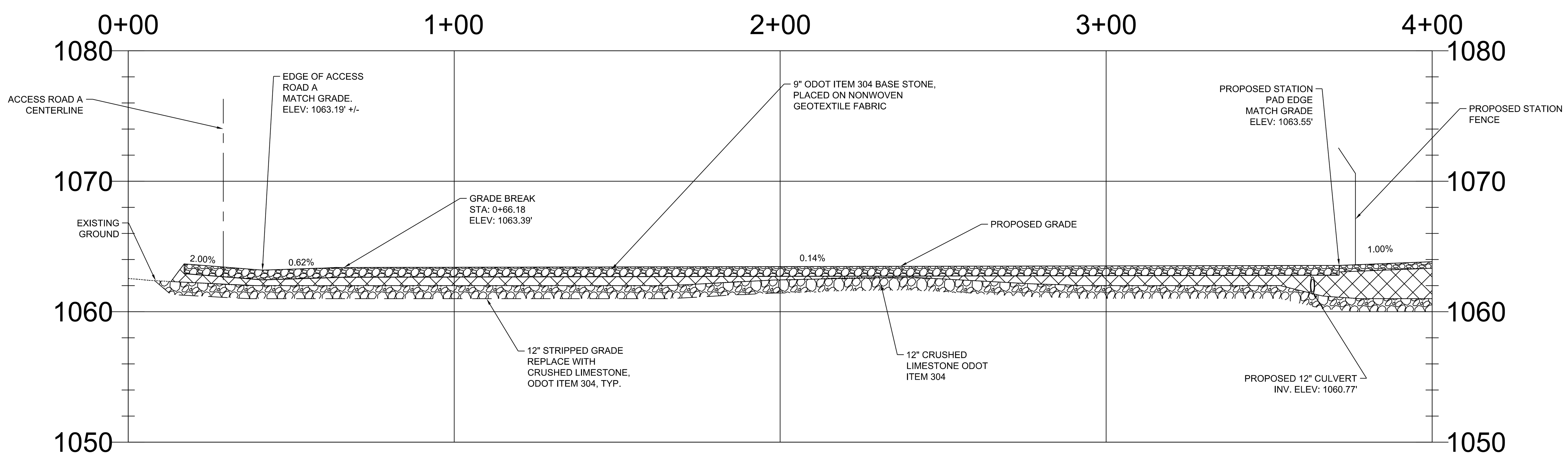
Access Road A PROFILE



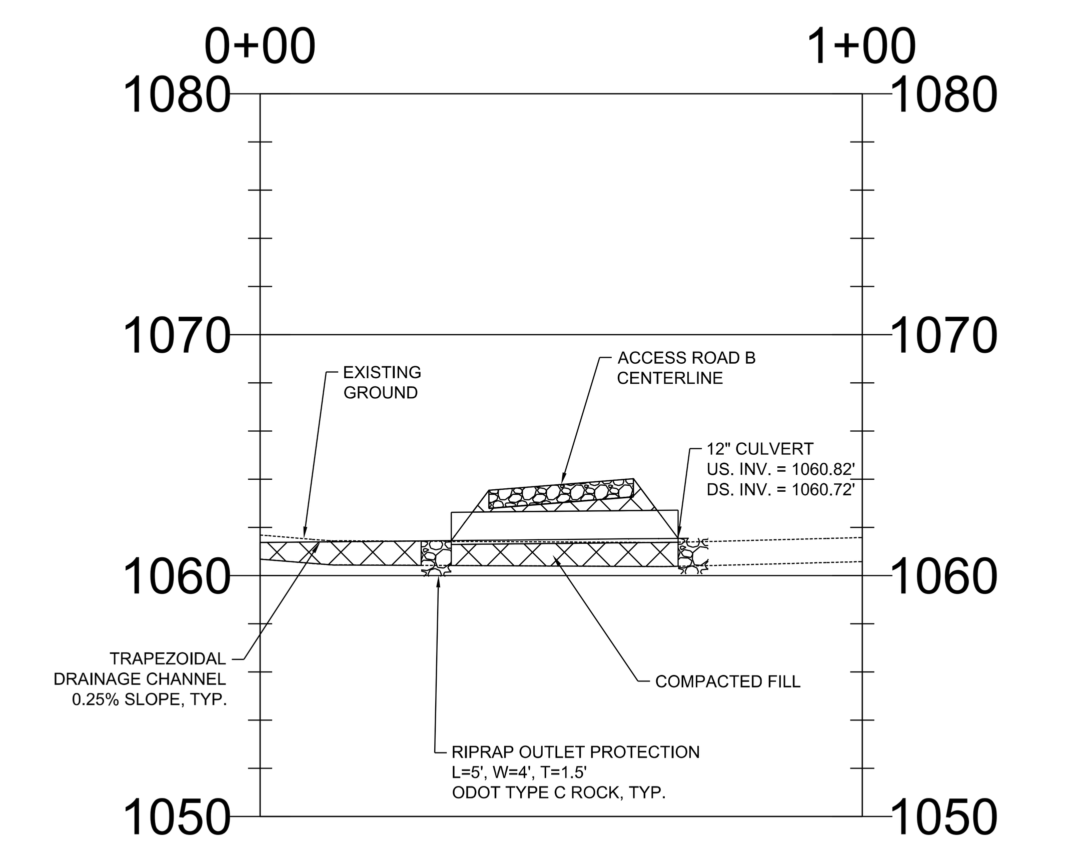
Access Road A Culvert PROFILE



Access Road B PROFILE

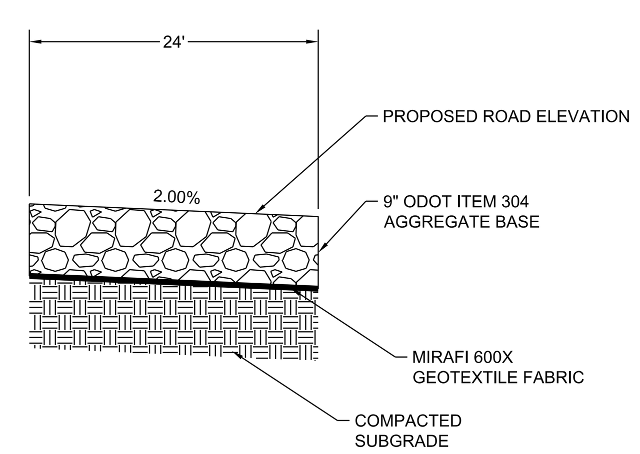


Access Road B Culvert PROFILE



ACCESS ROAD PROFILES AND DETAILS

SCALE:
1" = 20' (HORIZONTAL)
1" = 10' (VERTICAL)



TYPICAL ACCESS ROAD SECTION
(NTS)

DRAWING INDEX:

COVER SHEET	E-1301
EXISTING CONDITIONS PLAN	E-1302
SITE LAYOUT PLAN	E-1303
STATION GRADING PLAN	E-1304
STATION GRADING SECTIONS AND DETAILS	E-1305
ACCESS ROAD PROFILES AND DETAILS	E-1306
STORMWATER MANAGENT PLAN AND DETAILS	E-1307
EROSION & SEDIMENT CONTROL PLAN	E-1308
EROSION & SEDIMENT CONTROL NOTES & DETAILS	E-1309

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER

12/06/2022

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP — UNION COUNTY OHIO

345kV

ACCESS ROAD PROFILES AND DETAILS

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
1	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

SCALE: 1" = 20'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C1	APPD: AJW/PEI	DATE: 12/06/22
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1306	REV 1

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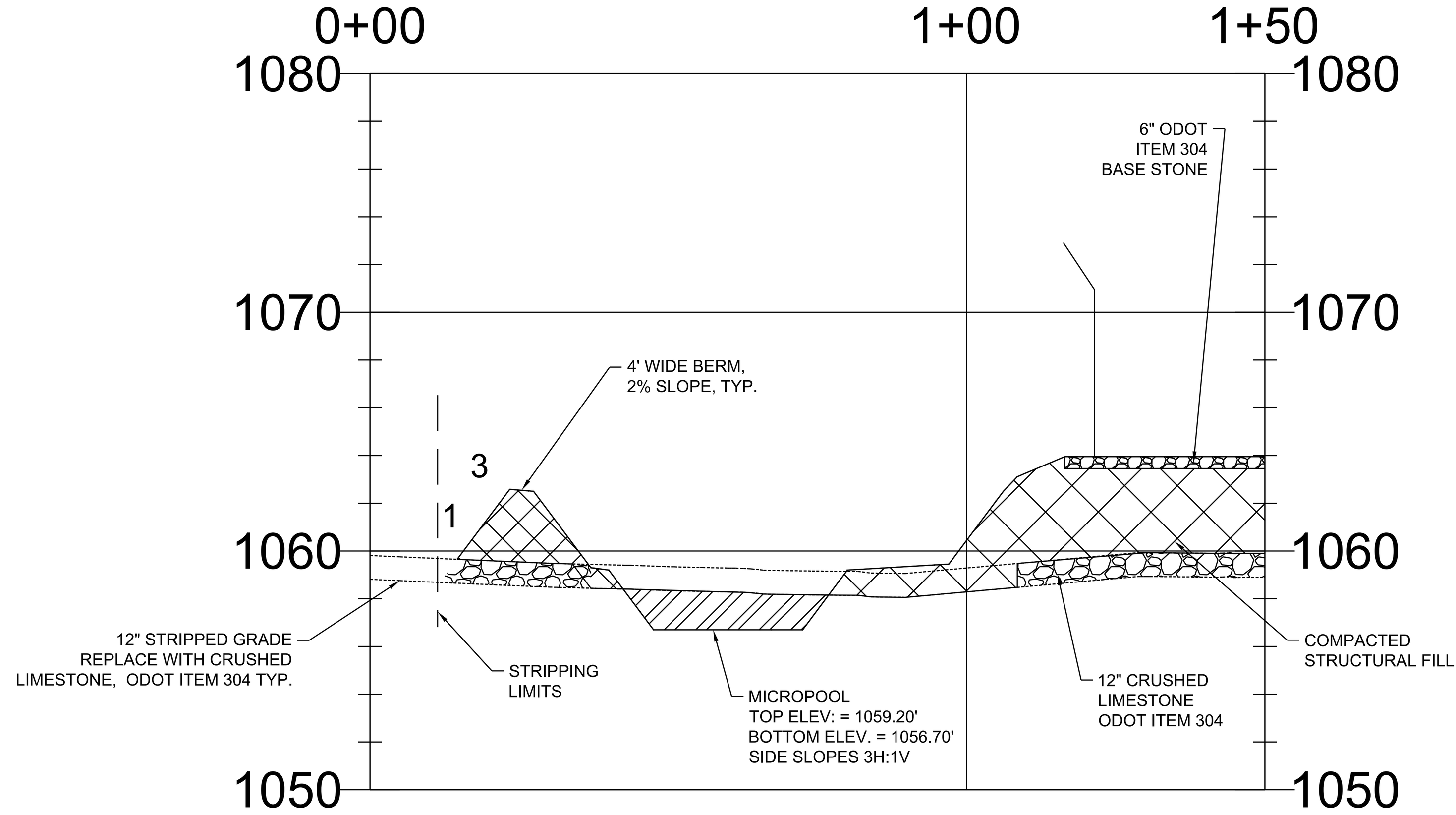
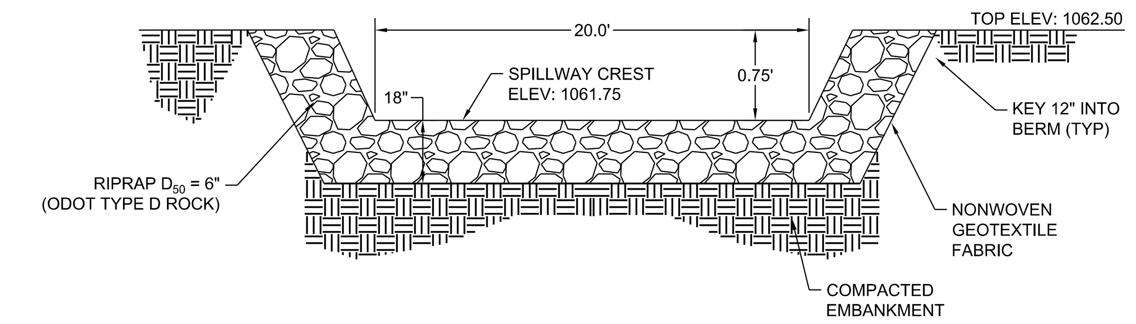
CADFILEPATH

STATION ENGINEERING
PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM
AEP G (30 X 46)

DWG. NO. E-1307

Section C PROFILE

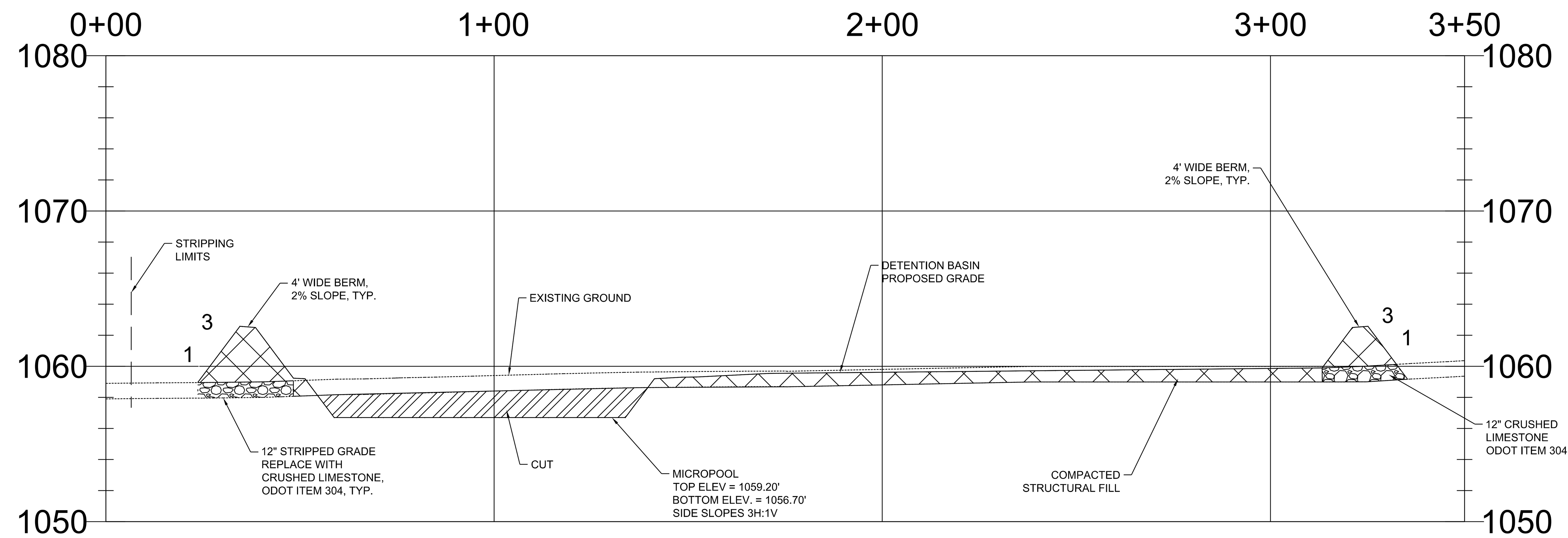


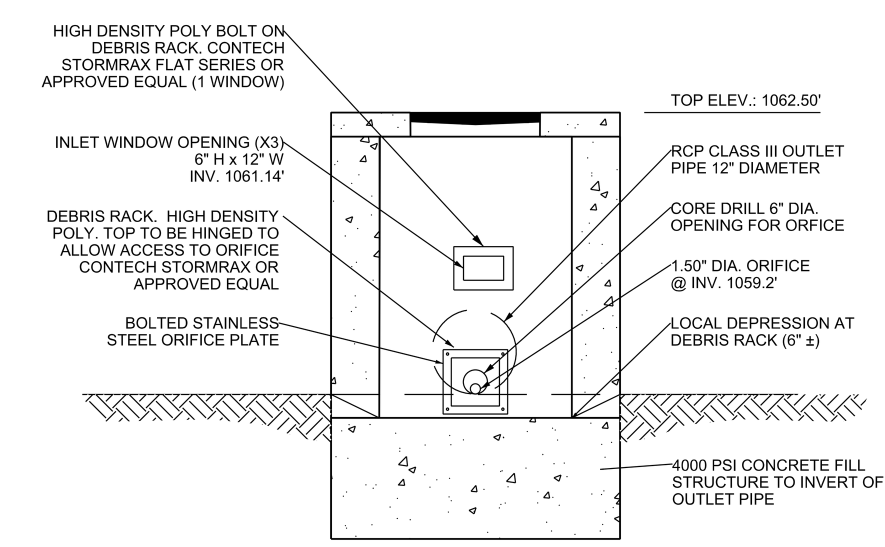


BASIN SPILLWAY DETAIL

N.T.S.

Section D PROFILE



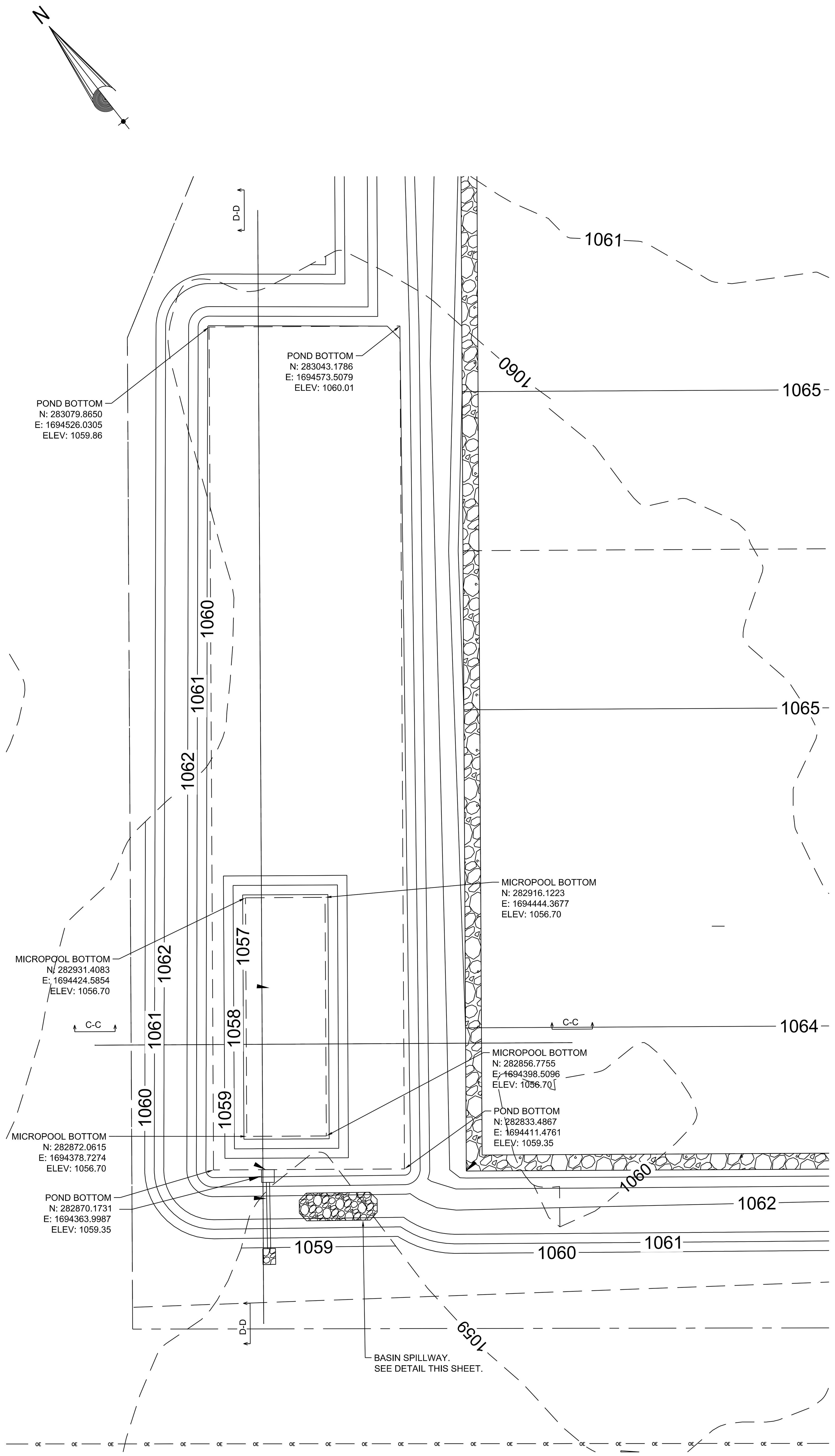


MODIFIED ODOT CB 2-4 OUTLET STRUCTURE DETAIL

N.T.S.

PROFILES AND DETAILS

SCALE: 1" = 20' (HORIZONTAL) 1" = 10' (VERTICAL)



STORMWATER MANAGEMENT PLAN

SCALE 1" = 20'

DRAWING INDEX:

COVER SHEET	E-1301
EXISTING CONDITIONS PLAN	E-1302
SITE LAYOUT PLAN	E-1303
STATION GRADING PLAN	E-1304
STATION GRADING SECTIONS AND DETAILS	E-1305
ACCESS ROAD PROFILES & DETAILS	E-1306
STORMWATER MANAGENT PLAN AND DETAILS	E-1307
EROSION & SEDIMENT CONTROL PLAN	E-1308
EROSION & SEDIMENT CONTROL NOTES & DETAILS	E-1309

STATE OF OHIO ANTHONY WEHR PE 86221 REGISTERED PROFESSIONAL ENGINEER

12/06/2022

OLD DWG #: STD DWG #:

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OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP — UNION COUNTY OHIO

345kV

STORMWATER MANAGEMENT PLAN AND DETAILS

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
1	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

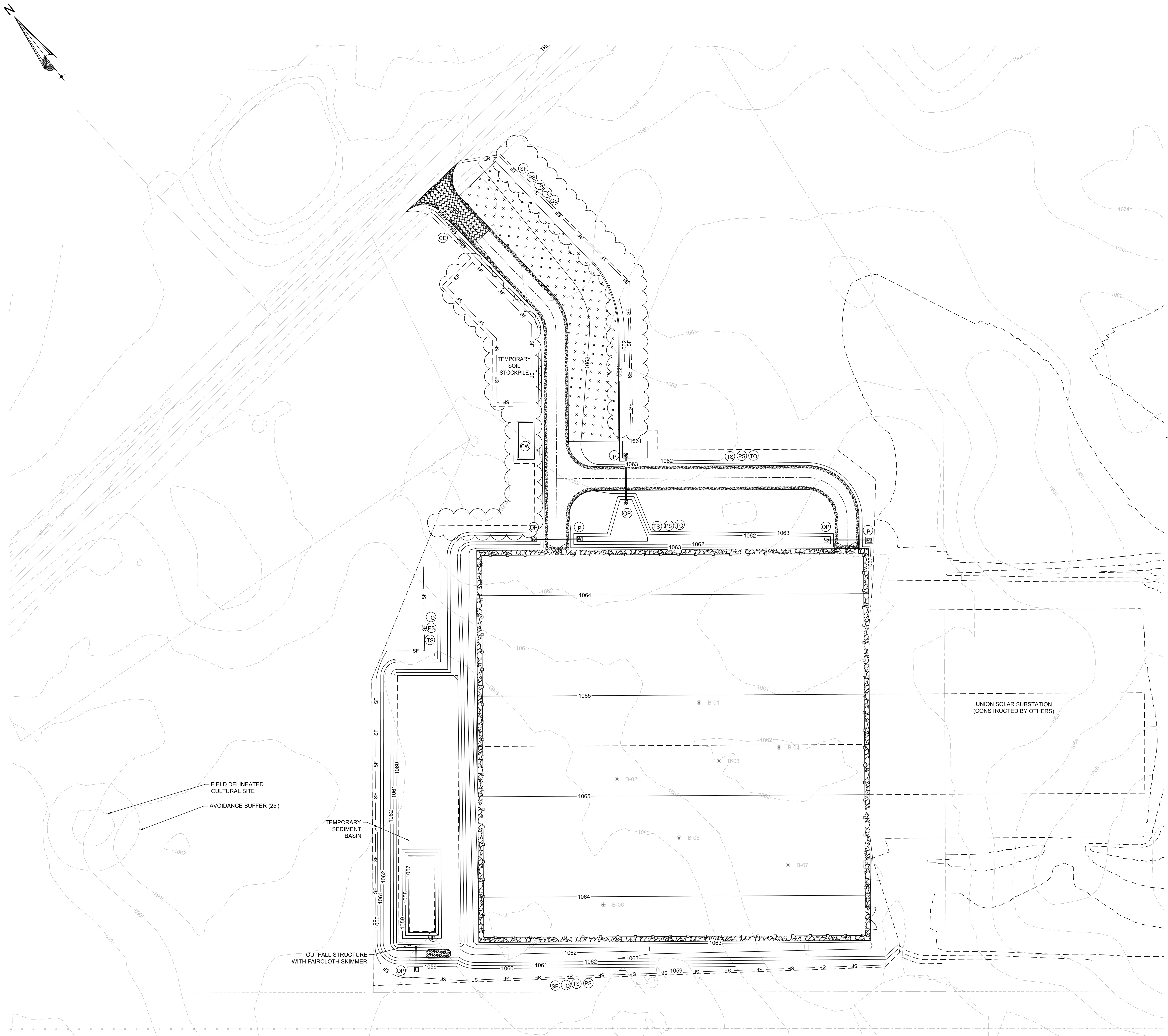
SCALE: 1" = 20'	DR: TVS/PEI	ENG: AJW/PEI	CH: TVS/PEI
	WO#: 10404234C1	APPD: AJW/PEI	DATE: 08/05/2022
AMERICAN ELECTRIC POWER	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1307	REV 1

CM 1 2 3 4 5 6 7 — 1/16 INCH 4 8 12 16 — TENTHS 10 20 30 — INCHES 1 2 3

CADFILEPATH

STATION ENGINEERING PLOTTED BY $USERS ON DD-MMM-YYYY AT HH:MM AEP G (30 X 46)

DWG. NO. E-1308



EROSION & SEDIMENT CONTROL PLAN

SCALE 1" = 40'

CONSTRUCTION SEQUENCE:

THIS PROJECT INCLUDES GRADING AND INSTALLATION OF AN ELECTRICAL SUBSTATION, ASSOCIATED ACCESS ROADS, DRAINAGE FEATURES AND STORMWATER MANAGEMENT / WATER QUALITY FEATURES. THE SUBSTATION PAD AND ACCESS ROAD WILL BE STABILIZED WITH STONE. OTHER DISTURBED AREAS WILL BE STABILIZED WITH PERMANENT SEEDING AND/OR VEGETATION WITH MULCH COVER.

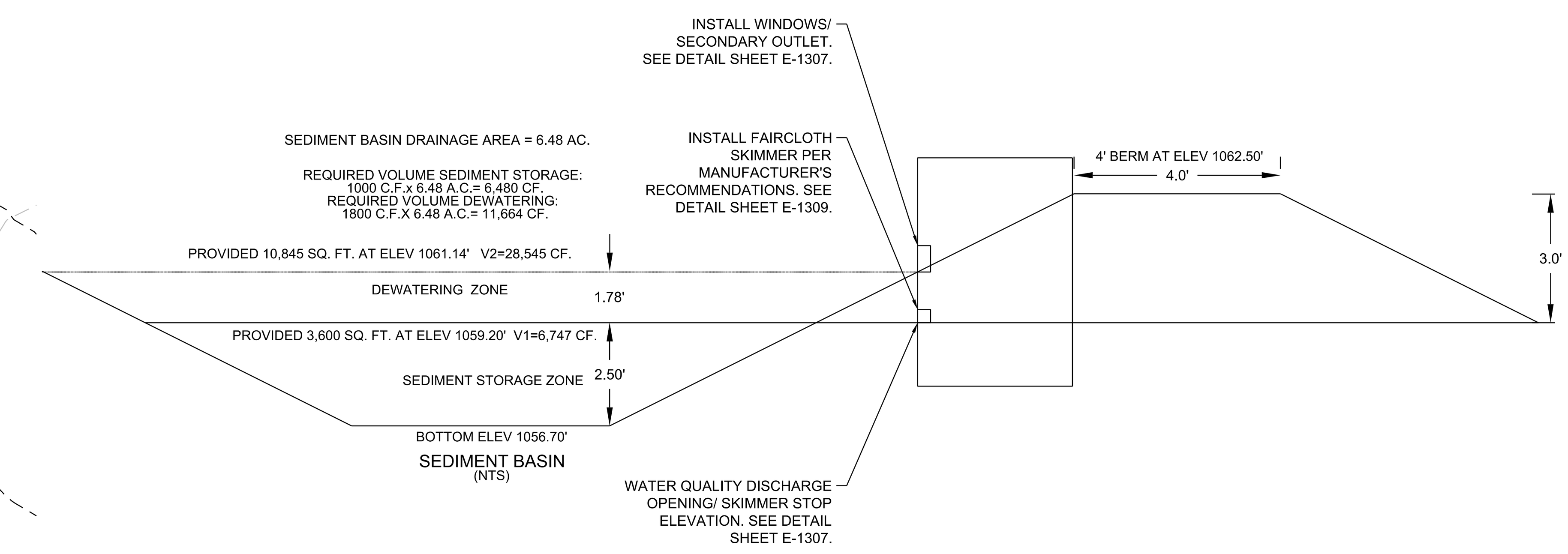
THE CONTRACTOR SHALL ADHERE TO THE FOLLOWING CONSTRUCTION AND MAINTENANCE SEQUENCE:

1. CONTACT OHIO 811 BEFORE ALL EARTHWORK AND LAND DISTURBANCE ACTIVITIES. ALL UTILITIES MAY NOT BE SHOWN. SOME LOCATIONS ARE APPROXIMATE.
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ACTUAL LOCATION AND DEPTH OF ALL EXISTING UTILITIES. THE OWNER AND SURVEYOR SHALL NOT BE RESPONSIBLE FOR ANY OMISSION OR VARIATION FROM THE LOCATION SHOWN. THE CONTRACTOR SHALL NOTIFY MISS UTILITY AT 811 TWO (2) WORKING DAYS PRIOR TO THE START OF CONSTRUCTION.
3. INITIATE MONITORING ACTIVITIES AND REPORTING.
4. INSTALL PERIMETER SILT FENCE CONTROLS AND BEGIN TOPSOIL STRIPPING.
5. EXCAVATE AND INSTALL TEMPORARY SEDIMENT BASIN WITH FAIRCLOTH SKIMMER.
6. MAKE APPROPRIATE DEWATERING ARRANGEMENTS IF REQUIRED. PUMP STANDING WATER THROUGH A SEDIMENT FILTER BAG PRIOR TO DISCHARGE.
7. ROUGH GRADE THE SITE. MAINTAIN/INSTALL DIVERSIONS AT NEW ELEVATIONS AS GRADES ARE ALTERED.TEMPORARILY STABILIZE SOIL STOCKPILE WITH TEMPORARY SEEDING AND MULCH. STRAW OR HAY MULCH IS REQUIRED.
8. PROVIDE SILT FENCE AROUND PERIMETER OF STOCKPILE.
9. INSTALL DITCHES AND PERMANENT VEGETATION AS SHOWN ON THE PLAN IN THE PROPOSED SWALES.
10. INSTALL PROPOSED DRAINAGE STRUCTURES AND PIPES
11. FINAL GRADE THE SITE AND STABILIZE WITH PERMANENT SEED AND VEGETATION:
    a. TOPSOIL ALL AREAS TO BE VEGETATED WITH 6 INCHES OF TOPSOIL. ONCE AREAS TO BE TOPSOILED HAVE BEEN BROUGHT TO GRADE AND IMMEDIATELY PRIOR TO DUMPING AND SPREADING TOPSOIL, THE SUBGRADE SHALL BE LOOSENED BY DISCING OR SCARIFYING TO A DEPTH OF AT LEAST 2 INCHES TO ENSURE BONDING OF THE TOPSOIL AND SUBGRADE
12. INSPECT DRAINAGE STRUCTURES AND PIPING FOR DEBRIS AND SEDIMENT BUILDUP. REMOVE DEBRIS AND FLUSH THE DRAINAGE PIPING AS REQUIRED TO REMOVE SEDIMENT
13. AFTER FINAL STABILIZATION AND AT THE APPROVAL OF THE INSPECTOR REMOVE REMAINING E&S MEASURES.

EROSION & SEDIMENT CONTROL GUIDELINES:

THE SITE IS TO BE GRADED TO PROPOSED FINISHED GRADE CONTOURS AS SHOWN. NO CRITICAL EROSION CONTROL PROBLEMS ARE ANTICIPATED AS MOST EROSION CONTROL MEASURES ARE TO BE IMPLEMENTED PRIOR TO LAND DISTURBANCE. THE CONTRACTOR SHALL ADHERE TO THE FOLLOWING MAINTENANCE PROCEDURES.

1. PERMANENT SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR MORE THAN FOURTEEN DAYS BUT LESS THAN ONE YEAR.
2. EXCESS EXCAVATION DISPOSED OF OFF SITE SHALL BE DISPOSED OF IN ACCORDANCE WITH OHIO EPA REQUIREMENTS.
3. EROSION AND SEDIMENT CONTROLS SHALL BE INSTALLED IN ACCORDANCE WITH LOCAL REGULATIONS AND BE PLACED PRIOR TO OR AS THE FIRST STEP IN LAND DISTURBING ACTIVITY.
4. EROSION AND SEDIMENT CONTROLS SHALL BE MAINTAINED SO THAT RUNOFF CARRYING SEDIMENT FROM THE SITE WILL NOT ENTER STORM DRAINAGE FACILITIES.
5. EROSION AND SEDIMENT CONTROLS SHALL BE MAINTAINED UNTIL THE DISTURBED AREA IS STABILIZED.
6. PROPERTIES ADJOINING THE SITE SHALL BE KEPT CLEAN OF MUD OR SILT CARRIED FROM THE SITE BY VEHICLE TRAFFIC OR RUNOFF.
7. THE DISPOSAL OF WASTE MATERIALS REMOVED FROM EROSION AND SEDIMENT CONTROL FACILITIES AND THE DISPOSAL OF THESE FACILITIES SHALL BE IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATION.
8. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DIKES, AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
9. DURING CONSTRUCTION OF THE PROJECT, SOIL STOCKPILES SHALL BE STABILIZED OR PROTECTED WITH SEDIMENT TRAPPING MEASURES. THE CONTRACTOR IS RESPONSIBLE FOR THE TEMPORARY PROTECTION AND PERMANENT STABILIZATION OF ALL SOIL STOCKPILES ON SITE AS WELL AS SOIL INTENTIONALLY TRANSPORTED FROM THE PROJECT SITE.
10. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CHECKED DAILY AND AFTER EACH RUNOFF PRODUCING RAINFALL.
11. CONSTRUCTION SEQUENCES ARE FOR REFERENCE ONLY. THE CONTRACTOR MAY MAKE VARIATIONS AS REQUIRED WITH THE ENGINEER'S APPROVAL.



SEDIMENT BASIN
(NTS)

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPERTY LINE
- RIGHT-OF-WAY
- EDGE OF PAVEMENT
- EXISTING ELECTRICAL TRANSMISSION LINES
- B-01 SOIL BORING
- PROPOSED STATION FENCE
- PROPOSED PAD BOUNDARY
- PROPOSED ACCESS ROAD
- UNION SOLAR SUBSTATION FENCE (BY OTHERS)
- LIMITS OF DISTURBANCE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

EROSION CONTROL LEGEND

- SF — SF (SF) - SILT FENCE
- (TS) - TEMPORARY SEEDING
- (PS) - PERMANENT SEEDING
- (MU) - MULCHING
- (TO) - TOPSOILING
- (GS) - GRASS FILTER STRIP
- (IP) (OP) - INLET/OUTLET PROTECTION
- (CE) - TEMPORARY CONSTRUCTION ENTRANCE
- (CW) - CONCRETE WASHOUT

DRAWING INDEX:

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER
12/06/2022

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
2	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C3
1	08/22/22	ADDED CULTURAL RESOURCES AREA	AJW	AJW	AJW	TJG	10404234C2
0	08/05/2022	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C1

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP — UNION COUNTY OHIO

345kV

EROSION & SEDIMENT CONTROL PLAN

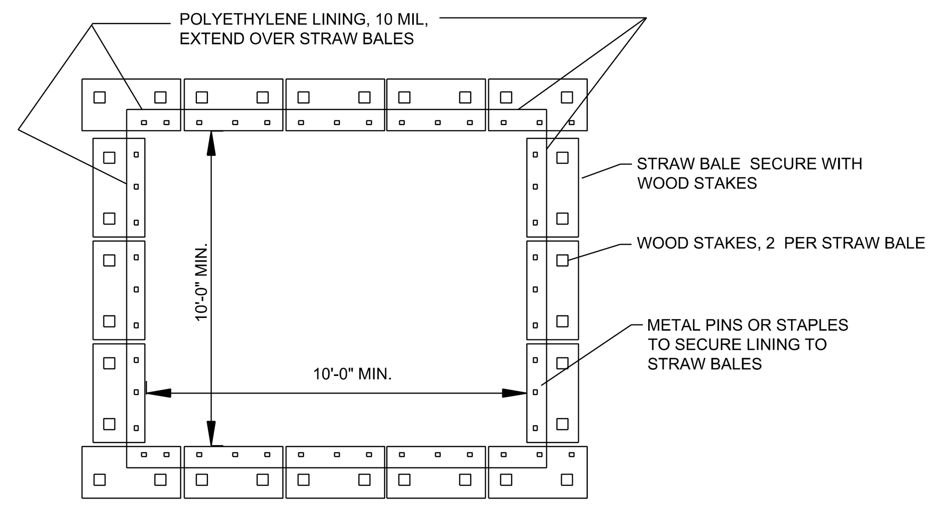
SCALE: 1" = 40'	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER BOUNDLESS ENERGY	WO#: 10404234C1	APPD: AJW/PEI	DATE: 08/05/2022
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1308	REV 2

CADFILEPATH

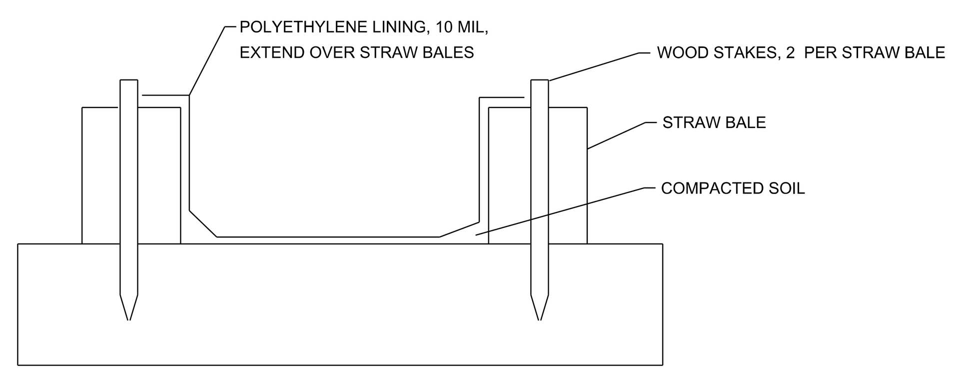
STATION ENGINEERING
PLOTTED BY $USER$ ON DD-MMM-YYYY AT HH:MM
AEP G (30 X 46)

CM 1 2 3 4 5 6 7 | 1/16 INCH 4 8 12 16 | TENTHS 10 20 30 | INCHES 1 2 3

DWG. NO. E-1309



PLAN



CONCRETE WASHOUT

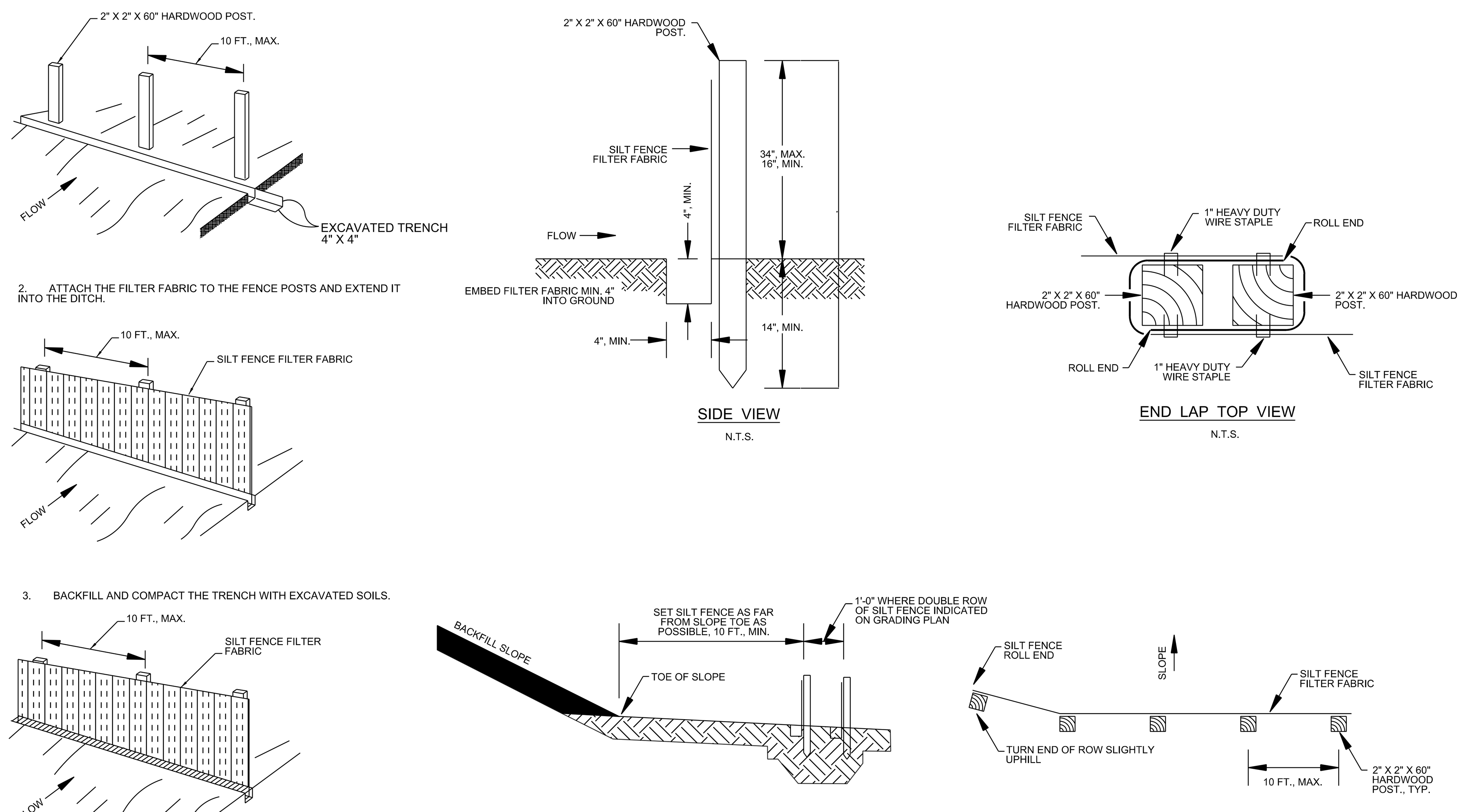
(TEMPORARY)
N.T.S.

1. CONCRETE WASHOUT SYSTEM WILL CONTAIN WASHOUT WATER WHEN CHUTES & HOPPERS ARE RINSED FOLLOWING CONCRETE DELIVERY TO THE CONSTRUCTION SITE.
2. SCRAPE AS MUCH MATERIAL FROM CHUTES AS POSSIBLE BEFORE WASHING THEM. USE NON-WATER CLEANING METHODS TO MINIMIZE THE CHANCE FOR WASTE TO FLOW OFF SITE.
3. DO NOT BACK FLUSH EQUIPMENT AT THE PROJECT SITE, IT SHOULD BE RESTRICTED TO PLANT.
4. DO NOT USE ADDITIVES WITH WASH WATER. DO NOT USE ACID OR SOLVENTS.
5. FURNISH A SIGNAGE FOR THE CONCRETE WASHOUT AREA.
6. FURNISH ORANGE SAFETY FENCING OR EQUAL.

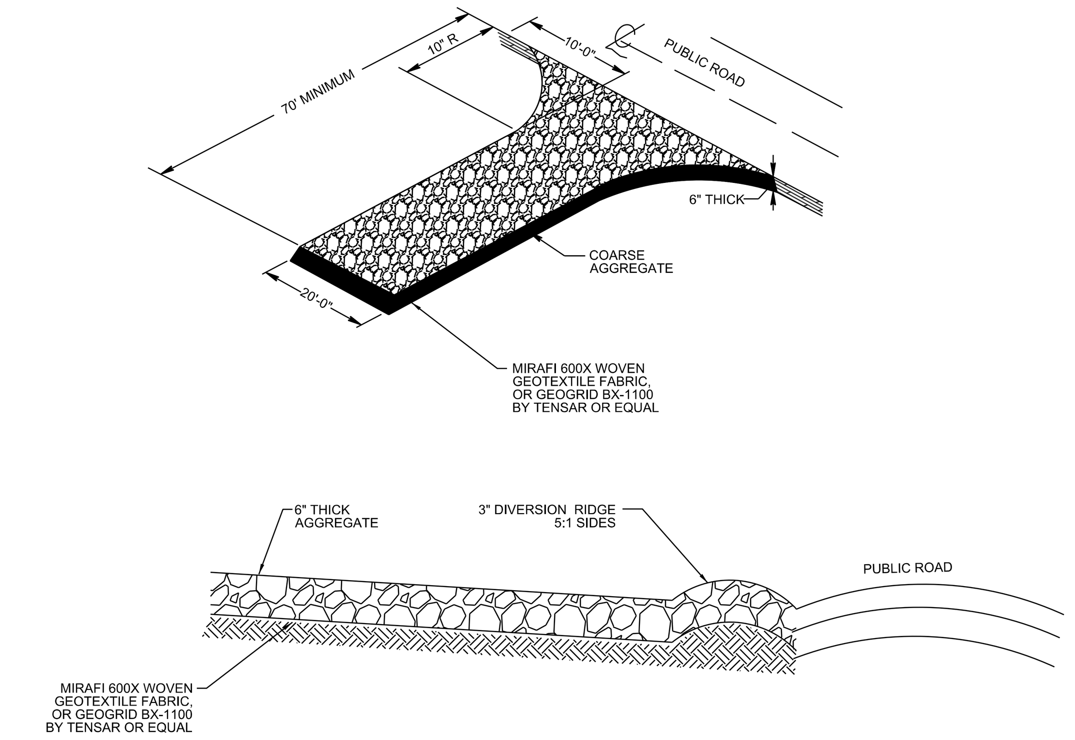
1. SET POSTS ALONG CONTOUR OF THE LAND AND EXCAVATE TRENCH UPSLOPE ALONG THE LINE OF POSTS.

2. ATTACH THE FILTER FABRIC TO THE FENCE POSTS AND EXTEND IT INTO THE DITCH.

3. BACKFILL AND COMPACT THE TRENCH WITH EXCAVATED SOILS.

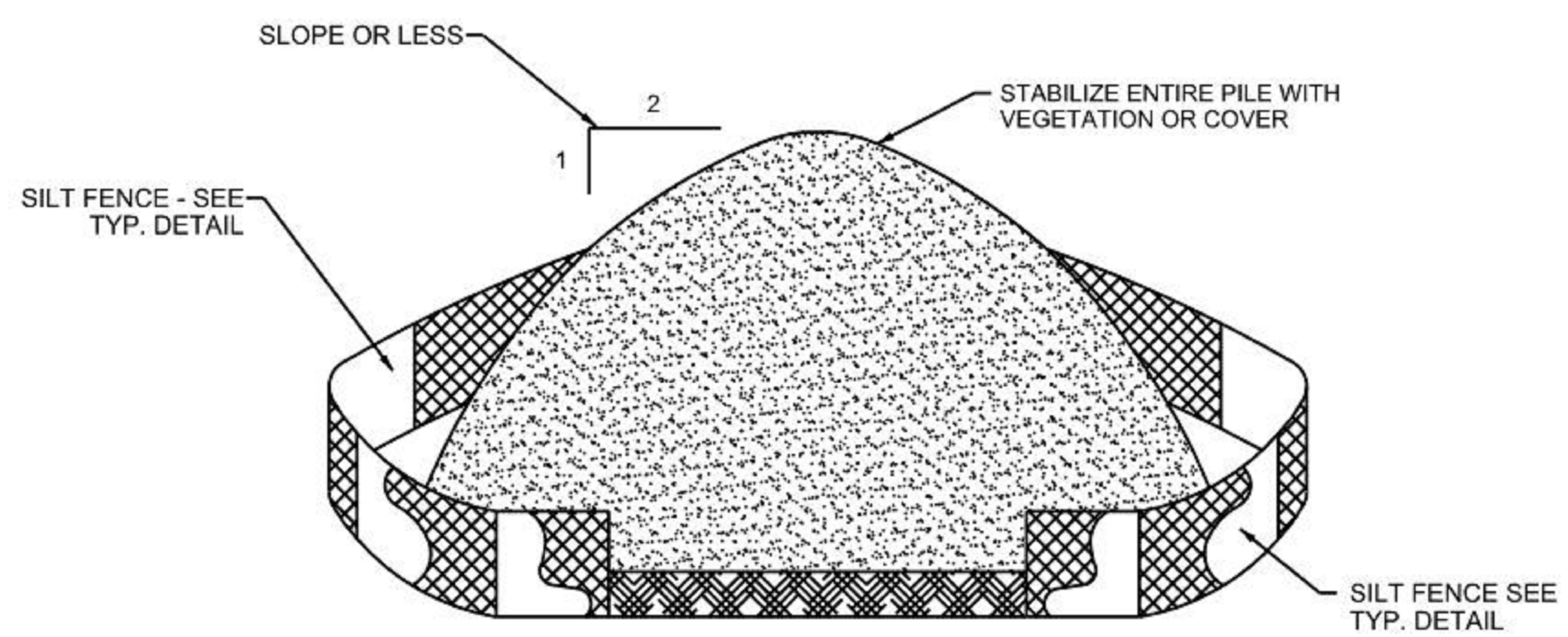


SF SILT FENCE
N.T.S.



CE TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

1. STONE SIZE - USE 2" STONE OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - AS SHOWN ON PLANS.
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - 14 FOOT MINIMUM BUT NOT LESS THAN FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. FILTER FABRIC - WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPINING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED TO PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC PLACEMENT OF ADDITIONAL STONE AS NEEDED. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAYS. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

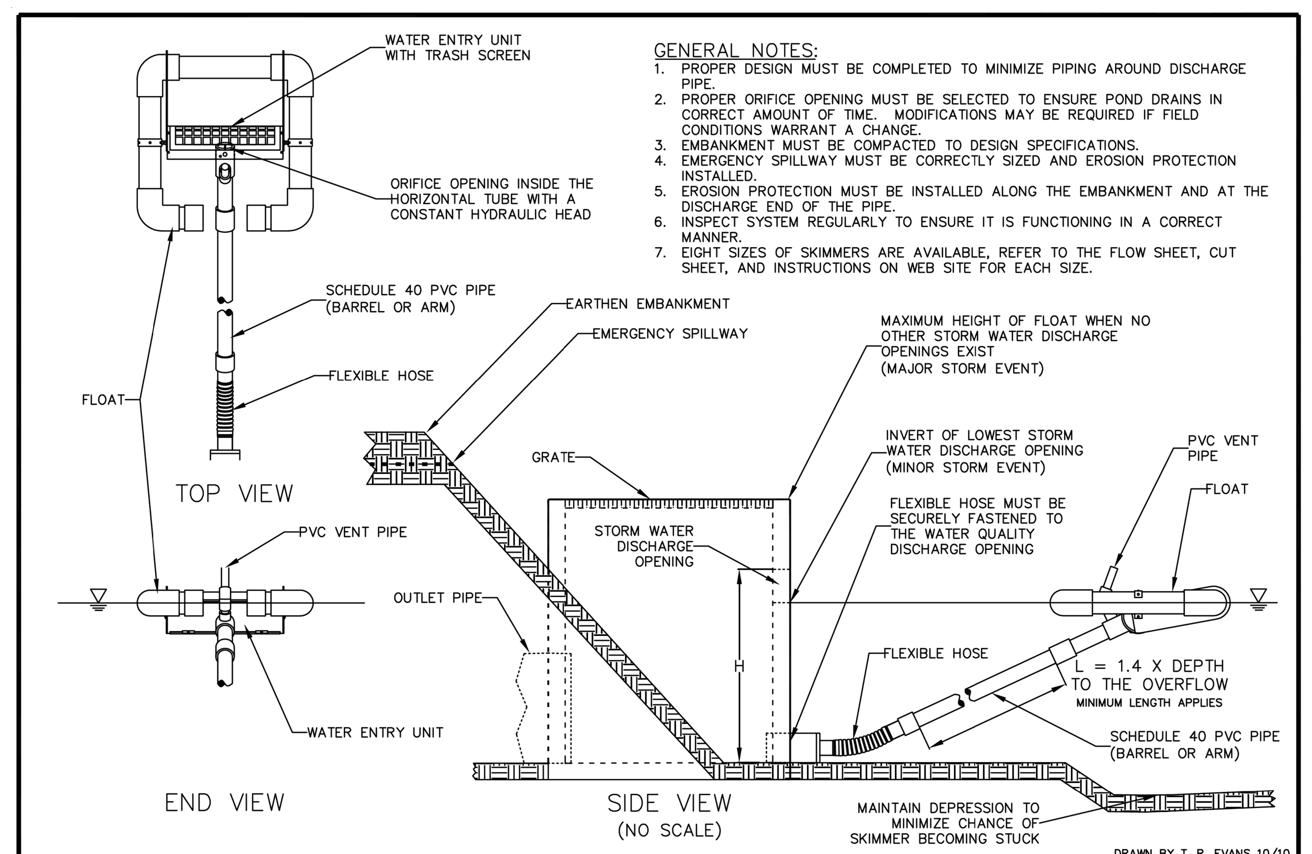


INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:1V.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR STRAW BALES, THEN STABILIZED WITH VEGETATION OR COVERED.

TYPICAL TOPSOIL STOCKPILE

N.T.S.



GENERAL NOTES:
1. PROPER DESIGN MUST BE COMPLETED TO MINIMIZE PIPING AROUND DISCHARGE PIPE.
2. PROPER ORIFICE OPENING MUST BE SELECTED TO ENSURE POND DRAINS IN CORRECT AMOUNT OF TIME. MODIFICATIONS MAY BE REQUIRED IF FIELD CONDITIONS WARRANT A CHANGE.
3. EMBANKMENT MUST BE COMPACTED TO DESIGN SPECIFICATIONS.
4. EMERGENCY SPILLWAY MUST BE CORRECTLY SIZED AND EROSION PROTECTION INSTALLED.
5. EROSION PROTECTION MUST BE INSTALLED ALONG THE EMBANKMENT AND AT THE DISCHARGE END OF THE PIPE.
6. INSPECT SYSTEM REGULARLY TO ENSURE IT IS FUNCTIONING IN A CORRECT MANNER.
7. EIGHT SIZES OF SKIMMERS ARE AVAILABLE, REFER TO THE FLOW SHEET, CUT SHEET, AND INSTRUCTIONS ON WEB SITE FOR EACH SIZE.

