

**EROSION & SEDIMENT  
POLLUTION CONTROL NARRATIVE**

**SNIPES TRACT ATHLETIC FIELDS**

**DOLINGTON ROAD AND QUARRY ROAD  
LOWER MAKEFIELD TOWNSHIP  
BUCKS COUNTY, PENNSYLVANIA**

**PROJECT NO. 1677054L**

**Prepared for:  
LOWER MAKEFIELD TOWNSHIP  
1100 EDGEWOOD ROAD  
YARDLEY, PENNSYLVANIA 19067**

**NOVEMBER 30, 2016**

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Revised JULY 17, 2017**

**Prepared by:**



**BOUCHER & JAMES, INC.**  
*Consulting Engineers*

*Corporate Office*  
Fountainville Professional Building  
1456 Ferry Road, Building 500  
Doylestown, PA 18901  
(215) 345-9400 Fax (215) 345-9401

Plan prepared by and under direction of:  
Maryellen Saylor, P.E.  
of the Corporate Office

*Regional Office*  
559 Main Street, Suite 230  
Bethlehem, PA 18018  
(610) 419-9407

SEAL

**IMPORTANT**

*A copy of this report must be on the site at all times during construction.*

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- Erosion and Sediment Control Plans
- Pre-Development Drainage Area Plan
- Post-Development Drainage Area Plan

# EROSION AND SEDIMENT CONTROL PLAN NARRATIVE

T.M.P. 20-016-001 AND 20-016-002 LOWER MAKEFIELD TOWNSHIP

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## PROJECT DESCRIPTION

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At the request of Lower Makefield Township, a stormwater management and erosion control study was conducted for the land development of a 32.86 acre property. The site is located within the Township owned Snipes Tract on Dolington Road (State Route Number SR 2075) and Quarry Road (Township Road Number T469), northwest of and adjacent to the intersection of the two roads in Lower Makefield Township, Bucks County, PA. The area of the site is 32.86 acres, the property being Tax Map Parcels 20-016-001-001 and 20-016-002. The site presently consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, a salt shed and a buffer of trees along Interstate 95 and the existing adjacent residential properties. The Township proposes the construction of a municipal athletic field complex, which will include one entrance drive each from Dolington Road and Quarry Road, an internal loop road with parking areas, one small and three large athletic fields, a pavilion, a concession stand with restrooms, a future skatepark, a walking trail system, and stormwater management facilities on the site. The site is proposed to be served by public water and sewer. The site will continue to be accessed by an existing drive from Dolington Road and a proposed drive from Quarry Road. The proposed earth disturbance of the site is approximately 24.98 acres. The disturbance of trees will be minimized with the proposed project design. The locations and functions of the proposed detention basin and infiltration trenches have been carefully planned to effectively manage the stormwater, and recharging the stormwater runoff into the ground, where feasible. The protection of the natural resources is one of the main priorities of the development of this site. This study provides relevant site information, including existing and proposed stormwater runoff flow rates and volumes, to assist in the evaluation the proposed project and the preparation of a successful erosion and sedimentation control plan.

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## ANALYSIS OF DOWNSTREAM IMPACT

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The pre-developed site consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, a salt shed and a buffer of trees along Interstate 95 and the existing adjacent residential properties. The drainage areas of the site were analyzed as woodlands, orchard, grass, bare earth, and paved areas. One portion of the site drains southeastward towards Quarry Road, and then to the intersection with Dolington Road to the existing offsite drainage ditch. The remaining area drains eastward towards Dolington Road and then to the intersection with Quarry Road to the existing offsite drainage ditch. The post-developed site will keep the existing drainage patterns generally in place. The proposed storm sewer has been disconnected to discharge overland through rip rap aprons into the detention basin. Infiltration trenches are proposed for ground recharge, stormwater management and water quality before discharging into the detention basin. The proposed development of the site will reduce the runoff rates to the adjacent roads and downstream offsite drainage ditch. There will be

no adverse impacts to the downstream properties with the proposed improvements.

The closest waterway is Buck Creek. **The Chapter 93 receiving Water Classification is WWF, MF (Warm Water Fishes, Migratory Fishes).**

The amount of stormwater that is discharged through the BMP'S is **2.2** acre-feet during a **2-year storm**.

### **STANDARD E & S COMPLETENESS REVIEW CHECKLIST NOTES**

**The E&S Plan is separate from the PCSM Plan, is labeled Erosion and Sedimentation Control Plan and shall be the Final Plan for Construction.**

**The E&S Plan minimizes the extent and duration of earth disturbance.**

**The E&S Plan maximizes protection of existing drainage features and vegetation.**

**The E&S Plan minimizes soil compaction.**

**The E&S Plan utilizes other measures or controls that prevent or minimize generation of increase stormwater runoff.**

**The Present Land Uses for the past five (5) years** have been a leaf and mulch storage yard for the Township Public Works Department and an abandoned tree nursery.

**The Past Land Uses for the past 50 years** have been agriculture and a tree nursery.

### **POTENTIAL FOR THERMAL IMPACTS ADDRESSED**

**Thermal impacts will be minimized by:**

1. Restricting the disturbance of onsite wooded areas and planting of trees (for shade and reduction of temperature).
2. Removing compacted bare ground, stone and paved areas onsite and replacing the areas with grassed athletic fields, which will promote infiltration, velocity of flow reduction and water temperature reduction.
3. Disconnection of storm sewer and roof drains to reduce the velocity of flow and allow for infiltration.
4. Construction of a stormwater detention basin to collect, cool and potentially infiltrate runoff before it is discharged at a controlled rate.
5. Construction of four (4) infiltration trenches to collect, store, cool and infiltrate stormwater runoff.

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**RESULTS SUMMARY: PEAK RUNOFF RATE TO INTERSECTION OF QUARRY ROAD AND DOLINGTON ROAD**

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<b>Storm Event (Year)</b>	<b>Rainfall (inches)</b>	<b>Pre-development Conditions (cfs)</b>	<b>Post-development Discharge (cfs)</b>	<b>Postdev Reduction From Pre-dev Condition (%)</b>
<b>1</b>	2.64	4.91	2.67	45.6%
<b>2</b>	3.36	13.27	4.86	63.4%
<b>5</b>	4.32	28.95	10.17	64.9%
<b>10</b>	5.28	47.69	29.71	37.7%
<b>25</b>	6.24	68.65	48.35	29.6%
<b>50</b>	7.20	91.14	64.02	29.8%
<b>100</b>	8.40	120.75	78.49	35.0%

The site is located in the Delaware River South Watershed. The peak rate of runoff to the intersection of Quarry Road and Dolington Road will be decreased from actual existing conditions to proposed conditions by **63.4%** for the **2-year** and **35.0%** for the **100-year storms**.

The **critical stages of implementation of the PCSM** for which a licensed professional or designee shall be present on-site are the installation of the infiltration trenches, the detention basin, the riprap aprons at the endwalls and the installation of the permanent orifice plate for the detention basin outlet structure.

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## COMPUTATION METHODS

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The design of the stormwater management proposed for this project has been performed with the aid of the Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2009 software package. Hydraflow was developed by Autodesk, Inc., San Rafael, California. The runoff hydrographs were calculated utilizing the Soil Conservation Service (SCS), or also known as the National Resource Conservation Service (NRCS) method within the Hydraflow software.

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## SOILS CHARACTERISTICS AND LIMITATIONS

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Soil Series & Map Symbol	Limitations			Hydrologic Soil Group	Depth to Seasonal High Water Table	Depth to Bedrock	Erodibility
	Bldg w/out Basements	Bldg w/ Basements	Small Commercial Bldgs				
<b>Abbottstown Silt Loam, 3 to 8% (AbB)</b>	Very Limited, Depth to saturated zone	Very Limited, Depth to saturated zone	Very Limited, Depth to saturated zone	D	6" - 18"	40" - 60"	Slight - Moderate
<b>Fountainville Silt Loam, 3 to 8% (FoB)</b>	Very Limited, Depth to saturated zone Limited, Depth to bedrock	Very Limited, Depth to saturated zone Limited, Depth to bedrock	Very Limited, Depth to saturated zone Limited, Depth to bedrock	C	18" - 30"	40" - 60"	Slight-Moderate
<b>Penns-Lansdale Complex 3 to 8% (PnB)</b>	Not Limited	Not Limited	Not Limited	B	>78"	20" - 40"	Slight-Moderate

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## Soils Use Limitations Resolutions

CHARACTERISTIC	RESOLUTION
ERODIBLE	Stabilize immediately after grading. Shape earthwork to reduce concentrated flow areas across bare earth. Provide and maintain effective erosion controls downstream of soil.
HIGH WATER TABLE/ DEPTH TO SATURATION ZONE	Provide adequate underdrain. Avoid basement construction. Any ponded water should be pumped to an adequate erosion and sedimentation control facility. For example, to a sedimentation basin/trap or to a dirt bag.
PONDING	Provide dewatering during construction activities. Provide adequate underdrain/floodproofing for permanent structures.
CUTBANKS CAVE	Use proper slope stabilization, minimize cutbank slope
DEPTH TO HARD BEDROCK	Blasting may be required if bedrock is encountered which is not rippable.
SLOPE	Minimize slope of proposed grading. Use proper slope stabilization.
FROST ACTION	Avoid winter grading.
PIPING/ SEEPAGE	Provide dewatering during construction activities. Provide adequate underdrain/floodproofing for permanent structures. Avoid basement construction. Any ponded water should be pumped to an adequate erosion and sedimentation control facility. For example, to a sedimentation basin/trap or to a dirt bag.
THIN LAYER	Use onsite soils better suited for embankments.



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## NARRATIVE DESCRIPTION OF EROSION AND SEDIMENT CONTROL BMPS

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### **Structural BMPs:**

***A construction entrance*** will be installed prior to construction to provide access into the area of construction.

***Tree protection fence*** will be installed prior to construction to protect the trees to remain throughout the site during construction.

***Silt sock*** will be installed downstream of the areas of disturbance prior to construction to prevent sedimentation from earth disturbance during construction. E-1

***Erosion control matting*** will be installed during construction on the side slopes and berm of the detention basin, the grassed swales and other steep slope areas for stabilization.

***Riprap aprons*** will be installed during construction and remain after construction at the outfall of the stormwater pipes at Endwalls # 1 through #3. Routine maintenance and any necessary repairs will be performed to remove built up sediment and debris.

***Silt Sack Inlet Protection*** will filter out sediment during construction before discharging into the storm sewer. Routine maintenance and any necessary repairs will be performed to remove built up sediment and debris.

***The sediment basin*** will settle out sediment during construction before discharging the stormwater runoff.

***The detention basin*** will reduce the runoff peak rate and the volume and will improve water quality after construction.

***Street Sweeping of the proposed parking lot*** on a regular basis after construction will reduce pollutants and improve water quality of the stormwater runoff.

### ***Non-structural BMPs Low Impact Design (LID) Feature:***

Natural hydrologic conditions and drainage features preserved.

Preserve integrity of ecological and biological systems.

Provide recharge of groundwater to manage stormwater close to its source.

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## EROSION AND SEDIMENT CONTROL NOTES

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The erosion and sedimentation control devices referenced in this plan have been designed in accordance with the standards and specifications of the Pennsylvania Department of Environmental Protection (PADEP) Chapter 102 Regulations. These regulations are outlined in the PADEP Bureau of Land and Water Conservation Publication, “Erosion and Sediment Pollution Control Program Manual” dated March 2012 and the Pennsylvania Stormwater Best Management Practices Manual, dated December 2006.

The following erosion and sedimentation control measures and facilities shall be utilized in controlling and preventing erosion and sedimentation.

**Vegetated Surface Stabilization –** Vegetation will be used as a control measure to achieve either temporary or permanent stabilization of disturbed earth surfaces. Such measures will be considered in place and functional when the required uniform rate of coverage (70%) is obtained.

Seed specifications, liming, fertilizing and seeding mixtures are based on recommendations set forth in the Penn State University’s 1991-92, The Agronomy Guide and Section 804 and 805 of PADOT Publication 408, 2000 Edition as amended.

The following liming, fertilizing and seeding specifications shall be applied in conformance with applicable specifications of Section 804 of PADOT Publication 408. Apply mulch in accordance with applicable specifications of Section 805 of PADOT Publication 408.

SEEDING, LIMING & FERTILIZER TYPE	APPLICATION RATE	SEEDING DATES
<b><i>Temporary Seeding</i></b>		
Annual Rye Grass	40 lb./ac.*	March 15- October 15
Limestone	1 ton/ac.	
Fertilizer (10-10-10)	50 lb./ac.	
Mulch (hay or straw)	3 ton/ac.	

***Permanent Seeding*** – See Erosion & Sediment Control plan and/or Landscaping Plan for these seed mixes.

***Interim Surface Stabilization*** – This work will consist of placing materials to prevent wash or erosion of seeded project areas until a uniform vegetative covering is achieved, or to allow the conveyance of flows in project water channels at velocities higher than what is permissible with bare earth channels. Mulching without seeding can be used as an interim stabilization control during non-growing seasons of the year. The following specifications apply:

***Mulching:*** Mulch materials, mulch binders, construction and maintenance of these products will be in accordance with the specifications contained in Section 806, PADOT Publication 408.

***Commercially produced matting and blankets:*** Requirements for materials, construction and maintenance of these products will be in accordance with the specifications contained in Section

806, PADOT Publication 408.

***Sodding:*** Seeding materials, construction and maintenance will be in accordance with the specifications contained in Section 809, PADOT Publication 408.

***Silt Sock*** will be installed as a sediment barrier and is to be placed below areas that are to be disturbed. Silt Fence shall be installed level to the slope. Silt Sock barrier locations are shown on the Erosion and Sedimentation Control Plans of this drawing set.

***Rock Construction Entrance*** – Rock construction entrances are constructed of a minimum 8” of AASHTO No. 1 rock on a PADOT Class 2 geotextile fabric, the dimensions are provided on the detail shown on the Erosion and Sedimentation Control Details Sheet of the plan set. The rock construction entrance is located at all the access points to the site to prevent the tracking of mud onto paved streets. The locations of rock construction entrances are shown on the Erosion and Sedimentation Control Plans of this drawing set. Access to the site is not permitted through other locations.

***Rip-Rap Apron*** – The rip-rap aprons shall be constructed as shown on the detail sheet of the drawing set. These aprons will reduce the velocity of water discharged from pipes and will prevent erosion.

***Sediment Basin*** – The sediment basin is designed to retain runoff for an extended duration to allow sediment to settle out.

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## **EROSION / SEDIMENT CONTROL PLAN STANDARD NOTES**

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Stockpile heights must not exceed 35 feet; stock pile slopes must not exceed 3:1.

The operator/responsible person (O/RP) on site shall assure that the approved erosion and sediment control plan is properly and completely implemented.

Immediately upon discovering unforeseen circumstances posing the potential for accelerated erosion and/or sediment pollution, the O/RP shall implement appropriate Best Management Practices (BMPs) to eliminate the potential for accelerated erosion and/or sediment pollution.

The O/RP shall assure that an erosion and sediment control plan has been prepared, approved by the Bucks County Conservation District and is being implemented and maintained for all soil and/or rock spoil and borrow areas regardless of their locations.

All pumping of sediment-laden water shall be through a sediment control BMP such as a pumped water filter bag discharging over undisturbed areas.

A copy of the approved erosion and sediment control plan must be available on the project site at all times.

Erosion and sediment BMPs must be constructed, stabilized and functional before site disturbance begins within the tributary areas of those BMPs.

After final site stabilization has been achieved, temporary erosion and sediment BMP controls must be removed. Areas disturbed during the removal of the BMPs must be stabilized immediately.

At least seven (7) days before starting any earth disturbance activity, the O/RP shall invite all contractors involved in that activity, the landowner, all appropriate municipal officials, the erosion and sediment control plan designer and the Bucks County Conservation District to a pre-construction meeting. Also, at least three days before starting any earth disturbance activity, all contractors involved in that activity shall notify the Pennsylvania One-Call System Inc. at 1-800-242-1776 to determine any underground utilities locations.

Immediately after earth disturbance activity ceases, the O/RP shall stabilize any areas disturbed by the activity. During non-germinating periods, mulch must be applied at specified rates. Disturbed areas that are not at finished grade and which will be re-disturbed within one year must be stabilized in accordance with temporary vegetative stabilization specifications. Disturbed areas that are at finished grade or which will not be re-disturbed within one year must be stabilized in accordance with permanent vegetative stabilization specifications.

An area shall be considered to have achieved final stabilization when it has a minimum uniform 70% (percent) vegetative or other permanent non-vegetative cover with a density sufficient to resist accelerated surface erosion and subsurface characteristics sufficient to resist sliding and other movements.

Upon the installation of temporary sediment basin riser(s), a qualified site representative shall conduct an immediate inspection of the riser(s), whereupon the Bucks County Conservation District shall be notified in writing that the riser is sealed (watertight).

At stream crossing, a 50-foot buffer shall be maintained. On buffers, clearings, sod disturbances and excavations, equipment traffic should be minimized. Activity such as stacking logs, burning cleared brush, discharging rainwater from trenches, welding pipe sections, refueling and maintaining equipment should be avoided within buffer zones.

Until a site is stabilized, all erosion and sediment BMPs must be maintained properly. Maintenance must include inspections of all erosion control BMPs after each runoff event and on a weekly basis. All preventative and remedial maintenance work, including cleanout, repair, replacement, re-grading, re-seeding, re-mulching and re-netting must be performed immediately. If erosion and sediment control BMPs fail to perform as expected, replacement BMPs, or modifications of those installed, will be required.

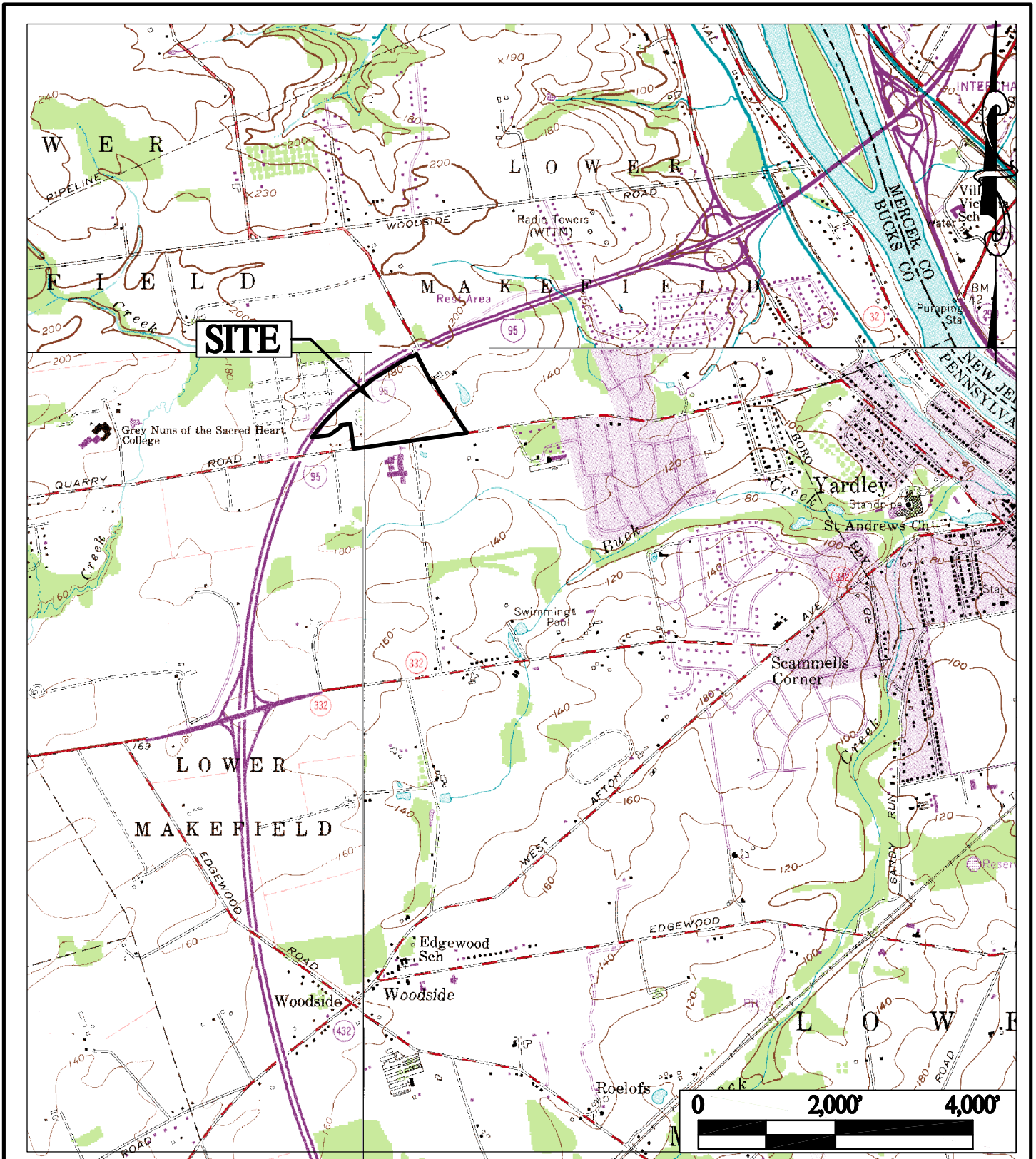
Sediment removed from BMPs shall be disposed of on-site in landscaped areas outside of steep slopes, wetlands, floodplains or drainage swales and immediately stabilized or placed in soil stockpiles and stabilized.

All building material and wastes must be removed from the site and recycled in accordance with DEP's Solid Waste Regulations (25 PA Code 260.1 et seq., 271.1 et seq., and 287.1 et seq.), and/or any additional local, state or federal regulations. No building materials (used or unused) or waste materials shall be burned, buried, dumped or discharged at the site.

# APPENDIX A:

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## SITE LOCATION



Base Map of USGS 7.5 Minute  
Trenton West & Langhorn, PA Quadrangle

**FIGURE 1**  
**LOCATION MAP**

Boucher & James, Inc.  
1456 Ferry Road Building 500  
Doylestown, Pennsylvania 18901



www.bjengineers.com

Lower Makefield Township  
Bucks County

# APPENDIX B:

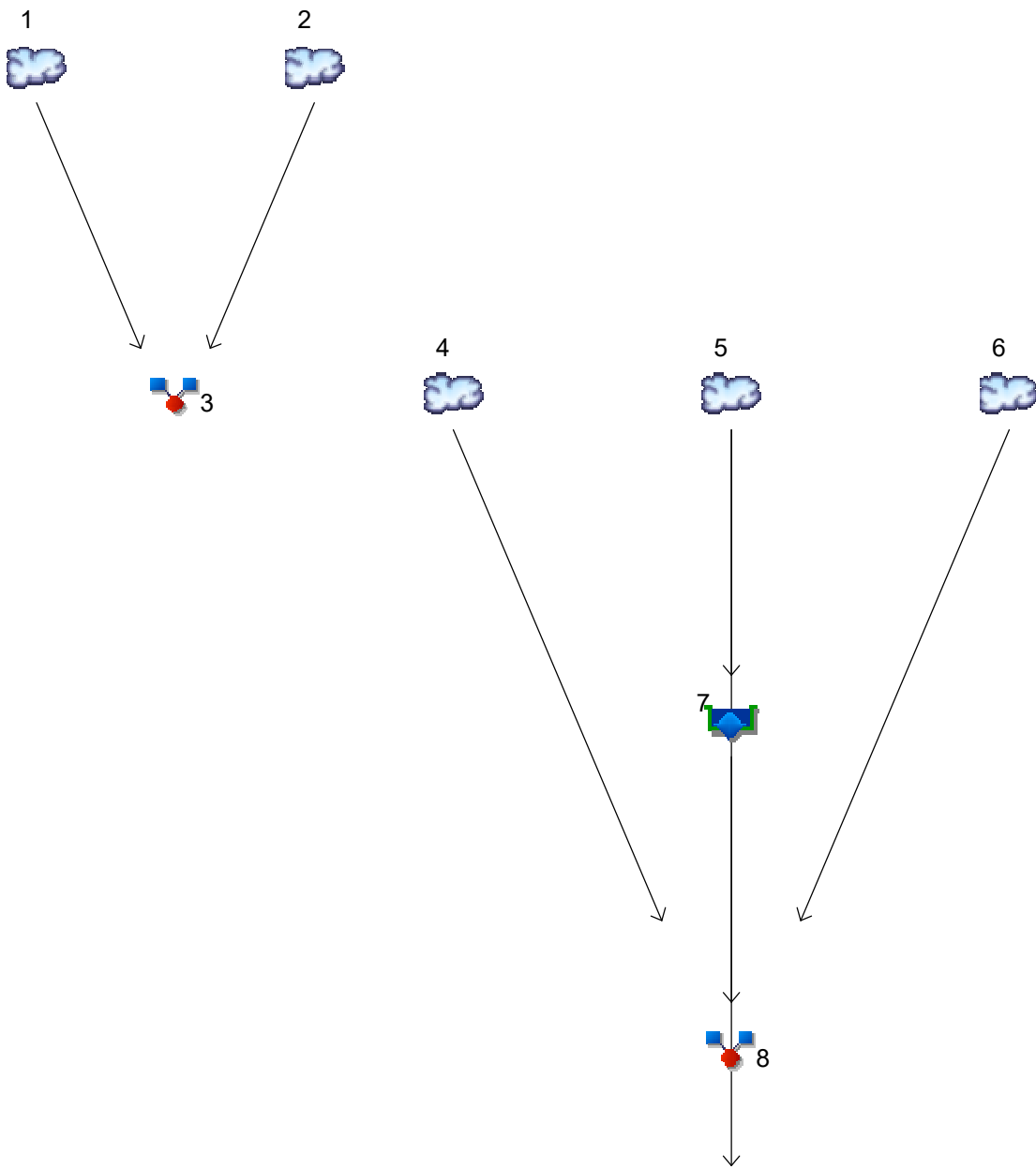
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## PRE-DEVELOPMENT DRAINAGE CALCULATIONS



# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



## Legend

Hyd.	Origin	Description
1	SCS Runoff	Predev DA to Quarry Road
2	SCS Runoff	Predev DA to Dolington Road
3	Combine	Predev to Intersection
4	SCS Runoff	Postdev Bypass DA to Quarry Road
5	SCS Runoff	Postdev to Detention Basin
6	SCS Runoff	Postdev Bypass Flow to Dolington Road
7	Reservoir	DetentionBasin Outflow
8	Combine	Postdev to Intersection
10	Reservoir	Sediment Basin

# Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	1.010	4.002	-----	10.45	18.86	28.40	38.74	52.51	Predev DA to Quarry Road
2	SCS Runoff	-----	3.939	9.282	-----	18.50	29.05	40.49	52.56	68.27	Predev DA to Dolington Road
3	Combine	1, 2	4.906	13.27	-----	28.95	47.69	68.65	91.14	120.75	Predev to Intersection
4	SCS Runoff	-----	0.596	2.070	-----	5.120	9.025	13.44	18.21	24.55	Postdev Bypass DA to Quarry Road
5	SCS Runoff	-----	8.247	16.63	-----	29.87	44.54	60.15	76.42	97.50	Postdev to Detention Basin
6	SCS Runoff	-----	0.200	0.526	-----	1.111	1.789	2.531	3.319	4.364	Postdev Bypass Flow to Dolington Ro
7	Reservoir	5	2.134	2.849	-----	7.914	23.56	37.63	48.89	56.99	DetentionBasin Outflow
8	Combine	4, 6, 7	2.673	4.858	-----	10.17	29.71	48.35	64.02	78.49	Postdev to Intersection
10	Reservoir	5	0.146	0.392	-----	1.417	5.374	21.48	49.63	81.20	Sediment Basin

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

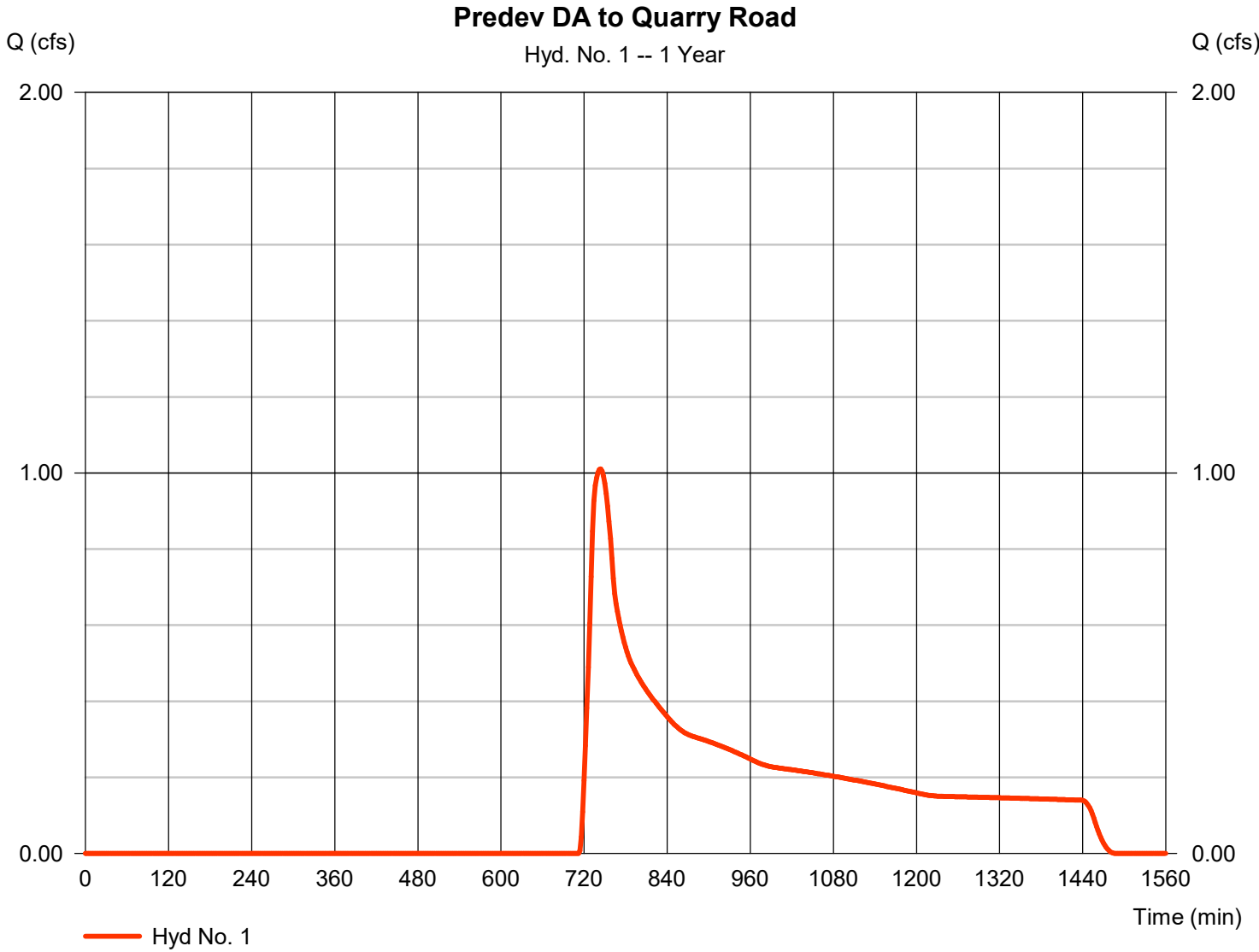
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	1.010	2	744	11,616	-----	-----	-----	Predev DA to Quarry Road	
2	SCS Runoff	3.939	2	736	26,190	-----	-----	-----	Predev DA to Dolington Road	
3	Combine	4.906	2	736	37,807	1, 2	-----	-----	Predev to Intersection	
4	SCS Runoff	0.596	2	748	6,683	-----	-----	-----	Postdev Bypass DA to Quarry Road	
5	SCS Runoff	8.247	2	738	48,117	-----	-----	-----	Postdev to Detention Basin	
6	SCS Runoff	0.200	2	732	1,263	-----	-----	-----	Postdev Bypass Flow to Dolington Ro	
7	Reservoir	2.134	2	780	46,021	5	161.11	13,460	DetentionBasin Outflow	
8	Combine	2.673	2	760	53,967	4, 6, 7	-----	-----	Postdev to Intersection	
10	Reservoir	0.146	2	1468	21,337	5	162.53	44,051	Sediment Basin	
Basin design.gpw					Return Period: 1 Year			Friday, 07 / 14 / 2017		

# Hydrograph Report

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 1.010 cfs
Storm frequency	= 1 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 11,616 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 1

Predev DA to Quarry Road

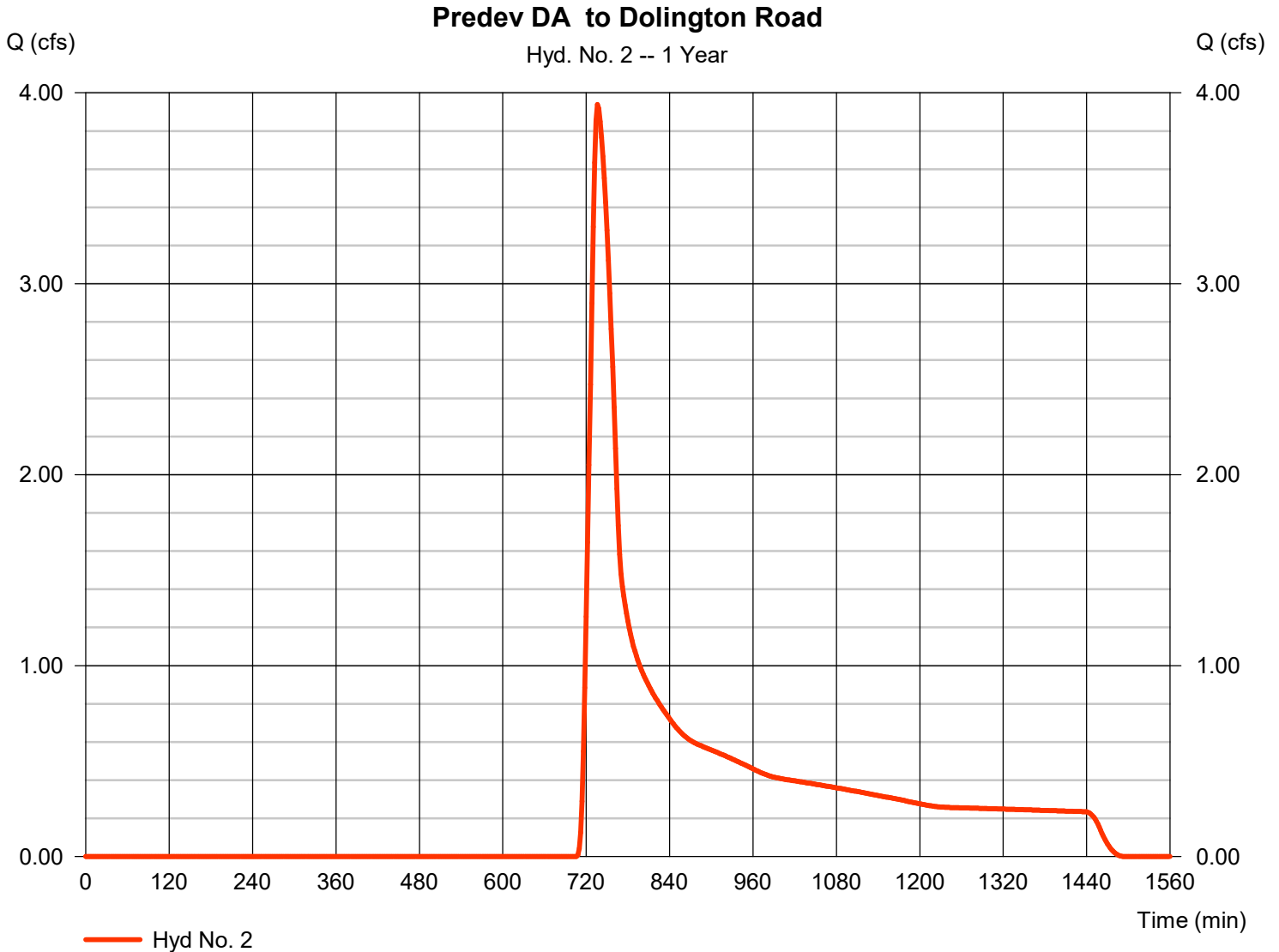
<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.350	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.36	0.00	0.00	
Land slope (%)	= 5.33	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 17.60</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 17.60</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 280.00	490.00	920.00	
Watercourse slope (%)	= 2.50	4.20	2.10	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=2.55	3.31	2.95	
<b>Travel Time (min)</b>	<b>= 1.83</b>	<b>+ 2.47</b>	<b>+ 5.21</b>	<b>= 9.50</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>27.10 min</b>

# Hydrograph Report

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 3.939 cfs
Storm frequency	= 1 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 26,190 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 2

Predev DA to Dolington Road

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.350	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.36	0.00	0.00	
Land slope (%)	= 6.67	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 16.09</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 16.09</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 1450.00	650.00	0.00	
Watercourse slope (%)	= 1.50	3.40	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=1.98	3.75	0.00	
<b>Travel Time (min)</b>	<b>= 12.23</b>	<b>+ 2.89</b>	<b>+ 0.00</b>	<b>= 15.12</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>31.20 min</b>

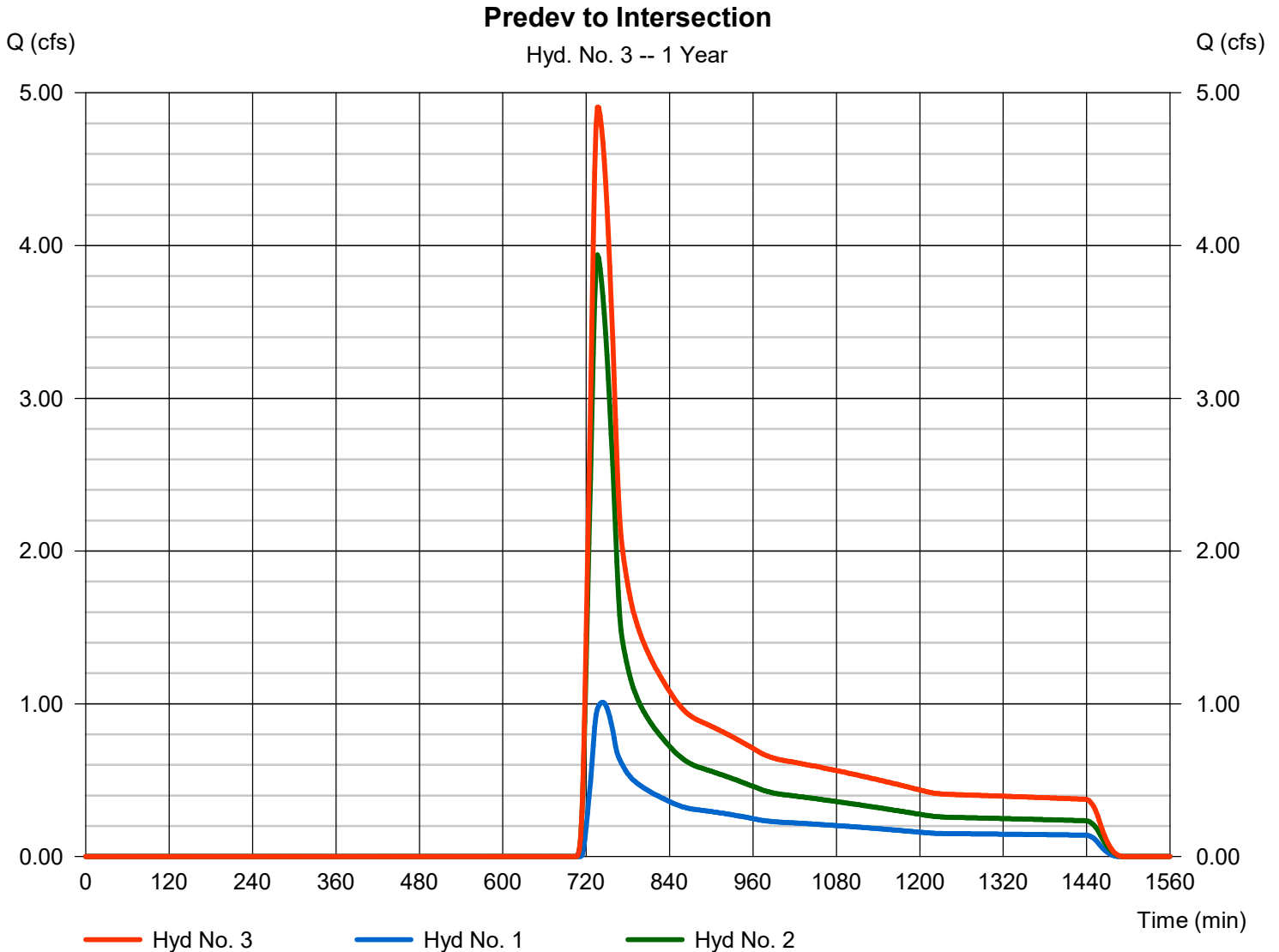
# Hydrograph Report

## Hyd. No. 3

Predev to Intersection

Hydrograph type = Combine  
Storm frequency = 1 yrs  
Time interval = 2 min  
Inflow hyds. = 1, 2

Peak discharge = 4.906 cfs  
Time to peak = 736 min  
Hyd. volume = 37,807 cuft  
Contrib. drain. area = 35.400 ac





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.002	2	734	26,520	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	9.282	2	736	49,595	-----	-----	-----	Predev DA to Dolington Road
3	Combine	13.27	2	734	76,115	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	2.070	2	738	14,751	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	16.63	2	736	84,777	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	0.526	2	730	2,498	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	2.849	2	790	79,181	5	162.19	31,099	DetentionBasin Outflow
8	Combine	4.858	2	746	96,430	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	0.392	2	1460	53,800	5	163.26	71,705	Sediment Basin
Basin design.gpw					Return Period: 2 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

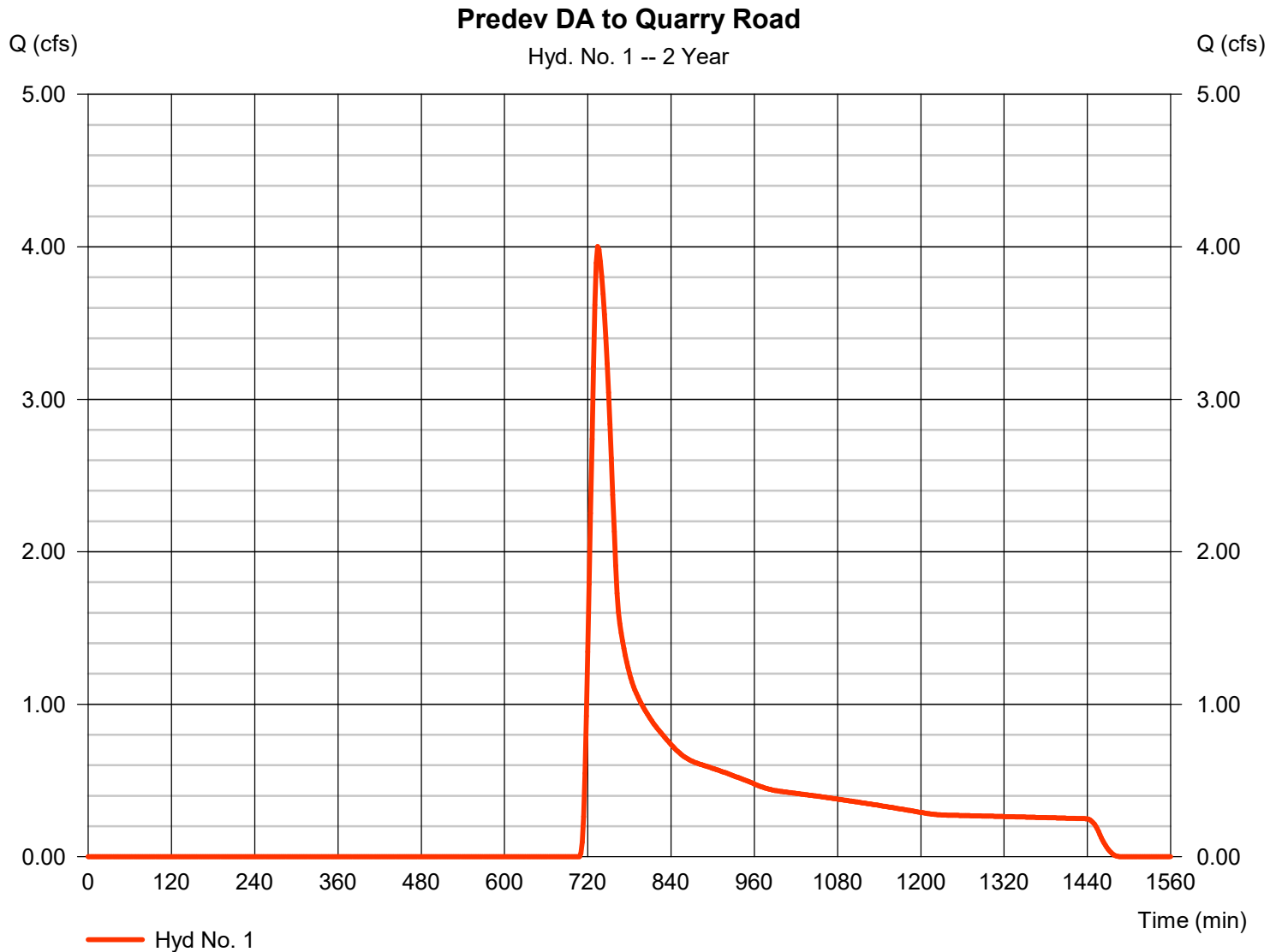
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 4.002 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 26,520 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 3.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

