POST CONSTRUCTION STORMWATER MANAGEMENT REPORT

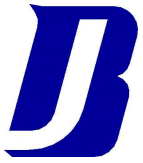
SNIPES TRACT ATHLETIC FIELDS

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 18, 2016
Revised MAY 30, 2017
Revised JULY 17, 2017
Prepared by:



BOUCHER & JAMES, INC.
Consulting Engineers

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

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- ✓ Predevelopment Drainage Area Map
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POST CONSTRUCTION STORMWATER MANAGEMENT PLAN

SITE DESCRIPTION & ANALYSIS

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

PROJECT DESCRIPTION

At the request of Lower Makefield Township, a stormwater management and erosion control study was conducted for the land development of a 36.26 acre property. The site is located within the Township owned Snipes Tract on Dolington Road (State Route 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 36.26 acres, the property being Tax Map Parcels 20-016-001-001 and 20-016-002. Access to the site is presently provided via an existing drive from Dolington Road. **The site presently consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, a Township 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 24.99 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, while recharging the ground. 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 evaluating the proposed project.

WATERSHED DESCRIPTION & HYDROLOGY

The pre-developed site consists of a paved entrance drive, a gravel loop road, open grassed areas, former tree nursery areas, 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**.

There are no naturally occurring geologic formations or soil conditions, such as Karst or Carbonate geology, that may have the potential to cause pollution during earth moving activities.

PCSM COMPLETENESS REVIEW CHECKLIST NOTES

The PCSM Plan is separate from the E&S Plan, is labeled "Post Construction Stormwater Management Plan" and shall be the Final Plan for Construction. The PCSM Plan has been designed/ prepared to:

- **Preserve the integrity of the stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream.**
- **Prevent an increase in the rate of stormwater runoff.**
- **Minimize any increase in stormwater runoff volume.**
- **Minimize impervious areas.**
- **Maximize the protection of existing drainage features and existing vegetation.**
- **Minimize land clearing and grading.**
- **Minimize soil compaction.**
- **Utilize other structural or nonstructural BMP's that prevent or minimize changes in stormwater runoff.**

The **Present Land Use 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

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 (2) infiltration trenches to collect, store, cool and infiltrate stormwater runoff.

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

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

The following permanent PCSM BMPs shall be installed:

- Two (2) Infiltration trenches
- Stormwater detention basin
- Three (3) Riprap aprons at the storm sewer outfalls
- Landscape Restoration

COMPUTATION METHODS

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.

The PCSM stormwater management calculations demonstrate that rate, volume and water quality were met in accordance with the Delaware River South Watershed Act 167 Plan, dated May 11, 2011.

SOILS CHARACTERISTICS AND LIMITATIONS

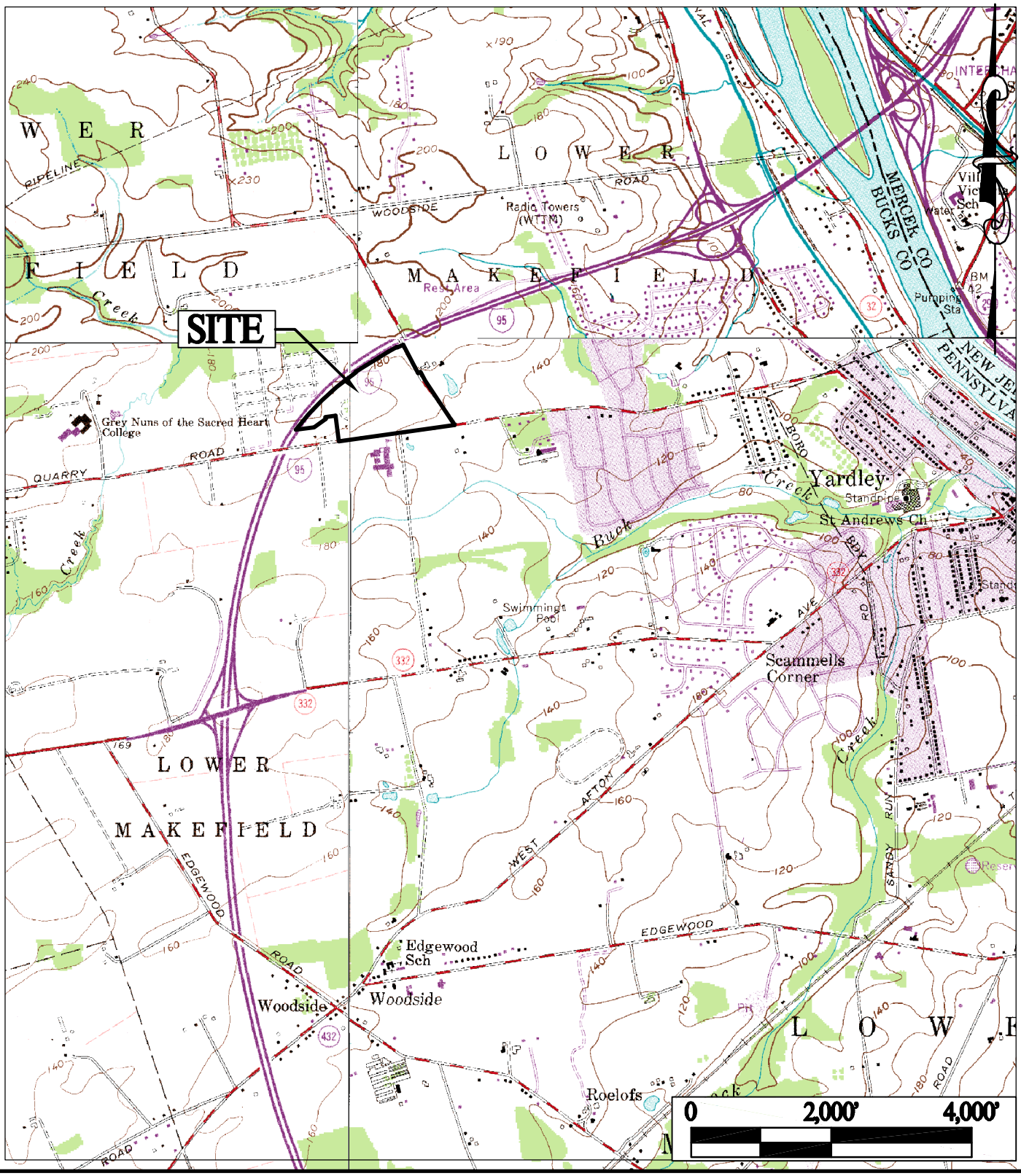
	Limitations						
Soil Series & Map Symbol	**Bldg w/out Basements**	**Bldg w/ Basements**	**Small Commercial Bldgs**	**Hydrologic Soil Group**	**Depth to Seasonal High Water Table**	**Depth to Bedrock**	**Erodibility**
Abbottstown Silt Loam, 3 to 8% (AbB)	Very Limited, Depth to saturated zone	Very Limited,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

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.