FAIRCLOTH SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE

J. W. FAIRCLOTH & SON INC.
WWW.FAIRCLOTHSKIMMER.COM
TELEPHONE: (919) 732-1244
FAX: (919) 732-1266
EMAIL: WARREN@FAIRCLOTHSKIMMER.COM

DRAWING INDEX:

STATE OF OHIO
ANTHONY WEHR
PE 86221
REGISTERED
PROFESSIONAL ENGINEER
12/06/2022

NO	DATE	REVISION DESCRIPTION	APPR	DR	ENG	CK	ISSUE#
1	12/06/22	SITE GRADING UPDATES AND REVISED LOD BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234C2
0	08/05/22	ISSUED FOR CONSTRUCTION BY POWER ENGINEERS, INC.	AJW	TVS	AJW	TJG	10404234 C1

OLD DWG #: | STD DWG #:

OHIO POWER COMPANY / OHIO TRANSMISSION COMPANY

BOKES CREEK STATION

YORK TOWNSHIP | UNION COUNTY OHIO

345kV

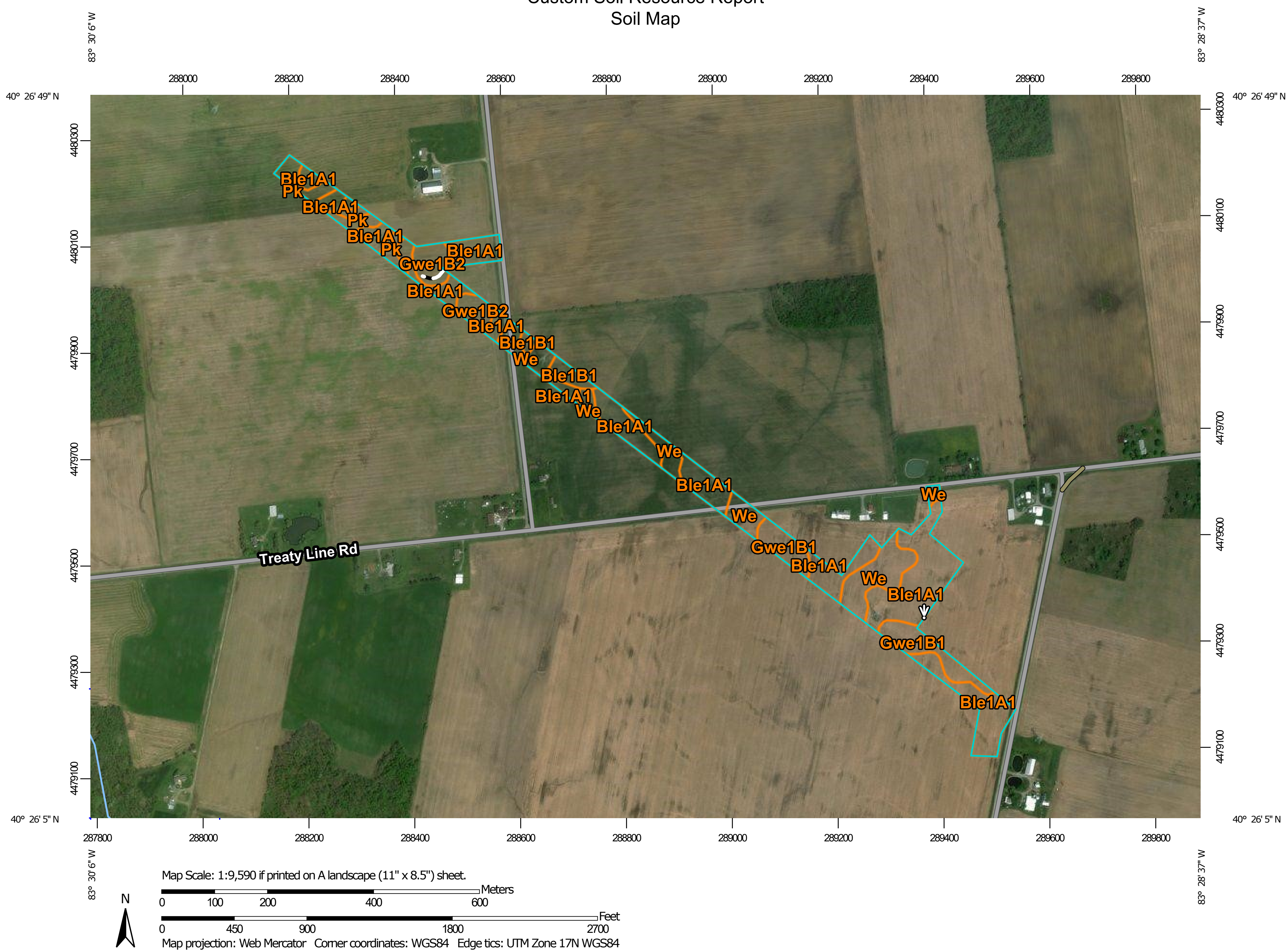
EROSION & SEDIMENT CONTROL NOTES AND DETAILS

SCALE: NONE	DR: TVS/PEI	ENG: AJW/PEI	CH: TJG/PEI
AMERICAN ELECTRIC POWER	WO#: 10404234C1	APPD: AJW/PEI	DATE: 08/05/2022
	1 RIVERSIDE PLAZA COLUMBUS, OH 43215	DWG. NO. E-1309	REV 1

STATION PROJECTS ENGINEERING
ATH-MM
PLOTTED: YYYY-MMM-DD
AEP G (30 X 46)
CADFILEPATH

CM 1 2 3 4 5 6 7 | 1/16 INCH 4 8 12 16 | TENTHS 10 20 30 | INCHES 1 2 3

Soil Map


83° 30' 6" W
83° 28' 37" W
40° 26' 49" N
40° 26' 5" N
288000
288200
288400
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288800
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Ble1A1
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Gwe1B2
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Gwe1B1
Treaty Line Rd
Map Scale: 1:9,590 if printed on A landscape (11" x 8.5") sheet.
Meters
0
100
200
400
600
Feet
0
450
900
1800
2700
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Union County, Ohio
Survey Area Data: Version 20, Sep 15, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

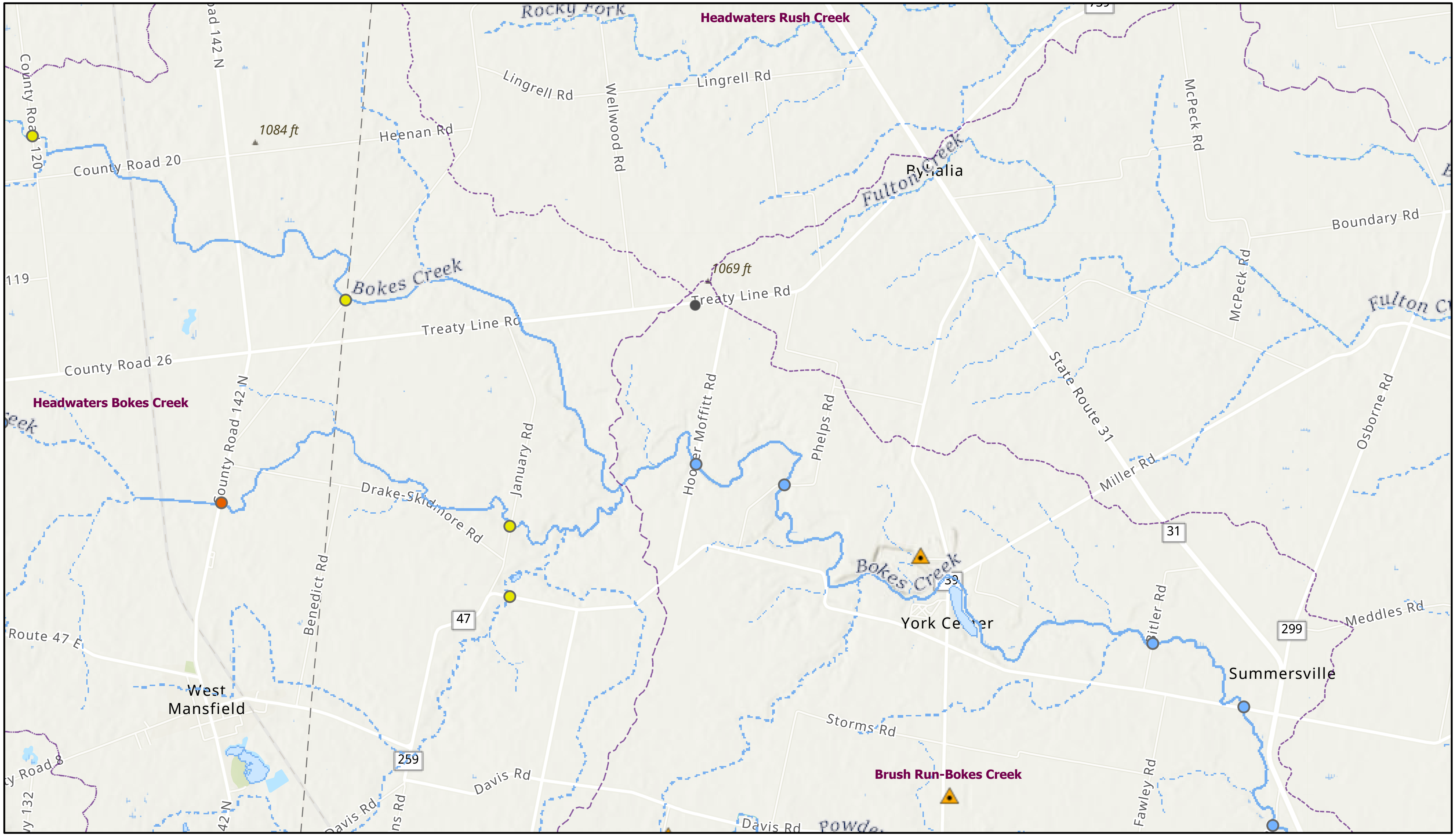
Date(s) aerial images were photographed: Nov 12, 2009—Dec 26, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ble1A1	Blount silt loam, end moraine, 0 to 2 percent slopes	15.8	53.9%
Ble1B1	Blount silt loam, end moraine, 2 to 4 percent slopes	0.9	3.2%
Gwe1B1	Glynwood silt loam, end moraine, 2 to 6 percent slopes	3.1	10.6%
Gwe1B2	Glynwood silt loam, end moraine, 2 to 6 percent slopes, eroded	2.0	6.8%
Pk	Pewamo silty clay loam, 0 to 1 percent slopes	1.8	6.0%
We	Wetzel silty clay loam	5.7	19.5%
Totals for Area of Interest		**29.3**	**100.0%**

Water Quality and Hydrologic Units



9/19/2022, 5:06:08 PM

NPDES Individual Permits

Individual Permit - Industrial

Aquatic Life Use Assessments

Full

Partial

Non

Watershed Assessment Units (HUC12)

1:72,224

0 0.47 0.95 1.9 mi

0 0.75 1.5 3 km

Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USGS The National Map: National Hydrography Dataset. Data refreshed July, 2022.

Ohio EPA

Division of Surface Water

BMP Detail Sheets:

Silt Fence

Filter Sock

Construction Entrance

Dust Control

Temporary Seeding

Permanent Seeding

Mulching

Construction Site Pollution Controls

6.3 Silt Fence

Description

Silt fence is a sediment-trapping practice utilizing a geotextile fence, topography and sometimes vegetation to cause sediment deposition. Silt fence reduces runoff's ability to transport sediment by ponding runoff and dissipating small rills of concentrated flow into uniform sheet flow. Silt fence is used to prevent sediment-laden sheet runoff from entering into downstream creeks and sewer systems.

Conditions Where Practice applies

Silt fence is used where runoff occurs as sheet flow or where flow through small rills can be converted to sheet flow. Major factors in its use are slope, slope length, and the amount of drainage area from which the fence will capture runoff. Silt fence cannot effectively treat flows in gullies, ditches or channels. For concentrated flow conditions see specifications for temporary diversions, sediment traps and sediment basins.

Planning Considerations

Alternatives: Silt Fence vs. Temporary Diversions and Settling Ponds. While silt fence requires less space and disturbs less area than other control measures there are significant disadvantages to its use. Silt fence is not as effective controlling sediment as routing runoff through a system of diversions and settling ponds. Settling ponds and earth diversions are more durable, easier to construct correctly and significantly more effective at removing sediments from runoff. Additionally earth diversions and settling ponds are less apt to fail during construction and typically require less repair and maintenance.

Proper installation is critical. Experience from ODNR and other field testing has shown that nearly 75 percent of silt fence does not function properly due to poor installation. Proper installation consists of it being installed: (1) on the contour; (2) with sufficient geotextile material buried; (3) with the fence pulled taut and supported on the downstream side by strong posts: (4) and with the fence backfilled and compacted.

Two general methods are used to install silt fence: (1) utilizing traditional method of digging the trench, installation of the fence materials, then backfilling and compaction; or (2) a method using an implement to static slice or narrow plow while installing the geotextile in the slot opening, followed by compaction and installation of posts. The latter methods generally installs silt fence more effectively and efficiently.

Silt fence is most applicable for relatively small areas with flat topography. Silt fence should be used below areas where erosion will occur in the form of sheet and rill erosion. For moderately steep areas, the area draining to the silt fence should be no larger that one quarter acre per 100 feet of fence length, the slope length no longer than 100 feet, and the maximum drainage gradient no steeper than 50 percent (2:1). This practice should be sited so that the entire fence ponds runoff and facilitates settling of suspended solids.

Design Criteria

Proper installation of silt fence requires utilizing the site topography. This is critical because the sediment removal process relies on ponding runoff behind the fence. As a ponding occurs behind the fence, coarser materials are allowed to settle out. Leaving a long, flat slope behind the silt fence maximizes areas for ponding (sediment deposition), and for water to disperse and flow over a much larger surface area of the silt fence. For silt fence to work effectively, runoff must be allowed to maintain sheet flow, to pond and to be released slowly. However, if silt fence is used without regard to a site's topography, it will typically concentrate runoff, increasing the likelihood of blocking and overtopping of the fence, thus reducing or eliminating its effectiveness.

Level Contour – For silt fence to promote deposition, it must be placed on the level contour of the land, so that flows are dissipated into uniform sheet flow that has less energy for transporting sediment. Silt fence should never concentrate runoff, which will result if it is placed up and down slopes rather than on the level contour.

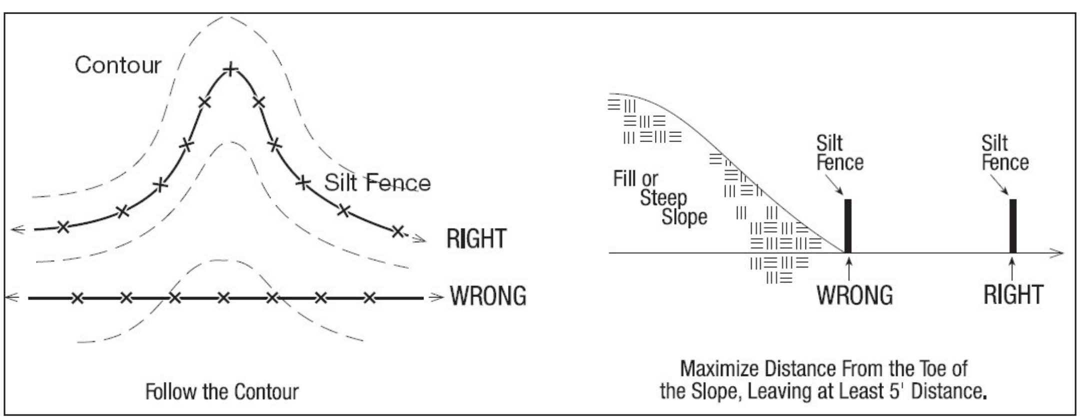


Figure 6.3.1 Silt fence layout

Flat Slopes – Slope has the greatest influence on runoff's ability to transport sediment, therefore silt fence should be placed several feet away from the toe of a slope if at all possible, to encourage deposition. Silt fence generally should be placed on the flattest area available to increase the shallow ponding of runoff and maximize space available for deposited sediment.

Flow Around Ends – To prevent water ponded by the silt fence from flowing around the ends, each end must be constructed upslope so that the ends are at a higher elevation.

Vegetation – Dense vegetation also has the effect of dissipating flow energies and causing sediment deposition. Sediment-trapping efficiency will be enhanced where a dense stand of vegetation occurs for several feet both behind and in front of a silt fence.

Table 6.3.1 Maximum area contributing area using slope length

Maximum Slope Length Above Silt Fence		
Slope		Slope Length (ft.)
0% - 2%	Flatter than 50:1	250
2% - 10%	50:1 - 10:1	125
10% - 20%	10:1 - 5:1	100
20% - 33%	5:1 - 3:1	75
33% - 50%	3:1 - 2:1	50
> 50%	> 2:1	25

Note: For larger drainage areas, see standards for temporary diversions, sediment traps and sediment basins.

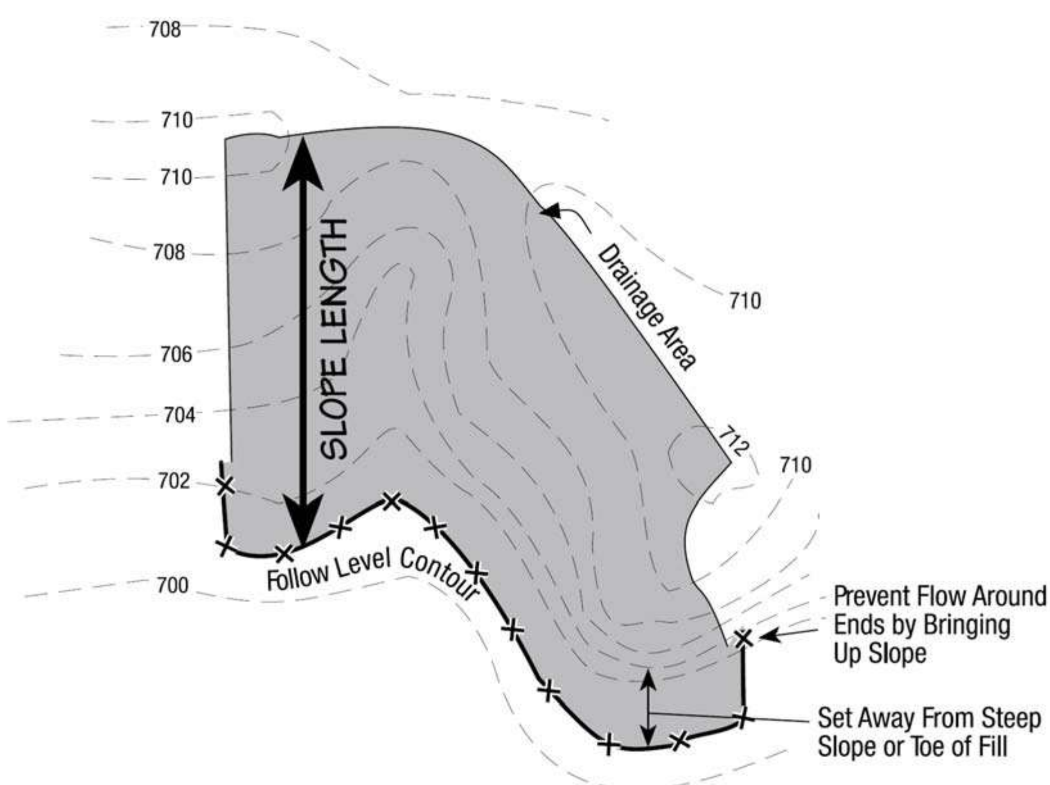


Figure 6.3.2 Silt fence and allowable drainage area

Dispersing Flow – Proper applications of silt fence allow all the intercepted runoff to pass as diffused flow through the geotextile. Runoff should never overtop silt fence, flow around the ends, or in any other way flow as concentrated flow from the practice. If any of these failures occurs, an alternative silt fence layout, or other practices are needed.

In cases where additional support of the fabric is needed, either wire or geogrid fencing may be used as a backing on the fabric. In these instances, the reinforcing material should be attached/erected first, then the fabric installed.

Materials

Fence posts shall be a minimum length of 32 inches long, composed of nominal dimensioned 2-by-2-inch hardwood of sound quality. They shall be free of knots, splits and other visible imperfections which would weaken the posts. Steel posts may be utilized in place of wood provide the geotextile can be adequately secured to the post.

Silt fence geotextile must meet the minimum criteria shown in the table below.

Table 6.3.2

Minimum criteria for Silt Fence Fabric (ODOT, 2002)		
Minimum Tensile Strength	120 lbs. (535 N)	ASTM D 4632
Maximum Elongation at 60 lbs	50%	ASTM D 4632
Minimum Puncture Strength	50 lbs (220 N)	ASTM D 4833
Minimum Tear Strength	40 lbs (180 N)	ASTM D 4533
Apparent Opening Size	≤ 0.84 mm	ASTM D 4751
Minimum Permittivity	$1X10^{-2}$ $sec.^{-1}$	ASTM D 4491
UV Exposure Strength Retention	70%	ASTM G 4355

Maintenance

Silt Fence requires regular inspection and maintenance to insure its effectiveness. Silt fences must be inspected after each rainfall and at least daily during prolonged rainfall. Silt fence found damaged or improperly installed shall be replaced or repaired immediately.

Sediment deposits shall be routinely removed when they reach approximately one-half the height of the silt fence.

Common Problems/Concerns

The predominant problems with silt fence regard inadequate installation or location that allows runoff to concentrate, overtop the fence, flow under the fabric or around the fence ends. If this occurs one of the following shall be performed, as appropriate:

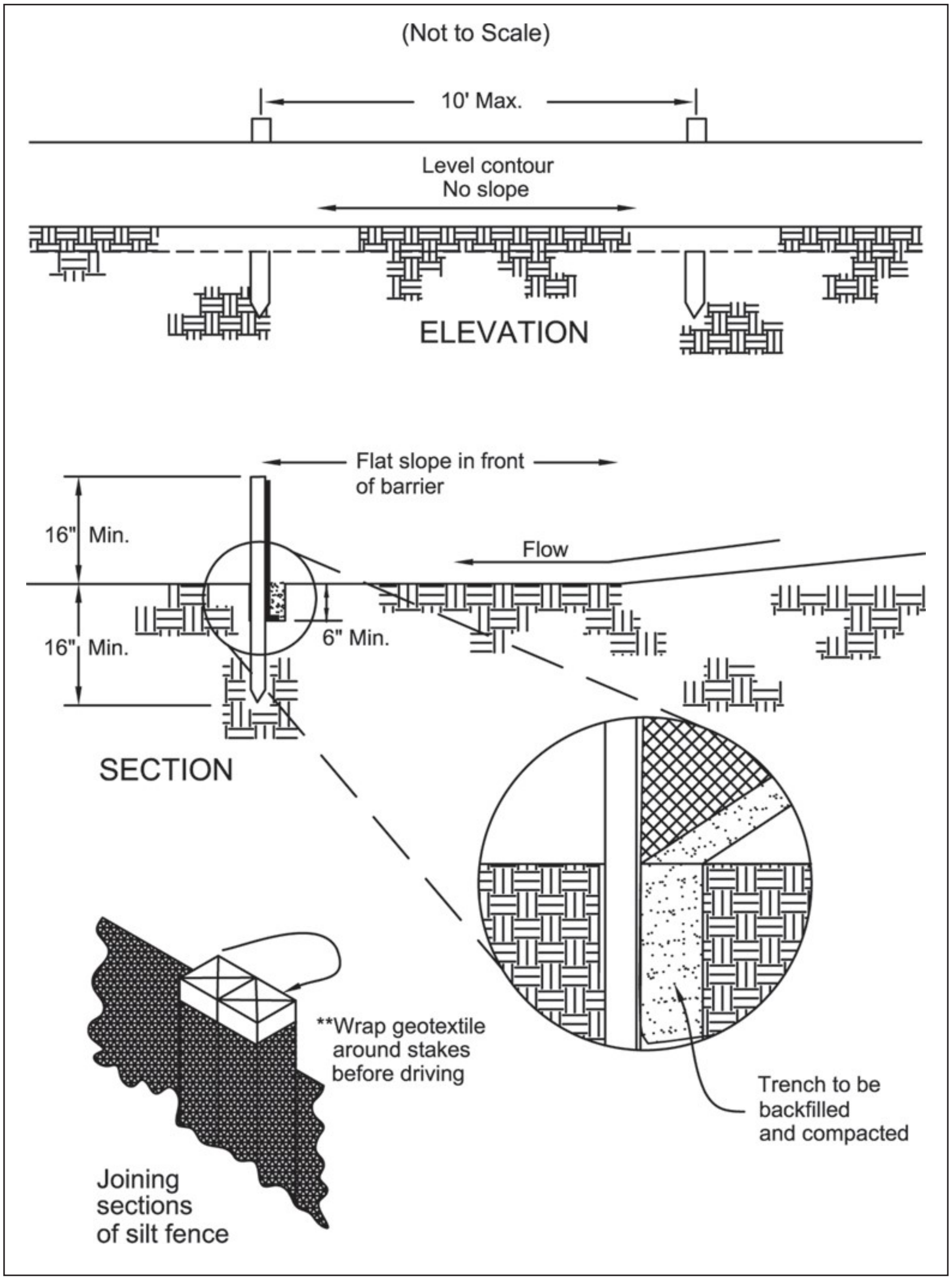
- The location and layout of the silt fence shall be changed to conform to the level contour
- The silt fence shall be reinstalled with proper burial, backfill and compaction and support
- Accumulated sediment shall be removed
- Alternative practices shall be installed.

References

Construction and Material Specifications, January 1, 2002. State of Ohio Department of Transportation, P.O. Box 899, Columbus, Ohio 43216-0899, http://www.dot.state.oh.us/construction/OCA/Specs/2002CMS/Specbook2002/Specbook2002.htm

Specifications
for

Silt Fence



Specifications
for
Silt Fence

1. Silt fence shall be constructed before upslope land disturbance begins.
2. All silt fence shall be placed as close to the contour as possible so that water will not concentrate at low points in the fence and so that small swales or depressions that may carry small concentrated flows to the silt fence are dissipated along its length.
3. Ends of the silt fences shall be brought upslope slightly so that water ponded by the silt fence will be prevented from flowing around the ends.
4. Silt fence shall be placed on the flattest area available.
5. Where possible, vegetation shall be preserved for 5 feet (or as much as possible) upslope from the silt fence. If vegetation is removed, it shall be reestablished within 7 days from the installation of the silt fence.
6. The height of the silt fence shall be a minimum of 16 inches above the original ground surface.
7. The silt fence shall be placed in an excavated or sliced trench cut a minimum of 6 inches deep. The trench shall be made with a trencher, cable laying machine, slicing machine, or other suitable device that will ensure an adequately uniform trench depth.
8. The silt fence shall be placed with the stakes on the downslope side of the geotextile. A minimum of 8 inches of geotextile must be below the ground surface. Excess material shall lay on the bottom of the 6-inch deep trench. The trench shall be backfilled and compacted on both sides of the fabric.
9. Seams between sections of silt fence shall be spliced together only at a support post with a minimum 6-in. overlap prior to driving into the ground, (see details).
10. Maintenance—Silt fence shall allow runoff to pass only as diffuse flow through the geotextile. If runoff overtops the silt fence, flows under the fabric or around the fence ends, or in any other way allows a concentrated flow discharge, one of the following shall be performed, as appropriate: 1) the layout of the silt fence shall be changed, 2) accumulated sediment shall be removed, or 3) other practices shall be installed.

    Sediment deposits shall be routinely removed when the deposit reaches approximately one-half of the height of the silt fence.

    Silt fences shall be inspected after each rainfall and at least daily during a prolonged rainfall. The location of existing silt fence shall be reviewed daily to ensure its proper location and effectiveness. If damaged, the silt fence shall be repaired immediately.

Criteria for silt fence materials

1. Fence post – The length shall be a minimum of 32 inches. Wood posts will be 2-by-2-in. nominal dimensioned hardwood of sound quality. They shall be free of knots, splits and other visible imperfections, that will weaken the posts. The maximum spacing between posts shall be 10 ft. Posts shall be driven a minimum 16 inches into the ground, where possible. If not possible, the posts shall be adequately secured to prevent overturning of the fence due to sediment/water loading.
2. Silt fence fabric – See chart below.

Table 6.3.2 **Minimum criteria for Silt Fence Fabric (ODOT, 2002)**

FABRIC PROPERTIES	VALUES	TEST METHOD
Minimum Tensile Strength	120 lbs. (535 N)	ASTM D 4632
Maximum Elongation at 60 lbs	50%	ASTM D 4632
Minimum Puncture Strength	50 lbs (220 N)	ASTM D 4833
Minimum Tear Strength	40 lbs (180 N)	ASTM D 4533
Apparent Opening Size	≤ 0.84 mm	ASTM D 4751
Minimum Permittivity	1X10-2 sec.-1	ASTM D 4491
UV Exposure Strength Retention	70%	ASTM G 4355

6.6 Filter Sock

Description

Filter socks are sediment-trapping devices using compost inserted into a flexible, permeable tube with a pneumatic blower device or equivalent. Filter socks trap sediment by filtering water passing through the berm and allowing water to pond, creating a settling of solids.

Conditions where practice applies

Filter socks are appropriate for limited drainage areas, requiring sediment control where runoff is in the form of sheet flow or in areas that silt fence is normally considered acceptable. The use of filter socks is applicable to slopes up to 2:1 (H:V), around inlets, and in other disturbed areas of construction sites requiring sediment control. Filter socks also may be useful in areas, where migration of aquatic life such as turtles, salamanders and other aquatic life would be impeded by the use of silt fence.

Planning Considerations

Filter socks are sediment barriers, capturing sediment by ponding and filtering water through the device during rain events. They may be a preferred alternative where equipment may drive near or over sediment barriers, as they are not as prone to complete failure as silt fence if this occurs during construction. Driving over filter socks is not recommended; but if it should occur, the filter sock should be inspected immediately, repaired and moved back into place as soon as possible.

Design Criteria

Typically, filter socks can handle the same water flow or slightly more than silt fence. For most applications, standard silt fence is replaced with 12" diameter filter socks. However, proper installation is especially important for them to work effectively.

Materials – Compost/mulch used for filter socks shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations, including time and temperature data indicating effective weed seed, pathogen and insect larvae kill. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Non-composted products are not acceptable.

Materials should meet the following requirements: pH between 5.0-8.0; 100% passing a 2" sieve and a minimum of 70% greater than the 3/8" sieve; moisture content is less than 60%; material shall be relatively free (<1% by dry weight) of inert or foreign man made materials.

Level Contour – Place filter socks on the level contour of the land so that flows are dissipated into uniform sheet flow. Flow coming to filter socks must not be concentrated and the filter sock should lie perpendicular to flows.

Flat Slopes – When possible, place filter socks at a 5' or greater distance away from the toe of the slopes in order for the water coming from the slopes to maximize space available for sediment deposit (see the illustration). When this is not possible due to construction limitations, additional filter socks may be required upslope of the initial filter sock (see the chart below for appropriate slope lengths and spacing).

Flow Around Ends – In order to prevent water flowing around the ends of filter socks, the ends of the filter socks must be constructed pointing upslope so the ends are at a higher elevation.

Vegetation – For permanent areas, seeding filter socks is recommended to establish vegetation directly in the sock and immediately in front and back of the sock at a distance of 5 feet. Vegetating on and around the filter socks will assist in slowing down water for filtration creating a more effective longer-term sediment control.

Drainage Area: Generally filter socks are limited to ¼ to ½ acre drainage area per 100 foot of the sediment barrier. Specific guidance is given in the chart below.

Table 6.6.1 Maximum Slope Length Above Filter Sock and Recommended Diameter

Slope	Ratio (H:V)	8"	12"	18"	24"
0% - 2%	10% - 20%	125	250	300	350
10% - 20%	50:1 - 10:1	100	125	200	250
2% - 10%	10:1 - 5:1	75	100	150	200
20% - 33%	5:1 - 2:1		50	75	100
>50%	>2:1		25	50	75

Note: For larger drainage areas, see standards for temporary diversions, sediment traps and sediment basins.

Dispersing flow – Sheet flow and runoff should not exceed berm height or capacity in most storm events. If overflow of the berm is a possibility, a larger filter sock should be installed or an alternative sediment control should be used.

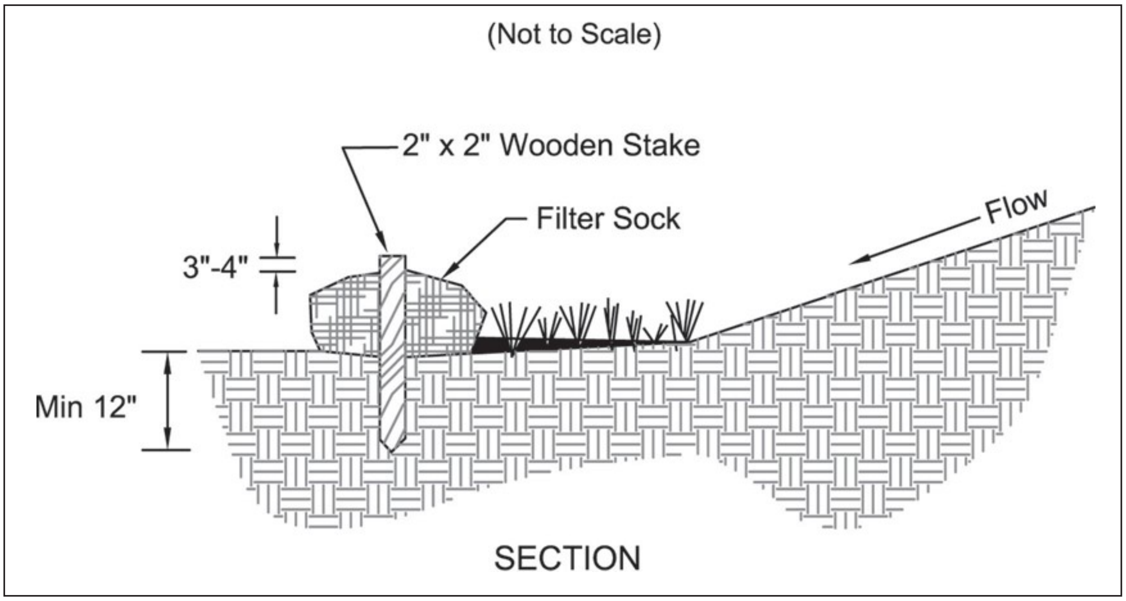
Maintenance – Filter socks should be regularly inspected to make sure they hold their shape, are ponding, and allowing adequate flow through. If ponding becomes excessive, filter socks should be replaced. Used filter socks may be cut and the compost dispersed and seeded to prevent captured sediment from being resuspended.

Removal – When construction is completed on site, the filter socks may be cut and dispersed with a loader, rake, bulldozer or other device to be incorporated into the soil or left on top of the soil for final seeding. The mesh netting material will be disposed of in normal trash container or removed by the contractor.

References

Standard Specification for Compost for Erosion/Sediment Control (Filter Berms) AASHTO Designation: MP-9 http://www.iaasla.org/NEWS/FILES/AASHTO-Filterberm6.doc

Specifications
for
Filter Sock



1. Materials – Compost used for filter socks shall be weed, pathogen and insect free and free of any refuse, contaminants or other materials toxic to plant growth. They shall be derived from a well-decomposed source of organic matter and consist of a particles ranging from 3/8" to 2".
2. Filter Socks shall be 3 or 5 mil continuous, tubular, HDPE 3/8" knitted mesh netting material, filled with compost passing the above specifications for compost products.

INSTALLATION:

3. Filter socks will be placed on a level line across slopes, generally parallel to the base of the slope or other affected area. On slopes approaching 2:1, additional socks shall be provided at the top and as needed mid-slope.
4. Filter socks intended to be left as a permanent filter or part of the natural landscape, shall be seeded at the time of installation for establishment of permanent vegetation.
5. Filter Socks are not to be used in concentrated flow situations or in runoff channels.

MAINTENANCE:

6. Routinely inspect filter socks after each significant rain, maintaining filter socks in a functional condition at all times.
7. Remove sediments collected at the base of the filter socks when they reach 1/3 of the exposed height of the practice.
8. Where the filter sock deteriorates or fails, it will be repaired or replaced with a more effective alternative.
9. Removal – Filter socks will be dispersed on site when no longer required in such as way as to facilitate and not obstruct seedings.

7.4 Construction Entrance

Description

A construction entrance is a stabilized pad of stone underlain with a geotextile and is used to reduce the amount of mud tracked off-site with construction traffic. Located at points of ingress/egress, the practice is used to reduce the amount of mud tracked off-site with construction traffic.

Conditions Where Practice Applies

A construction entrance is applicable where:

- Construction traffic leaves active construction areas and enters public roadways or areas unchecked by effective sediment controls;
- Areas where frequent vehicle and equipment access is expected and likely to contribute sediment to runoff, such as at the entrance to individual building lots.

Planning Considerations

Construction entrances address areas that contribute significant amounts of mud to runoff by providing a stable area for traffic. Although they allow some mud to be removed from construction vehicle tires before they enter a public roads, they should not be the only practice relied upon to manage off-site tracking. Since most mud is flung from tires as they reach higher speeds, restricting traffic to stabilized construction roads, entrances and away from muddy areas is necessary.

If a construction entrance is not sufficient to remove the majority of mud from wheels or there is an especially sensitive traffic situation on adjacent roads, wheel wash areas may be necessary. This requires an extended width pad to avoid conflicts with traffic, a supply of wash water and sufficient drainage to assure runoff is captured in a sediment pond or trap.

Proper installation of a construction entrance requires a geotextile and proper drainage to insure construction site runoff does not leave the site. The use of geotextile under the stone helps to prevent potholes from developing and will save the amount of stone needed during the life of the practice. Proper drainage may include culverts to direct water under the roadway or water bars to direct muddy water off the roadway toward sediment traps or ponds.

Design Criteria

The area of the entrance must be cleared of all vegetation, roots, and other objectionable material. Geotextile will then be placed the full width and length of the entrance.

Stone shall be placed to a depth of at least 6 inches. Roads subject to heavy duty loads should be increased to a minimum of 10 inches. Surface water shall be conveyed under the entrance, through culverts, or diverted via a water bars or mountable berms (minimum 5:1 slopes) so as to convey sediment laden runoff to sediment control practices or to allow clean water to pass by the entrance.

The stabilized construction entrance shall meet the specifications that follow.

Maintenance

The entrance shall be maintained in a condition that will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or cleanout of any structures used to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

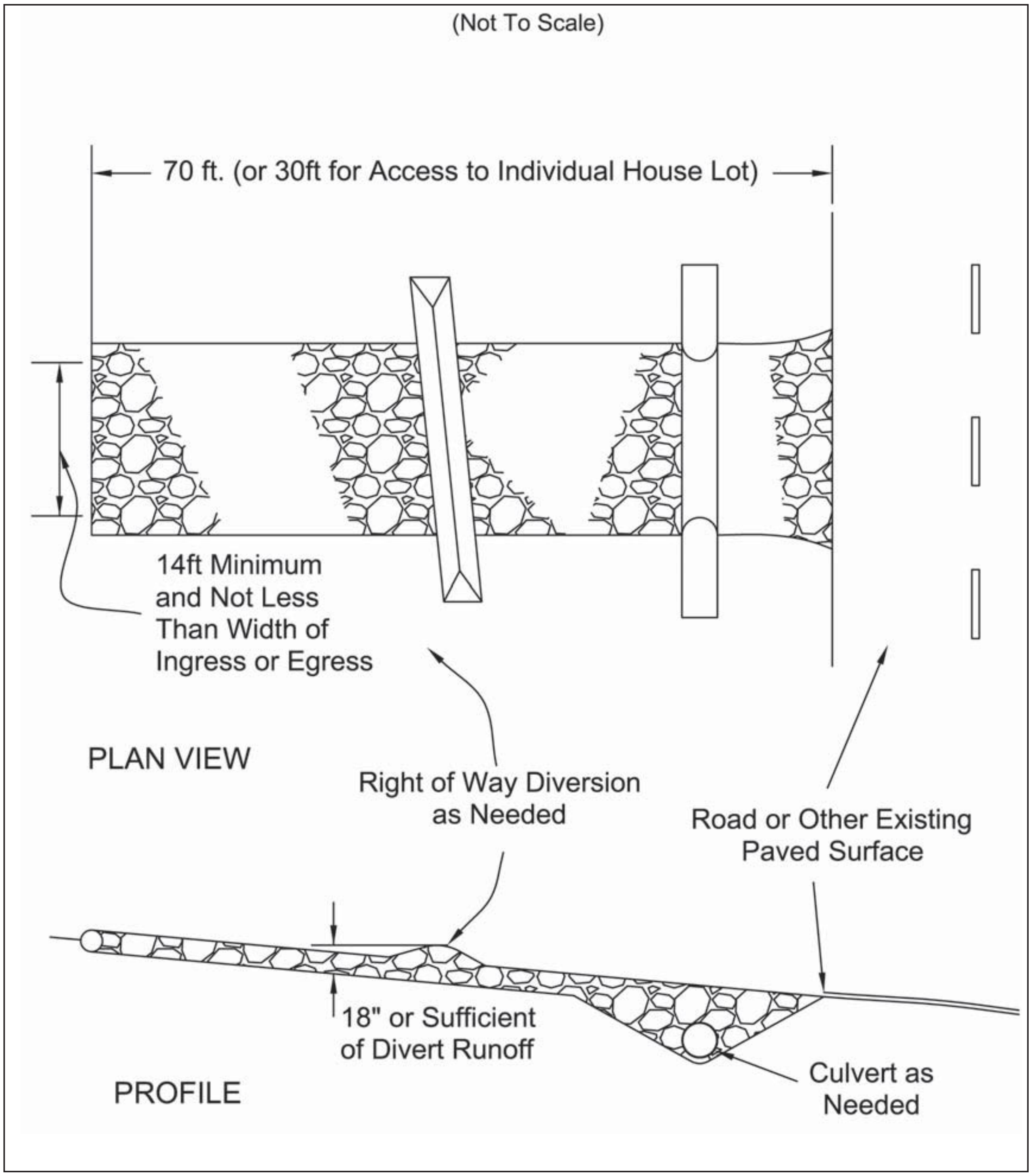
Common Problems / Concerns

Mud is allowed to accumulate and is tracked on to public right-of-ways. The entrance and associated construction roads may need dressing with additional stone.

Soft depression areas develop in entrance area. Stone may not have been underlain with geotextile or insufficient stone base has been provided.

Specifications
for

Construction Entrance



Specifications
for

Construction Entrance

1. Stone Size—ODOT # 2 (1.5-2.5 inch) stone shall be used, or recycled concrete equivalent.
2. Length—The Construction entrance shall be as long as required to stabilize high traffic areas but not less than 70 ft. (exception: apply 30 ft. minimum to single residence lots).
3. Thickness -The stone layer shall be at least 6 inches thick for light duty entrances or at least 10 inches for heavy duty use.
4. Width -The entrance shall be at least 14 feet wide, but not less than the full width at points where ingress or egress occurs.
5. Geotextile -A geotextile shall be laid over the entire area prior to placing stone. It shall be composed of strong rot-proof polymeric fibers and meet the following specifications:

Figure 7.4.1

Geotextile Specification for Construction Entrance	
Minimum Tensile Strength	200 lbs.
Minimum Puncture Strength	80 psi.
Minimum Tear Strength	50 lbs.
Minimum Burst Strength	320 psi.
Minimum Elongation	20%
Equivalent Opening Size	EOS < 0.6 mm.
Permittivity	1×10-3 cm/sec.

6. Timing—The construction entrance shall be installed as soon as is practicable before major grading activities.
7. Culvert -A pipe or culvert shall be constructed under the entrance if needed to prevent surface water from flowing across the entrance or to prevent runoff from being directed out onto paved surfaces.
8. Water Bar -A water bar shall 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 shall 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, shall be removed immediately. Removal shall be accomplished by scraping or sweeping.
10. Construction entrances shall not be relied upon to remove mud from vehicles and prevent off-site tracking. Vehicles that enter and leave the construction-site shall be restricted from muddy areas.
11. Removal—the entrance shall remain in place until the disturbed area is stabilized or replaced with a permanent roadway or entrance.

7.5 Dust Control

Description

Dust control involves preventing or reducing dust from exposed soils or other sources during land disturbing, demolition and construction activities to reduce the presence of airborne substances which may present health hazards, traffic safety problems or harm animal or plant life.

Conditions Where Practice Applies

In areas subject to surface and air movement of dust where on-site and off-site damage is likely to occur if preventive measures are not taken.

Planning Considerations

Construction activities inevitably result in the exposure and disturbance of soil. Fugitive dust results from both construction activities and as a result of wind erosion over the exposed earth surfaces. Large quantities of dust are typically generated in heavy construction activities, such as road construction and subdivision, commercial or industrial development, which involve disturbing significant areas of the soil surface. Research of construction sites has established an average dust emission rate of 1.2 tons/acre/month for active construction. Earth-moving activities comprise the major source of construction dust emissions, but traffic and general disturbance of the soil also generate significant dust emissions.

Planning for dust control involves limiting the amount of soil disturbance at any one time as a key objective. Therefore, phased clearing and grading operations (minimize disturbance-phasing) and the utilization of other stabilization practices can significantly reduce dust emissions. Undisturbed vegetative buffers (minimum 50-foot widths) left between graded areas and protected areas can also be very helpful in dust control by providing windbreaks and non-erosive areas.

Design Criteria

A number of measures can be utilized to limit dust either during or between construction stages or once construction is complete. Generally the same methods that are used to limit erosion by limiting exposure of soils to rainfall can be used to limit dust including: stabilizing exposed soils with mulch, vegetation or permanent cover. Additional methods particular to dust control include managing vehicles and construction traffic, road treatment and treatment of exposed soil with chemical stabilizers.

Vegetative Cover – The most effective way to prevent dust from exposed soil is to provide a dense cover of vegetation. In areas subject to little or no construction traffic, vegetative stabilization reduces dust drastically. Timely temporary and permanent seedings must be utilized to accomplish this. See TEMPORARY SEEDING & PERMANENT SEEDING.

Mulch - When properly applied, mulch offers a fast, effective means of controlling dust. Mulching is not recommended for areas within heavy traffic pathways. Binders or tackifiers should be used to tack organic mulches. See MULCHING.

Rough Graded Soils – Leaving the soil in a temporary state of rough grade, where clods rather than flattened soils predominate the surface can reduce the amount of dust generated from areas during periods of higher winds. This must be balanced by the need to reach a stage where the soil can be stabilized and may be only be necessary when high winds are predicted.

Watering - This is the most commonly used dust control practice. The site is sprinkled with water until the surface is wet before and during grading and is repeated as needed. It offers fast protection for haul roads and other heavy traffic routes. Watering should be done at a rate that prevents dust but does not cause soil erosion. Wetting agents are also available to increase the effectiveness of watering and must follow manufacturers instructions.

Chemical Stabilizers/Wetting Agents – Many products of this type are available and are usually most effective on typical mineral soils but may not be on predominantly organic soils such as muck. Users are advised to pay attention to the limitations and instructions regarding each product. The following table lists various adhesives and provides corresponding information on mixing and application:

Table 7.5.1 Adhesives for Dust Control

Adhesive	Water Dilution (Adhesive: Water)	Nozzle Type	Application Rate Gallon/Acre
Latex Emulsion	12.5:1	Fine	235
Resin in Water	4:1	Fine	300
Acrylic Emulsion (No-traffic)	7:1	Coarse	450
Acrylic Emulsion (Traffic)	3.5:1	Coarse	350

Stone - Stone can be used to stabilize roads or other areas during construction using crushed stone or coarse gravel. Research has shown the addition of bentonite to limestone roads (not igneous gravel) has shown benefits in reducing dust.

***Windbreaks and Barriers* –** Where dust is a known problem, existing windbreak vegetation should be preserved. Maintaining existing rows of trees or constructing a wind fence, sediment fence, or similar barrier can help to control air currents and blowing soil. Place barriers perpendicular to prevailing air currents at intervals of about 15 times the barrier height.

***Calcium Chloride* -** This chemical may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage. Liquid application of a 35% calcium chloride solution is common. Note: application rates should be strictly in accordance with suppliers' specified rates.

***Street Cleaning* -** Paved areas that have accumulated sediment from construction sites should be cleaned daily, or as needed, utilizing a street sweeper or bucket -type loader or scraper.

Operation and Maintenance

Most dust control measures, such as applications of water or road treatments will require monitoring and repeat applications as needed to accomplish good control.

Common Problems / Concerns

Vegetation is removed from large areas of the construction site and left barren for long periods of time.

Continuous, scheduled monitoring of the construction site conditions is not made.

Specifications
for
Dust Control

1. Vegetative Cover and/mulch – Apply temporary or permanent seeding and mulch to areas that will remain idle for over 21 days. Saving existing trees and large shrubs will also reduce soil and air movement across disturbed areas. See Temporary Seeding; Permanent Seeding; Mulching Practices; and Tree and Natural Area Protection practices.
2. Watering – Spray site with water until the surface is wet before and during grading and repeat as needed, especially on haul roads and other heavy traffic routes. Watering shall be done at a rate that prevents dust but does not cause soil erosion. Wetting agents shall be utilized according to manufacturers instructions.
3. Spray-On Adhesives – Apply adhesive according to the following table or manufacturers' instructions.

Table 7.5.1 Adhesives for Dust Control

Adhesive	Water Dilution (Adhesive: Water)	Nozzle Type	Application Rate Gal./Ac.
Latex Emulsion	12.5:1	Fine	235
Resin in Water Acrylic Emulsion (No-traffic)	4:1	Fine	300
Acrylic Emulsion (No-traffic)	7:1	Coarse	450
Acrylic Emulsion (Traffic)	3.5:1	Coarse	350

4. Stone – Graded roadways and other suitable areas will be stabilized using crushed stone or coarse gravel as soon as practicable after reaching an interim or final grade. Crushed stone or coarse gravel can be used as a permanent cover to provide control of soil emissions.
5. Barriers – Existing windbreak vegetation shall be marked and preserved. Snow fencing or other suitable barrier may be placed perpendicular to prevailing air currents at intervals of about 15 times the barrier height to control air currents and blowing soil.
6. Calcium Chloride - This chemical may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage. Application rates should be strictly in accordance with suppliers' specified rates.
7. Operation and Maintenance - When Temporary Dust Control measures are used; repetitive treatment should be applied as needed to accomplish control.

   Street Cleaning - Paved areas that have accumulated sediment from construction should be cleaned daily, or as needed, utilizing a street sweeper or bucket -type endloader or scraper.

7.8 Temporary Seeding

Description

Temporary seedings establish temporary cover on disturbed areas by planting appropriate rapidly growing annual grasses or small grains. Temporary seeding provides erosion control on areas in between construction operations. Grasses, which are quick growing, are seeded and usually mulched to provide prompt, temporary soil stabilization. It effectively minimizes the area of a construction site prone to erosion and should be used everywhere the sequence of construction operations allows vegetation to be established.

Conditions Where the Practice Applies

Temporary seeding should be applied on exposed soil where additional work (grading, etc.) is not scheduled for more than 21 days. Permanent seeding should be applied if the areas will be idle for more than one year.

Planning Considerations

This practice has the potential to drastically reduce the amount of sediment eroded from a construction site. Erosion control efficiencies greater than 90% will be achieved with proper applications of temporary seeding. Because practices used to trap sediment are usually much less effective, temporary seeding is to be use even on areas where runoff is treated by sediment trapping practices. Because temporary seeding is highly effective and practical on construction sites, its liberal use is highly recommended.

Design Criteria

Specifications follow these explanations of important aspects of temporary seeding.

Plant Selection: Select the plants appropriate from the table in the Specifications for Temporary seeding. Choose varieties of tall fescue that are endophyte free or have non-toxic endophytes. Seeding rates for dormant seedings are increased by 50 percent. More information on dormant seedings is given in the permanent seeding section.

The length of time the area will idle and the season in which seeding occurs should influence the selection of seeding species. For areas remaining idle for over a year, a mixture containing perennial ryegrass is recommended. Cereal grains (rye, oats and wheat) are included in some of the mixtures as cover crops. These are annual plants that will die after producing seed. Realize that oats will not over-winter and continue to grow as wheat and rye do.

Site preparation: Temporary seeding is best done on a prepared soil seedbed of loose pulverized soil. However, seedings should not be delayed, if additional grading operations are not possible. At a minimum, remove large rock or debris that will interfere with seeding operations. If the ground has become crusted, a disk or a harrow should be used to loosen the soil. Overall the best soil conditions will exist immediately after grading operations cease, when soils remain loose and moist.

Soil amendments: A soil test is necessary to adequately predict the need for lime and fertilizer. Seedings that are expected to be long lasting (over 1-3 months), should have lime and fertilizer applied as recommended by a soil test. In lieu of a soil test, fertilizer can be broadcast and worked into the top inch of soil at the rate of 6 pounds/1000 ft2 or 250 pounds per acre of 10-10-10 or 12-12-12.

Seeding Methods: Seed shall be applied uniformly with a cyclone spreader, drill, culti-packer seeder, or hydroseeder. When feasible, seed that has been broadcast shall be covered by raking or dragging and then lightly tamped into place using a roller or cultipacker. If hydroseeding is used, the seed and fertilizer will be mixed on-site and the seeding shall be done immediately and without interruption.

Maintenance

Areas failing to establish vegetative cover adequate to prevent erosion shall be reseeded as soon as such areas are identified.

Seeding performed during hot and dry summer months shall be watered at a rate of 1 inch per week.

Common Problems / Concerns

- Insufficient topsoil or inadequately tilled, limed, and/ or fertilized seedbed results in poor establishment of vegetation.
- An overly high seeding rate of nurse crop (oat, rye or wheat) in the seed mixture results in over competition with the perennials.
- Seeding outside of seeding dates results in poor vegetation establishment and a decrease in plant hardiness.
- An inadequate rate of mulch results in poor germination and failure.

Specifications
for

Temporary Seeding

Table 7.8.1 Temporary Seeding Species Selection

Seeding Dates	Species	Lb./1000 ft2	Lb/Acre
March 1 to August 15	Oats Tall Fescue Annual Ryegrass	3 1 1	128 (4 Bushel) 40 40
	Perennial Ryegrass Tall Fescue Annual Ryegrass	1 1 1	40 40 40
	Annual Ryegrass Perennial Ryegrass Creeping Red Fescue Kentucky Bluegrass	1.25 3.25 0.4 0.4	55 142 17 17
	Oats Tall Fescue Annual Ryegrass	3 1 1	128 (3 bushel) 40 40
August 16th to November	Rye Tall Fescue Annual Ryegrass	3 1 1	112 (2 bushel) 40 40
	Wheat Tall Fescue Annual Ryegrass	3 1 1	120 (2 bushel) 40 40
	Perennial Rye Tall Fescue Annual Ryegrass	1 1 1	40 40 40
	Annual Ryegrass Perennial Ryegrass Creeping Red Fescue Kentucky Bluegrass	1.25 3.25 0.4 0.4	40 40 40
November 1 to Feb. 29	Use mulch only or dormant seeding		

Note: Other approved species may be substituted.

1. Structural erosion and sediment control practices such as diversions and sediment traps shall be installed and stabilized with temporary seeding prior to grading the rest of the construction site.
2. Temporary seed shall be applied between construction operations on soil that will not be graded or reworked for 21 days or greater. These idle areas shall be seeded within 7 days after grading.
3. The seedbed should be pulverized and loose to ensure the success of establishing vegetation. Temporary seeding should not be postponed if ideal seedbed preparation is not possible.
4. Soil Amendments—Temporary vegetation seeding rates shall establish adequate stands of vegetation, which may require the use of soil amendments. Base rates for lime and fertilizer shall be used.
5. Seeding Method—Seed shall be applied uniformly with a cyclone spreader, drill, cultipacker seeder, or hydroseeder. When feasible, seed that has been broadcast shall be covered by raking or dragging and then lightly tamped into place using a roller or cultipacker. If hydroseeding is used, the seed and fertilizer will be mixed on-site and the seeding shall be done immediately and without interruption.

Specifications
for

Temporary Seeding

Mulching Temporary Seeding

1. Applications of temporary seeding shall include mulch, which shall be applied during or immediately after seeding. Seedings made during optimum seeding dates on favorable, very flat soil conditions may not need mulch to achieve adequate stabilization.

2. Materials:

- Straw—If straw is used, it shall be unrotted small-grain straw applied at a rate of 2 tons per acre or 90 lbs./ 1,000 sq. ft. (2-3 bales)
- Hydroseeders—If wood cellulose fiber is used, it shall be used at 2000 lbs./ ac. or 46 lb./ 1,000-sq.-ft.
- Other—Other acceptable mulches include mulch mattings applied according to manufacturer's recommendations or wood chips applied at 6 ton/ ac.

3. Straw Mulch shall be anchored immediately to minimize loss by wind or water. Anchoring methods:

- Mechanical—A disk, crimper, or similar type tool shall be set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but left to a length of approximately 6 inches.
- Mulch Netting—Netting shall be used according to the manufacturers recommendations. Netting may be necessary to hold mulch in place in areas of concentrated runoff and on critical slopes.
- Synthetic Binders—Synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Track or equivalent may be used at rates recommended by the manufacturer.
- Wood-Cellulose Fiber—Wood-cellulose fiber binder shall be applied at a net dry wt. of 750 lb./ac. The wood-cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb. / 100 gal.

7.9 Mulching

Description

A protective layer of mulch, usually of straw, applied to bare soil is used to abate erosion by shielding it from raindrop impact. Mulch also helps establish vegetation by conserving moisture and creating favorable conditions for seeds to germinate.

Conditions Where Practice Applies

Mulch should be used liberally throughout construction to limit the areas that are bare and susceptible to erosion. Mulch can be used in conjunction with seeding to establish vegetation or by itself to provide erosion control when the season does not allow grass to grow. Mulch and other vegetative practices must be applied on all disturbed portions of construction-sites that will not be re-disturbed for more than 21 days.

Design Criteria

See specifications for Mulching.

Maintenance

Additional mulching is necessary to cover exposed soil conditions when observed during routine maintenance inspections.

Common Problems / Concerns

The application of synthetic binders must be conducted in such a manner as to not be introduced into watercourses.

Weather considerations must be addressed to ensure the application of synthetic binders are not washed away and introduced into watercourses.

The use of a mulch cover is not recommended for areas, which will exhibit higher velocities than 3.5 feet/second. An erosion control matting is recommended for areas which will exhibit higher velocities.

Areas which have been mulched should be inspected and maintained if necessary every 7 days or within 24 hours of a rain event greater than or equal to 0.5 inches to ensure adequate protection.

Specifications
for

Mulching

1. Mulch and other appropriate vegetative practices shall be applied to disturbed areas within 7 days of grading if the area is to remain dormant (undisturbed) for more than 21 days or on areas and portions of the site which can be brought to final grade.
2. Mulch shall consist of one of the following:

- Straw - Straw shall be unrotted small grain straw applied at the rate of 2 tons/ac. or 90 lb./1,000 sq. ft. (two to three bales). The straw mulch shall be spread uniformly by hand or mechanically so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 sq.ft. sections and place two 45-lb. bales of straw in each section.
- Hydroseeders - Wood cellulose fiber should be used at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
- Other - Acceptable mulches include mulch mattings and rolled erosion control products applied according to manufacturer's recommendations or wood mulch/chips applied at 10-20 tons/ac.

3. Mulch Anchoring - Mulch shall be anchored immediately to minimize loss by wind or runoff. The following are acceptable methods for anchoring mulch.

- Mechanical - Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but be left generally longer than 6 inches.
- Mulch Nettings - Use according to the manufacturer's recommendations, following all placement and anchoring requirements. Use in areas of water concentration and steep slopes to hold mulch in place.
- Synthetic Binders - For straw mulch, synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Tack or equal may be used at rates recommended by the manufacturer. All applications of Sythetic Binders must be conducted in such a manner where there is no contact with waters of the state.
- Wood Cellulose Fiber - Wood cellulose fiber may be used for anchoring straw. The fiber binder shall be applied at a net dry weight of 750 lb./acre. The wood cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb./100 gal. of wood cellulose fiber.

7.10 Permanent Seeding

Description

Perennial vegetation is established on areas that will not be re-disturbed for periods longer than 12 months. Permanent seeding includes site preparation, seedbed preparation, planting seed, mulching, irrigation and maintenance.

Permanent vegetation is used to stabilize soil, reduce erosion, prevent sediment pollution, reduce runoff by promoting infiltration, and provide stormwater quality benefits offered by dense grass cover.

Conditions Where Practice Applies

Permanent seeding should be applied to:

- Any disturbed areas or portions of construction sites at final grade. Permanent seeding should not be delayed on any one portion of the site at final grade while construction on another portion of the site is being completed. Permanent seeding shall be completed in phases, if necessary.
- Areas subject to grading activities but will remain dormant for a year or more.