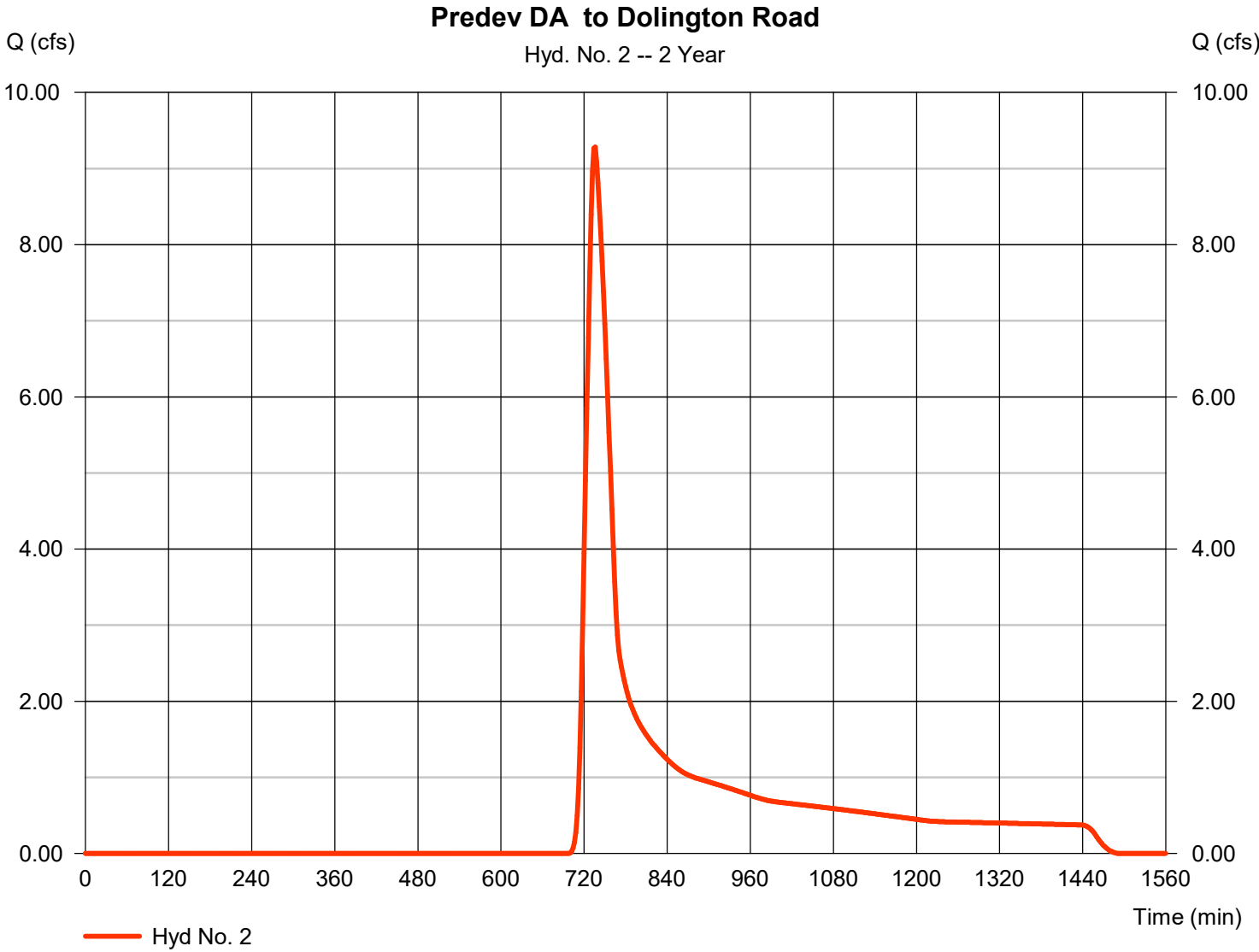


# Hydrograph Report

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 9.282 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 49,595 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 3.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 3

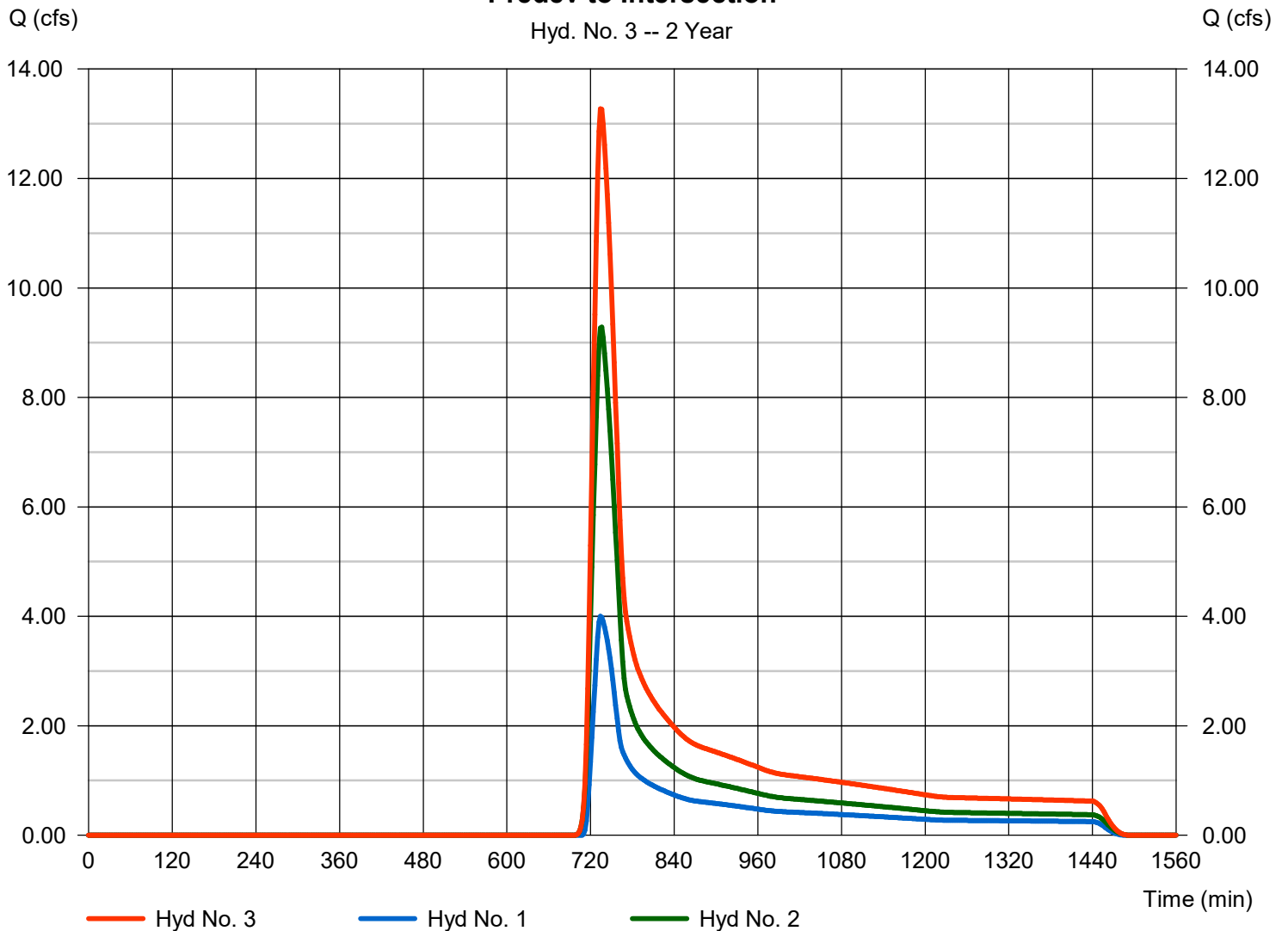
Predev to Intersection

Hydrograph type = Combine  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Inflow hyds. = 1, 2

Peak discharge = 13.27 cfs  
 Time to peak = 734 min  
 Hyd. volume = 76,115 cuft  
 Contrib. drain. area = 35.400 ac

### Predev to Intersection

Hyd. No. 3 -- 2 Year



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.45	2	734	52,999	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	18.50	2	734	87,644	-----	-----	-----	Predev DA to Dolington Road
3	Combine	28.95	2	734	140,643	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	5.120	2	738	28,851	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	29.87	2	736	142,177	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	1.111	2	730	4,549	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	7.914	2	770	131,400	5	162.86	56,558	DetentionBasin Outflow
8	Combine	10.17	2	766	164,800	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	1.417	2	1072	107,139	5	164.06	103,042	Sediment Basin
Basin design.gpw					Return Period: 5 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

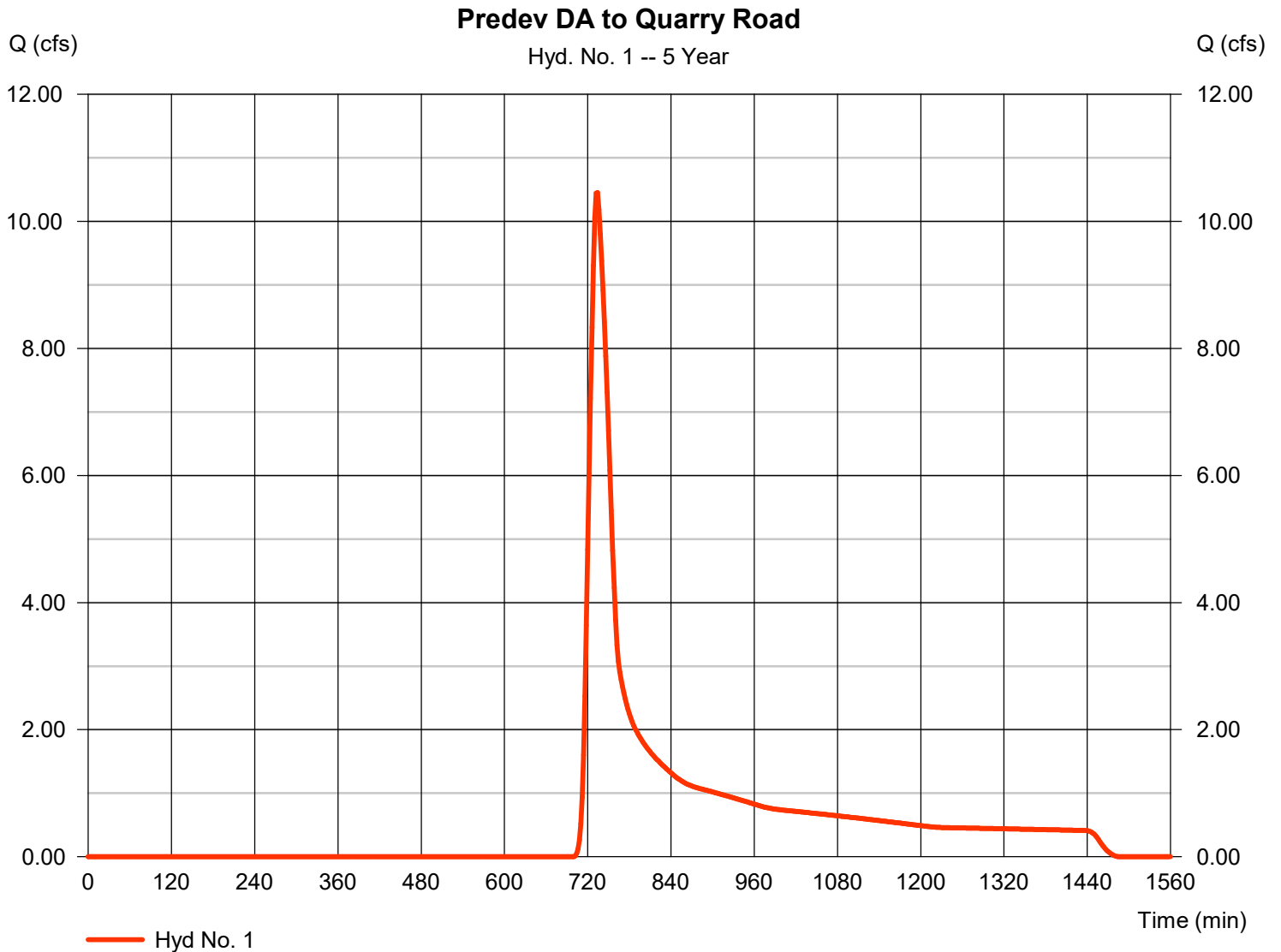
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 10.45 cfs
Storm frequency	= 5 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 52,999 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 4.32 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

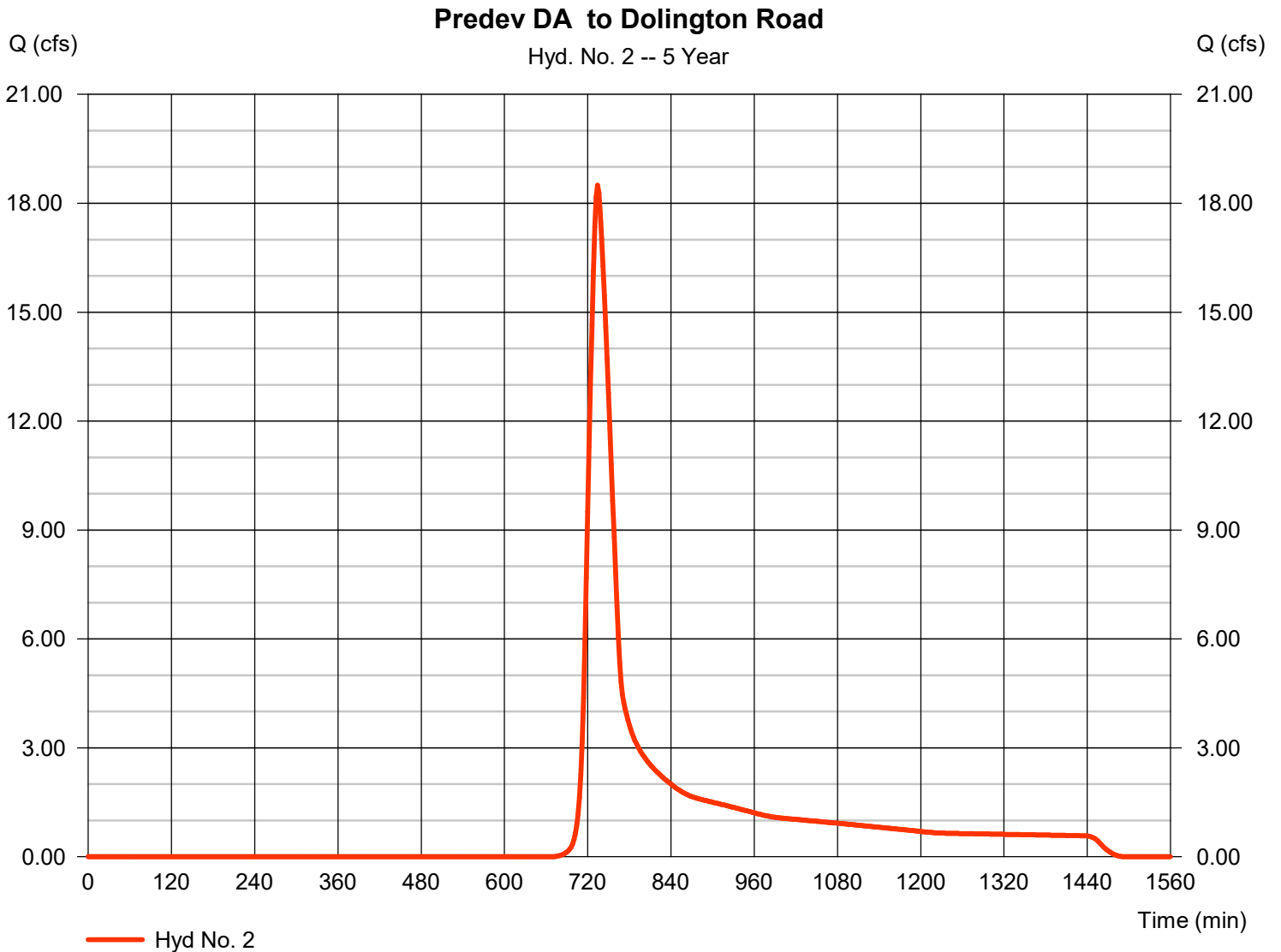
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 18.50 cfs
Storm frequency	= 5 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 87,644 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 4.32 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

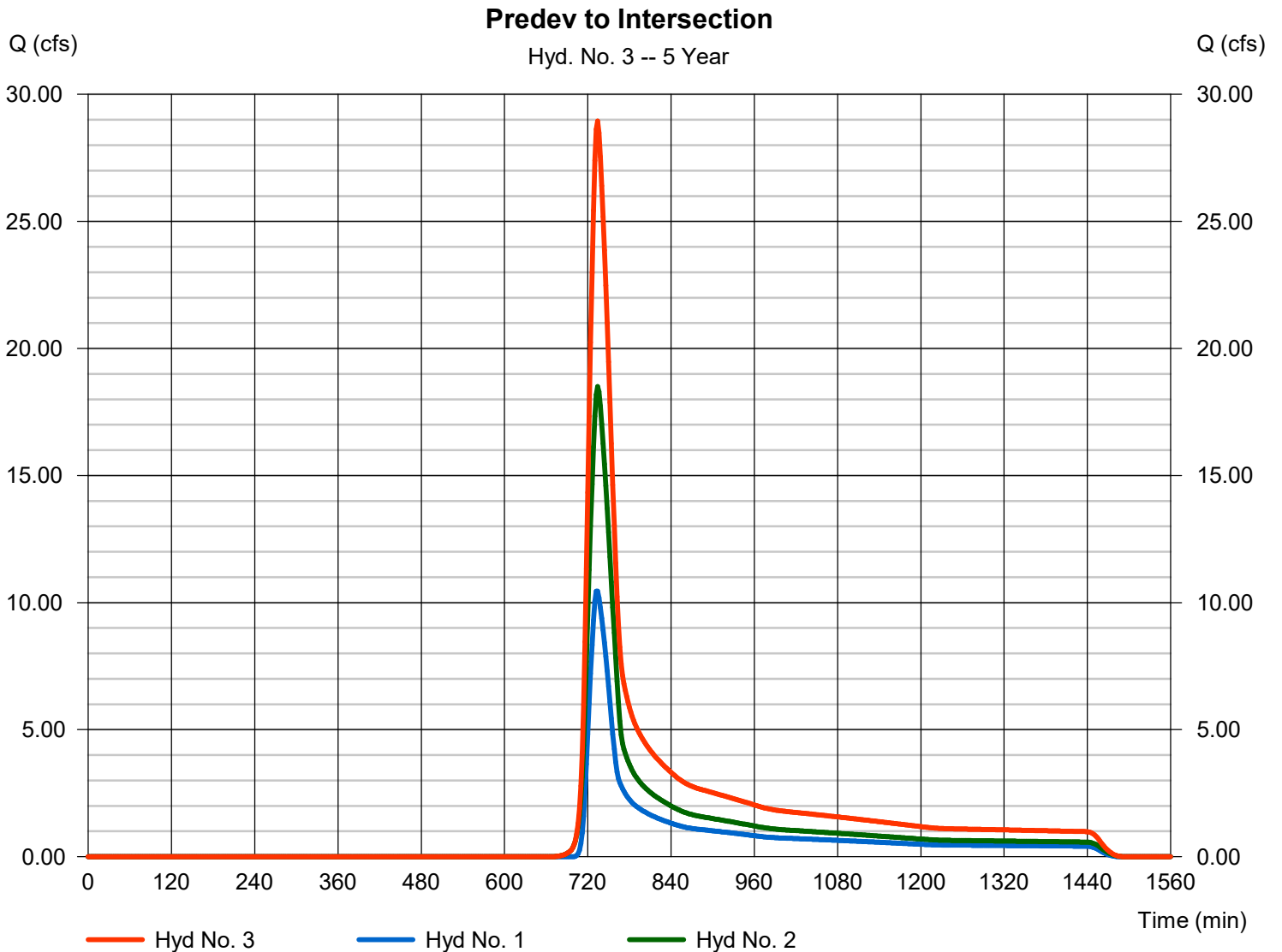
Friday, 07 / 14 / 2017

## Hyd. No. 3

Predev to Intersection

Hydrograph type = Combine  
 Storm frequency = 5 yrs  
 Time interval = 2 min  
 Inflow hyds. = 1, 2

Peak discharge = 28.95 cfs  
 Time to peak = 734 min  
 Hyd. volume = 140,643 cuft  
 Contrib. drain. area = 35.400 ac





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	18.86	2	732	85,143	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	29.05	2	734	131,325	-----	-----	-----	Predev DA to Dolington Road
3	Combine	47.69	2	734	216,468	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	9.025	2	736	45,822	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	44.54	2	736	206,368	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	1.789	2	730	6,938	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	23.56	2	758	193,132	5	163.21	69,937	DetentionBasin Outflow
8	Combine	29.71	2	754	245,892	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	5.374	2	812	171,233	5	164.26	115,142	Sediment Basin
Basin design.gpw					Return Period: 10 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

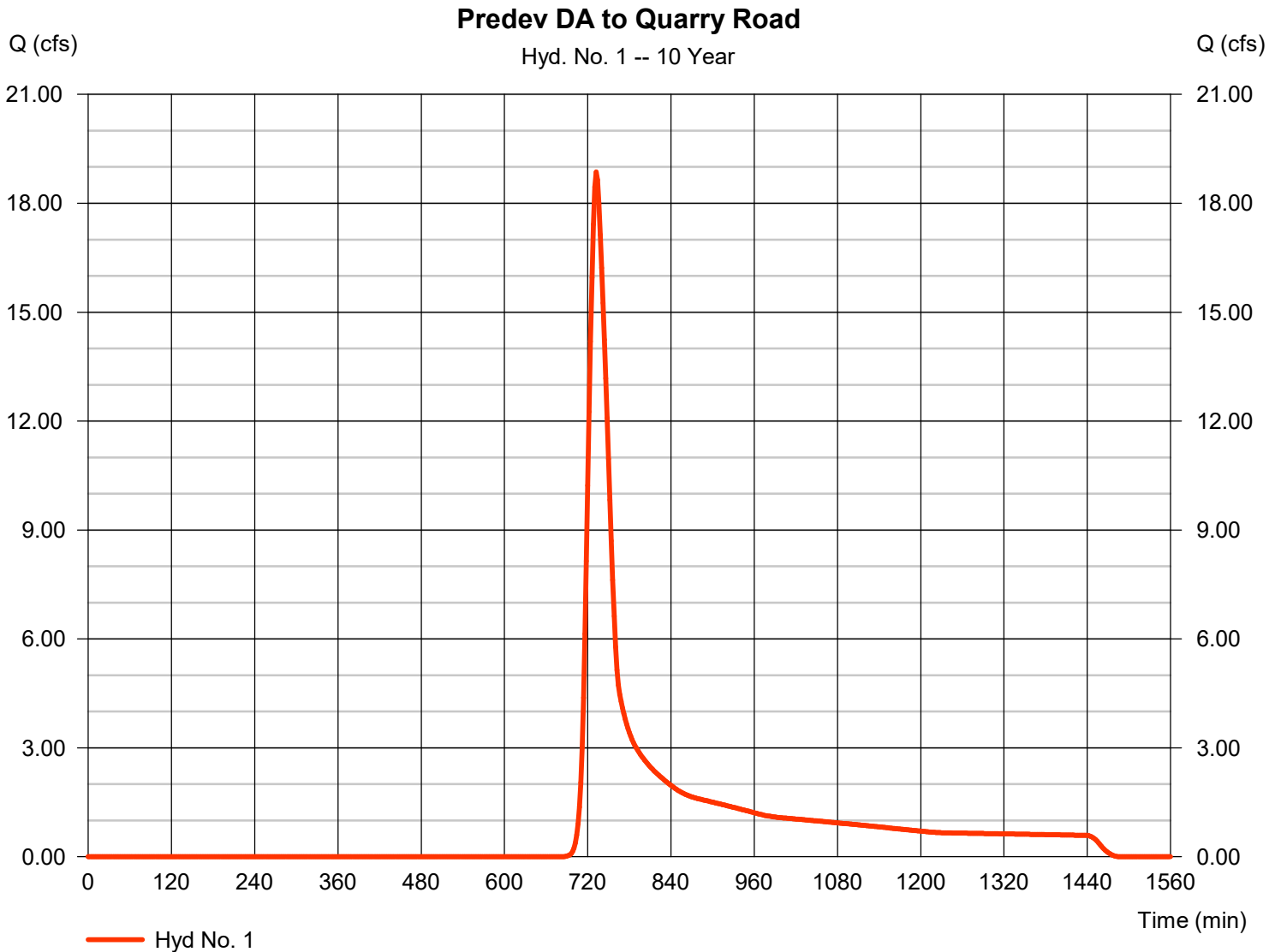
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 18.86 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 85,143 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

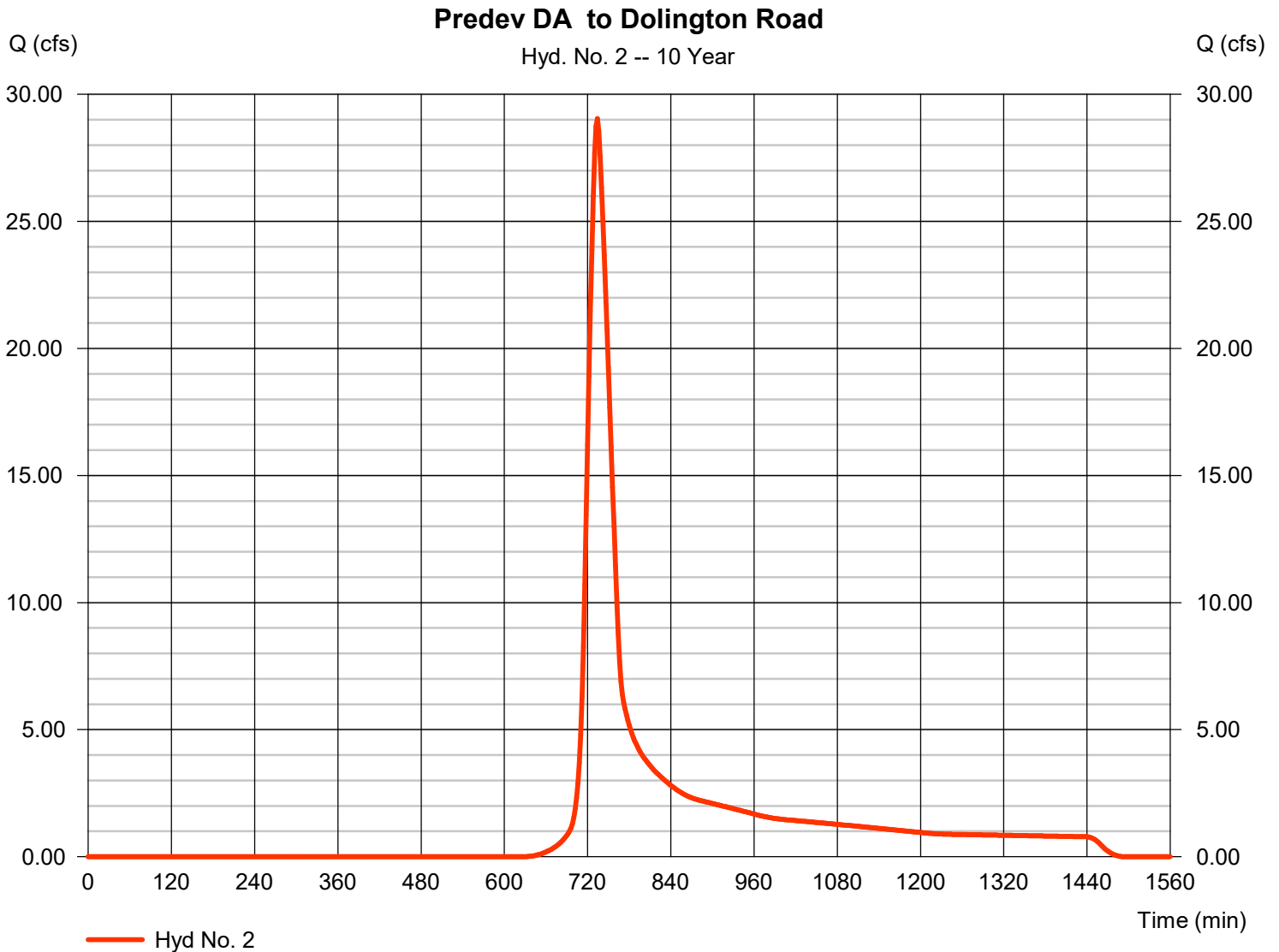
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 29.05 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 131,325 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

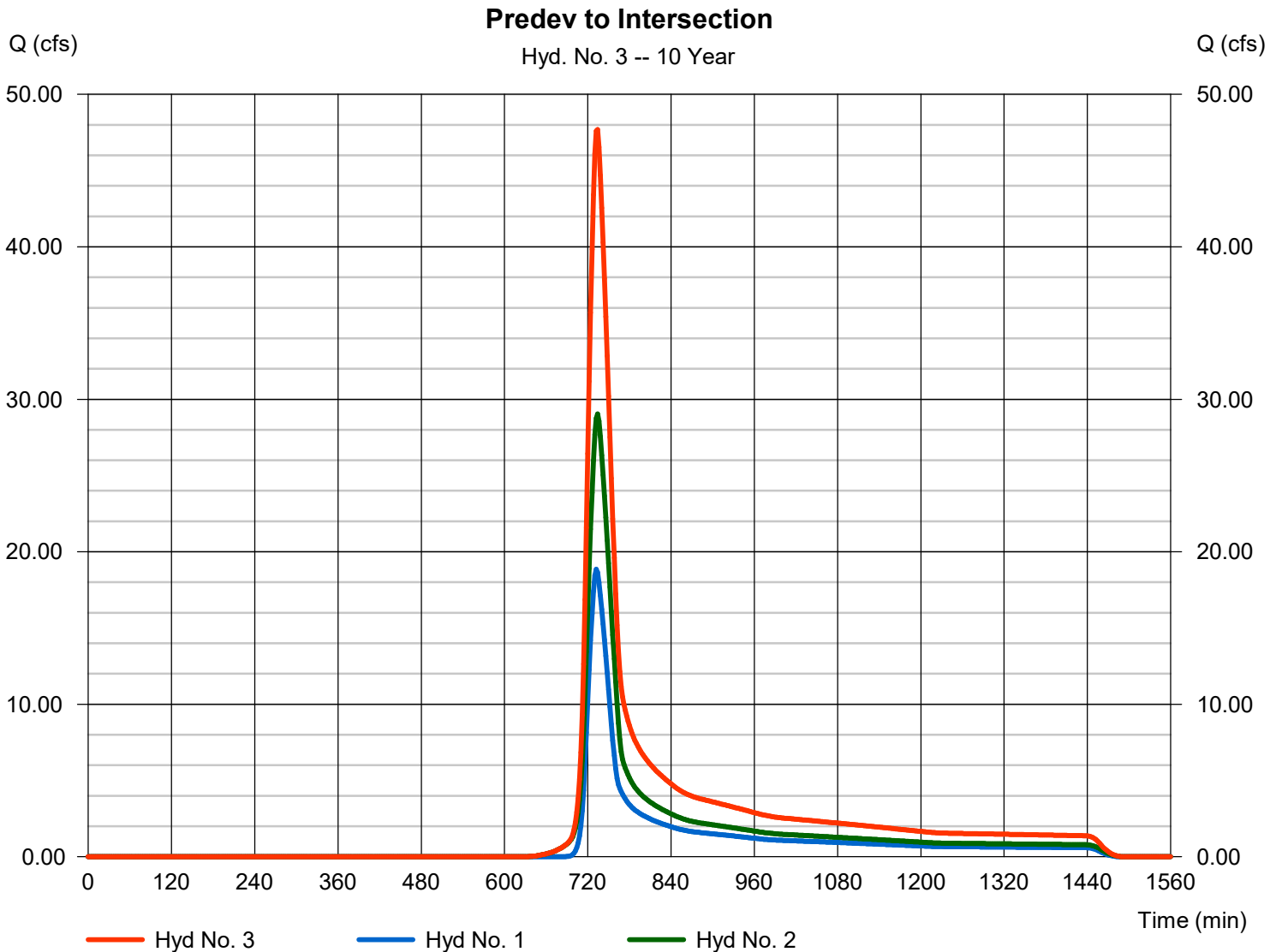
Friday, 07 / 14 / 2017

## Hyd. No. 3

Predev to Intersection

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 2 min  
Inflow hyds. = 1, 2

Peak discharge = 47.69 cfs  
Time to peak = 734 min  
Hyd. volume = 216,468 cuft  
Contrib. drain. area = 35.400 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.40	2	732	121,583	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	40.49	2	734	179,073	-----	-----	-----	Predev DA to Dolington Road
3	Combine	68.65	2	732	300,655	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	13.44	2	736	64,950	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	60.15	2	736	275,325	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	2.531	2	730	9,575	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	37.63	2	754	259,891	5	163.54	82,182	DetentionBasin Outflow
8	Combine	48.35	2	748	334,416	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	21.48	2	764	240,116	5	164.55	132,035	Sediment Basin
Basin design.gpw					Return Period: 25 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

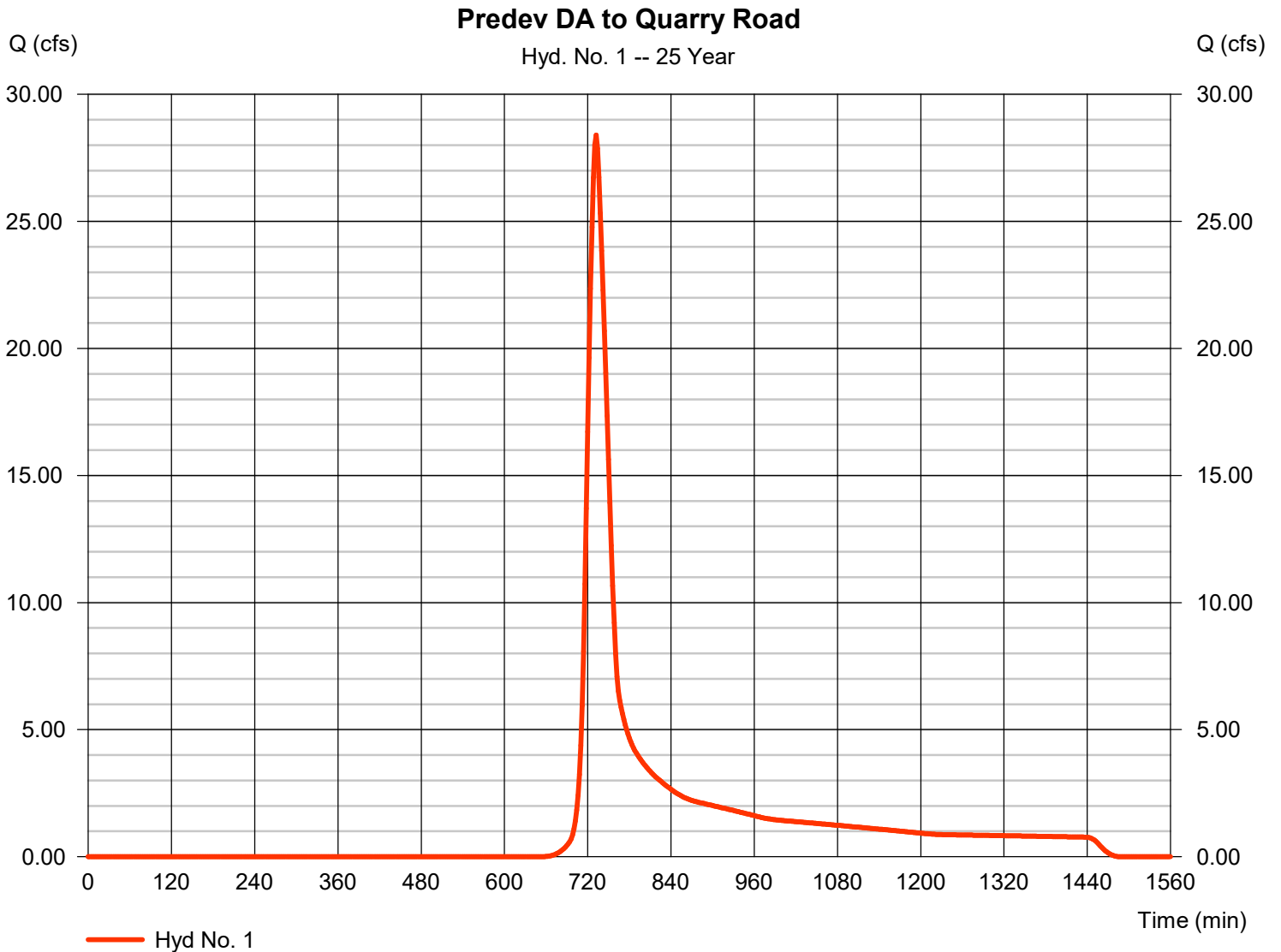
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 28.40 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 121,583 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

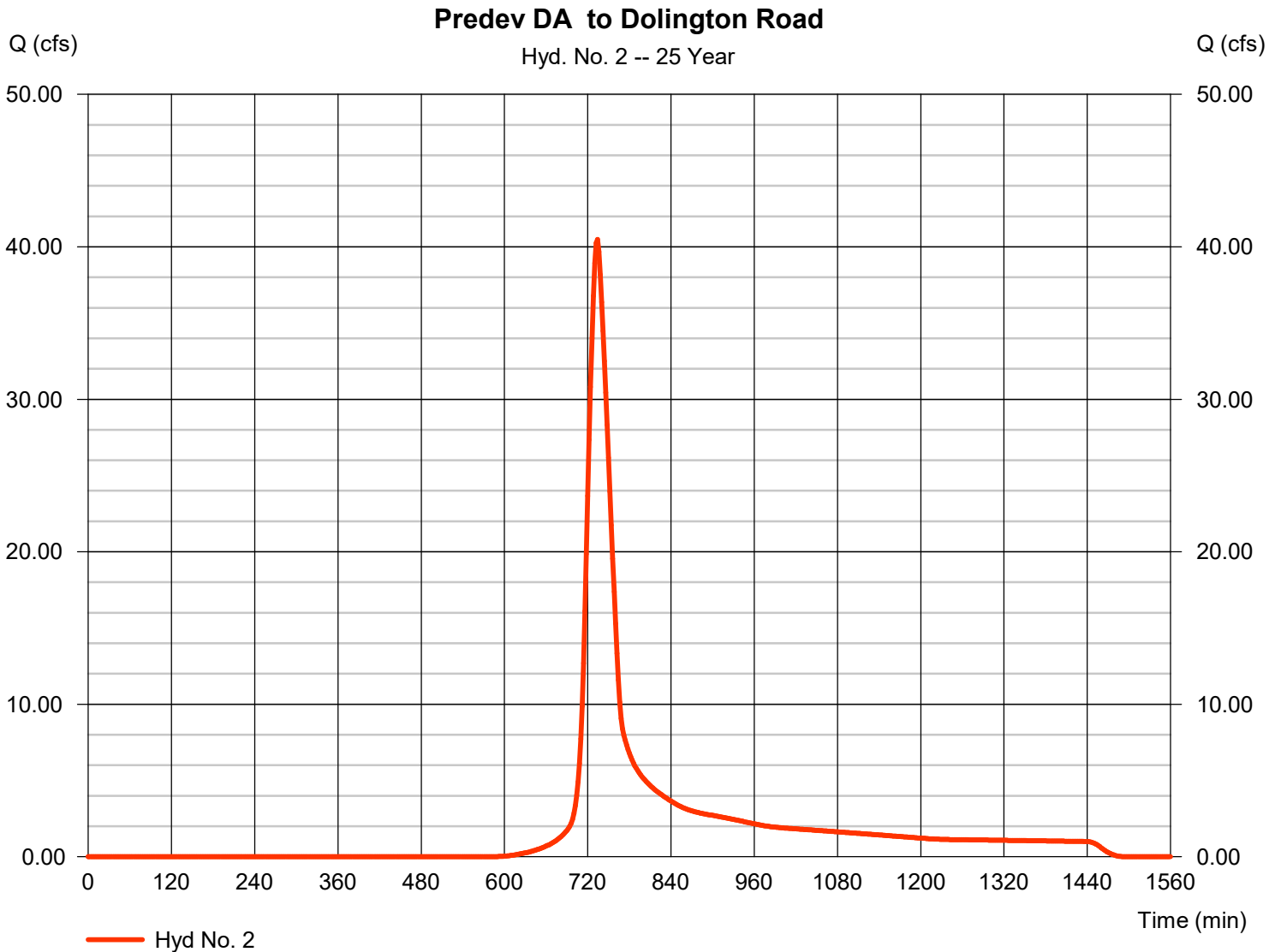
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 40.49 cfs
Storm frequency	= 25 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 179,073 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

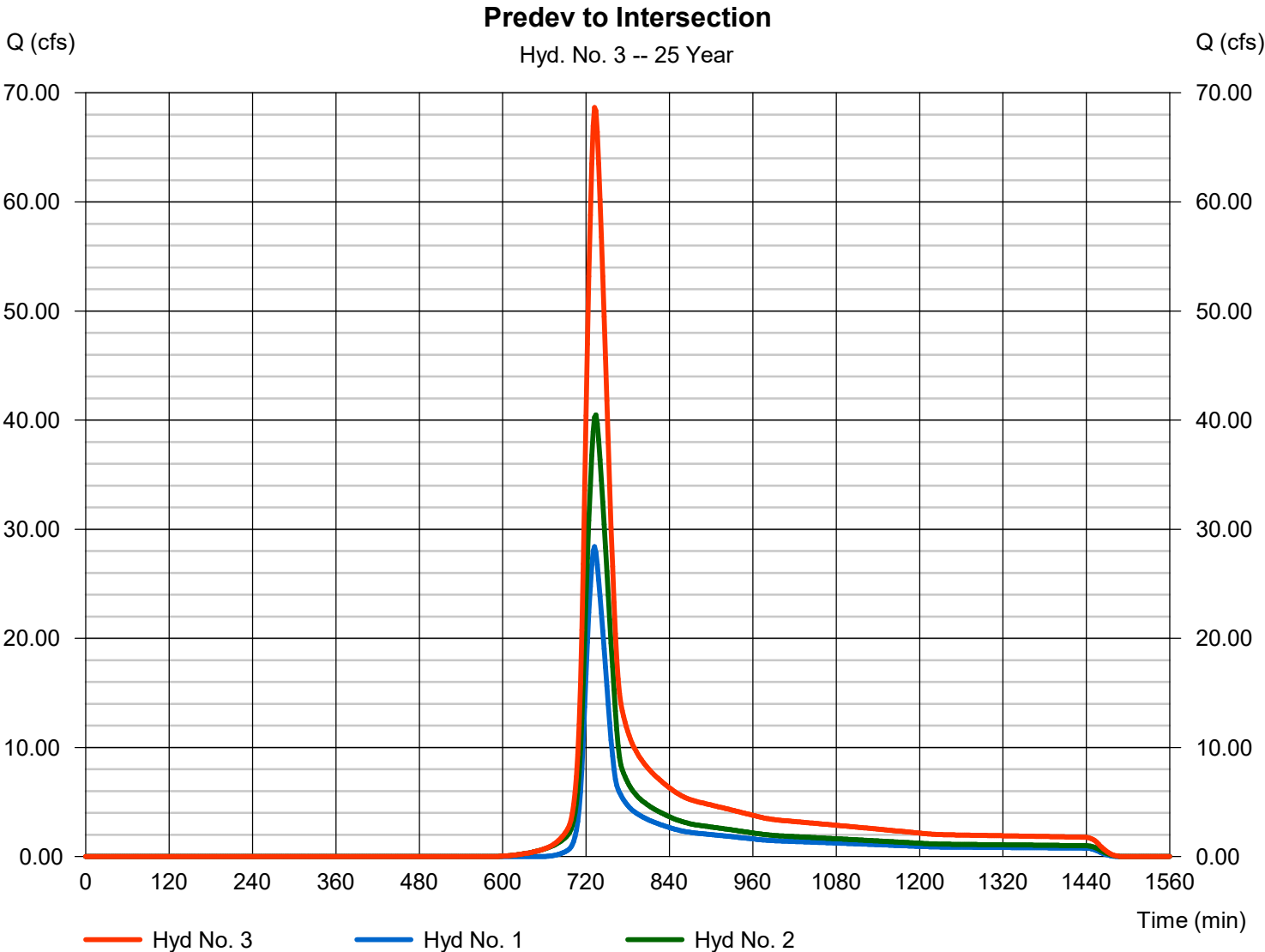
Friday, 07 / 14 / 2017

## Hyd. No. 3

Predev to Intersection

Hydrograph type = Combine  
Storm frequency = 25 yrs  
Time interval = 2 min  
Inflow hyds. = 1, 2

Peak discharge = 68.65 cfs  
Time to peak = 732 min  
Hyd. volume = 300,655 cuft  
Contrib. drain. area = 35.400 ac





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	38.74	2	732	161,349	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	52.56	2	734	229,853	-----	-----	-----	Predev DA to Dolington Road
3	Combine	91.14	2	732	391,201	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	18.21	2	736	85,739	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	76.42	2	734	347,759	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	3.319	2	728	12,398	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	48.89	2	752	330,285	5	163.95	97,741	DetentionBasin Outflow
8	Combine	64.02	2	746	428,422	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	49.63	2	752	312,487	5	164.71	140,946	Sediment Basin
Basin design.gpw					Return Period: 50 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