APPENDIX A:

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

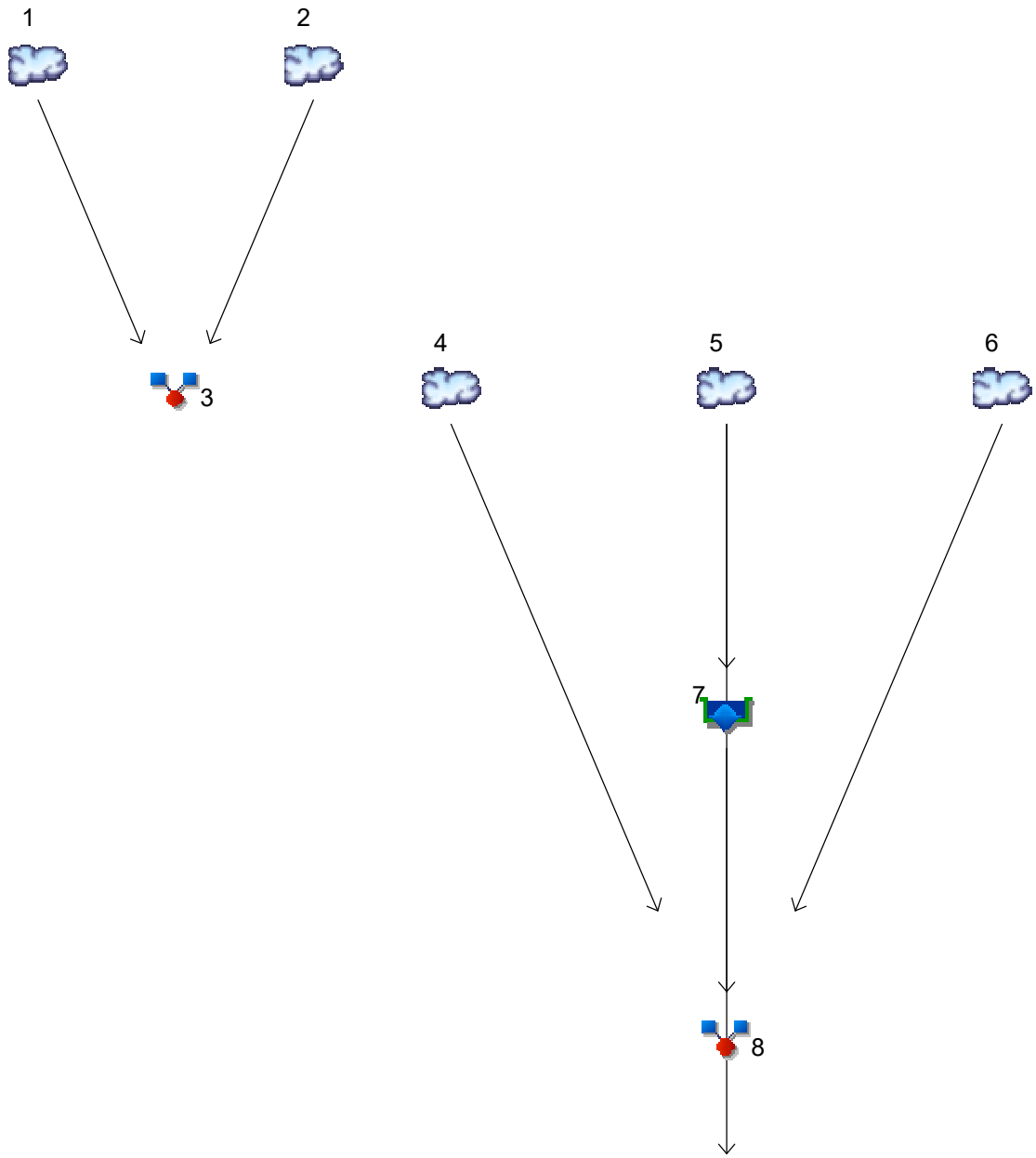
Lower Makefield Township
Bucks County

APPENDIX B:

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

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

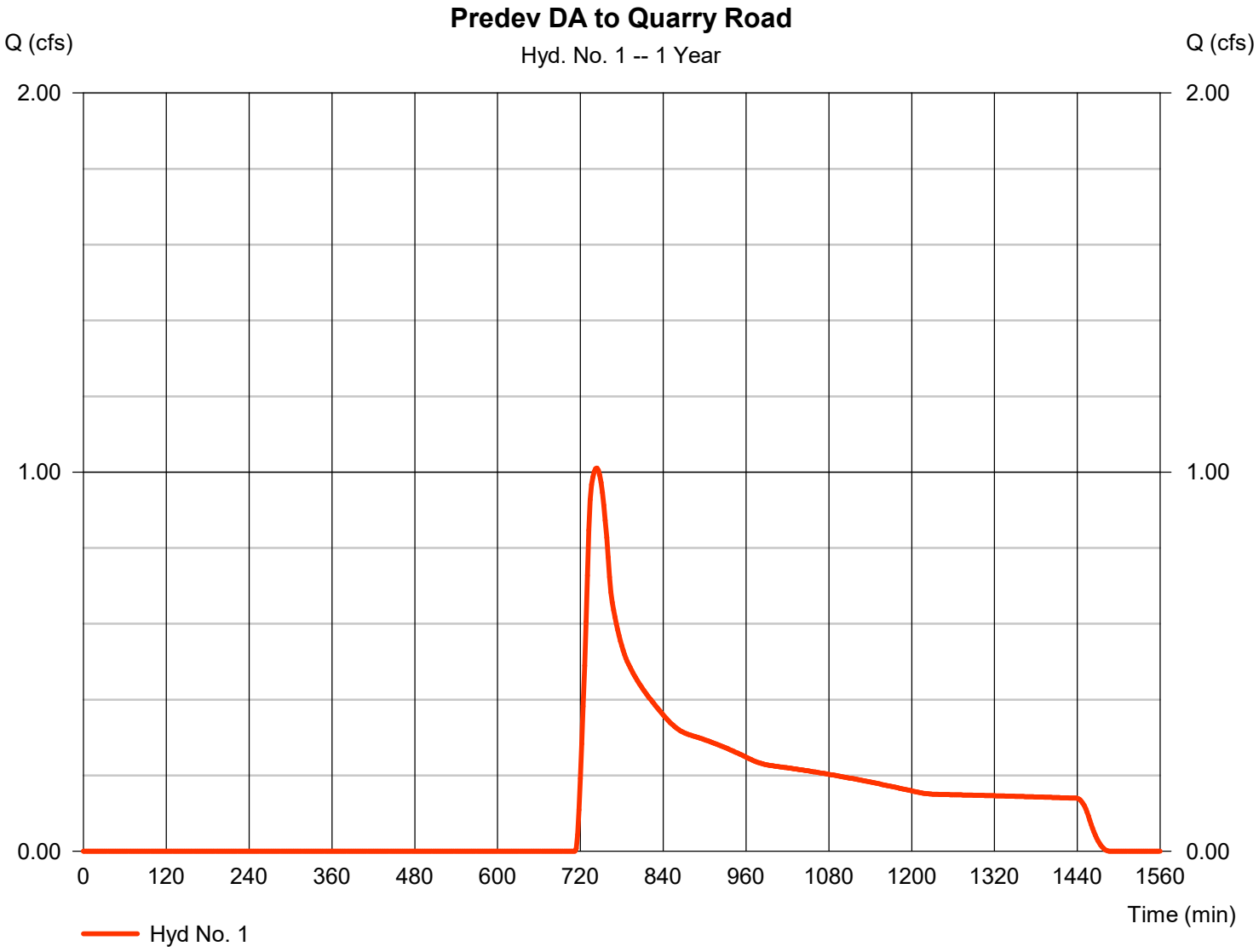
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.010	2	744	11,616	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	3.939	2	736	26,190	------	------	------	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

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

Hyd. No. 1

Predev DA to Quarry Road

Description	A		B		C		Totals
Sheet Flow							
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		
Travel Time (min)	**= 17.60**	**+**	**0.00**	**+**	**0.00**	**=**	**17.60**
Shallow Concentrated Flow							
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		
Travel Time (min)	**= 1.83**	**+**	**2.47**	**+**	**5.21**	**=**	**9.50**
Channel Flow							
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