Planning Considerations

Vegetation controls erosion by reducing the velocity and the volume of overland flow and protects bare soil surface from raindrop impact. A healthy, dense turf promotes infiltration and reduces the amount of runoff. The establishment of quality vegetation requires selection of the right plant materials for the site, adequate soil amendments, careful seedbed preparation, and maintenance.

***Soil Compaction*—**Storm water quality and the amount of runoff both vary significantly with soil compaction. Non-compacted soils improve stormwater infiltration by promoting:

- dense vegetative growth;
- high soil infiltration & lower runoff rates;
- pollutant filtration, deposition & absorption; and
- beneficial biologic activity in the soil.

Construction activity creates highly compacted soils that restrict water infiltration and root growth. The best time for improving soil condition is during the establishment of permanent vegetation. It is highly recommended that subsoilers, plows, or other implements are specified as part of final seedbed preparation. Use discretion in slip-prone areas.

***Minimum Soil Conditions*—**Vegetation cannot be expected to stabilize soil that is unstable due to its texture, structure, water movement or excessively steep slope. The following minimum soil conditions are needed for the establishment and maintenance of a long-lived vegetative cover. If these conditions cannot be met, see the standards and specifications for Topsoiling.

- Soils must include enough fine-grained material to hold at least a moderate amount of available moisture.
- The soil must be free from material that is toxic or otherwise harmful to plant growth.

Design Criteria

See specifications for permanent seeding below.

Maintenance

1. Expect emergence within 4 to 28 days after seeding, with legumes typically following grasses. Check permanent seedlings within 4 to 6 weeks after planting. Look for:
   - Vigorous seedlings;
   - Uniform ground surface coverage with at least 30% growth density;
   - Uniformity with legumes and grasses well intermixed;
   - Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.

2. Permanent seeding shall not be considered established for at least 1 full year from the time of planting. Inspect the seeding for soil erosion or plant loss during this first year. Repair bare and sparse areas. Fill gullies. Re-fertilize, re-seed, and re-mulch if required. Consider no-till planting. A minimum of 70% growth density, based on a visual inspection, must exist for an adequate permanent vegetative planting.

- If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action: choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, or weather. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.
- Depending on stand conditions, repair with complete seedbed preparation, then over-seed or re-seed.
- If it is the wrong time of year to plant desired species, over-seed with small grain cover crop to thicken the stand until timing is right to plant perennials or use temporary seeding. See Temporary Seeding standard.

3. Satisfactory establishment may require re-fertilizing the stand in the second growing season.
    - Do not fertilize cool season grasses in late May through July (i.e. Kentucky Bluegrass, Orchardgrass, Perrenial Ryegrass, Smooth Brome, Fescues, Timothy, Reed Canarygrass and Garrison Grass)
    - Grass that looks yellow may be nitrogen deficient. In lieu of a soil test, an application of 50 lbs. of N-P-K per acre in early spring will help cool season grasses compete against weeds or grow more successfully.
    - Do not use nitrogen fertilizer if the stand contains more than 20 percent legumes.

4. Long-term maintenance fertilization rates shall be established by following soil test recommendations or by using the rates shown in Table 2.

Table 7.10.1 Maintenance for Permanent Seedings Fertilization and Mowing

Mixture	Formula	Lbs./ Acre	Lbs./1,000 sq.ft.	Time	Mowing
Creeping Red Fescue Ryegrass Kentucky Bluegrass	10-10-10	500	12	Fall, yearly or as needed	Not closer than 3”
Tall Fescue	10-10-10	500	12		Not closer than 4”
Turf-type Fescue	10-10-10	500	12		
Crown Vetch Fescue	0-20-20	400	10	Spring, yearly following establishment and every 4-7 years thereafter	Do not mow
Flat Pea Fescue	0-20-20	400	10		Do not mow

Note: Following soil test recommendations is preferred to fertilizer rates shown above.

5. Consider mowing after plants reach a height of 6 to 8 inches. Mow grasses tall, at least 3 inches in height and minimize compaction during the mowing process. Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading the stand.

Common Problems / Concerns

- Insufficient topsoil or inadequately tilled, limed, and/or fertilized seedbed - results in poor establishment of vegetation.
- Unsuitable species or seeding mixture - results in competition with the perennials.
- Nurse crop rate too high in the mixture - results in competition with the perennials.
- Seeding done at the wrong time of year - results in poor establishment of vegetation, also plant hardiness is significantly decreased.
- Mulch rate inadequate - results in poor germination and failure.

Specifications
for

Permanent Seeding

Site Preparation

1. Subsoiler, plow, or other implement shall be used to reduce soil compaction and allow maximum infiltration. (Maximizing infiltration will help control both runoff rate and water quality.) Subsoiling should be done when the soil moisture is low enough to allow the soil to crack or fracture. Subsoiling shall not be done on slip-prone areas where soil preparation should be limited to what is necessary for establishing vegetation.
2. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation and seeding.
3. Topsoil shall be applied where needed to establish vegetation.

Seedbed Preparation

1. Lime—Agricultural ground limestone shall be applied to acid soil as recommended by a soil test. In lieu of a soil test, lime shall be applied at the rate of 100 pounds per 1,000-sq. ft. or 2 tons per acre.
2. Fertilizer—Fertilizer shall be applied as recommended by a soil test. In place of a soil test, fertilizer shall be applied at a rate of 25 pounds per 1,000-sq. ft. or 1000 pounds per acre of a 10-10-10 or 12-12-12 analyses.
3. The lime and fertilizer shall be worked into the soil with a disk harrow, spring-tooth harrow, or other suitable field implement to a depth of 3 inches. On sloping land, the soil shall be worked on the contour.

Seeding Dates and Soil Conditions

Seeding should be done March 1 to May 31 or August 1 to September 30. If seeding occurs outside of the above-specified dates, additional mulch and irrigation may be required to ensure a minimum of 80% germination. Tillage for seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand. For winter seeding, see the following section on dormant seeding.

Dormant Seedings

1. Seedings should not be made from October 1 through November 20. During this period, the seeds are likely to germinate but probably will not be able to survive the winter.
2. The following methods may be used for “Dormant Seeding”:

- From October 1 through November 20, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After November 20, and before March 15, broadcast the selected seed mixture. Increase the seeding rates by 50% for this type of seeding.
- From November 20 through March 15, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture, mulch and anchor. Increase the seeding rates by 50% for this type of seeding.
- Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed.
- Where feasible, except when a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

Mulching

1. Mulch material shall be applied immediately after seeding. Dormant seeding shall be mulched. 100% of the ground surface shall be covered with an approved material.
2. Materials

- Straw—If straw is used it shall be unrotted small-grain straw applied at the rate of 2 tons per acre or 90 pounds (two to three bales) per 1,000-sq. ft. The mulch shall be spread uniformly by hand or mechanically applied so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000-sq.-ft. sections and spread two 45-lb. bales of straw in each section.
- Hydroseeders—If wood cellulose fiber is used, it shall be applied at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
- Other—Other acceptable mulches include rolled erosion control mattings or blankets applied according to manufacturer’s recommendations or wood chips applied at 6 tons per acre.

3. Straw and Mulch Anchoring Methods

Straw mulch shall be anchored immediately to minimize loss by wind or water.

- Mechanical—A disk, crimper, or similar type tool shall be set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but, generally, be left longer than 6 inches.
- Mulch Netting—Netting shall be used according to the manufacturer's recommendations. Netting may be necessary to hold mulch in place in areas of concentrated runoff and on critical slopes.
- Asphalt Emulsion—Asphalt shall be applied as recommended by the manufacture or at the rate of 160 gallons per acre.
- Synthetic Binders—Synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Tack or equivalent may be used at rates specified by the manufacturer.
- Wood Cellulose Fiber—Wood cellulose fiber shall be applied at a net dry weight of 750 pounds per acre. The wood cellulose fiber shall be mixed with water with the mixture containing a maximum of 50 pounds cellulose per 100 gallons of water.

Irrigation

Permanent seeding shall include irrigation to establish vegetation during dry weather or on adverse site conditions, which require adequate moisture for seed germination and plant growth.

Irrigation rates shall be monitored to prevent erosion and damage to seeded areas from excessive runoff.

Table 7.10.2 Permanent Seeding

Seed Mix	Seeding Rate		Notes:
	Lbs./acre	Lbs./1,000 Sq. Feet	
General Use			
Creeping Red Fescue Domestic Ryegrass Kentucky Bluegrass	20-40 10-20 20-40	1⁄2-1 1⁄4-1⁄2 1⁄2-1	For close mowing & for waterways with <2.0 ft/sec velocity
Tall Fescue	40-50	1-1 1⁄4	
Turf-type (dwarf) Fescue	90	2 1⁄4	
Steep Banks or Cut Slopes			
Tall Fescue	40-50	1-1 1⁄4	
Crown Vetch Tall Fescue	10-20 20-30	1⁄4-1⁄2 1⁄2-3⁄4	Do not seed later than August
Flat Pea Tall Fescue	20-25 20-30	1⁄2-3⁄4 1⁄2-3⁄4	Do not seed later than August
Road Ditches and Swales			
Tall Fescue	40-50	1-11⁄4	
Turf-type (Dwarf) Fescue Kentucky Bluegrass	 90 5	 2 1⁄4 0.1	
Lawns			
Kentucky Bluegrass Perennial Ryegrass	100-120	2 2	
Kentucky Bluegrass Creeping Red Fescue	100-120	2 1-1/2	For shaded areas

Note: Other approved seed species may be substituted.

8.1 Additional Construction Site Pollution Controls

Description

Although sediment is the primary pollutant of concern resulting from construction activity, other pollutants need to be considered as well. These include petrochemicals: fuel, oil, and asphalt; and construction chemicals and materials: paints, solvents, fertilizer, soil additives, concrete wash water, etc. Also included are solid wastes and construction debris. Keeping these substances from polluting runoff can be accomplished to a large extent through good housekeeping and following the manufacturer's recommendations for their use and disposal.

Condition Where Practice Applies

Wastes generated by construction activities (i.e. construction materials such as paints, solvents, fuels, concrete, wood, etc.) must be disposed of in accordance with ORC 3734 and ORC 3714. Hazardous and toxic substances are used on virtually all construction-sites. Good management of these substances is always needed.

Planning Considerations

Good erosion and sediment control will prevent some pollutants in addition to sediment from leaving the site; however, pollutants carried in solution or as surface films on runoff water will be carried through most erosion and sediment control practices. These pollutants become nearly impossible to control once carried offsite in runoff. Adding to the problem is the fact that construction wastes, many containing toxic chemicals, are routinely buried on-site, dumped on the ground, poured down a storm drain, or disposed of with construction debris. So while typical erosion and sediment-control practices are important for controlling other pollutants, additional preventative measures are needed.

Reducing pollutants other than sediments depends heavily on construction personnel and how they carry out their operations. To help facilitate this, plans should contain standard notes clearly stating requirements to contractors. It also may be appropriate to include requirements for specific provisions for hazardous materials storage, handling and disposal.

Requirements

1. **Educate Construction Personnel**, including subcontractors who may use or handle hazardous or toxic materials, making them aware of the following general guidelines:

Disposal and Handling of Hazardous and Other Construction Waste	
DO:	• Prevent spills • Use products up • Follow label directions for disposal • Remove lids from empty bottles and cans when disposing in trash • Recycle wastes whenever possible
DON'T	• Don't pour into waterways, storm drains or onto the ground • Don't pour down the sink, floor drain or septic tanks • Don't bury chemicals or containers • Don't burn chemicals or containers • Don't mix chemicals together

2. **Waste disposal containers** shall be provided for the proper collection of all waste material including construction debris, sanitary garbage, petroleum products and any hazardous materials to be used on-site. Containers shall be covered and not leaking. All waste material shall be disposed of at facilities approved for that material. Construction Demolition and Debris (CD&D) waste must be disposed of in accordance with ORC 3714 at an approved Ohio EPA CD&D landfill.

3. **No construction related waste materials are to be buried on-site.** By exception, clean fill (bricks, hardened concrete, soil) may be utilized in a way that does not encroach upon natural wetlands, streams or their floodplains. Filling of stream side areas is Fill may not result in the contamination of waters of the state. unless prohibited by local ordinance or zoning.

4. **Construction and Demolition Debris (CD&D) Disposal.** CD&D waste must be disposed of in accordance with ORC 3714 at an approved Ohio EPA CD&D landfill. CD&D waste is defined as all materials attached to a structure, which is being demolished (for materials containing asbestos see Item 12).

5. **Handling Construction Chemicals.** Mixing, pumping, transferring or other handling of construction chemicals such as fertilizer, lime, asphalt, concrete drying compounds, and all other potentially hazardous materials shall be performed in an area away from any watercourse, ditch or storm drain.

6. **Equipment Fueling and Maintenance,** oil changing, etc., shall be performed away from watercourses, ditches or storm drains, in an area designated for that purpose. The designated area shall be equipped for recycling oil and catching spills. Secondary containment shall be provided for all fuel oil storage tanks. These areas must be inspected every seven days and within 24 hrs. of a 0.5 inch or greater rain event to ensure there are no exposed materials which would contaminate storm water. Site operators must be aware that Spill Prevention Control and Countermeasures (SPCC) requirements may apply. An SPCC plan is required for sites with one single aboveground tank of 660 gallons or more, accumulative aboveground storage of 1330 gallons or more, or 42,000 gallons of underground storage. Soils that have become contaminated must be disposed of accordance with Item 8 "Contaminated Soils".

7. **Concrete Wash Water/Wash Outs.** Concrete wash water shall not be allowed to flow to streams, ditches, storm drains, or any other water conveyance. A sump or pit with no potential for discharge shall be constructed if needed to contain concrete wash water. Field tile or other subsurface drainage structures within 10 ft. of the sump shall be cut and plugged. For small projects, truck chutes may be rinsed on the lot away from any water conveyances.

8. **Contaminated Soils**. If substances such as oil, diesel fuel, hydraulic fluid, antifreeze, etc. are spilled, leaked, or released onto the soil, the soil should be dug up and disposed of at licensed sanitary landfill or other approved petroleum contaminated soil remediation facility (not a construction/demolition debris landfill). Please be aware that storm water run off associated with contaminated soils are not authorized under Ohio EPA's General Storm Water Permit associated with Construction Activities. In the event there are large extensive areas of contaminated soils additional measures above and beyond the conditions of Ohio EPA's General Construction Storm Water Permit will be required. Depending on the extent of contamination, additional treatment and/or collection and disposal may be required. All storm water discharges associated with the contaminated soils must be authorized under an alternate NPDES (National Pollutant Discharge Elimination System) Permit.

9. **Spill Reporting Requirements:** Spills on pavement shall be absorbed with sawdust, kitty litter or other absorbant material and disposed of with the trash at a licensed sanitary landfill. Hazardous or industrial wastes such as most solvents, gasoline, oil-based paints, and cement curing compounds require special handling. Spills shall be reported to Ohio EPA (1-800-282-9378). Spills of 25 gallons or more of petroleum products shall be reported to Ohio EPA (1-800-282-9378), the local fire department, and the Local Emergency Planning Committee within 30 min. of the discovery of the release. All spills, which result in contact with waters of the state, must be reported to OHIO EPA's Hotline.

10. **Open Burning**. No materials may be burned which contain rubber, grease, asphalt, or petroleum products such as tires, cars, autoparts, plastics or plastic coated wire. (See OAC 3745-19) Open burning is not allowed in restricted areas. Restricted areas are defined as: 1) within corporation limits; 2) within 1000 feet outside a municipal corporation having a population of 1000 to 10,000; and 3) a one mile zone outside of a

corporation of 10, 000 or more. Outside a restricted area, no open burning can take place within a 1000 feet of an inhabited building located off the property where the fire is set. Open burning is permissible in a restricted area for the following activities: heating tar, welding and acetylene torches, smudge pots and similar occupational needs, and heating for warmth or outdoor barbeques. Outside of restricted areas, open burning is permissible for landscape wastes (plant material), land-clearing wastes (plant material, with prior written permission from Ohio EPA), and agricultural wastes (material generated by crop, horticultural, or livestock production practices. This includes fence posts and scrap lumber, but not buildings).

11. **Dust Control/Suppressants.** Dust control is required to prevent nuisance conditions. Dust controls must be used in accordance with the manufacturer's specifications and not be applied in a manner, which would result in a discharge to waters of the state. Isolation distances from bridges, catch basins, and other drainageways must be observed. Application (excluding water) may not occur when precipitation is imminent as noted in the short term forecast. Used oil may not be applied for dust control.

12. **Other Air Permitting Requirements:** All contractors and sub contractors must be made aware that certain activities associated with construction will require air permits. Activities including but not limited to mobile concrete batch plants, mobile asphalt plants, concrete crushers, large generators, etc., will require specific Ohio EPA Air Permits for installation and operation. These activities must seek authorization from the corresponding district of Ohio EPA. Notification for Restoration and Demolition must be submitted to Ohio EPA for all commercial sites to determine if asbestos corrective actions are required.

13. **Process Waste Water/Leachate Management.** All contractors shall be made aware that Ohio EPA's Construction General Permit only allows the discharge of storm water. Other waste streams/discharges including but not limited to vehicle and/or equipment washing, leachate associated with on-site waste disposal, concrete wash outs, etc are a process wastewater. They are not authorized for discharge under the General Storm Water Permit associated with Construction Activities. All process wastewaters must be collected and properly disposed at an approved disposal facility. In the event there are leachate outbreaks associated with onsite disposal, measures must be taken to isolate this discharge for collection and proper disposal. Investigative measures and corrective actions must be implemented to identify and eliminate the source of all leachate outbreaks.

14. **Permit To Install (PTI) Requirements:** All contractors and sub contractors must be made aware that a PTI must be submitted and approved by Ohio EPA prior to the construction of all centralized sanitary systems, including sewer extensions, and sewerage systems (except those serving one, two, and three family dwellings) and potable water lines. The issuance of an Ohio EPA Construction General Storm Water Permit does not authorize the installation of any sewerage system where Ohio EPA has not approved a PTI.

Specifications
for

Additional Construction Site Pollution Controls

1. Construction personnel, including subcontractors who may use or handle hazardous or toxic materials, shall be made aware of the following general guidelines regarding disposal and handling of hazardous and construction wastes:
    - Prevent spills
    - Use products up
    - Follow label directions for disposal
    - Remove lids from empty bottles and cans when disposing in trash
    - Recycle wastes whenever possible
    - Don't pour into waterways, storm drains or onto the ground
    - Don't pour down the sink, floor drain or septic tanks
    - Don't bury chemicals or containers
    - Don't burn chemicals or containers
    - Don't mix chemicals together
2. **Containers shall be provided for the proper collection of all waste material including construction debris, trash, petroleum products and any hazardous materials used on-site.** Containers shall be covered and not leaking. All waste material shall be disposed of at facilities approved for that material. Construction Demolition and Debris (CD&D) waste must be disposed of at an Ohio EPA approved CD&D landfill.
3. **No construction related waste materials are to be buried on-site.** By exception, clean fill (bricks, hardened concrete, soil) may be utilized in a way which does not encroach upon natural wetlands, streams or floodplains or result in the contamination of waters of the state.
4. **Handling Construction Chemicals.** Mixing, pumping, transferring or other handling of construction chemicals such as fertilizer, lime, asphalt, concrete drying compounds, and all other potentially hazardous materials shall be performed in an area away from any watercourse, ditch or storm drain.
5. **Equipment Fueling and Maintenance,** oil changing, etc., shall be performed away from watercourses, ditches or storm drains, in an area designated for that purpose. The designated area shall be equipped for recycling oil and catching spills. Secondary containment shall be provided for all fuel oil storage tanks. These areas must be inspected every seven days and within 24 hrs. of a 0.5 inch or greater rain event to ensure there are no exposed materials which would contaminate storm water. Site operators must be aware that Spill Prevention Control and Countermeasures (SPCC) requirements may apply. An SPCC plan is required for sites with one single above ground tank of 660

gallons or more, accumulative above ground storage of 1330 gallons or more, or 42,000 gallons of underground storage. Contaminated soils must be disposed of in accordance with Item 8.

6. **Concrete Wash Water** shall not be allowed to flow to streams, ditches, storm drains, or any other water conveyance. A sump or pit with no potential for discharge shall be constructed if needed to contain concrete wash water. Field tile or other subsurface drainage structures within 10 ft. of the sump shall be cut and plugged. For small projects, truck chutes may be rinsed away from any water conveyances.

7. **Spill Reporting Requirements:** Spills on pavement shall be absorbed with sawdust or kitty litter and disposed of with the trash at a licensed sanitary landfill. Hazardous or industrial wastes such as most solvents, gasoline, oil-based paints, and cement curing compounds require special handling. Spills shall be reported to Ohio EPA (1-800-282-9378). Spills of 25 gallons or more of petroleum products shall be reported to Ohio EPA, the local fire department, and the Local Emergency Planning Committee within 30 min. of the discovery of the release. All spills which contact waters of the state must be reported to Ohio EPA.

8. **Contaminated Soils.** If substances such as oil, diesel fuel, hydraulic fluid, antifreeze, etc. are spilled, leaked, or released onto the soil, the soil should be dug up and disposed of at licensed sanitary landfill or other approved petroleum contaminated soil remediation facility. (not a construction/demolition debris landfill). Note that storm water run off associated with contaminated soils are not be authorized under Ohio EPA's General Storm Water Permit associated with Construction Activities.

9. **Open Burning.** No materials containing rubber, grease, asphalt, or petroleum products, such as tires, autoparts, plastics or plastic coated wire may be burned (OAC 3745-19). Open burning is not allowed in restricted areas, which are defined as: 1) within corporation limits; 2) within 1000 feet outside a municipal corporation having a population of 1000 to 10,000; and 3) a one mile zone outside of a corporation of 10, 000 or more. Outside of restricted areas, no open burning is allowed within a 1000 feet of an inhabited building on another property. Open burning is permissible in a restricted area for: heating tar, welding, smudge pots and similar occupational needs, and heating for warmth or outdoor barbeques. Outside of restricted areas, open burning is permissible for landscape or land-clearing wastes (plant material, with prior written permission from Ohio EPA), and agricultural wastes, excluding buildings.

10. **Dust Control or dust suppressants** shall be used to prevent nuisance conditions, in accordance with the manufacturer's specifications and in a manner, which prevent a discharge to waters of the state. Sufficient distance must be provided between applications and nearby bridges, catch basins, and other waterways. Application (excluding water) may not occur when rain is imminent as noted in the short term forecast. Used oil may not be applied for dust control.

11. **Other Air Permitting Requirements:** Certain activities associated with construction will require air permits including but not limited to: mobile concrete batch plants, mobile asphalt plants, concrete crushers, large generators, etc. These activities will require specific Ohio EPA Air Permits for installation and operation. Operators must seek authorization from the corresponding district of Ohio EPA. For demolition of all

commercial sites, a Notification for Restoration and Demolition must be submitted to Ohio EPA to determine if asbestos corrective actions are required.

12. **Process Waste Water/Leachate Management.** Ohio EPA's Construction General Permit only allows the discharge of storm water and does not include other waste streams/discharges such as vehicle and/or equipment washing, on-site septic leachate concrete wash outs, which are considered process wastewaters. All process wastewaters must be collected and properly disposed at an approved disposal facility. In the event, leachate or septage is discharged; it must be isolated for collection and proper disposal and corrective actions taken to eliminate the source of waste water.

13. **A Permit To Install (PTI)** is required prior to the construction of all centralized sanitary systems, including sewer extensions, and sewerage systems (except those serving one, two, and three family dwellings) and potable water lines. Plans must be submitted and approved by Ohio EPA. Issuance of an Ohio EPA Construction General Storm Water Permit does not authorize the installation of any sewerage system where Ohio EPA has not approved a PTI.

APPENDIX 3

SWP3 Inspection Forms and SWP3 Amendments, Grading, and Stabilization Log

AEP OHIO TRANSMISSION COMPANY, INC.
BOKES CREEK IPP SWITCHING STATION PROJECT
STORM WATER POLLUTION PREVENTION PLAN (SWP3) INSPECTION FORM

Date: ________________ Inspector's Name/Title: ____

Inspector's Company: ____

Inspector Qualified in accordance with Part VII.BB of Permit: ☐ Yes ☐ No (Document Qualifications in Appendix 3 of SWP3)

Inspection Type: ☐ Weekly (once every seven calendar days)

☐ Storm Event (0.5 inch or greater) Date: ____________ Amount: ____________ Duration: ____________

Rain Event(s) Since Last Inspection:

Date: ____________ Amount: ________ Duration: _________	Date: ____________ Amount: ________ Duration: _________
Date: ____________ Amount: ________ Duration: _________	Date: ____________ Amount: ________ Duration: _________

Did any discharges occur during these events? ☐ No ☐ Yes, Location: ________________________________

Current Weather: ☐ Clear ☐ Cloudy ☐ Fog ☐ Rain ☐ Snow ☐ Sleet ☐ High Winds ☐ Other: __________ Temp: _______

Current Discharges: ☐ No ☐ Yes, Location: ________________________________

Evidence of Sediment/Pollutants Leaving the Site? ☐ No ☐ Yes, Location: ________________________________

Has Seeding Taken Place? ☐ No ☐ Yes, Location/Seed tag photo included: ________________________________

Erosion and Sediment Control Features / BMPs Inspected:

☐ **Silt Fence / Filter Sock (Mark which one applies)**

Location(s) (Structure # (STR#)): ________________________________

Properly anchored/installed: ☐ Yes ☐ No Repairs Needed: ☐ Yes ☐ No

Sediment Removal Required (Sediment one-half height for fence & one-third height for sock): ☐ Yes ☐ No

Action Required/Taken/Location(s): ________________________________

____

☐ **Orange Barrier Fence**

Location(s) (Wetland / Access Road / STR#): ________________________________

Properly anchored/installed: ☐ Yes ☐ No Repairs Needed: ☐ Yes ☐ No

Action Required/Taken/Location(s): ________________________________

____

☐ **Construction Entrance**

Location(s) (Reference intersection of road and nearest STR#): ________________________________

Entrance Stabilized: ☐ Yes ☐ No Evidence of mud tracked on roadway: ☐ Yes ☐ No

Action Required/Taken/Location(s): ________________________________

____

☐ **Material Storage Areas (Including waste containers, fuel areas)**

Material Storage Areas located on site and shown on the SWP3: ☐ Yes ☐ No

Materials properly contained and labeled: ☐ Yes ☐ No Evidence of spills or releases: ☐ Yes ☐ No

Action Required/Taken/Location(s): ________________________________

____

☐ **Concrete Washouts**

Location(s) (Access Road / STR#): ____

Properly installed and located at least 50 feet from wetlands/streams/ditches/storm drains: ☐ Yes ☐ No

Replacement needed (concrete reaches 50 percent of the system): ☐ Yes ☐ No

Action Required/Taken/Location(s): ____

____

Comments / Additional Control Measures Recommended: ____

____

____

If BMP modifications are made, you must update the SWP3 drawings and document changes on the SWP3 amendment log.

Inspector's Signature: ____ Date: ____________________

AEP OHIO TRANSMISSION COMPANY, INC.
BOKES CREEK IPP SWITCHING STATION PROJECT

STORM WATER POLLUTION PREVENTION PLAN
AMENDMENTS, GRADING, AND STABILIZATION LOG

Date: ___________________ Inspector's Name/Title: ____

Location and Description of Grading and Stabilization Activities

____

____

____

____

Amendments to SWP3:

____

____

____

Date: ___________________ Inspector's Name/Title: ____

Location and Description of Grading and Stabilization Activities

____

____

____

____

Amendments to SWP3:

____

____

____

Date: ___________________ Inspector's Name/Title: ____

Location and Description of Grading and Stabilization Activities

____

____

____

____

Amendments to SWP3:

____

____

____

AEP OHIO TRANSMISSION COMPANY, INC. BOKES CREEK IPP SWITCHING STATION PROJECT

SUMMARY SWP3 INSPECTION RECORDS – FOR TCRs

I have completed a review of the SWP3 inspections completed on the project for the period of ______________ to ______________.

The following major observations were made relating to the implementation of the SWP3 and review of the inspection log.

Inspector Qualifications:

☐ The inspections were performed by "qualified inspection personnel" knowledgeable in the principles of erosion and sediment control and skilled in assessing the effectiveness of control measures.

☐ The inspections were NOT performed by "qualified inspection personnel" knowledgeable in the principles of erosion and sediment control and skilled in assessing the effectiveness of control measures.

☐ Corrective Measures were taken on ______________ to provide "qualified inspection personnel" at the site.

Permit Compliance Observations:

☐ The project was in compliance with the SWP3 and permit during the review period.

☐ The project was NOT in compliance with the SWP3 and permit during the review period as noted below:

☐ Non-compliance issues included:

____

____

____

____

____

____

____

____

☐ Corrective Measures were taken on ______________ to correct the above non-compliance issues.

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 gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, 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.

Name: ____

Title: ____

Signature: ____

Date: ____

APPENDIX 4

Duty to Inform Contractors and Subcontractors Signature Form

AEP OHIO TRANSMISSION COMPANY, INC. BOKES CREEK IPP SWITCHING STATION PROJECT

DUTY TO INFORM CONTRACTORS AND SUBCONTRACTORS SIGNATURE FORM

By signing below, I acknowledge that I have been informed of the terms and conditions of the Ohio Environmental Protection Agency's General NPDES Permit for Storm Water Associated with Construction Activity, and have reviewed and understand the conditions and responsibilities of the Storm Water Pollution Prevention Plan for the AEP Ohio Transmission Company, Inc. Bokes Creek IPP Switching Station Project. I understand that Inspectors shall meet the qualifications outlined in Part VII.BB. of Ohio EPA Permit No.: OHC000005.

Printed Name	Company	Signature	Date

APPENDIX 5

Storm Water Calculations

Sediment Basin Sizing and Dewatering Compliance Tool

version 1.1 2020-06-26

Project Summary

Project Name:	Bokes Creek Station	
Project Location:	Treaty Line Road & Hoover-Moffitt Road	Street address (or street name and nearest intersection), City, state, zip code
Subwatershed ID/Label:		
Project Latitude:	40.438611	Enter latitude at entrance to site in decimal degrees (format: 40.947544)
Project Longitude:	-83.483611	Enter longitude at entrance to site in decimal degrees (format: -81.465240)
NPDES Permit Applicant:		
Submitted by:	Anthony J. Wehr, P.E.	Name of design engineer
Date:	8/5/2022	mm/dd/yyyy

Watershed: Statewide

Select from dropdown which watershed the project is located in, select "Statewide" if not in the Big Darby Creek Watershed

Subwatershed Total Drainage Area, A_{total} =	6.48	acres	=	282,269	ft^2
Subwatershed Disturbed Drainage Area, A_{dist} =	6.48	acres	=	282,269	ft^2

Report to the nearest 0.01 acre; include any drainage from off-site

All Basin dewatering discharge calculations in these worksheets assume free discharge from the outlet (i.e., no tailwater)

Step 1 - Sediment Basin Volume Requirements

For Statewide Watersheds

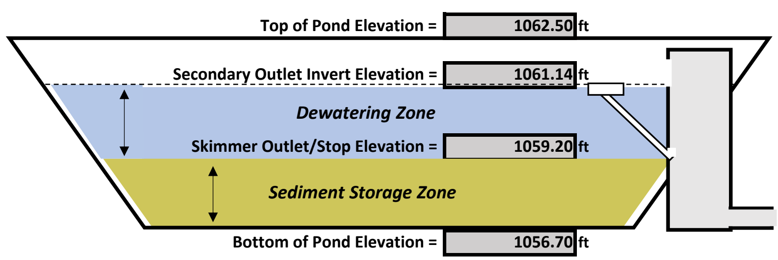
Minimum Sediment Storage Volume, Vsediment =	6480	ft3	=	240	yd3	=	0.149	acre-ft	Requirement: Minimum Sediment Volume = 1000 ft3/acre of disturbed drainage area
Minimum Dewatering Zone Volume, Vdewatering =	11664	ft3	=	432	yd3	=	0.268	acre-ft	Requirement: Minimum Dewatering Volume = 1800 ft3/acre of total drainage area

Step 2 - Basin Stage-Storage Relationship

	Elevation ft	Area ft^2	Incremental Volume ft^3	Cumulative Volume ft^3
Bottom of Sediment Storage (Pond) =	1056.70	1,875		
	1057.00	2,058	590	590
	1058.00	2,716	2,379	2,969
	1059.00	3,445	3,073	6,043
	1059.20	3,600	704	6,747
	1060.00	16,669	7,471	14,218
	1061.00	19,899	18,260	32,478
	1061.14	20,305	2,814	35,292
	1062.50	25,825	31,293	66,586

IMPORTANT: Must include the exact Skimmer Outlet/Skimmer Stop Elevation and the Secondary Outlet Invert Elevation in the Stage-Storage Table

Basin Schematic



Note: The basin dewatering discharge calculation in this worksheet assumes a free discharge from the outlet (i.e., no tailwater). The skimmer outlet elevation may need to be adjusted upward to account for tailwater as appropriate. Tailwater is common to low gradient ditches or water bodies with prolonged increases in water level

Step 3 - Outlet Elevations and Storage Volumes

Skimmer Outlet Invert/Skimmer Stop Elevation =	1059.20	ft	OKAY	The invert of the Skimmer Outlet/Skimmer Stop (ex. stone pad) corresponds to the top of the sediment storage zone/permanent pool and the bottom of the Dewatering Volume. It cannot be below the bottom of the pond.
Secondary Outlet Invert Elevation =	1061.14	ft	OKAY	The invert elevation for the next (usually peak discharge or flood control) outlet. This elevation must exceed that of the Skimmer Outlet Invert Elevation and be below the top of the pond. *Check - The difference between the skimmer outlet invert/skimmer stop elevation and the secondary outlet invert elevation (dewatering zone depth) must not exceed 5ft.
Provided Sediment Storage Volume =	6,747	ft^3	OKAY	The Sediment Storage Volume must exceed the requirement listed above in Step 1
Provided Dewatering Volume =	28,545	ft^3	OKAY	The Dewatering Volume must exceed the requirement listed above in Step 1

Step 4 - Skimmer-Type Outlet Sizing

Select Skimmer Type or Manufacturer: Faircloth Skimmer

Faircloth Skimmer Sizing Calculator: Click Here For Link to Online Calculator

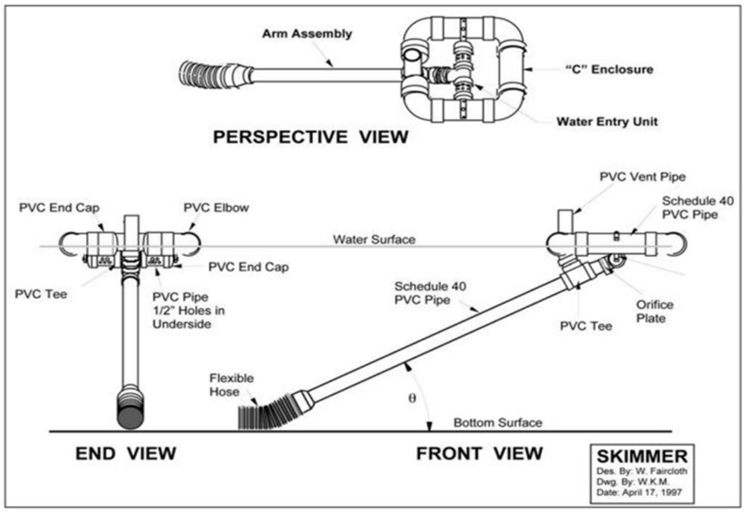
Follow directions on webpage to calculate exact skimmer size and model, include screenshot of results in SWP3. *Note* Input requir

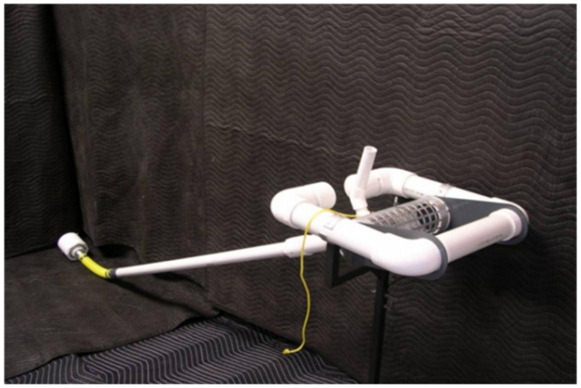
Orifice Size Selected:	1.5	in	Check to ensure that orifice sizing calculation is done using required, NOT provided dewatering volume
Dewatering Drawdown Time:	54	hrs	Check that dewatering drawdown time is greater than 2 days and less than 7 days

Example Faircloth Float Spec Sheet

Faircloth Float Photo

Please note the drawing and image shown below are provided solely to assist with identification of the skimmer type and its associated componants. The drawing and photo below does not necessarily depict an installation that complies with the General Permit or Rainwater & Land Development specification, especially where the sediment storage zone in omitted.





Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes...	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links...	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-001	Cumulative	inches	Ohio	Union	1	2.14	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	2.14	1.14	7.39	8.38	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

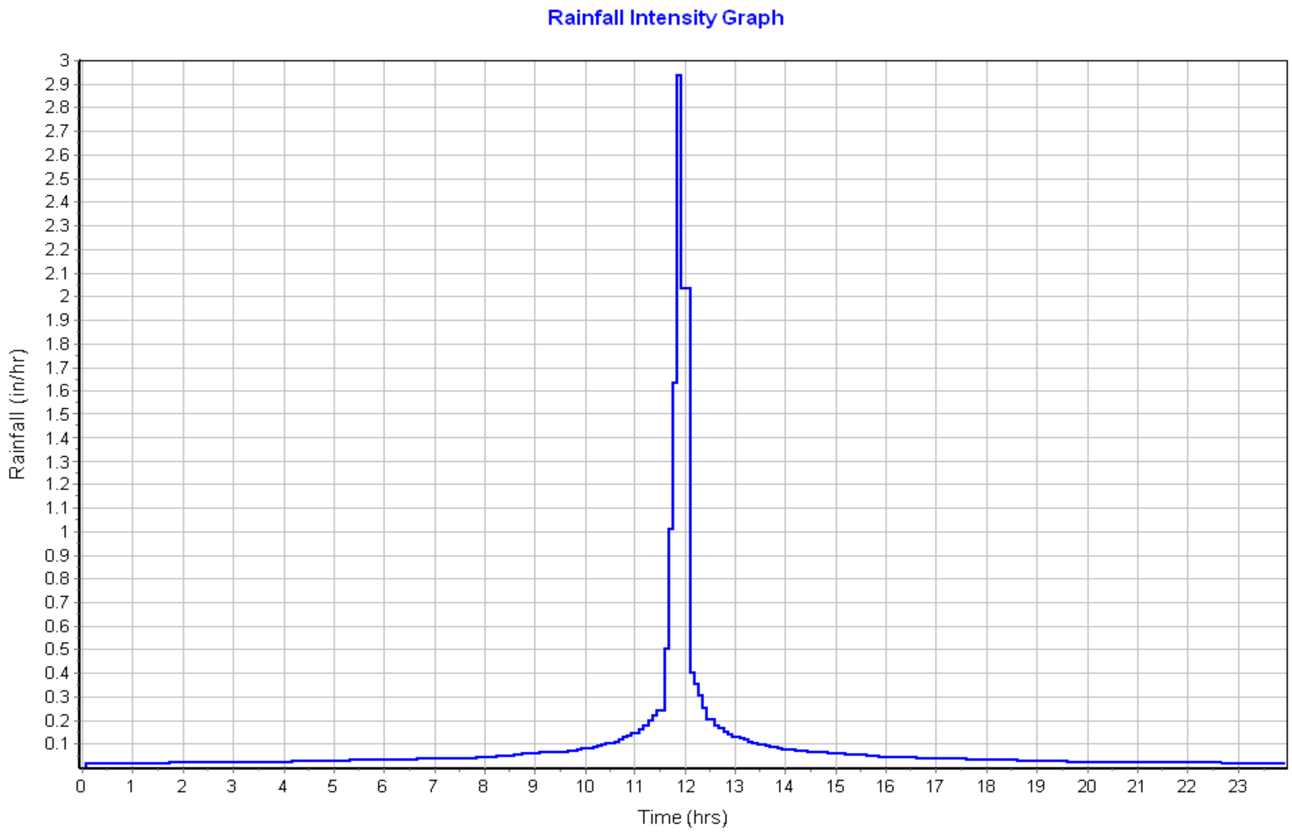
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

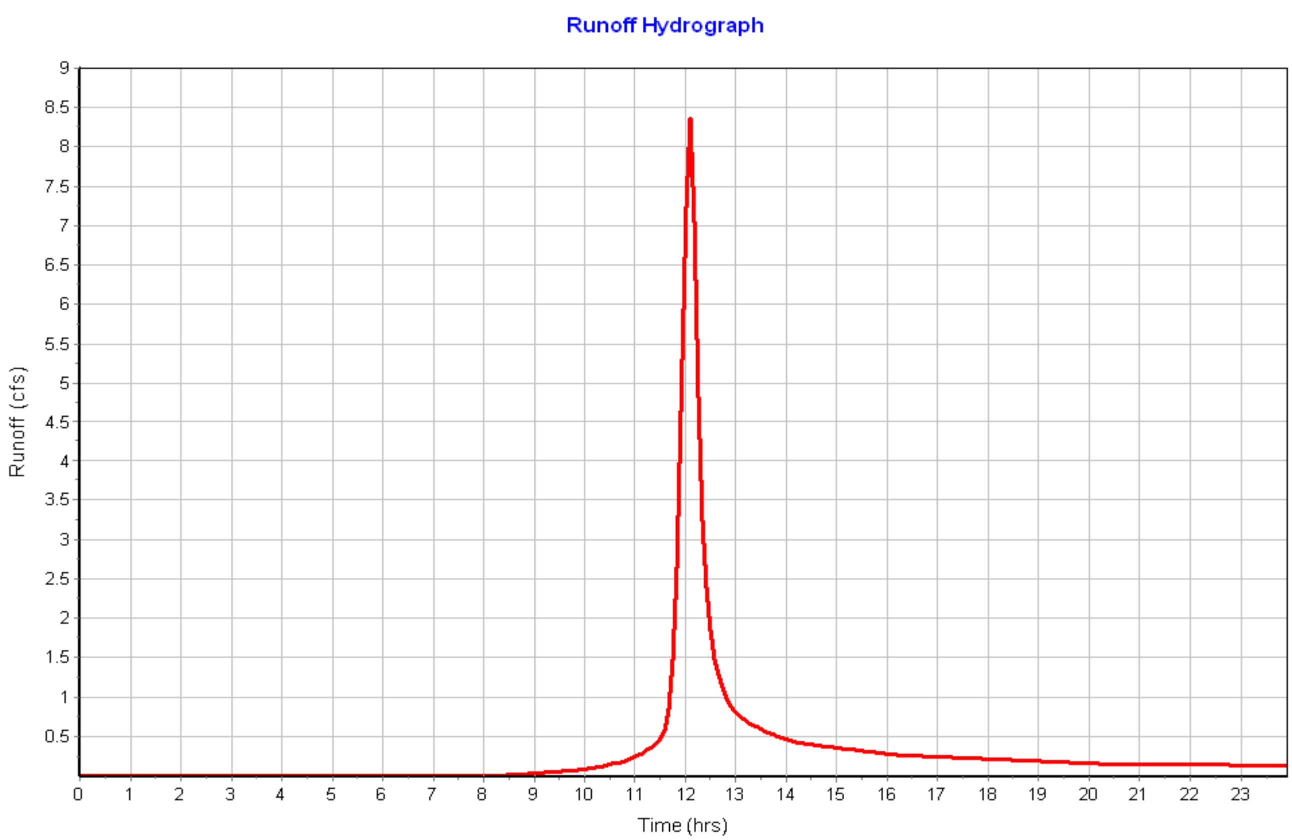
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 2.14
Total Runoff (in) 1.14
Peak Runoff (cfs) 8.38
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Hydrodynamic
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes...	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links...	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-001	Cumulative	inches	Ohio	Union	1	2.14	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Pad-North	2.11	89.12	2.14	1.15	2.43	3.76	0 00:06:00
2	Pad-South	2.18	88.83	2.14	1.13	2.47	3.81	0 00:06:00
3	Pond-Direct	0.63	80.00	2.14	0.65	0.41	0.60	0 00:06:00
4	ROAD	1.61	91.00	2.14	1.29	2.07	2.60	0 00:14:30

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	3.68	1062.29	0.00	1.26	0 00:00	0.00	0.00
2	Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	0.07	1059.29	0.00	3.21	0 00:00	0.00	0.00
3	South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	3.74	1063.11	0.00	0.44	0 00:00	0.00	0.00
4	Access-Road	Outfall	1062.00					2.51	1062.00					
5	Detention-Basin	Outfall	1058.94					0.07	1059.03					
6	Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
7	Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	5.93	1060.46				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
1	Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.2400	12.000	0.0130	0.07	3.96	0.02	1.80	0.09	0.09	0.00	Calculated
2	North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.2700	24.000	0.0250	2.27	1.79	1.27	0.89	0.47	0.24	0.00	
3	South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.2500	12.000	0.0250	3.24	16.10	0.20	1.53	0.40	0.41	0.00	
4	Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.000		0.00							
5	WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.500		0.07							
6	Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00							

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

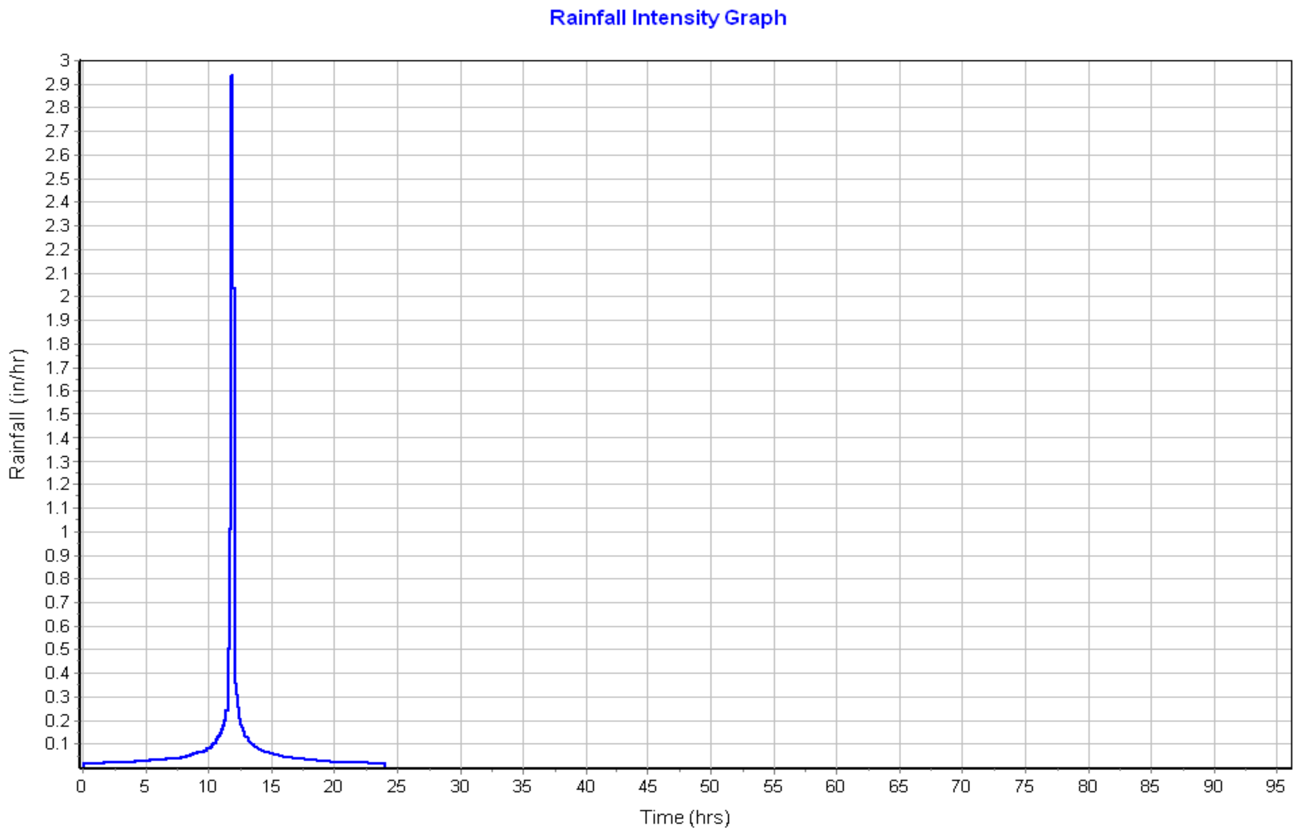
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

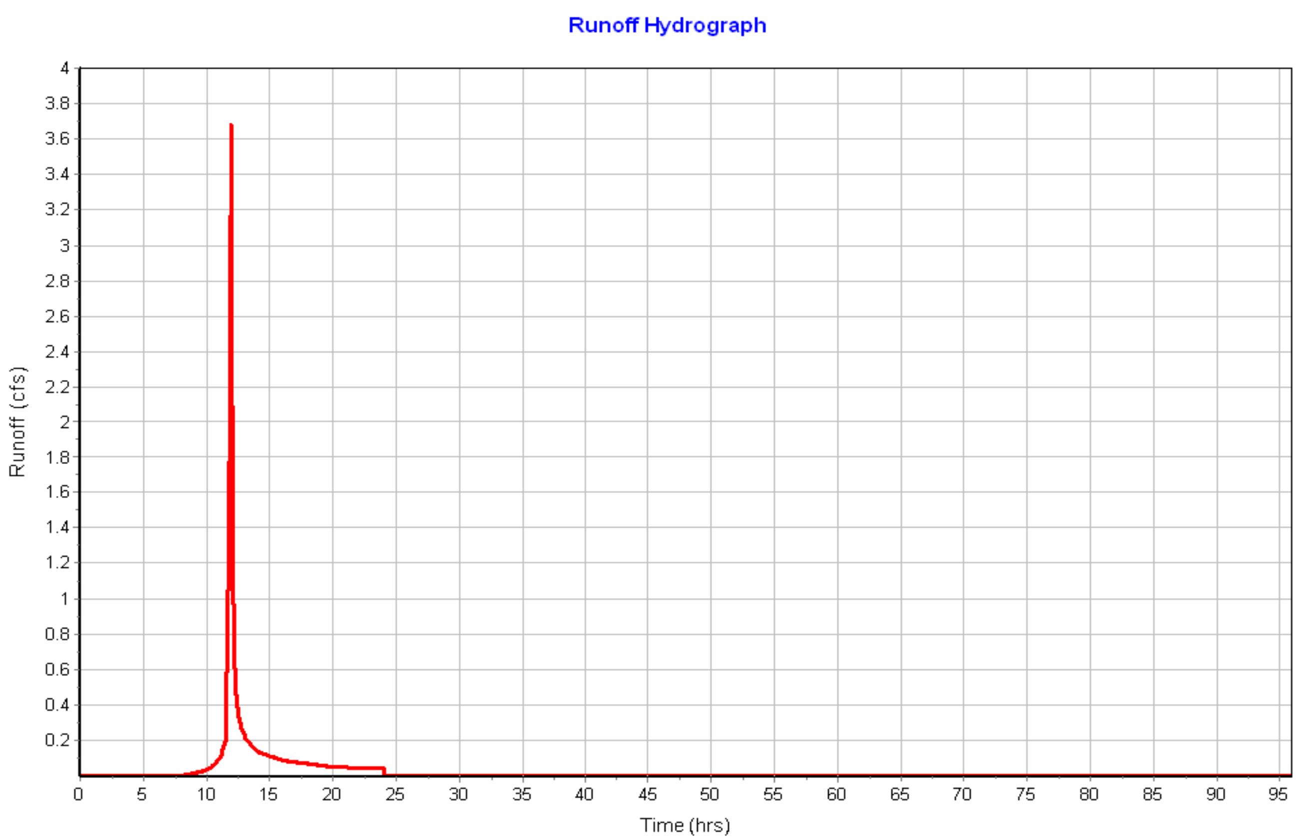
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

Total Rainfall (in) 2.14
Total Runoff (in) 1.15
Peak Runoff (cfs) 3.76
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North





Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

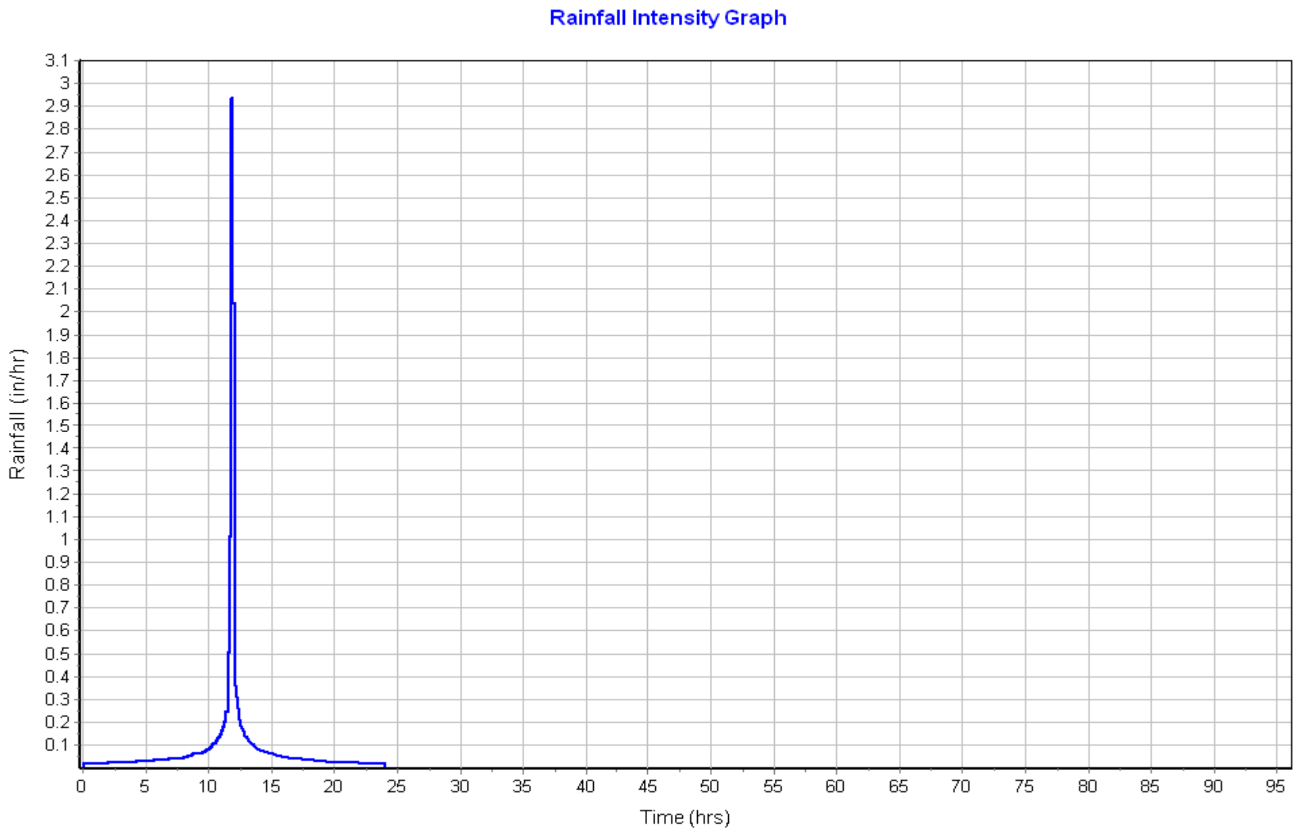
Time of Concentration

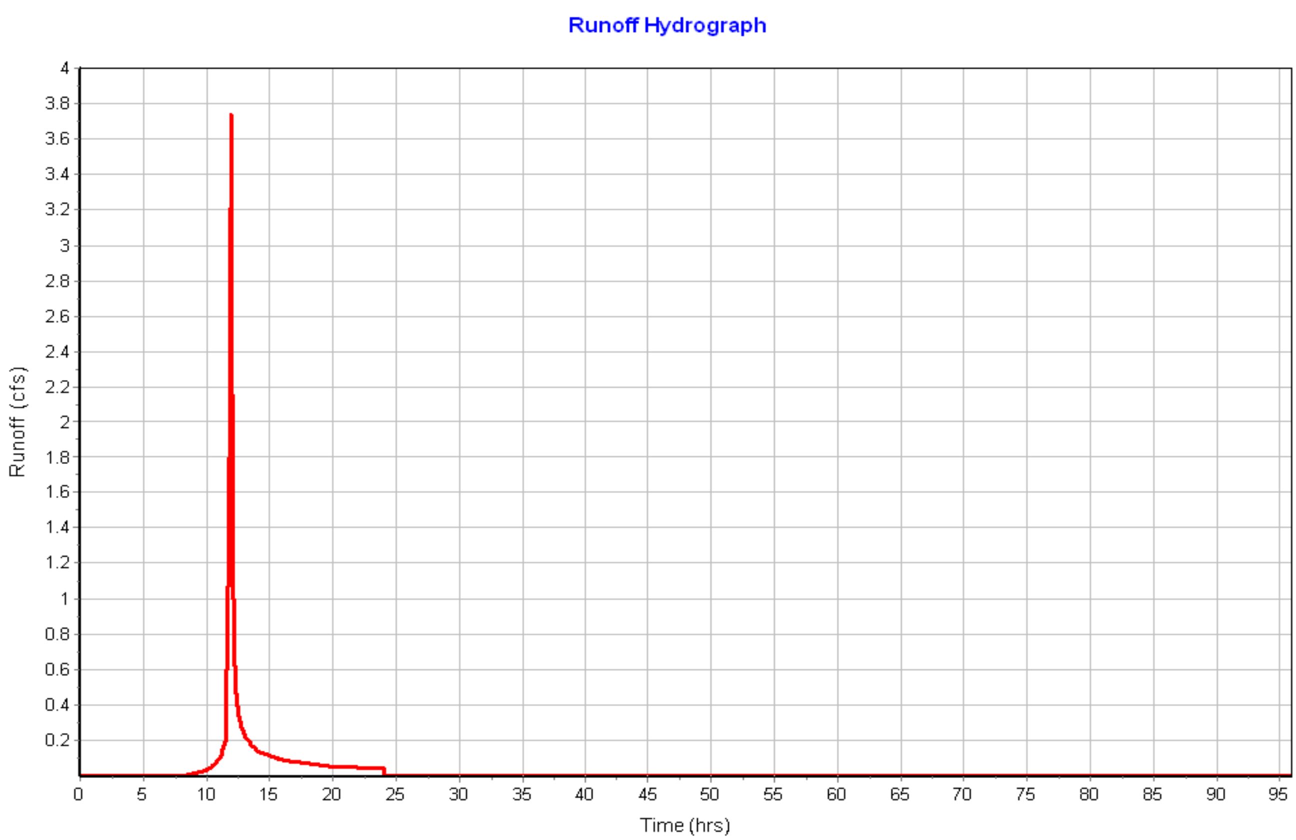
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 2.14
Total Runoff (in) 1.13
Peak Runoff (cfs) 3.81
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