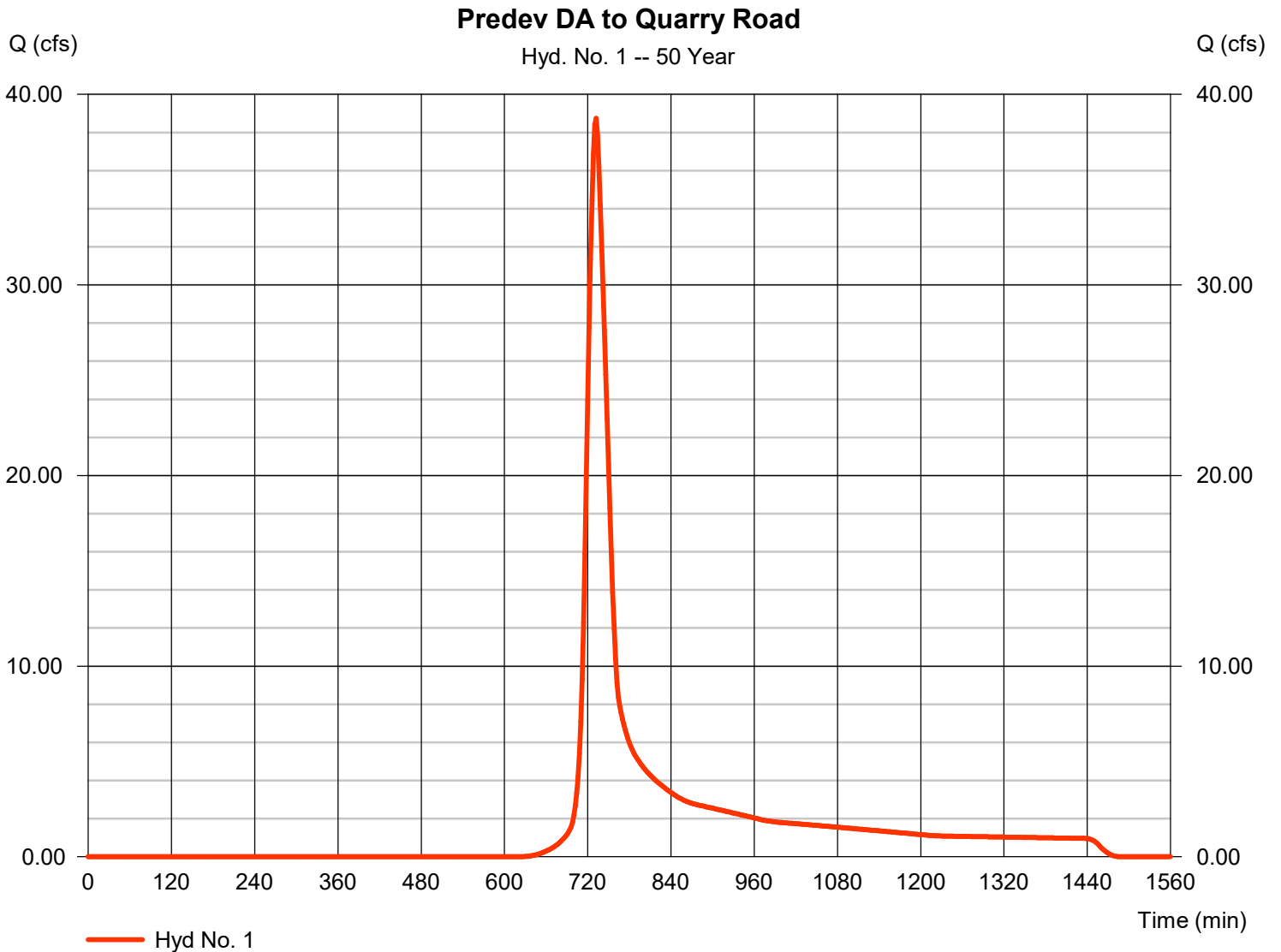
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 38.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 161,349 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

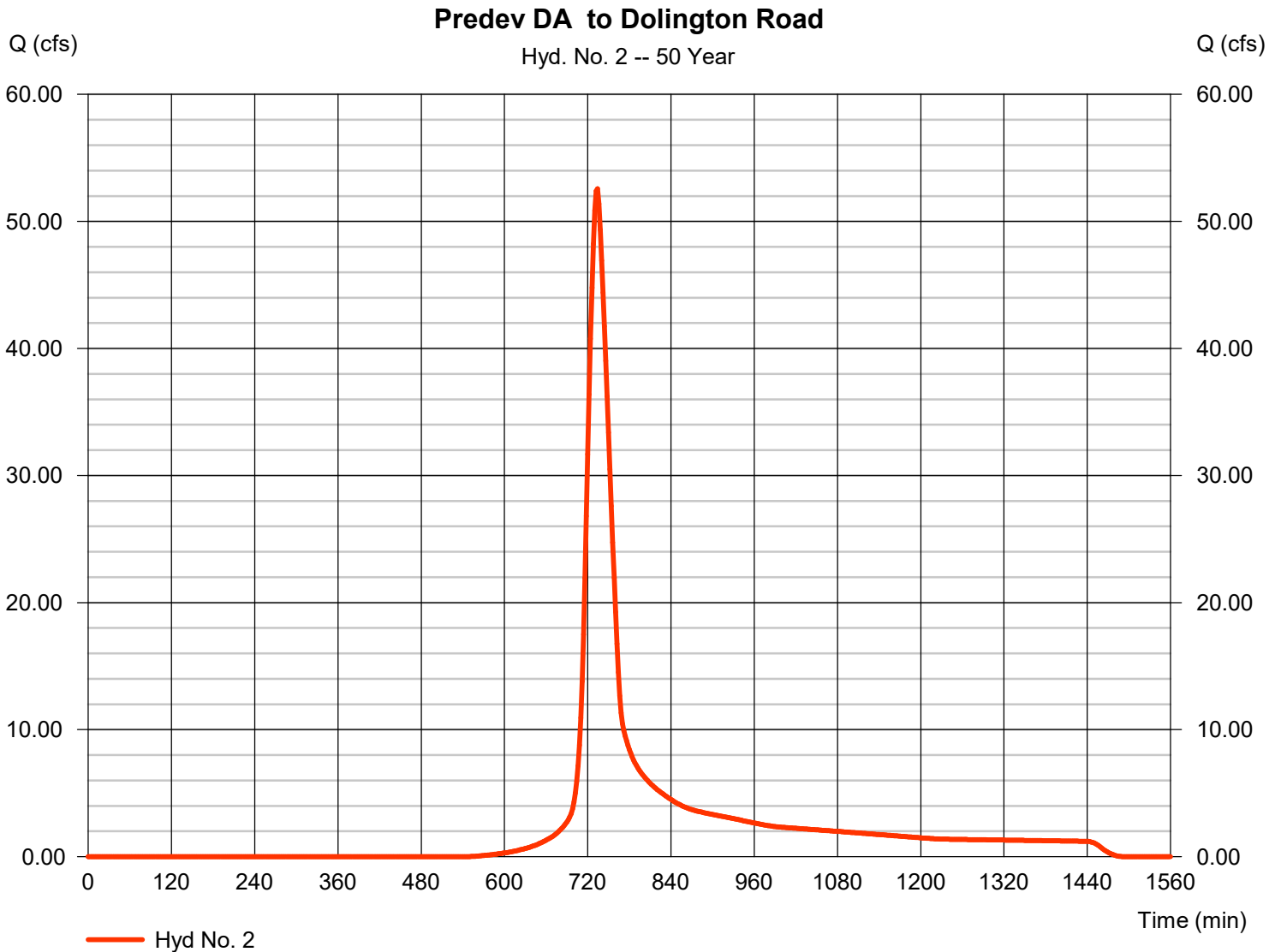
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 52.56 cfs
Storm frequency	= 50 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 229,853 cuft
Drainage area	= 18.600 ac	Curve number	= 66
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 31.20 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 3

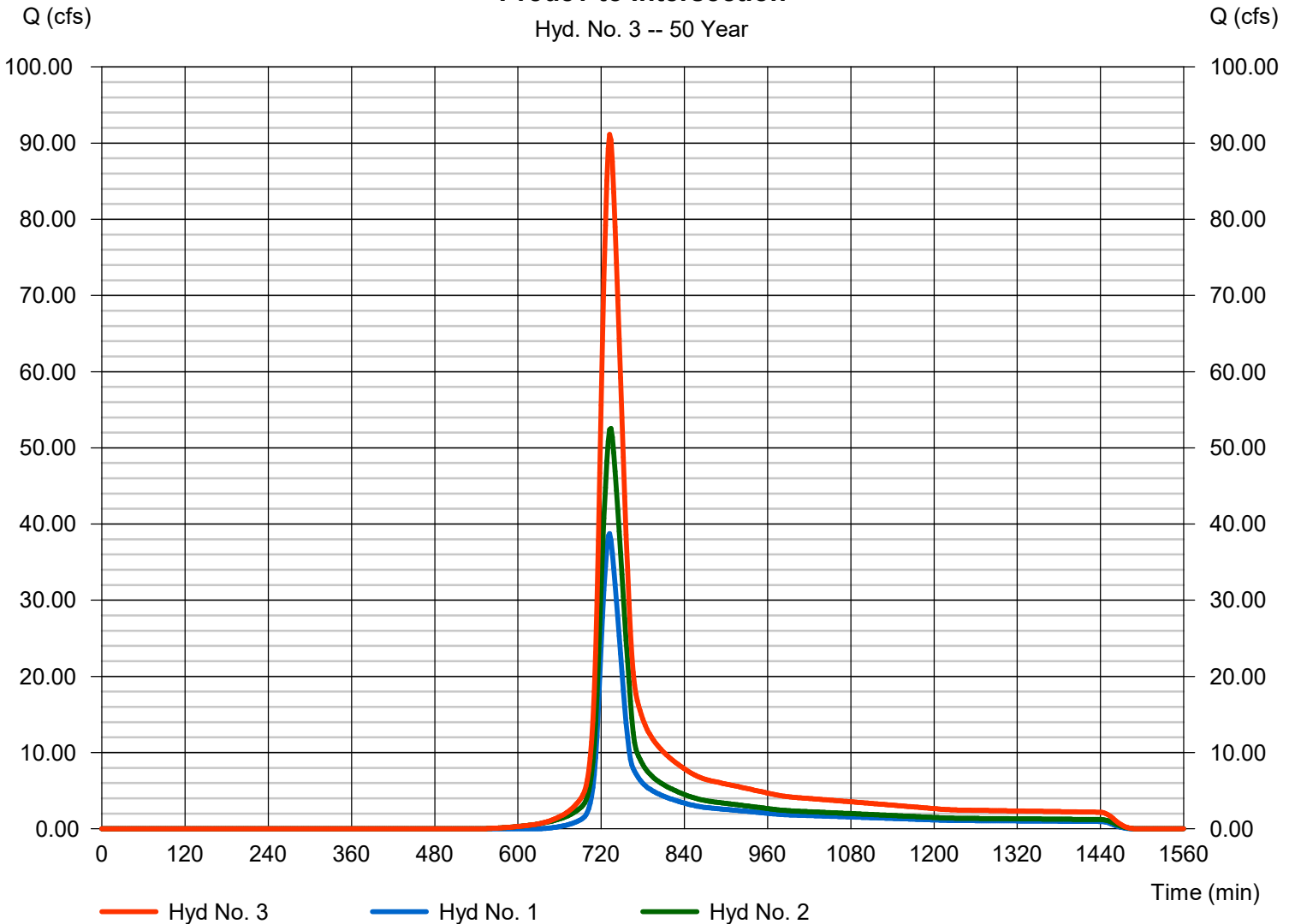
Predev to Intersection

Hydrograph type = Combine  
 Storm frequency = 50 yrs  
 Time interval = 2 min  
 Inflow hyds. = 1, 2

Peak discharge = 91.14 cfs  
 Time to peak = 732 min  
 Hyd. volume = 391,201 cuft  
 Contrib. drain. area = 35.400 ac

### Predev to Intersection

Hyd. No. 3 -- 50 Year



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	52.51	2	732	214,688	-----	-----	-----	Predev DA to Quarry Road	
2	SCS Runoff	68.27	2	734	296,529	-----	-----	-----	Predev DA to Dolington Road	
3	Combine	120.75	2	732	511,218	1, 2	-----	-----	Predev to Intersection	
4	SCS Runoff	24.55	2	736	113,531	-----	-----	-----	Postdev Bypass DA to Quarry Road	
5	SCS Runoff	97.50	2	734	441,899	-----	-----	-----	Postdev to Detention Basin	
6	SCS Runoff	4.364	2	728	16,126	-----	-----	-----	Postdev Bypass Flow to Dolington Ro	
7	Reservoir	56.99	2	754	422,212	5	164.42	124,298	DetentionBasin Outflow	
8	Combine	78.49	2	740	551,870	4, 6, 7	-----	-----	Postdev to Intersection	
10	Reservoir	81.20	2	744	406,561	5	164.83	148,276	Sediment Basin	
Basin design.gpw					Return Period: 100 Year			Friday, 07 / 14 / 2017		

# Hydrograph Report

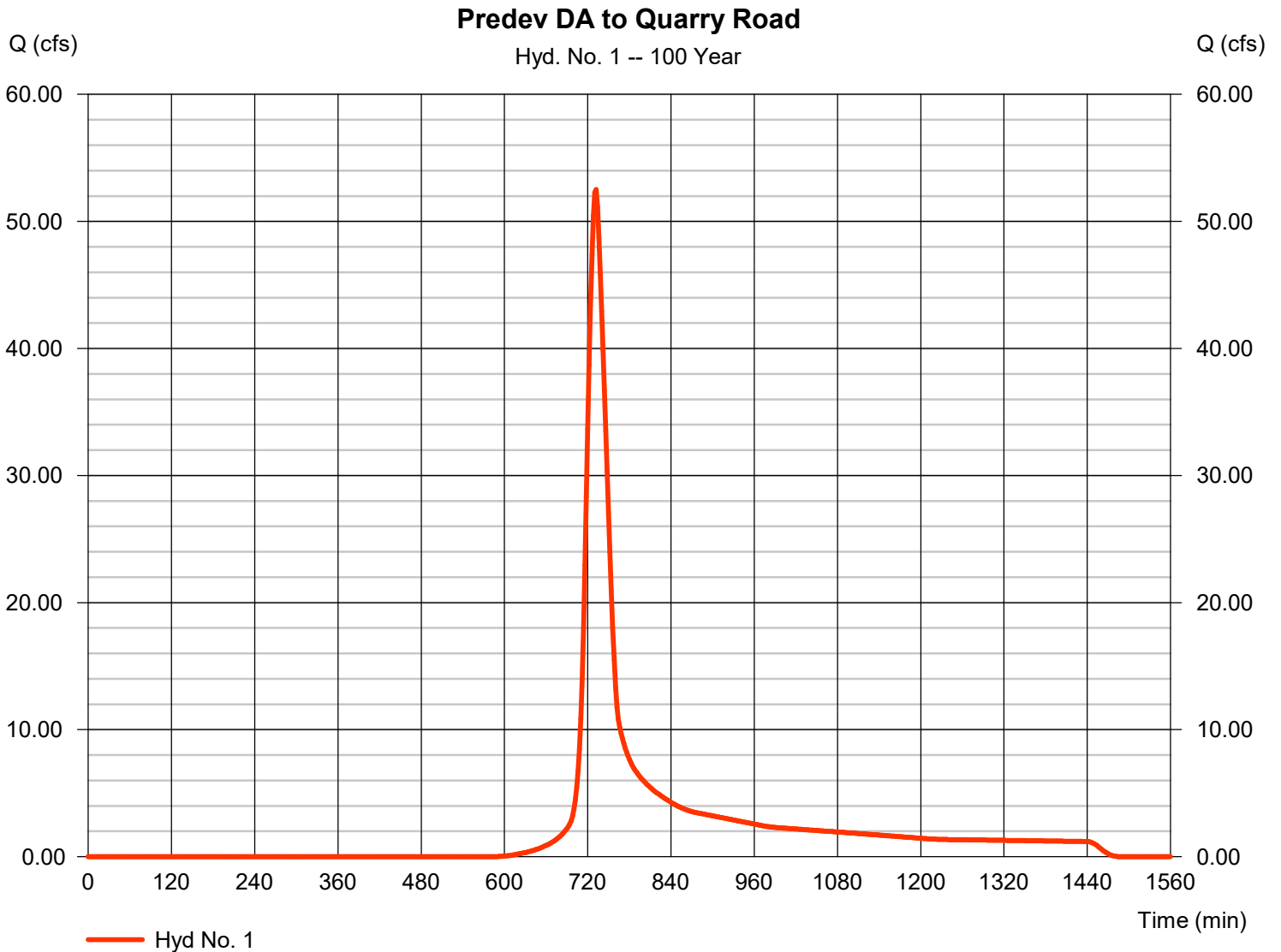
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 1

Predev DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 52.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 214,688 cuft
Drainage area	= 16.800 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 8.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



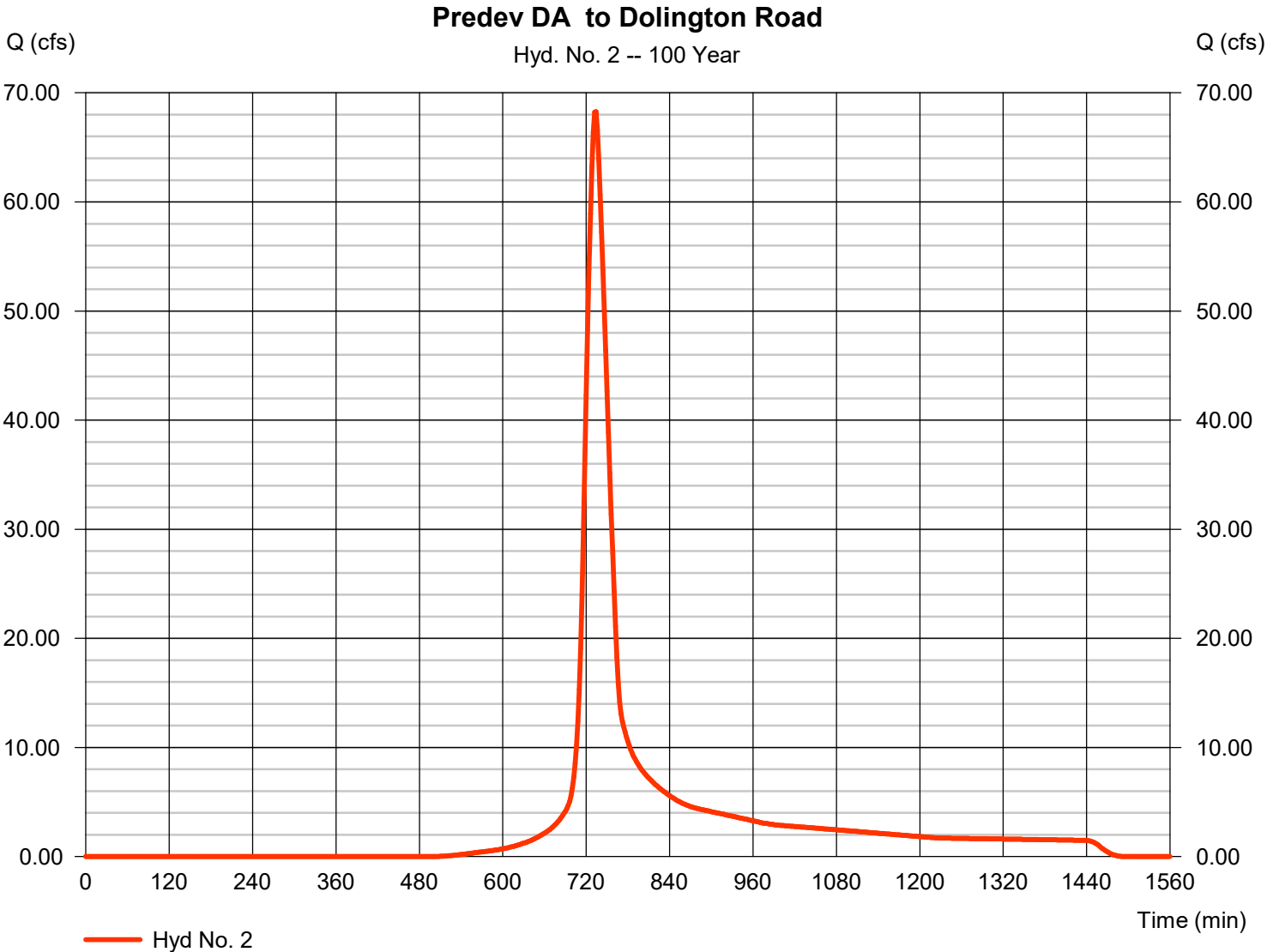
# Hydrograph Report

## Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type = SCS Runoff  
Storm frequency = 100 yrs  
Time interval = 2 min  
Drainage area = 18.600 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 8.40 in  
Storm duration = 24 hrs

Peak discharge = 68.27 cfs  
Time to peak = 734 min  
Hyd. volume = 296,529 cuft  
Curve number = 66  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 31.20 min  
Distribution = Type II  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 3

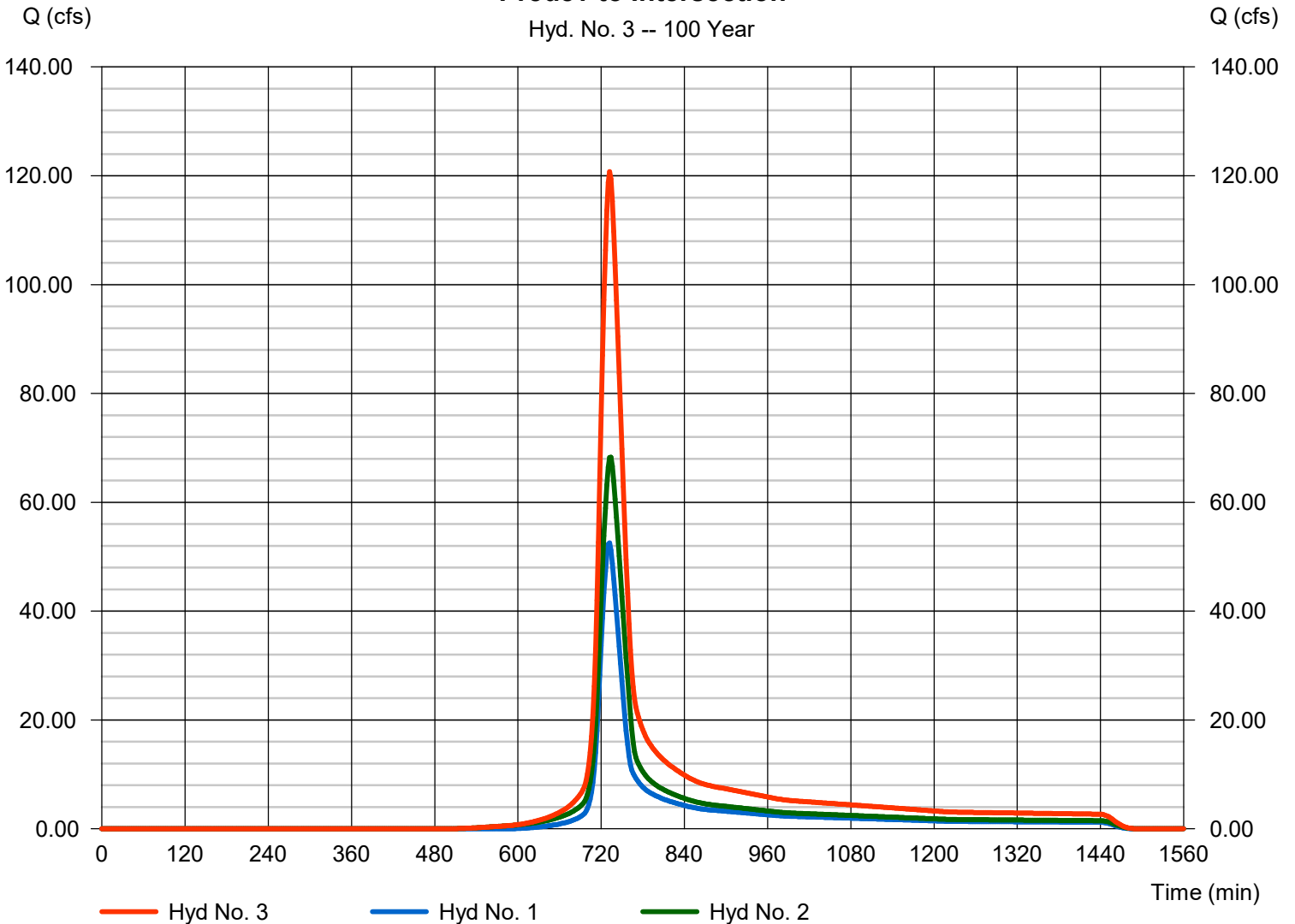
Predev to Intersection

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Inflow hyds. = 1, 2

Peak discharge = 120.75 cfs  
 Time to peak = 732 min  
 Hyd. volume = 511,218 cuft  
 Contrib. drain. area = 35.400 ac

### Predev to Intersection

Hyd. No. 3 -- 100 Year





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**100 - Year**

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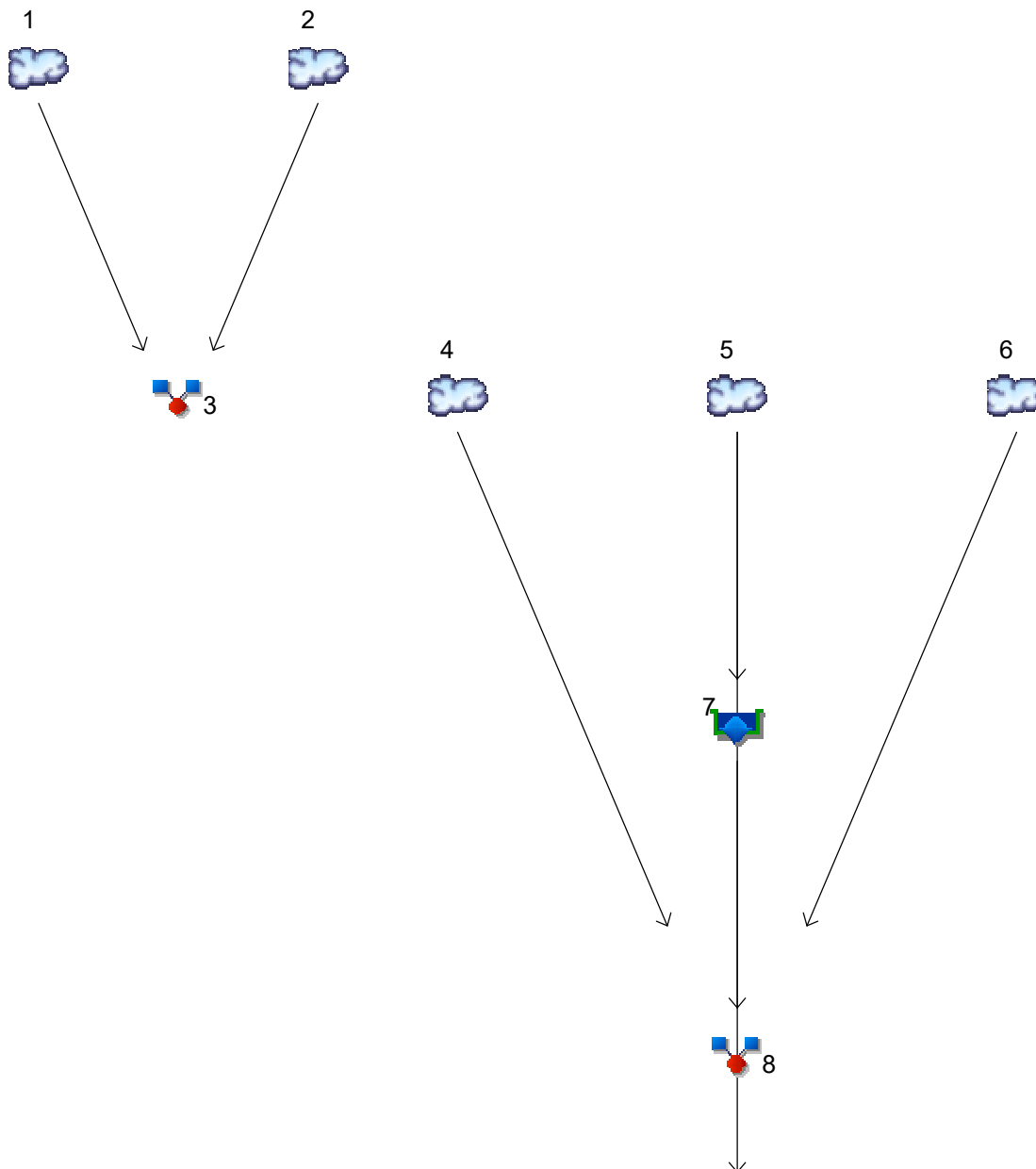
# APPENDIX C:

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## POST-DEVELOPMENT DRAINAGE CALCULATIONS

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



## Legend

Hyd.	Origin	Description
1	SCS Runoff	Predev DA to Quarry Road
2	SCS Runoff	Predev DA to Dolington Road
3	Combine	Predev to Intersection
4	SCS Runoff	Postdev Bypass DA to Quarry Road
5	SCS Runoff	Postdev to Detention Basin
6	SCS Runoff	Postdev Bypass Flow to Dolington Road
7	Reservoir	DetentionBasin Outflow
8	Combine	Postdev to Intersection
10	Reservoir	Sediment Basin

# Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	1.010	4.002	-----	10.45	18.86	28.40	38.74	52.51	Predev DA to Quarry Road
2	SCS Runoff	-----	3.939	9.282	-----	18.50	29.05	40.49	52.56	68.27	Predev DA to Dolington Road
3	Combine	1, 2	4.906	13.27	-----	28.95	47.69	68.65	91.14	120.75	Predev to Intersection
4	SCS Runoff	-----	0.596	2.070	-----	5.120	9.025	13.44	18.21	24.55	Postdev Bypass DA to Quarry Road
5	SCS Runoff	-----	8.247	16.63	-----	29.87	44.54	60.15	76.42	97.50	Postdev to Detention Basin
6	SCS Runoff	-----	0.200	0.526	-----	1.111	1.789	2.531	3.319	4.364	Postdev Bypass Flow to Dolington Ro
7	Reservoir	5	2.134	2.849	-----	7.914	23.56	37.63	48.89	56.99	DetentionBasin Outflow
8	Combine	4, 6, 7	2.673	4.858	-----	10.17	29.71	48.35	64.02	78.49	Postdev to Intersection
10	Reservoir	5	0.146	0.392	-----	1.417	5.374	21.48	49.63	81.20	Sediment Basin

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.010	2	744	11,616	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	3.939	2	736	26,190	-----	-----	-----	Predev DA to Dolington Road
3	Combine	4.906	2	736	37,807	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	0.596	2	748	6,683	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	8.247	2	738	48,117	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	0.200	2	732	1,263	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	2.134	2	780	46,021	5	161.11	13,460	DetentionBasin Outflow
8	Combine	2.673	2	760	53,967	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	0.146	2	1468	21,337	5	162.53	44,051	Sediment Basin
Basin design.gpw					Return Period: 1 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

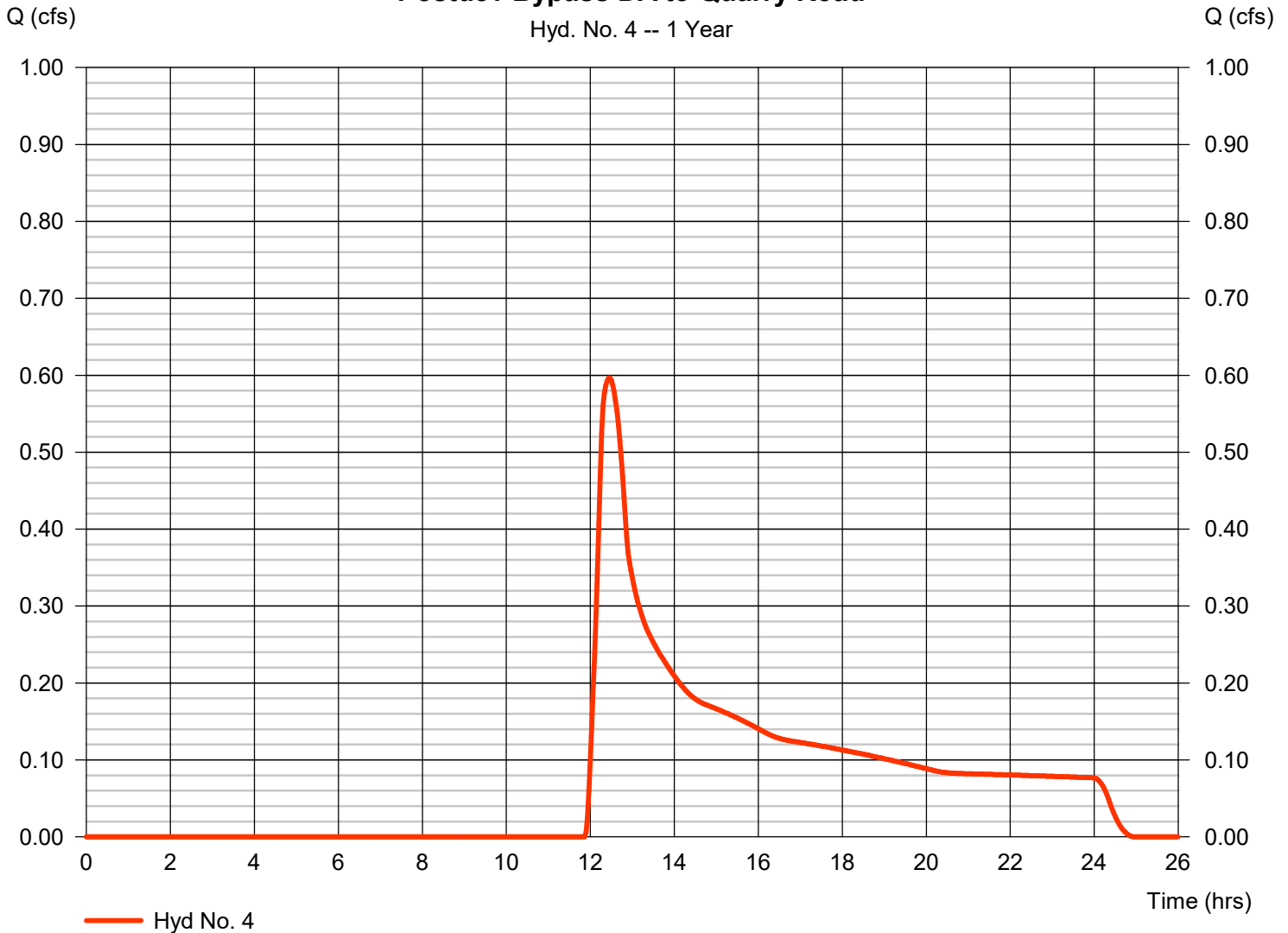
## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 0.596 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 6,683 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Postdev Bypass DA to Quarry Road

Hyd. No. 4 -- 1 Year



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.36	0.00	0.00	
Land slope (%)	= 2.67	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 25.82</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 25.82</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 580.00	1260.00	0.00	
Watercourse slope (%)	= 3.60	2.30	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=3.06	3.08	0.00	
<b>Travel Time (min)</b>	<b>= 3.16</b>	<b>+ 6.81</b>	<b>+ 0.00</b>	<b>= 9.97</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>35.80 min</b>

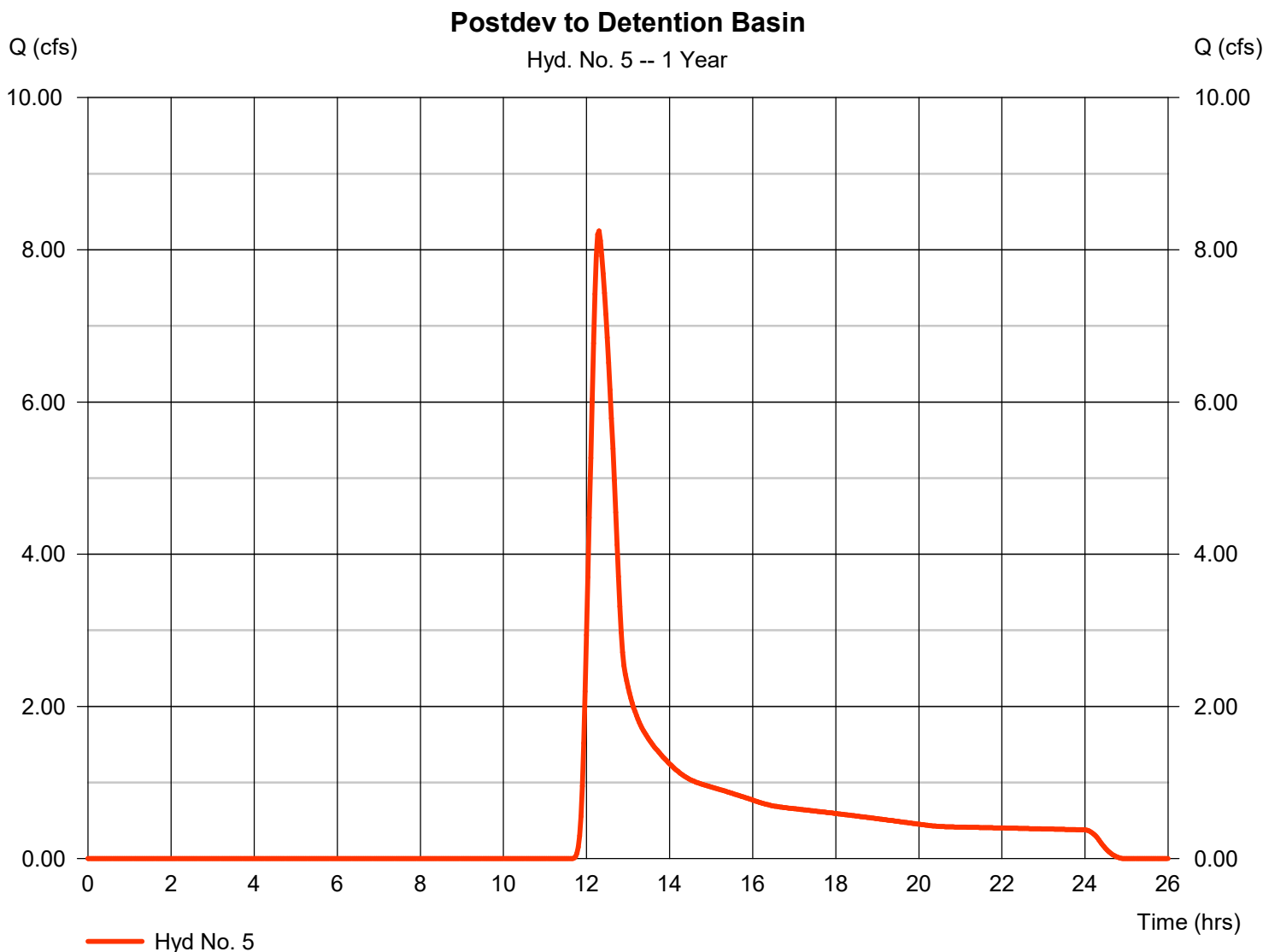


# Hydrograph Report

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 8.247 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 48,117 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 5

Postdev to Detention Basin

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.36	0.00	0.00	
Land slope (%)	= 2.20	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 27.90</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 27.90</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 660.00	250.00	65.00	
Watercourse slope (%)	= 1.70	0.60	1.50	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=2.10	1.57	1.98	
<b>Travel Time (min)</b>	<b>= 5.23</b>	<b>+</b> <b>2.65</b>	<b>+</b> <b>0.55</b>	<b>= 8.42</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>36.30 min</b>

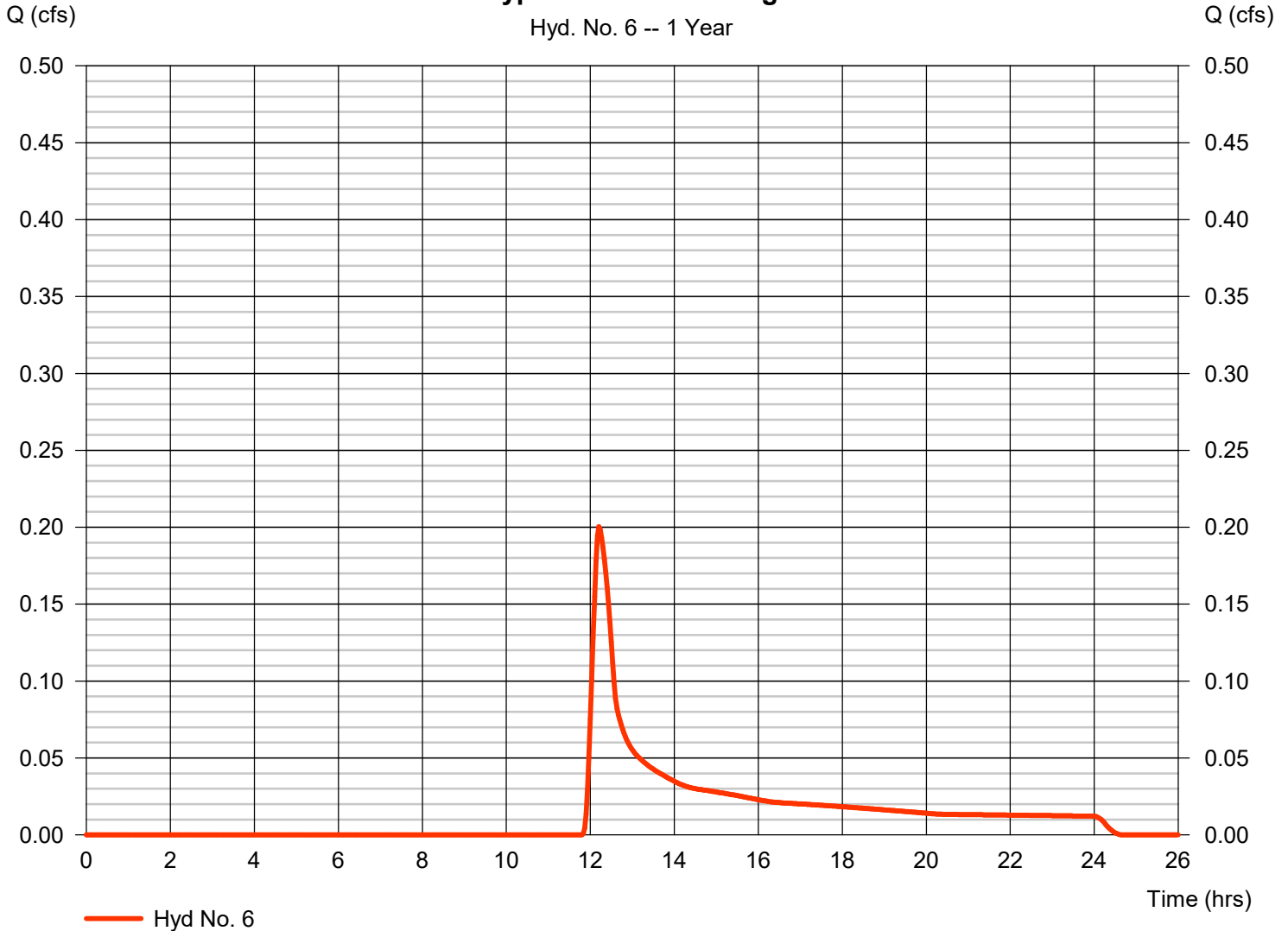
# Hydrograph Report

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 0.200 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,263 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 2.64 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

**Postdev Bypass Flow to Dolington Road**



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 150.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.36	0.00	0.00	
Land slope (%)	= 3.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 22.91</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 22.91</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 400.00	0.00	0.00	
Watercourse slope (%)	= 4.40	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=3.38	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 1.97</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 1.97</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>24.90 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