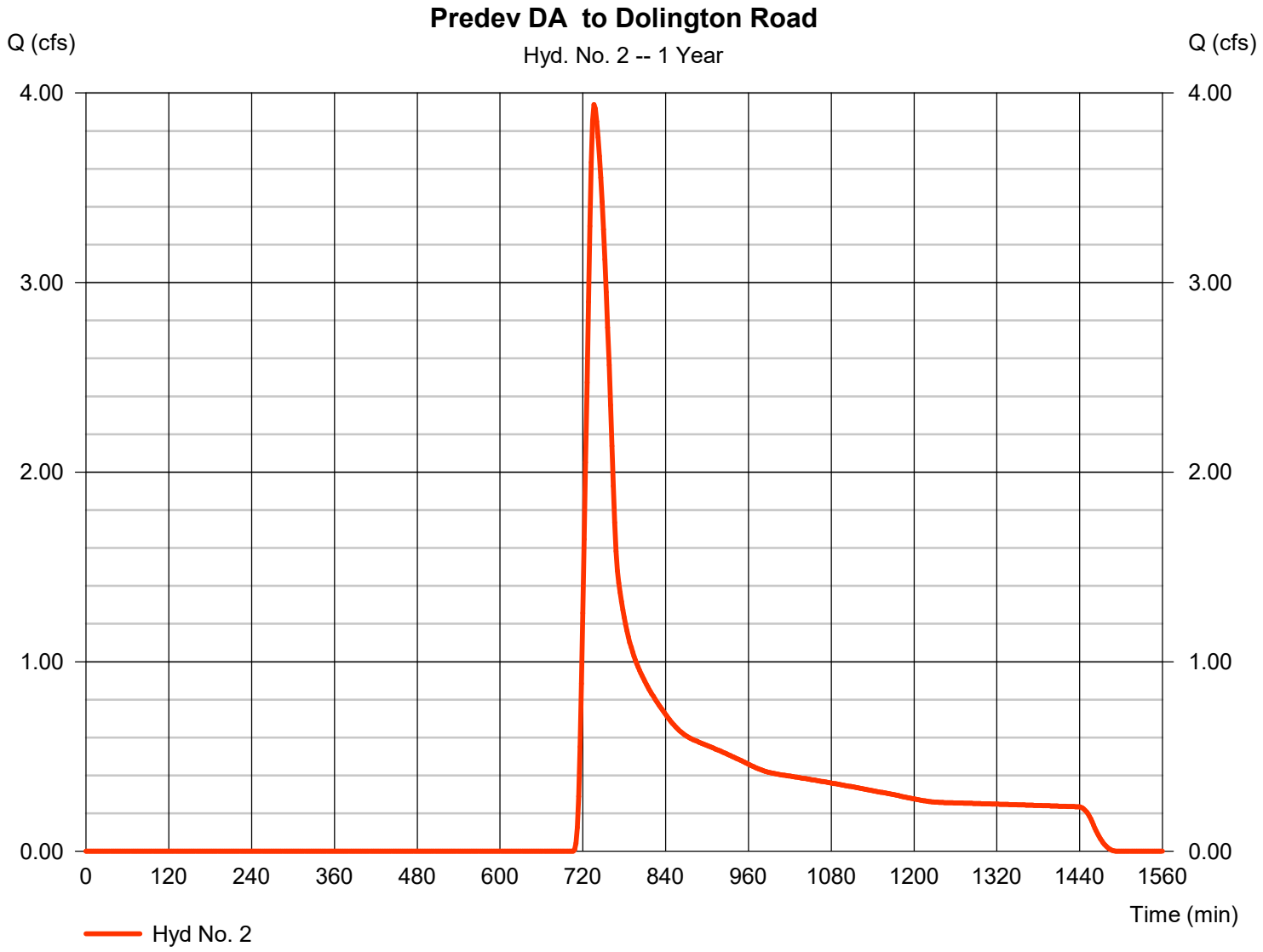
Total Travel Time, Tc ..... 27.10 min

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

Hyd. No. 2

Predev DA to Dolington Road

Description	A		B		C		Totals
Sheet Flow							
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		
Travel Time (min)	**= 16.09**	**+**	**0.00**	**+**	**0.00**	**=**	**16.09**
Shallow Concentrated Flow							
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		
Travel Time (min)	**= 12.23**	**+**	**2.89**	**+**	**0.00**	**=**	**15.12**
Channel Flow							
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

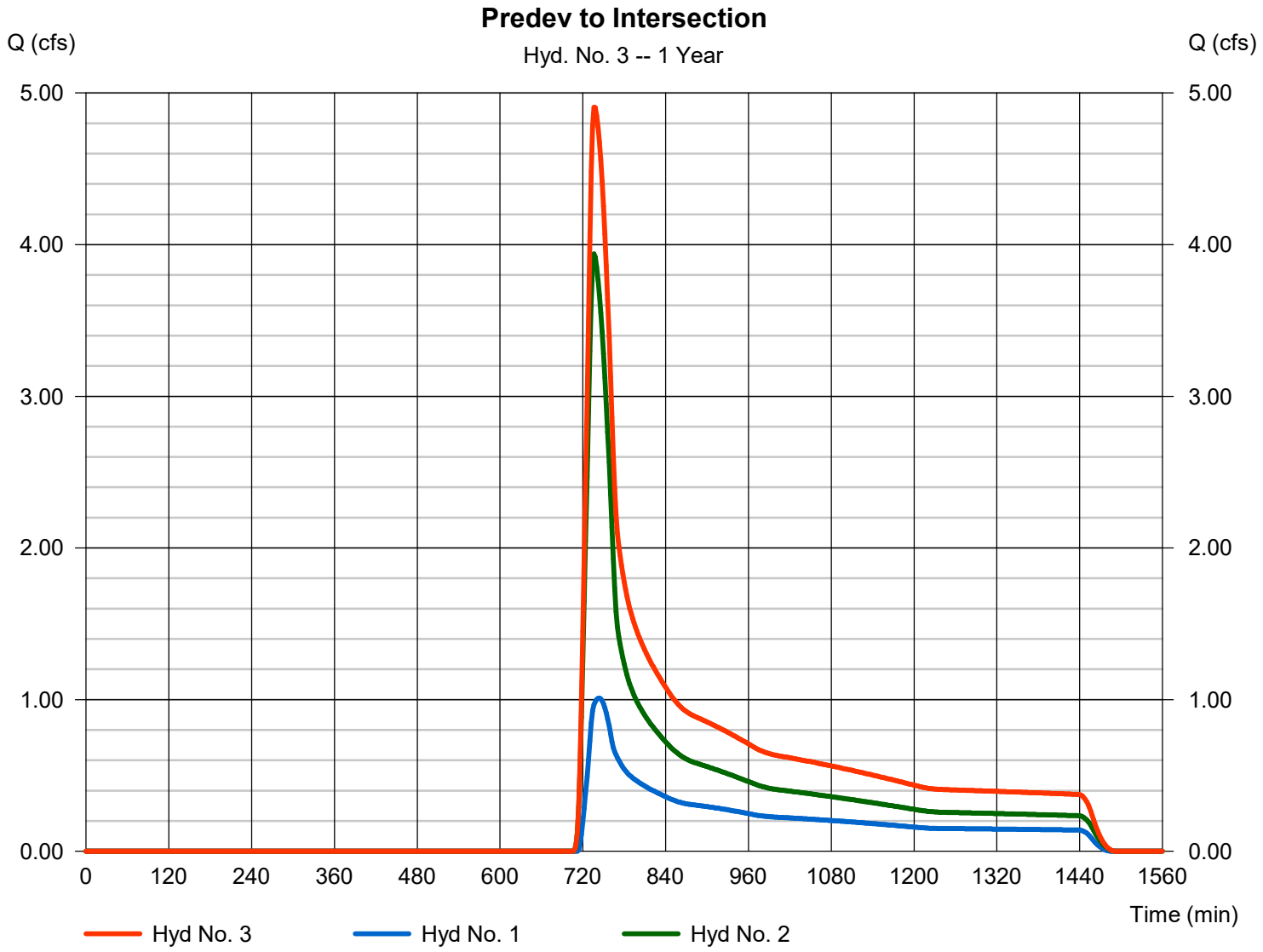
Total Travel Time, Tc ..... 31.20 min

Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 4.906 cfs
Storm frequency	= 1 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 37,807 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