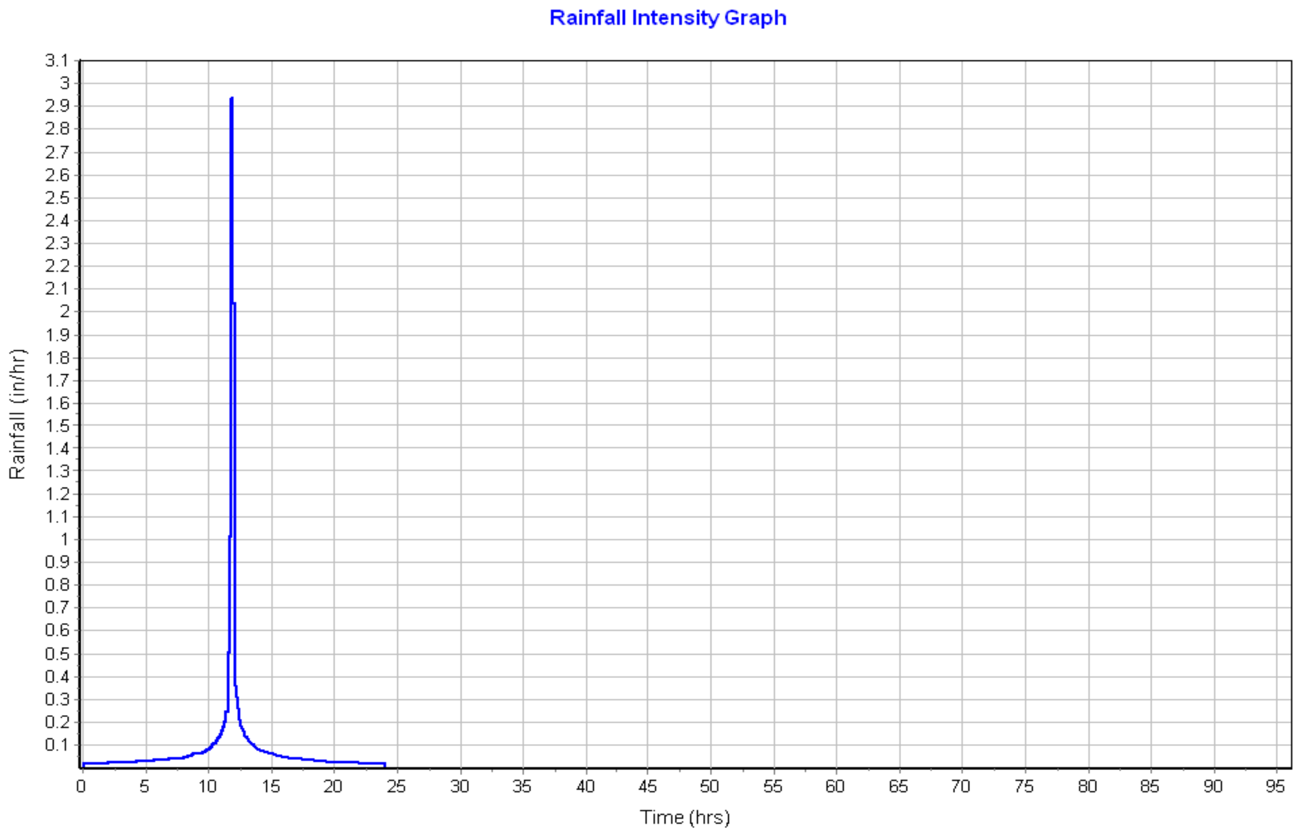
Time of Concentration

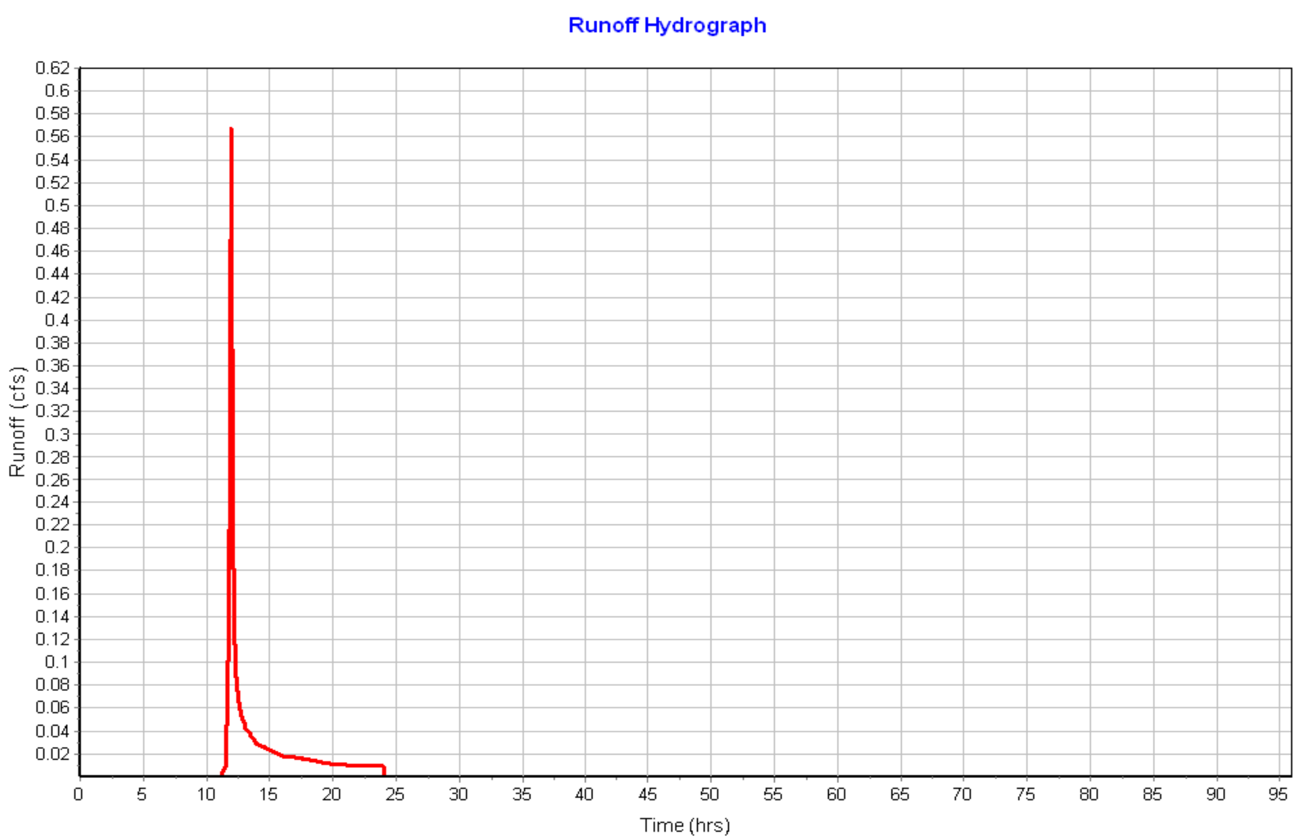
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

Total Rainfall (in) 2.14
Total Runoff (in) 0.65
Peak Runoff (cfs) 0.60
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct





Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

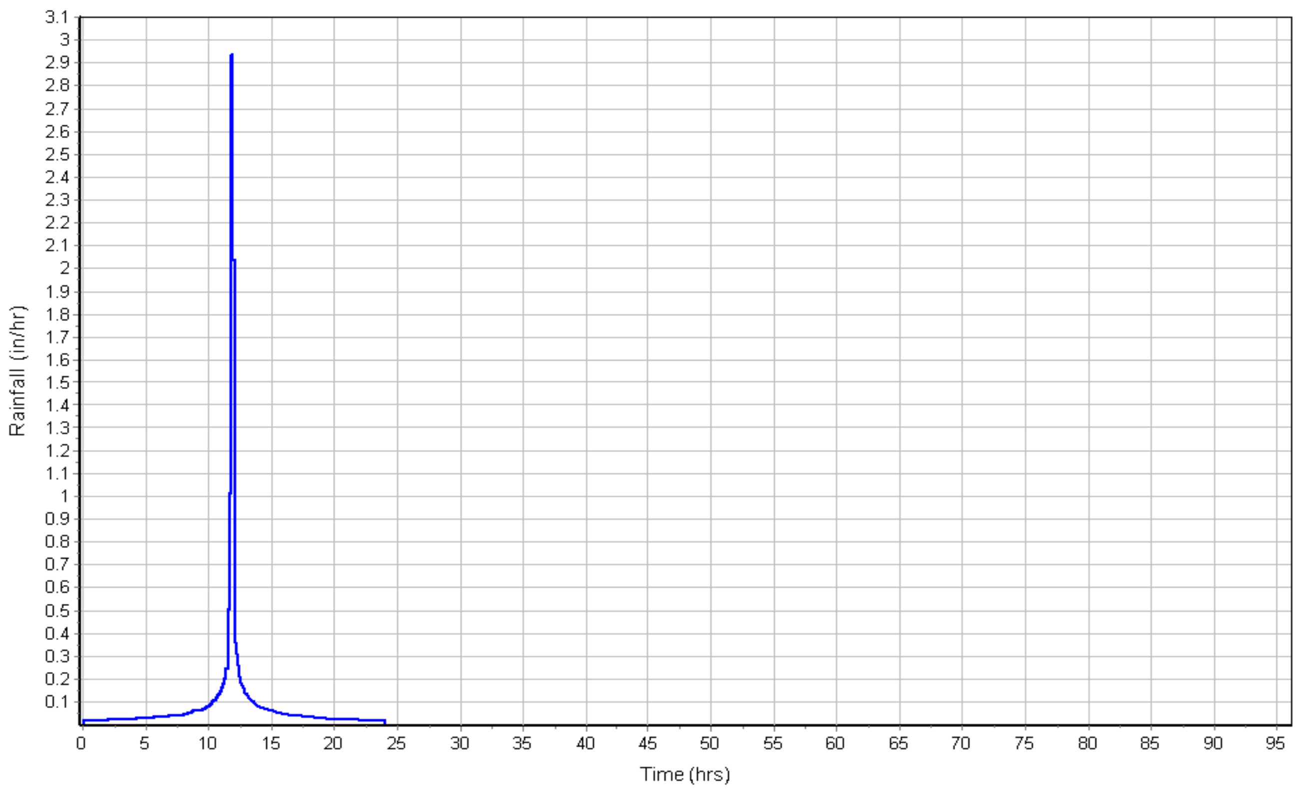
Total TOC (min) 14.51

Subbasin Runoff Results

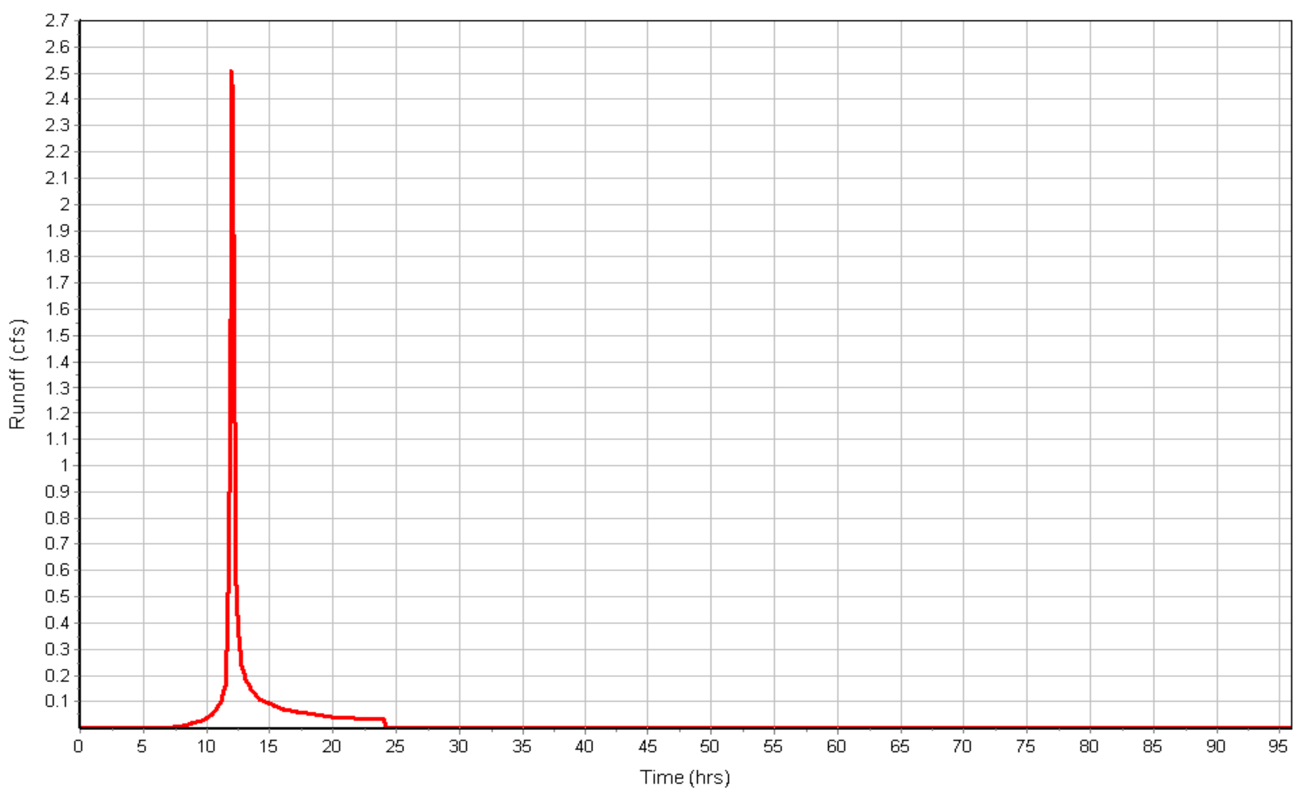
Total Rainfall (in) 2.14
Total Runoff (in) 1.29
Peak Runoff (cfs) 2.60
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
2	Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
3	South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	North-Ditch	3.68	3.68	1062.29	0.74	0.00	1.26	1061.59	0.04	0 12:08	0 00:00	0.00	0.00
2	Primary-Spillway	0.07	0.00	1059.29	0.09	0.00	3.21	1059.27	0.07	1 00:20	0 00:00	0.00	0.00
3	South-Ditch	3.74	3.74	1063.11	0.56	0.00	0.44	1062.56	0.01	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
2	South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	North-Pad-Ditch	2.27	0 12:08	1.79	1.27	0.89	10.51	0.47	0.24	0.00		
2	South-Pad-Ditch	3.24	0 12:05	16.10	0.20	1.53	4.25	0.40	0.41	0.00		

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

No. of Barrels
1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	Detention-Basin-Outlet	0.07	1 00:20	3.96	0.02	1.80	0.19	0.09	0.09	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

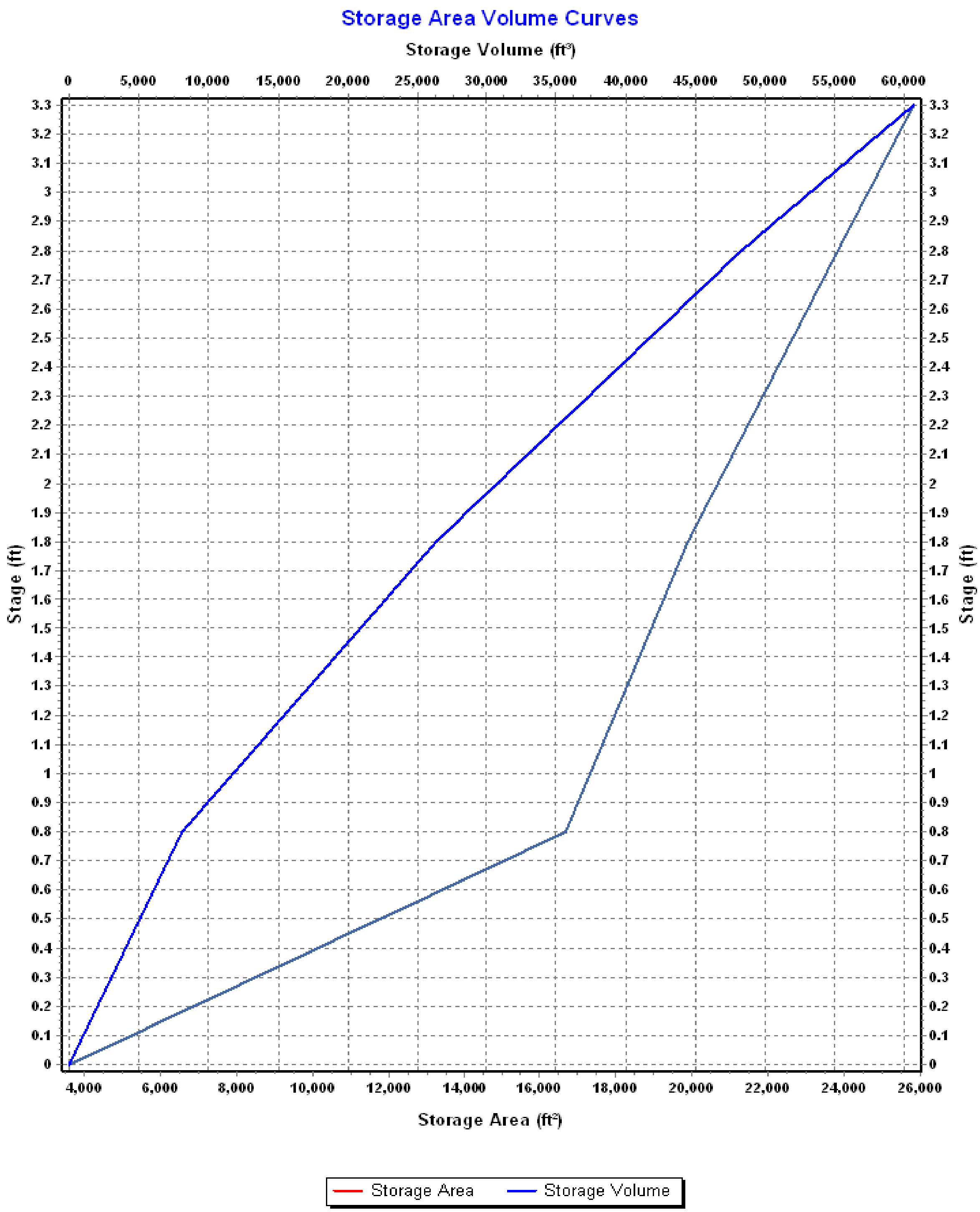
Input Data

Invert Elevation (ft)	1059.20
Max (Rim) Elevation (ft)	1062.50
Max (Rim) Offset (ft)	3.30
Initial Water Elevation (ft)	1059.20
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
Storage Area (ft²)
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

SN	Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1	Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

SN	Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1	Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
2	WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 5.93
Peak Lateral Inflow (cfs) 0.57
Peak Outflow (cfs) 0.07
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1060.46
Max HGL Depth Attained (ft) 1.26
Average HGL Elevation Attained (ft) 1059.98
Average HGL Depth Attained (ft) 0.78
Time of Max HGL Occurrence (days hh:mm) 1 00:19
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes..	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links..	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-002	Cumulative	inches	Ohio	Union	2	2.57	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	2.57	1.51	9.79	11.05	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

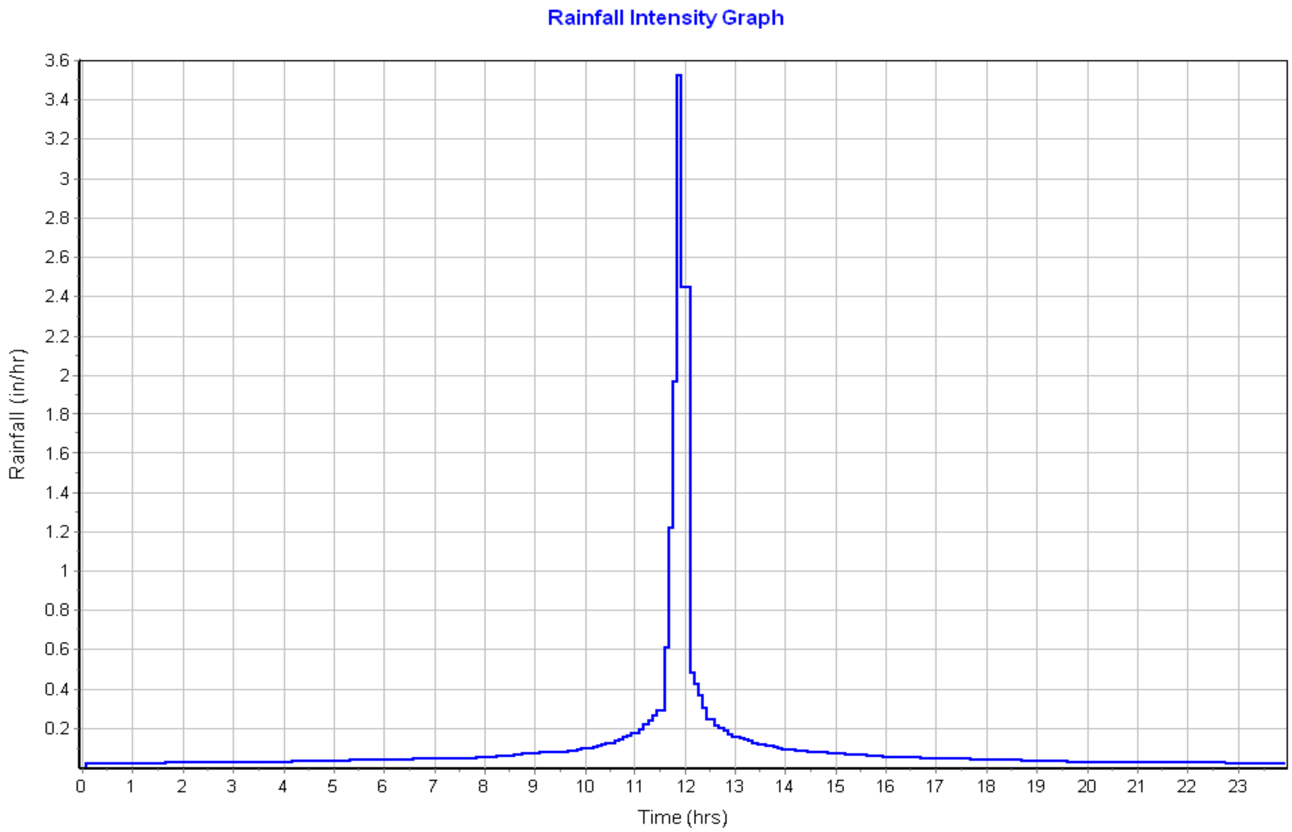
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

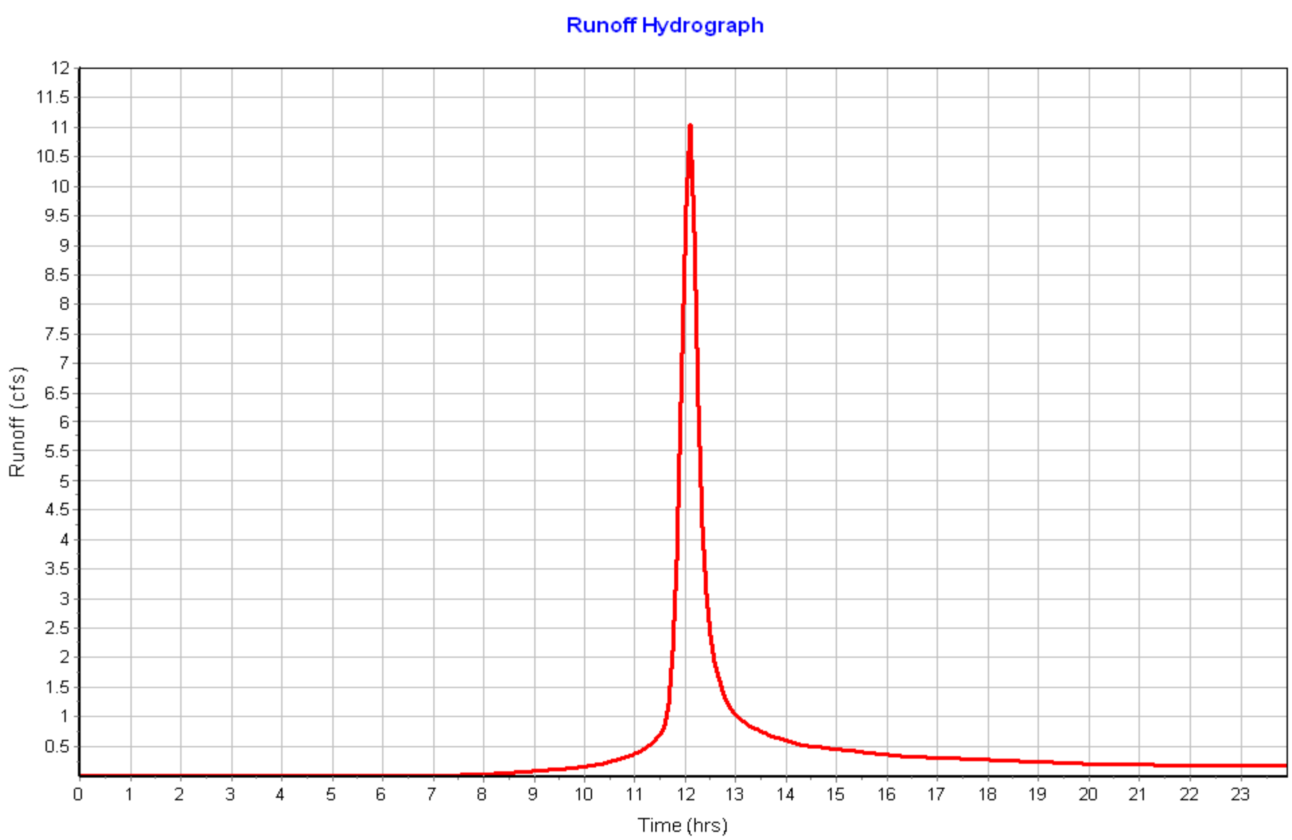
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 2.57
Total Runoff (in) 1.51
Peak Runoff (cfs) 11.05
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Hydrodynamic
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes...	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links...	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-002	Cumulative	inches	Ohio	Union	2	2.57	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	2.57	1.53	3.22	4.95	0 00:06:00
Pad-South	2.18	88.83	2.57	1.50	3.28	5.05	0 00:06:00
Pond-Direct	0.63	80.00	2.57	0.94	0.59	0.89	0 00:06:00
ROAD	1.61	91.00	2.57	1.67	2.70	3.36	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	4.87	1062.41	0.00	1.14	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	0.07	1059.30	0.00	3.20	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	4.95	1063.19	0.00	0.36	0 00:00	0.00	0.00
Access-Road	Outfall	1062.00					3.26	1062.00					
Detention-Basin	Outfall	1058.94					0.07	1059.04					
Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	8.26	1060.78				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow Velocity	Peak Flow Depth	Total Time Surcharged
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)	(ft/sec)	(ft)	(min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	0.07	3.96	1.85	0.10	0.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	3.26	1.79	1.03	0.55	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	4.34	16.10	1.68	0.48	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		0.00				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.07				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

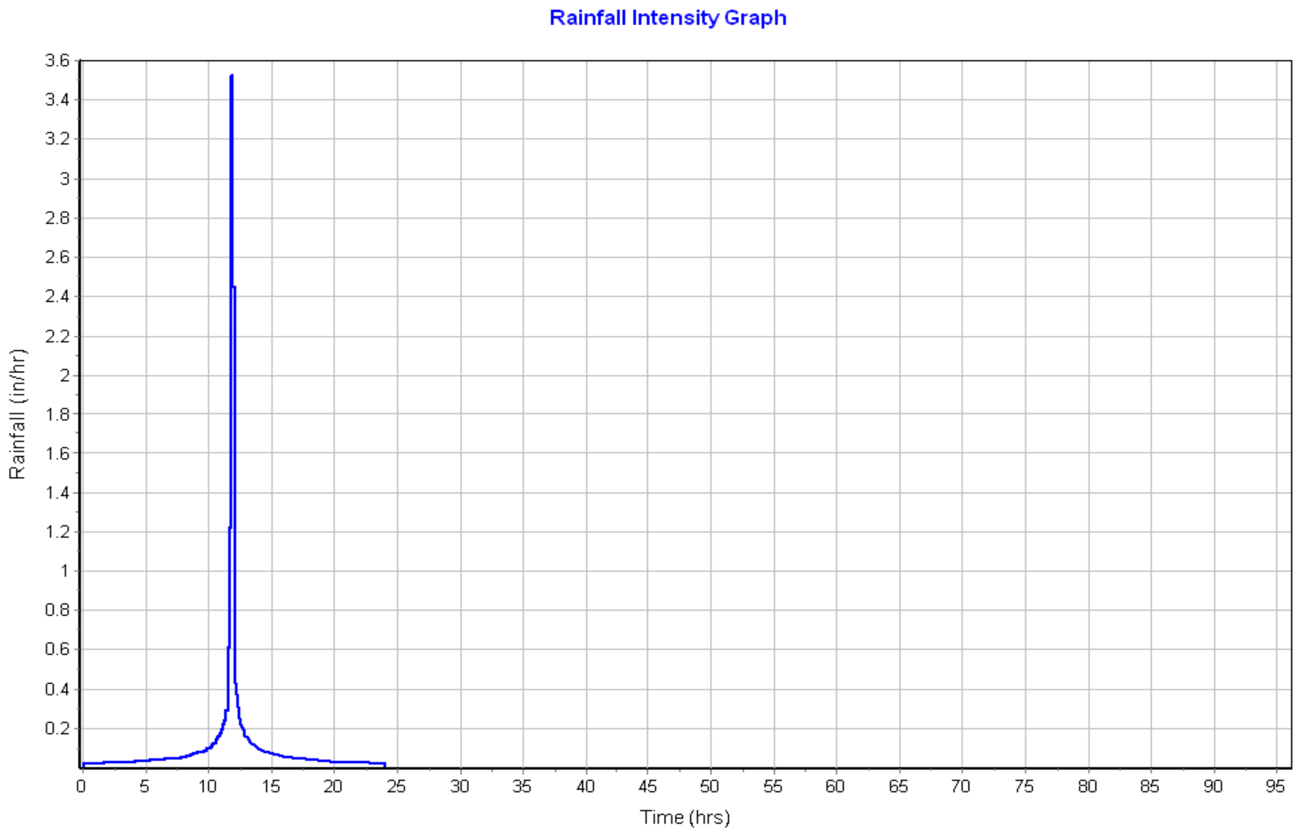
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

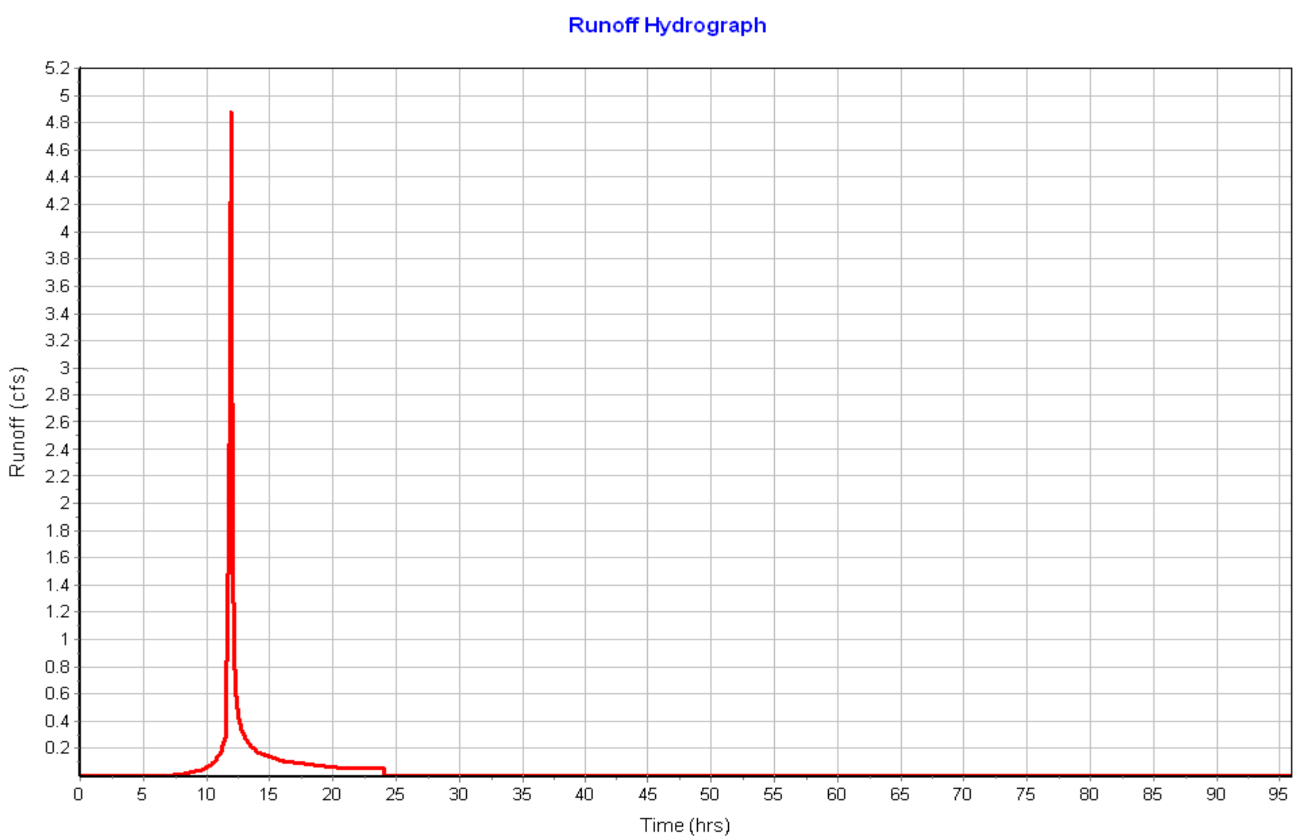
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

Total Rainfall (in) 2.57
Total Runoff (in) 1.53
Peak Runoff (cfs) 4.95
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North





Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

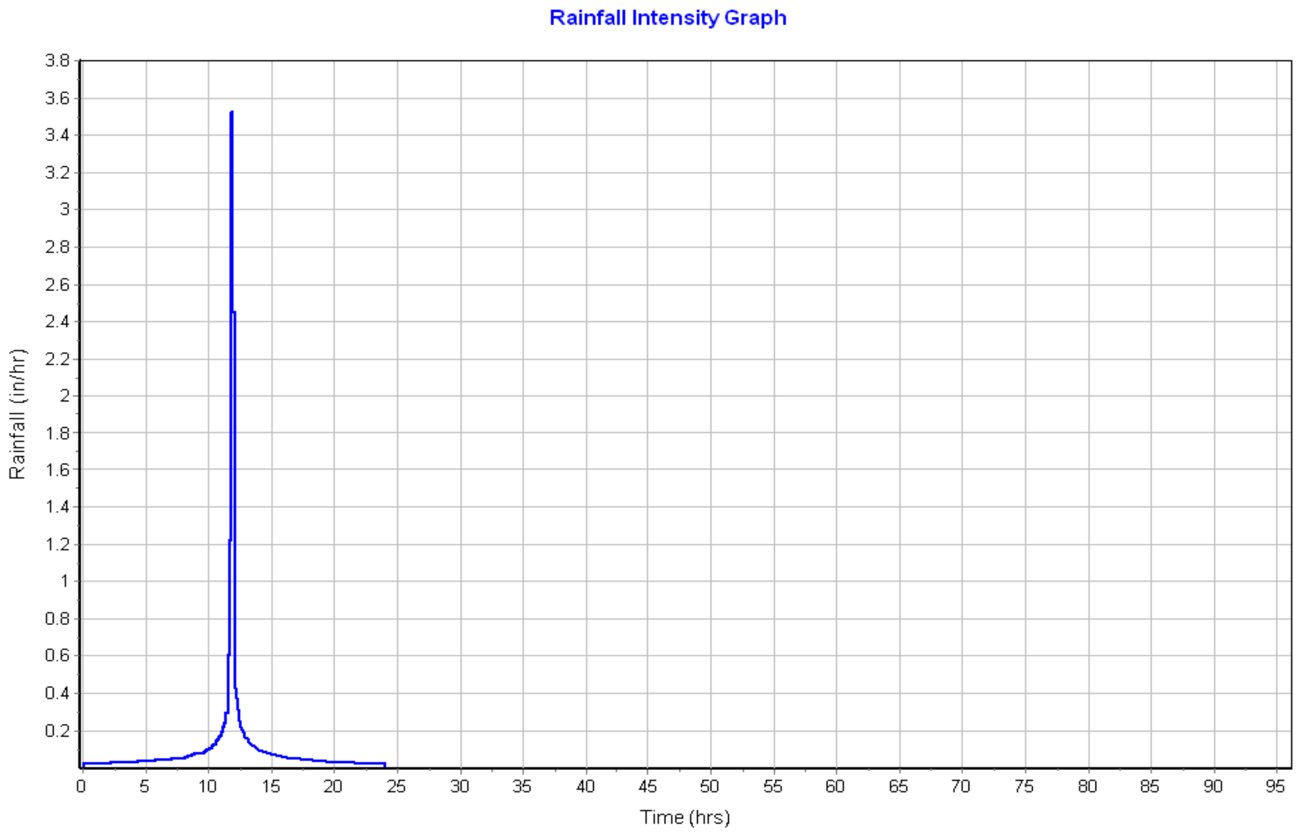
Time of Concentration

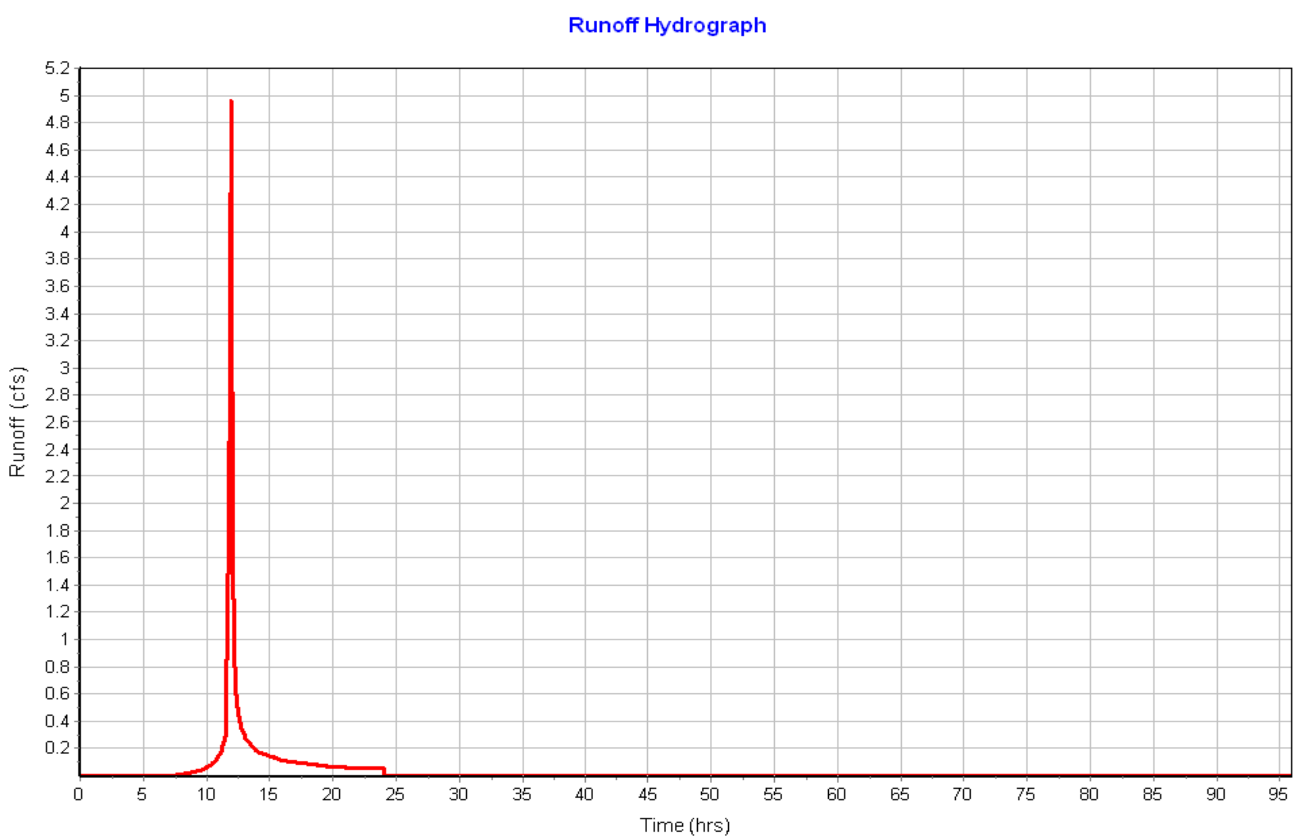
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 2.57
Total Runoff (in) 1.50
Peak Runoff (cfs) 5.05
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

Time of Concentration

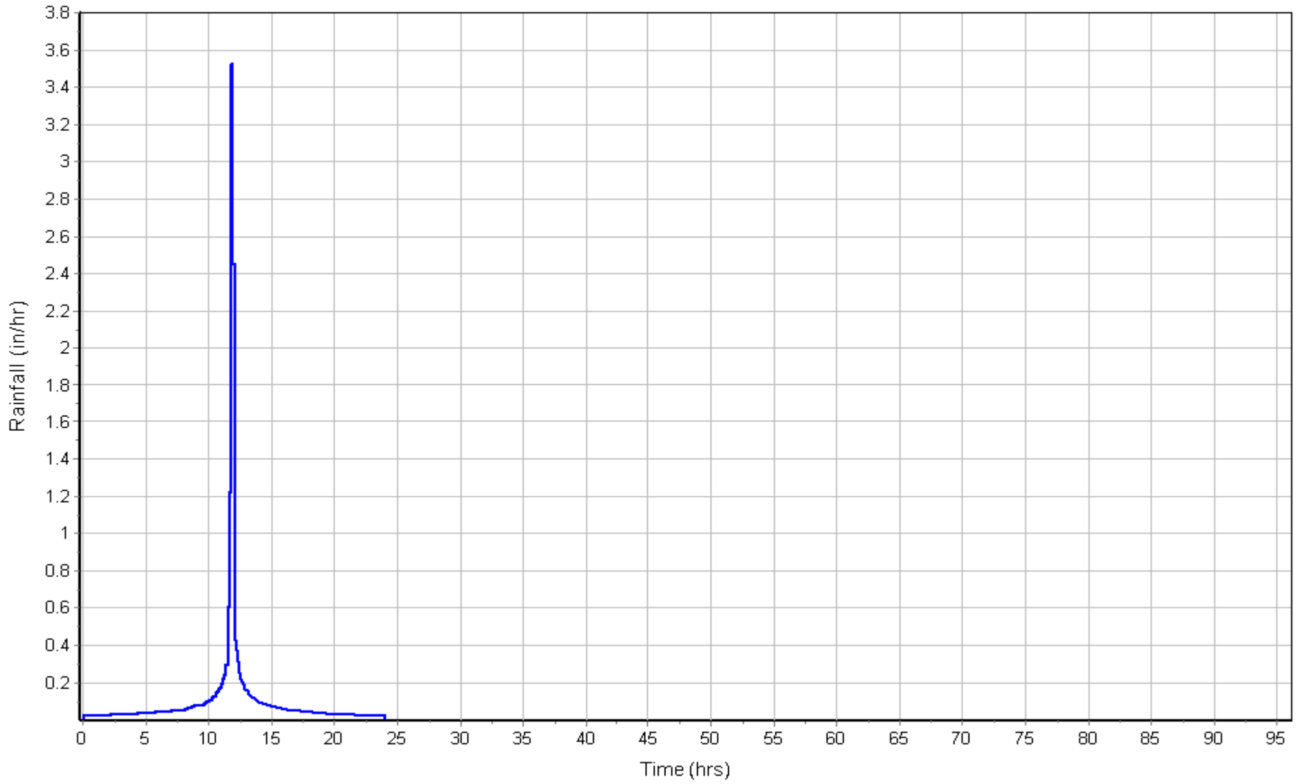
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

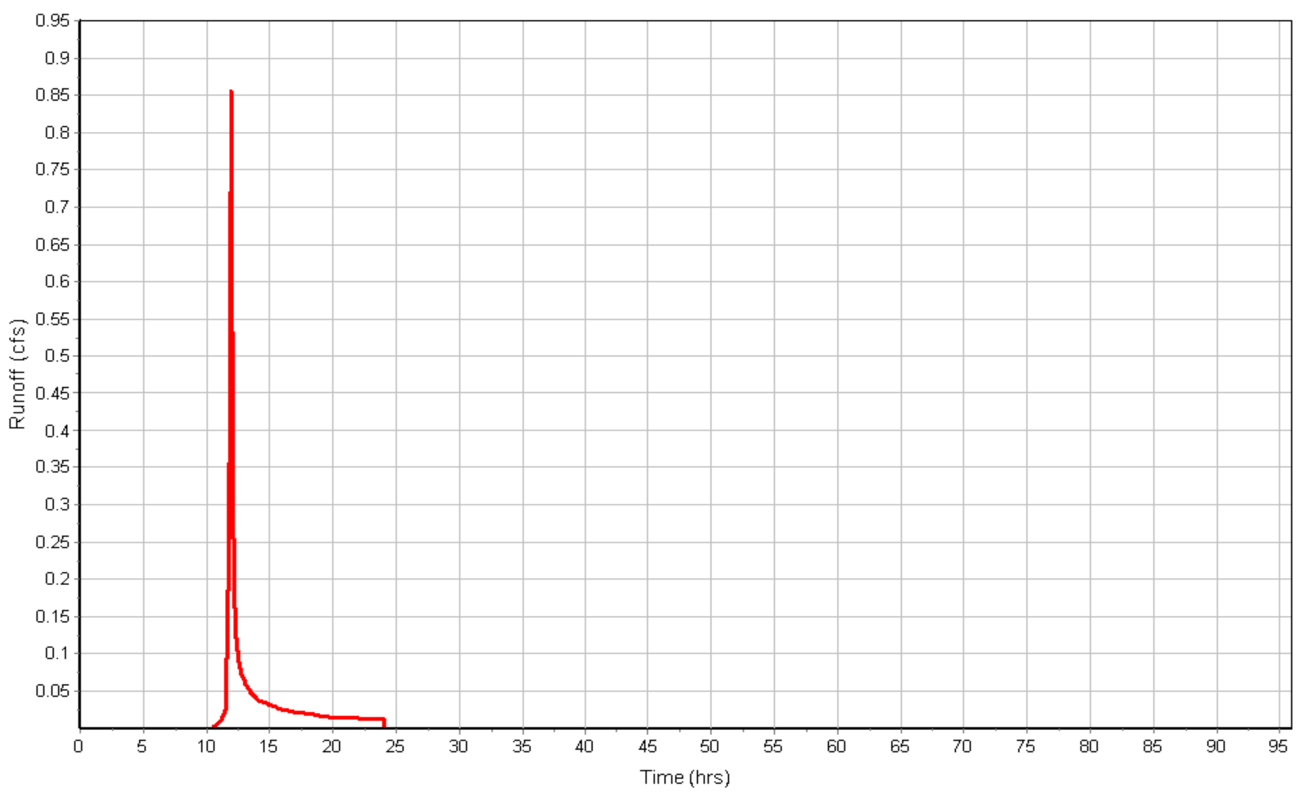
Total Rainfall (in) 2.57
Total Runoff (in) 0.94
Peak Runoff (cfs) 0.89
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

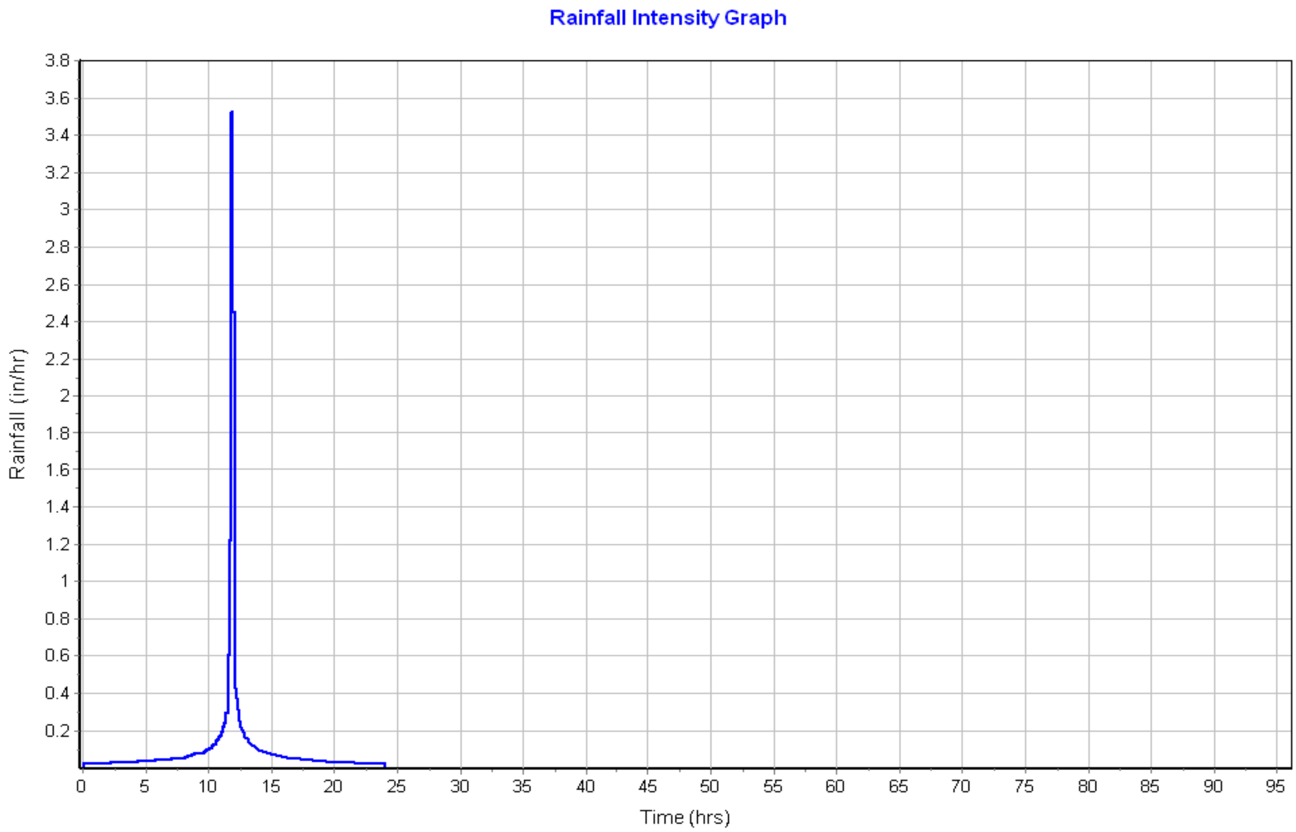
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

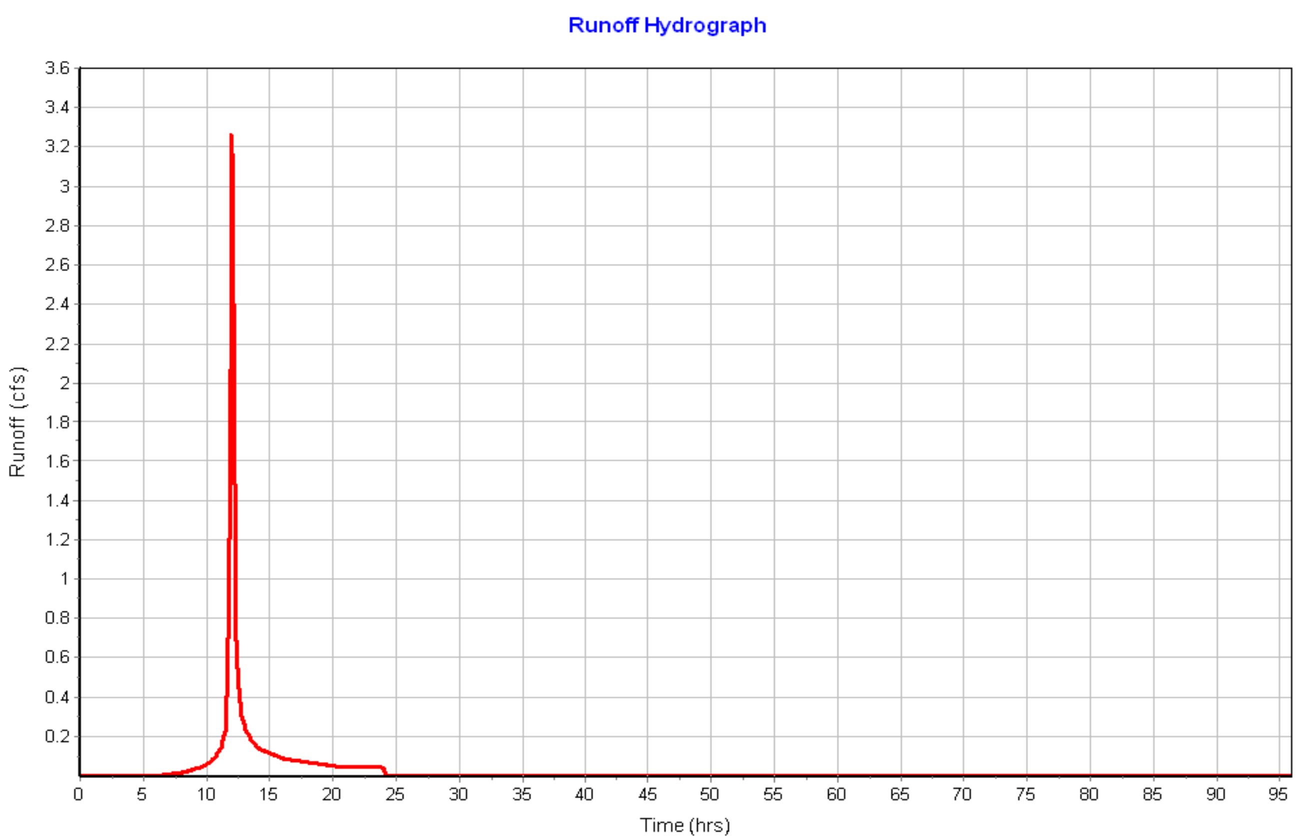
Total TOC (min) 14.51

Subbasin Runoff Results

Total Rainfall (in) 2.57
Total Runoff (in) 1.67
Peak Runoff (cfs) 3.36
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD





Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	4.87	4.87	1062.41	0.86	0.00	1.14	1061.60	0.05	0 12:07	0 00:00	0.00	0.00
Primary-Spillway	0.07	0.00	1059.30	0.10	0.00	3.20	1059.28	0.08	1 00:22	0 00:00	0.00	0.00
South-Ditch	4.95	4.95	1063.19	0.64	0.00	0.36	1062.57	0.02	0 12:05	0 00:00	0.00	0.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
3.26	0 12:07	1.79	1.03	9.08	0.55	0.00		
4.34	0 12:05	16.10	1.68	3.87	0.48	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	0.07	1 00:22	3.96	1.85	0.19	0.10	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