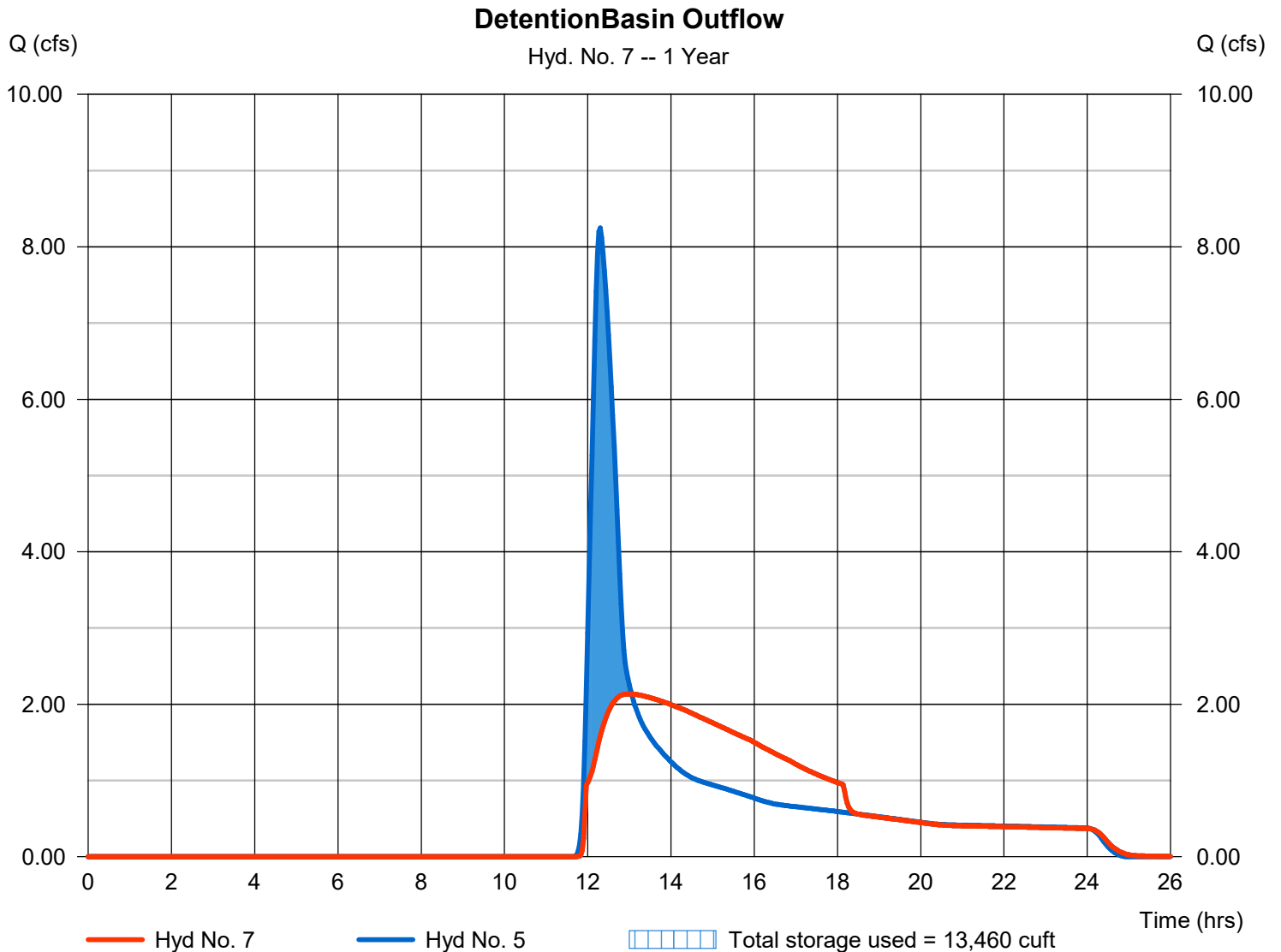
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 2.134 cfs
Storm frequency	= 1 yrs	Time to peak	= 13.00 hrs
Time interval	= 2 min	Hyd. volume	= 46,021 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 161.11 ft
Reservoir name	= Basin No. 1	Max. Storage	= 13,460 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



## Pond No. 1 - Basin No. 1

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 159.50 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	159.50	00	0	0
0.50	160.00	1,543	386	386
2.50	162.00	22,000	23,543	23,929
4.50	164.00	53,882	75,882	99,811
6.50	166.00	62,428	116,310	216,121

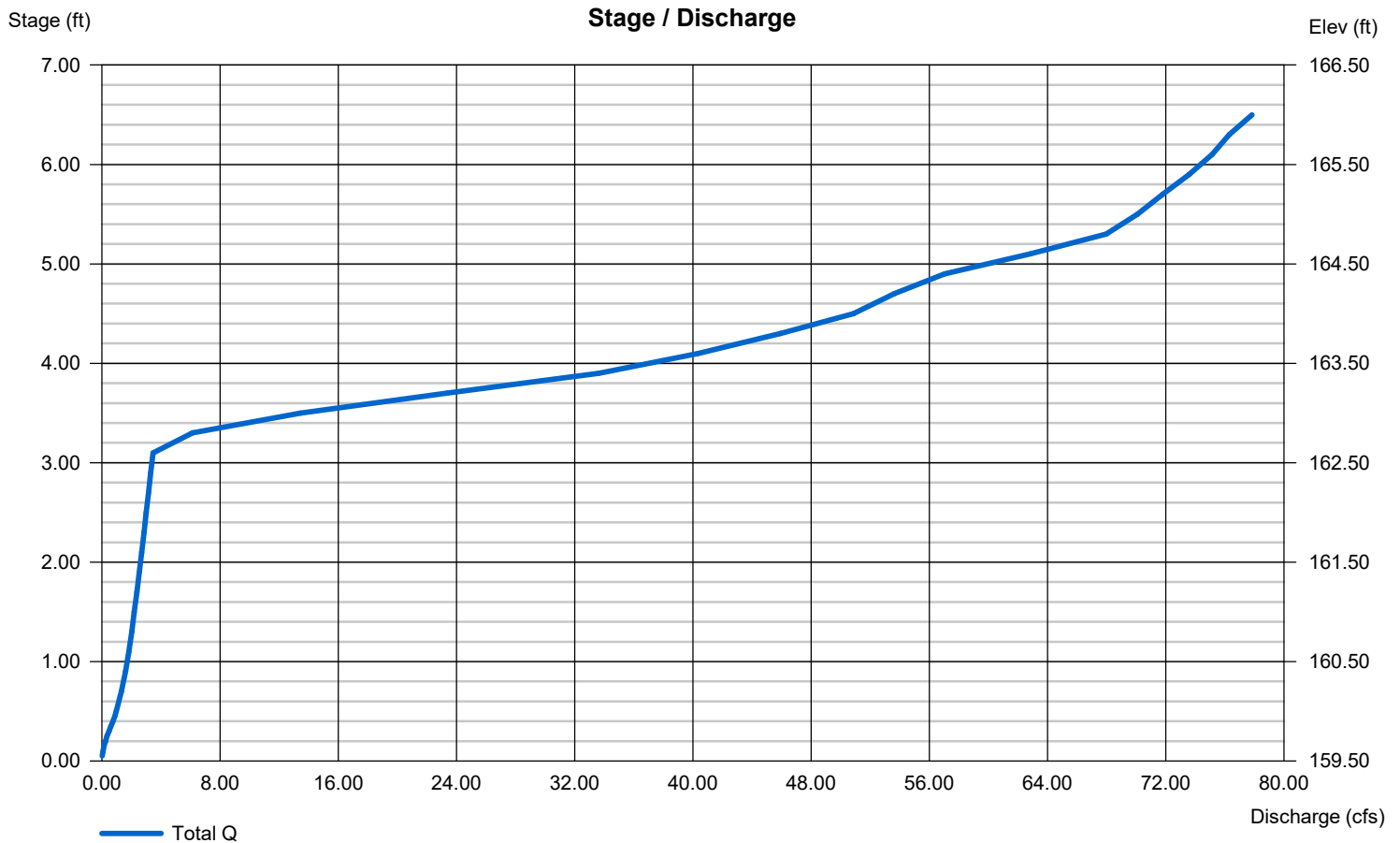
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	6.00	8.00	0.00
Span (in)	= 36.00	6.00	45.00	0.00
No. Barrels	= 1	2	4	0
Invert El. (ft)	= 159.30	159.50	162.66	0.00
Length (ft)	= 45.00	0.00	0.00	0.00
Slope (%)	= 2.89	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	100.00	Inactive	Inactive
Crest El. (ft)	= 164.00	164.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Broad	Rect	Rect
Multi-Stage	= Yes	Yes	No	No
Exfil. (in/hr)	= 0.500 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

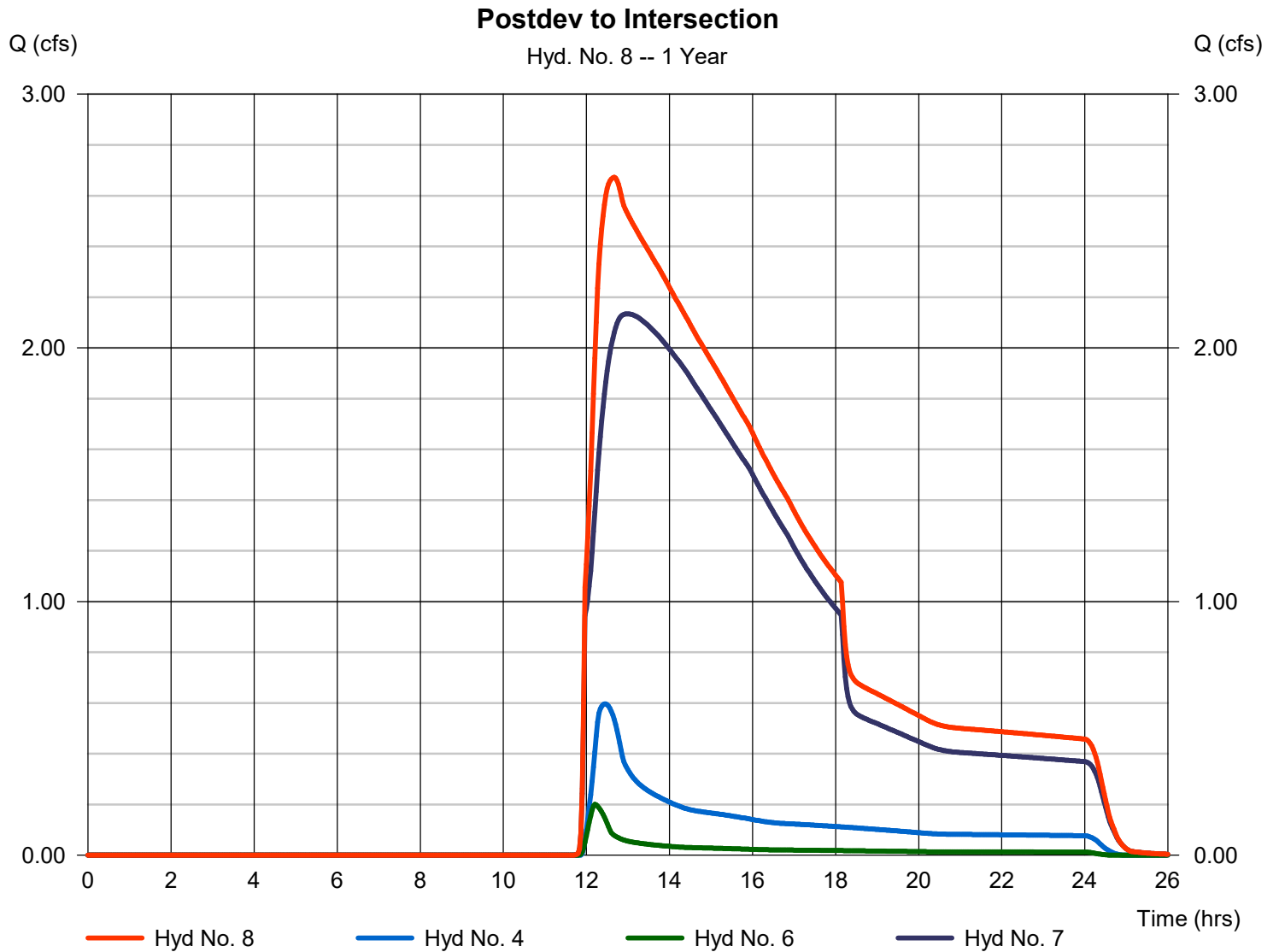
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 1 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 2.673 cfs  
 Time to peak = 12.67 hrs  
 Hyd. volume = 53,967 cuft  
 Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	4.002	2	734	26,520	-----	-----	-----	Predev DA to Quarry Road	
2	SCS Runoff	9.282	2	736	49,595	-----	-----	-----	Predev DA to Dolington Road	
3	Combine	13.27	2	734	76,115	1, 2	-----	-----	Predev to Intersection	
4	SCS Runoff	2.070	2	738	14,751	-----	-----	-----	Postdev Bypass DA to Quarry Road	
5	SCS Runoff	16.63	2	736	84,777	-----	-----	-----	Postdev to Detention Basin	
6	SCS Runoff	0.526	2	730	2,498	-----	-----	-----	Postdev Bypass Flow to Dolington Ro	
7	Reservoir	2.849	2	790	79,181	5	162.19	31,099	DetentionBasin Outflow	
8	Combine	4.858	2	746	96,430	4, 6, 7	-----	-----	Postdev to Intersection	
10	Reservoir	0.392	2	1460	53,800	5	163.26	71,705	Sediment Basin	
Basin design.gpw					Return Period: 2 Year			Friday, 07 / 14 / 2017		



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

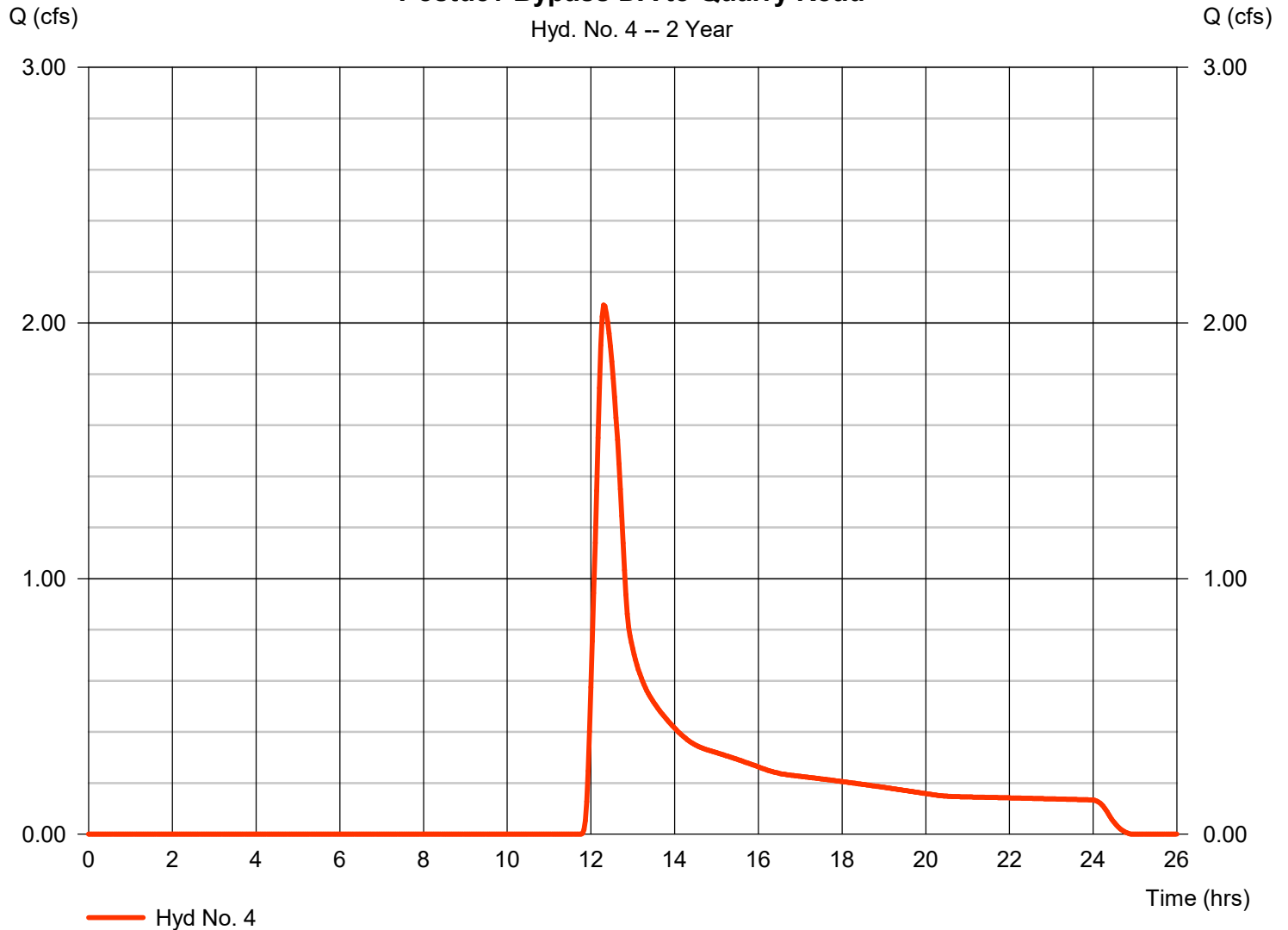
Friday, 07 / 14 / 2017

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 2.070 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 14,751 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 3.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev Bypass DA to Quarry Road



# Hydrograph Report

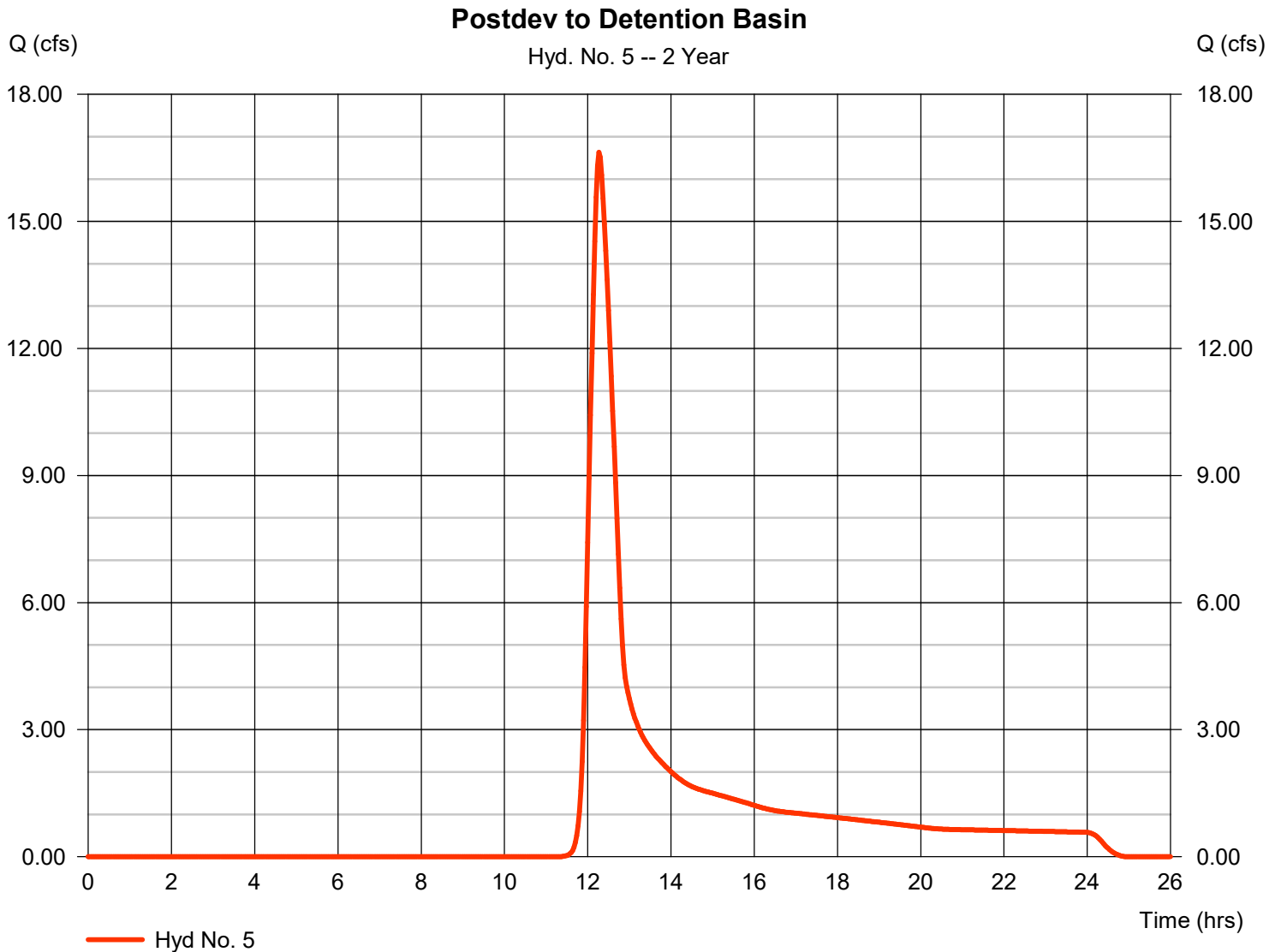
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 16.63 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 84,777 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 3.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

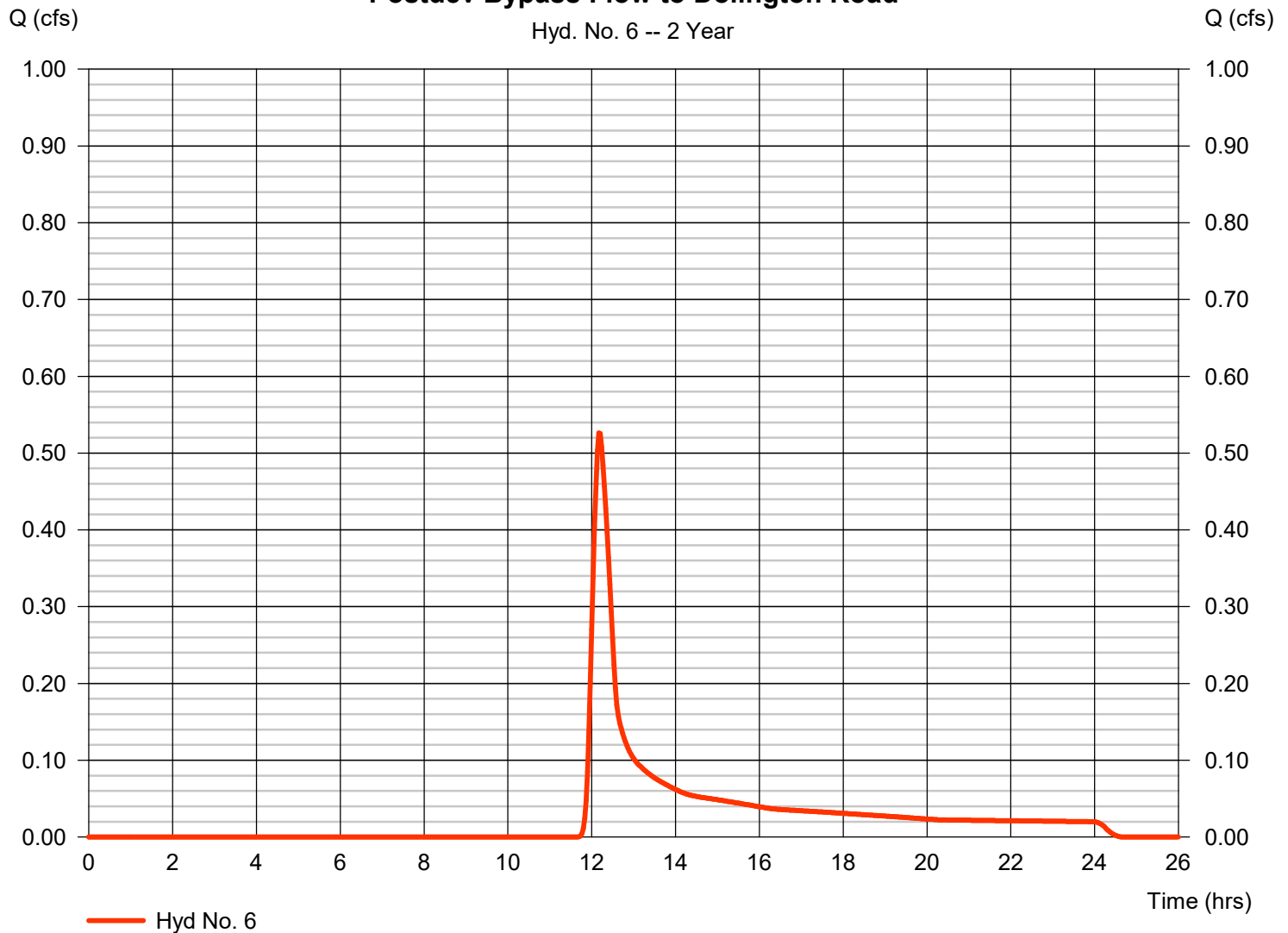
## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 0.526 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,498 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 3.36 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

**Postdev Bypass Flow to Dolington Road**

Hyd. No. 6 -- 2 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

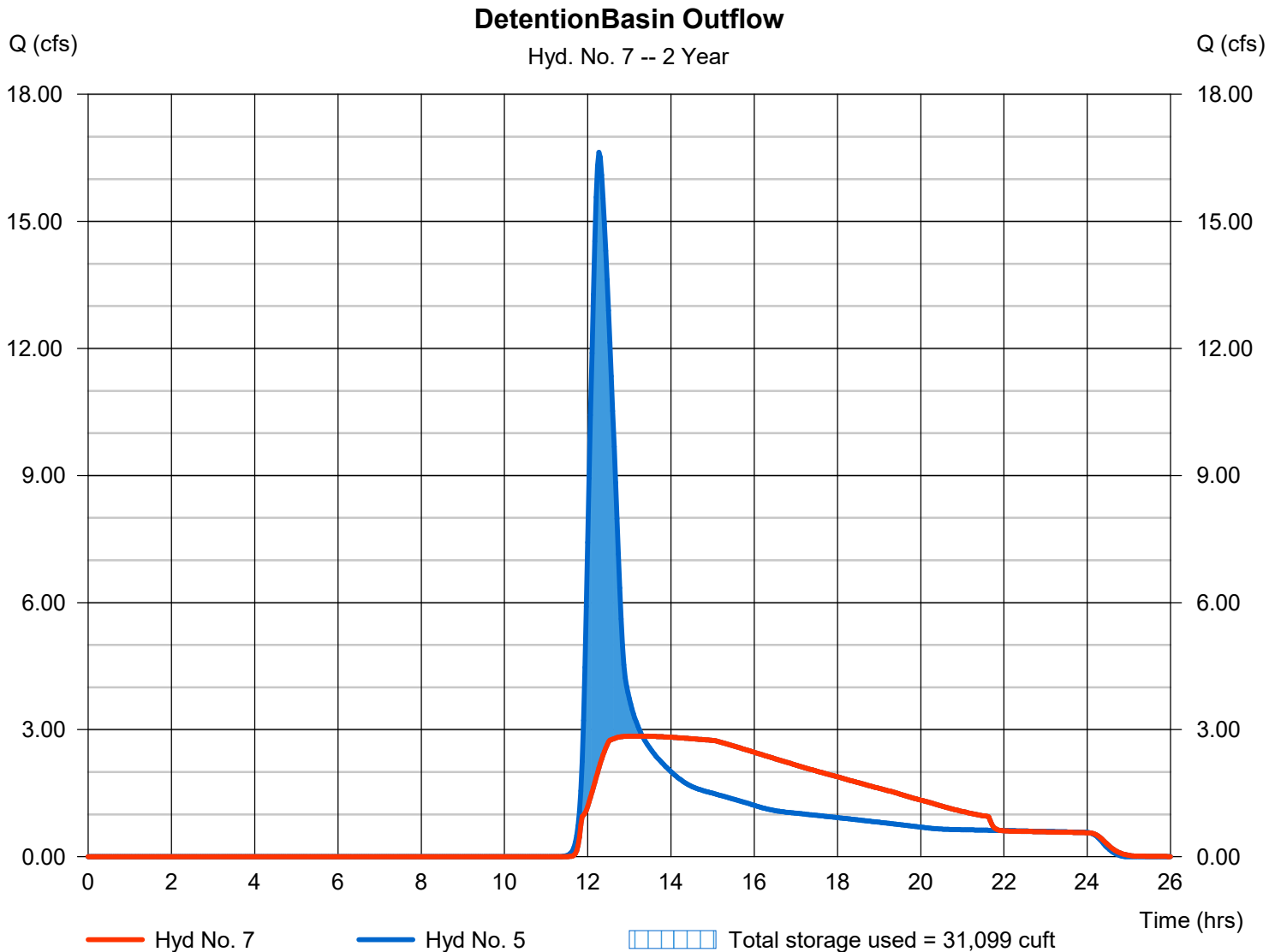
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 2.849 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.17 hrs
Time interval	= 2 min	Hyd. volume	= 79,181 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 162.19 ft
Reservoir name	= Basin No. 1	Max. Storage	= 31,099 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

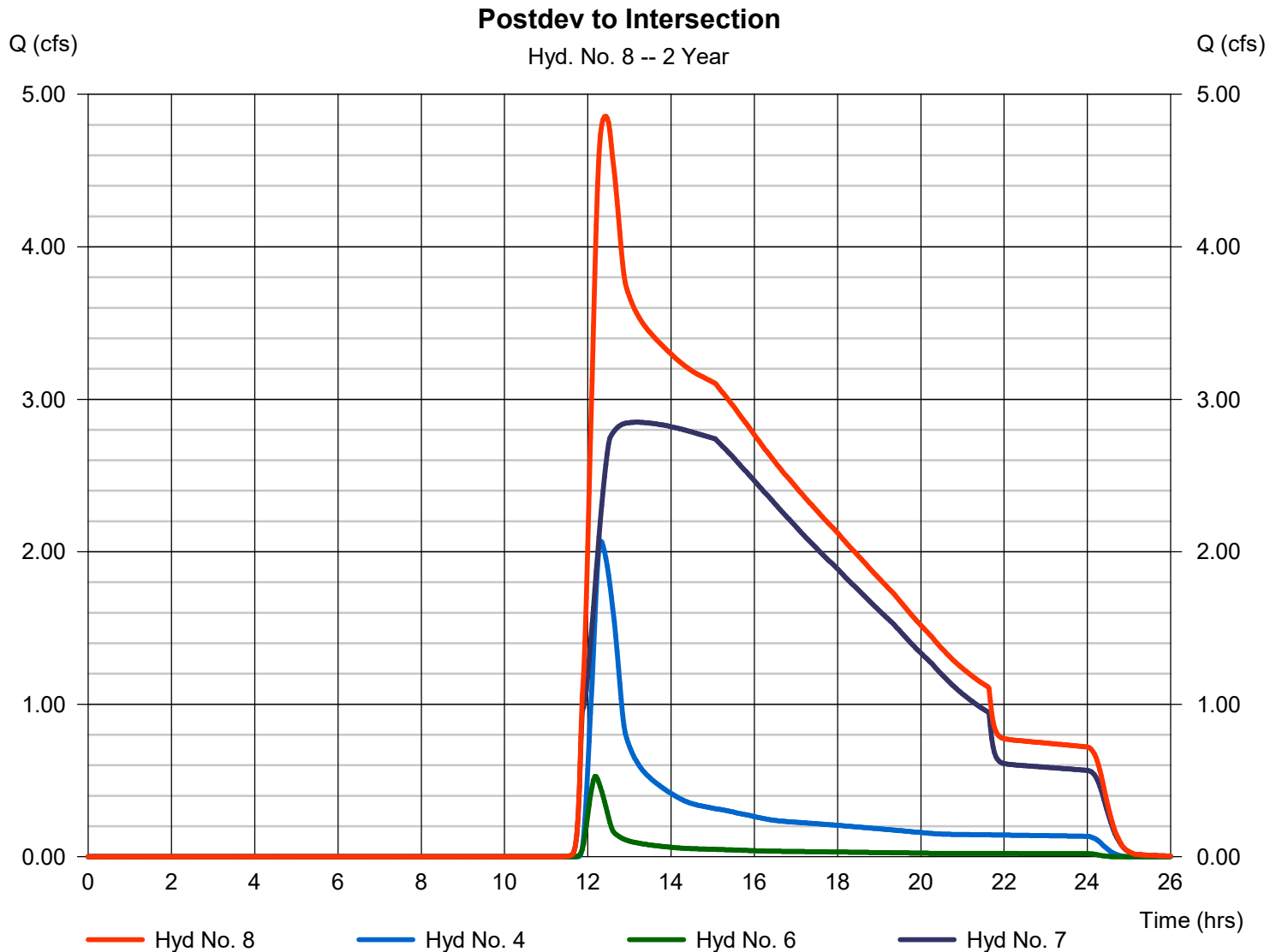
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 4.858 cfs  
 Time to peak = 12.43 hrs  
 Hyd. volume = 96,430 cuft  
 Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.45	2	734	52,999	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	18.50	2	734	87,644	-----	-----	-----	Predev DA to Dolington Road
3	Combine	28.95	2	734	140,643	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	5.120	2	738	28,851	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	29.87	2	736	142,177	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	1.111	2	730	4,549	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	7.914	2	770	131,400	5	162.86	56,558	DetentionBasin Outflow
8	Combine	10.17	2	766	164,800	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	1.417	2	1072	107,139	5	164.06	103,042	Sediment Basin
Basin design.gpw					Return Period: 5 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

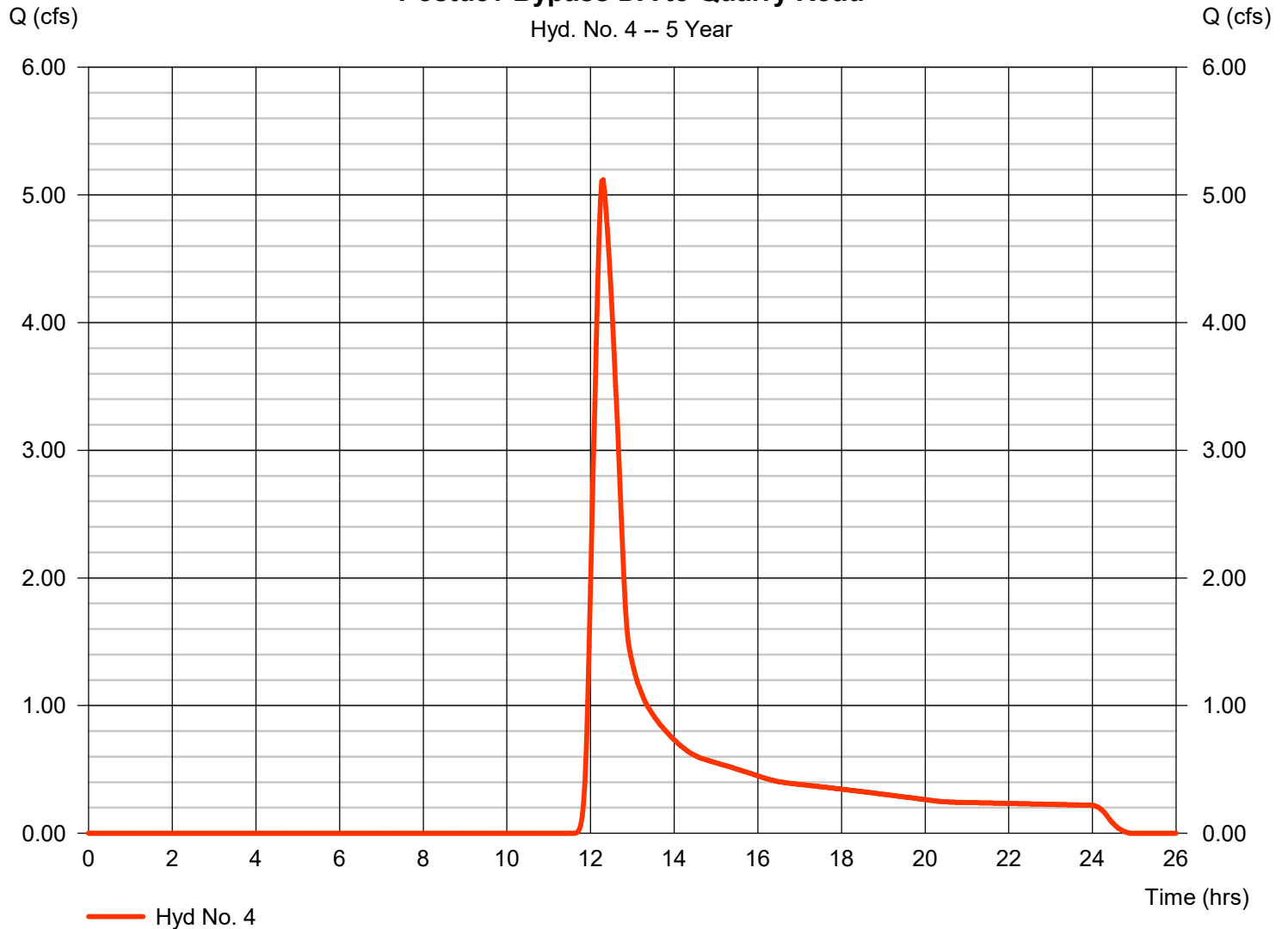
Friday, 07 / 14 / 2017

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 5.120 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 28,851 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 4.32 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev Bypass DA to Quarry Road

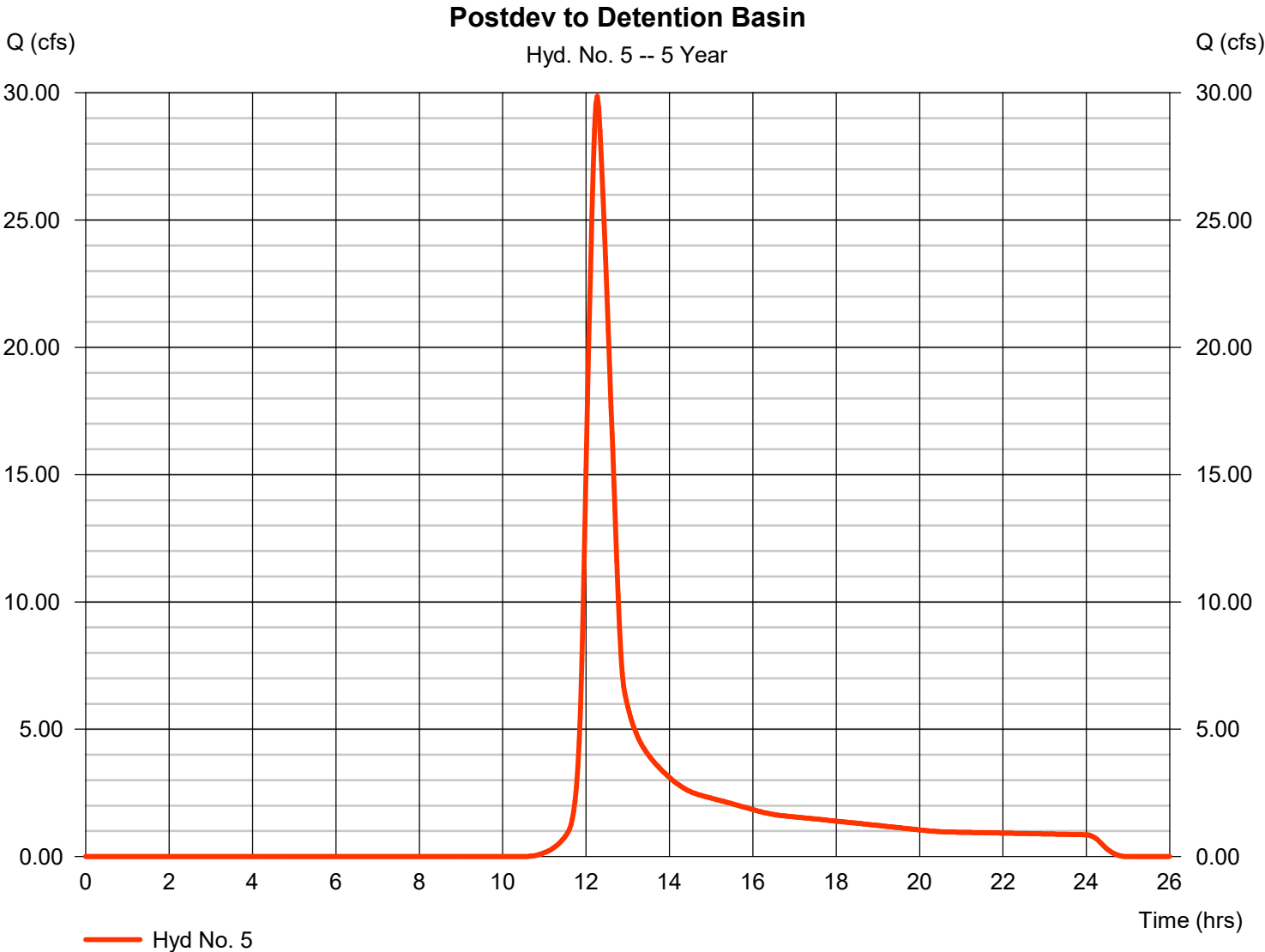


# Hydrograph Report

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 29.87 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 142,177 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 4.32 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

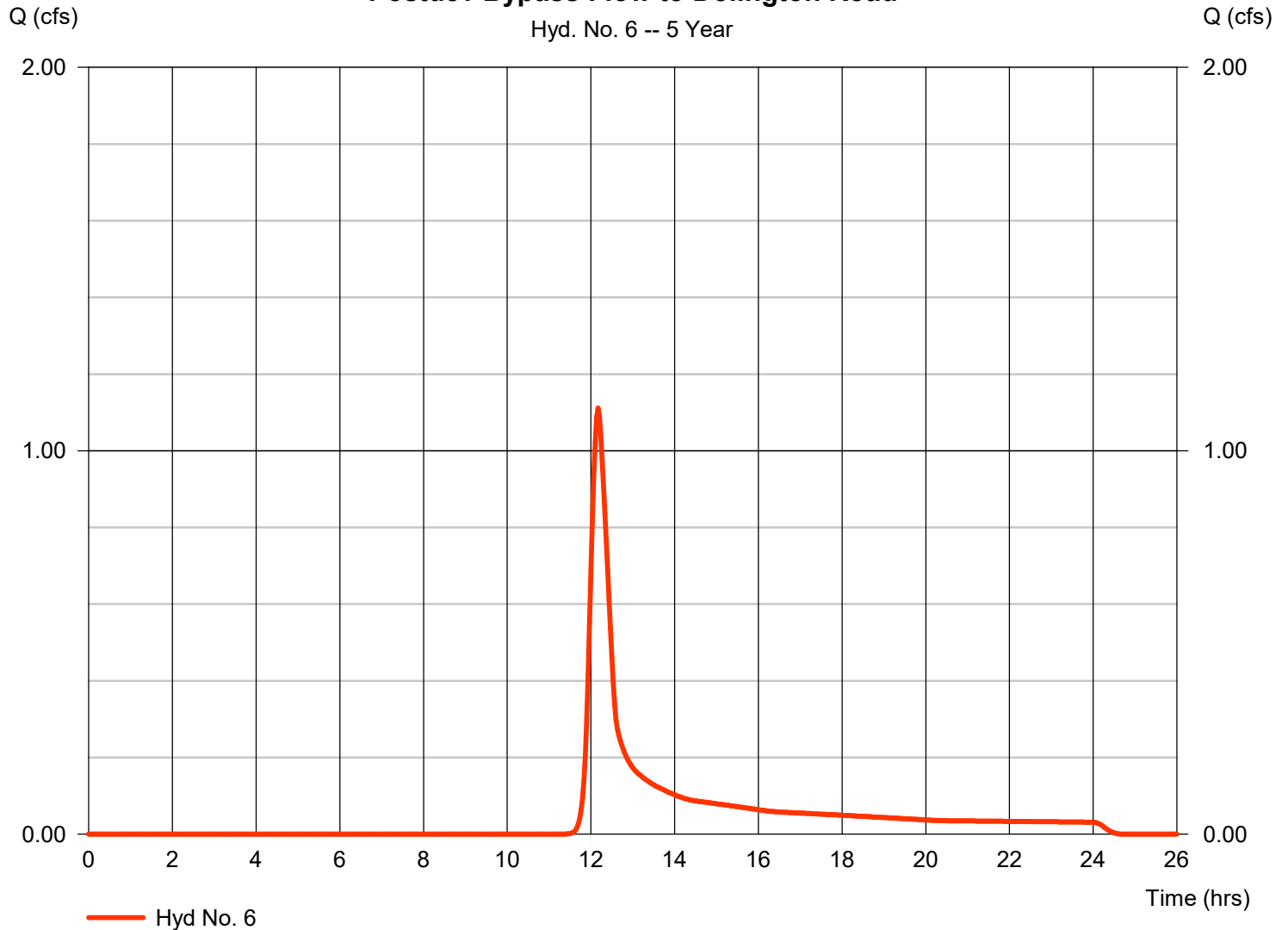
Friday, 07 / 14 / 2017

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 1.111 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 4,549 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 4.32 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