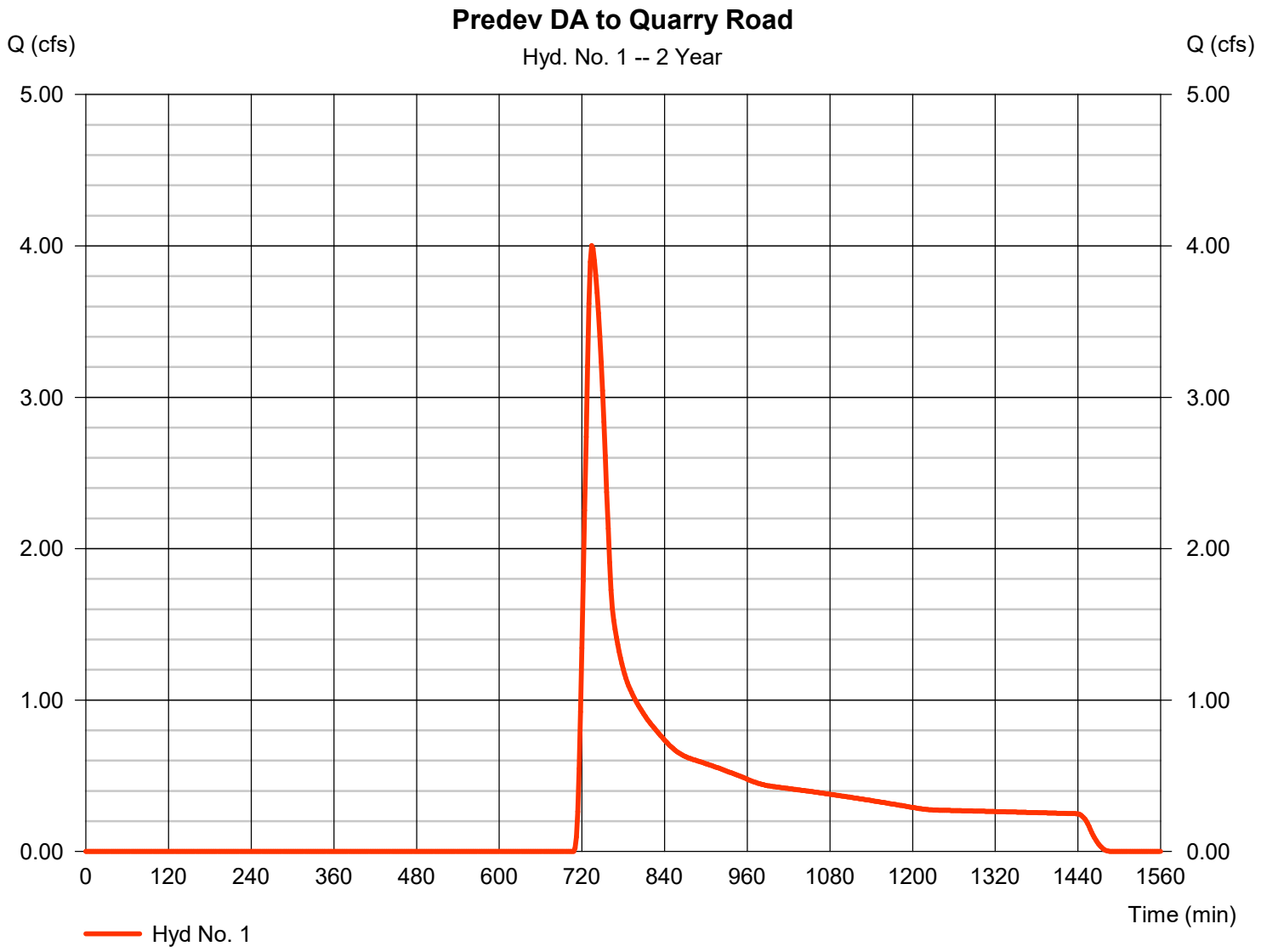
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.002	2	734	26,520	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	9.282	2	736	49,595	------	------	------	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