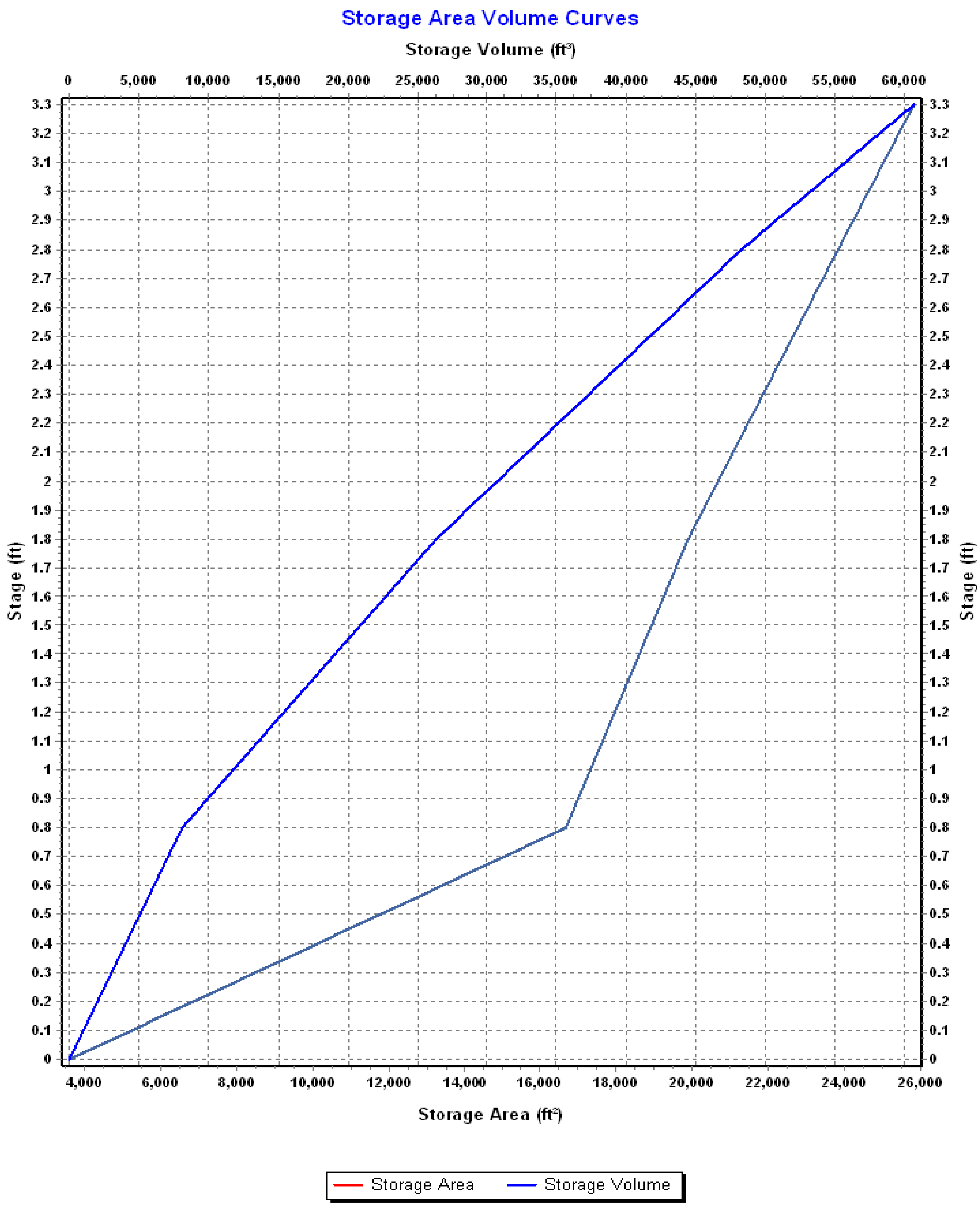
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft^2) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99



Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
Storage Area (ft²)
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 8.26
Peak Lateral Inflow (cfs) 0.85
Peak Outflow (cfs) 0.07
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1060.78
Max HGL Depth Attained (ft) 1.58
Average HGL Elevation Attained (ft) 1060.23
Average HGL Depth Attained (ft) 1.03
Time of Max HGL Occurrence (days hh:mm) 1 00:22
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-005	Cumulative	inches	Ohio	Union	5	3.19	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	3.19	2.07	13.39	15.08	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

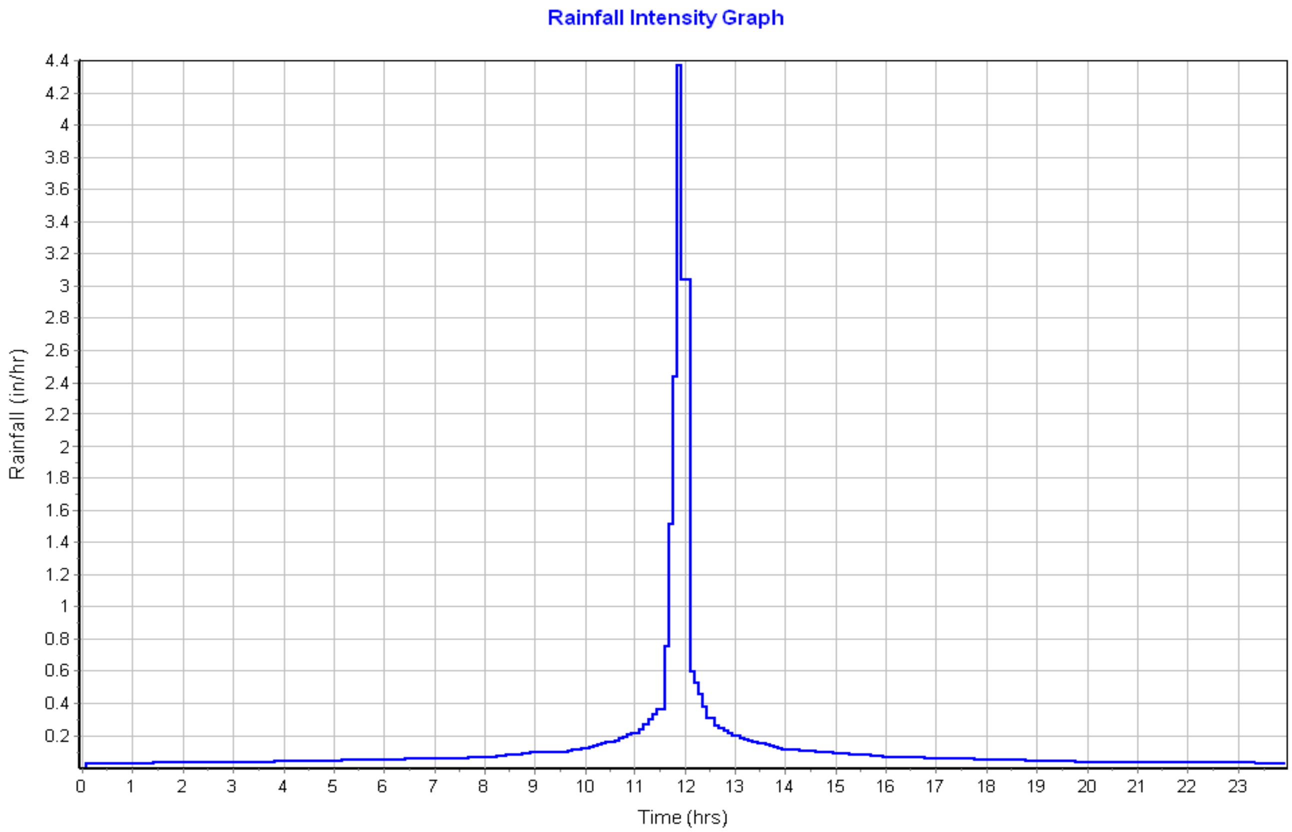
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

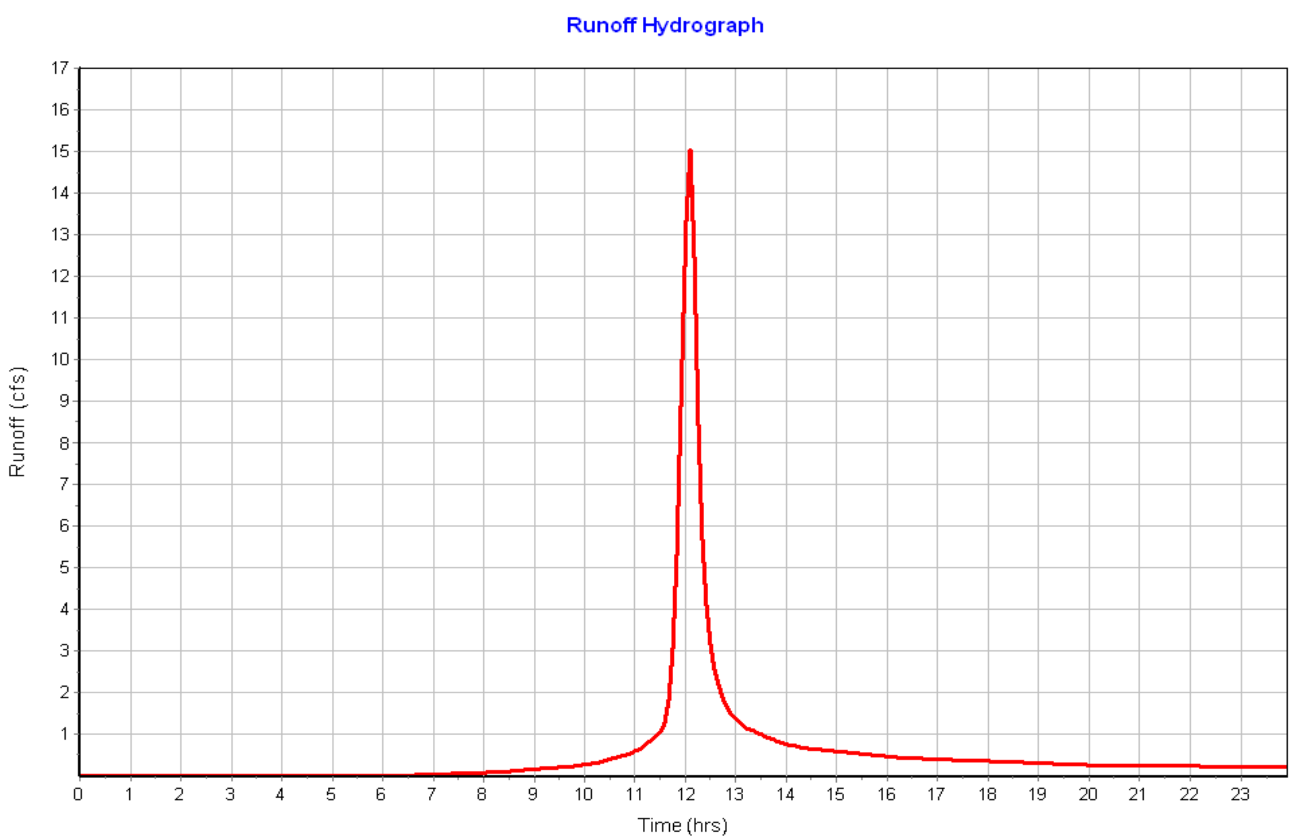
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 3.19
Total Runoff (in) 2.07
Peak Runoff (cfs) 15.08
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes..	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links..	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-005	Cumulative	inches	Ohio	Union	5	3.19	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	3.19	2.08	4.40	6.71	0 00:06:00
Pad-South	2.18	88.83	3.19	2.06	4.49	6.86	0 00:06:00
Pond-Direct	0.63	80.00	3.19	1.39	0.88	1.34	0 00:06:00
ROAD	1.61	91.00	3.19	2.25	3.62	4.45	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	6.63	1062.55	0.00	1.00	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	0.16	1059.35	0.00	3.15	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	6.77	1063.31	0.00	0.24	0 00:00	0.00	0.00
Access-Road	Outfall	1062.00					4.34	1062.00					
Detention-Basin	Outfall	1058.94					0.17	1059.08					
Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	11.76	1061.18				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Total Time Surcharged (min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	0.17	3.96	2.40	0.14	0.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	4.72	1.79	1.19	0.65	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	5.98	16.10	1.86	0.56	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		0.08				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.08				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

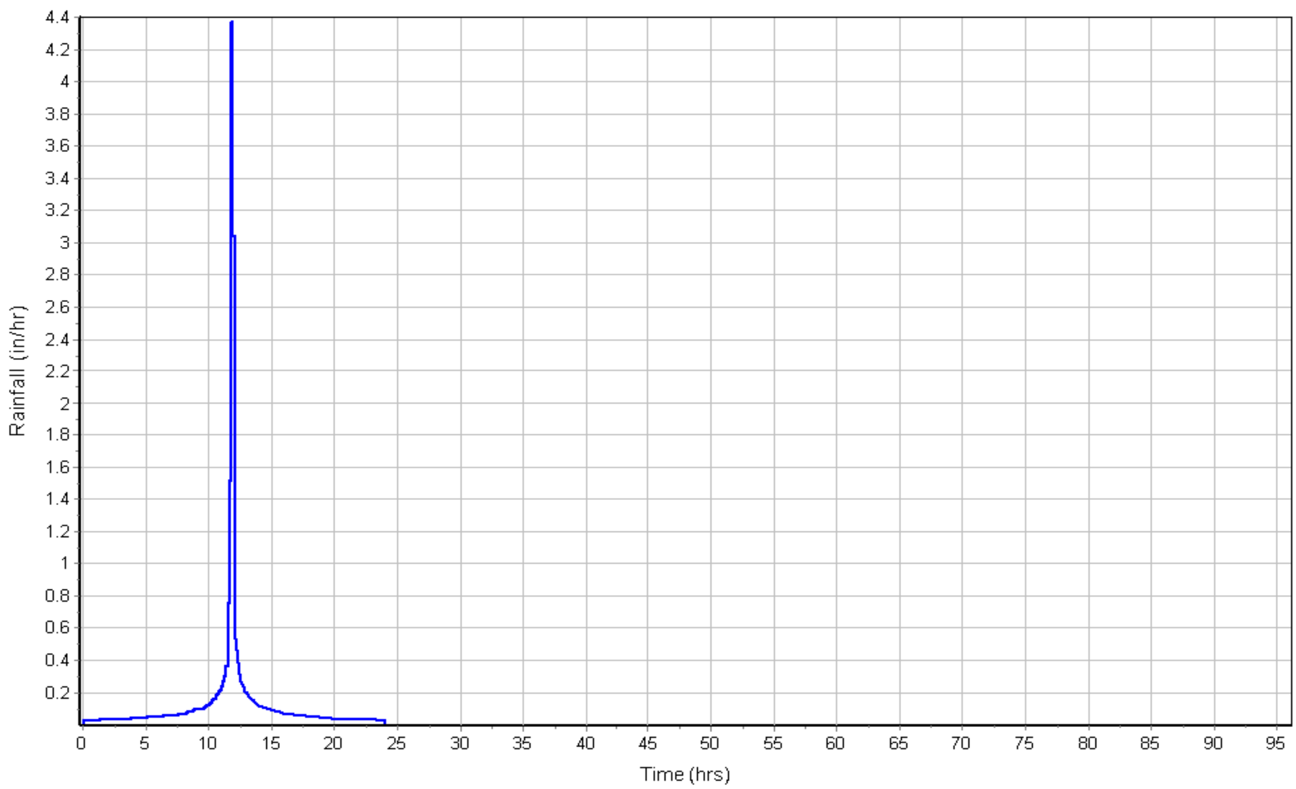
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

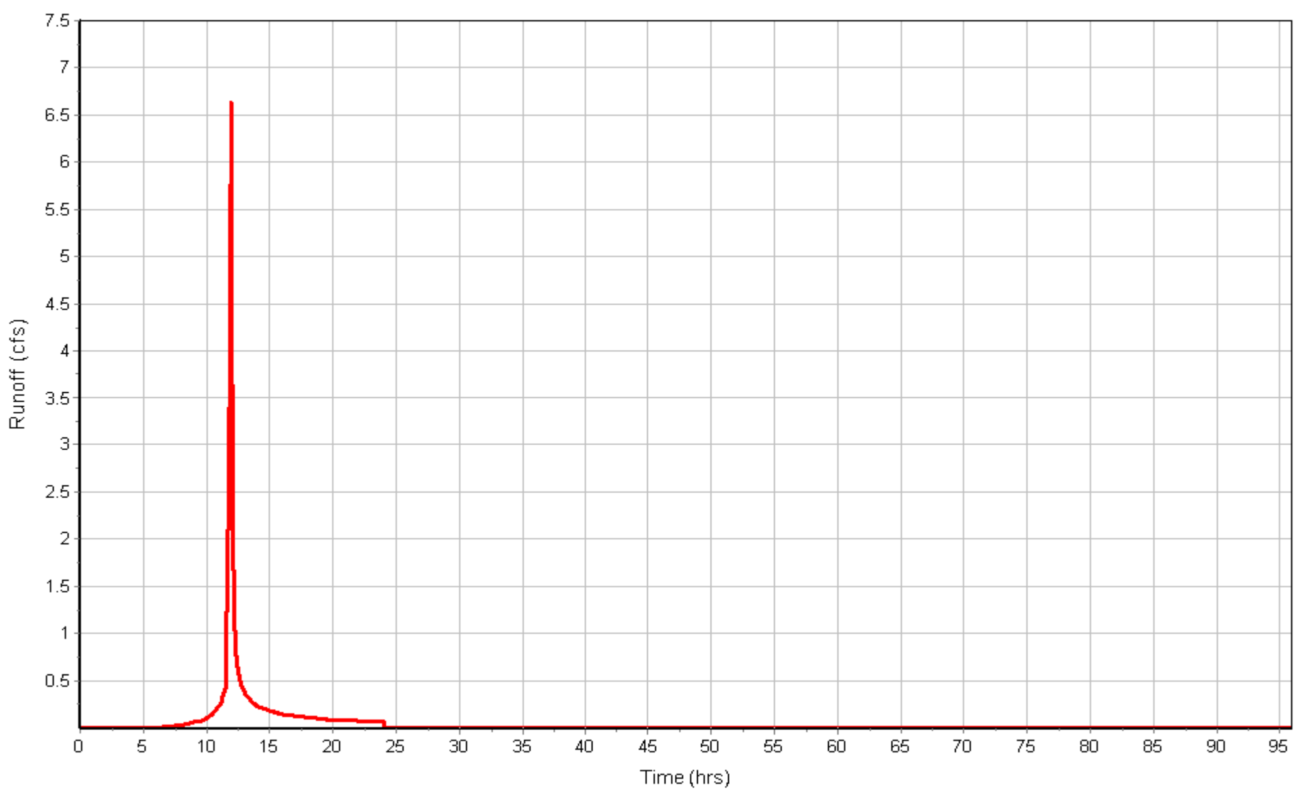
Total Rainfall (in) 3.19
Total Runoff (in) 2.08
Peak Runoff (cfs) 6.71
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

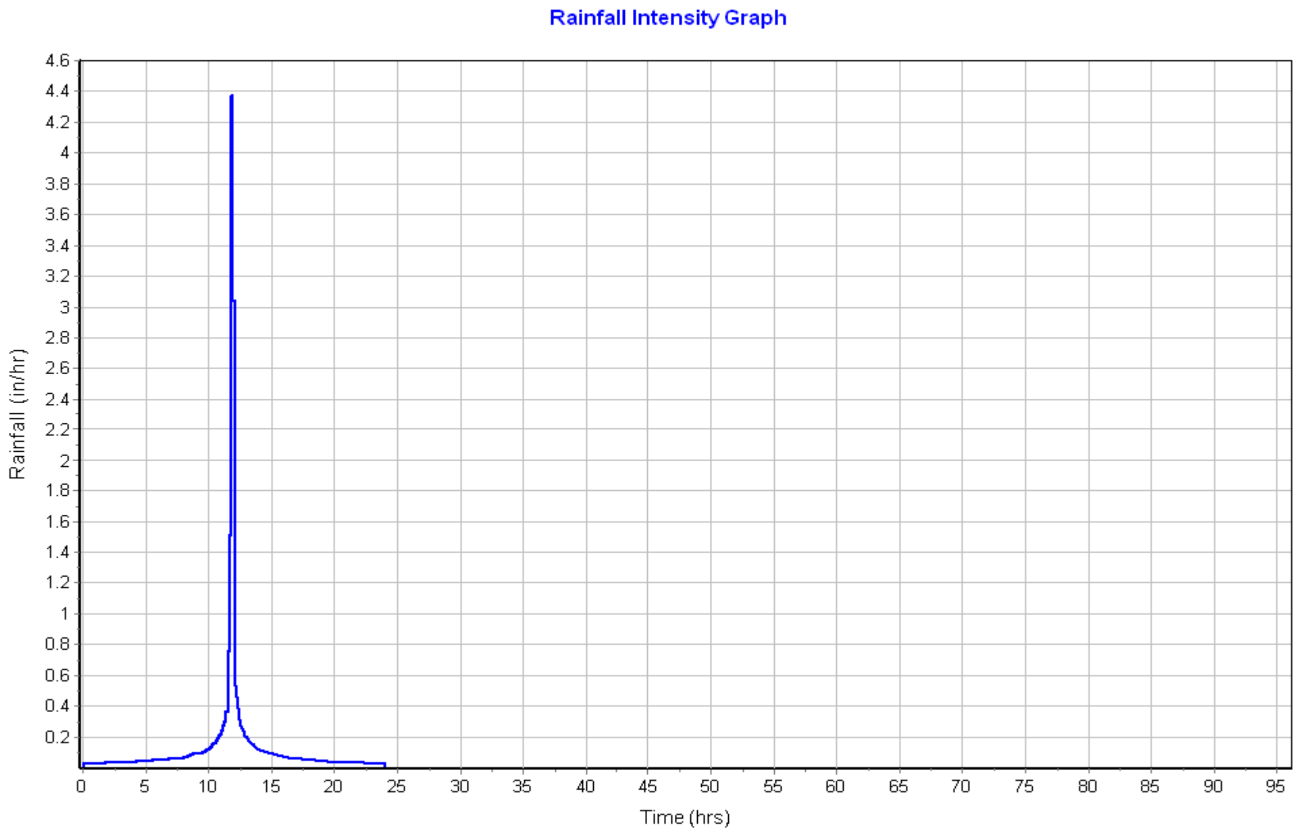
Time of Concentration

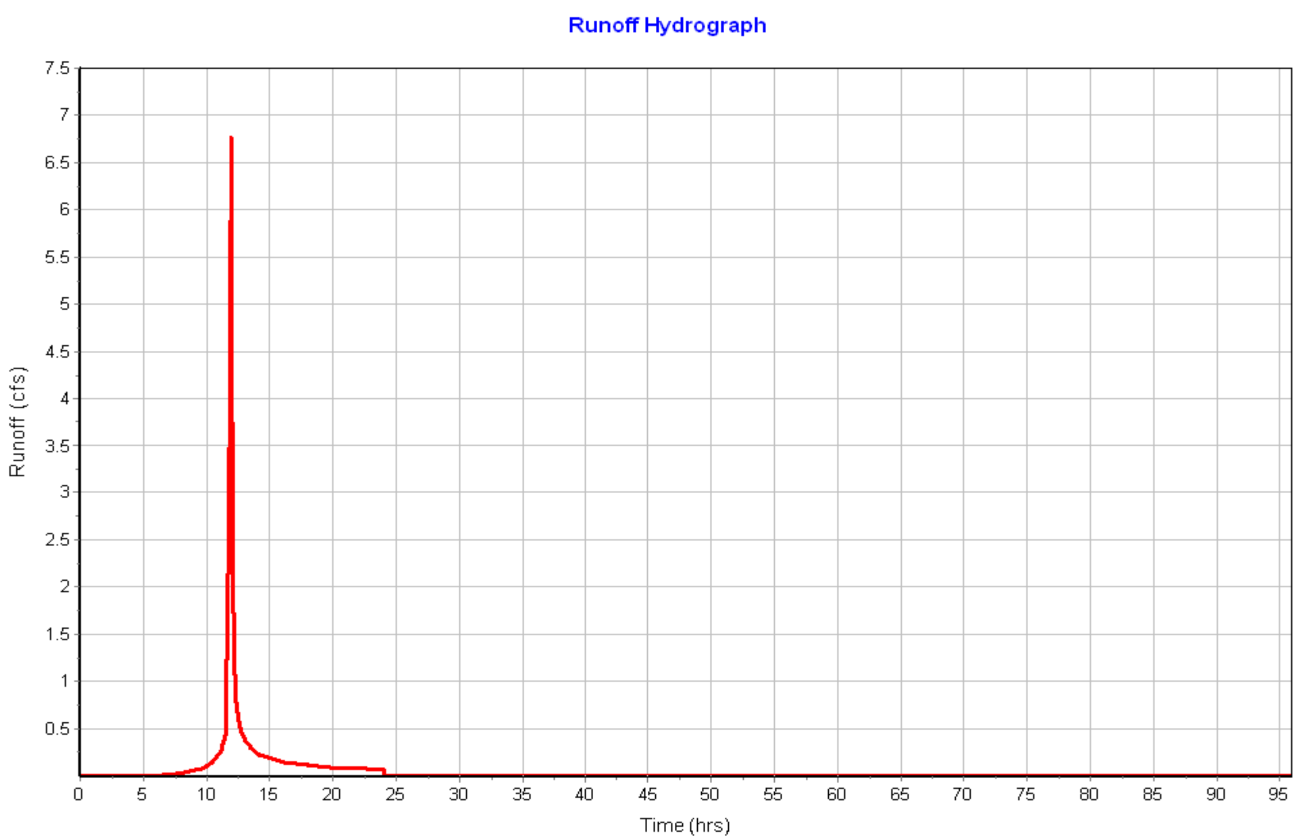
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 3.19
Total Runoff (in) 2.06
Peak Runoff (cfs) 6.86
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

Time of Concentration

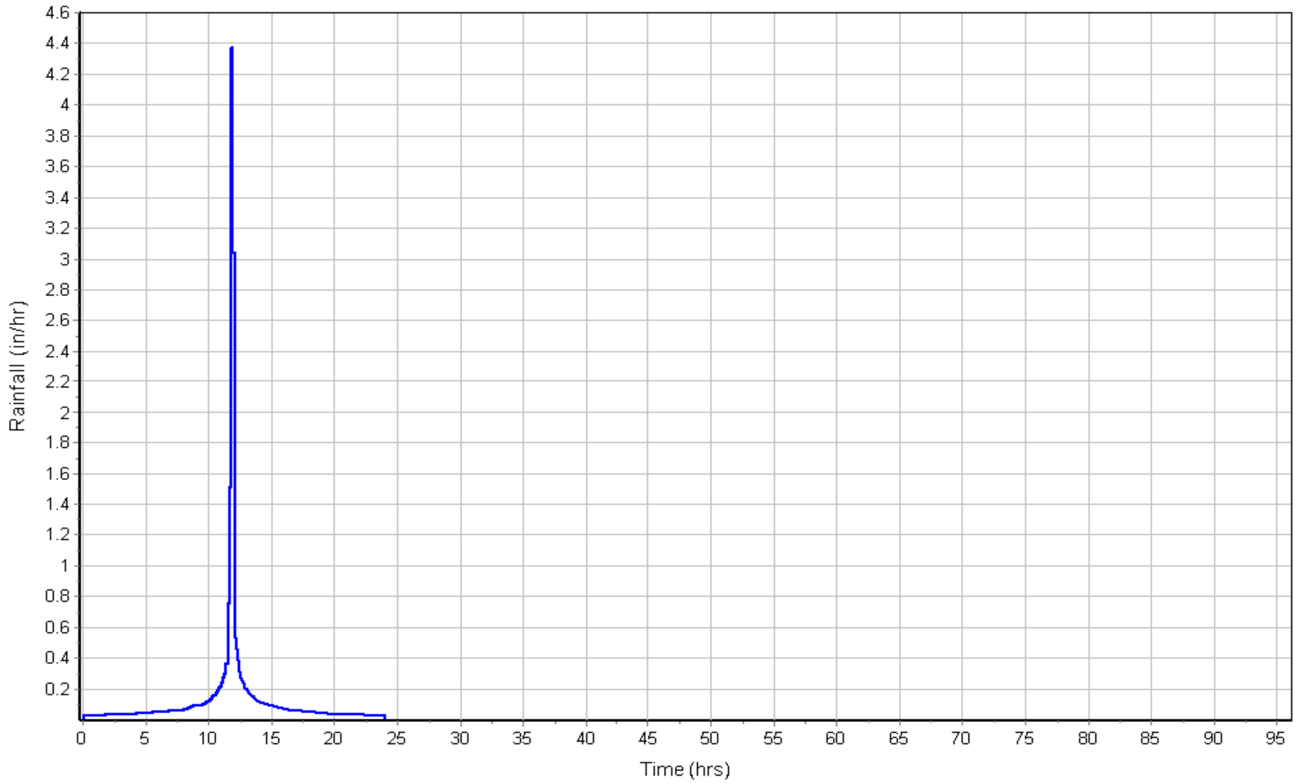
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

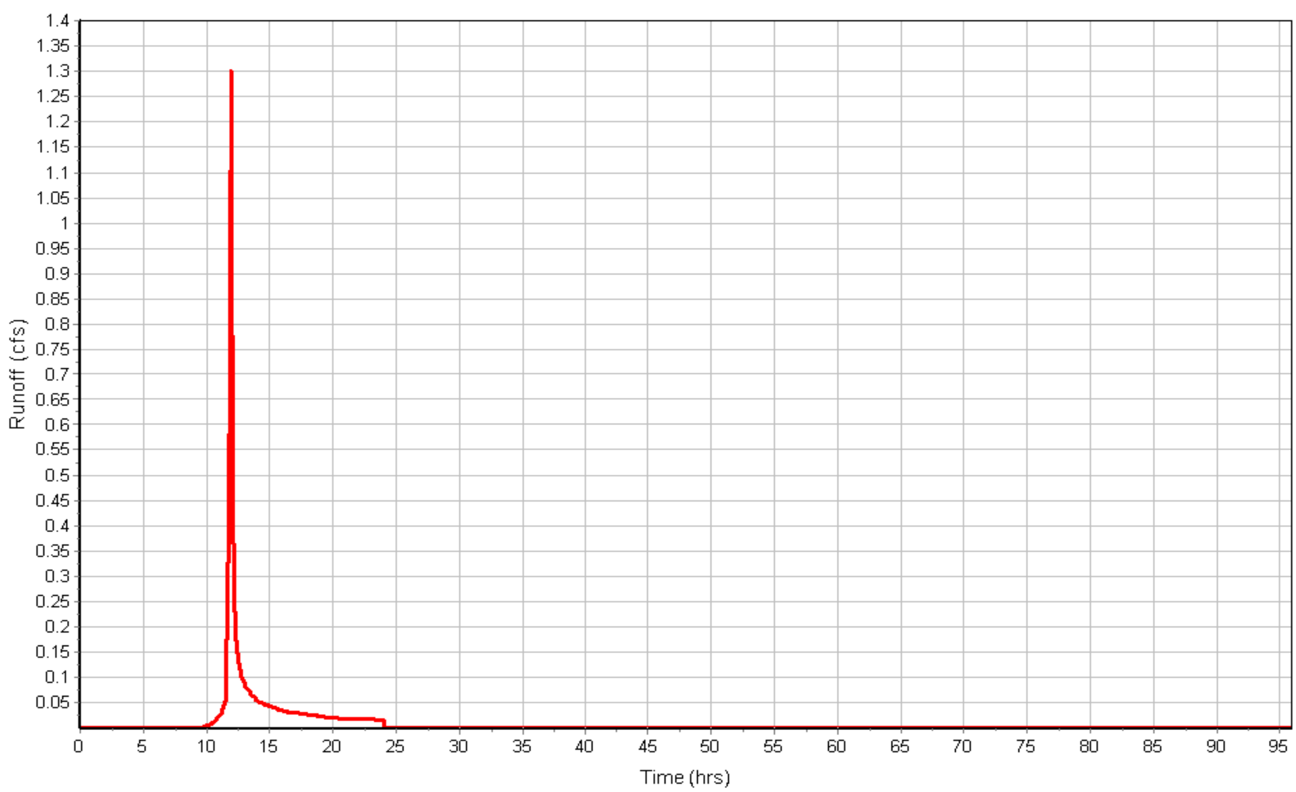
Total Rainfall (in) 3.19
Total Runoff (in) 1.39
Peak Runoff (cfs) 1.34
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

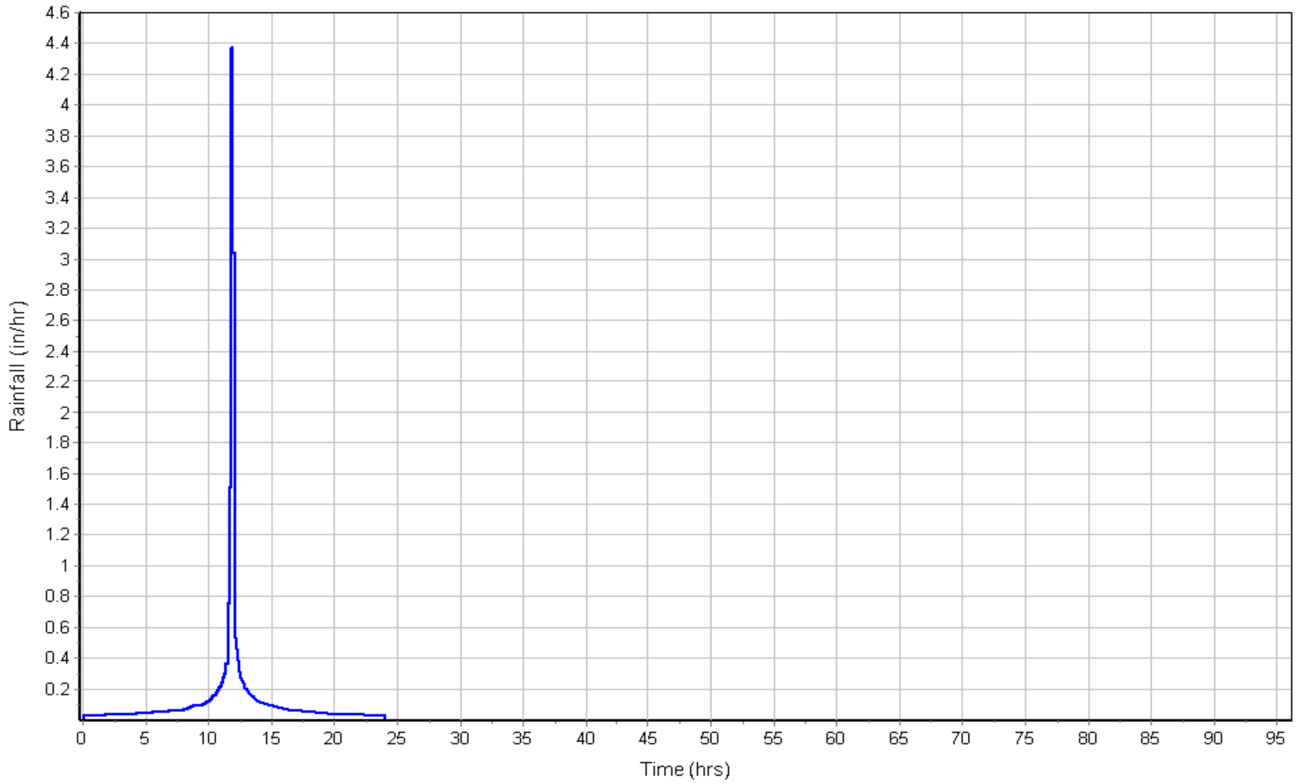
Total TOC (min) 14.51

Subbasin Runoff Results

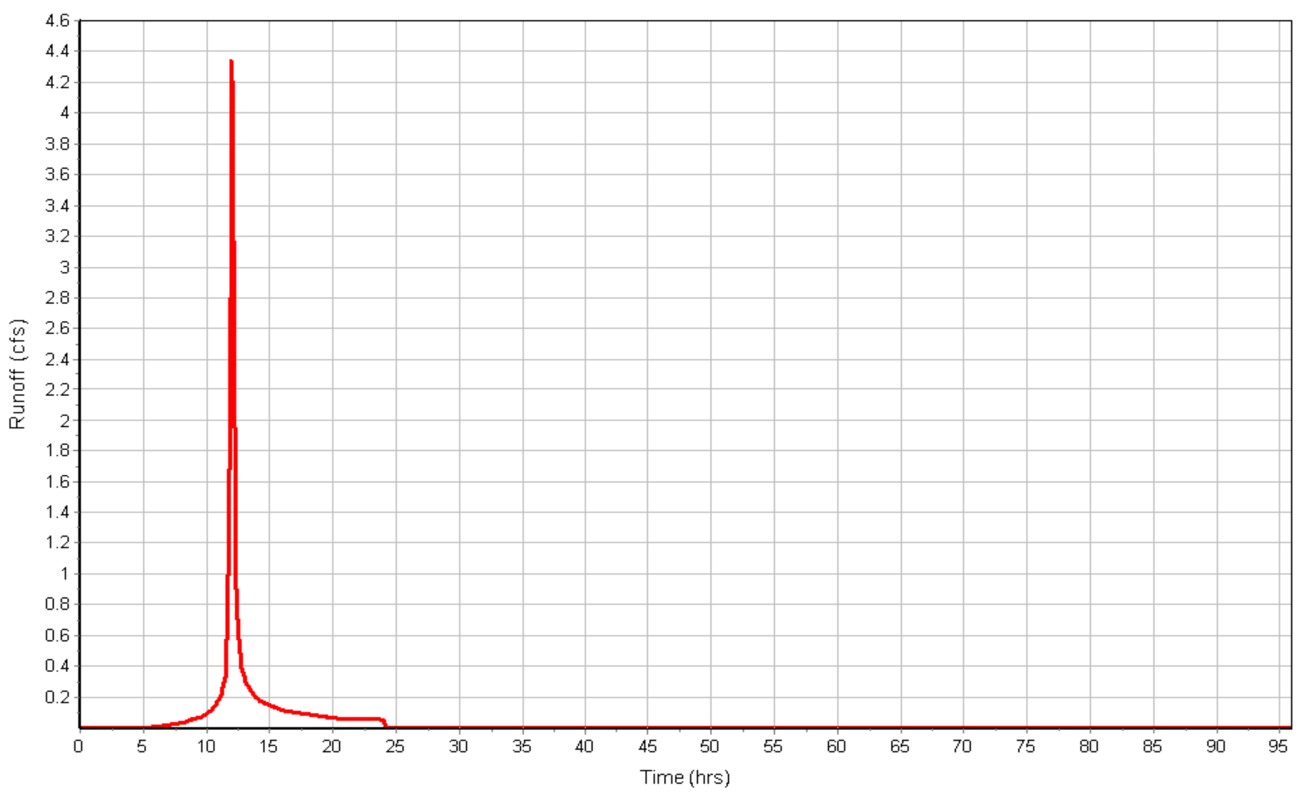
Total Rainfall (in) 3.19
Total Runoff (in) 2.25
Peak Runoff (cfs) 4.45
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
North-Ditch	6.63	6.63	1062.55	1.00	0.00	1.00	1061.60	0.05	0 12:06	0 00:00	0.00	0.00
Primary-Spillway	0.16	0.00	1059.35	0.15	0.00	3.15	1059.29	0.09	0 23:18	0 00:00	0.00	0.00
South-Ditch	6.77	6.77	1063.31	0.76	0.00	0.24	1062.57	0.02	0 12:04	0 00:00	0.00	0.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
4.72	0 12:07	1.79	1.19	7.86	0.65	0.00		
5.98	0 12:04	16.10	1.86	3.49	0.56	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	0.17	0 23:17	3.96	2.40	0.15	0.14	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

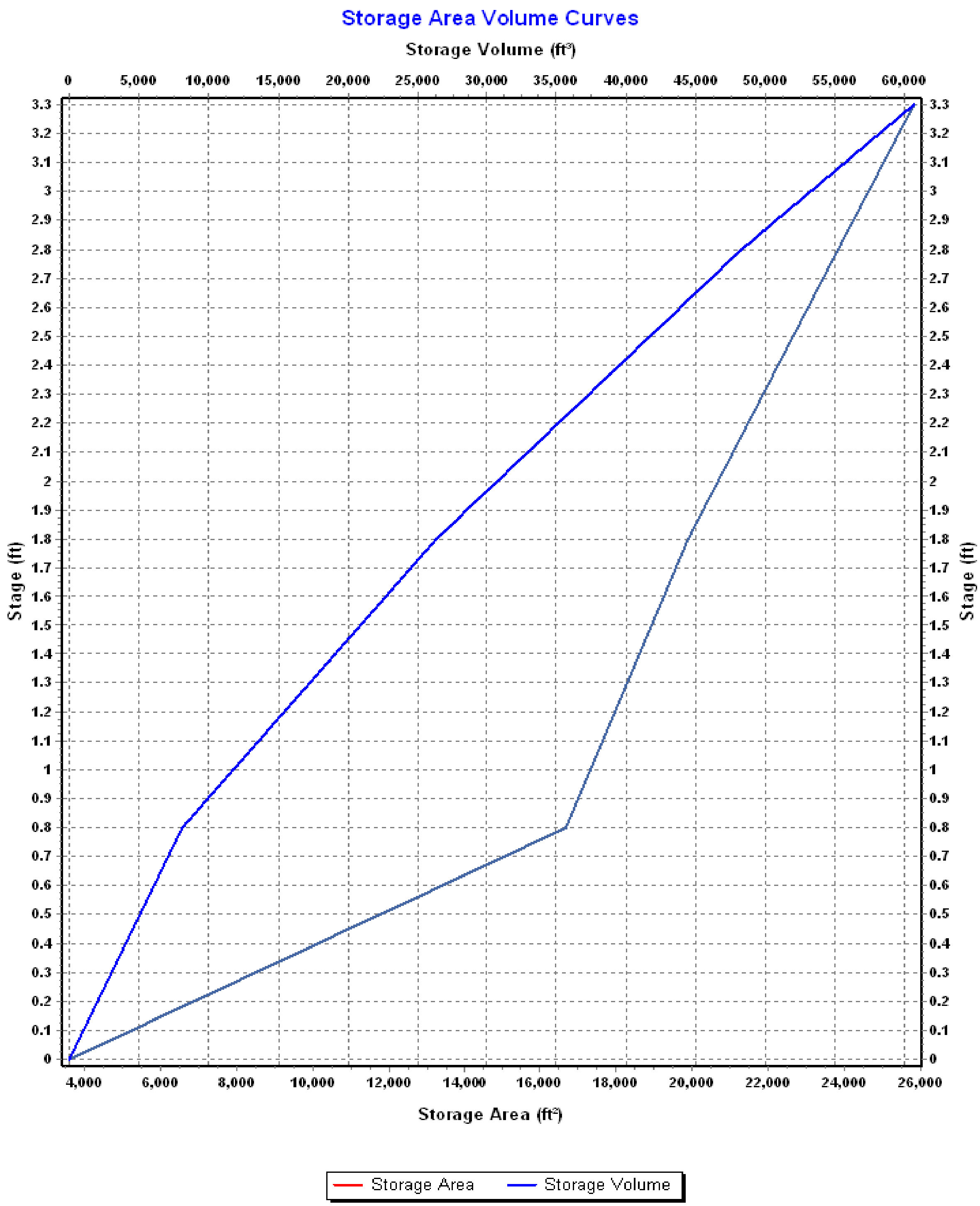
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 11.76
Peak Lateral Inflow (cfs) 1.30
Peak Outflow (cfs) 0.16
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1061.18
Max HGL Depth Attained (ft) 1.98
Average HGL Elevation Attained (ft) 1060.55
Average HGL Depth Attained (ft) 1.35
Time of Max HGL Occurrence (days hh:mm) 0 23:25
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes...	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links...	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-010	Cumulative	inches	Ohio	Union	10	3.73	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	3.73	2.56	16.61	18.57	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

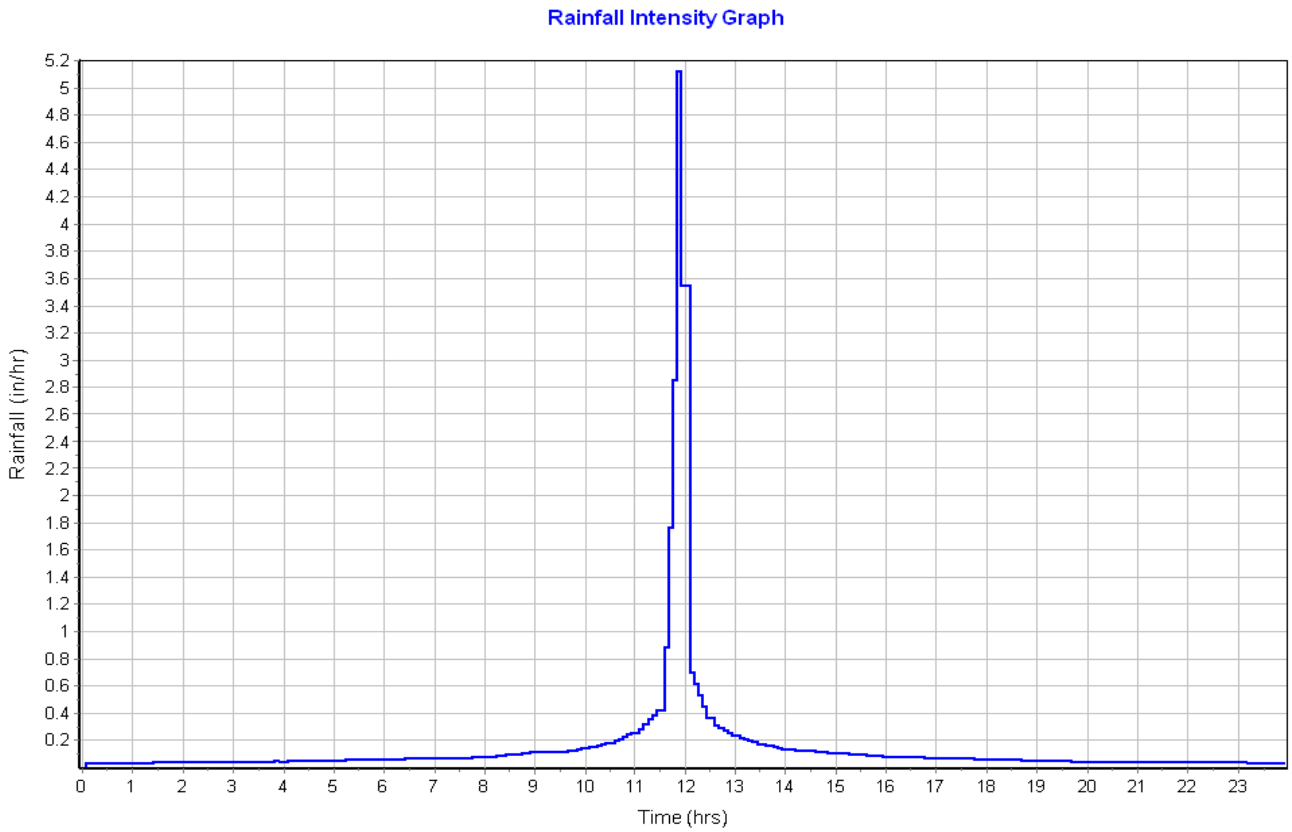
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

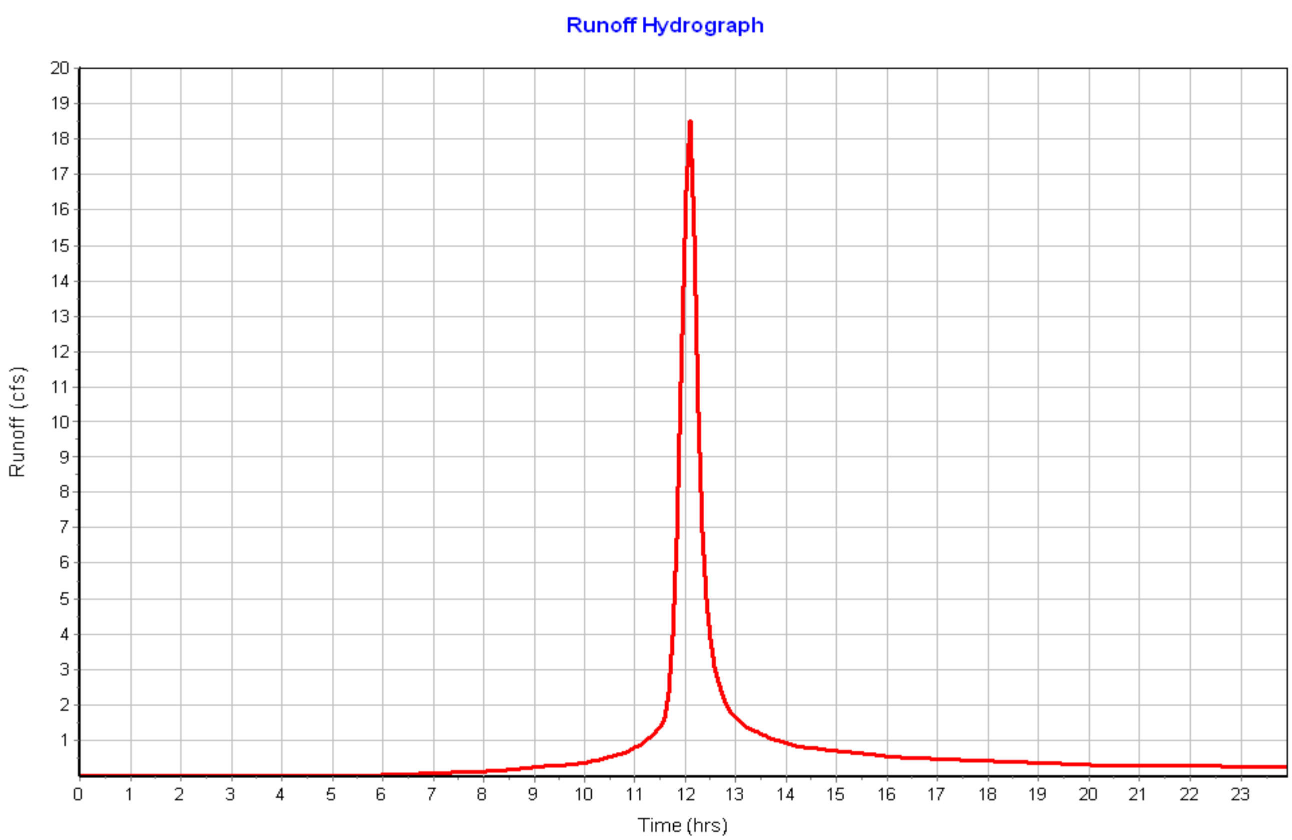
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 3.73
Total Runoff (in) 2.56
Peak Runoff (cfs) 18.57
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes...	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links...	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-010	Cumulative	inches	Ohio	Union	10	3.73	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	3.73	2.58	5.45	8.25	0 00:06:00
Pad-South	2.18	88.83	3.73	2.56	5.57	8.45	0 00:06:00
Pond-Direct	0.63	80.00	3.73	1.82	1.15	1.76	0 00:06:00
ROAD	1.61	91.00	3.73	2.76	4.44	5.42	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	8.16	1062.66	0.00	0.89	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	0.48	1059.47	0.00	3.03	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	8.36	1063.39	0.00	0.16	0 00:00	0.00	0.00
Access-Road	Outfall	1062.00					5.30	1062.00					
Detention-Basin	Outfall	1058.94					0.48	1059.18					
Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	14.92	1061.25				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Total Time Surcharged (min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	0.48	3.96	3.08	0.25	0.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	6.03	1.79	1.30	0.74	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	7.50	16.10	2.01	0.63	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		0.40				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.08				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

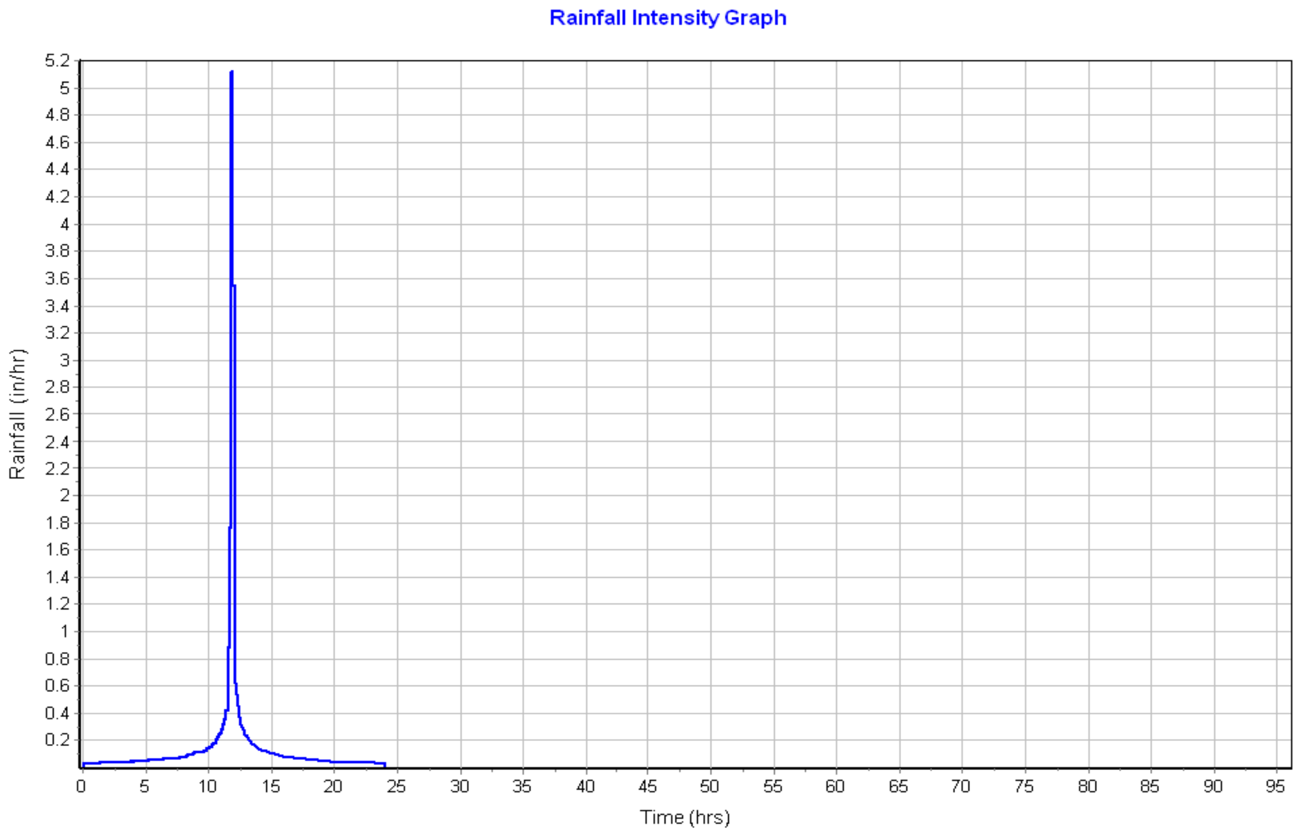
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

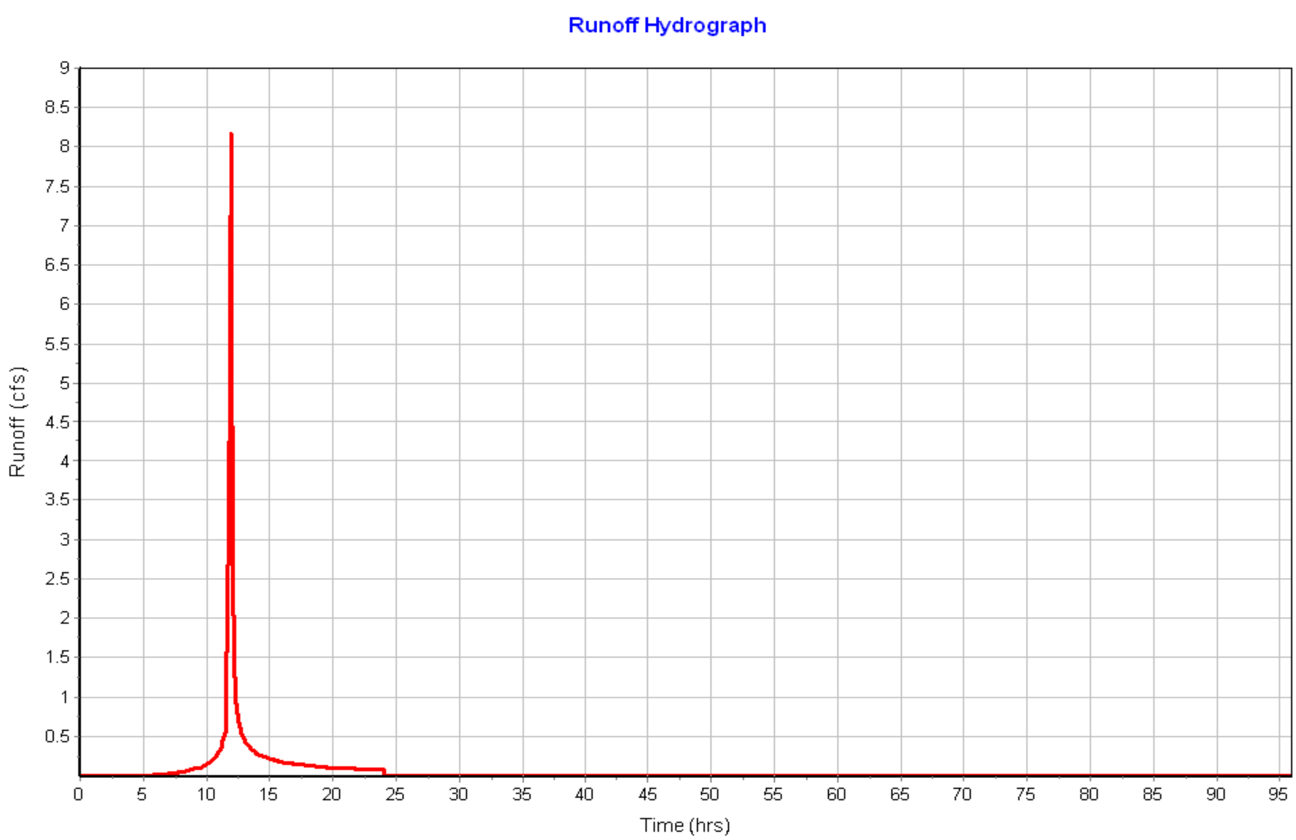
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

Total Rainfall (in) 3.73
Total Runoff (in) 2.58
Peak Runoff (cfs) 8.25
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North





Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

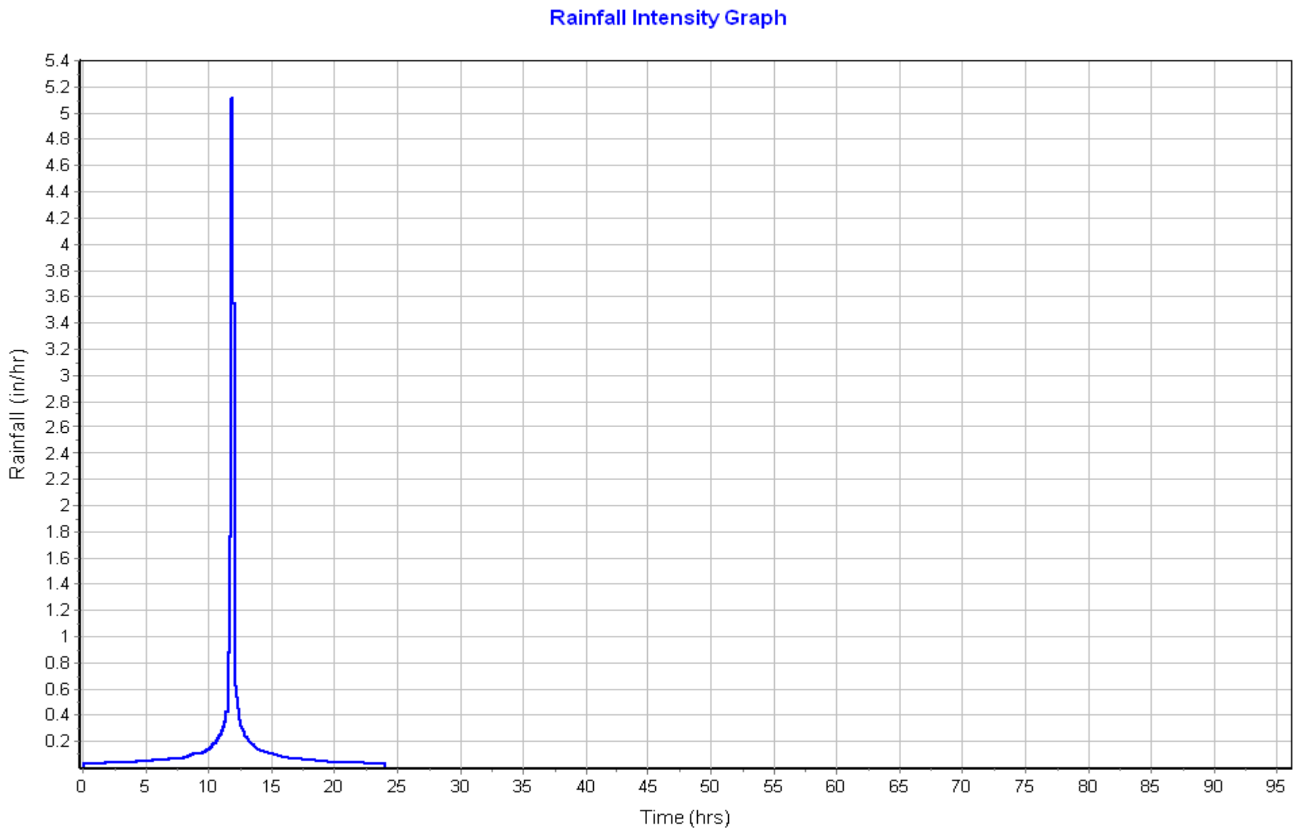
Time of Concentration

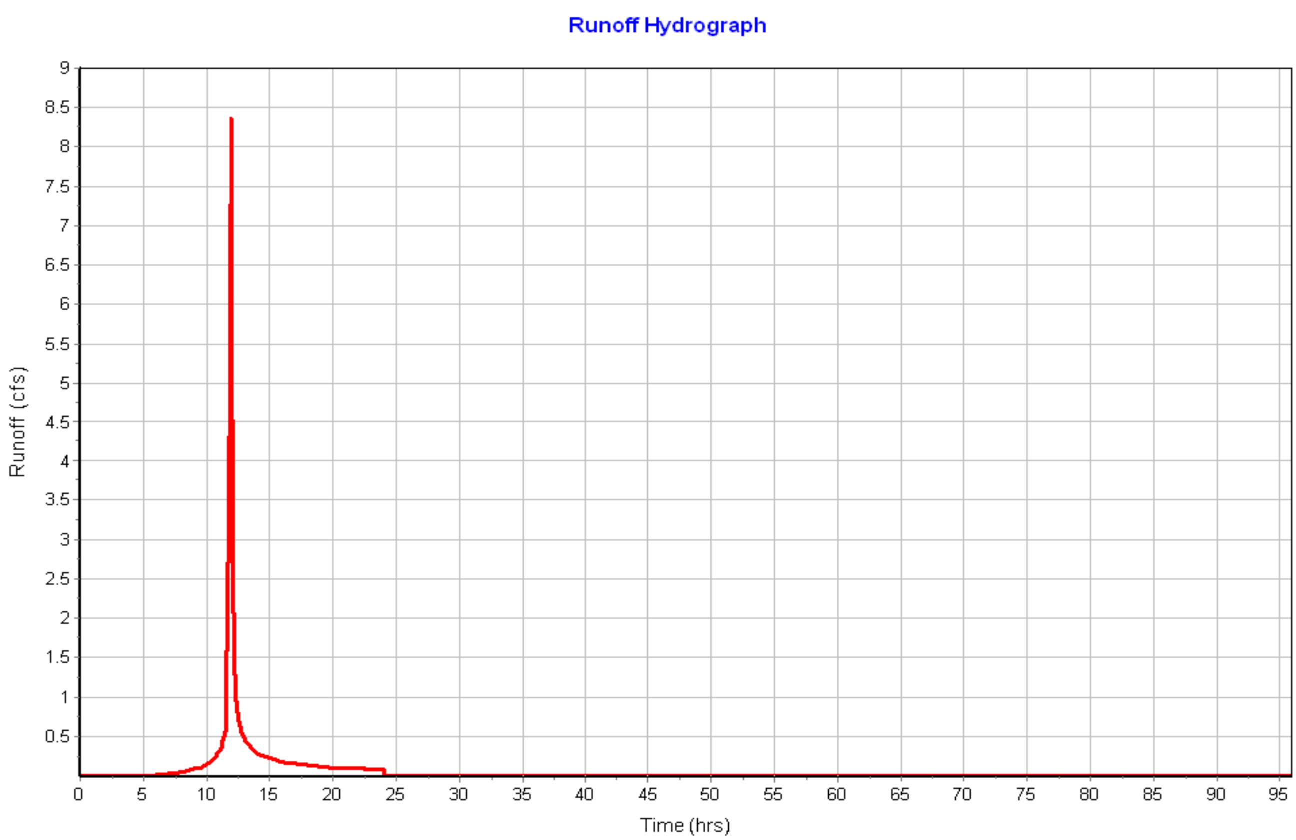
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 3.73
Total Runoff (in) 2.56
Peak Runoff (cfs) 8.45
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

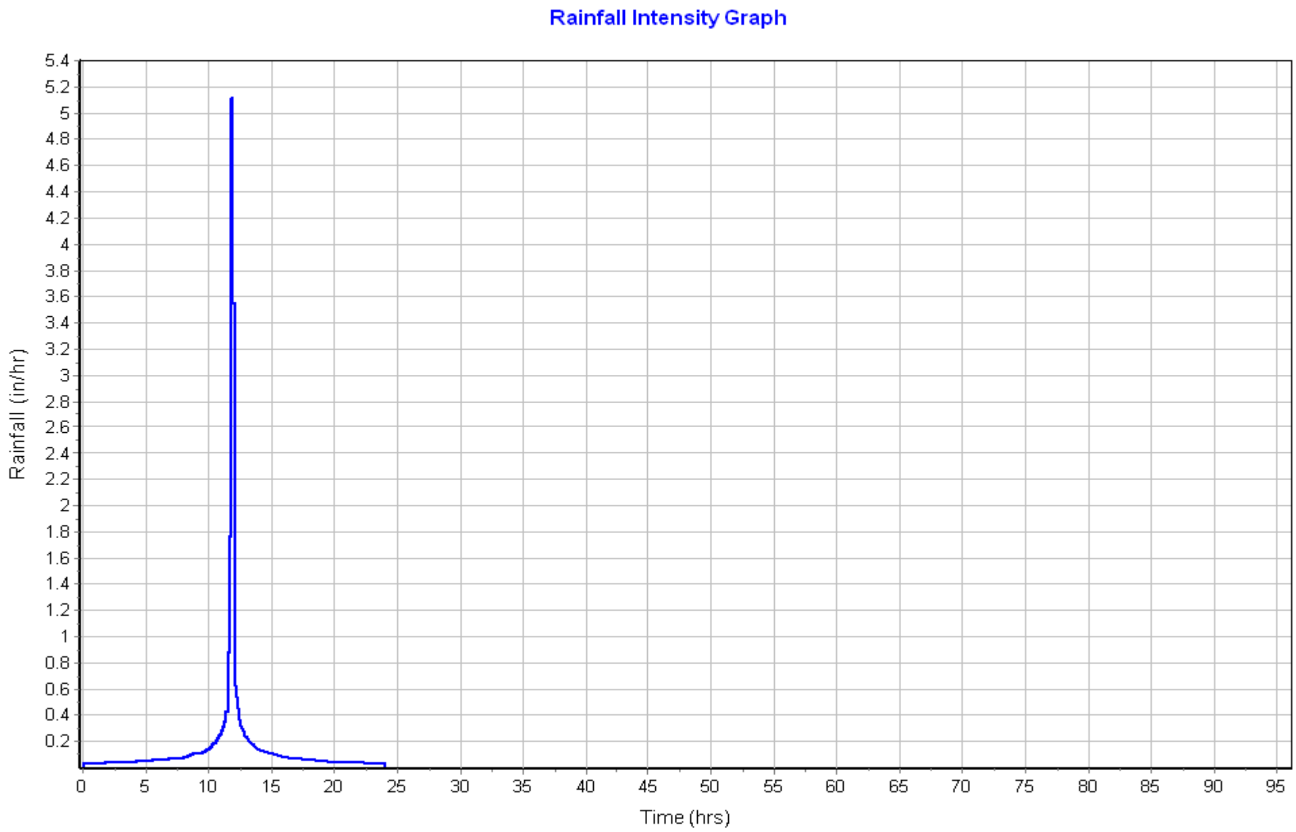
Time of Concentration

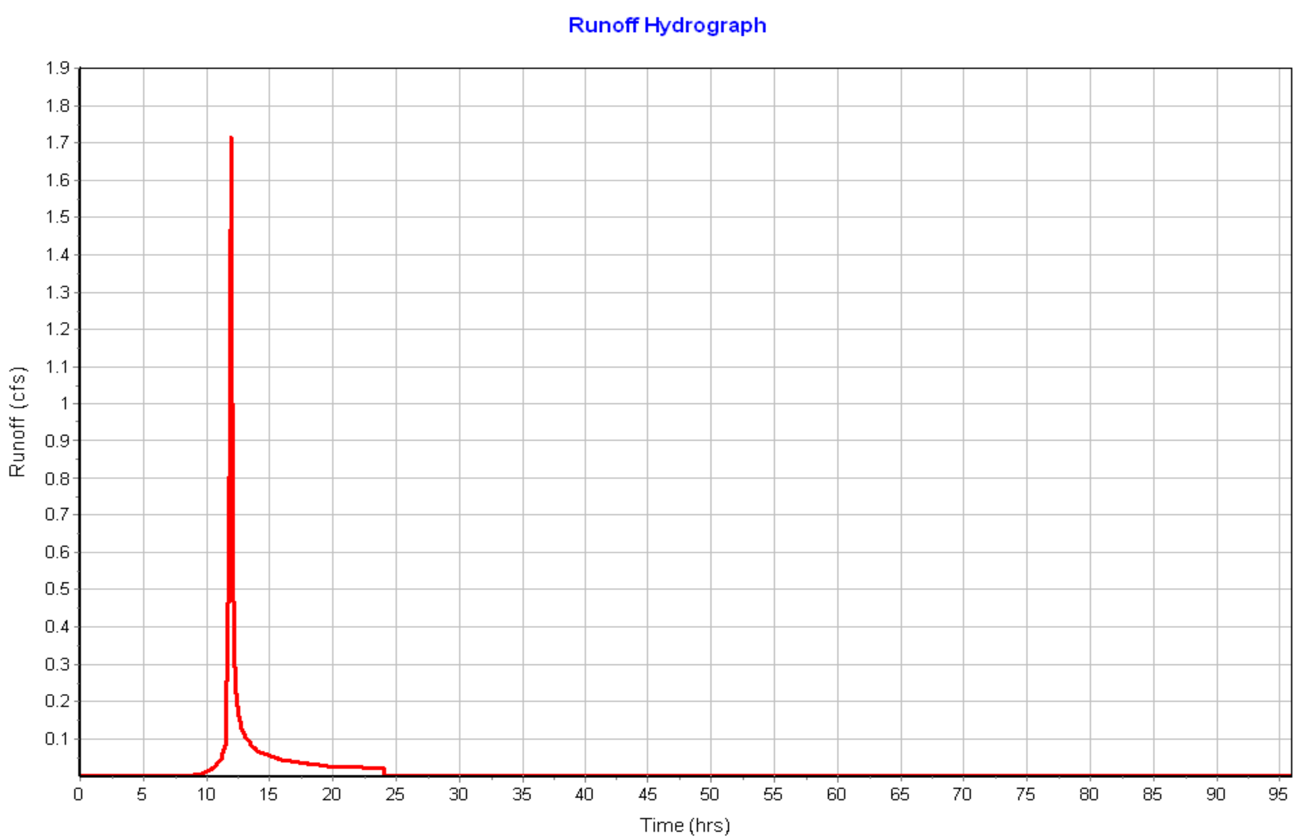
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

Total Rainfall (in) 3.73
Total Runoff (in) 1.82
Peak Runoff (cfs) 1.76
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct





Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

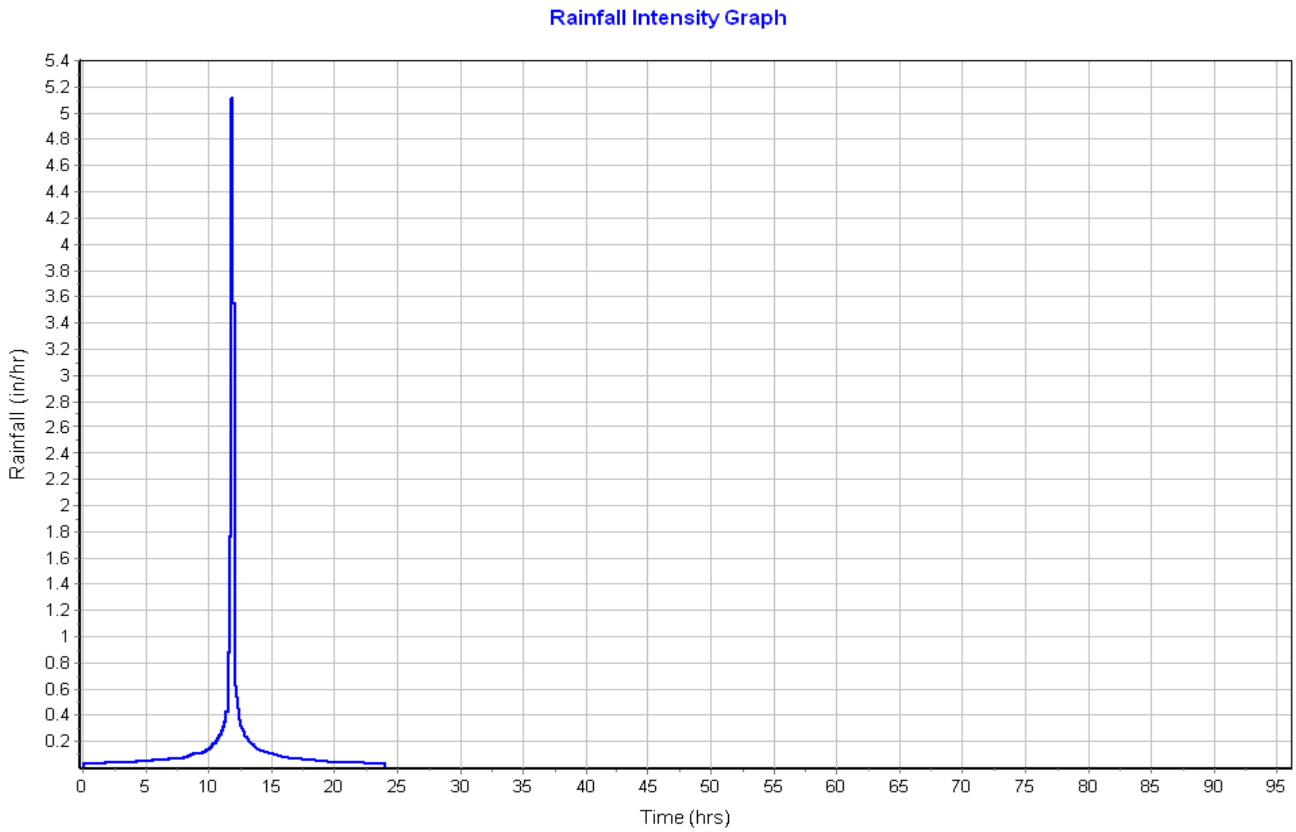
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

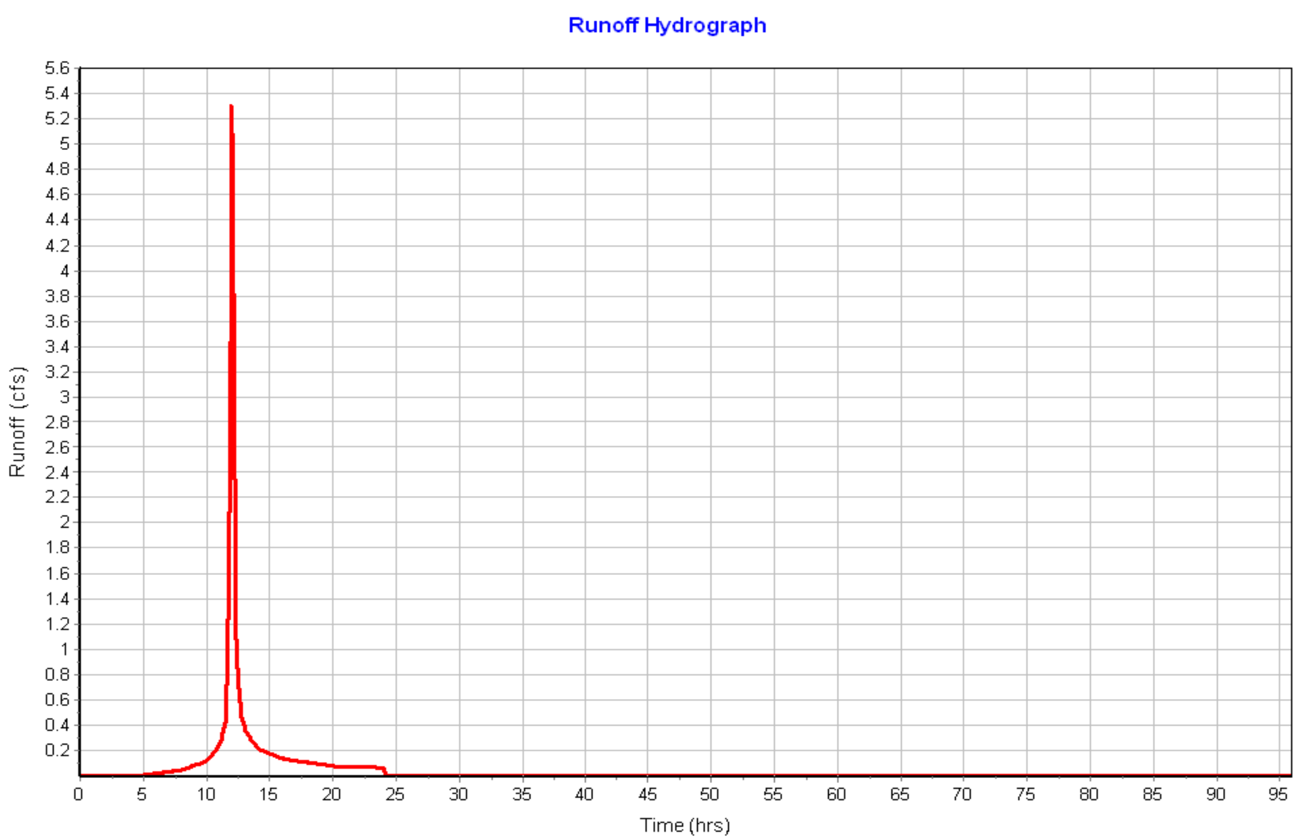
Total TOC (min) 14.51

Subbasin Runoff Results

Total Rainfall (in) 3.73
Total Runoff (in) 2.76
Peak Runoff (cfs) 5.42
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD





Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	8.16	8.16	1062.66	1.11	0.00	0.89	1061.69	0.14	0 12:06	0 00:00	0.00	0.00
Primary-Spillway	0.48	0.00	1059.47	0.27	0.00	3.03	1059.36	0.16	0 15:32	0 00:00	0.00	0.00
South-Ditch	8.36	8.36	1063.39	0.84	0.00	0.16	1062.61	0.06	0 12:03	0 00:00	0.00	0.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
6.03	0 12:06	1.79	1.30	7.19	0.74	0.00		
7.50	0 12:04	16.10	2.01	3.23	0.63	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	0.48	0 15:32	3.96	3.08	0.11	0.25	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

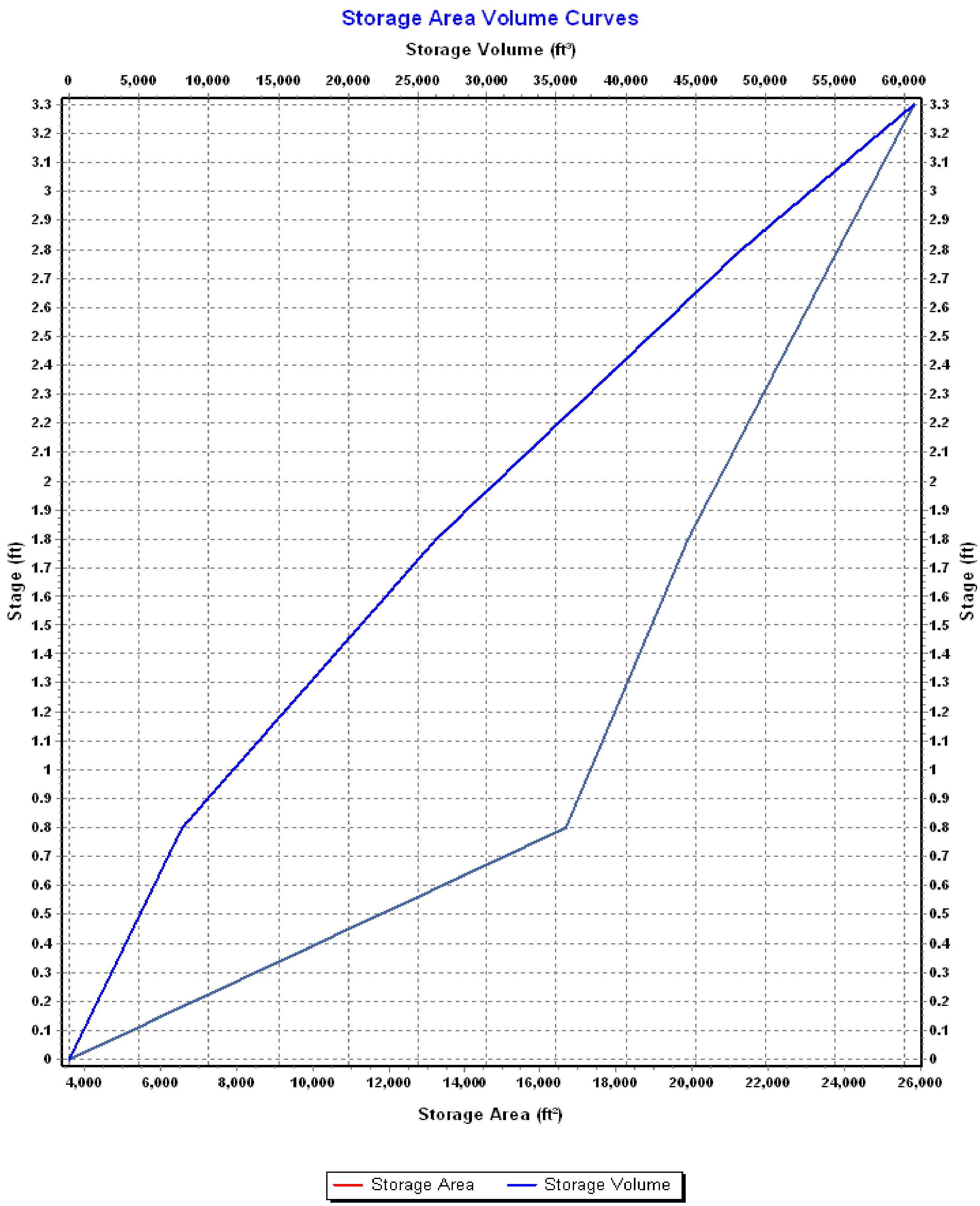
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft^2) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillwa	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 14.92
Peak Lateral Inflow (cfs) 1.71
Peak Outflow (cfs) 0.48
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1061.25
Max HGL Depth Attained (ft) 2.05
Average HGL Elevation Attained (ft) 1060.89
Average HGL Depth Attained (ft) 1.69
Time of Max HGL Occurrence (days hh:mm) 0 15:32
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Kinematic Wave
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes..	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links..	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-025	Cumulative	inches	Ohio	Union	25	4.54	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	4.54	3.33	21.55	23.82	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

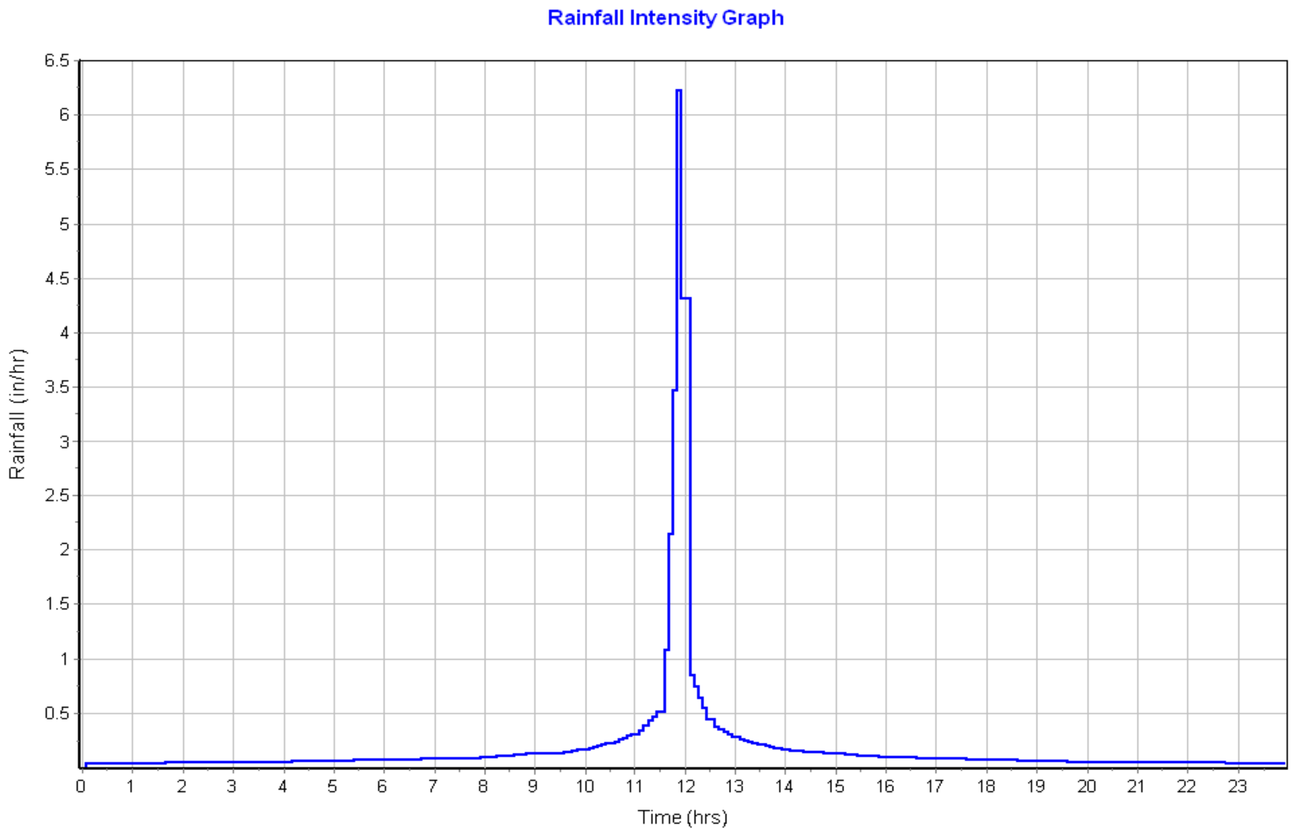
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

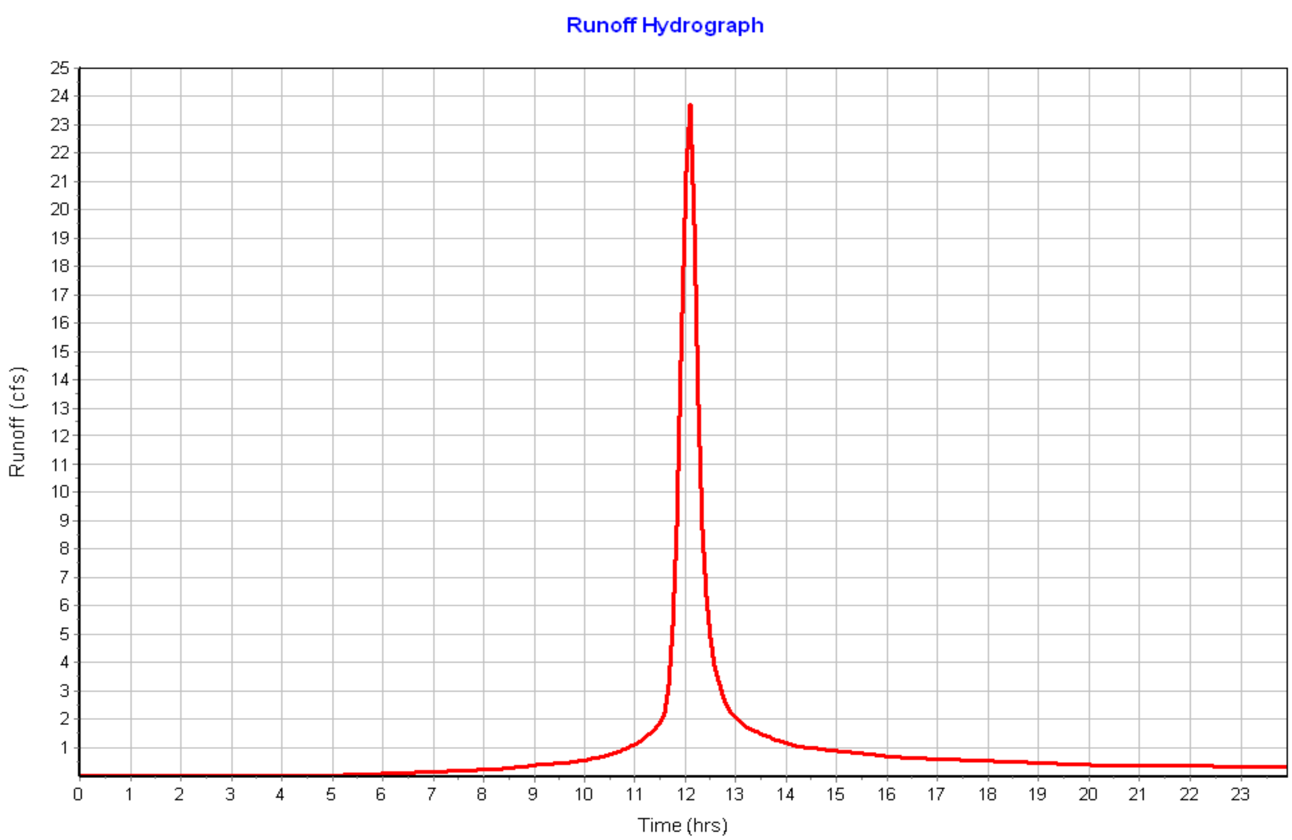
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 4.54
Total Runoff (in) 3.33
Peak Runoff (cfs) 23.82
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes...	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links...	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-025	Cumulative	inches	Ohio	Union	25	4.54	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	4.54	3.35	7.06	10.57	0 00:06:00
Pad-South	2.18	88.83	4.54	3.32	7.23	10.85	0 00:06:00
Pond-Direct	0.63	80.00	4.54	2.50	1.57	2.41	0 00:06:00
ROAD	1.61	91.00	4.54	3.54	5.69	6.86	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	10.48	1062.80	0.00	0.75	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	1.50	1059.73	0.00	2.77	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	10.75	1063.49	0.00	0.06	0 00:00	0.00	0.00
Access-Road	Outfall	1062.00					6.72	1062.00					
Detention-Basin	Outfall	1058.94					1.50	1059.37					
Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	19.68	1061.40				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Total Time Surcharged (min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	1.50	3.96	4.04	0.48	0.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	8.00	1.79	1.45	0.84	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	9.81	16.10	2.20	0.72	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		1.42				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.08				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

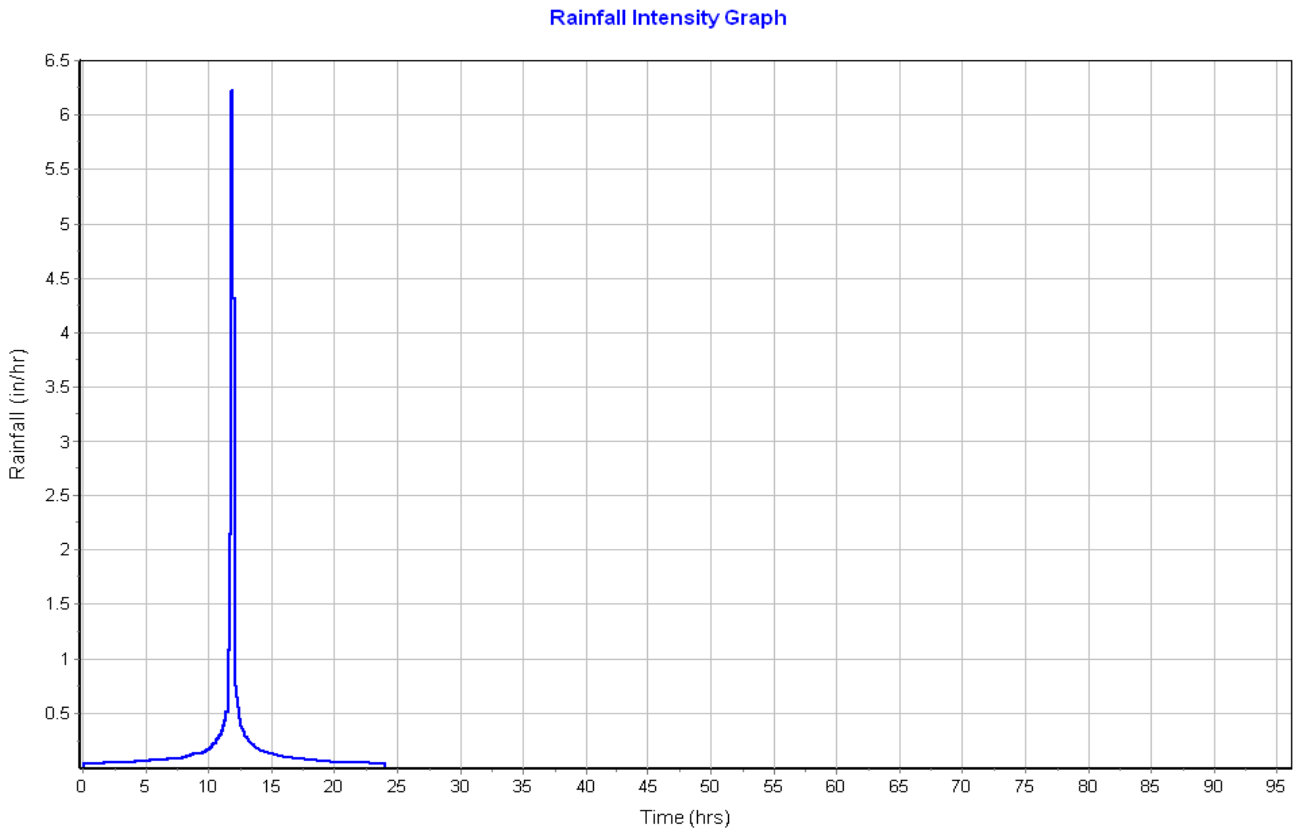
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

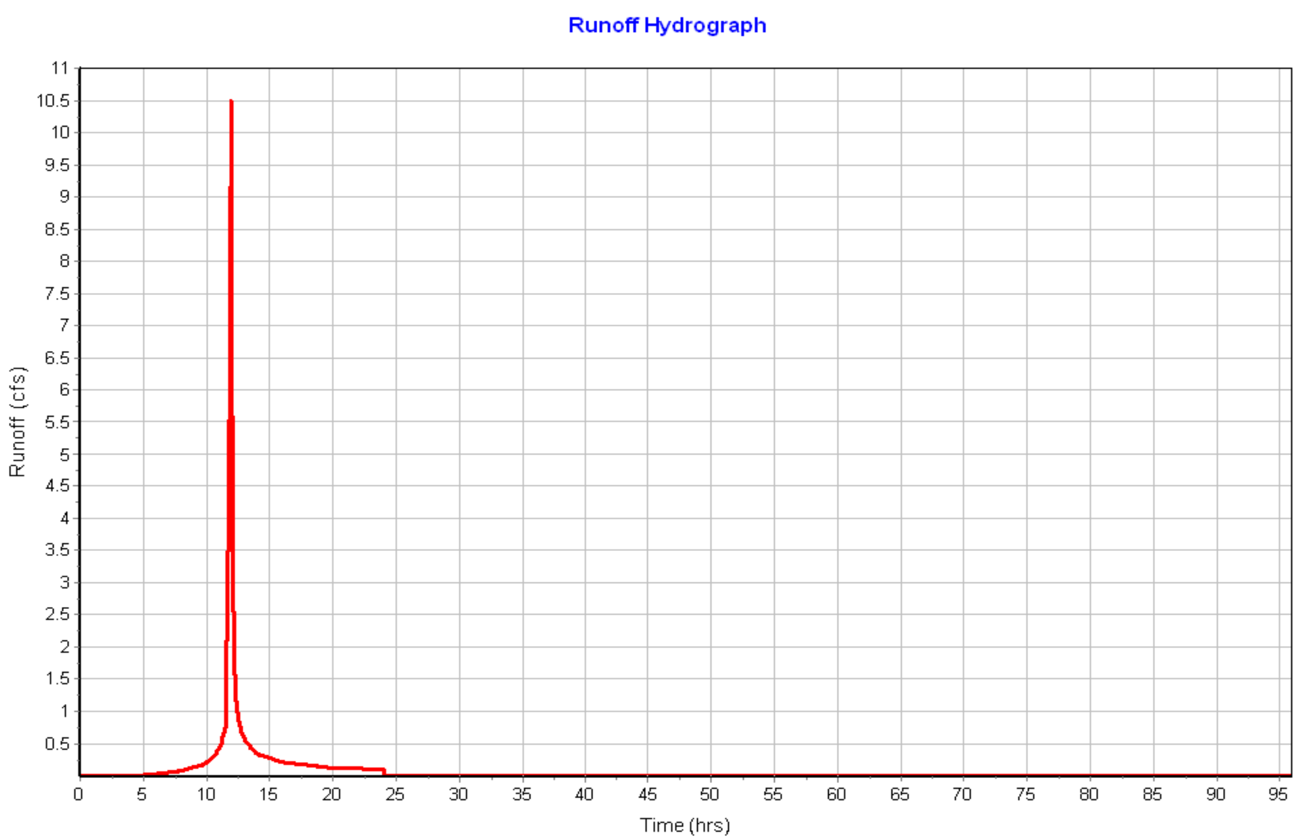
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

Total Rainfall (in) 4.54
Total Runoff (in) 3.35
Peak Runoff (cfs) 10.57
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North





Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

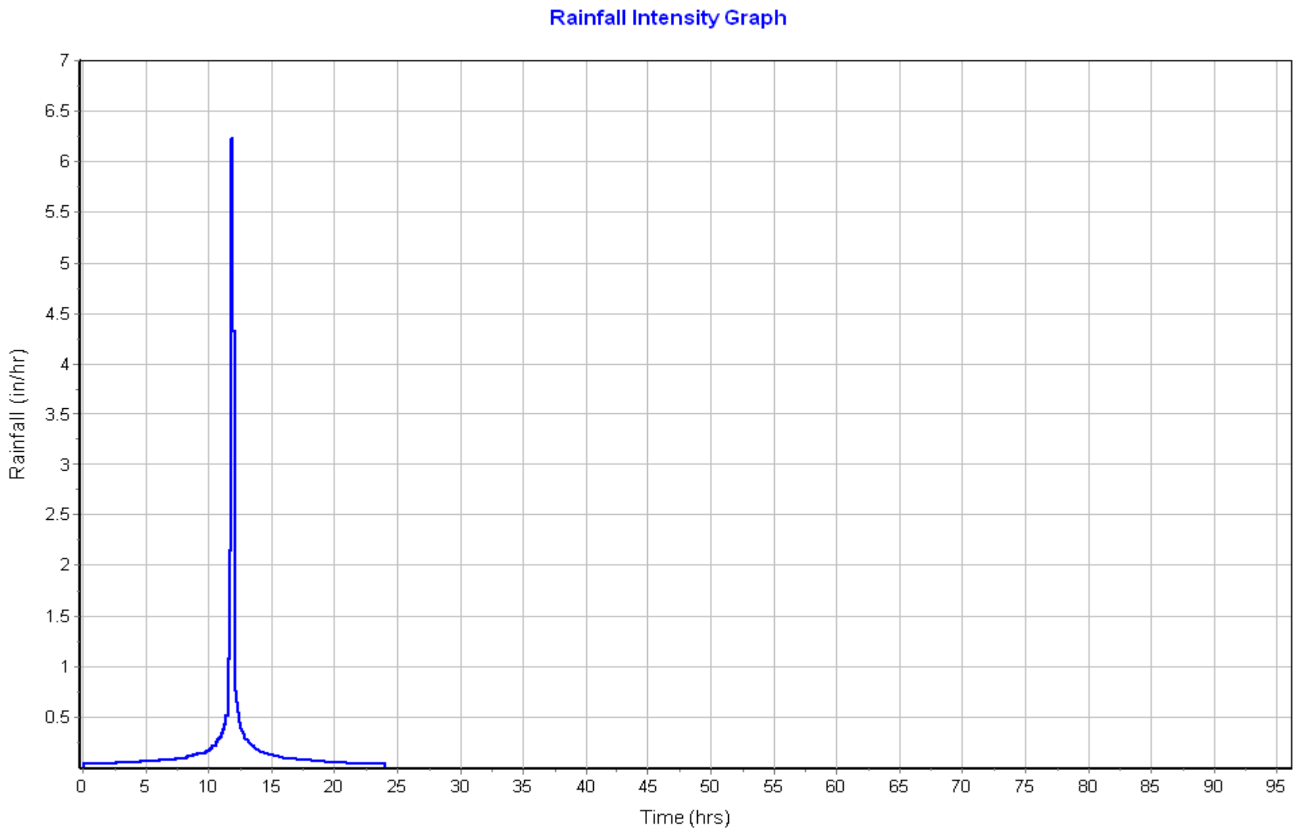
Time of Concentration

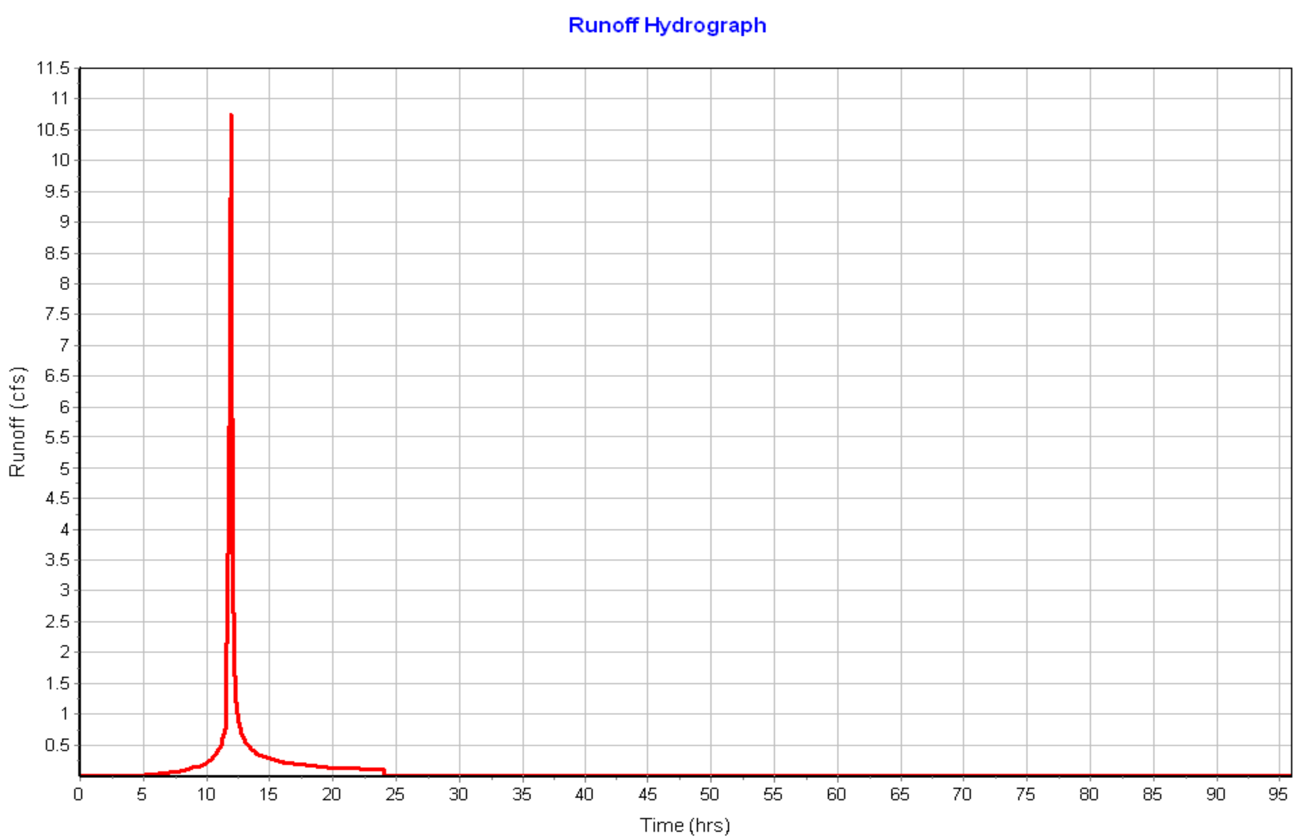
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 4.54
Total Runoff (in) 3.32
Peak Runoff (cfs) 10.85
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

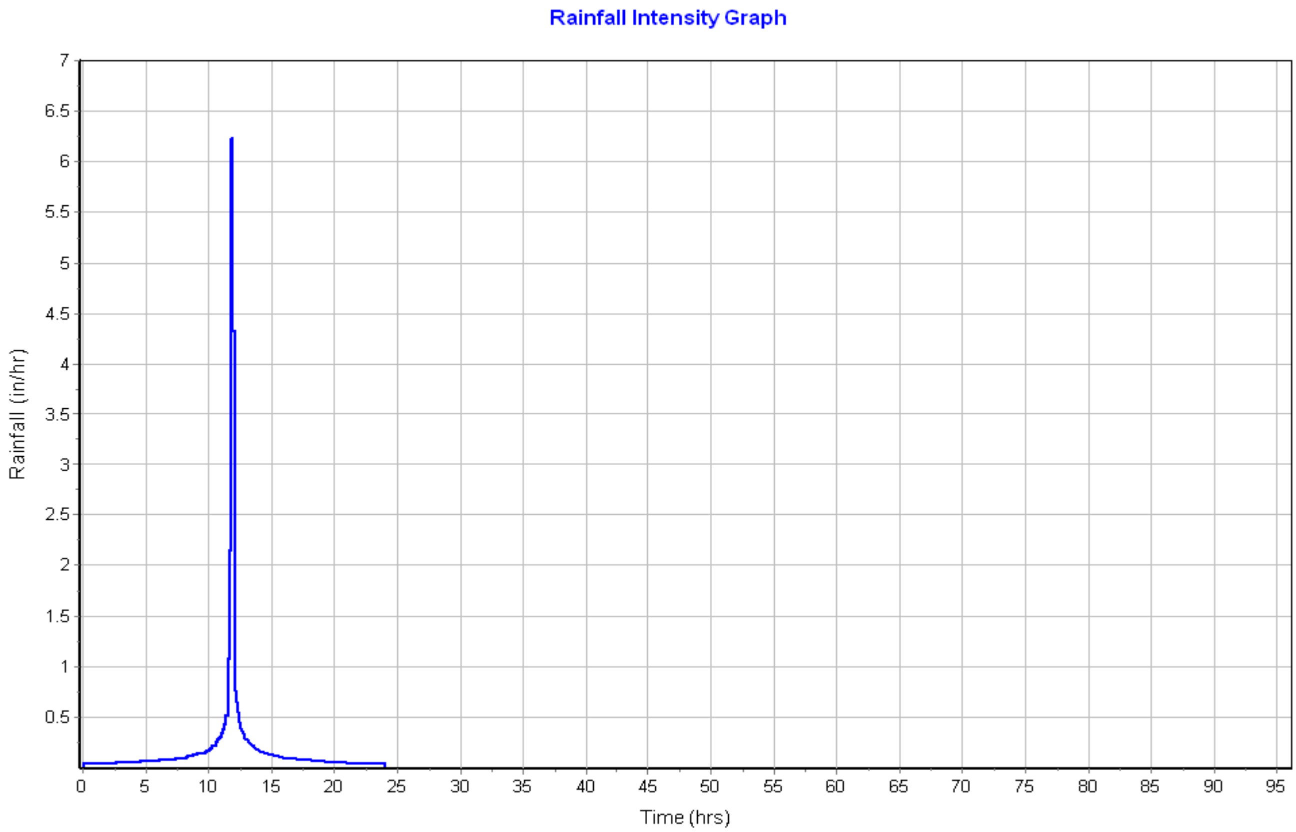
Time of Concentration

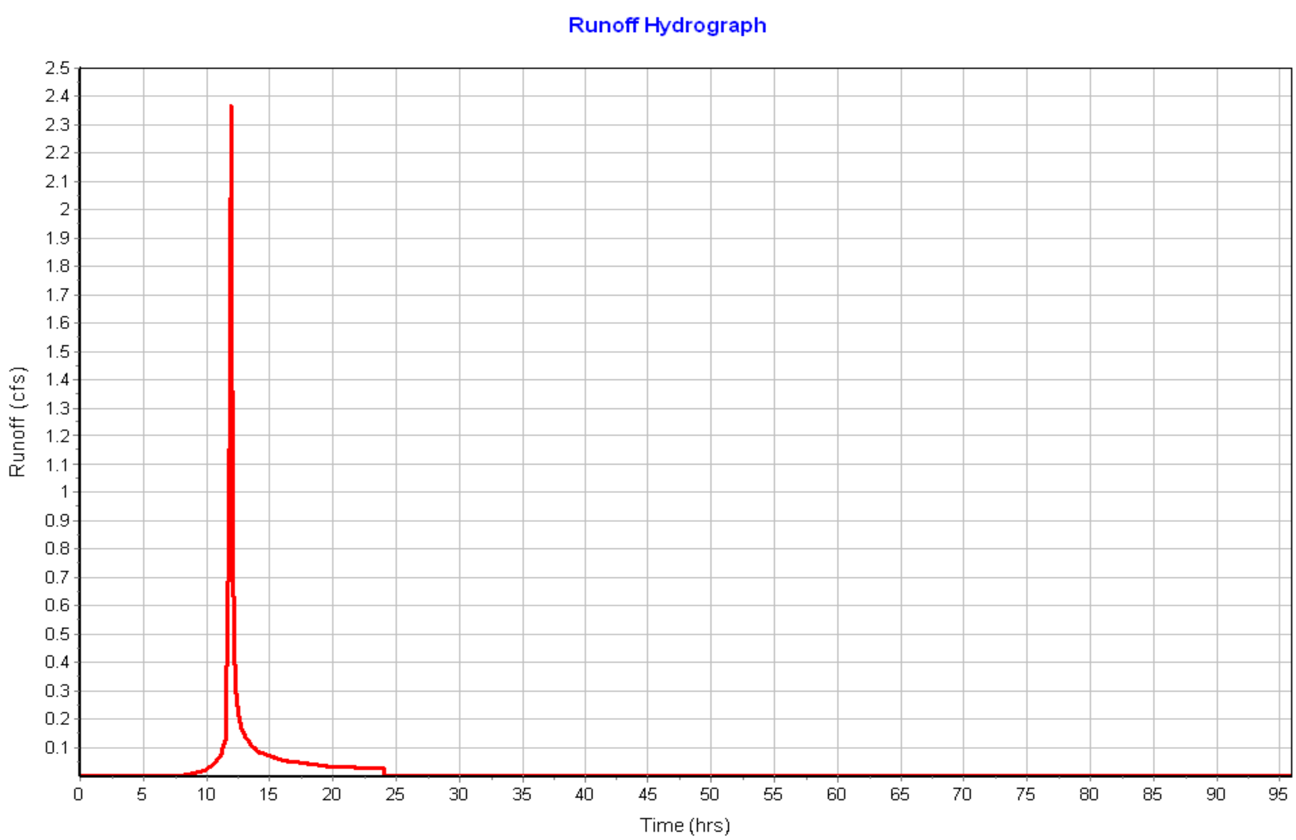
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

Total Rainfall (in) 4.54
Total Runoff (in) 2.50
Peak Runoff (cfs) 2.41
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct





Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

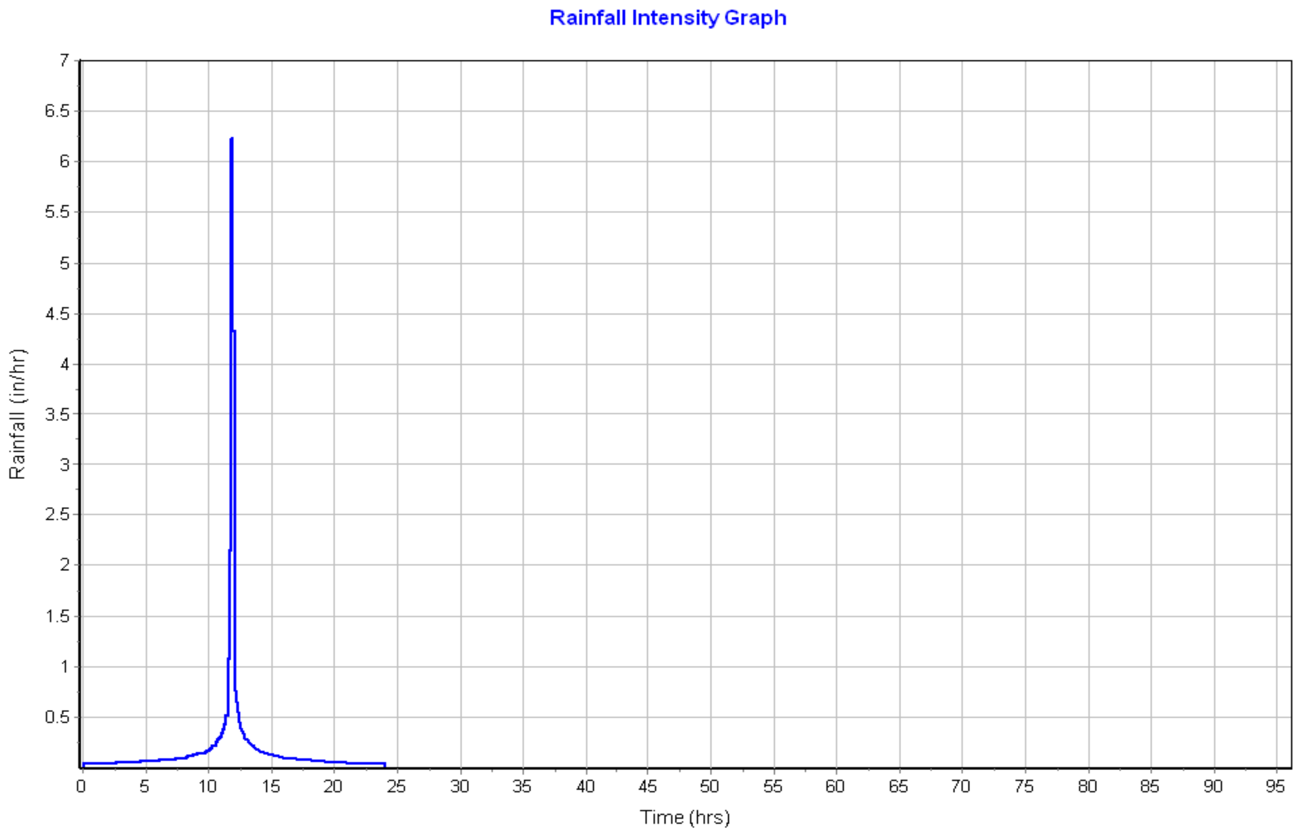
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