**Postdev Bypass Flow to Dolington Road**



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

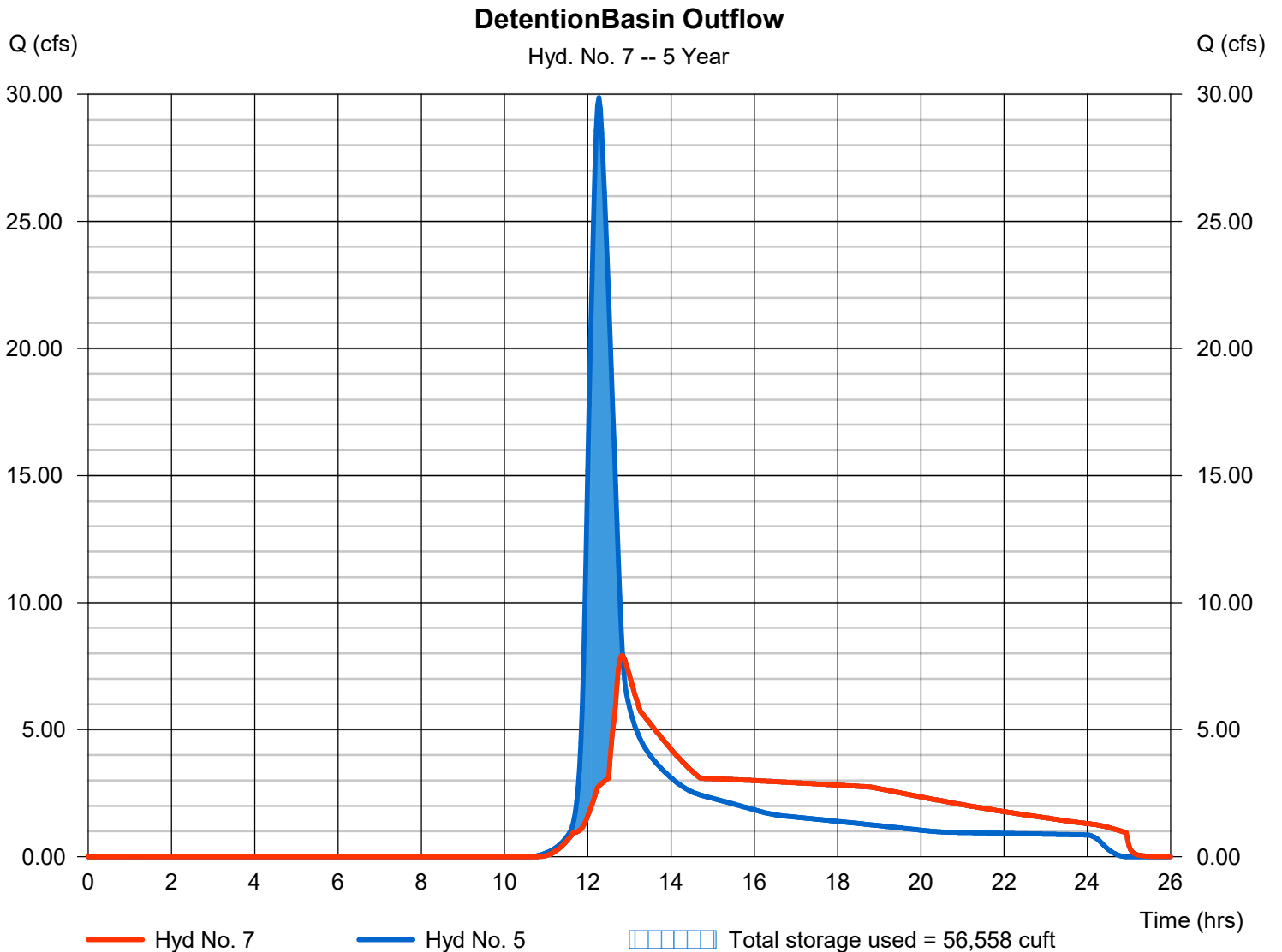
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 7.914 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.83 hrs
Time interval	= 2 min	Hyd. volume	= 131,400 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 162.86 ft
Reservoir name	= Basin No. 1	Max. Storage	= 56,558 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

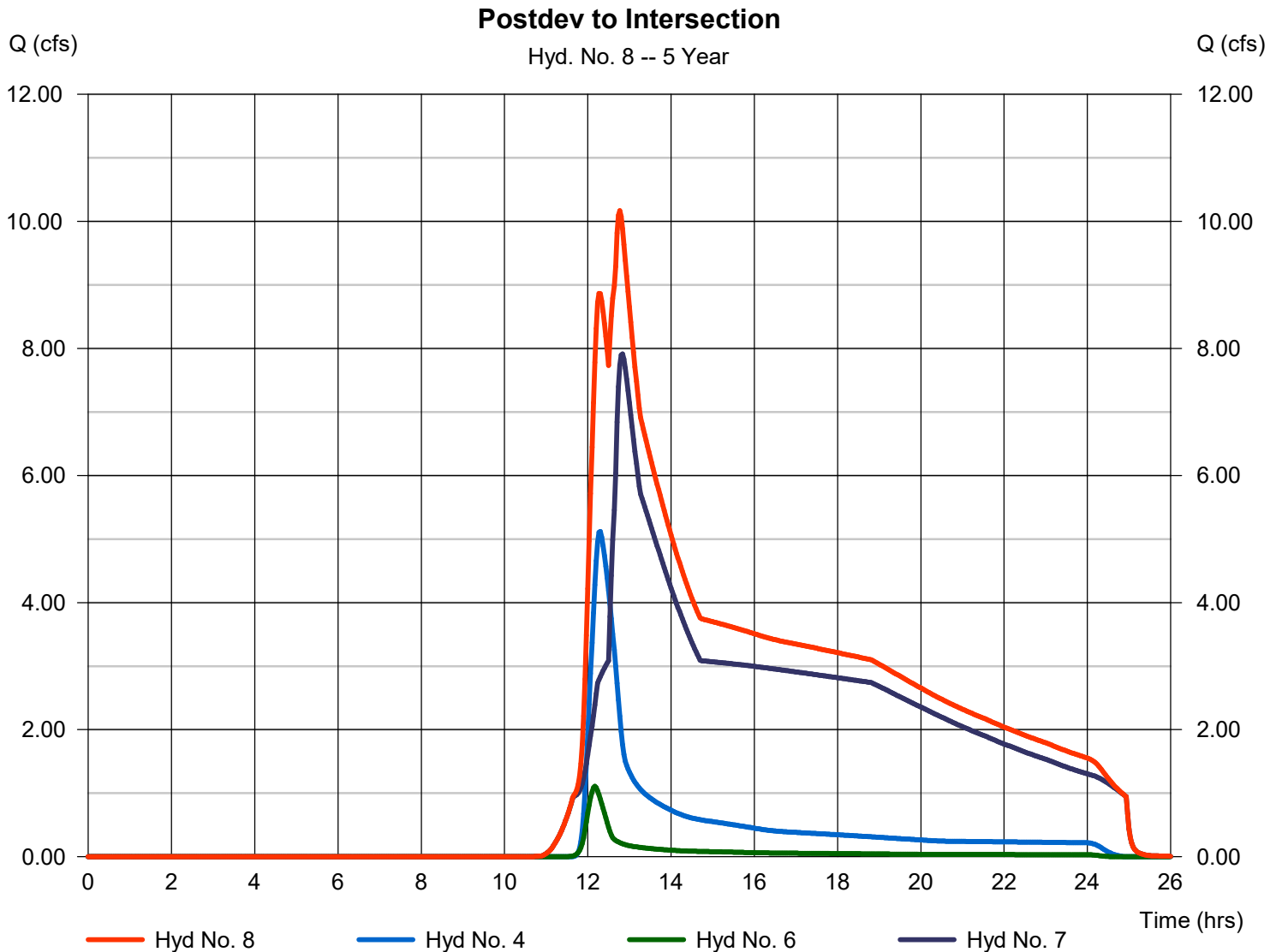
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 5 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 10.17 cfs  
 Time to peak = 12.77 hrs  
 Hyd. volume = 164,800 cuft  
 Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	18.86	2	732	85,143	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	29.05	2	734	131,325	-----	-----	-----	Predev DA to Dolington Road
3	Combine	47.69	2	734	216,468	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	9.025	2	736	45,822	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	44.54	2	736	206,368	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	1.789	2	730	6,938	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	23.56	2	758	193,132	5	163.21	69,937	DetentionBasin Outflow
8	Combine	29.71	2	754	245,892	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	5.374	2	812	171,233	5	164.26	115,142	Sediment Basin
Basin design.gpw					Return Period: 10 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

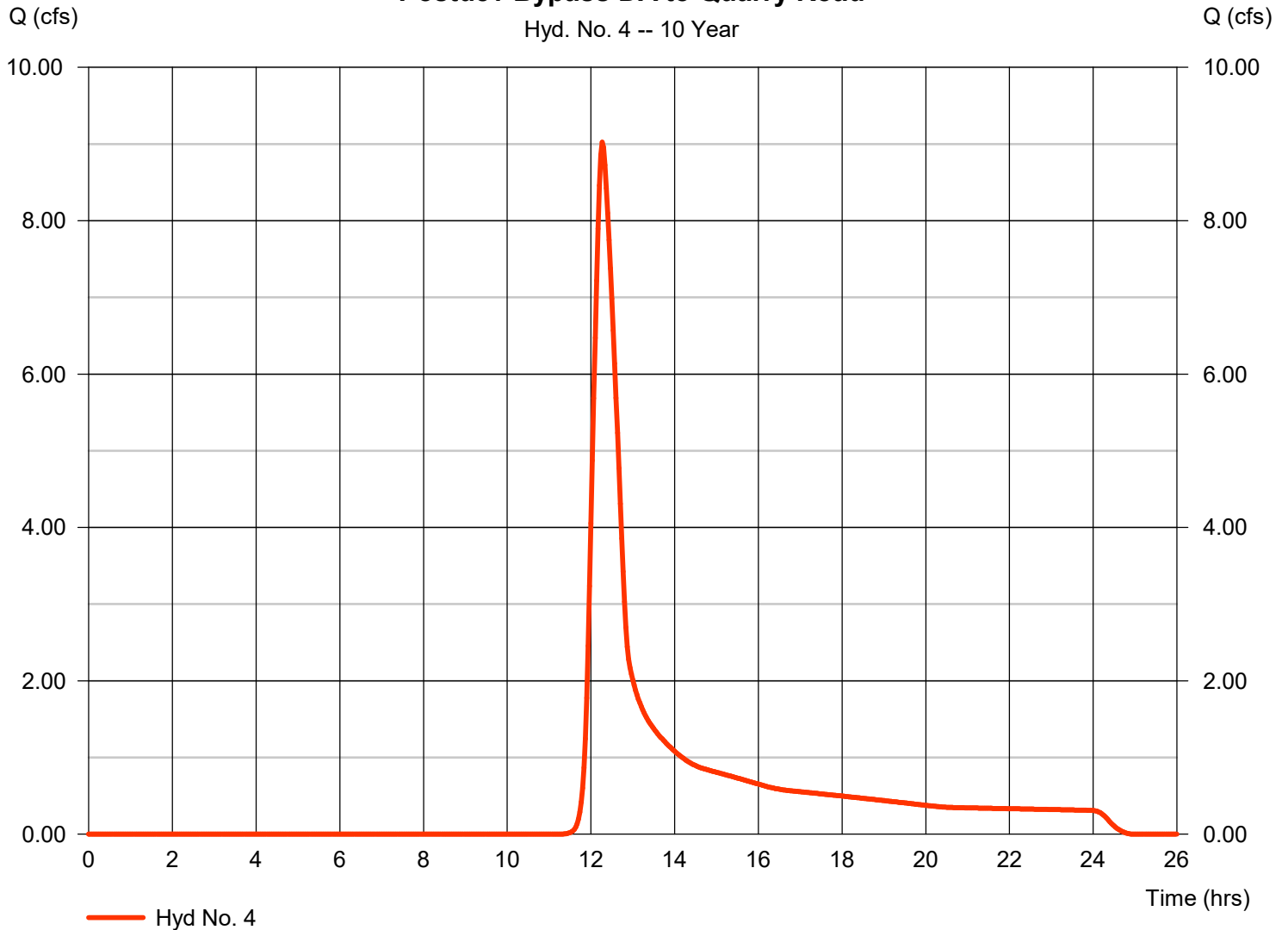
Friday, 07 / 14 / 2017

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 9.025 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 45,822 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev Bypass DA to Quarry Road



# Hydrograph Report

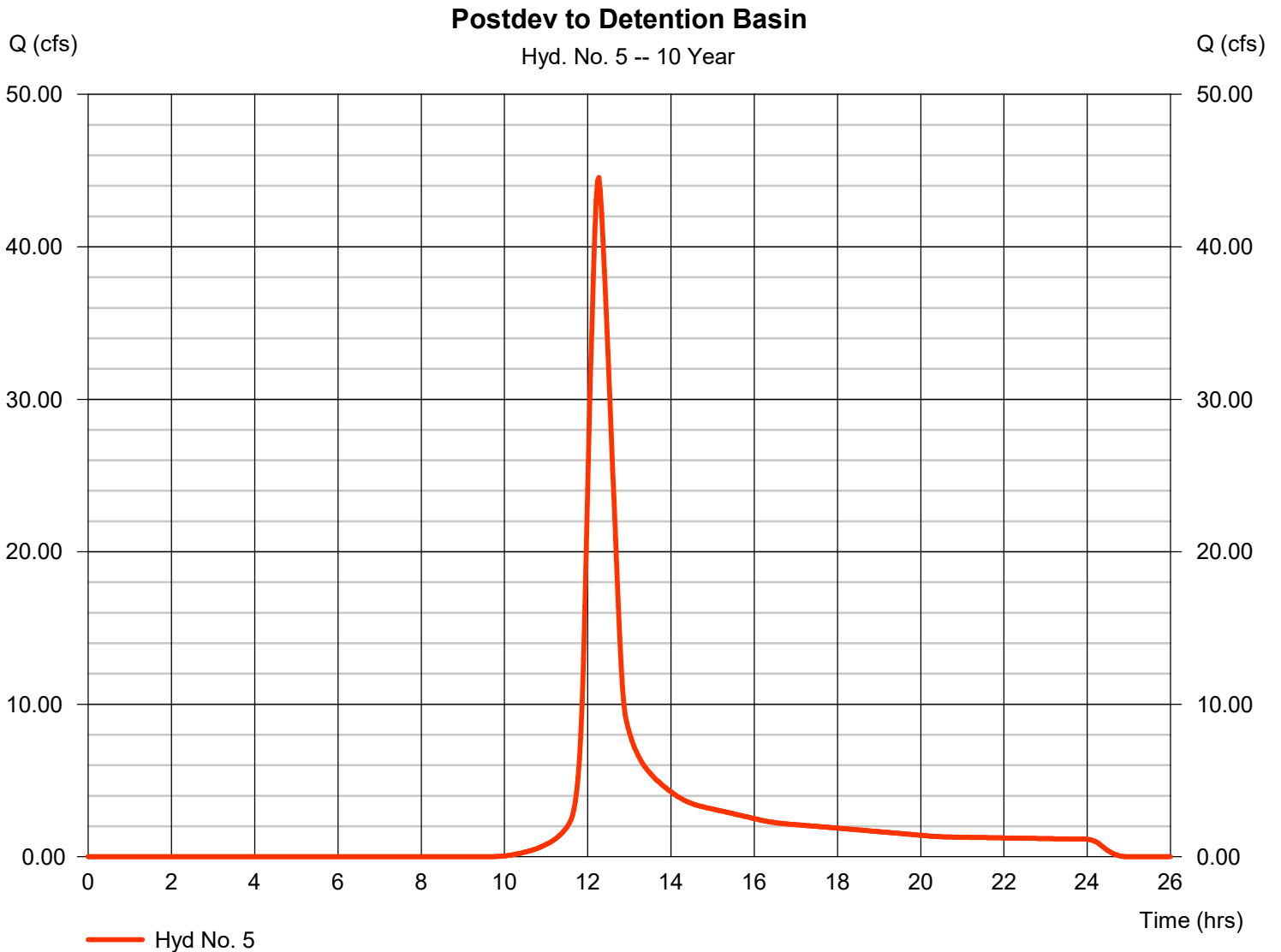
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 44.54 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 206,368 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

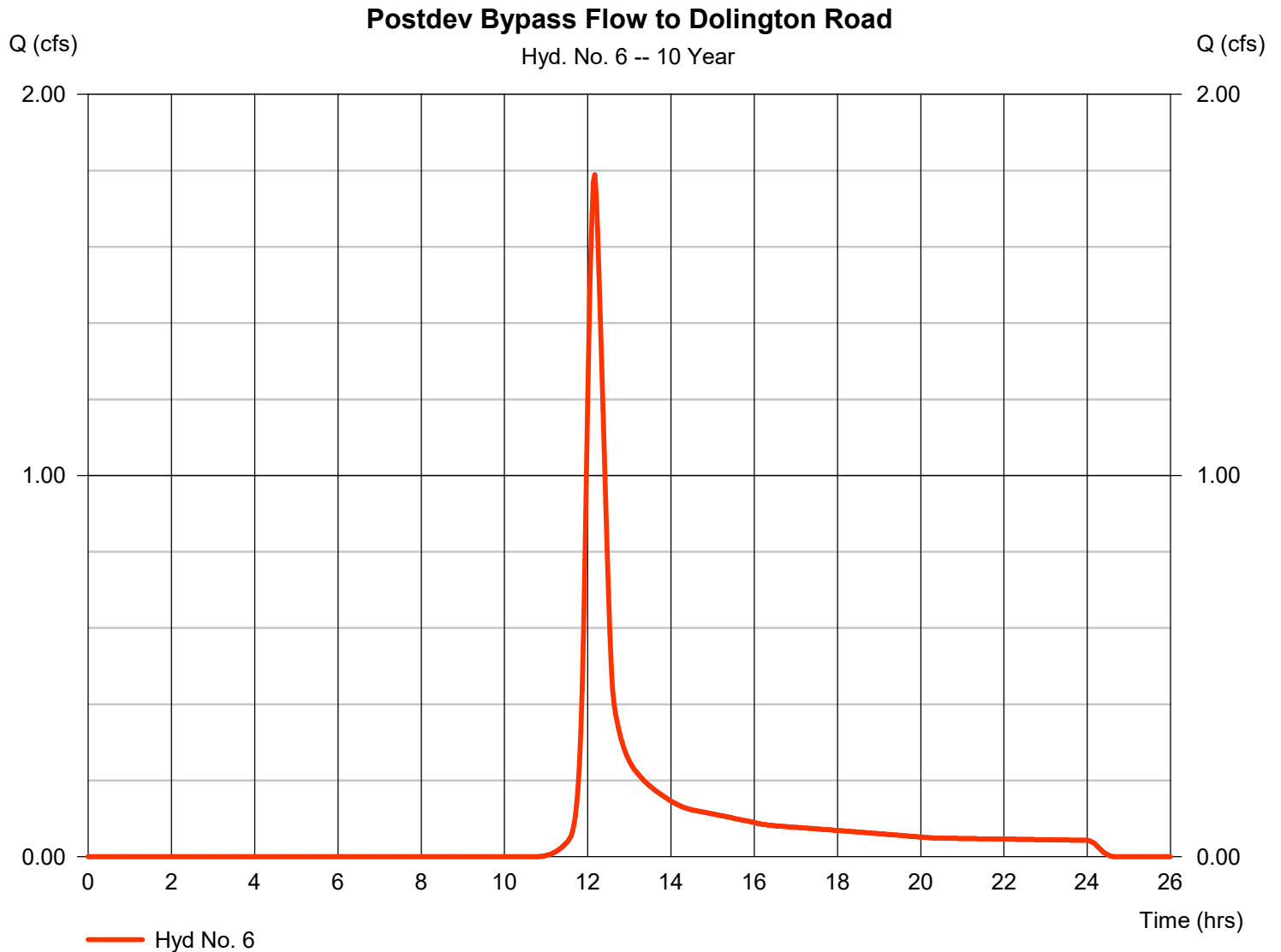
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 1.789 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 6,938 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

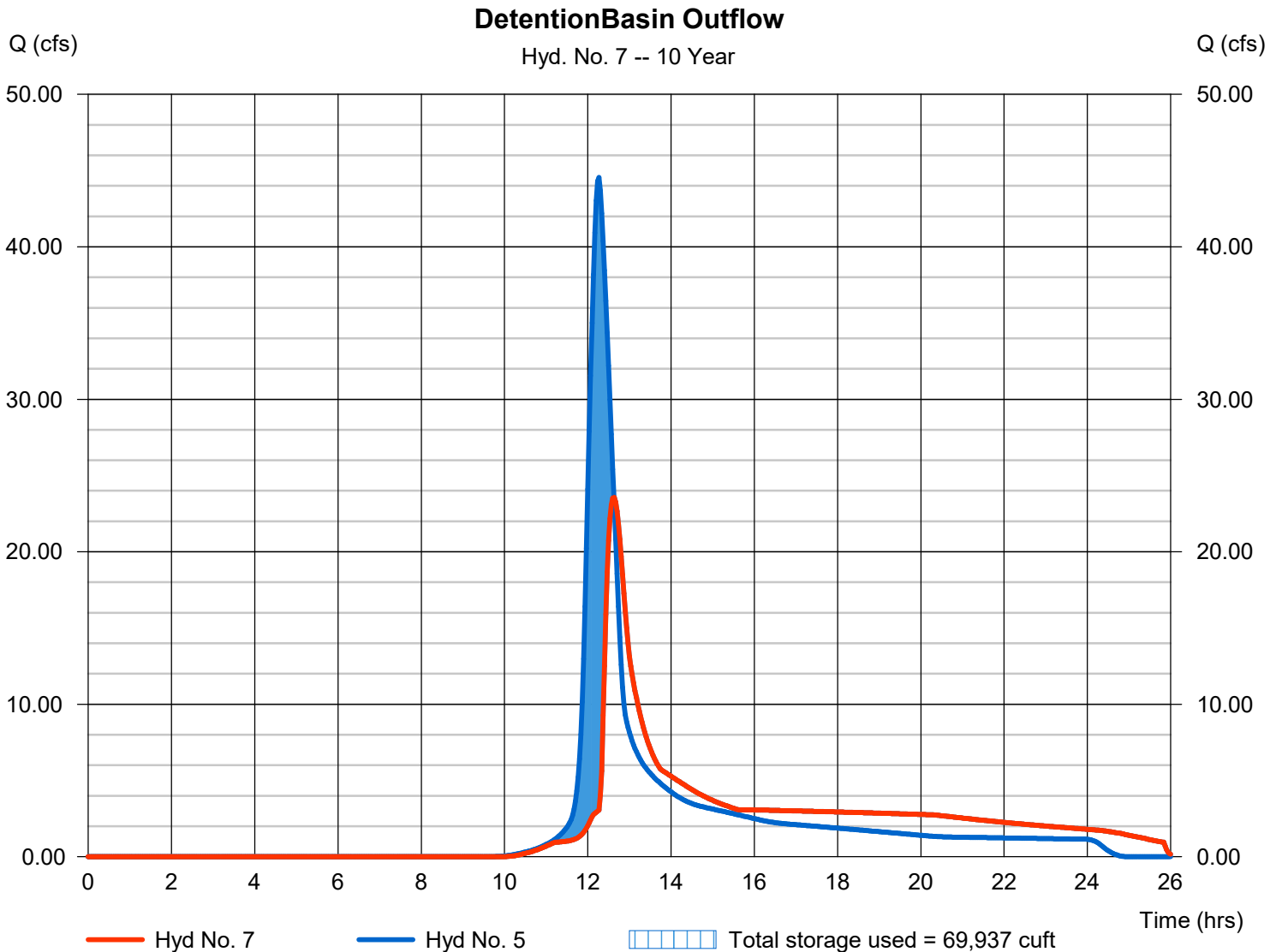
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 23.56 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 193,132 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 163.21 ft
Reservoir name	= Basin No. 1	Max. Storage	= 69,937 cuft

Storage Indication method used. Exfiltration extracted from Outflow.





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

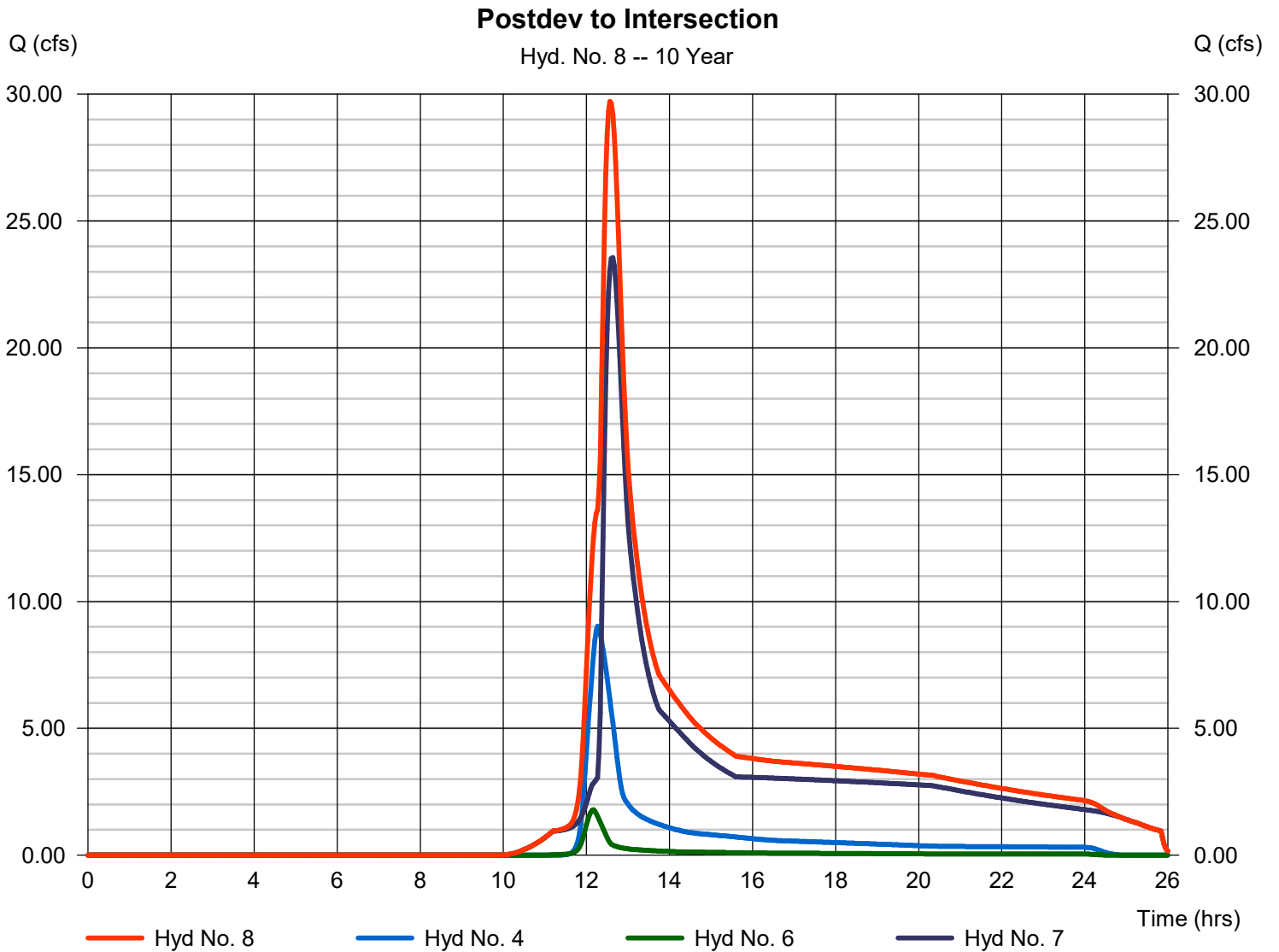
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 29.71 cfs  
 Time to peak = 12.57 hrs  
 Hyd. volume = 245,892 cuft  
 Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.40	2	732	121,583	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	40.49	2	734	179,073	-----	-----	-----	Predev DA to Dolington Road
3	Combine	68.65	2	732	300,655	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	13.44	2	736	64,950	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	60.15	2	736	275,325	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	2.531	2	730	9,575	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	37.63	2	754	259,891	5	163.54	82,182	DetentionBasin Outflow
8	Combine	48.35	2	748	334,416	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	21.48	2	764	240,116	5	164.55	132,035	Sediment Basin
Basin design.gpw					Return Period: 25 Year			Friday, 07 / 14 / 2017	

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

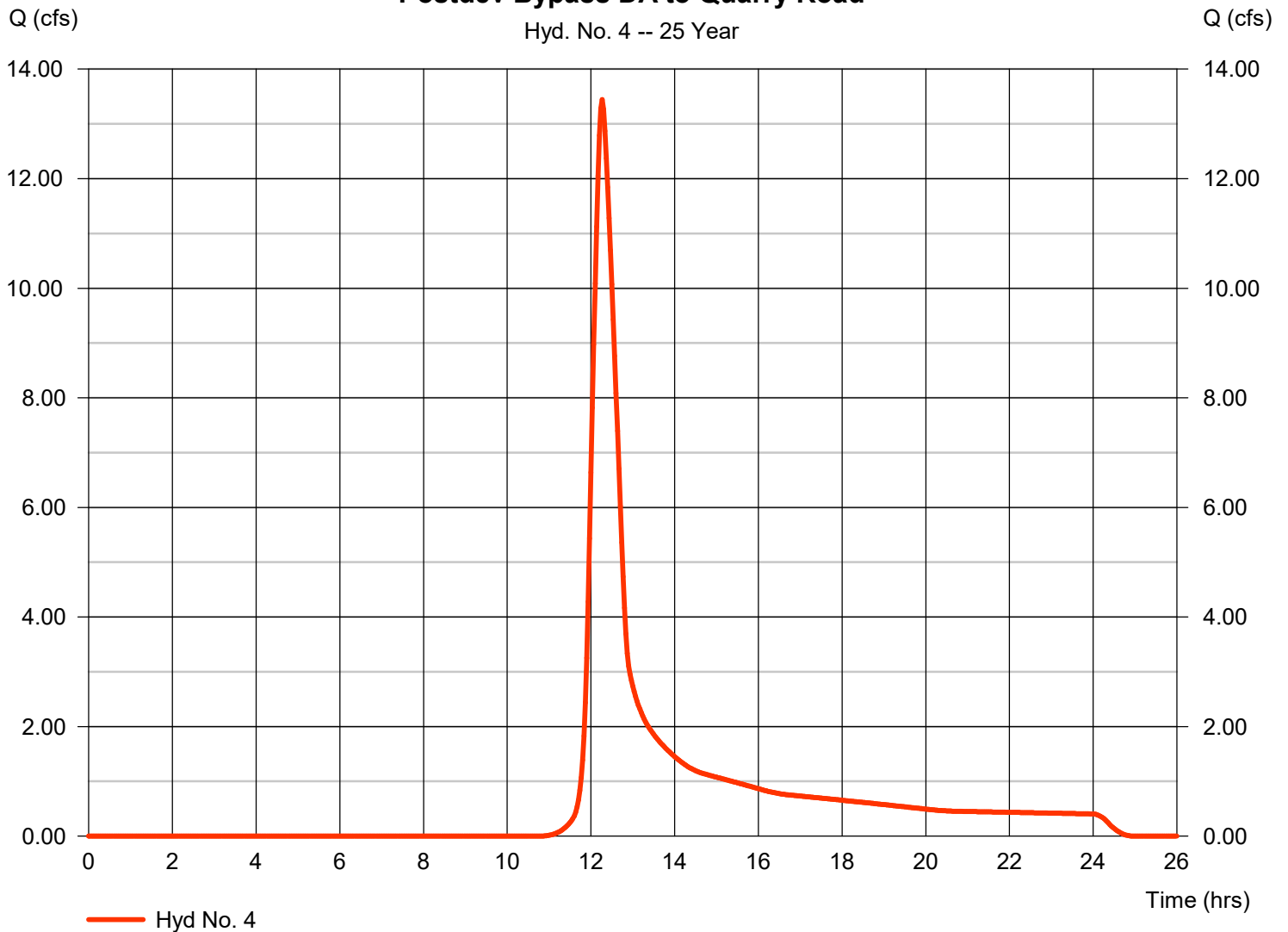
Friday, 07 / 14 / 2017

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 13.44 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 64,950 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev Bypass DA to Quarry Road



# Hydrograph Report

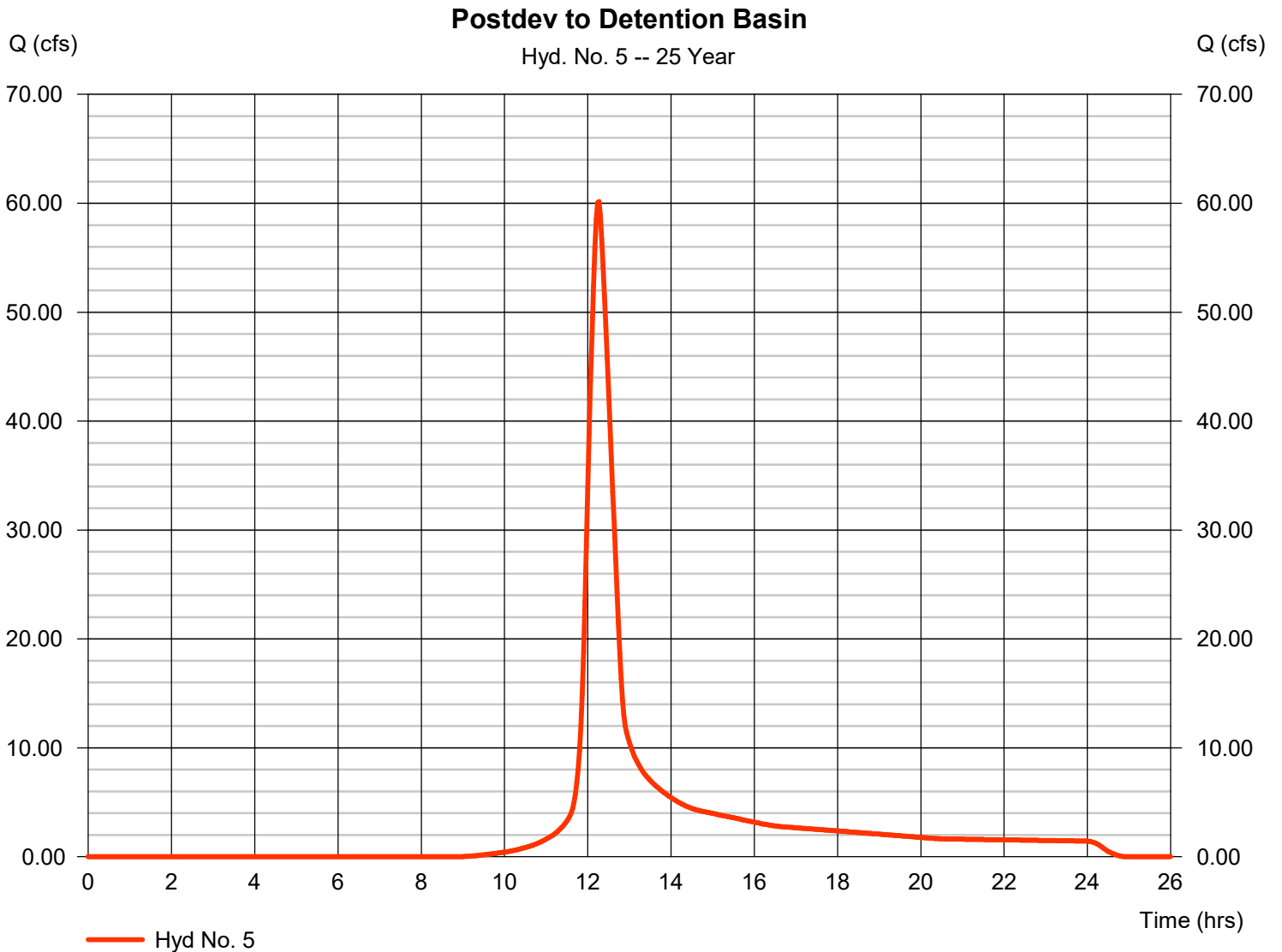
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 60.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 275,325 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

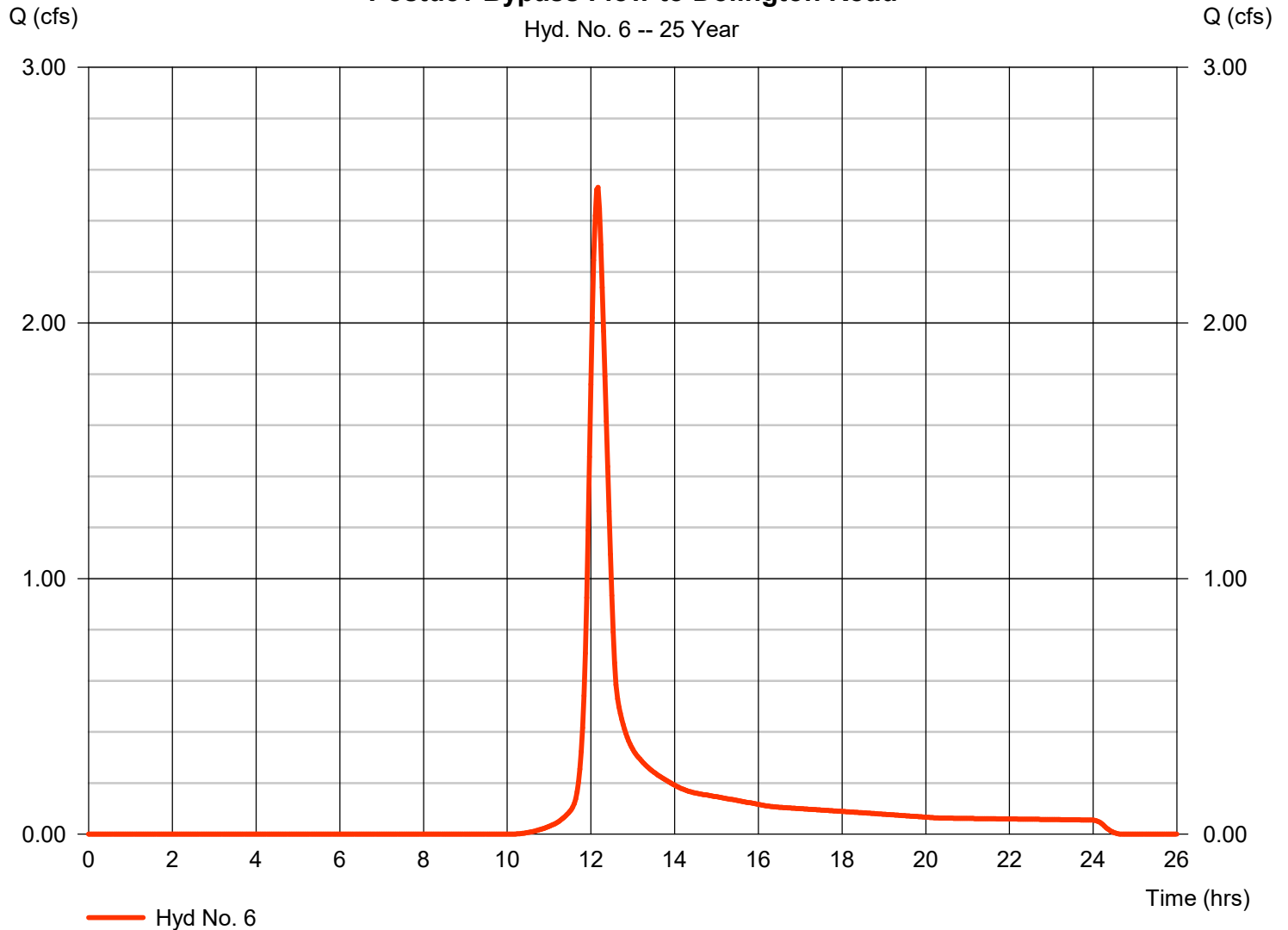
Friday, 07 / 14 / 2017

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 2.531 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 9,575 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 6.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

**Postdev Bypass Flow to Dolington Road**



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

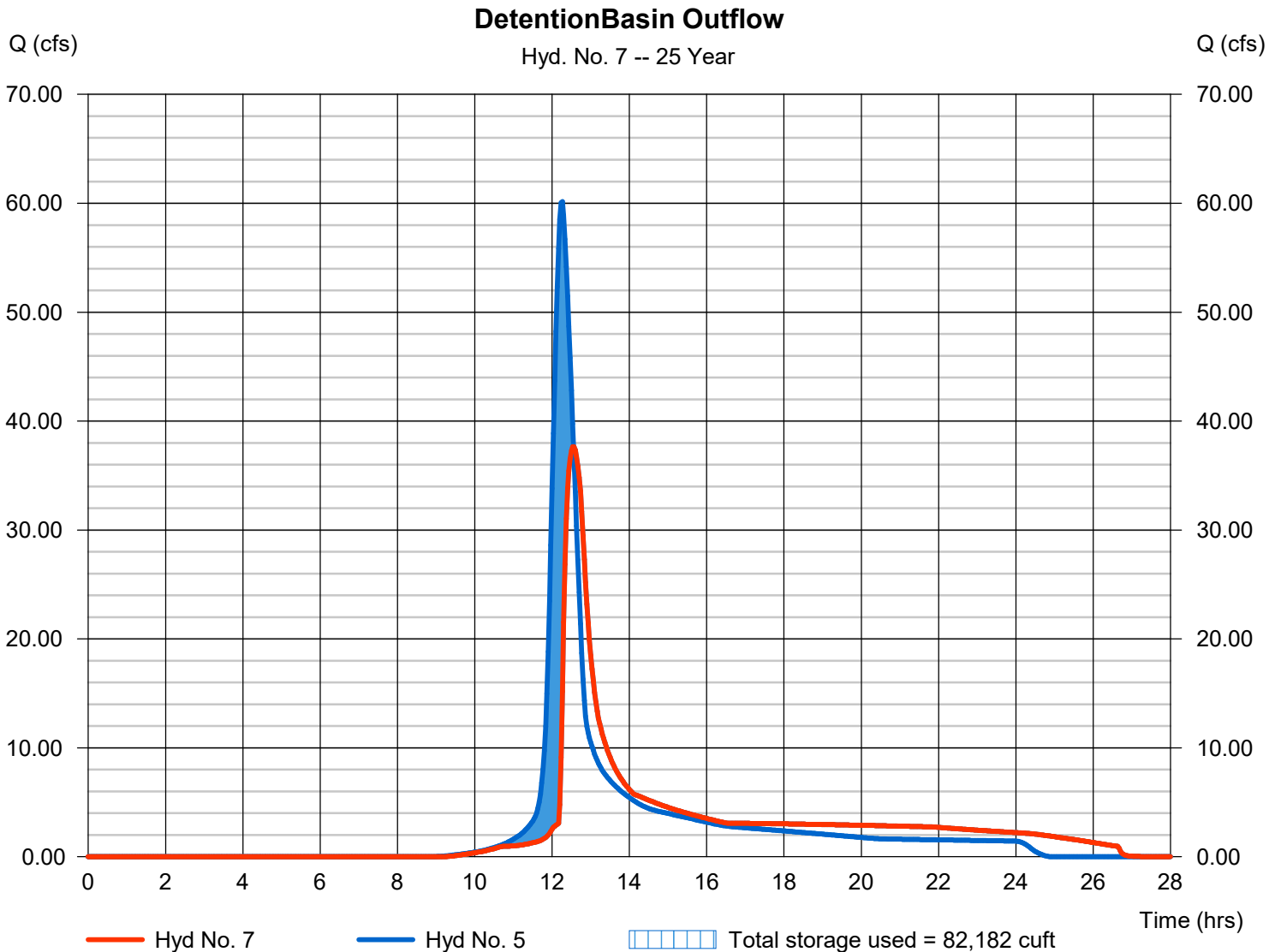
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 37.63 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.57 hrs
Time interval	= 2 min	Hyd. volume	= 259,891 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 163.54 ft
Reservoir name	= Basin No. 1	Max. Storage	= 82,182 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

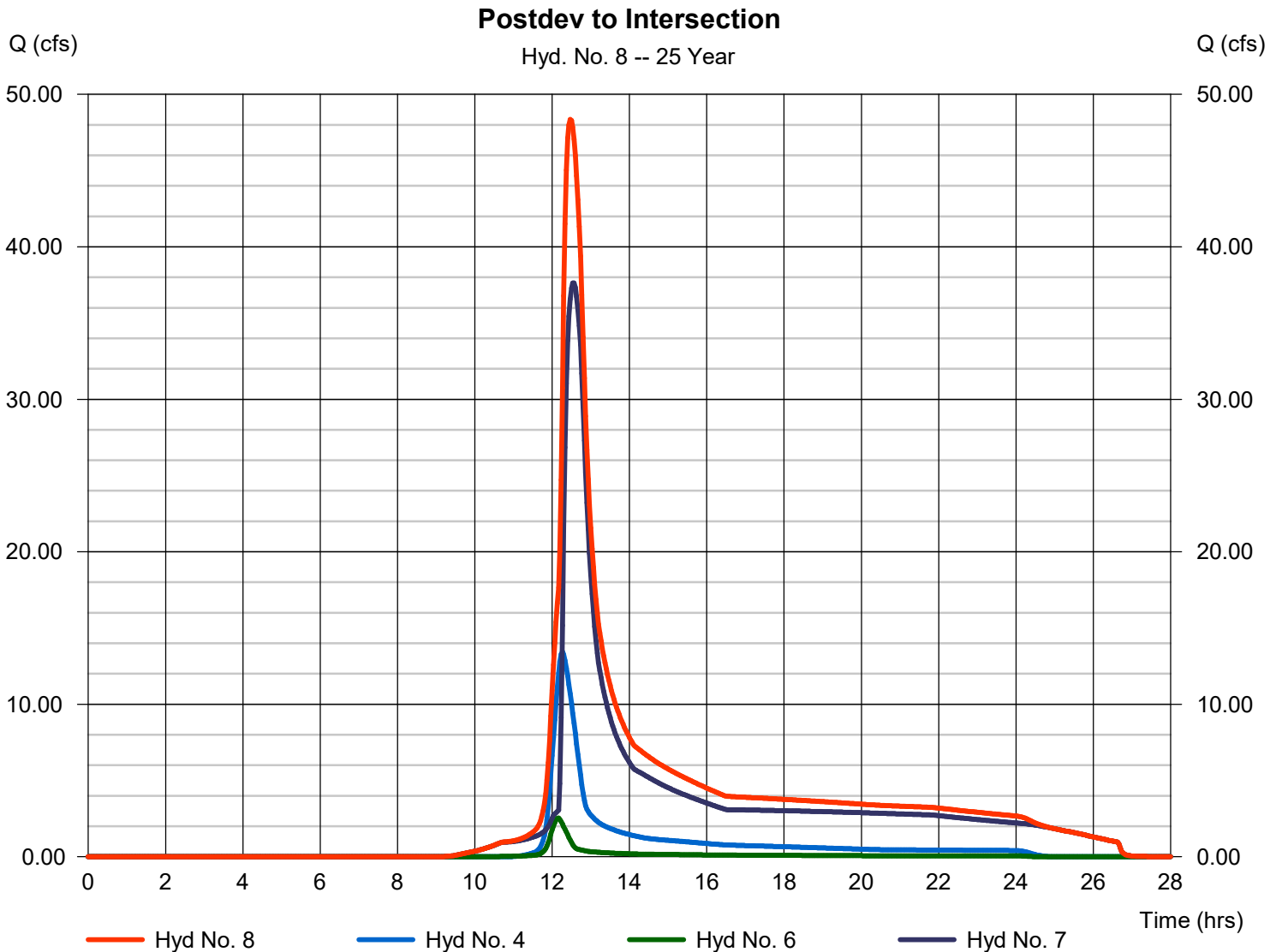
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 48.35 cfs  
 Time to peak = 12.47 hrs  
 Hyd. volume = 334,416 cuft  
 Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	38.74	2	732	161,349	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	52.56	2	734	229,853	-----	-----	-----	Predev DA to Dolington Road
3	Combine	91.14	2	732	391,201	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	18.21	2	736	85,739	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	76.42	2	734	347,759	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	3.319	2	728	12,398	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	48.89	2	752	330,285	5	163.95	97,741	DetentionBasin Outflow
8	Combine	64.02	2	746	428,422	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	49.63	2	752	312,487	5	164.71	140,946	Sediment Basin
Basin design.gpw					Return Period: 50 Year			Friday, 07 / 14 / 2017	