Hydrograph Report

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

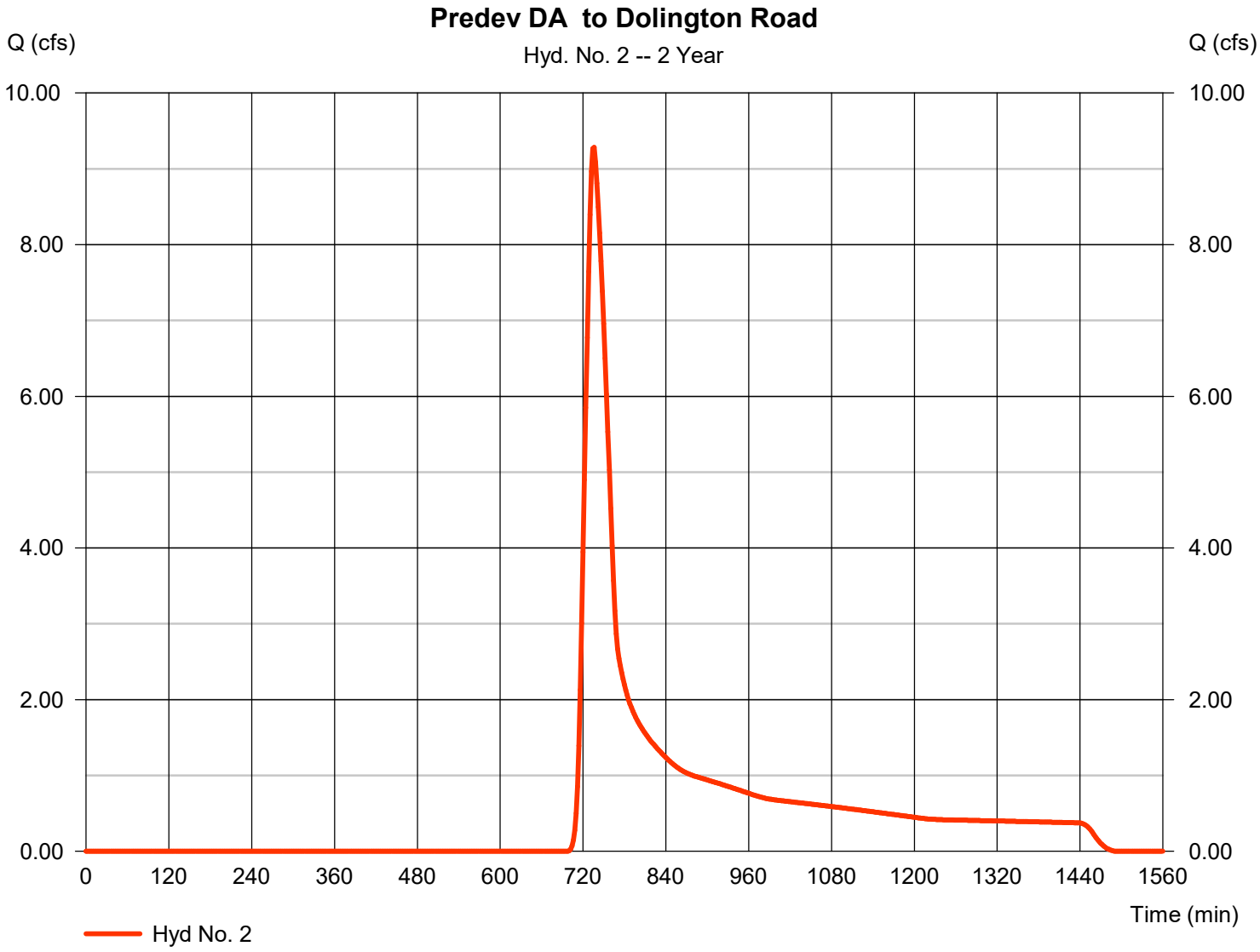


Hydrograph Report

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

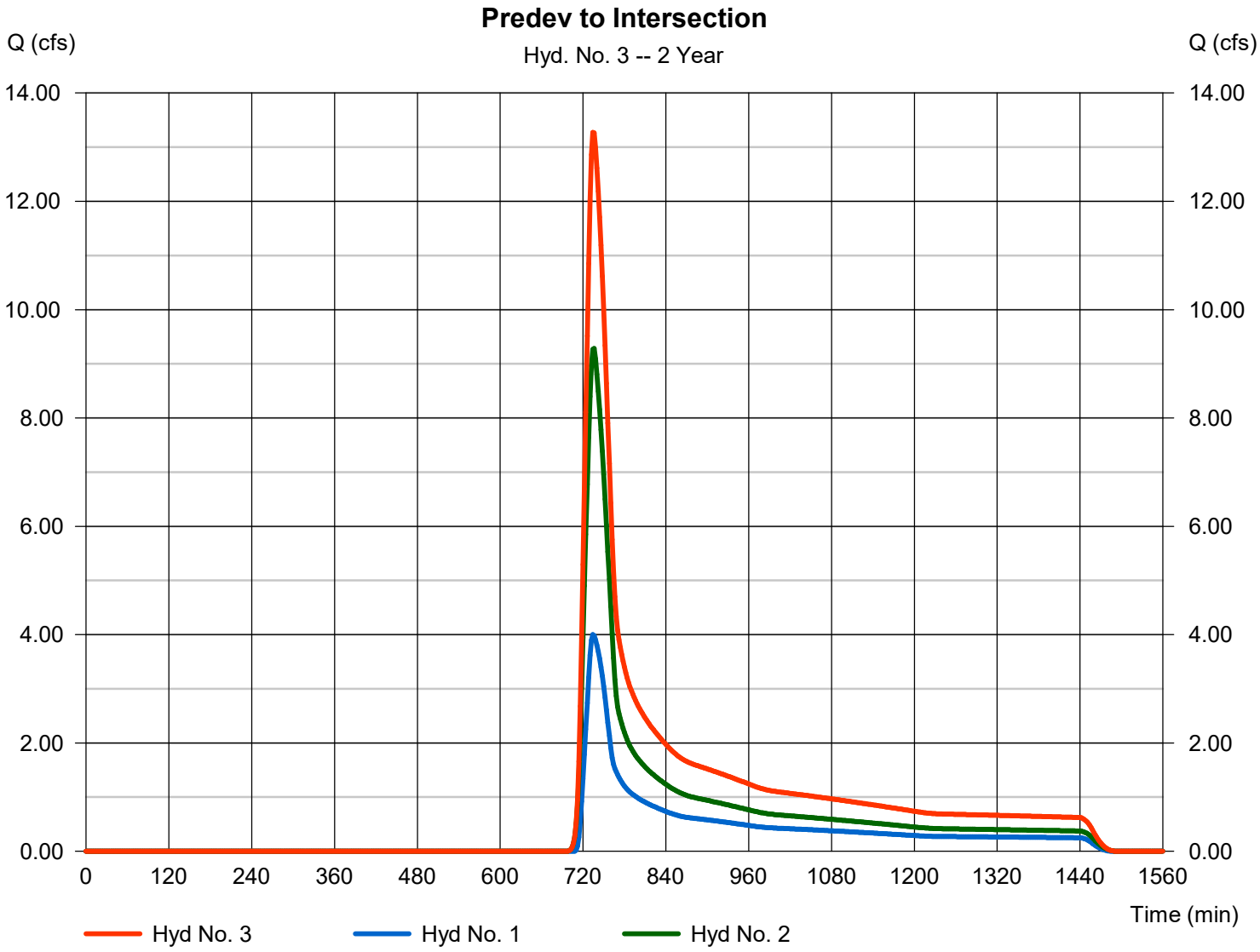


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 13.27 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 76,115 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

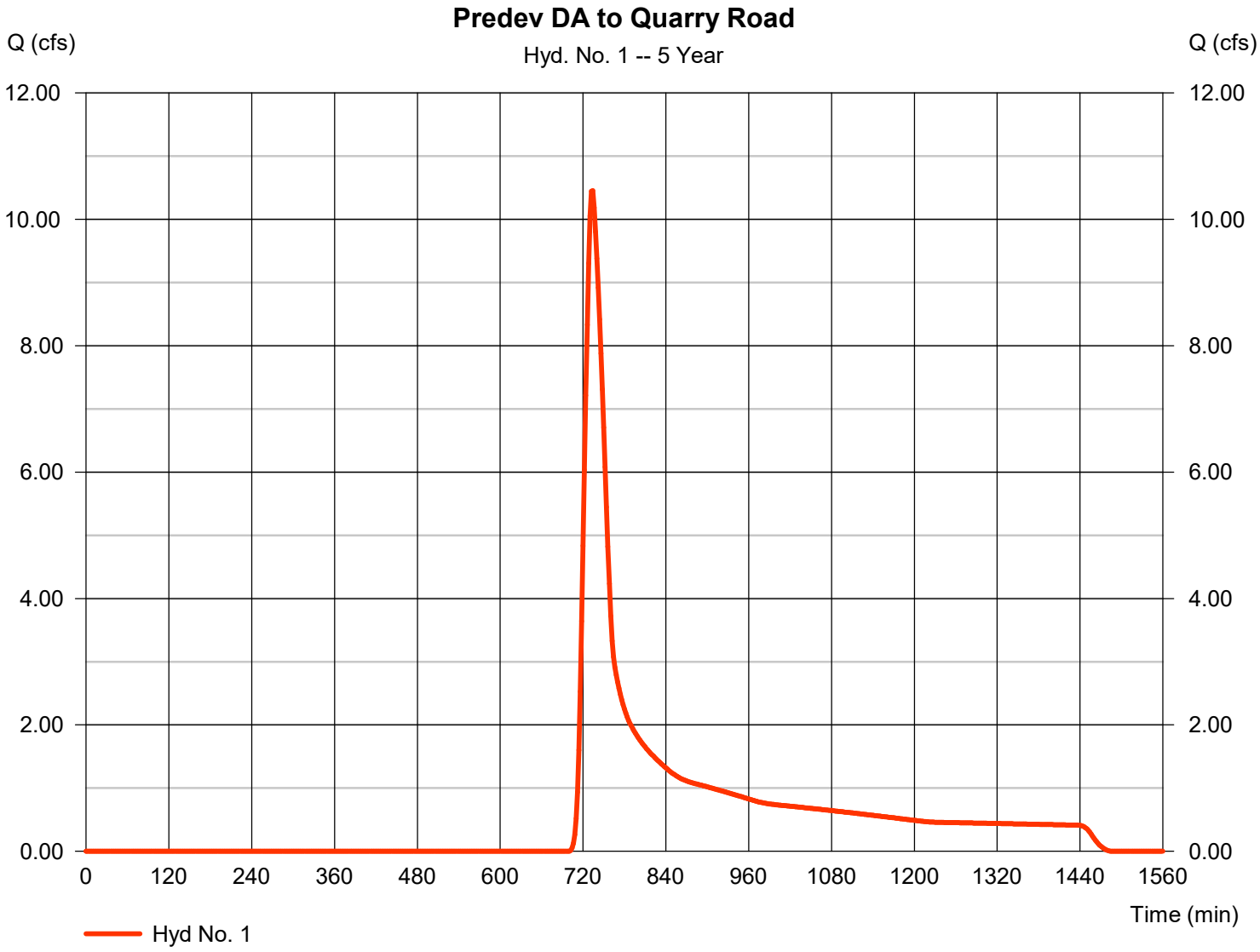
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.45	2	734	52,999	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	18.50	2	734	87,644	------	------	------	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