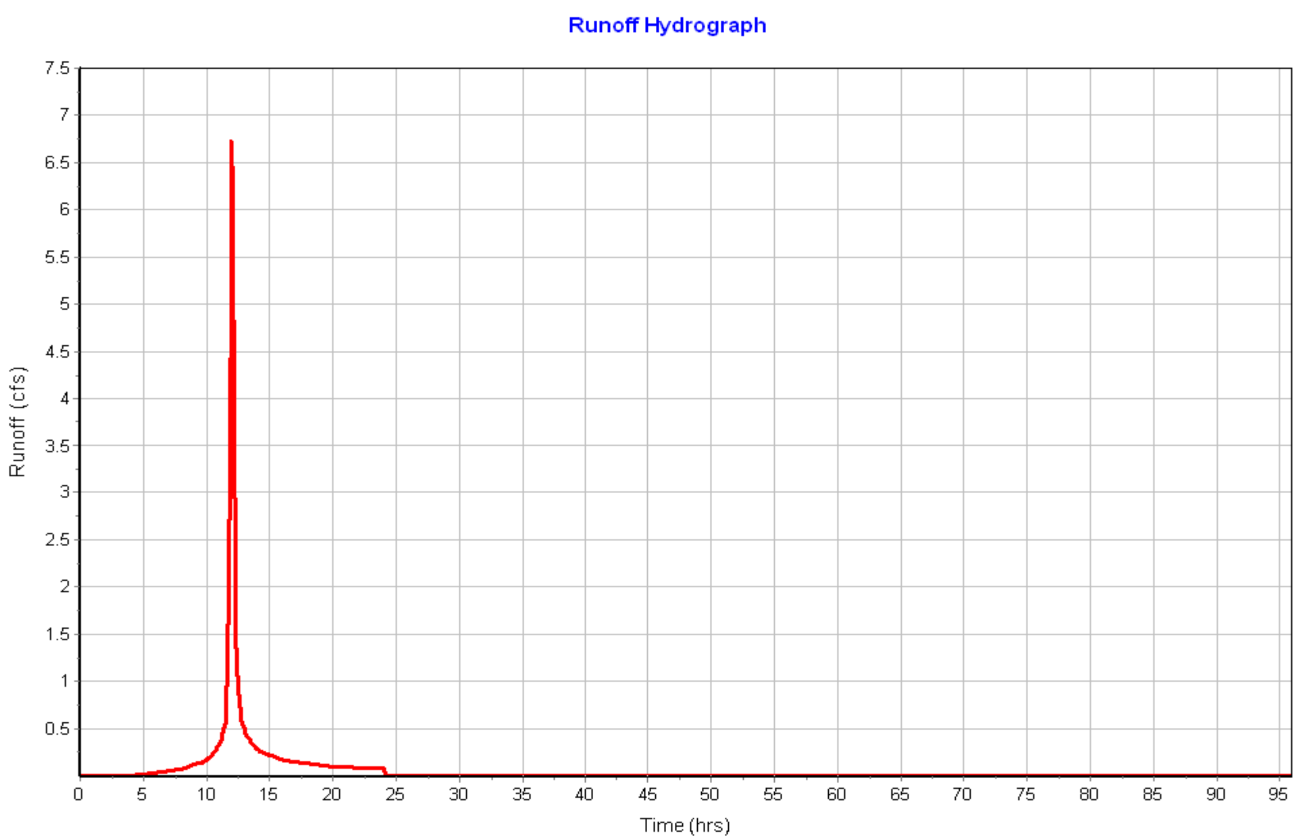
Total TOC (min) 14.51

Subbasin Runoff Results

Total Rainfall (in) 4.54
Total Runoff (in) 3.54
Peak Runoff (cfs) 6.86
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD





Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	10.48	10.48	1062.80	1.25	0.00	0.75	1061.74	0.19	0 12:06	0 00:00	0.00	0.00
Primary-Spillway	1.50	0.00	1059.73	0.53	0.00	2.77	1059.42	0.22	0 13:08	0 00:00	0.00	0.00
South-Ditch	10.75	10.75	1063.49	0.94	0.00	0.06	1062.64	0.09	0 12:03	0 00:00	0.00	0.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Travel Time	Peak Flow Depth	Total Time Surcharged	Froude Number	Reported Condition
(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(min)	(ft)	(min)		
8.00	0 12:06	1.79	1.45	6.45	0.84	0.00		
9.81	0 12:03	16.10	2.20	2.95	0.72	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	1.50	0 13:08	3.96	4.04	0.09	0.48	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

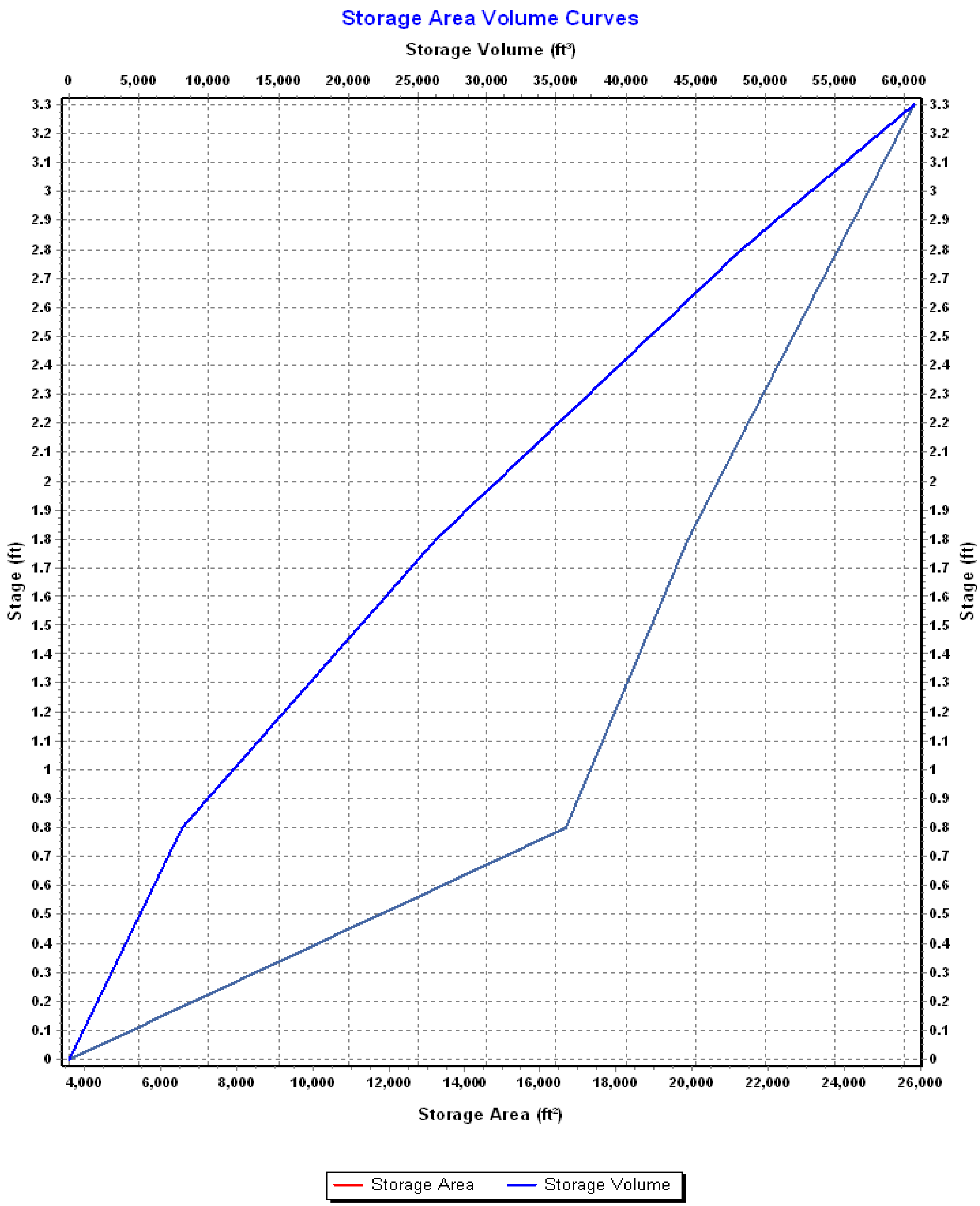
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99


Storage Area Volume Curves
Storage Volume (ft³)
Stage (ft)
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 19.68
Peak Lateral Inflow (cfs) 2.37
Peak Outflow (cfs) 1.50
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1061.40
Max HGL Depth Attained (ft) 2.2
Average HGL Elevation Attained (ft) 1060.97
Average HGL Depth Attained (ft) 1.77
Time of Max HGL Occurrence (days hh:mm) 0 13:08
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Kinematic Wave
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes...	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links..	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-050	Cumulative	inches	Ohio	Union	50	5.22	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	5.22	3.98	25.76	28.25	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

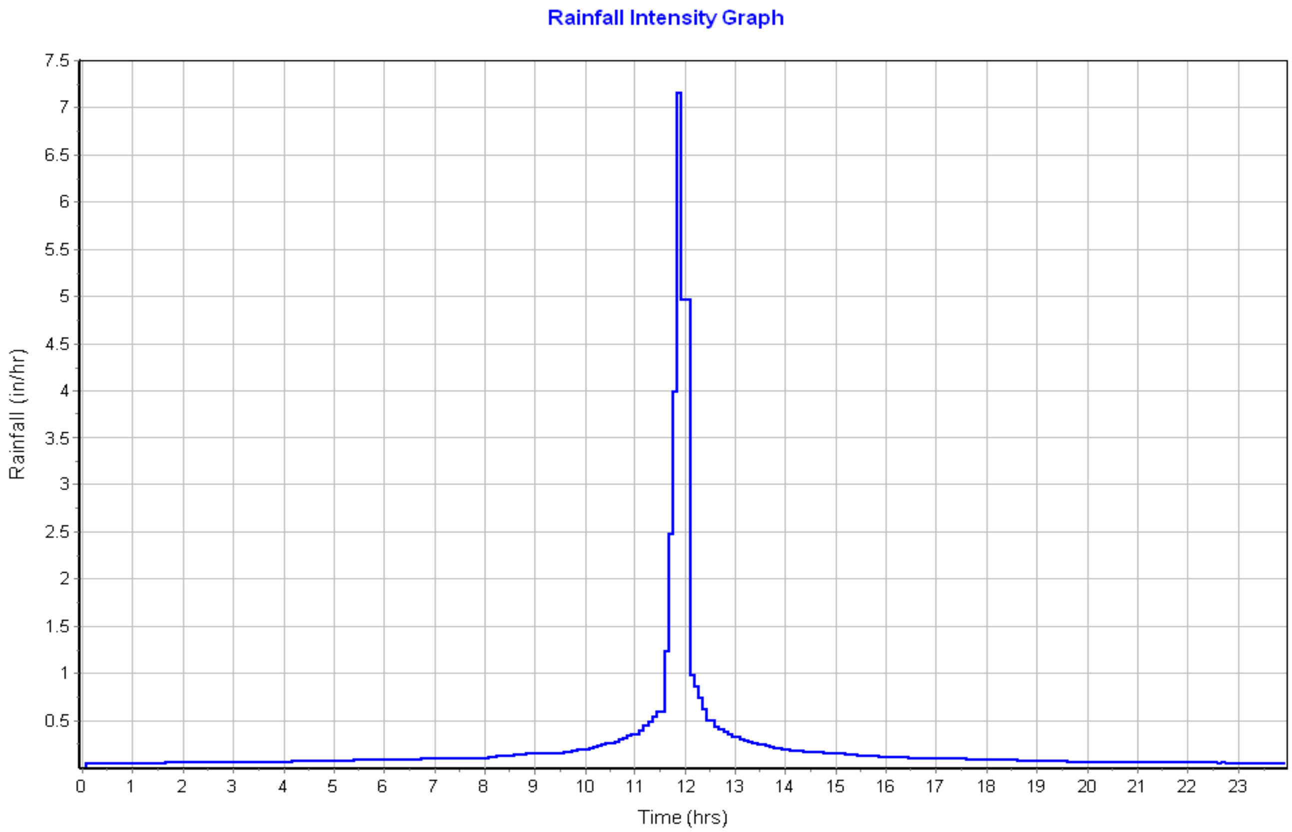
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

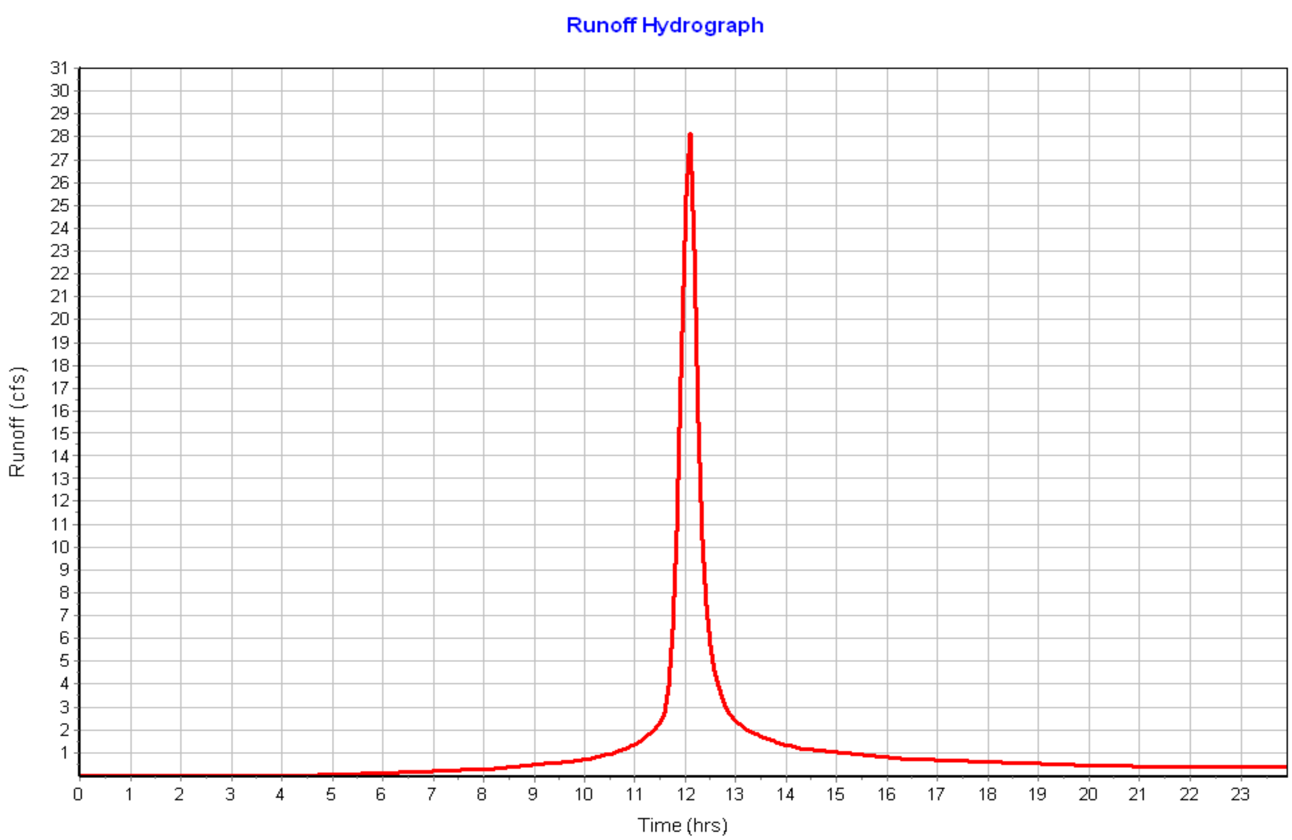
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 5.22
Total Runoff (in) 3.98
Peak Runoff (cfs) 28.25
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Hydrodynamic
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes...	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links...	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-050	Cumulative	inches	Ohio	Union	50	5.22	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	5.22	4.00	8.43	12.52	0 00:06:00
Pad-South	2.18	88.83	5.22	3.97	8.64	12.86	0 00:06:00
Pond-Direct	0.63	80.00	5.22	3.09	1.94	2.97	0 00:06:00
ROAD	1.61	91.00	5.22	4.20	6.76	8.06	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	12.39	1062.90	0.00	0.65	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	3.02	1060.09	0.00	2.41	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	12.77	1063.55	0.00	0.00	0 12:01	0.04	4.00
Access-Road	Outfall	1062.00					7.92	1062.00					
Detention-Basin	Outfall	1058.94					3.02	1059.59					
Emergency-Spillway	Outfall	1058.94					0.00	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	23.32	1061.56				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Total Time Surcharged (min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	3.02	3.96	4.66	0.77	0.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	9.68	1.79	1.55	0.92	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	11.20	16.10	2.30	0.77	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		2.95				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.08				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.00				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

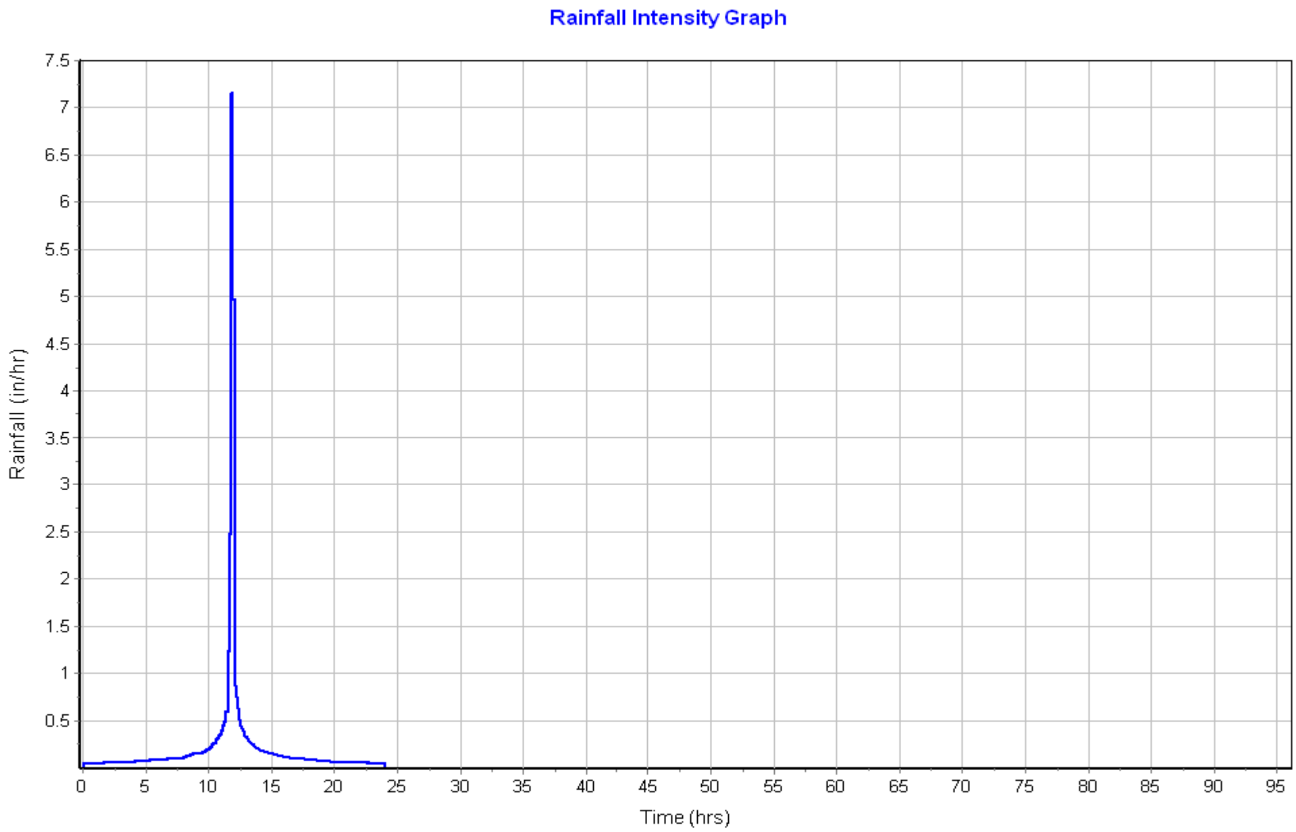
Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

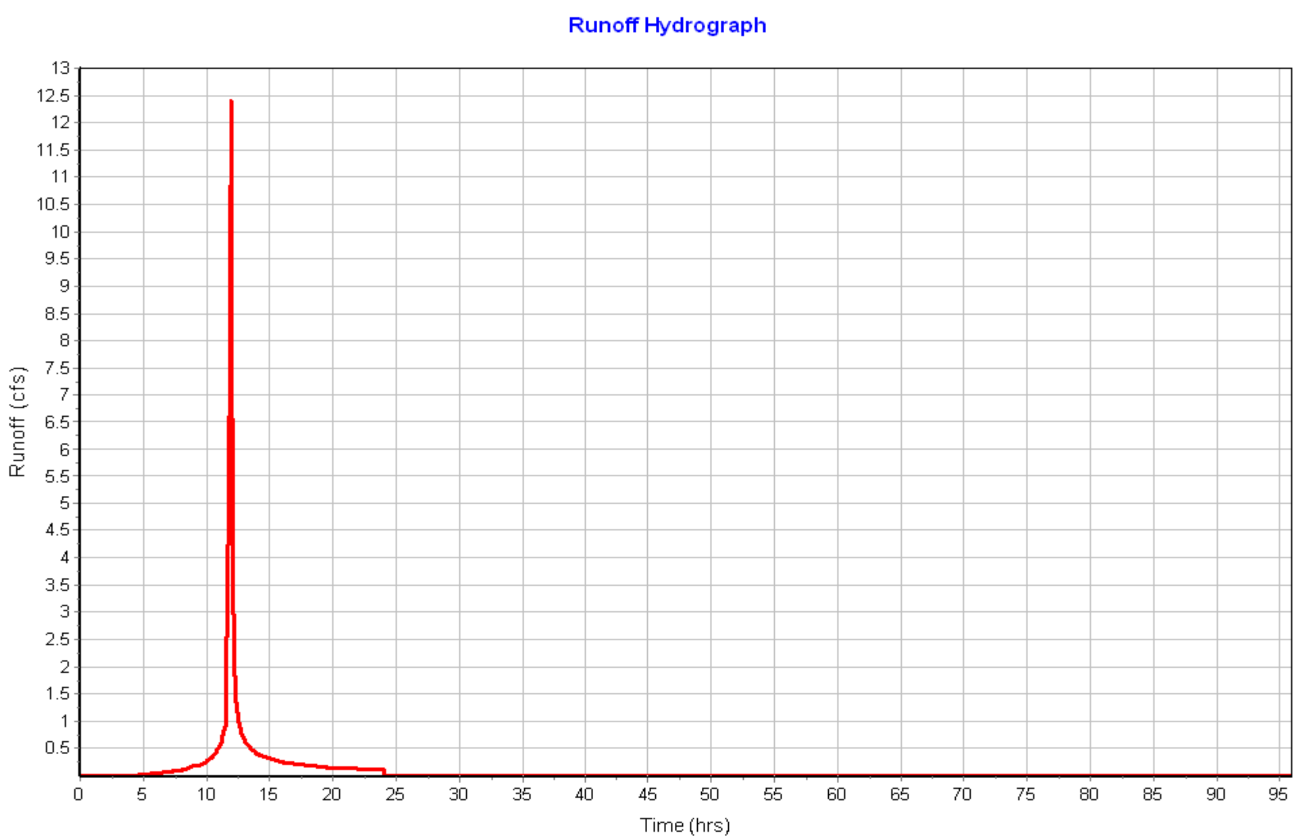
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

Total Rainfall (in) 5.22
Total Runoff (in) 4.00
Peak Runoff (cfs) 12.52
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North





Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

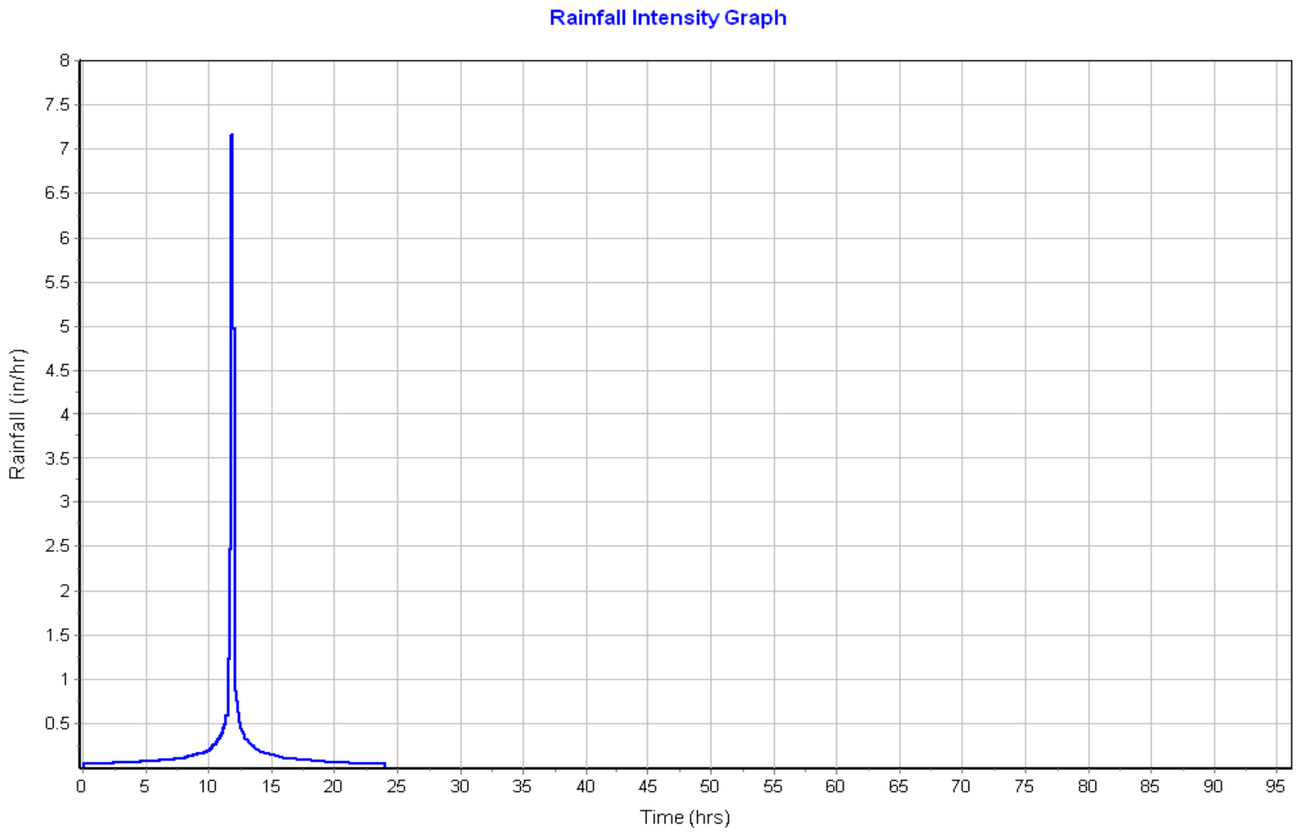
Time of Concentration

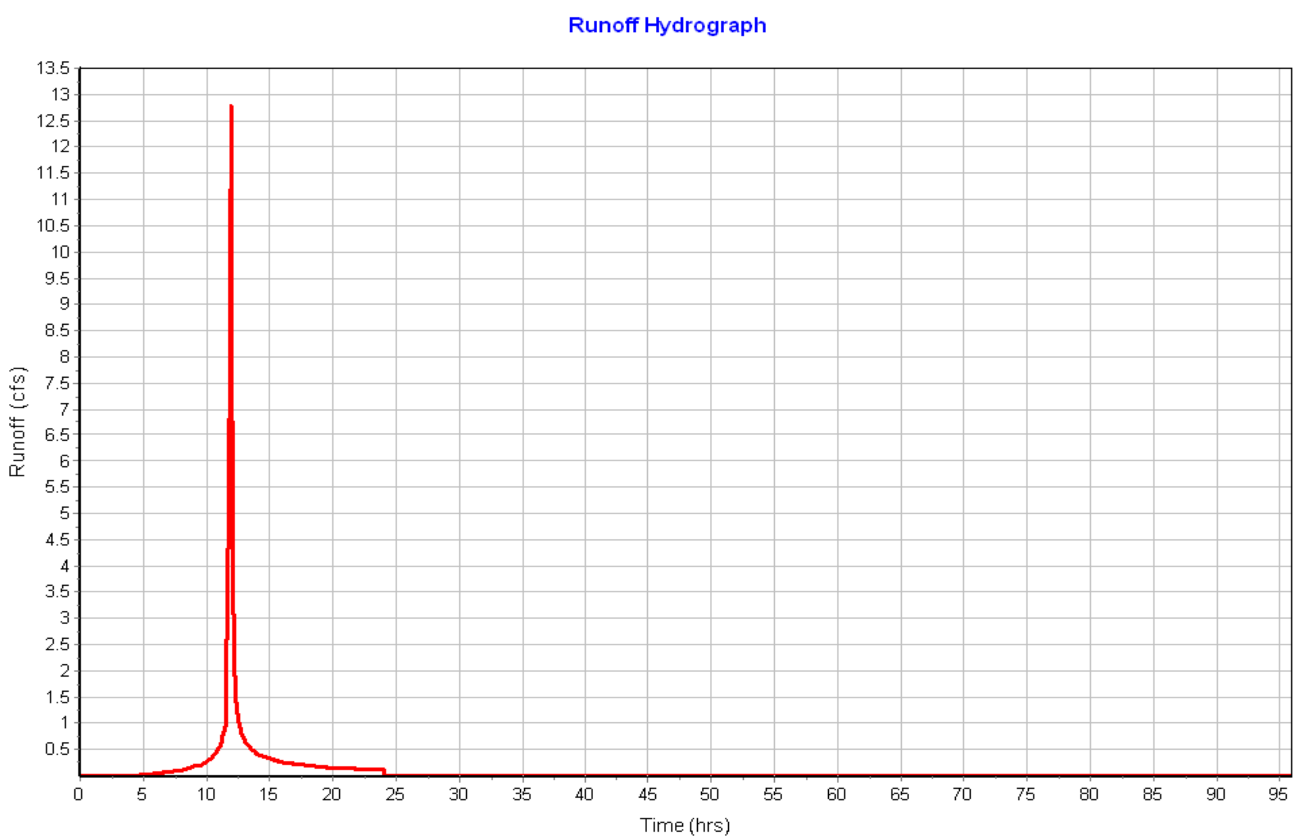
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 5.22
Total Runoff (in) 3.97
Peak Runoff (cfs) 12.86
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

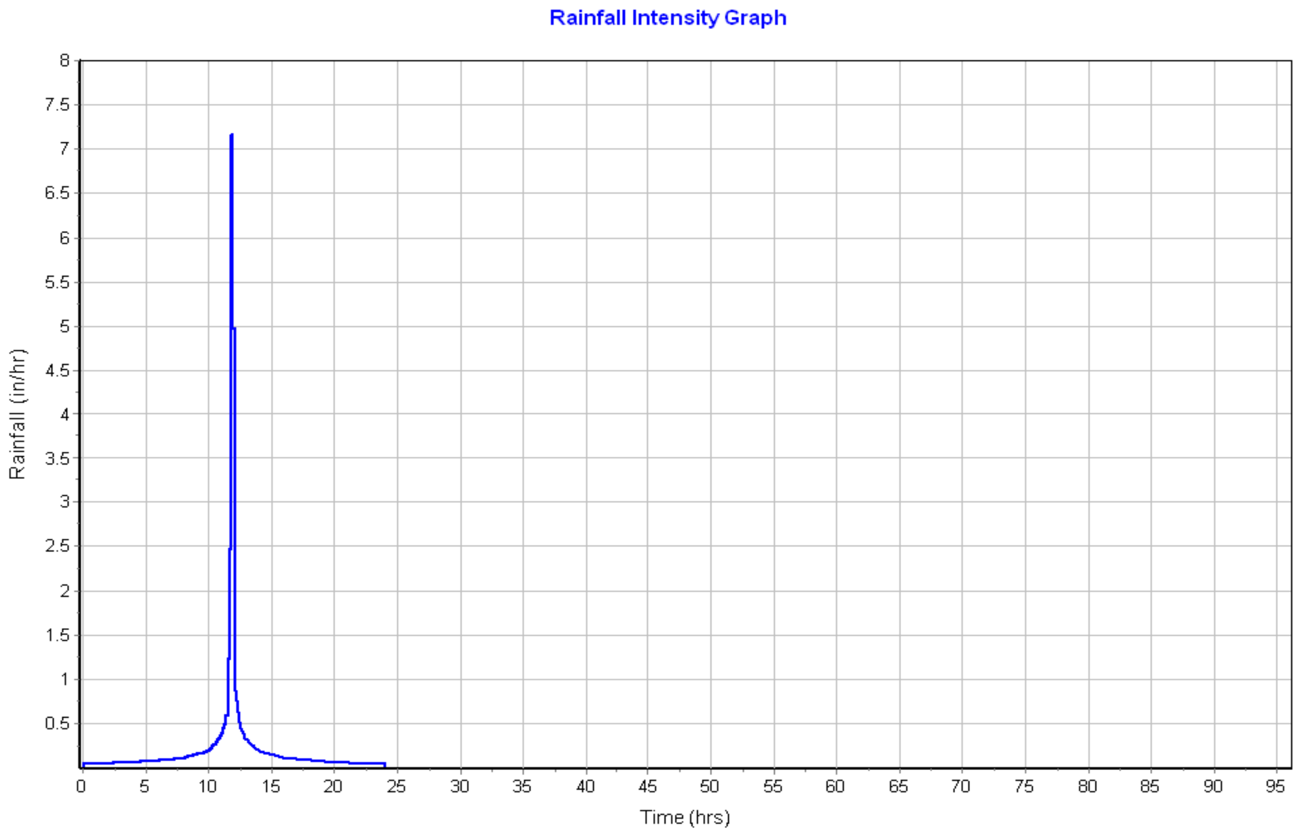
Time of Concentration

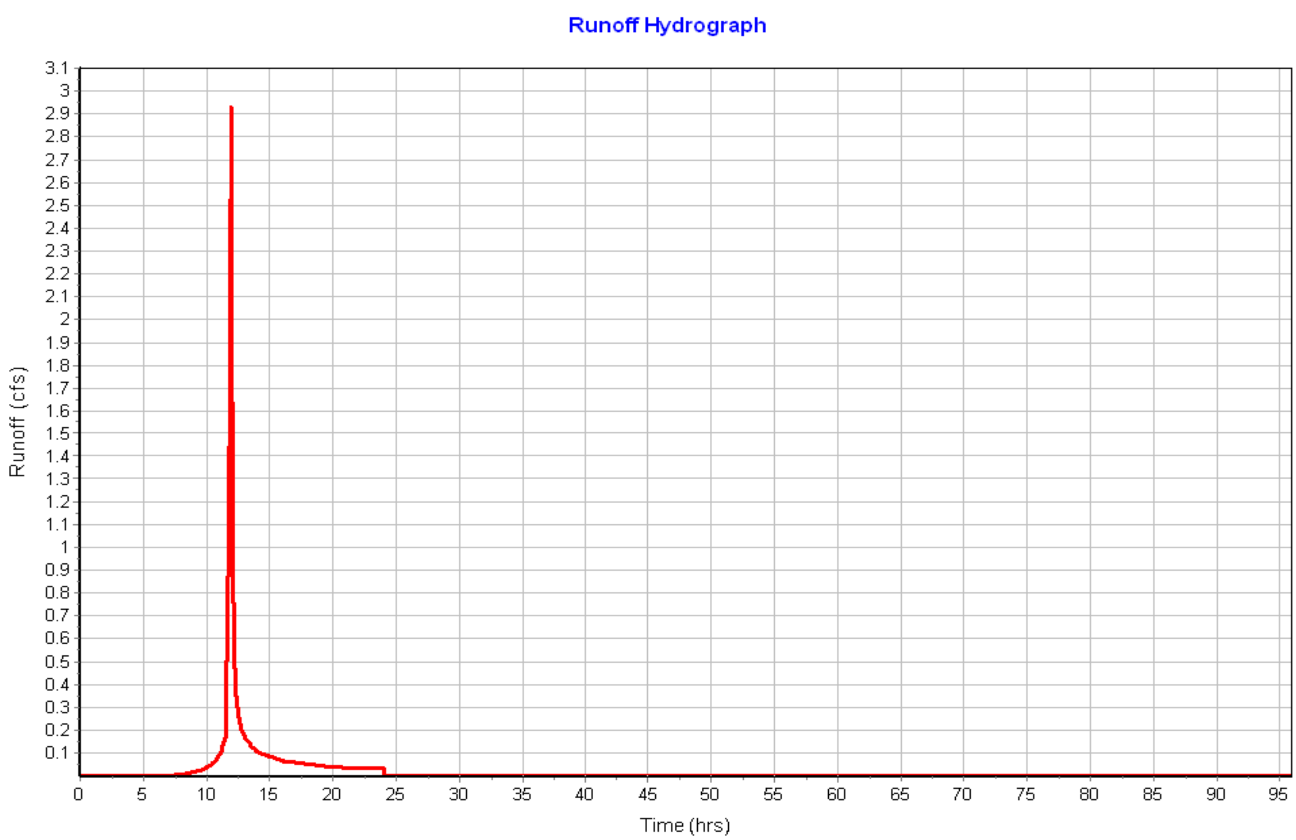
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

Total Rainfall (in) 5.22
Total Runoff (in) 3.09
Peak Runoff (cfs) 2.97
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct





Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

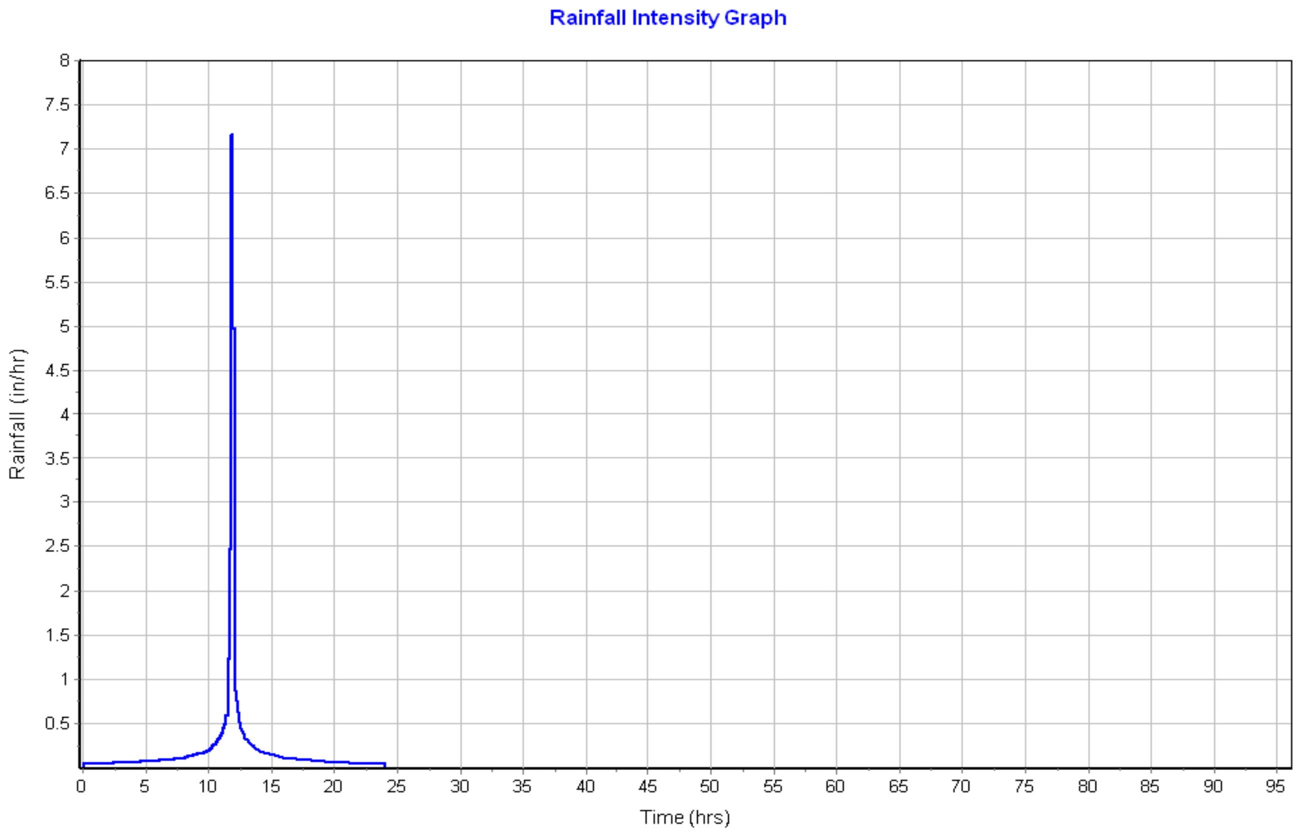
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

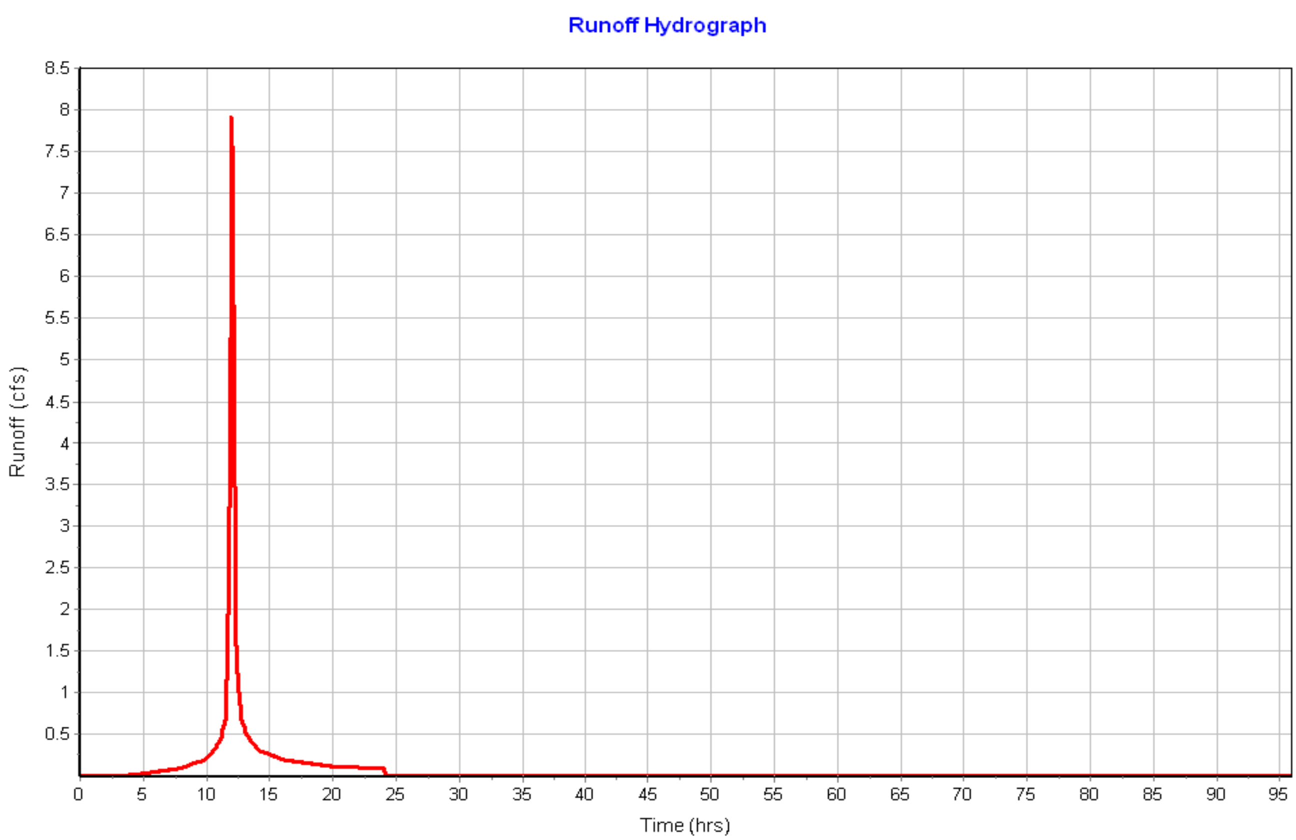
Total TOC (min) 14.51

Subbasin Runoff Results

Total Rainfall (in) 5.22
Total Runoff (in) 4.20
Peak Runoff (cfs) 8.06
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD





Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	12.39	12.39	1062.90	1.35	0.00	0.65	1061.77	0.22	0 12:05	0 00:00	0.00	0.00
Primary-Spillway	3.02	0.00	1060.09	0.89	0.00	2.41	1059.48	0.28	0 12:39	0 00:00	0.00	0.00
South-Ditch	12.77	12.77	1063.55	1.00	0.00	0.00	1062.66	0.11	0 12:01	0 12:01	0.04	4.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow Velocity	Travel Time	Peak Flow Depth	Total Time Surcharged	Froude Number	Reported Condition
(cfs)	(days hh:mm)	(cfs)	(ft/sec)	(min)	(ft)	(min)		
9.68	0 12:06	1.79	1.55	6.03	0.92	0.00		
11.20	0 12:04	16.10	2.30	2.83	0.77	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	3.02	0 12:39	3.96	4.66	0.08	0.77	0.00		Calculated

Storage Nodes

Storage Node : Detention-Pond

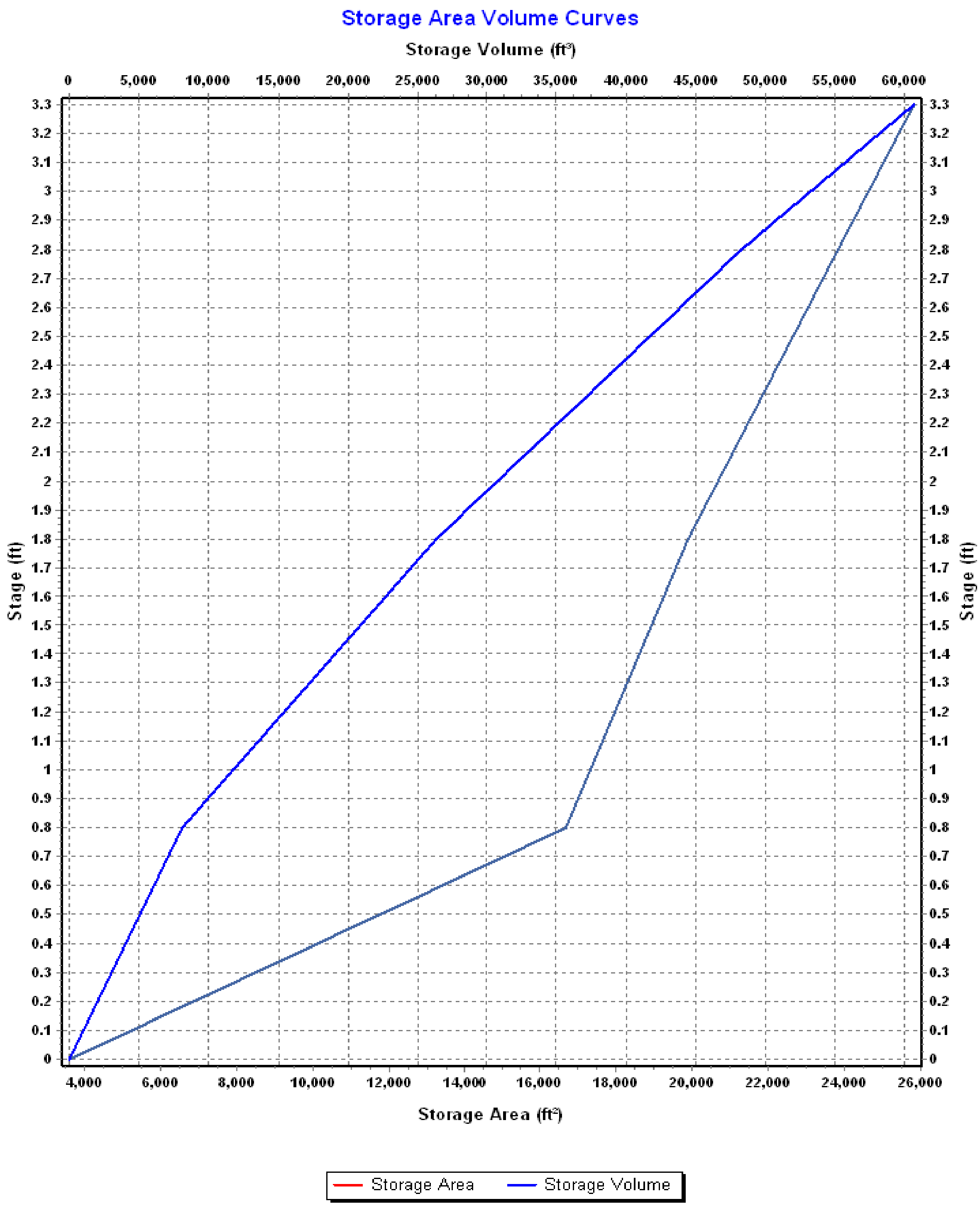
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft^2) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 23.32
Peak Lateral Inflow (cfs) 2.93
Peak Outflow (cfs) 3.02
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1061.56
Max HGL Depth Attained (ft) 2.36
Average HGL Elevation Attained (ft) 1061.02
Average HGL Depth Attained (ft) 1.82
Time of Max HGL Occurrence (days hh:mm) 0 12:38
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

Project Description

File Name .... Pre-Development.SPF

Project Options

Flow Units .... CFS
Elevation Type .... Elevation
Hydrology Method .... SCS TR-55
Time of Concentration (TOC) Method .... SCS TR-55
Link Routing Method .... Kinematic Wave
Enable Overflow Ponding at Nodes .... YES
Skip Steady State Analysis Time Periods .... YES

Analysis Options

Start Analysis On	Jun 08, 2022	00:00:00
End Analysis On	Jun 09, 2022	00:00:00
Start Reporting On	Jun 08, 2022	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	1
Nodes...	1
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links...	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-100	Cumulative	inches	Ohio	Union	100	5.98	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
LOD_Pre-Development	6.48	88.93	5.98	4.71	30.51	33.18	0 00:18:50

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	0.00					0.00	0.00					

Subbasin Hydrology

Subbasin : LOD_Pre-Development

Input Data

Area (ac) 6.48
Weighted Curve Number 88.93
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Row crops, straight row, Good	6.43	D	89.00
> 75% grass cover, Good	0.05	D	80.00
Composite Area & Weighted CN	6.48		88.93

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.56	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.50	0.00	0.00
Velocity (ft/sec) :	0.19	0.00	0.00
Computed Flow Time (min) :	8.85	0.00	0.00

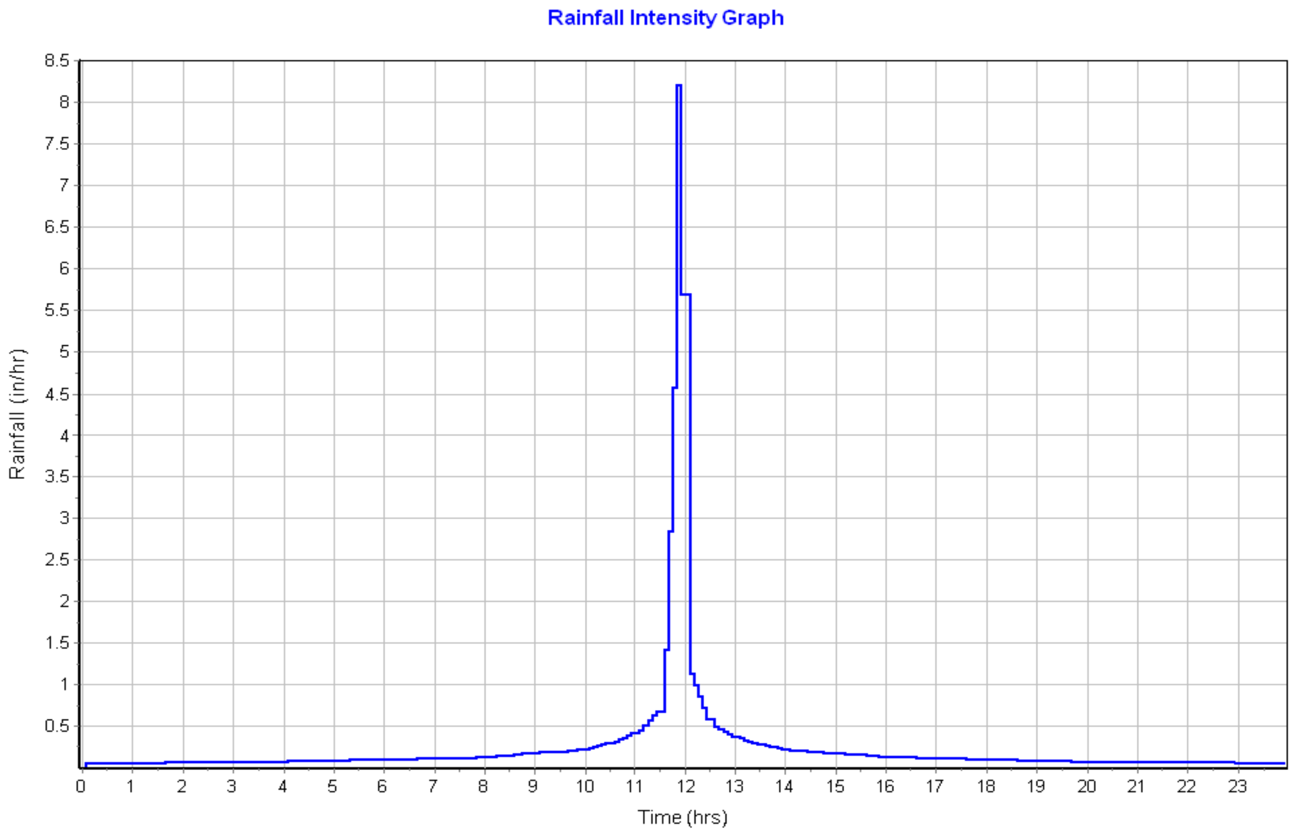
Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	118.5	57.4	224.7
Slope (%) :	1.17	.5	0.41
Surface Type :	Straight rows	Straight rows	Straight rows
Velocity (ft/sec) :	0.97	0.64	0.58
Computed Flow Time (min) :	2.04	1.49	6.46

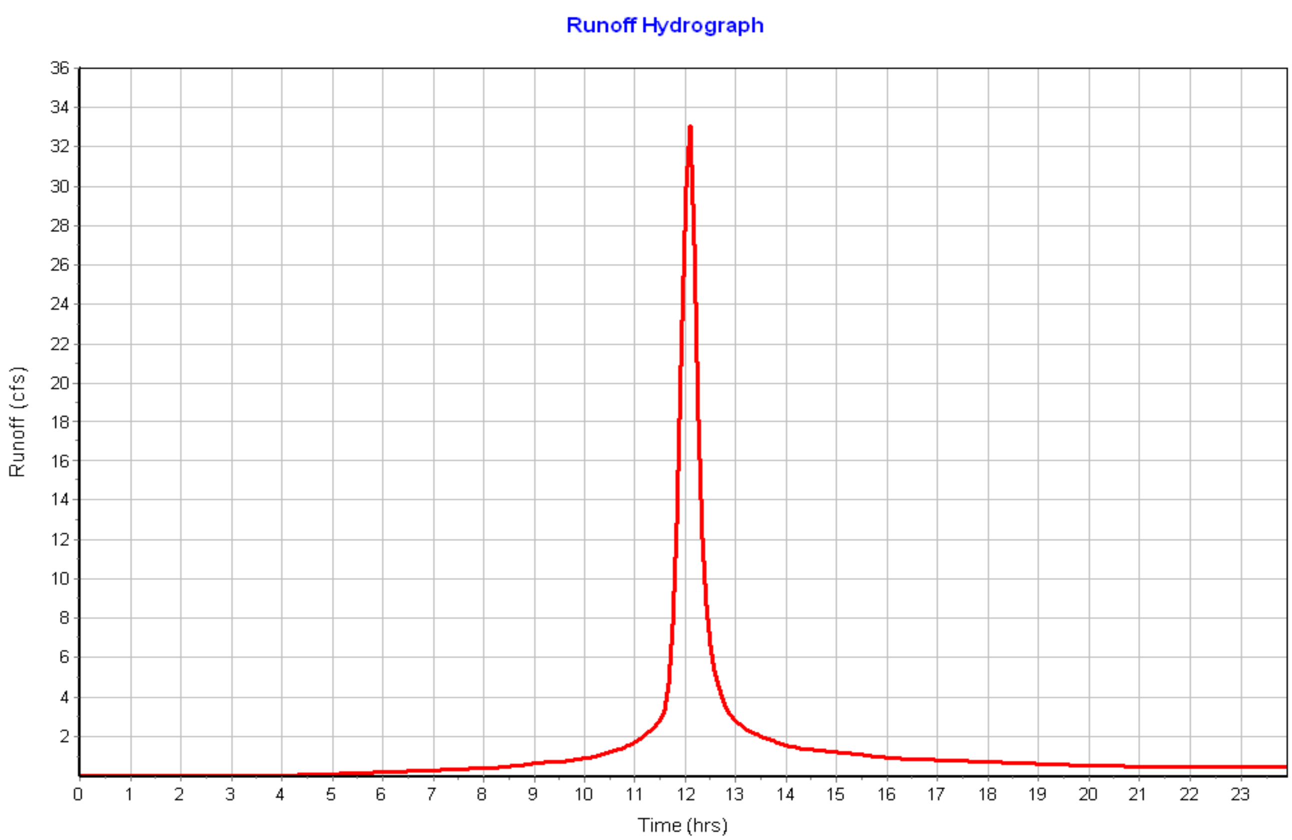
Total TOC (min) 18.84

Subbasin Runoff Results

Total Rainfall (in) 5.98
Total Runoff (in) 4.71
Peak Runoff (cfs) 33.18
Weighted Curve Number 88.93
Time of Concentration (days hh:mm:ss) 0 00:18:50

Subbasin : LOD_Pre-Development





Project Description

File Name .... Post-Development.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Dec 08, 2021	00:00:00
End Analysis On	Dec 12, 2021	00:00:00
Start Reporting On	Dec 08, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins...	4
Nodes..	7
Junctions	3
Outfalls	3
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links..	6
Channels	2
Pipes	1
Pumps	0
Orifices	2
Weirs	1
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01	Time Series	TS-100	Cumulative	inches	Ohio	Union	100	5.98	SCS Type II 24-hr

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Pad-North	2.11	89.12	5.98	4.73	9.98	14.68	0 00:06:00
Pad-South	2.18	88.83	5.98	4.70	10.24	15.09	0 00:06:00
Pond-Direct	0.63	80.00	5.98	3.76	2.37	3.61	0 00:06:00
ROAD	1.61	91.00	5.98	4.94	7.95	9.40	0 00:14:30

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	Junction	1061.55	1063.55	1061.55	1063.55	0.00	14.56	1063.00	0.00	0.55	0 00:00	0.00	0.00
Primary-Spillway	Junction	1059.20	1062.50	1059.20	1062.50	0.00	4.66	1060.85	0.00	1.65	0 00:00	0.00	0.00
South-Ditch	Junction	1062.55	1063.55	1062.55	1063.55	0.00	14.95	1063.55	0.00	0.00	0 12:00	0.30	8.00
Access-Road	Outfall	1062.00					9.23	1062.00					
Detention-Basin	Outfall	1058.94					4.66	1059.94					
Emergency-Spillway	Outfall	1058.94					0.09	1058.94					
Detention-Pond	Storage Node	1059.20	1062.50	1059.20		0.00	25.83	1061.76				0.00	0.00