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

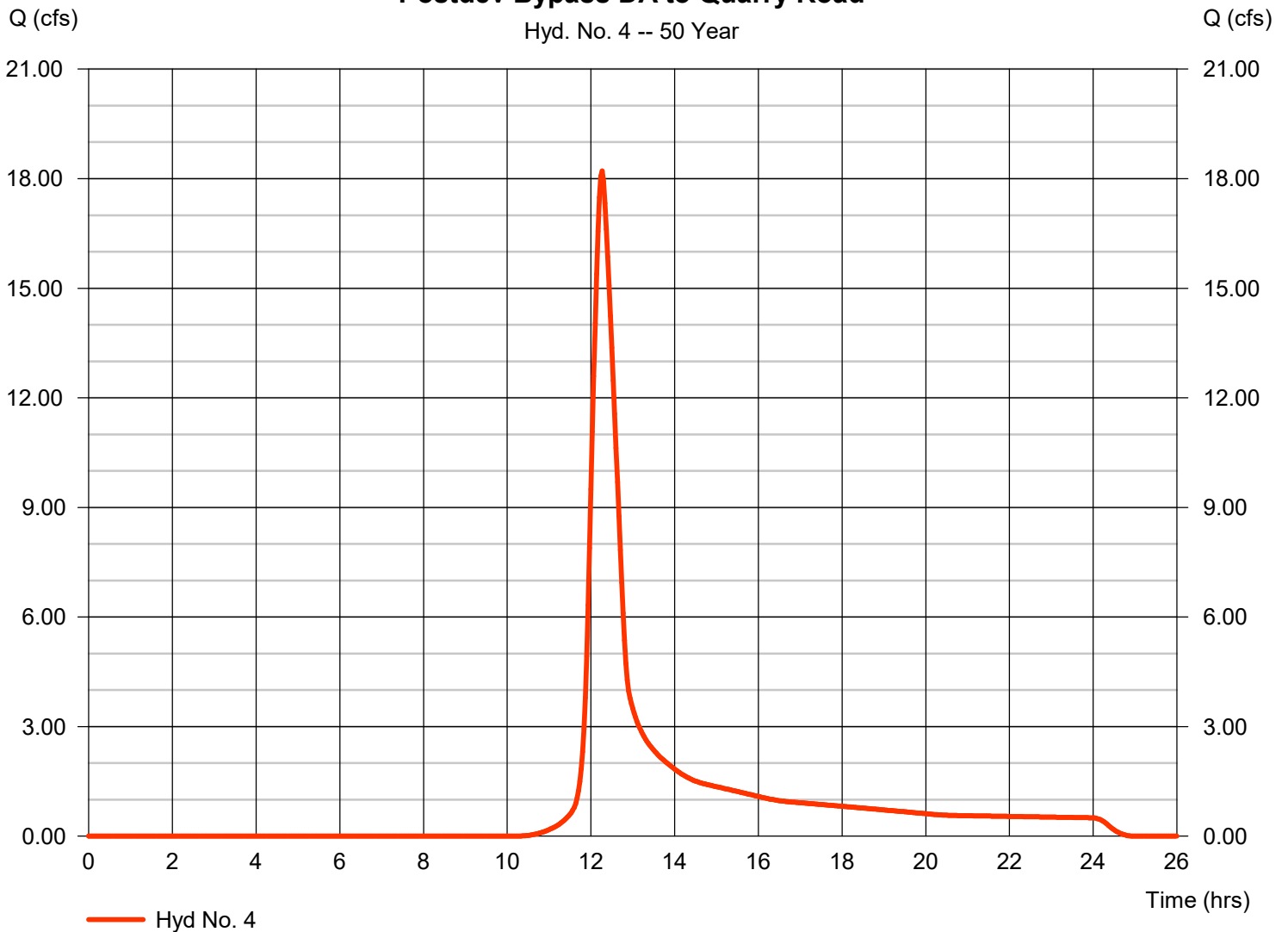
Friday, 07 / 14 / 2017

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 18.21 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 85,739 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev Bypass DA to Quarry Road



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

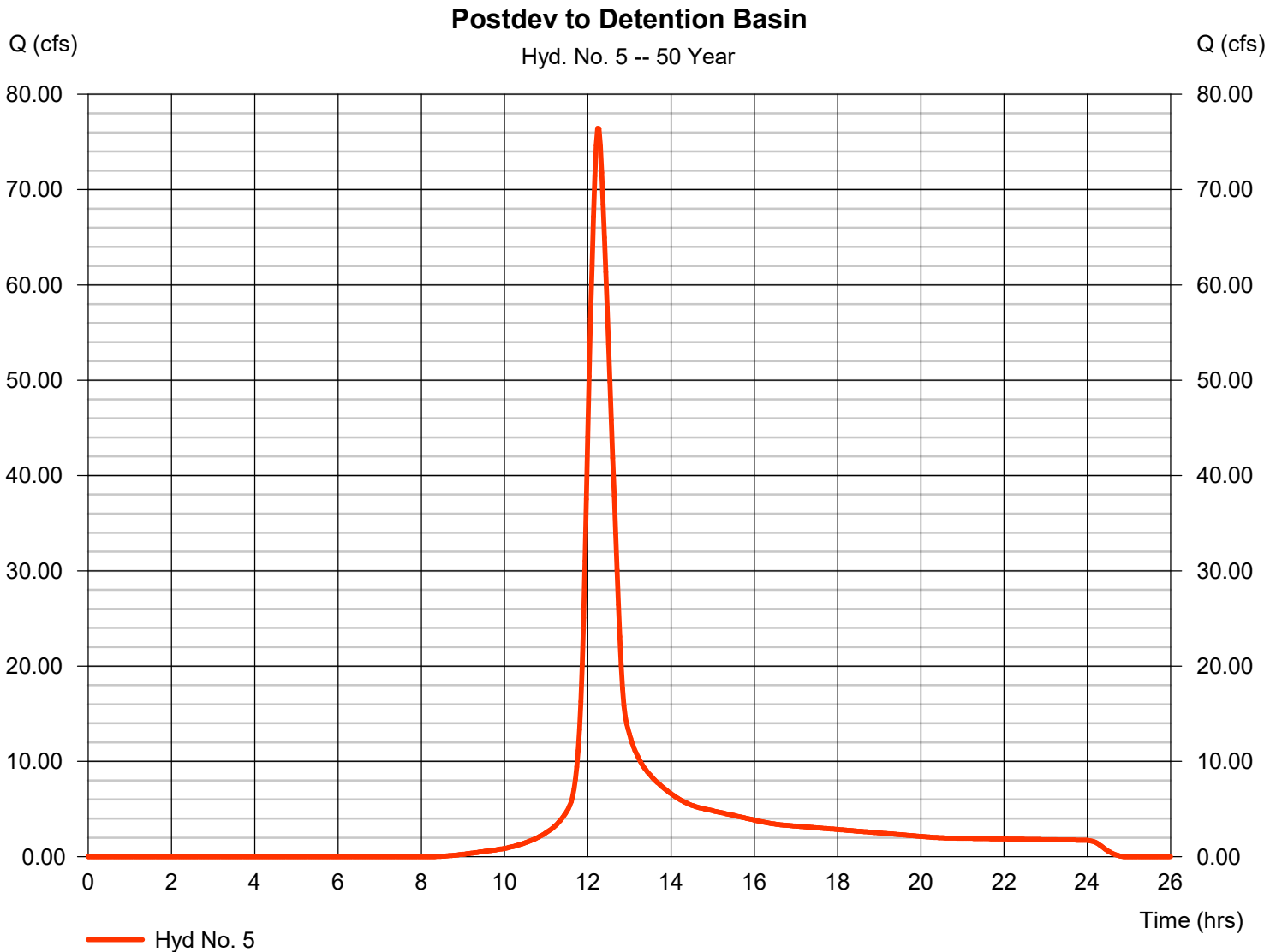
Friday, 07 / 14 / 2017

## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type = SCS Runoff  
 Storm frequency = 50 yrs  
 Time interval = 2 min  
 Drainage area = 25.600 ac  
 Basin Slope = 0.0 %  
 Tc method = TR55  
 Total precip. = 7.20 in  
 Storm duration = 24 hrs

Peak discharge = 76.42 cfs  
 Time to peak = 12.23 hrs  
 Hyd. volume = 347,759 cuft  
 Curve number = 70  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 36.30 min  
 Distribution = Type II  
 Shape factor = 484

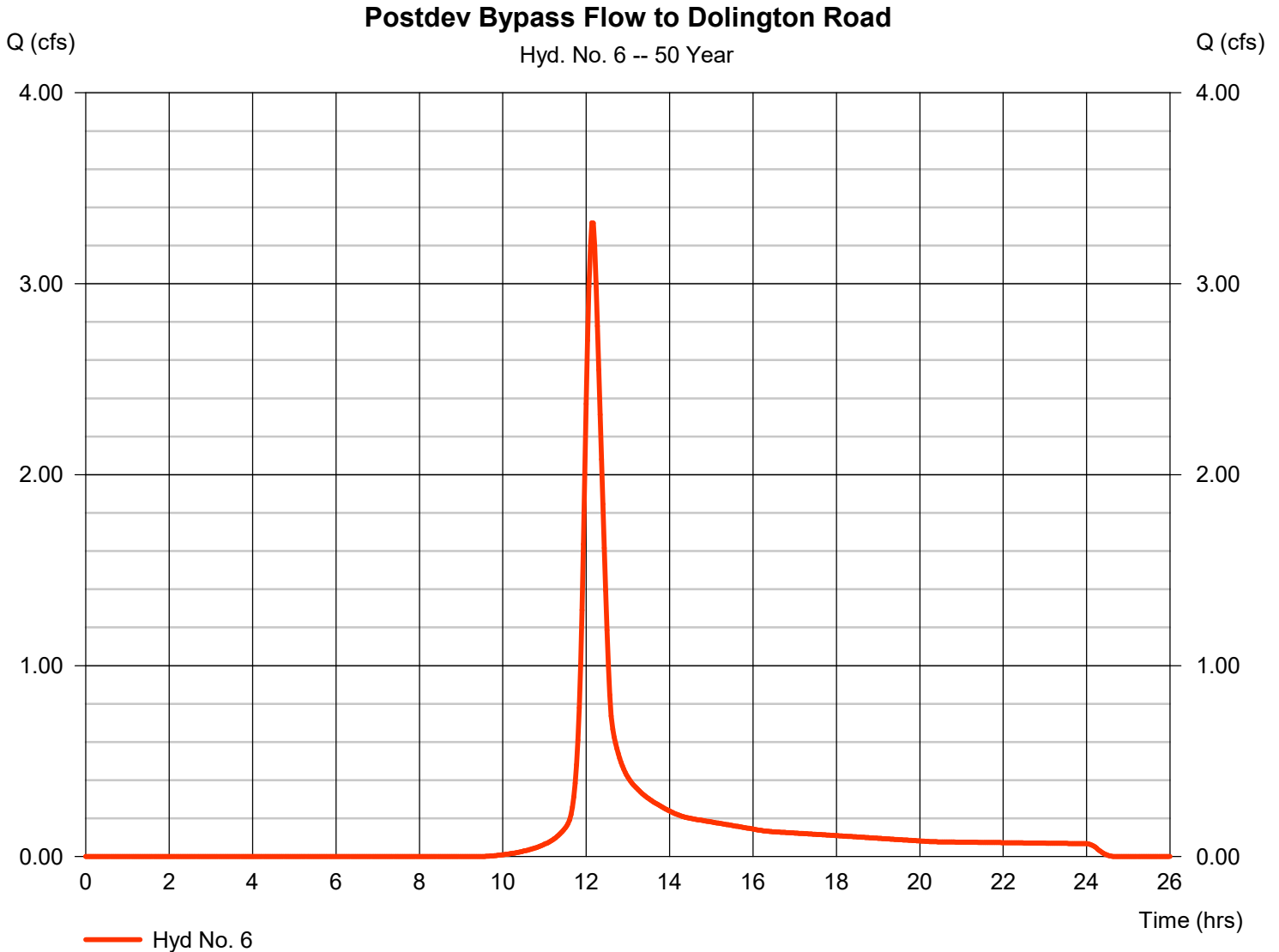


# Hydrograph Report

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 3.319 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 12,398 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 7.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

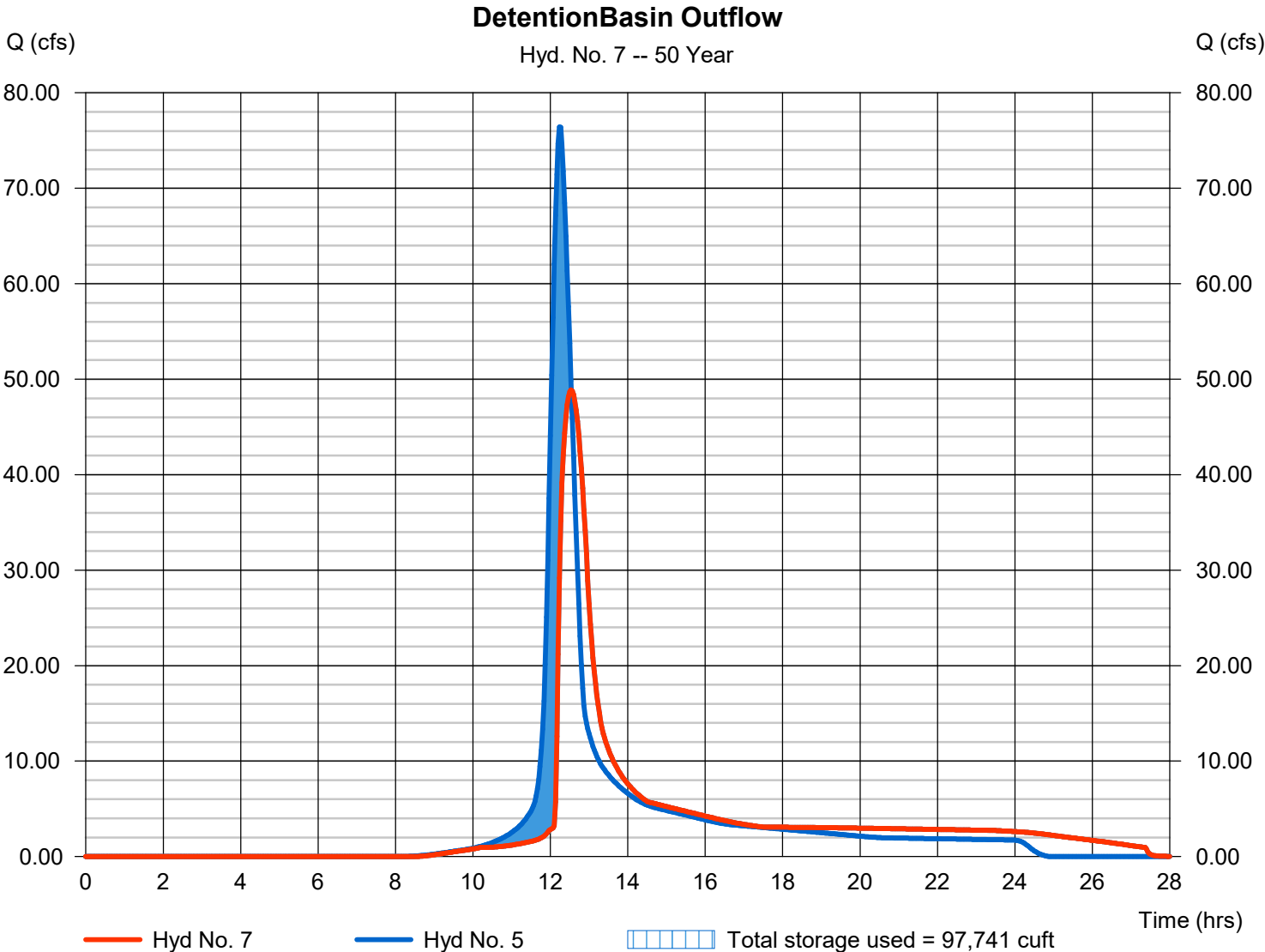
Friday, 07 / 14 / 2017

## Hyd. No. 7

### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 48.89 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 330,285 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 163.95 ft
Reservoir name	= Basin No. 1	Max. Storage	= 97,741 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

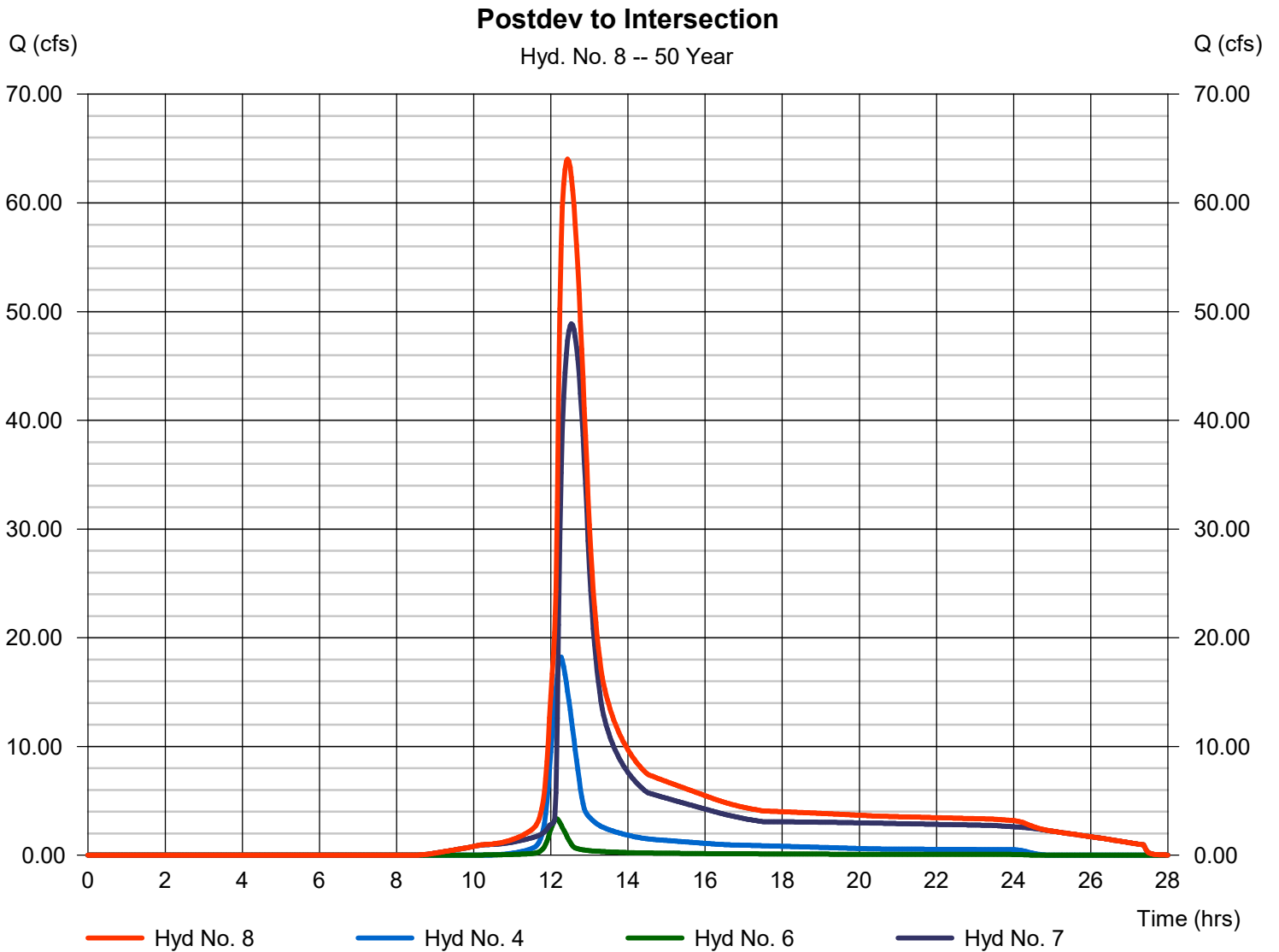
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
Storm frequency = 50 yrs  
Time interval = 2 min  
Inflow hyds. = 4, 6, 7

Peak discharge = 64.02 cfs  
Time to peak = 12.43 hrs  
Hyd. volume = 428,422 cuft  
Contrib. drain. area = 9.800 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	52.51	2	732	214,688	-----	-----	-----	Predev DA to Quarry Road
2	SCS Runoff	68.27	2	734	296,529	-----	-----	-----	Predev DA to Dolington Road
3	Combine	120.75	2	732	511,218	1, 2	-----	-----	Predev to Intersection
4	SCS Runoff	24.55	2	736	113,531	-----	-----	-----	Postdev Bypass DA to Quarry Road
5	SCS Runoff	97.50	2	734	441,899	-----	-----	-----	Postdev to Detention Basin
6	SCS Runoff	4.364	2	728	16,126	-----	-----	-----	Postdev Bypass Flow to Dolington Ro
7	Reservoir	56.99	2	754	422,212	5	164.42	124,298	DetentionBasin Outflow
8	Combine	78.49	2	740	551,870	4, 6, 7	-----	-----	Postdev to Intersection
10	Reservoir	81.20	2	744	406,561	5	164.83	148,276	Sediment Basin
Basin design.gpw					Return Period: 100 Year			Friday, 07 / 14 / 2017	

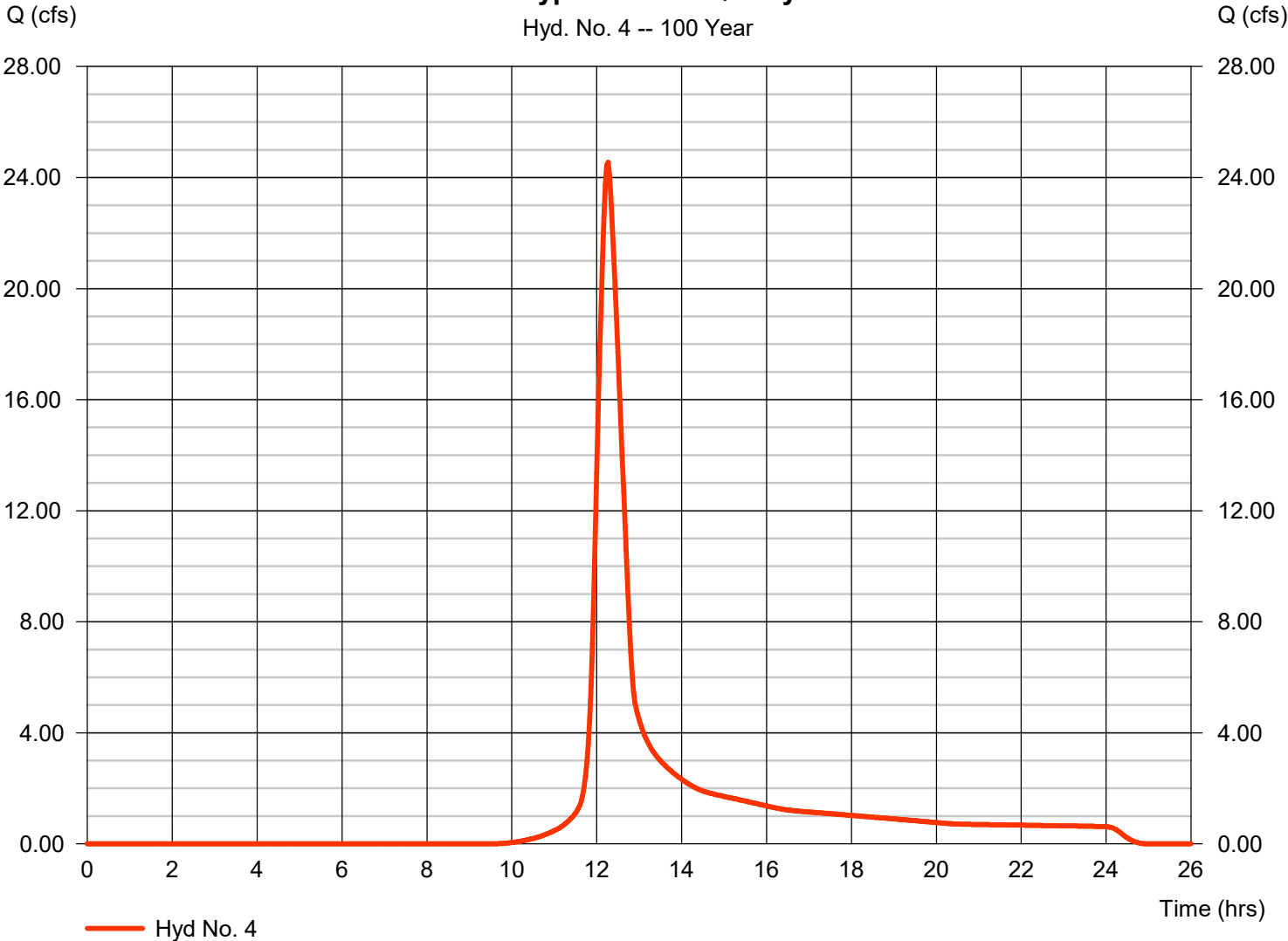
# Hydrograph Report

## Hyd. No. 4

Postdev Bypass DA to Quarry Road

Hydrograph type	= SCS Runoff	Peak discharge	= 24.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 113,531 cuft
Drainage area	= 8.700 ac	Curve number	= 60
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 35.80 min
Total precip.	= 8.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Postdev Bypass DA to Quarry Road



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

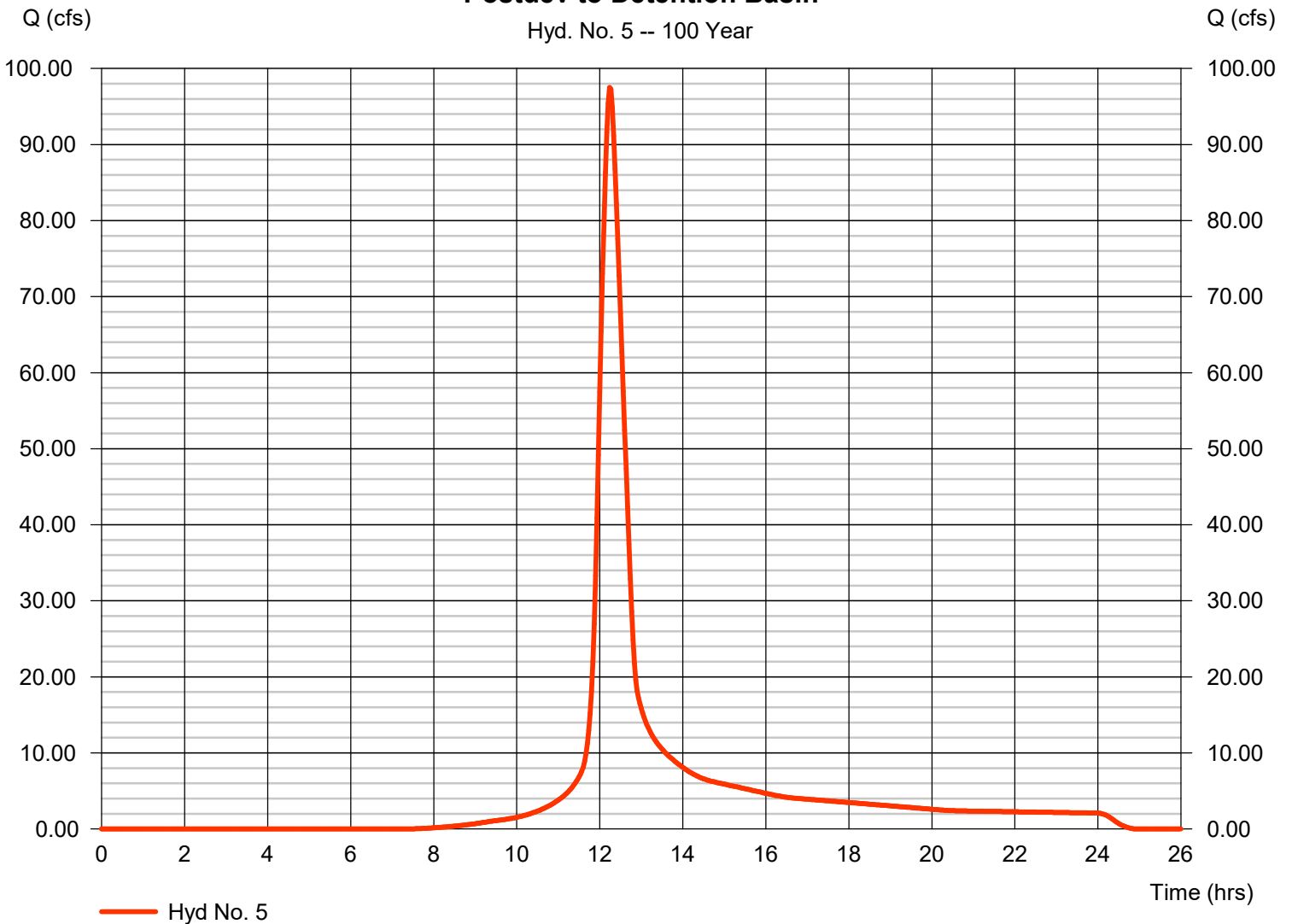
## Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 97.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 441,899 cuft
Drainage area	= 25.600 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.30 min
Total precip.	= 8.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Postdev to Detention Basin

Hyd. No. 5 -- 100 Year





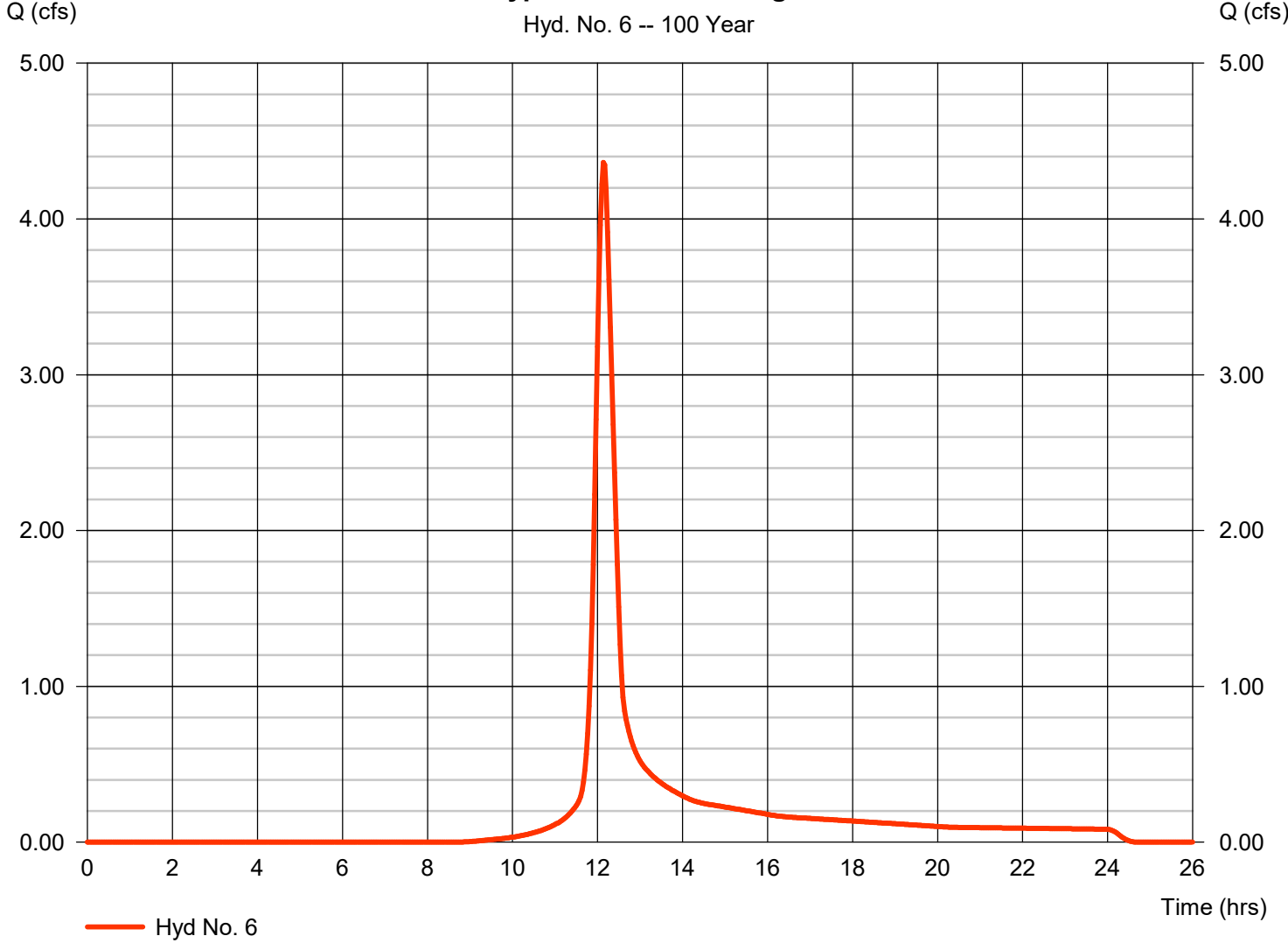
# Hydrograph Report

## Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 4.364 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 16,126 cuft
Drainage area	= 1.100 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.90 min
Total precip.	= 8.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

**Postdev Bypass Flow to Dolington Road**



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 07 / 14 / 2017

## Hyd. No. 7

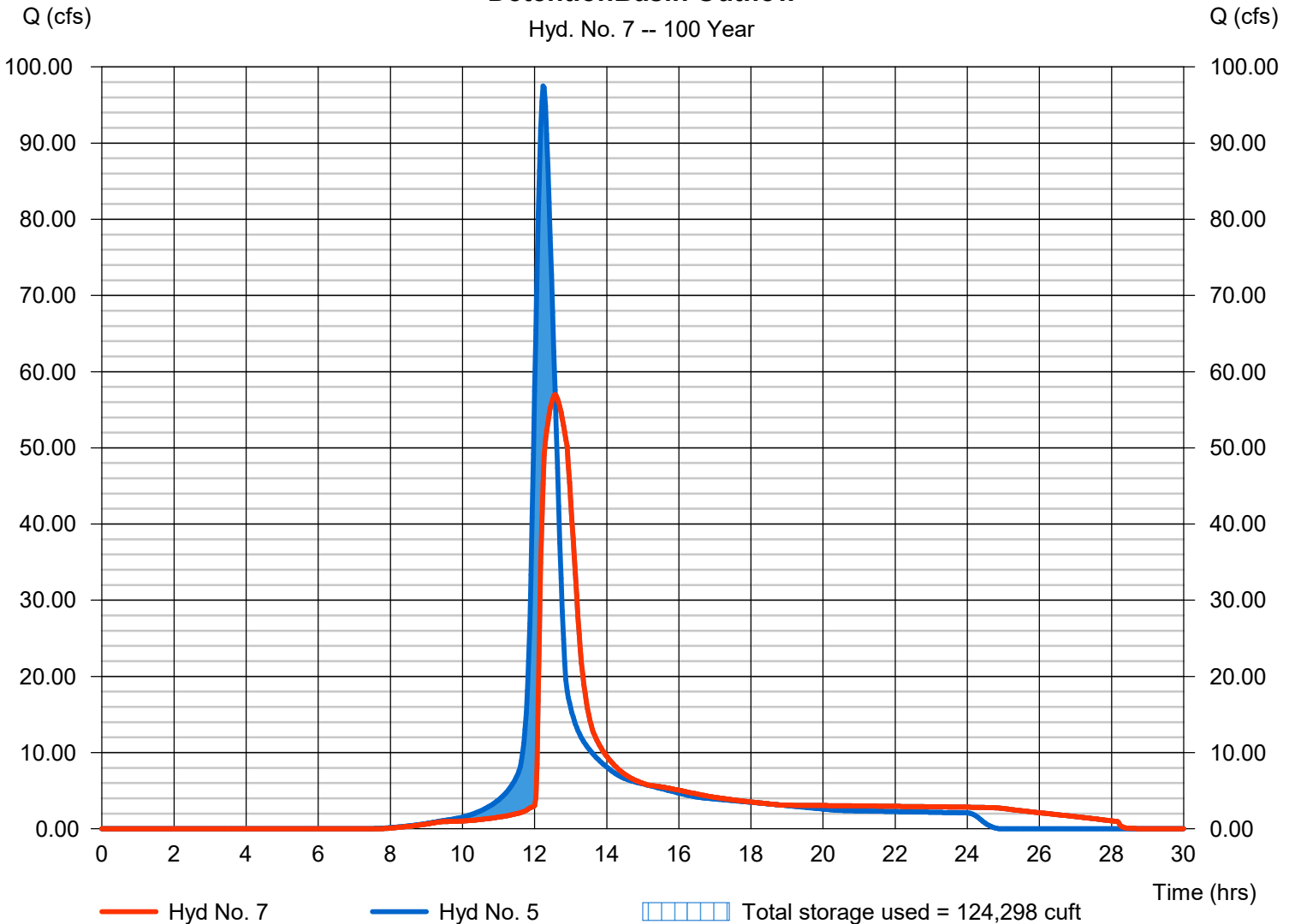
### DetentionBasin Outflow

Hydrograph type	= Reservoir	Peak discharge	= 56.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.57 hrs
Time interval	= 2 min	Hyd. volume	= 422,212 cuft
Inflow hyd. No.	= 5 - Postdev to Detention Basin	Max. Elevation	= 164.42 ft
Reservoir name	= Basin No. 1	Max. Storage	= 124,298 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

### DetentionBasin Outflow

Hyd. No. 7 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

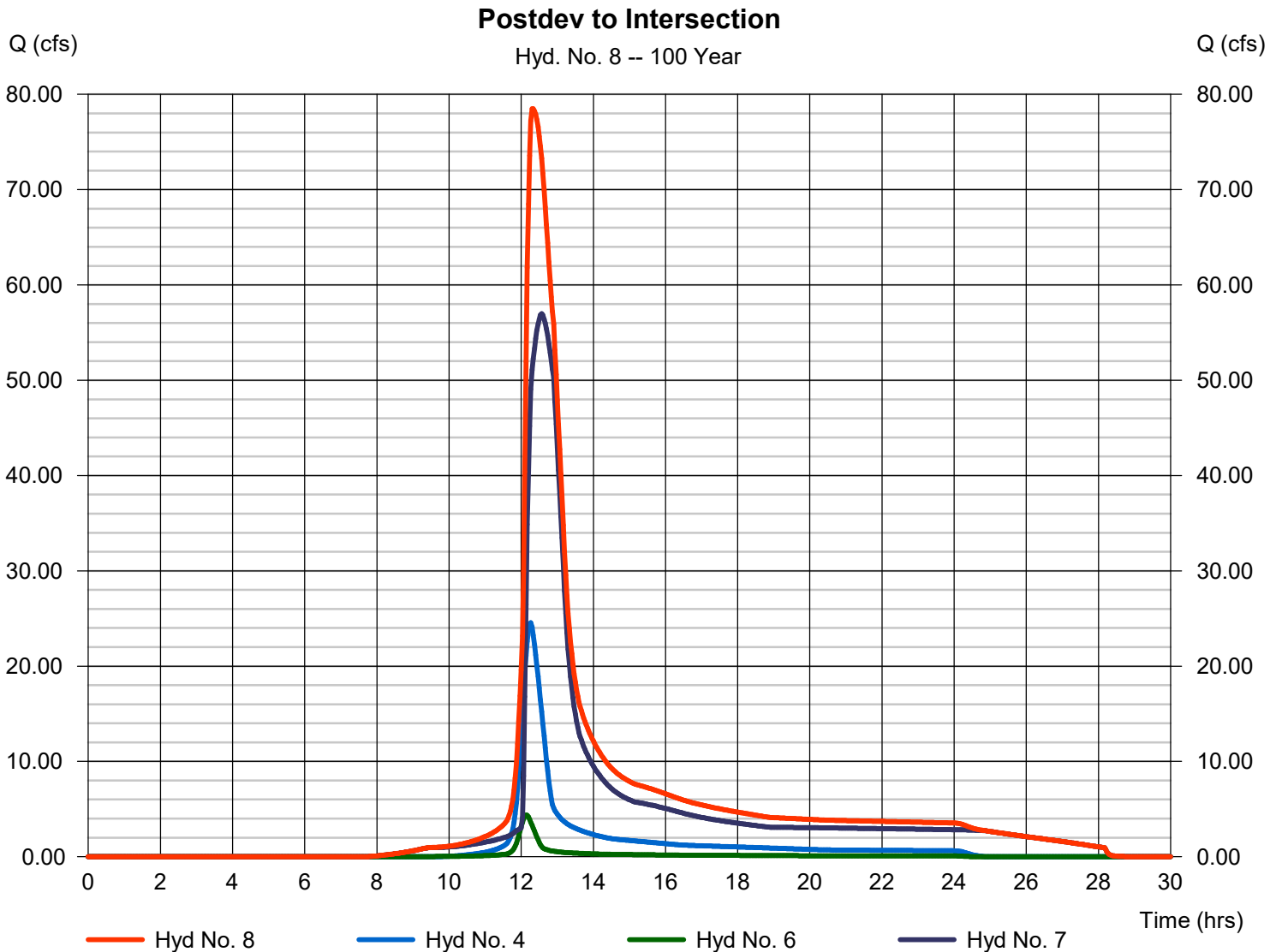
Friday, 07 / 14 / 2017

## Hyd. No. 8

Postdev to Intersection

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Inflow hyds. = 4, 6, 7

Peak discharge = 78.49 cfs  
 Time to peak = 12.33 hrs  
 Hyd. volume = 551,870 cuft  
 Contrib. drain. area = 9.800 ac



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**50 - Year**

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APPENDIX D:

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STORM SEWER

INFILTRATION TRENCH

DESIGN CALCULATIONS

## Infiltration Trench Calculations

### 1. Infiltration Trench from Inlet #2 to Inlet #3

Length = 170 feet, Width = 45 feet

Surface Area = 7,650 sf

Design Infiltration Rate =  $1.52/2 = 0.760''/\text{hr}$

2 Year Storm Runoff Volume = 44,345 cf

- Dewatering Time =  $\frac{44,345 \text{ cf}}{(0.76''/\text{hr})(1 \text{ ft}/12'')(7,650 \text{ sf})} = 92 \text{ hrs} > 72 \text{ hrs}$ , use 24 hrs

- Infiltration Volume =  $(24 \text{ hr})(0.76''/\text{hr})(1 \text{ ft}/12'')(7,650 \text{ sf}) = \underline{11,628 \text{ cf}}$

- Storage Volume

Stone =  $5.0(170 \text{ feet})(45 \text{ feet})(0.40 \text{ Voids Ratio}) = \underline{15,300 \text{ cf}}$

Pipe =  $.6(3.412 \text{ sf})(170 \text{ ft})\{(.5(0.4+1.9)/2.0)\} = \underline{184 \text{ cf}}$

Total Storage = 15,484 cf

- Managed Volume =  $11,628 \text{ cf} + 15,484 \text{ cf} = \underline{27,112 \text{ cf}}$

## Infiltration Trench Calculations

### 3. Infiltration Trench from Inlet #18 to Inlet #22

Length = 640 feet,      Width = 10 feet

Surface Area = 6,400 sf

Design Infiltration Rate = 2.38"/hr

2 Year Storm Runoff Volume = 17,037 cf

- Dewatering Time =  $\frac{17,037 \text{ cf}}{(2.38"/\text{hr})(1 \text{ ft}/12") (6,400 \text{ sf})} = 14 \text{ hrs} < 72 \text{ hrs}$
- Managed Volume = Infiltrated Volume = 17,037 cf



**Worksheet 4. Change in Runoff for 2-YR Storm Event**

**PROJECT:** Snipes Tract Athletic Fields Infiltration Trench I#2  
12.13 Ac.  
**2-Year Rainfall:** 3.36 in.  
**Total Site Area:** 12.13 acres  
**Protected Site Area:** acres  
**Managed Area:** 12.13 acres

**Existing Conditions:**

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Woodland	B		0.00	55	8.18	1.64	0.30	0
Woodland	C		0.00	70	4.29	0.86	0.92	0
Meadow	B		0.00	58	7.24	1.45	0.40	0
Meadow	C		0.00	71	4.08	0.82	0.98	0
Meadow	D		0.00	78	2.82	0.56	1.39	0
Impervious	B/D		0.00	98	0.20	0.04	3.13	0
<b>TOTAL:</b>		<b>0</b>	<b>0.00</b>				<b>7.12</b>	<b>0</b>