Hydrograph Report

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

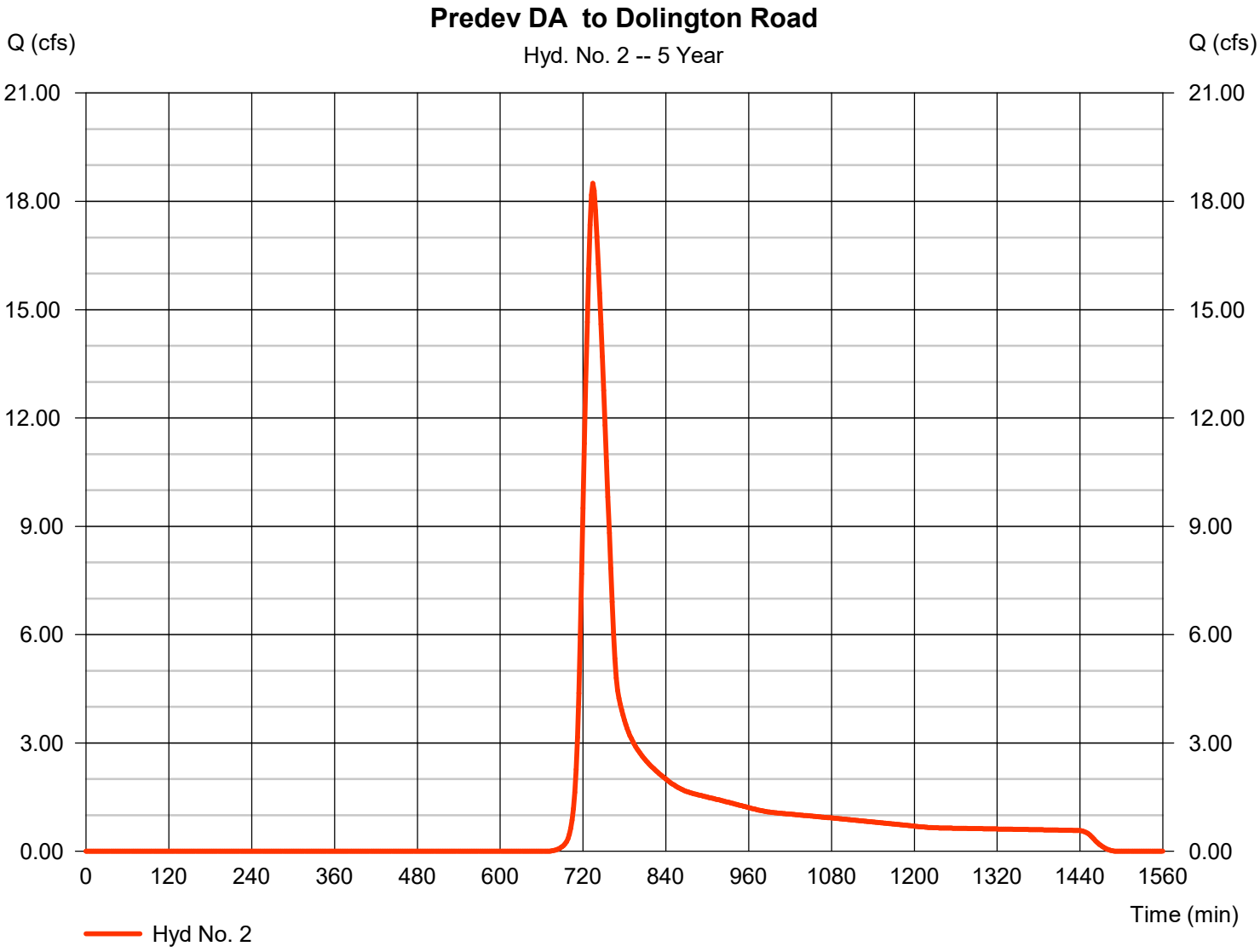


Hydrograph Report

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

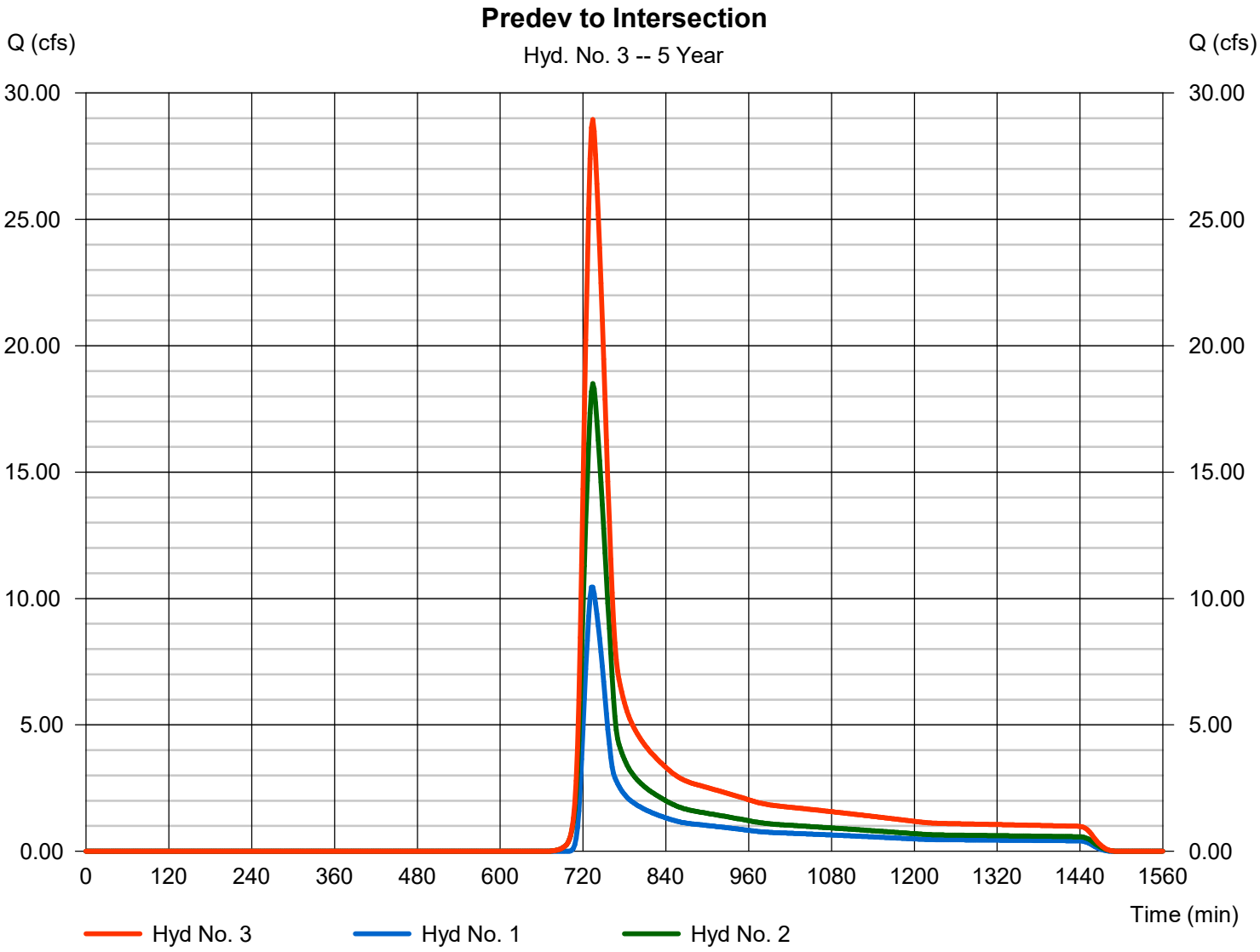


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 28.95 cfs
Storm frequency	= 5 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 140,643 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