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Total Time Surcharged (min)
Detention-Basin-Outlet	Pipe	Primary-Spillway	Detention-Basin	21.00	1059.20	1058.94	1.24	12.00	0.0130	4.66	3.96	6.05	1.00	50.00
North-Pad-Ditch	Channel	Detention-Pond	North-Ditch	561.00	1061.55	1060.06	0.27	24.00	0.0250	11.58	1.79	1.65	1.00	0.00
South-Pad-Ditch	Channel	South-Ditch	Detention-Pond	390.00	1062.55	1061.57	0.25	12.00	0.0250	11.20	16.10	2.30	0.77	0.00
Side_Window	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		6.00		4.60				
WQv	Orifice	Detention-Pond	Primary-Spillway		1059.20	1059.20		1.50		0.08				
Emergency-Spillway	Weir	Detention-Pond	Emergency-Spillway		1059.20	1058.94				0.09				

Subbasin Hydrology

Subbasin : Pad-North

Input Data

Area (ac) 2.11
Weighted Curve Number 89.12
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.75	D	91.00
> 75% grass cover, Good	0.36	D	80.00
Composite Area & Weighted CN	2.11		89.12

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

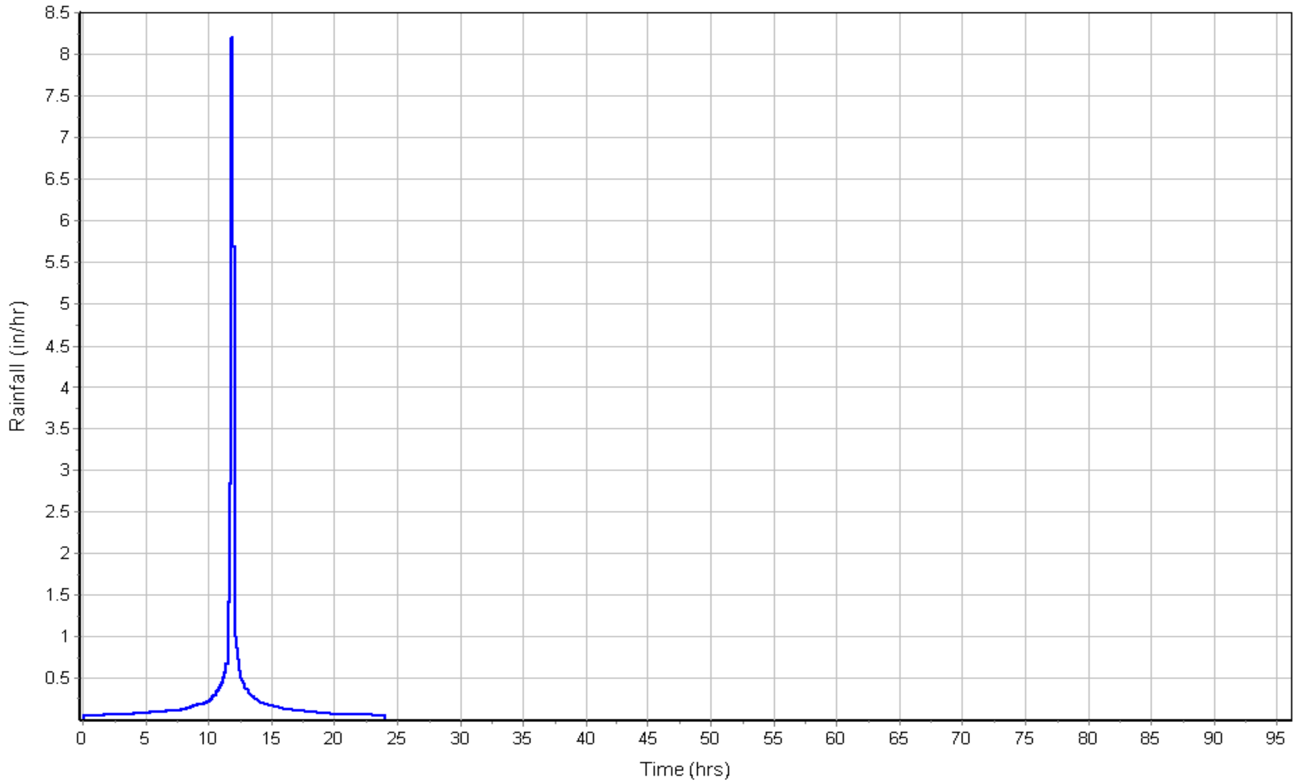
User-Defined TOC override (minutes): 6.0

Subbasin Runoff Results

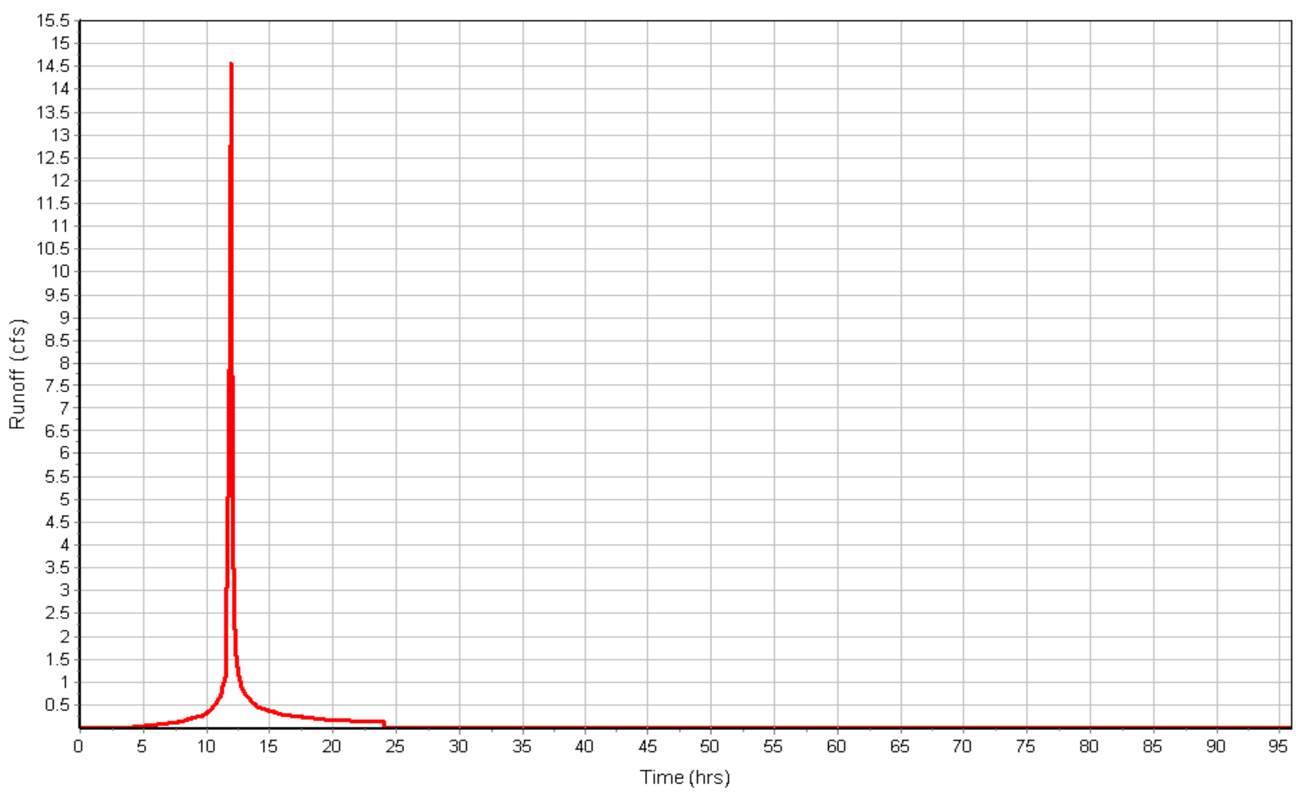
Total Rainfall (in) 5.98
Total Runoff (in) 4.73
Peak Runoff (cfs) 14.68
Weighted Curve Number 89.12
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-North

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Pad-South

Input Data

Area (ac) 2.18
Weighted Curve Number 88.83
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.43	D	80.00
Gravel roads	1.75	D	91.00
Composite Area & Weighted CN	2.18		88.83

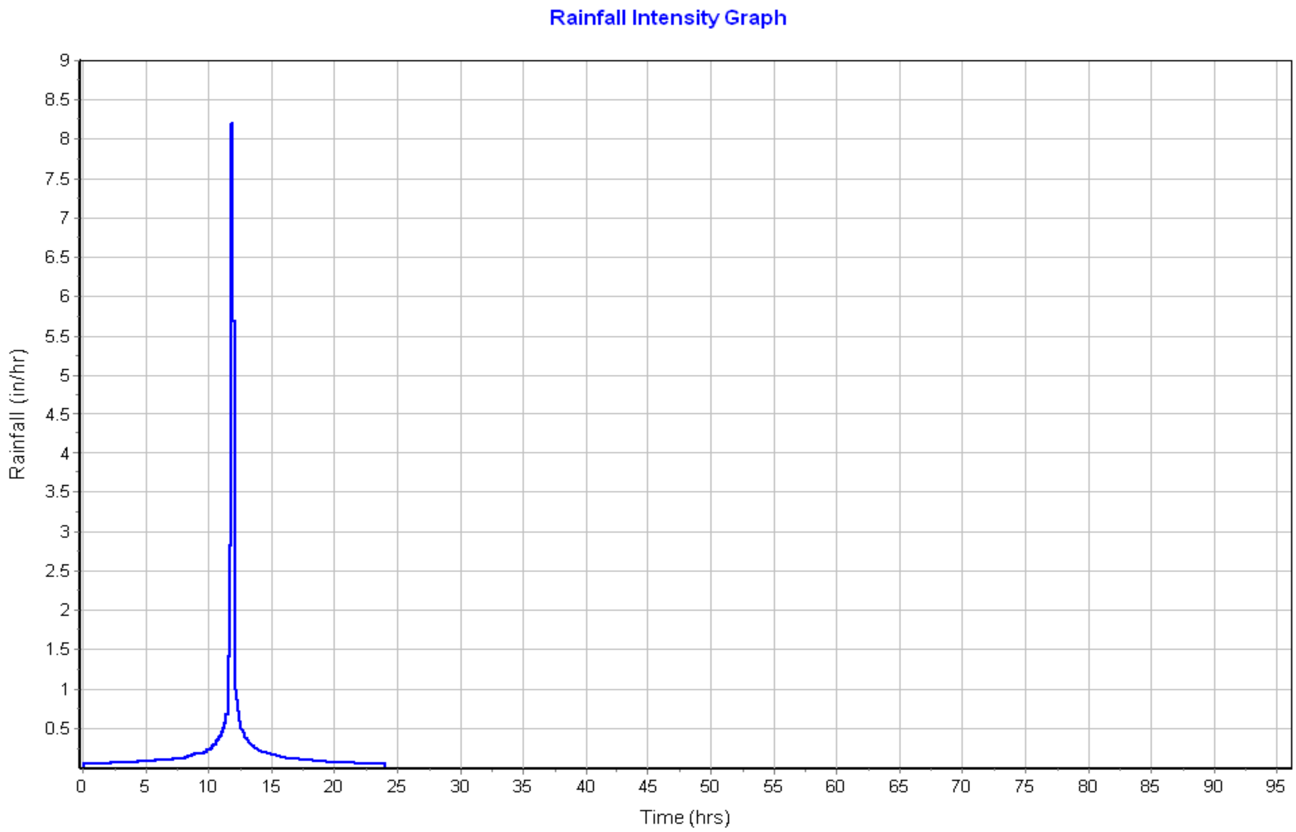
Time of Concentration

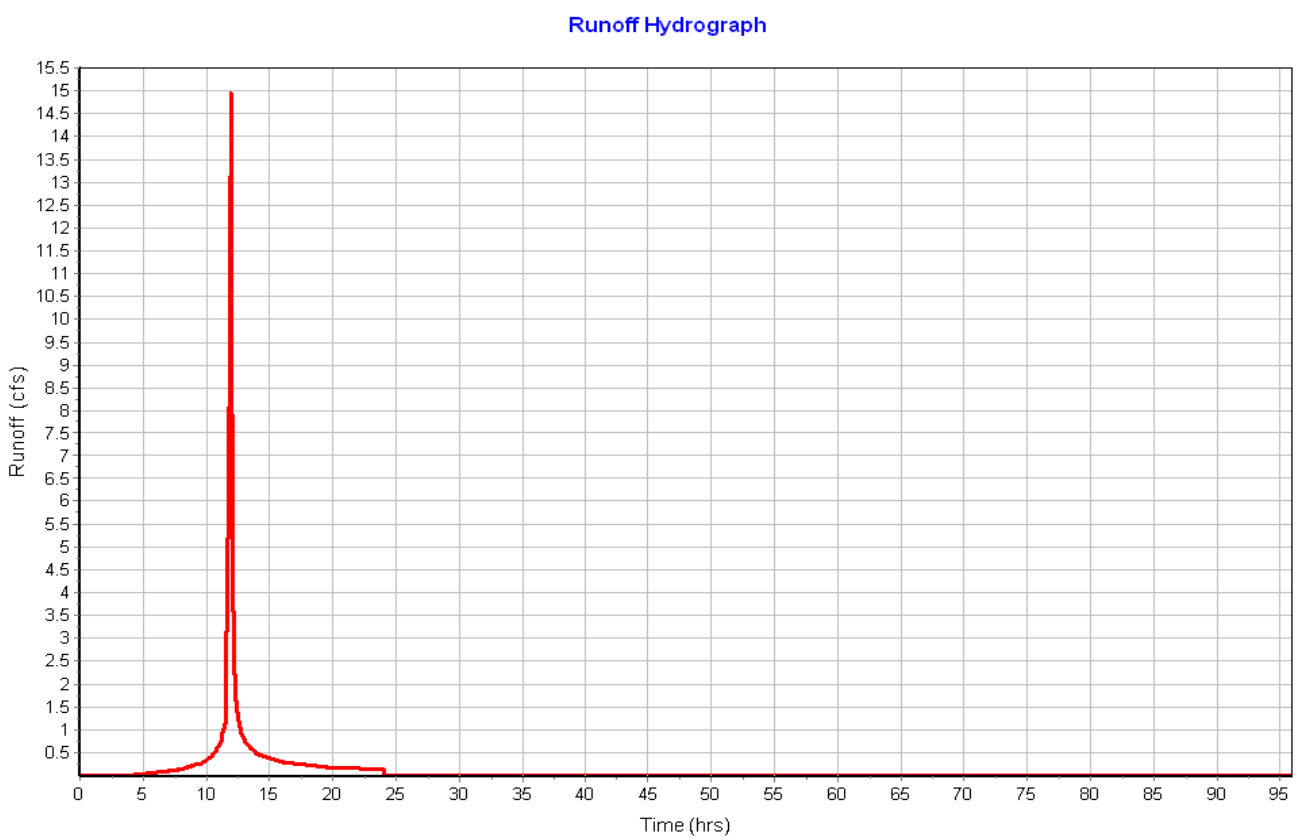
User-Defined TOC override (minutes): 6.00

Subbasin Runoff Results

Total Rainfall (in) 5.98
Total Runoff (in) 4.70
Peak Runoff (cfs) 15.09
Weighted Curve Number 88.83
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pad-South





Subbasin : Pond-Direct

Input Data

Area (ac) 0.63
Weighted Curve Number 80.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
> 75% grass cover, Good	0.63	D	80.00
Composite Area & Weighted CN	0.63		80.00

Time of Concentration

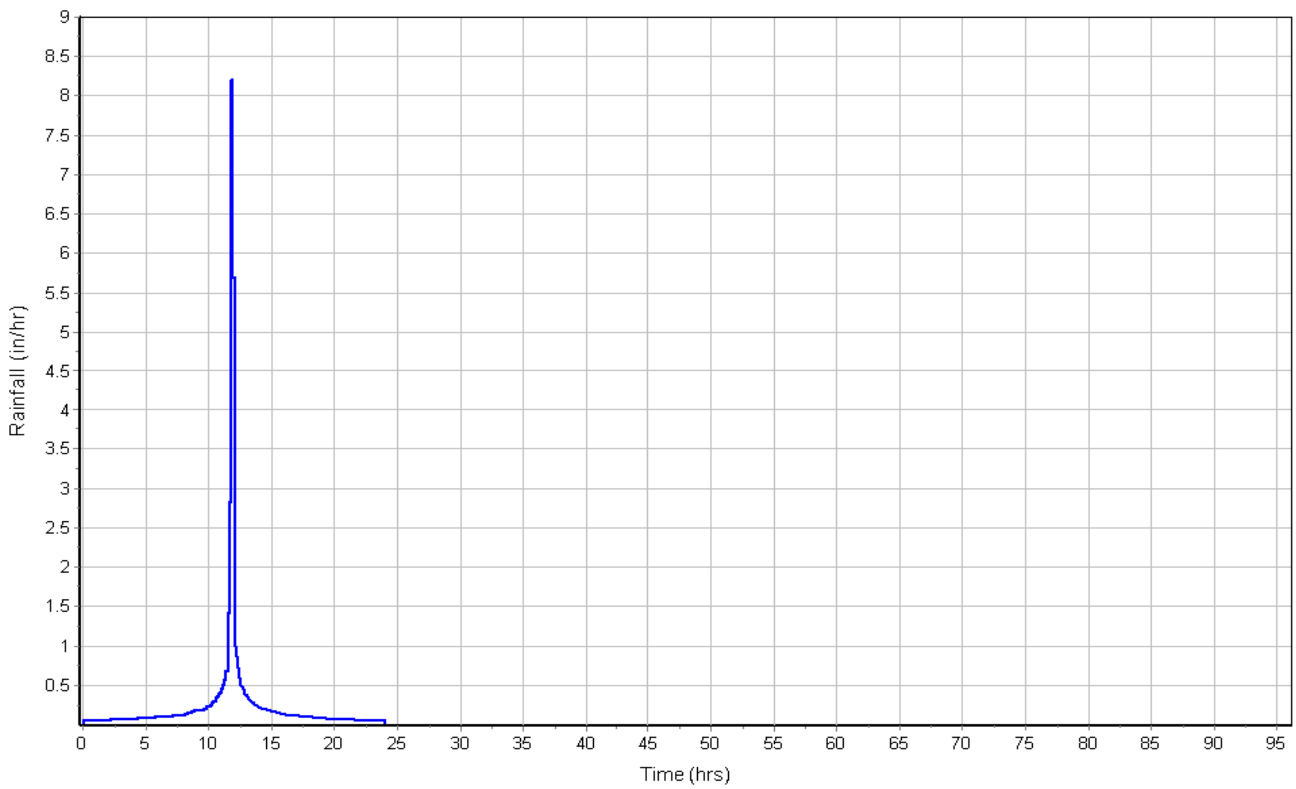
User-Defined TOC override (minutes): 6

Subbasin Runoff Results

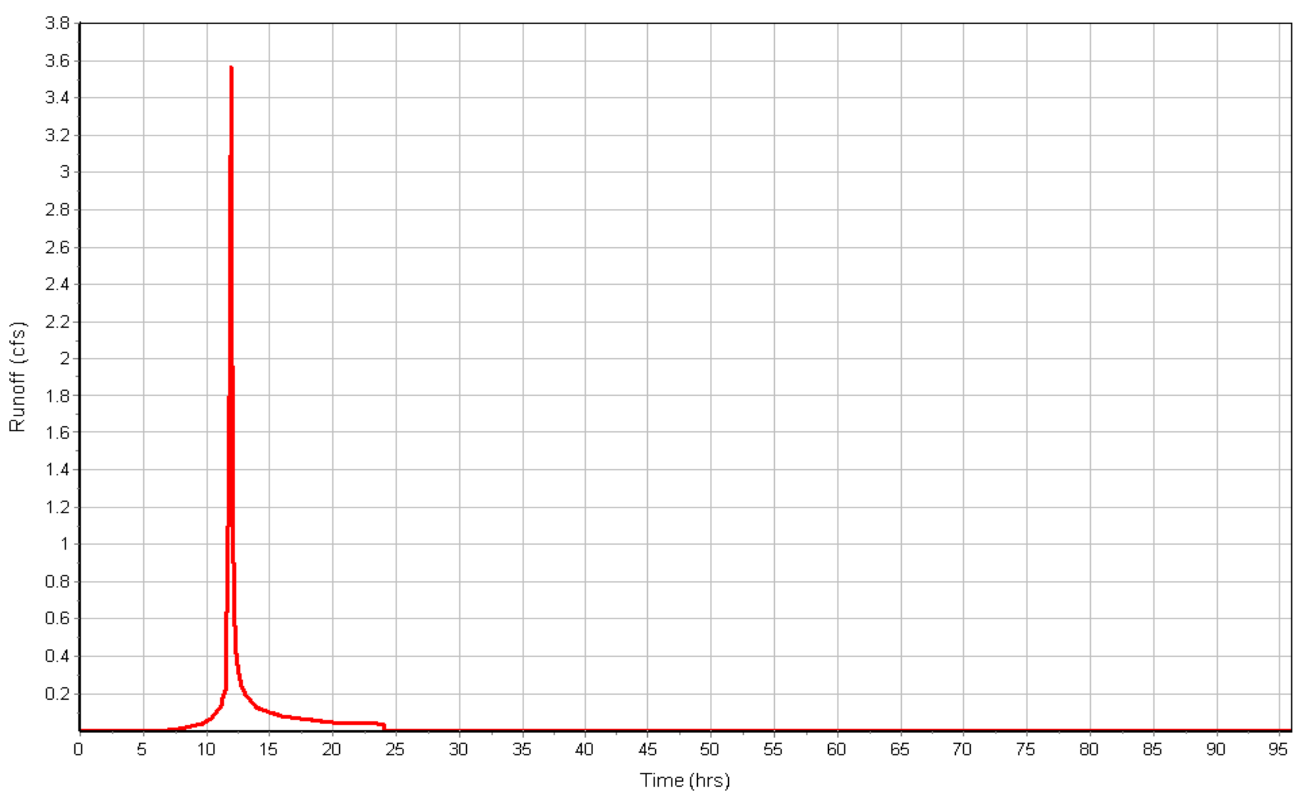
Total Rainfall (in) 5.98
Total Runoff (in) 3.76
Peak Runoff (cfs) 3.61
Weighted Curve Number 80.00
Time of Concentration (days hh:mm:ss) 0 00:06:00

Subbasin : Pond-Direct

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : ROAD

Input Data

Area (ac) 1.61
Weighted Curve Number 91.00
Rain Gage ID .... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	1.61	D	91.00
Composite Area & Weighted CN	1.61		91.00

Time of Concentration

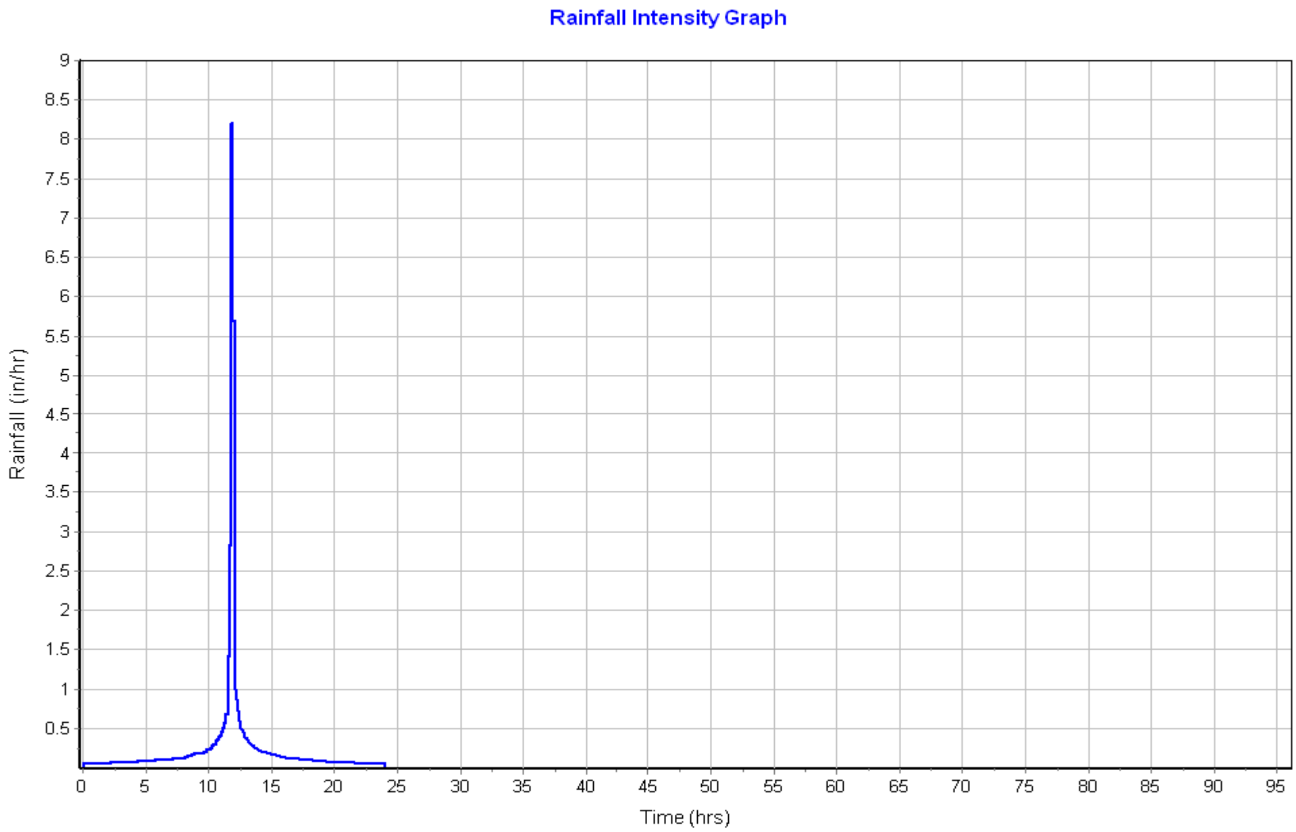
Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.015	0.4	0.00
Flow Length (ft) :	24	50	0.00
Slope (%) :	2	2	0.00
2 yr, 24 hr Rainfall (in) :	2.50	2.50	0.00
Velocity (ft/sec) :	0.71	0.06	0.00
Computed Flow Time (min) :	0.56	13.95	0.00

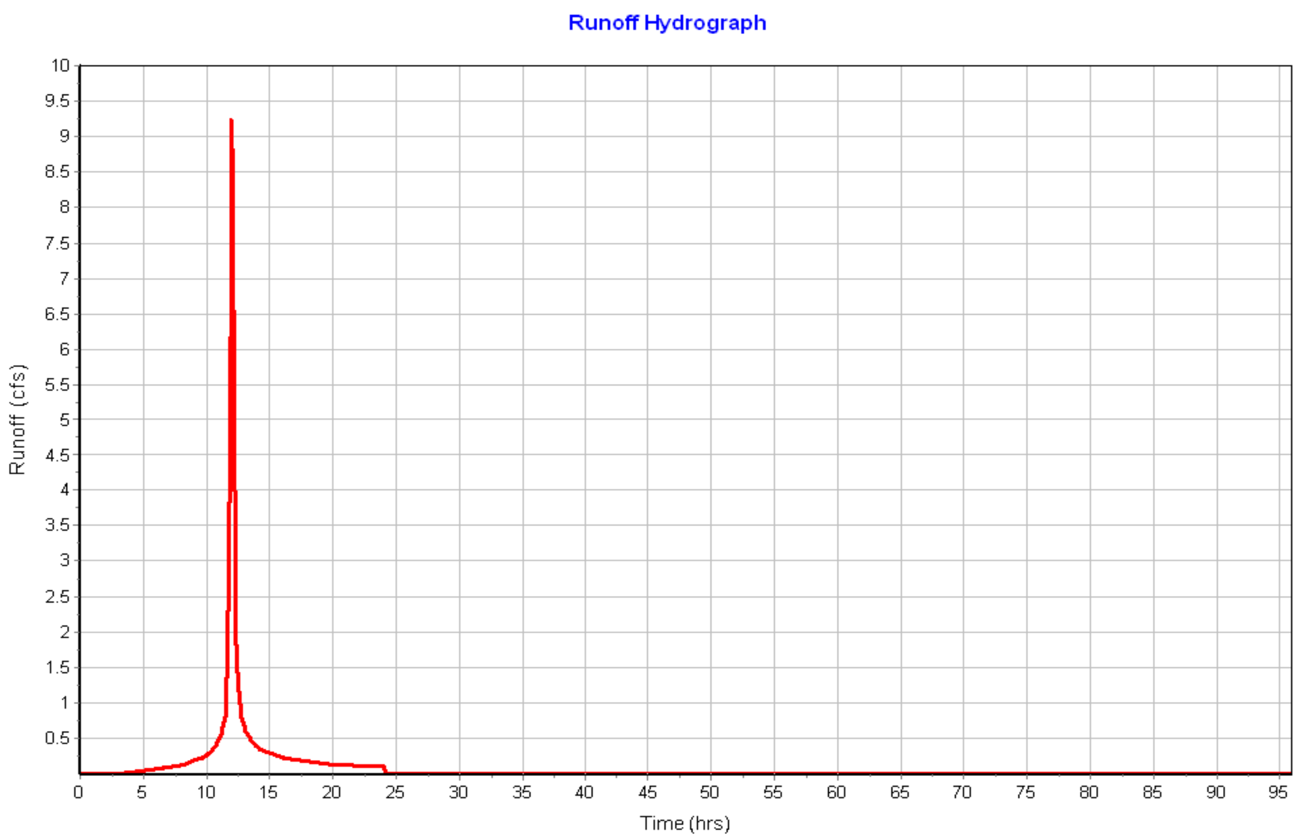
Total TOC (min) 14.51

Subbasin Runoff Results

Total Rainfall (in) 5.98
Total Runoff (in) 4.94
Peak Runoff (cfs) 9.40
Weighted Curve Number 91.00
Time of Concentration (days hh:mm:ss) 0 00:14:31

Subbasin : ROAD





Junction Input

Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
North-Ditch	1061.55	1063.55	2.00	1061.55	0.00	1063.55	0.00	0.00	0.00
Primary-Spillway	1059.20	1062.50	3.30	1059.20	0.00	1062.50	0.00	0.00	0.00
South-Ditch	1062.55	1063.55	1.00	1062.55	0.00	1063.55	0.00	0.00	0.00

Junction Results

Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
North-Ditch	14.56	14.56	1063.00	1.45	0.00	0.55	1061.76	0.21	0 12:05	0 00:00	0.00	0.00
Primary-Spillway	4.66	0.00	1060.85	1.65	0.00	1.65	1059.48	0.28	0 12:30	0 00:00	0.00	0.00
South-Ditch	14.95	14.95	1063.55	1.00	0.00	0.00	1062.66	0.11	0 11:59	0 12:00	0.30	8.00

Channel Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
North-Pad-Ditch	561.00	1061.55	2.35	1060.06	-1.49	1.49	0.2700	Trapezoidal	2.000	16.000	0.0250	0.5000	0.5000	0.0000	0.00	No
South-Pad-Ditch	390.00	1062.55	0.00	1061.57	2.37	0.98	0.2500	Trapezoidal	1.000	10.000	0.0250	0.5000	0.5000	0.0000	0.00	No

Channel Results

Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
11.58	0 12:05	1.79	1.65	5.67	1.00	0.00		
11.20	0 12:06	16.10	2.30	2.83	0.77	0.00		

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
Detention-Basin-Outlet	21.00	1059.20	0.00	1058.94	0.00	0.26	1.2400	CIRCULAR	12.000	12.000	0.0130	0.5000	0.5000	0.0000	0.00	No

Pipe Results

Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Total Time Surcharged (min)	Froude Number	Reported Condition
Detention-Basin-Outlet	4.66	0 12:32	3.96	6.05	0.06	1.00	50.00		SURCHARGED

Storage Nodes

Storage Node : Detention-Pond

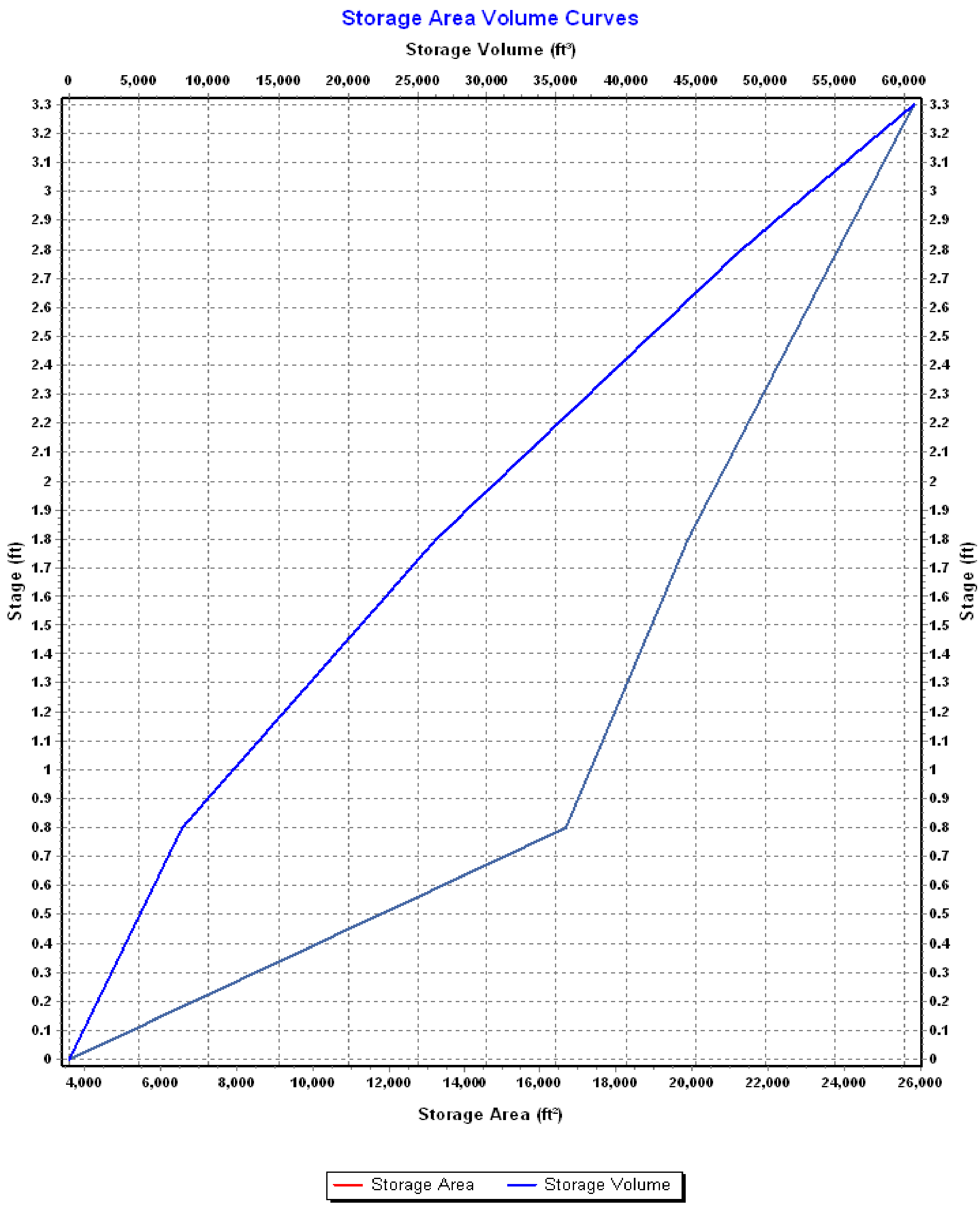
Input Data

Invert Elevation (ft) 1059.20
Max (Rim) Elevation (ft) 1062.50
Max (Rim) Offset (ft) 3.30
Initial Water Elevation (ft) 1059.20
Initial Water Depth (ft) 0.00
Ponded Area (ft²) 0.00
Evaporation Loss 0.00

Storage Area Volume Curves

Storage Curve : Detention Basin

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	3600	0.000
0.8	16669.9851	8107.99
1.8	19899.7351	26392.85
2.8	23809.2088	48247.32
3.3	25825.4817	60655.99



Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
Stage (ft)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
Storage Area (ft²)
Storage Area
Storage Volume

Storage Node : Detention-Pond (continued)

Outflow Weirs

Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
Emergency-Spillway	Trapezoidal	No	1061.75	2.55	20.00	0.75	3.33

Outflow Orifices

Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
Side_Window	Side	Rectangular	No		6.00	36.00	1061.14	0.63
WQv	Side	CIRCULAR	No	1.50			1059.20	0.61

Output Summary Results

Peak Inflow (cfs) 25.83
Peak Lateral Inflow (cfs) 3.56
Peak Outflow (cfs) 4.75
Peak Exfiltration Flow Rate (cfm) 0.00
Max HGL Elevation Attained (ft) 1061.76
Max HGL Depth Attained (ft) 2.56
Average HGL Elevation Attained (ft) 1061.02
Average HGL Depth Attained (ft) 1.82
Time of Max HGL Occurrence (days hh:mm) 0 12:29
Total Exfiltration Volume (1000-ft³) 0.000
Total Flooded Volume (ac-in) 0
Total Time Flooded (min) 0
Total Retention Time (sec) 0.00

NOAA Atlas 14, Volume 2, Version 3
Location name: Danville, Ohio, USA*
Latitude: 40.5312°, Longitude: -82.2588°
Elevation: 1232.83 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.345** (0.314-0.381)	**0.414** (0.376-0.457)	**0.501** (0.454-0.553)	**0.567** (0.512-0.624)	**0.650** (0.585-0.714)	**0.714** (0.640-0.782)	**0.774** (0.691-0.847)	**0.835** (0.743-0.913)	**0.917** (0.810-1.00)	**0.975** (0.858-1.07)
10-min	**0.537** (0.487-0.591)	**0.647** (0.587-0.714)	**0.779** (0.705-0.859)	**0.875** (0.791-0.963)	**0.994** (0.895-1.09)	**1.08** (0.970-1.19)	**1.17** (1.04-1.27)	**1.25** (1.11-1.36)	**1.35** (1.19-1.47)	**1.42** (1.25-1.55)
15-min	**0.658** (0.597-0.725)	**0.791** (0.717-0.873)	**0.957** (0.866-1.06)	**1.08** (0.973-1.19)	**1.23** (1.11-1.35)	**1.34** (1.20-1.47)	**1.45** (1.29-1.58)	**1.55** (1.38-1.70)	**1.68** (1.49-1.84)	**1.78** (1.56-1.94)
30-min	**0.871** (0.790-0.959)	**1.06** (0.960-1.17)	**1.31** (1.19-1.44)	**1.50** (1.35-1.65)	**1.73** (1.56-1.90)	**1.91** (1.72-2.10)	**2.09** (1.87-2.29)	**2.26** (2.01-2.47)	**2.49** (2.20-2.72)	**2.66** (2.34-2.91)
60-min	**1.06** (0.965-1.17)	**1.30** (1.18-1.43)	**1.64** (1.49-1.81)	**1.90** (1.72-2.09)	**2.25** (2.03-2.47)	**2.52** (2.26-2.77)	**2.79** (2.50-3.06)	**3.07** (2.73-3.36)	**3.45** (3.05-3.76)	**3.74** (3.29-4.08)
2-hr	**1.23** (1.11-1.35)	**1.49** (1.36-1.65)	**1.91** (1.74-2.10)	**2.25** (2.03-2.47)	**2.72** (2.46-2.98)	**3.11** (2.80-3.41)	**3.53** (3.16-3.86)	**3.98** (3.54-4.35)	**4.63** (4.08-5.05)	**5.16** (4.53-5.62)
3-hr	**1.31** (1.20-1.45)	**1.60** (1.46-1.77)	**2.04** (1.86-2.26)	**2.40** (2.17-2.65)	**2.92** (2.63-3.21)	**3.35** (3.01-3.67)	**3.82** (3.41-4.17)	**4.31** (3.83-4.71)	**5.04** (4.43-5.49)	**5.65** (4.93-6.15)
6-hr	**1.56** (1.41-1.74)	**1.88** (1.70-2.10)	**2.38** (2.15-2.66)	**2.80** (2.52-3.11)	**3.41** (3.06-3.78)	**3.92** (3.49-4.33)	**4.47** (3.97-4.93)	**5.08** (4.47-5.59)	**5.97** (5.21-6.56)	**6.72** (5.82-7.37)
12-hr	**1.85** (1.68-2.07)	**2.23** (2.02-2.49)	**2.79** (2.52-3.12)	**3.27** (2.94-3.64)	**3.97** (3.56-4.41)	**4.57** (4.07-5.07)	**5.23** (4.63-5.78)	**5.95** (5.23-6.57)	**7.02** (6.09-7.72)	**7.93** (6.83-8.71)
24-hr	**2.14** (1.98-2.33)	**2.57** (2.38-2.80)	**3.19** (2.96-3.48)	**3.73** (3.44-4.06)	**4.54** (4.15-4.92)	**5.22** (4.75-5.66)	**5.98** (5.39-6.47)	**6.81** (6.08-7.38)	**8.06** (7.09-8.72)	**9.12** (7.92-9.89)
2-day	**2.47** (2.28-2.69)	**2.95** (2.73-3.22)	**3.64** (3.36-3.96)	**4.22** (3.89-4.60)	**5.08** (4.64-5.52)	**5.81** (5.28-6.31)	**6.61** (5.95-7.17)	**7.47** (6.67-8.12)	**8.75** (7.68-9.54)	**9.82** (8.51-10.7)
3-day	**2.65** (2.46-2.87)	**3.17** (2.94-3.43)	**3.88** (3.60-4.21)	**4.49** (4.15-4.86)	**5.36** (4.93-5.80)	**6.10** (5.57-6.59)	**6.89** (6.26-7.45)	**7.75** (6.97-8.40)	**9.01** (7.98-9.79)	**10.1** (8.80-11.0)
4-day	**2.84** (2.65-3.06)	**3.38** (3.16-3.65)	**4.13** (3.85-4.45)	**4.75** (4.42-5.12)	**5.64** (5.22-6.08)	**6.39** (5.87-6.88)	**7.18** (6.56-7.74)	**8.03** (7.27-8.67)	**9.27** (8.28-10.0)	**10.3** (9.09-11.2)
7-day	**3.43** (3.22-3.67)	**4.08** (3.82-4.37)	**4.93** (4.62-5.28)	**5.65** (5.27-6.05)	**6.67** (6.19-7.13)	**7.50** (6.94-8.04)	**8.38** (7.71-8.99)	**9.32** (8.51-10.0)	**10.7** (9.61-11.5)	**11.7** (10.5-12.7)
10-day	**3.94** (3.70-4.19)	**4.67** (4.39-4.97)	**5.59** (5.25-5.96)	**6.34** (5.94-6.74)	**7.37** (6.88-7.84)	**8.21** (7.62-8.73)	**9.06** (8.38-9.66)	**9.95** (9.15-10.6)	**11.2** (10.2-12.0)	**12.2** (11.0-13.1)
20-day	**5.47** (5.16-5.81)	**6.47** (6.10-6.86)	**7.62** (7.18-8.08)	**8.52** (8.02-9.04)	**9.72** (9.13-10.3)	**10.6** (9.97-11.3)	**11.6** (10.8-12.3)	**12.5** (11.6-13.3)	**13.7** (12.6-14.6)	**14.6** (13.4-15.6)
30-day	**6.87** (6.49-7.27)	**8.09** (7.64-8.56)	**9.42** (8.88-9.97)	**10.4** (9.83-11.0)	**11.8** (11.0-12.4)	**12.8** (12.0-13.5)	**13.7** (12.8-14.6)	**14.7** (13.7-15.6)	**15.9** (14.7-16.9)	**16.8** (15.5-17.9)
45-day	**8.78** (8.33-9.26)	**10.3** (9.78-10.9)	**11.8** (11.2-12.5)	**13.0** (12.3-13.7)	**14.5** (13.7-15.2)	**15.5** (14.7-16.4)	**16.6** (15.6-17.5)	**17.5** (16.4-18.5)	**18.7** (17.5-19.8)	**19.6** (18.2-20.8)
60-day	**10.6** (10.1-11.2)	**12.4** (11.8-13.1)	**14.2** (13.4-14.9)	**15.4** (14.6-16.3)	**17.0** (16.2-18.0)	**18.2** (17.2-19.2)	**19.3** (18.2-20.3)	**20.3** (19.1-21.4)	**21.5** (20.1-22.7)	**22.3** (20.9-23.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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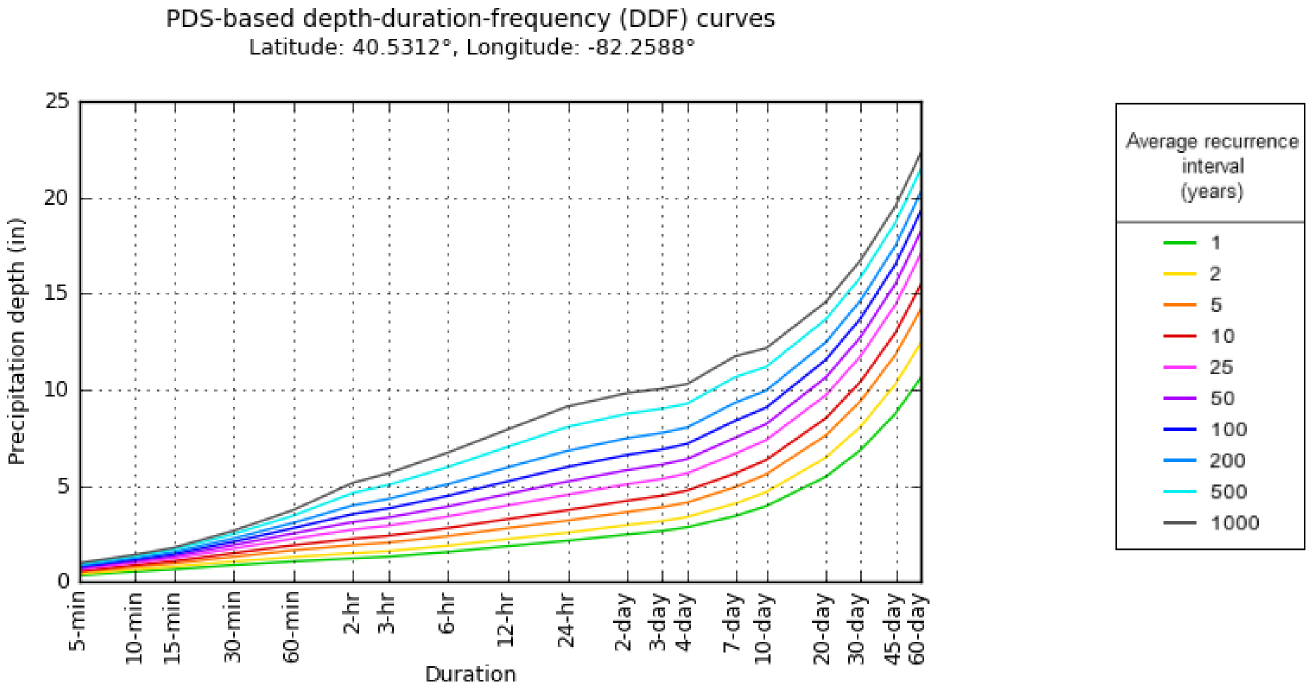
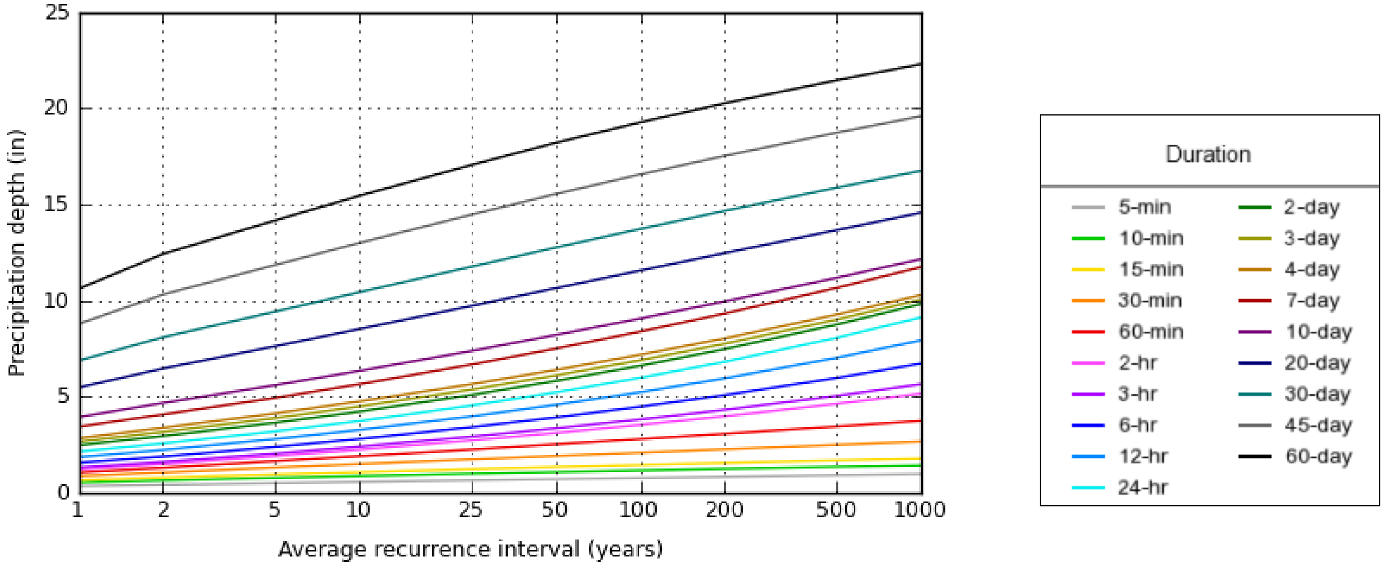
PF graphical





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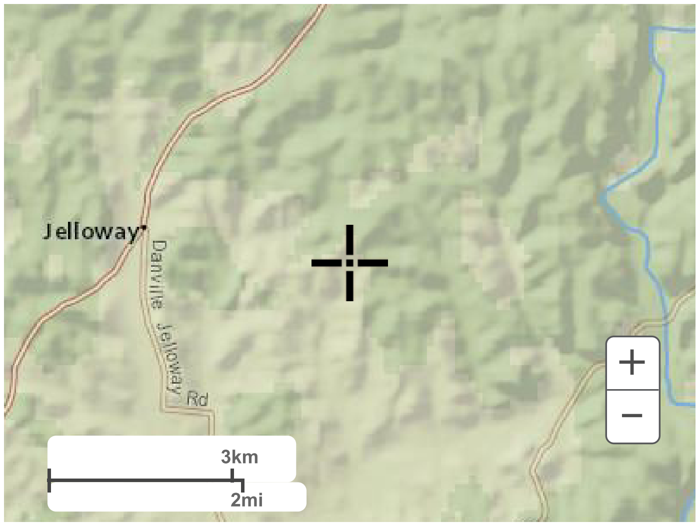
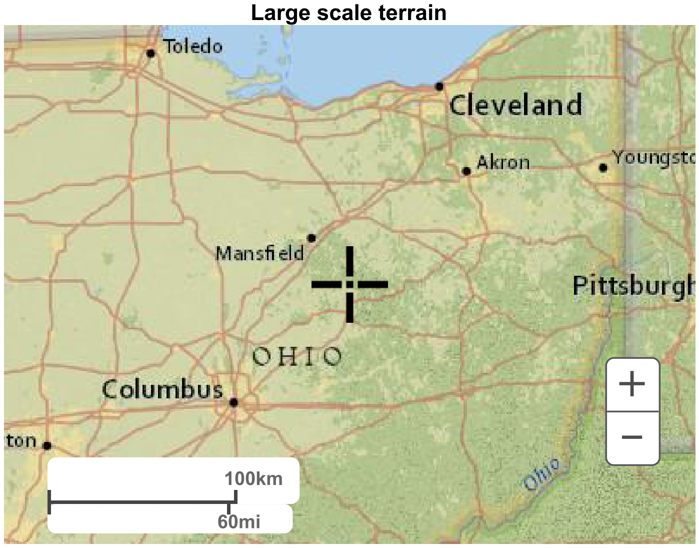
Maps & aerials

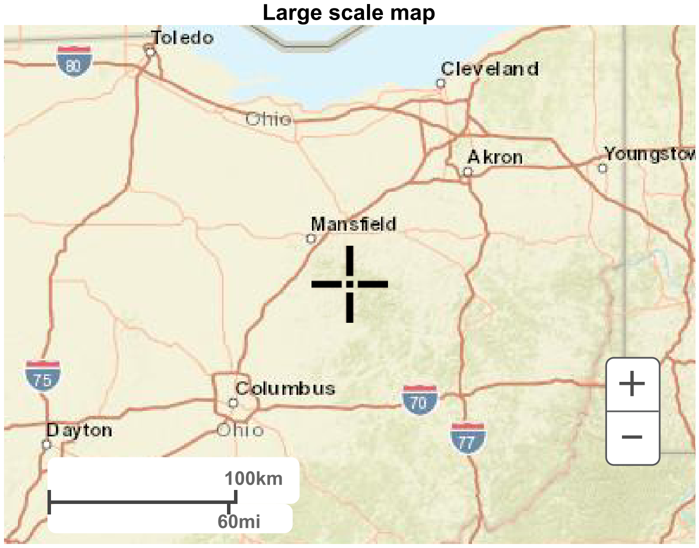
Small scale terrain



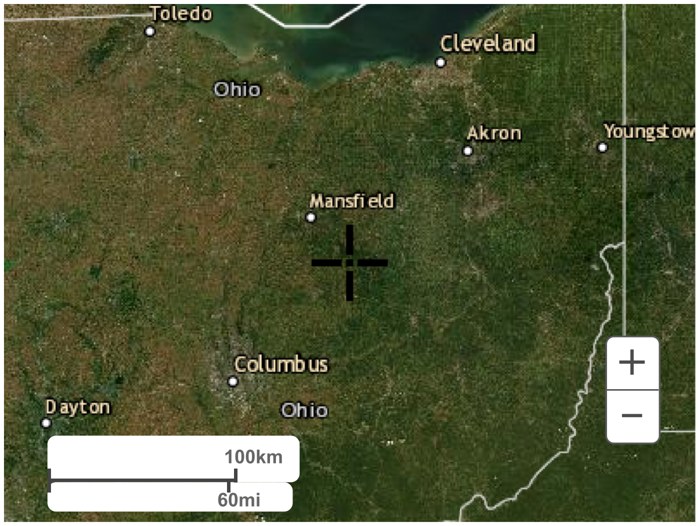
Large scale terrain



Large scale map



Large scale aerial



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

Bokes Creek WQv	
i	0.60
Rv	0.59
A	6.48
P	0.90
WQv (acre-feet)	0.287
WQv (CF)	12,490
10% WQv	1,249

Critical Storm Method		
	Pre-Development	Post-Development
Area (ac.)	6.48	6.48
Total Runoff (in.)	1.111	3.152
Peak Runoff (CFS)	7.74	8.80
Volume (CF)	25,911	20,464
Runoff Volume Increa	**-21.02%**	
Critical Storm = 1-Year Storm		

TR-55 RUNOFF METHODOLOGY (CFS)							
Site Condition	Design Storm						
	1-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Pre-Development	8.38	11.05	15.08	18.57	23.82	28.25	33.18
Post-Development	2.58	3.33	4.51	5.78	8.22	10.94	13.98

EXTENDED DETENTION BASIN WATER QUALITY VOLUME CALCULATION

WQv Required (CF)	Detention Time (HR)	Flow Rate (CFS)	Average Head (FT)	Orifice Coefficient	Orifice Area (SF)	Orifice Diameter (IN)[1]
12,490.39	54	**0.064**	**1.11**	**0.614**	**0.01**	**1.51**

[1]Use 1.50" orifice to achieve > 48 hours of drain time

1/3 Drain Time (sec) =	64,800
Volume Discharged Over 1/3 Drain Time (CF) =	4,163.46
1/2 WQv (CF) =	6,245.20

Calculation Above Shows <1/2 WQV is drained in 1/3 Drain Time

APPENDIX 6

Long-term Maintenance Plan

LONG-TERM MAINTENANCE PLAN

AEP OHIO TRANSMISSION COMPANY
{Bokes Creek IPP Switching Station}

The Storm Water Pollution Prevention Plan (SWPPP) prepared for construction of the Bokes Creek IPP Switching Station includes Best Management Practices (BMPs) for storm water management. As a condition of Part III.G.2.e of the General Permit (OHC000005), a maintenance plan is required for all post-construction BMPs to ensure that permanent storm water management systems continue to function as designed and constructed. For this Project, BMPs that will remain in place following the Notice of Termination (NOT) to Ohio EPA include a detention basin (see Station Grading Plan and Details).

INSPECTION AND MAINTENANCE RESPONSIBILITIES

Following construction, the Bokes Creek IPP Switching Station will be operated and maintained by AEP. As part of routine and periodic maintenance activities, a representative from AEP's Transmission Field Services (TFS) will inspect the BMPs according to the schedule outlined in Table 1 below.

Table 1 - INSPECTION AND MAINTENANCE ACTIVITIES FOR BMPs

ACTIVITY	SCHEDULE
Detention Basin • Mowing/cleanup (based on mowing growth) • Inspect for erosion along the banks • Restore dead or damaged ground cover that is preventing the stormwater system from properly operating via sodding or seeding and mulching • Inspection of condition of berms – repair as warranted • Monitor sediment accumulation and remove buildup if necessary - remove sediment from basin when it fills the design depth of the sediment storage zone • Check operation of outlet structures and remove accumulated debris	Mowing/Cleanup as needed Inspections Annually 15-20 years to monitor sediment volume and clean to restore pool volume