**Developed Conditions:**

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Lawn	B	251,136	5.77	61	6.39	1.28	0.51	10,697
Lawn	C	77,164	1.77	74	3.51	0.70	1.14	7,358
Woods	B	31,659	0.73	55	8.18	1.64	0.30	791
Woods	C	100,074	2.30	70	4.29	0.86	0.92	7,695
Impervious	B/C	68,320	1.57	98	0.20	0.04	3.13	17,803
<b>TOTAL:</b>		<b>528,353</b>	<b>12.13</b>				<b>6.01</b>	<b>44,345</b>

359,959

**2-Year Volume Increase (ft<sup>3</sup>):** **44,345**

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

- Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where  
 P = 2-Year Rainfall (in)  
 S =  $(1000/CN) - 10$
- Runoff Volume (CF) =  $Q \times Area \times 1/12$   
 Q = Runoff (in)  
 Area = Land Use Area (Sq. ft)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

**Worksheet 4. Change in Runoff for 2-YR Storm Event**

**PROJECT:** Snipes Tract Athletic Fields Infiltration Trench I#18  
5.24 Ac.  
**2-Year Rainfall:** 3.36 in.  
**Total Site Area:** 5.24 acres  
**Protected Site Area:** acres  
**Managed Area:** 5.24 acres

**Existing Conditions:**

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Woodland	B		0.00	55	8.18	1.64	0.30	0
Woodland	C		0.00	70	4.29	0.86	0.92	0
Meadow	B		0.00	58	7.24	1.45	0.40	0
Meadow	C		0.00	71	4.08	0.82	0.98	0
Meadow	D		0.00	78	2.82	0.56	1.39	0
Impervious	B/D		0.00	98	0.20	0.04	3.13	0
<b>TOTAL:</b>		<b>0</b>	<b>0.00</b>				<b>7.12</b>	<b>0</b>

**Developed Conditions:**

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Lawn	B	171,141	3.93	61	6.39	1.28	0.51	7,290
Lawn	C		0.00	74	3.51	0.70	1.14	0
Woods	B	21,673	0.50	55	8.18	1.64	0.30	542
Woods	C		0.00	70	4.29	0.86	0.92	0
Impervious	B/C	35,327	0.81	98	0.20	0.04	3.13	9,205
<b>TOTAL:</b>		<b>228,141</b>	<b>5.24</b>				<b>6.01</b>	<b>17,037</b>

192,814

**2-Year Volume Increase (ft<sup>3</sup>):** **17,037**

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

- Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$  where  
 P = 2-Year Rainfall (in)  
 S =  $(1000/CN) - 10$
- Runoff Volume (CF) =  $Q \times \text{Area} \times 1/12$   
 Q = Runoff (in)  
 Area = Land Use Area (Sq. ft)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

PROJECT : SNIPES TRACT

PROJECT No. 1677054L

DATE : 06/07/17

STORM PIPE COMPUTATION SHEET

CALC. BY: MES

SHEET : 1 OF 1

Run			Drainage Area			Runoff				Pipe Data					Profile Data				
Locaton	From	To	A Area (acres)	C	CA	Time of Conc. (min.)	I Inten. (in.)	Q (cfs.)	Cum. Q (cfs)	Pipe Size (in.)	Pipe Slope (ft/ft.)	n	Pipe Cap. (cfs.)	V Vel. (ft/sec.)	L Length (ft.)	Fall (ft.)	TG/Rim Elev.(up) (ft.)	Invert Up (ft.)	Invert Down (ft.)
Inlet	23	22	1.391	0.21	0.29	5.00	8.40	2.5	2.5	18	0.0051	0.011	8.9	5.0	35	0.18	186.50	183.85	183.67
Inlet	22	20	0.126	0.43	0.05	5.00	8.40	0.5	2.9	18	0.0100	0.011	12.4	7.0	309	3.10	187.50	183.50	180.40
Inlet	21	20	1.149	0.16	0.18	5.00	8.40	1.5	1.5	18	0.0061	0.011	9.6	5.5	66	0.40	181.90	178.90	178.50
Inlet	20	18	0.813	0.43	0.35	5.00	8.40	2.9	7.4	18	0.0099	0.011	12.3	7.0	313	3.10	183.15	177.00	173.90
Inlet	19	18	1.008	0.15	0.15	5.00	8.40	1.3	1.3	18	0.0050	0.011	8.7	5.0	70	0.35	177.00	174.25	173.90
Inlet	18	17	0.750	0.50	0.38	5.00	8.40	3.2	11.8	18	0.0095	0.011	12.0	6.8	95	0.90	176.70	173.70	172.80
Inlet	17	16	0.299	0.25	0.07	5.00	8.40	0.6	12.4	18	0.0163	0.011	15.8	8.9	202	3.30	176.70	172.60	169.30
Inlet	16	1	0.507	0.47	0.24	5.00	8.40	2.0	14.4	18	0.0171	0.011	16.2	9.2	35	0.60	172.50	169.10	168.50
Inlet	15	14	2.972	0.23	0.68	5.00	8.40	5.7	5.7	18	0.0087	0.011	11.5	6.5	264	2.30	186.60	183.60	181.30
Inlet	14	13	0.433	0.25	0.11	5.00	8.40	0.9	6.7	18	0.0661	0.011	31.8	18.0	28	1.85	185.50	181.10	179.25
Inlet	13	12	1.711	0.26	0.44	5.00	8.40	3.7	10.4	18	0.0089	0.011	11.7	6.6	263	2.35	182.00	179.05	176.70
Inlet	12	11	0.435	0.32	0.14	5.00	8.40	1.2	11.6	18	0.0321	0.011	22.2	12.5	39	1.25	181.00	176.00	174.75
Inlet	11	6	1.323	0.23	0.30	5.00	8.40	2.6	14.1	24	0.0060	0.011	20.6	6.6	251	1.50	177.50	174.25	172.75
Inlet	10	9	2.962	0.16	0.47	5.00	8.40	4.0	4.0	18	0.0050	0.011	8.7	5.0	87	0.45	177.50	174.90	174.45
Inlet	9	8	0.645	0.14	0.09	5.00	8.40	0.8	4.7	18	0.0050	0.011	8.7	5.0	100	0.50	177.94	174.25	173.75
Inlet	8	7	0.432	0.48	0.21	5.00	8.40	1.7	6.5	18	0.0050	0.011	8.7	5.0	62	0.31	177.51	173.55	173.24
Inlet	7	6	0.034	0.25	0.01	5.00	8.40	0.1	6.6	18	0.0051	0.011	8.8	5.0	57	0.29	176.67	173.04	172.75
Inlet	6	5	0.231	0.27	0.06	5.00	8.40	0.5	21.2	24	0.0063	0.011	21.1	6.7	78	0.49	176.97	172.75	172.26
Inlet	5	4	0.018	0.74	0.01	5.00	8.40	0.1	21.3	24	0.0064	0.011	21.4	6.8	103	0.66	175.23	172.06	171.40
Inlet	4	3	0.089	0.27	0.02	5.00	8.40	0.2	21.5	24	0.0066	0.011	21.7	6.9	100	0.66	175.50	171.20	170.54
Inlet*	3	2	0.131	0.33	0.04	5.00	8.40	0.4	21.9	24	0.0067	0.011	21.9	7.0	221	1.49	175.25	170.54	169.05
Inlet	2	1	0.712	0.58	0.41	5.00	8.40	3.5	25.3	24	0.0225	0.011	40.1	12.7	51	1.15	172.60	169.15	168.00
Inlet	1	EW1	0.224	0.24	0.05	5.00	8.40	0.5	40.2	24	0.0463	0.011	57.4	18.3	54	2.50	172.50	167.50	165.00
Inlet	28	27	1.423	0.23	0.33	5.00	8.40	2.7	2.7	18	0.0144	0.011	14.9	8.4	260	3.75	175.50	172.75	169.00
Inlet*	27	26	2.273	0.18	0.41	5.00	8.40	3.4	6.2	18	0.0103	0.011	12.6	7.1	150	1.55	171.80	168.80	167.25
Inlet*	26	EW2	0.770	0.28	0.22	5.00	8.40	1.8	8.0	18	0.0090	0.011	11.7	6.6	50	0.45	170.00	167.05	166.60
Inlet	25	24	0.130	0.69	0.09	5.00	8.40	0.8	0.8	18	0.0194	0.011	17.2	9.8	35	0.68	164.00	161.00	160.32

\* Infiltration Trench

# APPENDIX E:

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## EROSION AND SEDIMENT CONTROL CALCULATIONS

## STANDARD E&S WORKSHEET # 20

### Riprap Apron Outlet Protection

PROJECT NAME: Snipes Tract Athletic Fields

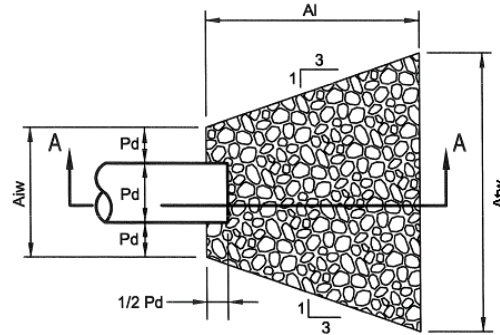
LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

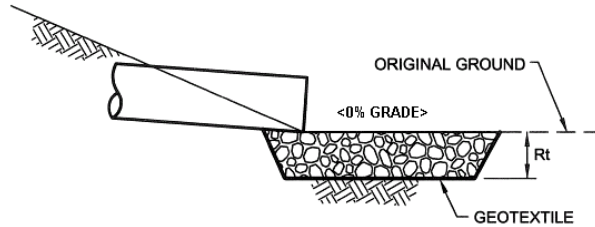
DATE: November 18, 2016, Revised June 7, 2017

CHECKED BY: Mark Eisold, P.E.

DATE: November 18, 2016, Revised June 7, 2017



PLAN VIEW



SECTION A - A

NO.	PIPE DIA. Do (in.)	TAIL WATER COND. (Max or Min)	MAN. "n" FOR PIPE	PIPE SLOPE (FT/FT)	Q (CFS)	V* (FPS)	RIPRAP SIZE	Rt (in)	Al (ft)	Aiw (ft)	Atw (ft)
EW #1	24"	Min.	0.011	0.0463	40.2	12.8	R-6	36"	22	6	22
EW #2	18"	Min.	0.011	0.0100	12.7	7.0	R-4	18"	12	5	13
EW #3	36"	Min.	0.012	0.0289	57.0	8.1	R-5	27"	20	9	24

\*:The anticipated velocity (V) should not exceed the maximum permissible shown in Table 6.6 for the proposed riprap protection. Adjust for less than full pipe flow. Use Manning's equation to calculate velocity for pipe slopes  $\geq 0.05$  ft/ft.

**STANDARD E&S WORKSHEET # 22**  
**PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND**  
**SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES**

**NAME OF PLAN PREPARER:** Maryellen Saylor, P.E.

**FORMAL EDUCATION:**

**Name of College or Technical Institute:** The Pennsylvania State University

**Curriculum or Program:** College of Engineering, Civil

**Dates of Attendance:**     **From:** August 1979                     **To:** August 1983

**Degree Received** Bachelor of Science Civil Engineering

**OTHER TRAINING:**

**Name of Training:**     Changes to the PADEP Chapter 102  
Regulations for the Reg'd Community     NPDES, MS4 Permit Renewal, NPDES Workshop

**Presented By:**             PADEP                                     PADEP

**Date:**                     November 2, 2012                     January 5, 2012, May 24, 2016

**EMPLOYMENT HISTORY:**

**Current Employer:** Boucher & James, Inc.

**Telephone:**             (215) 345-9400

**Former Employer:** Pickering, Corts & Summerson, Inc.

**Telephone:**             (215) 968-9300

**RECENT E&S PLANS PREPARED:**

**Name of Project:**     Delancey Court                     Giant Food Store                     Samost Ballfields

**County:**                 Bucks                                     Bucks                                     Bucks

**Municipality:**        Newtown Township                     Middletown Township                     Lower Makefield Township

**Permit Number:**        \_\_\_\_\_

**Approving Agency:** PADEP, BCCD                     BCCD                                     BCCD

**STANDARD E&S WORKSHEET # 12**  
**Sediment Basin Capacity Requirements**

PROJECT NAME: Snipes Tract Athletic Field

LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark W. Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017

BASIN NUMBER		1	
PERMANENT OR TEMPORARY BASIN? (P or T)		P	
SPECIAL PROTECTION WATERSHED? (YES OR NO)		N	
Karst soils? (YES OR NO)		N	
(A) MAXIMUM TOTAL DRAINAGE AREA (AC)		25.6	
IS DRAINAGE AREA (A) MORE THAN 10% LARGER THAN THE PRECONSTRUCTION CONDITION? (YES OR NO)		N	
(A <sub>1</sub> ) DISTURBED ACRES IN DRAINAGE AREA (AC)		20.0	
(I) INITIAL REQ'D DEWATERING ZONE (5,000 X A) (CF)		100,000	
(T) REDUCTION FOR TOP DEWATERING (-700 X A) (CF)		14,000	
(P) REDUCTION FOR PERMANENT POOL (-700 X A) (CF)			
(L) REDUCTION FOR 4:1 FLOW LENGTH:WIDTH (-350 X A) (CF)			
(D) REDUCTION FOR 4 TO 7 DAY DEWATERING (- 350 X A) (CF)		7,000	
(S <sub>v</sub> ) REQUIRED DEWATERING ZONE [(I - (T+P+L+D))]¹ (CF)		79,000	
(S <sub>d</sub> ) REQUIRED SEDIMENT STORAGE VOLUME (1000 X A <sub>1</sub> ) (CF)		20,000	
(S <sub>t</sub> ) TOTAL REQUIRED STORAGE VOLUME (S <sub>v</sub> + S <sub>d</sub> ) (CF)		99,000	
TOTAL STORAGE VOLUME PROVIDED (@ ELEV 3)² (CF)		99,811	
DEWATERING TIME FOR DEWATERING ZONE (DAYS)		4	
REQUIRED DISCHARGE CAPACITY (2 X A) (CFS)³		40	
PRINCIPAL SPILLWAY TYPE (PERFORATED RISER, SKIMMER, etc.)		Outlet Structure Grate	
PEAK FLOW FROM 10 YR/24 HR STORM FOR DRAINAGE AREA (A)		44.5	
PRINCIPAL SPILLWAY CAPACITY (@ ELEV 5) (CFS)⁴		19.7 *	
EMERGENCY SPILLWAY CAPACITY (@ ELEV 5) (CFS)⁴		25.0 *	
TOTAL BASIN DISCHARGE CAPACITY (@ ELEV 5) (CFS)		44.7	
EMERGENCY SPILLWAY PROTECTIVE LINING⁵		Erosion Control Liner	
OUTLET TO A SURFACE WATER? (YES OR NO)⁶		Yes (swale)	
PEAK FLOW FROM A 100 YR/24 HR STORM FOR DRG. AREA (A)		97.5	

1 The minimum dewatering zone capacity for sediment basins is (3,600 X A). No reduction is permitted in Special Protection (HQ and EV) Watersheds.

2 Total Storage Volume provided at riser crest.

3 Or provide calculations to show peak flow from 25 yr./24 hr. storm for area (A) is routed through the basin.

4 Provide supporting computations.  $Q = 2.8(164.70-164.00)(12)^{1.5} = 19.7 \text{ cfs}$   $Q = 2.8(100)(164.70-164.50)^{1.5} = 25.0 \text{ cfs}$

5 If grass lining is proposed, spillway should be constructed in original ground unless a suitable TRM lining is used. Wherever a TRM is used, riprap should be placed at the bottom of the embankment to prevent scour.

6 If no, and basin is permanent or drainage area is more than 10% larger than pre-construction, provide supporting calculations to show accelerated erosion will not result from the proposed discharge. For discharges increasing volume or rate of flow onto a neighboring property prior to entering a surface water, an easement should be obtained prior to plan submittal.

## STANDARD E&S WORKSHEET # 13 Sediment Basin Dimensions and Elevations

PROJECT NAME: Snipes Tract Athletic Fields

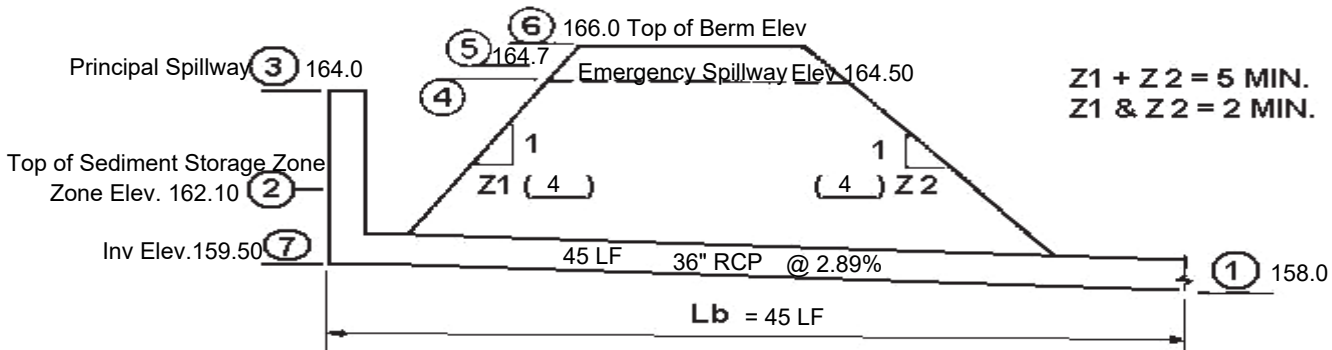
LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark W. Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017



BASIN NUMBER			
1.	DISCHARGE PIPE ELEVATION (FT)	158.00	
2.	ELEVATION AT TOP OF SEDIMENT STORAGE ZONE (@ Sd) (FT) (MIN. 1.0' ABOVE ELEVATION 7)	162.10	
3.	ELEVATION AT TOP OF DEWATERING ZONE (St) (FT) (CREST OF PRINCIPAL SPILLWAY)	164.00	
4.	EMERGENCY SPILLWAY CREST ELEVATION (FT) (MIN. 0.5' ABOVE ELEVATION 3)	164.50	
5.	2 CFS/ACRE OR 25-YR/24-HR FLOW ELEVATION (FT)	164.70	
6.	TOP OF EMBANKMENT ELEVATION (FT) (MIN. 24" ABOVE ELEVATION 5 OR 12" WITH ROUTED 100-YR/24-HR STORM)	166.00	
7.	BASIN BOTTOM ELEVATION (FT)	159.50	
	AVERAGE BOTTOM WIDTH (FT)	20	
	AVERAGE BOTTOM LENGTH (FT)	40	
	(SA <sub>min</sub> ) REQUIRED SURFACE AREA AT ELEVATION 2 (SQ. FT.)	1,206	
	SURFACE AREA PROVIDED AT ELEVATION 2 (SQ. FT.)	25,500	
	AVERAGE BASIN WIDTH (W) AT ELEVATION 3 (FT)	180	
	FLOW LENGTH (L) AT ELEVATION 3 (FT)	400	
	FLOW LENGTH:WIDTH RATIO AT ELEVATION 3 (L/W)	2	
	SILT CURTAIN OR FOREBAY? (IF YES, INDICATE WHICH)	No	
	EMBANKMENT TOP WIDTH (FT, 8' MIN.)	10	
	EMBANKMENT SOIL TYPE(S)	PnB	
	KEY TRENCH DEPTH (FT, 2' MIN.)	2	
	KEY TRENCH WIDTH (FT, 4' MIN.)	8	
	RISER DIAMETER/TYPE (15" MIN.)	24 "x 48" Type M Inlet	
	BARREL DIAMETER/TYPE (12" MIN.)	36"	
	Lb (BARREL LENGTH) (FT)	45	
	EMERGENCY SPILLWAY WIDTH (FT)	100	
	EMERGENCY SPILLWAY SIDE SLOPES (H:V)	4:1	
	EMERGENCY SPILLWAY DEPTH (FT)	1.5	

For irregular shaped traps, provide stage storage data



## STANDARD E&S WORKSHEET # 14

### Sediment Basin/Sediment Trap Storage Data

PROJECT NAME: Snipes Tract Athletic Fields

LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

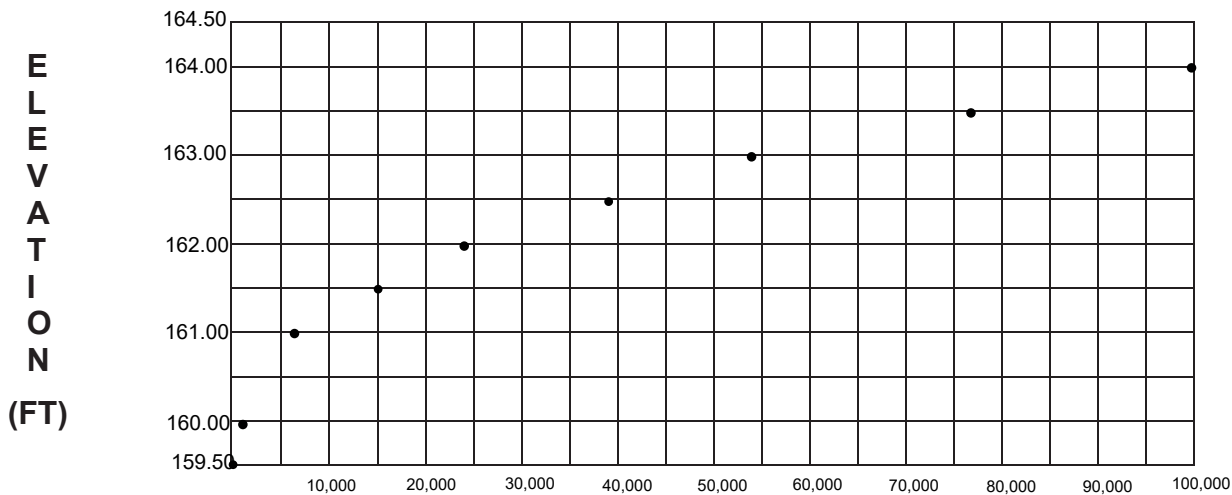
DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017

WATER SURFACE ELEVATION (FEET)	AREA (SQ. FT.)	AVERAGE AREA (SQ. FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
159.5	0				0
		772	0.5	386	
160.0	1,543				386
		5,774	1.0	5,774	
161.0	13,538				6,160
		17,769	1.0	17,769	
162.0	22,000				23,929
		29,970	1.0	29,970	
163.0	37,941				53,899
		45,912	1.0	45,912	
164.0	53,882				99,811
		56,018	1.0	56,018	
165.0	58,155				155,829
		60,292	1.0	60,292	
166.0	62,428				216,121

### STAGE STORAGE CURVE



### STORAGE VOLUME (CF)

**NOTE: Show Elevation 2 and Elevation 3 in above table as well as on the Stage Storage Curve.**

**STANDARD E&S WORKSHEET # 15**  
**Sediment Basin/Sediment Trap Dewatering Discharge Data**

PROJECT NAME: Snipes Tract Athletic Fields

LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark W. Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017

**PERFORATION DISCHARGE (TOP OF RISER TO SEDIMENT CLEAN-OUT ELEVATION)**

WATER SURFACE ELEVATION <sup>1</sup> Elevation 3	RISER PERFORATION DISCHARGE RATES									TOTAL DISCHARGE (CFS) <sup>3</sup>
	ROW ELEVATION <sup>2</sup>									
	ROW 1	ROW 2	ROW 3	ROW 4	ROW 5	ROW 6	ROW 7	ROW 8	ROW 9	
164.00	0.36	0.28								0.64
163.00	0.25	0.10								0.35
162.85	0.23	0								0.23
162.10	0	0								0.0

- From E&S Worksheet #14: Top elevation is Top of Dewatering Zone (Elevation 3 on E&S Worksheet #13), and bottom elevation is Top of Sediment Storage Zone (Elevation 2 on E&S Worksheet #13).
- All perforations should be the same size. One-inch diameter perforations are preferred. Specify size of perforations 1 inch diameter. Each orifice row should have approximately the same number of perforations and the orifice rows should be equally spaced vertically. Specify the number of perforations in each orifice row 9.
- Insert value into column 4 of Standard E&S Worksheet #16

**NOTE: Where skimmers are used, Figure 7.2, with basin dewatering volume and skimmer orifice size plotted (or calculations as per Faircloth's handbook), should be submitted instead of Standard E&S Worksheets #15 and #16.**

**STANDARD E&S WORKSHEET # 16**  
**Sediment Basin Dewatering Time Data**

PROJECT NAME: Snipes Tract Athletic Fields

LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark W. Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017

WATER SURFACE ELEVATION (FT) <sup>1</sup>	STORAGE VOLUME (CU. FT.) <sup>2</sup>	INCREMENTAL STORAGE VOLUME (CU. FT.)	DISCHARGE (CFS) <sup>3</sup>	AVERAGE DISCHARGE (CFS)	TIME (HRS)	ACCUMULATED TIME (HRS)
164.0	99,811		0.58			
		45,912		0.44	29.0	29.0
163.0	53,899		0.31			
		4,495		0.25	5.0	34.0
162.85	49,404		0.20			
		23,904		0.10	66.4	100.4
162.10	25,500		0			

1. From E&S Worksheet #15, first column
2. From E&S Worksheet #14, fifth column
3. From E&S Worksheet #15, last column

**NOTE: Calculate dewatering time from top of Dewatering Zone (Elevation 3, top of riser) to top of Sediment Storage Zone (Elevation 2).**

## STANDARD E&S WORKSHEET # 17 Sediment Basin Discharge Capacity

PROJECT NAME: Snipes Tract Athletic Fields

LOCATION: Dolington Road and Quarry Road, Lower Makefield Township, Bucks County, PA

PREPARED BY: Maryellen Saylor, P.E.

DATE: December 6, 2016, Revised July 17, 2017

CHECKED BY: Mark W. Eisold, P.E.

DATE: December 6, 2016, Revised July 17, 2017

### PRINCIPAL SPILLWAY DISCHARGE CAPACITY

**BASIN NO:**

WATER SURFACE ELEVATION <sup>4</sup> (FT)	Flow into Top of TEMPORARY RISER			Flow into Top of PERMANENT RISER			BARREL PIPE FLOW		PRINCIPAL SPILLWAY CAPACITY <sup>3</sup> (CFS)
	HEAD (FT)	ORIFICE FLOW <sup>1</sup> Q(CFS)	WEIR FLOW Q(CFS)	HEAD (FT)	ORIFICE FLOW <sup>1</sup> Q(CFS)	WEIR FLOW Q(CFS)	HEAD <sup>2</sup> (FT)	Q (CFS)	
165.0	0.5	38.5	33.6	0.5	38.5	33.6	5.5	122.8	33.6

### EMERGENCY SPILLWAY DISCHARGE CAPACITY

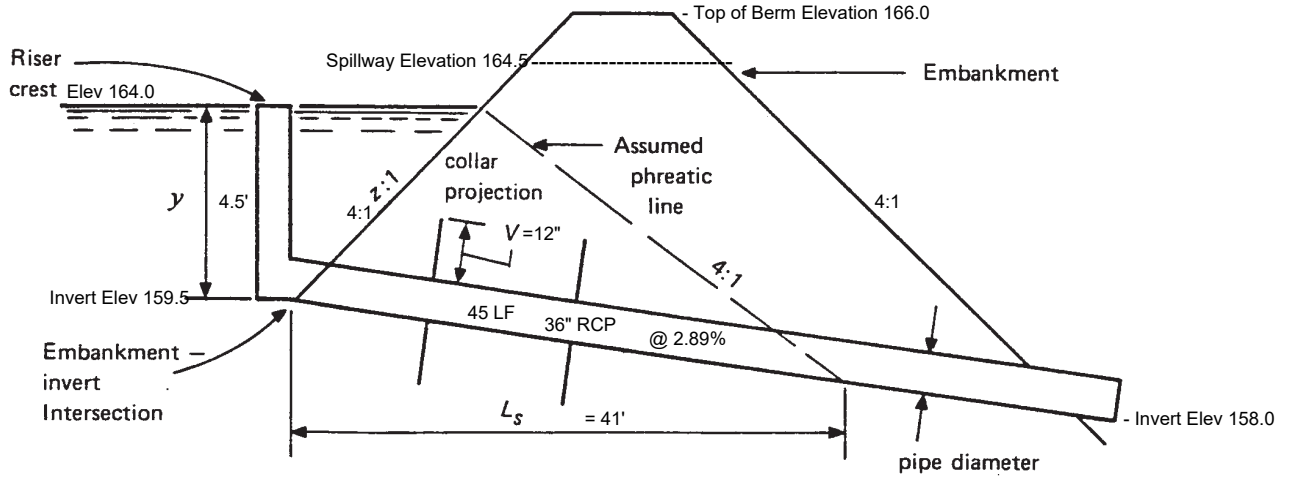
WATER SURFACE ELEVATION <sup>4</sup> (FT)	EMERGENCY SPILLWAY BOTTOM WIDTH <sup>5</sup> (FT)	TABLE OR C VALUE USED <sup>6</sup>	EMERGENCY SPILLWAY CAPACITY (CFS)	REQUIRED DISCHARGE CAPACITY (CFS)	TOTAL DISCHARGE CAPACITY PROVIDED (CFS) <sup>7</sup>
165.0	10	2.8	99	97.5	132.6

1. Flow into top of riser only (Flow through perforations not included)  $Q = cA(2gh)^{1/2} = 0.6(8)(2 \times 32.2 \times 1.0)^{1/2} = 38.5 \text{ cfs}$
2. Water surface elevation minus elevation at centerline of pipe outlet
3. Least of orifice, weir, or pipe flow (Peak flow from 10 yr/24 hr storm Min.)
4. 24" below top of embankment (12" if 100-year storm routed through basin)
5. 8 Ft. minimum
6. Use Tables 7.5 through 7.8 or equation for broad-crested weir [ $Q = CLH^{1.5}$ , where  $C \leq 2.8$  (MAX)]; for Riprap larger than R-3 or flows less than 1.5' deep adjust C downward]
7. Principal Spillway Capacity + Emergency Spillway Capacity

$$\begin{aligned} \text{Principal Spillway } Q &= 2.8(12)(1.0)^{1.5} = 33.6 \text{ cfs} \\ \text{Emergency Spillway } Q &= 2.8(100)(0.5)^{0.5} = 99.0 \text{ cfs} \\ \hline \text{Total Discharge Capacity} &= 132.6 \text{ cfs} \end{aligned}$$

### STANDARD E&S WORKSHEET # 18

#### Anti-seep Collar Design



BASIN NO.	TEMP. OR PERM.	Y (FT)	Z	Ls (FT)	Lf (FT)	V (IN)	BARREL DIA. (IN)	COLLAR SIZE (IN)	NO. COLLARS	COLLAR SPACING (FT)	DISTANCE TO 1 <sup>ST</sup> COLLAR (FT)
1	PERM	4.5	4	41	45	12	36	60	2	14	14

APPENDIX F:

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SOILS REPORT

## **AbB—Abbottstown silt loam, 3 to 8 percent slopes**

### **Map Unit Setting**

- *National map unit symbol:* 17n4
- *Elevation:* 200 to 1,300 feet
- *Mean annual precipitation:* 36 to 50 inches
- *Mean annual air temperature:* 46 to 57 degrees F
- *Frost-free period:* 130 to 200 days
- *Farmland classification:* Farmland of statewide importance

### **Map Unit Composition**

- *Abbottstown and similar soils:* 88 percent
- *Minor components:* 12 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Abbottstown**

#### **Setting**

- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Footslope, toeslope
- *Landform position (three-dimensional):* Base slope, head slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Parent material:* Acid reddish brown residuum weathered from shale and siltstone

#### **Typical profile**

- *Ap - 0 to 10 inches:* silt loam
- *Bt - 10 to 20 inches:* silt loam
- *Bx - 20 to 39 inches:* channery loam
- *BCg - 39 to 48 inches:* channery silt loam
- *R - 48 to 49 inches:* bedrock

#### **Properties and qualities**

- *Slope:* 3 to 8 percent
- *Depth to restrictive feature:* 15 to 30 inches to fragipan; 40 to 60 inches to lithic bedrock
- *Natural drainage class:* Somewhat poorly drained
- *Runoff class:* Very high
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
- *Depth to water table:* About 6 to 18 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 3.7 inches)

#### **Interpretive groups**

- *Land capability classification (irrigated):* None specified

- *Land capability classification (nonirrigated):* 3w
- *Hydrologic Soil Group:* D
- *Hydric soil rating:* No

**Minor Components**

**Penn**

- *Percent of map unit:* 5 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Summit, shoulder, backslope
- *Landform position (three-dimensional):* Interfluve, side slope, nose slope
- *Down-slope shape:* Linear, convex
- *Across-slope shape:* Linear, convex
- *Hydric soil rating:* No

**Croton**

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Landform position (two-dimensional):* Toeslope
- *Landform position (three-dimensional):* Base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Hydric soil rating:* Yes

**Klinesville**

- *Percent of map unit:* 2 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Shoulder, summit
- *Landform position (three-dimensional):* Interfluve, nose slope
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Hydric soil rating:* No

**BwB—Buckingham silt loam, 3 to 8 percent slopes**

**Map Unit Setting**

- *National map unit symbol:* 17nv
- *Elevation:* 150 to 900 feet
- *Mean annual precipitation:* 38 to 48 inches
- *Mean annual air temperature:* 45 to 57 degrees F
- *Frost-free period:* 150 to 210 days
- *Farmland classification:* Farmland of statewide importance

**Map Unit Composition**

- *Buckingham and similar soils:* 88 percent
- *Minor components:* 12 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*



## **Description of Buckingham**

### **Setting**

- *Landform*: Drainageways
- *Landform position (two-dimensional)*: Toeslope
- *Landform position (three-dimensional)*: Head slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Concave, linear
- *Parent material*: Fine-loamy colluvium and old alluvium derived from shale and siltstone

### **Typical profile**

- *A - 0 to 7 inches*: silt loam
- *Bt - 7 to 30 inches*: silt loam
- *Btx1 - 30 to 44 inches*: silty clay loam
- *Btx2 - 44 to 70 inches*: gravelly silt loam

### **Properties and qualities**

- *Slope*: 3 to 8 percent
- *Depth to restrictive feature*: 20 to 40 inches to fragipan; 80 to 99 inches to lithic bedrock
- *Natural drainage class*: Somewhat poorly drained
- *Runoff class*: Very high
- *Capacity of the most limiting layer to transmit water (Ksat)*: Moderately low to moderately high (0.06 to 0.60 in/hr)
- *Depth to water table*: About 6 to 18 inches
- *Frequency of flooding*: None
- *Frequency of ponding*: None
- *Available water storage in profile*: Low (about 5.5 inches)

### **Interpretive groups**

- *Land capability classification (irrigated)*: None specified
- *Land capability classification (nonirrigated)*: 3w
- *Hydrologic Soil Group*: C/D
- *Hydric soil rating*: No

## **Minor Components**

### **Bowmansville**

- *Percent of map unit*: 8 percent
- *Landform*: Flood plains
- *Landform position (two-dimensional)*: Footslope, toeslope
- *Landform position (three-dimensional)*: Head slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Linear, concave
- *Hydric soil rating*: No

### **Knauers**

- *Percent of map unit*: 2 percent

- *Landform*: Flood plains
- *Landform position (two-dimensional)*: Toeslope, footslope
- *Landform position (three-dimensional)*: Tread
- *Down-slope shape*: Linear, concave
- *Across-slope shape*: Linear, concave
- *Hydric soil rating*: Yes

**Croton**

- *Percent of map unit*: 2 percent
- *Landform*: Depressions
- *Landform position (two-dimensional)*: Toeslope
- *Landform position (three-dimensional)*: Base slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Linear, concave
- *Hydric soil rating*: Yes

**FoB—Fountainville silt loam, 3 to 8 percent slopes**

**Map Unit Setting**

- *National map unit symbol*: l7pr
- *Elevation*: 250 to 1,000 feet
- *Mean annual precipitation*: 38 to 48 inches
- *Mean annual air temperature*: 45 to 63 degrees F
- *Frost-free period*: 155 to 200 days
- *Farmland classification*: All areas are prime farmland

**Map Unit Composition**

- *Fountainville and similar soils*: 90 percent
- *Minor components*: 7 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Fountainville**

**Setting**

- *Landform*: Hills
- *Landform position (two-dimensional)*: Backslope, summit
- *Landform position (three-dimensional)*: Interfluvium
- *Down-slope shape*: Linear, convex
- *Across-slope shape*: Linear, convex

**Typical profile**

- *Ap - 0 to 8 inches*: silt loam
- *Bt - 8 to 22 inches*: silt loam
- *2Btx - 22 to 46 inches*: channery silt loam
- *R - 46 to 56 inches*: bedrock

**Properties and qualities**

- *Slope*: 3 to 8 percent

- *Depth to restrictive feature:* 20 to 40 inches to fragipan; 40 to 60 inches to lithic bedrock
- *Natural drainage class:* Moderately well drained
- *Runoff class:* Medium
- *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
- *Depth to water table:* About 18 to 30 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 4.0 inches)

#### **Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2e
- *Hydrologic Soil Group:* c
- *Hydric soil rating:* No

#### **Minor Components**

##### **Penn**

- *Percent of map unit:* 5 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Shoulder, backslope
- *Landform position (three-dimensional):* Side slope, nose slope
- *Down-slope shape:* Linear, convex
- *Across-slope shape:* Convex, linear
- *Hydric soil rating:* No

##### **Doylestown**

- *Percent of map unit:* 1 percent
- *Landform:* Drainageways
- *Landform position (two-dimensional):* Toeslope, footslope, backslope
- *Landform position (three-dimensional):* Head slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Hydric soil rating:* Yes

##### **Abbottstown**

- *Percent of map unit:* 1 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Footslope, toeslope
- *Hydric soil rating:* No

#### **PnB—Penn-Lansdale complex, 3 to 8 percent slopes**

##### **Map Unit Setting**

- *National map unit symbol:* 17rv
- *Elevation:* 250 to 950 feet
- *Mean annual precipitation:* 36 to 50 inches

- *Mean annual air temperature:* 46 to 57 degrees F
- *Frost-free period:* 160 to 200 days
- *Farmland classification:* All areas are prime farmland

**Map Unit Composition**

- *Penn and similar soils:* 69 percent
- *Lansdale and similar soils:* 25 percent
- *Minor components:* 6 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Penn**

**Setting**

- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Shoulder, backslope
- *Landform position (three-dimensional):* Side slope, nose slope
- *Down-slope shape:* Linear, convex
- *Across-slope shape:* Convex, linear
- *Parent material:* Residuum weathered from shale and siltstone

**Typical profile**

- *Ap - 0 to 10 inches:* channery silt loam
- *Bt - 10 to 22 inches:* channery silt loam
- *C - 22 to 28 inches:* very channery silt loam
- *R - 28 to 48 inches:* bedrock

**Properties and qualities**

- *Slope:* 3 to 8 percent
- *Depth to restrictive feature:* 20 to 40 inches to lithic bedrock
- *Natural drainage class:* Well drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 6.00 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 4.1 inches)

**Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2e
- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

**Description of Lansdale**

**Setting**

- *Landform:* Hillsides
- *Landform position (two-dimensional):* Summit, shoulder, backslope

- *Landform position (three-dimensional):* Side slope
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Residuum weathered from sandstone and/or residuum weathered from conglomerate

**Typical profile**

- *Ap - 0 to 10 inches:* channery loam
- *Bt - 10 to 30 inches:* sandy loam
- *C - 30 to 47 inches:* channery loamy sand
- *R - 47 to 57 inches:* bedrock

**Properties and qualities**

- *Slope:* 3 to 8 percent
- *Depth to restrictive feature:* 42 to 60 inches to lithic bedrock
- *Natural drainage class:* Well drained
- *Runoff class:* Medium
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Low (about 5.6 inches)

**Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2e
- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

**Minor Components**

**Readington**

- *Percent of map unit:* 6 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Footslope, backslope
- *Landform position (three-dimensional):* Base slope, head slope, side slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Concave, linear
- *Hydric soil rating:* No

**UdB—Udorthents, shale and sandstone**

**Map Unit Setting**

- *National map unit symbol:* 17sm
- *Elevation:* 200 to 1,500 feet
- *Mean annual precipitation:* 36 to 55 inches
- *Mean annual air temperature:* 45 to 57 degrees F

- *Frost-free period:* 160 to 214 days
- *Farmland classification:* Not prime farmland

**Map Unit Composition**

- *Udorthents, shale and sandstone, and similar soils:* 85 percent
- *Minor components:* 15 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Udorthents, Shale And Sandstone**

**Setting**

- *Landform:* Ridges
- *Landform position (two-dimensional):* Summit, shoulder, backslope
- *Landform position (three-dimensional):* Interfluve, side slope, nose slope
- *Down-slope shape:* Convex, linear
- *Across-slope shape:* Convex, linear
- *Parent material:* Graded areas of shale and siltstone; graded areas of sandstone and shale

**Typical profile**

- *Ap - 0 to 6 inches:* silt loam
- *C - 6 to 60 inches:* silt loam

**Properties and qualities**

- *Slope:* 0 to 8 percent
- *Depth to restrictive feature:* 20 to 99 inches to lithic bedrock
- *Natural drainage class:* Well drained
- *Runoff class:* Very high
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to high (0.06 to 6.00 in/hr)
- *Depth to water table:* About 60 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Very low (about 2.9 inches)

**Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 7s
- *Hydrologic Soil Group:* A
- *Hydric soil rating:* No

**Minor Components**

**Penn**

- *Percent of map unit:* 5 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Shoulder, backslope
- *Landform position (three-dimensional):* Side slope, nose slope

- *Down-slope shape*: Linear, convex
- *Across-slope shape*: Convex, linear
- *Hydric soil rating*: No

#### **Abbottstown**

- *Percent of map unit*: 2 percent
- *Landform*: Hillslopes
- *Landform position (two-dimensional)*: Footslope, toeslope
- *Landform position (three-dimensional)*: Base slope, head slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Concave, linear
- *Hydric soil rating*: No

#### **Readington**

- *Percent of map unit*: 2 percent
- *Landform*: Hillslopes
- *Landform position (two-dimensional)*: Footslope, backslope
- *Landform position (three-dimensional)*: Base slope, head slope, side slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Concave, linear
- *Hydric soil rating*: No

#### **Reaville**

- *Percent of map unit*: 2 percent
- *Landform*: Hillslopes
- *Landform position (two-dimensional)*: Footslope, summit
- *Landform position (three-dimensional)*: Interfluve, base slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Concave, linear
- *Hydric soil rating*: No

#### **Bowmansville**

- *Percent of map unit*: 2 percent
- *Landform*: Flood plains
- *Landform position (two-dimensional)*: Footslope, toeslope
- *Landform position (three-dimensional)*: Head slope
- *Down-slope shape*: Concave, linear
- *Across-slope shape*: Linear, concave
- *Hydric soil rating*: No

#### **Berks**

- *Percent of map unit*: 1 percent
- *Landform*: Ridges, valleys
- *Landform position (two-dimensional)*: Backslope
- *Landform position (three-dimensional)*: Side slope
- *Down-slope shape*: Convex, linear
- *Across-slope shape*: Convex, linear

- *Hydric soil rating:* No

**Croton**

- *Percent of map unit:* 1 percent
- *Landform:* Depressions
- *Landform position (two-dimensional):* Toeslope
- *Landform position (three-dimensional):* Base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Hydric soil rating:* Yes

**UrB—Urban land-Lansdale complex, 0 to 8 percent slopes**

**Map Unit Setting**

- *National map unit symbol:* l7t1
- *Mean annual precipitation:* 40 to 48 inches
- *Mean annual air temperature:* 48 to 57 degrees F
- *Frost-free period:* 160 to 215 days
- *Farmland classification:* Not prime farmland

**Map Unit Composition**

- *Urban land:* 65 percent
- *Lansdale and similar soils:* 25 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Urban Land**

**Setting**

- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Parent material:* Pavement, buildings and other artificially covered areas

**Typical profile**

- *H1 - 0 to 6 inches:* variable

**Properties and qualities**

- *Slope:* 0 to 8 percent
- *Depth to restrictive feature:* 10 to 99 inches to lithic bedrock
- *Runoff class:* Very high
- *Available water storage in profile:* Very low (about 0.0 inches)

**Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 8s
- *Hydric soil rating:* No

**Description of Lansdale**

**Setting**

- *Landform:* Hillsides
- *Landform position (two-dimensional):* Summit, shoulder, backslope



- *Landform position (three-dimensional):* Side slope
- *Down-slope shape:* Convex
- *Across-slope shape:* Convex
- *Parent material:* Residuum weathered from sandstone and/or residuum weathered from conglomerate

**Typical profile**

- *Ap - 0 to 10 inches:* loam
- *B - 10 to 38 inches:* loam
- *C - 38 to 55 inches:* loamy sand
- *R - 55 to 60 inches:* bedrock

**Properties and qualities**

- *Slope:* 0 to 8 percent
- *Depth to restrictive feature:* 42 to 99 inches to lithic bedrock
- *Natural drainage class:* Well drained
- *Runoff class:* Low
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Available water storage in profile:* Moderate (about 6.7 inches)

**Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 2e
- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

**UxB—Urban land—Penn complex, 0 to 8 percent slopes**

**Map Unit Setting**

- *National map unit symbol:* 17t9
- *Elevation:* 200 to 1,000 feet
- *Mean annual precipitation:* 36 to 55 inches
- *Mean annual air temperature:* 46 to 57 degrees F
- *Frost-free period:* 160 to 215 days
- *Farmland classification:* Not prime farmland

**Map Unit Composition**

- *Urban land:* 65 percent
- *Penn and similar soils:* 25 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Urban Land**

**Setting**

- *Landform*: Hills
- *Down-slope shape*: Linear
- *Across-slope shape*: Linear
- *Parent material*: Pavement, buildings and other artificially covered areas

**Typical profile**

- *C - 0 to 6 inches*: variable

**Properties and qualities**

- *Slope*: 0 to 8 percent
- *Depth to restrictive feature*: 10 to 100 inches to lithic bedrock
- *Available water storage in profile*: Very low (about 0.0 inches)

**Interpretive groups**

- *Land capability classification (irrigated)*: None specified
- *Land capability classification (nonirrigated)*: 8s
- *Hydric soil rating*: No

**Description of Penn**

**Setting**

- *Landform*: Hillslopes
- *Landform position (two-dimensional)*: Shoulder, backslope
- *Landform position (three-dimensional)*: Side slope, nose slope
- *Down-slope shape*: Linear, convex
- *Across-slope shape*: Convex, linear
- *Parent material*: Residuum weathered from shale and siltstone

**Typical profile**

- *Ap - 0 to 8 inches*: channery silt loam
- *Bt - 8 to 21 inches*: channery silt loam
- *C - 21 to 34 inches*: very channery silt loam
- *R - 34 to 44 inches*: bedrock

**Properties and qualities**

- *Slope*: 0 to 8 percent
- *Depth to restrictive feature*: 20 to 40 inches to lithic bedrock
- *Natural drainage class*: Well drained
- *Runoff class*: Very low
- *Capacity of the most limiting layer to transmit water (Ksat)*: Moderately high to high (0.20 to 6.00 in/hr)
- *Depth to water table*: More than 80 inches
- *Frequency of flooding*: None
- *Frequency of ponding*: None
- *Available water storage in profile*: Low (about 4.1 inches)

**Interpretive groups**

- *Land capability classification (irrigated)*: None specified
- *Land capability classification (nonirrigated)*: 2e
- *Hydrologic Soil Group*: B

- *Hydric soil rating:* No

#### **Minor Components**

##### **Readington**

- *Percent of map unit:* 4 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Foothlope, backslope
- *Landform position (three-dimensional):* Base slope, head slope, side slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Concave, linear
- *Hydric soil rating:* No

##### **Croton**

- *Percent of map unit:* 4 percent
- *Landform:* Depressions
- *Landform position (two-dimensional):* Toeslope
- *Landform position (three-dimensional):* Base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Hydric soil rating:* Yes

##### **Reaville**

- *Percent of map unit:* 2 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Foothlope, summit
- *Landform position (three-dimensional):* Interfluve, base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Concave, linear
- *Hydric soil rating:* No

#### **UxD—Urban land-Penn complex, 8 to 25 percent slopes**

##### **Map Unit Setting**

- *National map unit symbol:* 17tb
- *Elevation:* 200 to 1,000 feet
- *Mean annual precipitation:* 36 to 55 inches
- *Mean annual air temperature:* 44 to 57 degrees F
- *Frost-free period:* 130 to 200 days
- *Farmland classification:* Not prime farmland

##### **Map Unit Composition**

- *Urban land:* 65 percent
- *Penn and similar soils:* 25 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

##### **Description of Urban Land**

**Setting**

- *Landform*: Hills
- *Down-slope shape*: Linear
- *Across-slope shape*: Linear
- *Parent material*: Pavement, buildings and other artificially covered areas

**Typical profile**

- *C - 0 to 6 inches*: variable

**Properties and qualities**

- *Slope*: 8 to 25 percent
- *Depth to restrictive feature*: 10 to 79 inches to lithic bedrock
- *Available water storage in profile*: Very low (about 0.0 inches)

**Interpretive groups**

- *Land capability classification (irrigated)*: None specified
- *Land capability classification (nonirrigated)*: 8s
- *Hydric soil rating*: No

**Description of Penn****Setting**

- *Landform*: Hillslopes
- *Landform position (two-dimensional)*: Shoulder, backslope
- *Landform position (three-dimensional)*: Side slope, nose slope
- *Down-slope shape*: Linear, convex
- *Across-slope shape*: Convex, linear
- *Parent material*: Residuum weathered from shale and siltstone

**Typical profile**

- *Ap - 0 to 8 inches*: channery silt loam
- *Bt - 8 to 21 inches*: channery silt loam
- *C - 21 to 34 inches*: very channery silt loam
- *R - 34 to 44 inches*: bedrock

**Properties and qualities**

- *Slope*: 8 to 25 percent
- *Depth to restrictive feature*: 20 to 40 inches to lithic bedrock
- *Natural drainage class*: Well drained
- *Runoff class*: Low
- *Capacity of the most limiting layer to transmit water (Ksat)*: Moderately high to high (0.20 to 6.00 in/hr)
- *Depth to water table*: More than 80 inches
- *Frequency of flooding*: None
- *Frequency of ponding*: None
- *Available water storage in profile*: Low (about 4.1 inches)

**Interpretive groups**

- *Land capability classification (irrigated)*: None specified
- *Land capability classification (nonirrigated)*: 4e

- *Hydrologic Soil Group:* B
- *Hydric soil rating:* No

**Minor Components**

**Croton**

- *Percent of map unit:* 4 percent
- *Landform:* Depressions
- *Landform position (two-dimensional):* Toeslope
- *Landform position (three-dimensional):* Base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Linear, concave
- *Hydric soil rating:* Yes

**Readington**

- *Percent of map unit:* 4 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Foothslope, backslope
- *Landform position (three-dimensional):* Base slope, head slope, side slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Concave, linear
- *Hydric soil rating:* No

**Reaville**

- *Percent of map unit:* 2 percent
- *Landform:* Hillslopes
- *Landform position (two-dimensional):* Foothslope, summit
- *Landform position (three-dimensional):* Interfluve, base slope
- *Down-slope shape:* Concave, linear
- *Across-slope shape:* Concave, linear
- *Hydric soil rating:* No

**INFILTRATION REPORT  
FOR THE  
SNIPES SITE**

**Block and Lot: 016-002**

**Lower Makefield Township, Bucks County, Pennsylvania**

**November 1, 2016 (Revised May 11, 2017)**

**Prepared for:**

**Lower Makefield Township  
1100 Edgewood Road  
Yardley, PA 19067**



**Boucher & James, Inc.**  
CONSULTING ENGINEERS

***Corporate Headquarters:***  
1456 Ferry Road, Building 500  
Doylestown, PA 18901  
(215) 345-9400

***Regional Office:***  
2738 Rimrock Drive  
Stroudsburg, PA 18360  
(570) 629-0300

***Regional Office:***  
559 Main Street, Suite 230  
Bethlehem, PA 18018  
(610) 419-9407

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## **PROJECT OBJECTIVE AND SCOPE OF WORK**

**Boucher & James, Inc.** has completed the geotechnical investigation for the Snipes Tract located in Lower Makefield Township, Bucks County, Pennsylvania. The investigation involved evaluation of the subsurface soil conditions for stormwater infiltration.