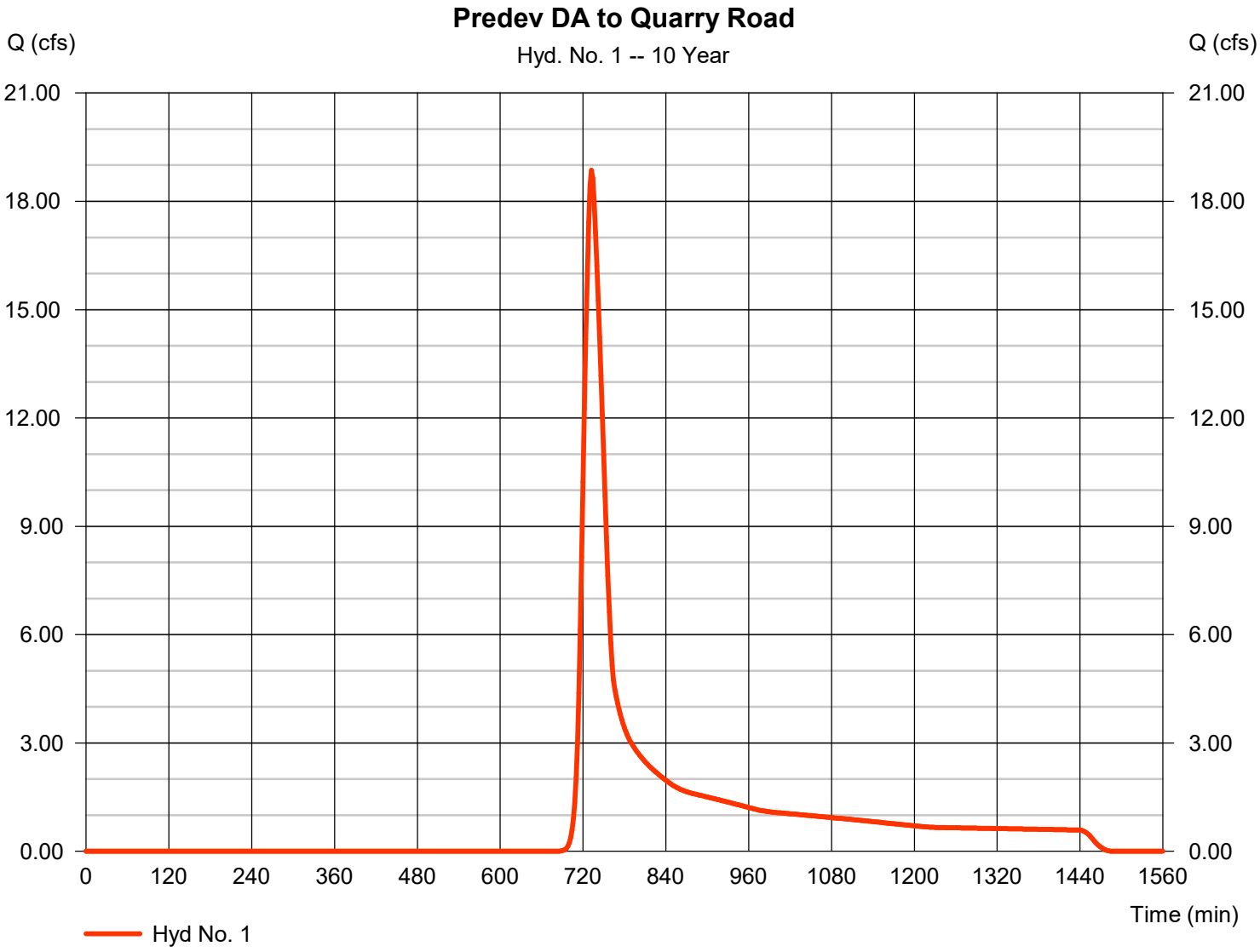
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	18.86	2	732	85,143	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	29.05	2	734	131,325	------	------	------	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