The scope of work included performing test pits in areas proposed for stormwater infiltration. Soils profiles were examined and described using standard nomenclature including Munsell color charts. Test pits were dug typically to a minimum depth of six feet from the soil surface or until refusal at bedrock. Following examination of the soils, infiltration testing at representative locations was conducted. The infiltration testing was performed using double ring infiltrometers and percolation tests. Methods described in the Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer (ASTM D 3385-03), as referenced in Appendix C of the Pennsylvania Stormwater Best Management Practices Manual (BMP Manual), as well as percolation testing directly described in the BMP Manual were utilized to conduct the testing.

## **PUBLISHED GEOLOGIC / SOILS INFORMATION**

According to the Geologic Map of Bucks County, Pennsylvania (1950) the site is situated within an area underlain by the Triassic Period Stockton Formation. The excavations appear to confirm the presence of the Stockton Formation bedrock which typically consists of medium to coarse grained sandstone, siltstone and mudstone with interbedded shale. The Stockton Formation does not consist of Karst or carbonate geology. No sinkhole evidence was noted on the site.

According to the USDA Natural Resources Conservation Service Web Soil Survey, soils on site in the area of the test pits consist of the Penn – Lansdale Complex. These soils are described as well drained with water tables at more than eighty inches from the soil surface. Bedrock is typically encountered between twenty-eight and forty-eight inches from the soil surface. Examination of the test pits appears to generally match with the published soils data.

## **FIELD INVESTIGATION, OBSERVATIONS AND DATA**

On October 14<sup>th</sup> and 26<sup>th</sup>, 2016 and May 10<sup>th</sup> 2017, nineteen test pits were performed on the site. Pits were dug at the locations shown on the plan in Appendix I. The pit locations corresponded to potential infiltration areas associated with stormwater facilities. Topsoil depths at the test pits ranged between seven and ten inches thick.

Overall soils varied in composition throughout the test areas. Mottling was noted in only one test pit, near the soil surface, and appeared to be due to soil compaction. Bedrock was encountered in a third of the test pits at depths between twenty and ninety-six from the soil surface.



The soil examinations and testing revealed variable soils across the site which resulted in a wide range of infiltration rates, from limited to good infiltration capacity. Additional measures, such as modified soils as described in the BMP manual, should be considered for infiltration rates exceeding six inches per hour. The test pit soil descriptions and infiltration test results are included in Appendix II.

## **APPENDIX I**

## **APPENDIX II**

## **APPENDIX III**

# SITE INVESTIGATION AND PERCOLATION TEST REPORT FOR STORMWATER INFILTRATION

Site Location: Snipes Tract Municipality: Lower Makefield County: Bucks

Soil Type: PnB

**Soil Description:**

Soil Description Completed by: Terry Harris, SEO #02596 Date: October 14, 2017

Inches		Test Pit # A	Description of Horizon	Additional Pits
0	TO 8		A, 10YR4/3, SIL, VFR, GR	
8	TO 33		B1, 10YR5/8, SIL, FR, SBK	
33	TO 80		B2, 5YR3/3, SIL, VFI, SBK	
80	TO		BEDROCK	
	TO			
	TO			
	TO			Depth to Limiting Zone <b>80</b> Inches

**Percolation Test:**

Percolation Test Completed by: James Haklar Date: May 10, 2017

Test depth below existing grade: 5 Feet

Weather Conditions: Below 40 F  40 F or above  Dry Rain, Sleet, Snow (last 24 hours)  
 Soil Conditions: Wet  Dry  Frozen 24 Hour Presoak Yes  No

Hole No.	***		Reading Interval	Reading No. 1: Inches of Drop	Reading No. 2: Inches of Drop	Reading No. 3: Inches of Drop	Reading No. 4: Inches of Drop	Reading No. 5: Inches of Drop	Reading No. 6: Inches of Drop	Reading No. 7: Inches of Drop	Reading No. 8: Inches of Drop
	Yes	No									
1	X		XX / 30	0.125	0.125	0.125	0.125				
2	X		XX / 30	0.125	0.125	0.125	0.125				
3	X		XX / 30	0.125	0.125	0.125	0.125				

\*\*\* Water remaining in the hole at the end of the final 30 minute presoak? Yes, use 30 minute interval; No use 10 minute interval

Hole No.	Drop during final period	Perc. Rate as Minutes / Inch	Depth of Hole
1	0.125	240.00	12 "
2	0.125	240.00	12 "
3	0.125	240.00	12 "

**Infiltration Rate  
(Reduction Factor from BMP Manual Applied)**

240.00	Percolation Rate (minutes / inch)
6.00	Initial Water Depth (Inches)
0.125	Average / Final Water Level Drop (Inches)
8.00	Diameter of Percolation Holes (Inches)

Converted Percolation Rate (inches / hour)  
 **Infiltration Rate, I, (inches / hour)**

Total of Minutes / Inch: 720.00 = 240.00 Minutes / Inch  
 Total Number of Holes: 3

# SITE INVESTIGATION AND PERCOLATION TEST REPORT FOR STORMWATER INFILTRATION

Site Location: Snipes Tract Municipality: Lower Makefield County: Bucks

Soil Type: PnB

**Soil Description:**

Soil Description Completed by: Terry Harris, SEO #02596 Date: October 14, 2017

Inches		Test Pit # B	Description of Horizon	Additional Pits
0	TO 8		A, 10YR4/3, SIL, VFR, GR	
8	TO 32		B1, 10YR5/8, SIL, FR, SBK	
32	TO 70		B2, 5YR3/3, SIL, VFI, SBK	
70	TO		BEDROCK	
TO	TO			
TO	TO			
				Depth to Limiting Zone <b>70</b> Inches

**Percolation Test:**

Percolation Test Completed by: James Haklar Date: May 10, 2017

Test depth below existing grade: 5 Feet

Weather Conditions: Below 40 F  40 F or above  Dry Rain, Sleet, Snow (last 24 hours)  
 Soil Conditions: Wet  Dry  Frozen 24 Hour Presoak Yes  No

Hole No.	***		Reading Interval	Reading No. 1: Inches of Drop	Reading No. 2: Inches of Drop	Reading No. 3: Inches of Drop	Reading No. 4: Inches of Drop	Reading No. 5: Inches of Drop	Reading No. 6: Inches of Drop	Reading No. 7: Inches of Drop	Reading No. 8: Inches of Drop
	Yes	No									
1	x		XX / 30	2.500	2.500	2.375	2.250				
2	x		XX / 30	4.500	4.500	4.375	4.250				
3	x		XX / 30	2.625	2.750	2.625	2.500				

\*\*\* Water remaining in the hole at the end of the final 30 minute presoak? Yes, use 30 minute interval; No use 10 minute interval

Hole No.	Drop during final period	Perc. Rate as Minutes / Inch	Depth of Hole
1	2.250	13.33	12 "
2*	4.250	7.06	12 "
3	2.500	12.00	12 "

**Infiltration Rate  
(Reduction Factor from BMP Manual Applied)**

12.67	Percolation Rate (minutes / inch)
6.00	Initial Water Depth (Inches)
2.375	Average / Final Water Level Drop (Inches)
8.00	Diameter of Percolation Holes (Inches)

Total of Minutes / Inch:  $\frac{25.33}{2} = 12.67$  Minutes / Inch

4.74	Converted Percolation Rate (inches / hour)
2.15	<b>Infiltration Rate, I, (inches / hour)</b>

\* - Perc rate not used in calculation per BMP Guidance

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **C**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 26, 2016**  
 Personnel: **Mr. James Haklar**

Head or Depth of Water (H): **6 Inches**  
 Outer Ring Diameter: **12 Inches**  
 Inner Ring Diameter: **8 Inches**  
 Depth of Test Below Grade: **48 Inches**  
 Soil Description: **Soil Type: PnB**

0	TO	9	A, 10YR4/3, SIL, VFR, GR
9	TO	33	B1, 10YR5/8, SIL, FR, SBK
33	TO	96	B2, 2.5YR5/3, SL, VFR, GR
	TO		
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	10:35 AM	---	---	---	---
10/26/16	10:50 AM	15	2,100	140.0	0.174
10/26/16	11:05 AM	15	2,000	133.3	0.166
10/26/16	11:20 AM	15	2,000	133.3	0.166
10/26/16	11:35 AM	15	1,930	128.7	0.160

**INFILTRATION TEST 2**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
		---	---	---	---
		15	2,600	173.3	0.215
		15	2,350	156.7	0.195
		15	2,000	133.3	0.166
		15	1,960	130.7	0.162
		15	1,250	83.3	0.104
		15	1,300	86.7	0.108
		15	1,250	83.3	0.104
		15	1,240	82.7	0.103

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.16  
 Inches per hour 9.60  
 Inches per day 230.30

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.10  
 Inches per hour 6.17  
 Inches per day 147.97

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **D**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 26, 2016**  
 Personnel: **Mr. James Haklar**

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: 48 Inches  
 Soil Description: Soil Type: PnB

0	TO	8	A, 10YR4/3, SIL, VFR, GR
8	TO	32	B1, 10YR5/8, SIL, FR, SBK
32	TO	80	B2, 2.5YR5/3, CBSL, VFR, GR
	TO		
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	10:40 AM	---	---	---	---
10/26/16	10:55 AM	15	4,000	266.7	0.331
10/26/16	11:10 AM	15	4,000	266.7	0.331
10/26/16	11:25 AM	15	4,000	266.7	0.331
10/26/16	11:40 AM	15	4,000	266.7	0.331

**INFILTRATION TEST 2**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
		---	---	---	---
		15	3,420	228.0	0.283
		15	3,430	228.7	0.284
		15	3,400	226.7	0.282
		15	3,420	228.0	0.283

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.33  
 Inches per hour 19.89  
 Inches per day 477.31

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.28  
 Inches per hour 17.00  
 Inches per day 408.10



**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **E**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 26, 2016**  
 Personnel: **Mr. James Haklar**

Head or Depth of Water (H): **6 Inches**  
 Outer Ring Diameter: **12 Inches**  
 Inner Ring Diameter: **8 Inches**  
 Depth of Test Below Grade: **48 Inches**  
 Soil Description: **Soil Type: PnB**

0	TO	10	A, 10YR4/3, SIL, VFR, GR
10	TO	50	B1, 10YR5/8, SIL, FR, SBK
50	TO	72	B2, 5YR4/6, SL, VFR, GR
72	TO	84	B3, 2.5YR5/3, SL, VFR, GR
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	10:45 AM	---	---	---	---
10/26/16	11:00 AM	15	30	2.0	0.002
10/26/16	11:15 AM	15	30	2.0	0.002
10/26/16	11:30 AM	15	20	1.3	0.002
10/26/16	11:45 AM	15	20	1.3	0.002

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
---	---	---	---
15	1,000	66.7	0.083
15	850	56.7	0.070
15	680	45.3	0.056
15	600	40.0	0.050
15	600	40.0	0.050
15	600	40.0	0.050
15	600	40.0	0.050

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.10  
 Inches per day 2.39

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.05  
 Inches per hour 2.98  
 Inches per day 71.60

# SITE INVESTIGATION AND PERCOLATION TEST REPORT FOR STORMWATER INFILTRATION

Site Location: Snipes Tract Municipality: Lower Makefield County: Bucks

Soil Type: PnB

**Soil Description:**

Soil Description Completed by: Terry Harris, SEO #02596 Date: October 14, 2017

	<b>Test Pit # F</b>		<u>Additional Pits</u>
<u>Inches</u>		<u>Description of Horizon</u>	
0 TO 8		A, 10YR4/3, SIL, VFR, GR	
8 TO 25		B1, 10YR5/8, SIL, FR, SBK	
25 TO 34		B2, 10YR5/6, SIL, FR, SBK	
34 TO 90		B3, 5YR3/3, SIL, VFI, SBK	
TO			
TO			
			Depth to Limiting Zone > <b>90</b> Inches

**Percolation Test:**

Percolation Test Completed by: James Haklar Date: May 10, 2017

Test depth below existing grade: 2 Feet

Weather Conditions: Below 40 F  40 F or above  Dry Rain, Sleet, Snow (last 24 hours)  
 Soil Conditions: Wet  Dry  Frozen 24 Hour Presoak Yes  No

Hole No.	***		Reading Interval	Reading No. 1: Inches of Drop	Reading No. 2: Inches of Drop	Reading No. 3: Inches of Drop	Reading No. 4: Inches of Drop	Reading No. 5: Inches of Drop	Reading No. 6: Inches of Drop	Reading No. 7: Inches of Drop	Reading No. 8: Inches of Drop
	Yes	No									
1	x		XX / 30	0.250	0.250	0.125	0.125				
2	x		XX / 30	0.250	0.250	0.250	0.250				
3	x		XX / 30	0.125	0.125	0.125	0.125				

\*\*\* Water remaining in the hole at the end of the final 30 minute presoak? Yes, use 30 minute interval; No use 10 minute interval

Hole No.	Drop during final period	Perc. Rate as Minutes / Inch	Depth of Hole
1	0.125	240.00	12 "
2*	0.250	120.00	12 "
3	0.125	240.00	12 "

**Infiltration Rate  
(Reduction Factor from BMP Manual Applied)**

<b>240.00</b>	Percolation Rate (minutes / inch)
<b>6.00</b>	Initial Water Depth (Inches)
<b>0.125</b>	Average / Final Water Level Drop (Inches)
<b>8.00</b>	Diameter of Percolation Holes (Inches)

Total of Minutes / Inch: 480.00 = **240.00** Minutes / Inch  
 Total Number of Holes: 2

<b>0.25</b>	Converted Percolation Rate (inches / hour)
<b>0.10</b>	<b>Infiltration Rate, I, (inches / hour)</b>

\* - Perc rate not used in calculation per BMP Guidance

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **G**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date:  
 Personnel:

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: Inches  
 Soil Description: Soil Type: PnB

0	TO	9	A, 10YR4/3, SIL, VFR, GR
9	TO	21	B1, 10YR5/8, SIL, FR, SBK
21	TO	33	B2, 10YR5/6, SIL, FR, SBK
33	TO	84	B3, 5YR3/3, SIL, VFI, SBK
	TO		
	TO		
	TO		

**INFILTRATION TESTING WAS NOT PERFORMED AT THIS LOCATION**

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
		---	---	---	---

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
---	---	---	---

**TEST 1 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**TEST 2 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **H**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**

Head or Depth of Water (H): **6 Inches**  
 Outer Ring Diameter: **12 Inches**  
 Inner Ring Diameter: **8 Inches**  
 Depth of Test Below Grade: **48 Inches**  
 Soil Description: **Soil Type: PnB**

0	TO	10	A, 10YR4/3, SIL, VFR, GR
10	TO	20	B1, 10YR5/8, SIL, FR, SBK
20	TO	96	B2, 5YR3/3, SIL, VFI, SBK
96	TO		BEDROCK
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
10/14/16	12:35 PM	---	---	---	---
10/14/16	12:50 PM	15	0	0.0	0.000
10/14/16	1:05 PM	15	40	2.7	0.003
10/14/16	1:20 PM	15	20	1.3	0.002
10/14/16	1:35 PM	15	10	0.7	0.001
10/14/16	1:50 PM	15	0	0.0	0.000

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
---	---	---	---
15	0	0.0	0.000
15	0	0.0	0.000
15	0	0.0	0.000
15	0	0.0	0.000
15	0	0.0	0.000
15	0	0.0	0.000

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **I**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**

Head or Depth of Water (H): **6 Inches**  
 Outer Ring Diameter: **12 Inches**  
 Inner Ring Diameter: **8 Inches**  
 Depth of Test Below Grade: **48 Inches**  
 Soil Description: **Soil Type: PnB**

0	TO	8	A, 10YR4/3, SIL, VFR, GR
8	TO	27	B1, 10YR5/8, SIL, FR, SBK
27	TO	49	B2, 2.5YR5/4, SL, VFR, GR
49	TO	84	B3, 2.5YR5/3, SL, VFR, GR
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/14/16	12:40 PM	---	---	---	---
10/14/16	12:55 PM	15	650	43.3	0.054
10/14/16	1:10 PM	15	700	46.7	0.058
10/14/16	1:25 PM	15	670	44.7	0.056
10/14/16	1:40 PM	15	680	45.3	0.056
10/14/16	1:55 PM	15	670	44.7	0.056

**INFILTRATION TEST 2**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/14/16	12:40 PM	---	---	---	---
10/14/16	12:55 PM	15	500	33.3	0.041
10/14/16	1:10 PM	15	460	30.7	0.038
10/14/16	1:25 PM	15	420	28.0	0.035
10/14/16	1:40 PM	15	470	31.3	0.039
10/14/16	1:55 PM	15	440	29.3	0.036

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.06  
 Inches per hour 3.33  
 Inches per day 79.95

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.04  
 Inches per hour 2.19  
 Inches per day 52.50

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **J**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date:  
 Personnel:

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: Inches  
 Soil Description: Soil Type: PnB

0	TO	8	A, 10YR4/3, SIL, VFR, GR
8	TO	19	B1, 10YR5/8, SIL, FR, SBK
19	TO	31	B1, 7.5YR5/8, SIL, FR, SBK
31	TO	60	B3, 5YR3/3, FLSIL, VFI, SBK
60	TO		BEDROCK
	TO		
	TO		

**INFILTRATION TESTING WAS NOT PERFORMED AT THIS LOCATION**

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
		---	---	---	---

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
---	---	---	---

**TEST 1 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**TEST 2 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **K**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 26, 2016**  
 Personnel: **Mr. James Haklar**

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: 48 Inches  
 Soil Description: Soil Type: PnB

0	TO	7	A, 10YR4/3, SIL, VFR, GR
7	TO	40	B1, 7.5YR5/8, SIL, FR, SBK
40	TO	80	B2, 2.5YR5/3, SL, VFR, GR
	TO		
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	8:25 AM	---	---	---	---
10/26/16	8:40 AM	15	850	56.7	0.070
10/26/16	8:55 AM	15	850	56.7	0.070
10/26/16	9:10 AM	15	820	54.7	0.068
10/26/16	9:25 AM	15	820	54.7	0.068

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
---	---	---	---
15	3,450	230.0	0.286
15	3,000	200.0	0.249
15	3,000	200.0	0.249
15	3,000	200.0	0.249
15	3,000	200.0	0.249

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.07  
 Inches per hour 4.08  
 Inches per day 97.85

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.25  
 Inches per hour 14.92  
 Inches per day 357.98

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **L**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date:  
 Personnel:

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: Inches  
 Soil Description: Soil Type: PnB

0	TO	8	A, 10YR4/3, SIL, VFR, GR
8	TO	20	B1, 10YR5/8, SIL, FR, SBK
20	TO		BEDROCK
	TO		
	TO		
	TO		
	TO		

**INFILTRATION TESTING WAS NOT PERFORMED AT THIS LOCATION**

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
		---	---	---	---

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
---	---	---	---

**TEST 1 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**TEST 2 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day



**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **M**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date:  
 Personnel:

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: Inches  
 Soil Description: Soil Type: PnB

0	TO	9	A, 10YR4/3, SIL, VFR, GR
9	TO	34	B1, 10YR5/8, SIL, FR, SBK
34	TO		BEDROCK
	TO		
	TO		
	TO		
	TO		

**INFILTRATION TESTING WAS NOT PERFORMED AT THIS LOCATION**

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
		---	---	---	---

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
---	---	---	---

**TEST 1 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**TEST 2 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **N**  
 Date Soil Described: **October 14, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date: **October 26, 2016**  
 Personnel: **Mr. James Haklar**

Head or Depth of Water (H): **6 Inches**  
 Outer Ring Diameter: **12 Inches**  
 Inner Ring Diameter: **8 Inches**  
 Depth of Test Below Grade: **48 Inches**  
 Soil Description: **Soil Type: PnB**

0	TO	7	A, 10YR4/3, SIL, VFR, GR
7	TO	24	B1, 10YR5/8, SIL, FR, SBK
24	TO	44	B2, 2.5YR5/3, SL, VFI, GR
44	TO	84	B3, 2.5YR5/3, SL, VFR, GR
	TO		
	TO		
	TO		

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	8:20 AM	---	---	---	---
10/26/16	8:35 AM	15	100	6.7	0.008
10/26/16	8:50 AM	15	50	3.3	0.004
10/26/16	9:05 AM	15	30	2.0	0.002
10/26/16	9:20 AM	15	20	1.3	0.002

**INFILTRATION TEST 2**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (l) (ml/min)	Infiltration Rate (l) (inches/min)
10/26/16	8:20 AM	---	---	---	---
10/26/16	8:35 AM	15	200	13.3	0.017
10/26/16	8:50 AM	15	150	10.0	0.012
10/26/16	9:05 AM	15	150	10.0	0.012
10/26/16	9:20 AM	15	150	10.0	0.012

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.10  
 Inches per day 2.39

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.01  
 Inches per hour 0.75  
 Inches per day 17.90

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract - Lower Makefield Township**  
 Pit # / Location: **O**  
 Date Soil Described: **October 26, 2016**  
 Personnel: **Mr. Terry Harris**  
 Infiltration Date:  
 Personnel:

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: Inches  
 Soil Description: Soil Type: PnB

0	TO	8	A, 10YR4/3, SIL, VFR, GR
8	TO	43	B1, 10YR5/8, SIL, FR, SBK
43	TO	64	B2, 5YR3/3, FLSIL, VFI, SBK
	TO		
	TO		
	TO		
	TO		

**INFILTRATION TESTING WAS NOT PERFORMED AT THIS LOCATION**

**INNER RING READINGS**

**INFILTRATION TEST 1**

Date	Time	Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
		---	---	---	---

**INFILTRATION TEST 2**

Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (inches/min)
---	---	---	---

**TEST 1 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

**TEST 2 INFILTRATION RATE**  
 Inches per minute  
 Inches per hour  
 Inches per day

# SITE INVESTIGATION AND PERCOLATION TEST REPORT FOR STORMWATER INFILTRATION

Site Location: Snipes Municipality: Lower Makefield County: Bucks

Soil Type: PnB

**Soil Description:**

Soil Description Completed by: Terry Harris, SEO #02596 Date: May 10, 2017

Inches	Test Pit # P	Description of Horizon	Additional Pits
0 TO 8		A, 7.5YR5/4, SIL, FR, SBK	
8 TO 34		B1, 10YR6/6, SIL, FR, SBK	
34 TO 68		B2, 2.5YR4/4, SIL, FI, SBK	
68 TO 96		B3, 2.5YR4/4, VCBSIL, FI, SBK	
TO			
TO			
			Depth to Limiting Zone > 96 Inches

**Percolation Test:**

Percolation Test Completed by: James Haklar Date: May 10, 2017

Test depth below existing grade: 5 Feet

Weather Conditions: Below 40 F  40 F or above  Dry Rain, Sleet, Snow (last 24 hours)  
 Soil Conditions: Wet  Dry  Frozen 24 Hour Presoak Yes  No

Hole No.	***		Reading Interval	Reading No. 1: Inches of Drop	Reading No. 2: Inches of Drop	Reading No. 3: Inches of Drop	Reading No. 4: Inches of Drop	Reading No. 5: Inches of Drop	Reading No. 6: Inches of Drop	Reading No. 7: Inches of Drop	Reading No. 8: Inches of Drop
	Yes	No									
1	x		XX / 30	0.375	0.250	0.250	0.250				
2	x		XX / 30	0.250	0.375	0.250	0.250				
3	x		XX / 30	0.125	0.125	0.125	0.125				

\*\*\* Water remaining in the hole at the end of the final 30 minute presoak? Yes, use 30 minute interval; No use 10 minute interval

Hole No.	Drop during final period	Perc. Rate as Minutes / Inch	Depth of Hole
1*	0.250	120.00	12 "
2	0.250	120.00	12 "
3	0.125	240.00	12 "

**Infiltration Rate  
(Reduction Factor from BMP Manual Applied)**

180.00	Percolation Rate (minutes / inch)
6.00	Initial Water Depth (Inches)
0.188	Average / Final Water Level Drop (Inches)
8.00	Diameter of Percolation Holes (Inches)

Total of Minutes / Inch:  $\frac{360.00}{2} = 180.00$  Minutes / Inch  
 Total Number of Holes: 2

0.33	Converted Percolation Rate (inches / hour)
0.13	<b>Infiltration Rate, I, (inches / hour)</b>

\* - Perc rate not used in calculation per BMP Guidance

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract**  
 Pit # / Location: **Pit Q**  
 Date Soil Described: **May 10, 2017**  
 Personnel: **Terry Harris**  
 Infiltration Date: **May 10, 2017**  
 Personnel: **Matt Roberts**

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: 54 Inches  
 Soil Description: Soil Type: PnB

0	TO	12	A, 7.5YR4/2, SIL, FI, PL, FEW / FAINT MOTTLES
12	TO	34	B1, 7.5YR4/2, SIL, FR, SBK
34	TO	51	B2, 7.5YR4/4, SIL, FR, SBK
51	TO	75	B3, 10YR6/6, SIL, FR, SBK
75	TO	80	B4, 2.5YR4/4, SIL, FI, SBK
	TO		
	TO		

**INNER RING READINGS**

		INFILTRATION TEST 1				INFILTRATION TEST 2				INFILTRATION TEST 3			
Date	Time	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)
5/10/17	8:15 AM	---	---	---	---	---	---	---	---	---	---	---	---
5/10/17	8:30 AM	15	30	2.0	0.002	15	100	6.7	0.008	15	0	0.0	0.000
5/10/17	8:45 AM	15	50	3.3	0.004	15	200	13.3	0.017	15	150	10.0	0.012
5/10/17	9:00 AM	15	30	2.0	0.002	15	180	12.0	0.015	15	70	4.7	0.006
5/10/17	9:15 AM	15	30	2.0	0.002	15	250	16.7	0.021	15	80	5.3	0.007

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.15  
 Inches per day 3.58

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.02  
 Inches per hour 1.24  
 Inches per day 29.83

**TEST 3 INFILTRATION RATE**  
 Inches per minute 0.01  
 Inches per hour 0.40  
 Inches per day 9.55

0.27 Inches per Hour (Average of Test 1 and 3, highest rate not utilized per BMP Manual)

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract**  
 Pit # / Location: **Pit R**  
 Date Soil Described: **May 10, 2017**  
 Personnel: **Terry Harris**  
 Infiltration Date: **May 10, 2017**  
 Personnel: **Matt Roberts**

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: 48 Inches  
 Soil Description: Soil Type: PnB

0	TO	13	FILL, 7.5YR4/3, SIL, FR, SBK
13	TO	24	Ab, 7.5YR4/4, SIL, FR, SBK
24	TO	48	B1, 7.5YR5/6, SIL, FR, SBK
48	TO	75	B2, 2.5YR4/4, SIL, FI, SBK
	TO		
	TO		
	TO		

**INNER RING READINGS**

		INFILTRATION TEST 1				INFILTRATION TEST 2				INFILTRATION TEST 3			
Date	Time	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)
5/10/17	8:40 AM	---	---	---	---	---	---	---	---	---	---	---	---
5/10/17	8:55 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	0	0.0	0.000
5/10/17	9:10 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	0	0.0	0.000
5/10/17	9:25 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	0	0.0	0.000
5/10/17	9:40 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	0	0.0	0.000

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**TEST 3 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

0.00 Inches per Hour

**DOUBLE RING INFILTRMETER TEST**

Site Name: **Snipes Tract**  
 Pit # / Location: **Pit S**  
 Date Soil Described: **May 10, 2017**  
 Personnel: **Terry Harris**  
 Infiltration Date: **May 10, 2017**  
 Personnel: **James Haklar**

Head or Depth of Water (H): 6 Inches  
 Outer Ring Diameter: 12 Inches  
 Inner Ring Diameter: 8 Inches  
 Depth of Test Below Grade: 72 Inches  
 Soil Description: Soil Type: PnB

0	TO	7	A, 7.5YR5/4, SIL, FR, SBK
7	TO	30	B1, 10YR6/6, SIL, FR, SBK
30	TO	84	B2, 2.5YR4/4, SIL, FI/FR, SBK
84	TO		BEDROCK
	TO		
	TO		
	TO		

**INNER RING READINGS**

		INFILTRATION TEST 1				INFILTRATION TEST 2				INFILTRATION TEST 3			
Date	Time	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)	Lapse (min.)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (in./min.)
5/10/17	9:15 AM	---	---	---	---	---	---	---	---	---	---	---	---
5/10/17	9:30 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	460	30.7	0.038
5/10/17	9:45 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	260	17.3	0.022
5/10/17	10:00 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	200	13.3	0.017
5/10/17	10:15 AM	15	0	0.0	0.000	15	0	0.0	0.000	15	180	12.0	0.015
										15	170	11.3	0.014

**TEST 1 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**TEST 2 INFILTRATION RATE**  
 Inches per minute 0.00  
 Inches per hour 0.00  
 Inches per day 0.00

**TEST 3 INFILTRATION RATE**  
 Inches per minute 0.01  
 Inches per hour 0.85  
 Inches per day 20.29

\* \_\_\_\_\_ Inches per Hour

SOIL DESCRIPTIONS

Site Location: Snipes Tract
Municipality: Lower Makefield Township County: Bucks

Soils Description Complete by: Terry Harris, SEO# 02596 Date: May 10, 2017

Test Pit # L Soil Type: PnB Limiting Zone (Inches):

Inches

TO Test pit performed to confirm depth and competency of bedrock.
TO Bedrock encountered at 20" below soil surface, pit extended to a total depth of 48" below the soil surface.
TO Bedrock was relatively easily excavated utilizing a standard backhoe.
TO
TO

Test Pit # T Soil Type: PnB Limiting Zone (Inches):

Inches

TO Test pit performed to confirm depth and competency of bedrock.
TO Bedrock encountered at 37" below soil surface, pit extended to a total depth of 48" below the soil surface.
TO Bedrock was relatively easily excavated utilizing a standard backhoe.
TO
TO

Test Pit # U Soil Type: PnB Limiting Zone (Inches):

Inches

TO Test pit performed to confirm depth and competency of bedrock.
TO Bedrock encountered at 65" below soil surface, pit extended to a total depth of 96" below the soil surface.
TO Bedrock was relatively easily excavated utilizing a standard backhoe.
TO
TO

Test Pit # V Soil Type: PnB Limiting Zone (Inches):

Inches

TO Test pit performed to confirm depth and competency of bedrock.
TO Bedrock encountered at 96" below soil surface, pit extended to a total depth of 114" below the soil surface.
TO Bedrock was relatively easily excavated utilizing a standard backhoe.
TO
TO

Test Pit # W Soil Type: PnB Limiting Zone (Inches):

Inches

TO Test pit performed to confirm depth and competency of bedrock.
TO Bedrock encountered at 72" below soil surface, pit extended to a total depth of 89" below the soil surface.
TO Bedrock was relatively easily excavated utilizing a standard backhoe.
TO
TO



# APPENDIX G:

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## E & S COMPLETENESS REVIEW CHECKLIST



**COMPLETENESS REVIEW CHECKLIST**

Check-off: C = Complete, NC = Not Complete

STANDARD E & S AND PCSM COMPLETENESS REVIEW CHECKLIST					
General					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	1-14	<input type="checkbox"/>	<input type="checkbox"/>	Fully completed, properly signed and notarized Notice of Intent Form (1 original and 2 copies)	NOI
<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	Permit filing fee of \$500 (general permit) or \$1500 (individual permit) payable to the appropriate Clean Water Fund	Enclosed
<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	Disturbed acre fee payable to the Commonwealth of Pennsylvania Clean Water Fund	Enclosed
<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	Proof of receipt of municipal and county Acts 14, 67, 68, and 127 notifications; copies of certified mail receipts or acknowledgment letters from the local municipality and county government.	Enclosed
<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	A signed PNDI receipt for the project area showing "No Known Impact", or "Avoidance Measures" or "Potential Impact" and proof of delivery to the appropriate jurisdictional agency(ies) where further coordination is required, as appropriate) <i>(Reference the Instructions for a General (PAG-02) OR Individual NPDES Permit for stormwater discharges associated with construction activities- Pennsylvania Natural Heritage Program (PNHP) &amp; Pennsylvania Natural Diversity Inventory)</i>	Enclosed
<input checked="" type="checkbox"/>	D 6 & 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Complete Erosion and Sediment Control Plans (3 copies)	Drawings
<input checked="" type="checkbox"/>	D11&12 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Complete Post Construction Stormwater Management Plan (3 copies)	Drawings
<input type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Fully completed General Information Form (GIF) (Individual Permits	N/A-General Permit
<input type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	PHMC coordination letter/clearance (Individual Permits for 10 acres or more of disturbance only)	N/A-General Permit
<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	Appendix A land use questions	NOI
Item Location: D = E&S Drawings, N = E&S Narrative, D or N = Drawings or Narrative D & N = Drawings and Narrative					
E&S Plan Planning & Design 102.4(b)(4)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 6 of 14 E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	The E&S Plan is separate from the PCSM Plan and labeled "E&S" or "Erosion and Sediment Control Plan" and is the final plan for construction.	D & N
<input checked="" type="checkbox"/>	E&S N 14	<input type="checkbox"/>	<input type="checkbox"/>	Documentation provided that E&S Plan was prepared by person trained and experienced in E&S design methods and techniques applicable to the size and scope of the project	N
<input checked="" type="checkbox"/>	D 6 of 14 E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	E&S Plan minimizes extent and duration of earth disturbance	D & N
<input checked="" type="checkbox"/>	D 6 of 14 E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	E&S Plan maximizes protection of existing drainage features and vegetation	D & N
<input checked="" type="checkbox"/>	D 6 of 14 E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	E&S Plan minimizes soil compaction	D & N
<input checked="" type="checkbox"/>	D 6 of 14 E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	E&S Plan utilizes other measures or controls that prevent or minimize generation of increased stormwater runoff	D & N
Existing topographic features of the project site and the immediate surrounding area §102.4(b)(5)(i)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Topographic map(s) of the project site provided	D
<input checked="" type="checkbox"/>	E&S N A-1	<input type="checkbox"/>	<input type="checkbox"/>	Location map (USGS quadrangle) provided	D or N

Types, depth, slope, locations and limitations of the soils §102.4(b)(5)(ii)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Soil map provided	D or N
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Soil use limitations and their resolutions provided	D or N
Past, present and proposed land uses and proposed alteration to project site §102.4(b)(5)(iii)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	Past land uses for past 50 years addressed	N
<input checked="" type="checkbox"/>	E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	Present land uses for last 5 years addressed	N
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Proposed alteration/land uses shown on a plan map	D
Volume and rate of runoff from the project site and its upstream watershed area §102.4(b)(5)(iv)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	E&S N D.A. MAPS 1 & 2 of 2	<input type="checkbox"/>	<input type="checkbox"/>	Drainage area maps provided for proposed channels, basins, and traps * Located in E&S Narrative Report File Pockets	D or N
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Runoff calculations provided for proposed channels * No channels	N
Location of all surface waters and their classification under Chapter 93 §102.4(b)(5)(v)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Surface waters shown on plan map(s)	D
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Existing/designated uses of all streams, lakes, ponds, wetlands or other surface waters identified	D or N
Narrative description of the location and type of perimeter and onsite BMPs §102.4(b)(5)(vi)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	E&S N 8	<input type="checkbox"/>	<input type="checkbox"/>	E&S BMPs identified/described	N
<input checked="" type="checkbox"/>	D 6 & 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	E&S BMPs shown on plan map(s)	D
Sequence of BMP installation and removal §102.4(b)(5)(vii)					
Applicant		Reviewer		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Construction sequence provided	D
Supporting calculations and measurements §102.4(b)(5)(viii)					
Applicant		Department		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	E&S N E-1	<input type="checkbox"/>	<input type="checkbox"/>	Calculations provided for all proposed channels, traps, and basins	N
<input checked="" type="checkbox"/>	E&S N E-1	<input type="checkbox"/>	<input type="checkbox"/>	Standard E&S worksheets or equivalents completely filled out	N
Plan drawings §102.4(b)(5)(ix)					
Applicant		Department		Item	Item Location
Included	Page Number	C	NC		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Plan map(s) showing proposed earthmoving provided	D
<input checked="" type="checkbox"/>	D 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Details and/or typicals provided for each proposed E&S BMP	D

<b>Maintenance program §102.4(b)(5)(x)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
<input checked="" type="checkbox"/>	D 6 & 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Maintenance of proposed BMPs addressed	D
<input checked="" type="checkbox"/>	D 6 & 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Inspection schedule for proposed BMPs provided	D
<input checked="" type="checkbox"/>	D 7 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Written report documenting inspections and repairs specified	D
<b>Recycling or disposal of materials §102.4(b)(5)(xi)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Anticipated construction wastes identified	D
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Instructions provided for proper recycling/disposal of materials provided	D
<b>Geologic formations/soil conditions that may have the potential to cause pollution §102.4(b)(5)(xii)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
<input checked="" type="checkbox"/>	E&S N F-3	<input type="checkbox"/>	<input type="checkbox"/>	Geologic/soil conditions addressed	D or N
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Where potential for pollution identified, measures provided to avoid/minimize/or mitigate	D
<b>Potential thermal impacts to surface waters §102.4(b)(5)(xiii)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
<input checked="" type="checkbox"/>	E&S N 4	<input type="checkbox"/>	<input type="checkbox"/>	Potential for thermal impacts addressed	D or N
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Where potential for impacts exists, measures provided to avoid/minimize/or mitigate	D
<b>E&amp;S Plan designed and implemented to be consistent with PCSM Plan §102.4(b)(5)(xiv)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Proposed structural PCSM BMPs shown on the E&S plan map(s)	D
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Existing/proposed riparian buffers outside limits of disturbance	D
<input checked="" type="checkbox"/>	D 6 of 14	<input type="checkbox"/>	<input type="checkbox"/>	Proposed infiltration BMPs outside proposed grading areas	D
<b>Existing/proposed riparian forest buffers §102.4(b)(5)(xv)</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>N/A Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
				No Riparian Buffer	
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Existing/proposed riparian forest buffers shown on plan map(s)	D
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Existing/proposed riparian forest buffers outside limits of disturbance	D
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Protection provided for wetlands within riparian forest buffer	D or N
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Riparian buffer offset shown, if necessary	D
<b>Antidegradation Analysis</b>					
<b>Applicant</b>		<b>Reviewer</b>		<b>Item</b>	<b>Item Location</b>
<b>N/A Included</b>	<b>Page Number</b>	<b>C</b>	<b>NC</b>		
				N/A: There are no HQ or EV Waters or Wetlands Present Onsite	
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Equivalency demonstration for alternative BMPs to a riparian buffer or riparian forest buffer	
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Evaluation of nondischarge alternatives, including demonstration that a nondischarge alternative does not exist for both E&S and PCSM	N
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	ABACT included where a nondischarge alternative does not exist for both E&S and PCSM	D or N
<input checked="" type="checkbox"/>	N/A	<input type="checkbox"/>	<input type="checkbox"/>	Nondischarge and ABACT BMPs have been identified for both E&S and PCSM	D or N