Hydrograph Report

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

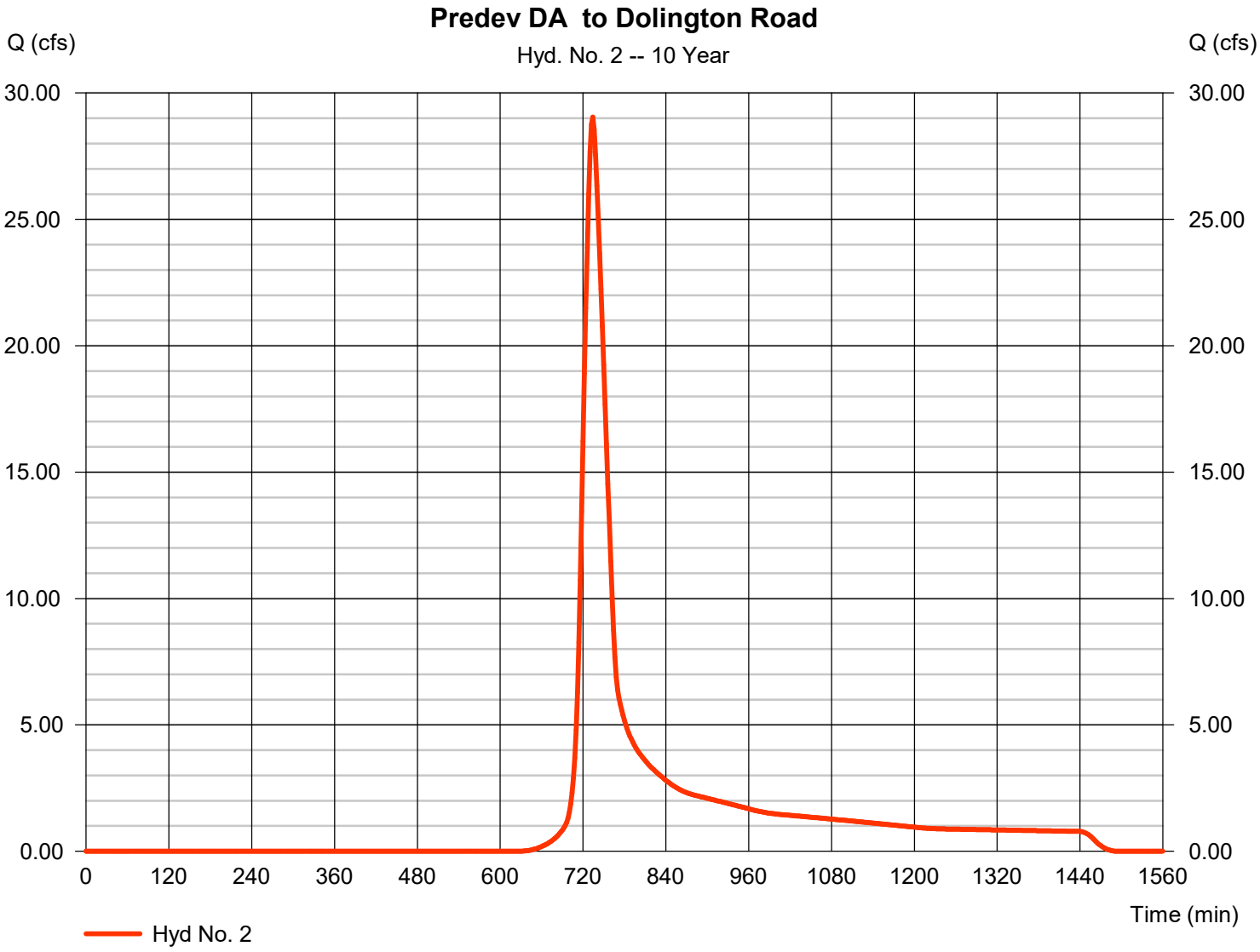


Hydrograph Report

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

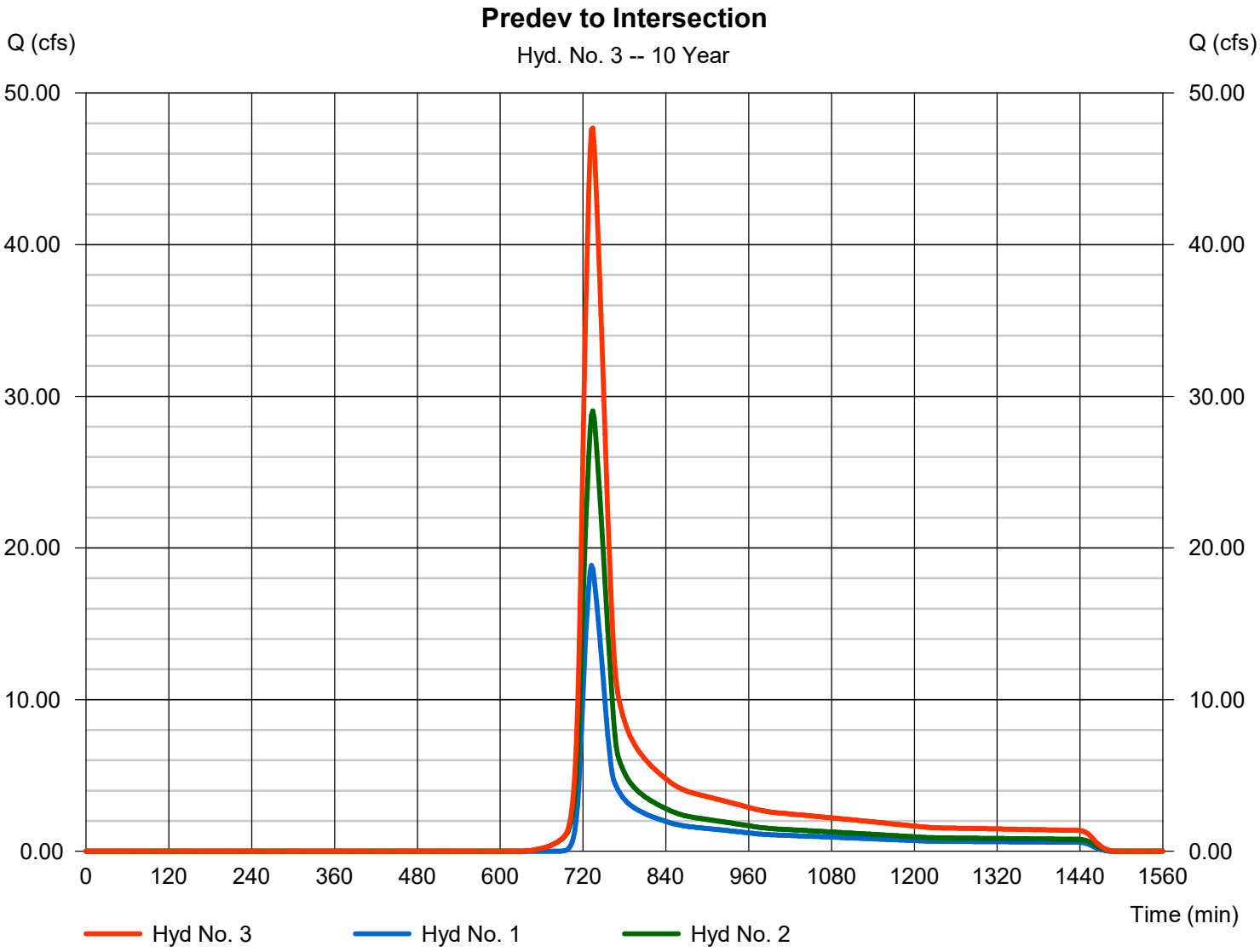


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 47.69 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 216,468 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

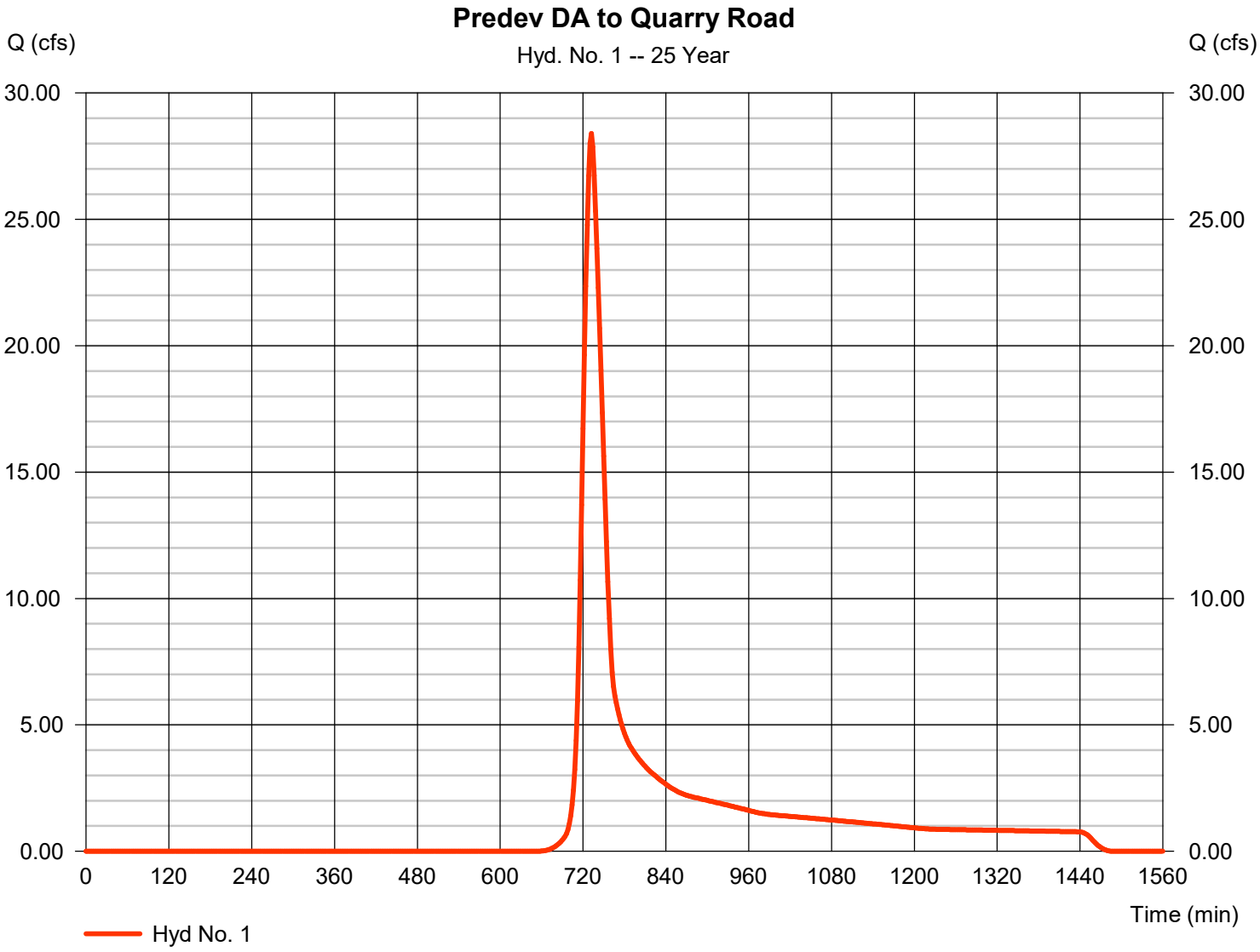
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.40	2	732	121,583	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	40.49	2	734	179,073	------	------	------	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

Hydrograph Report

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

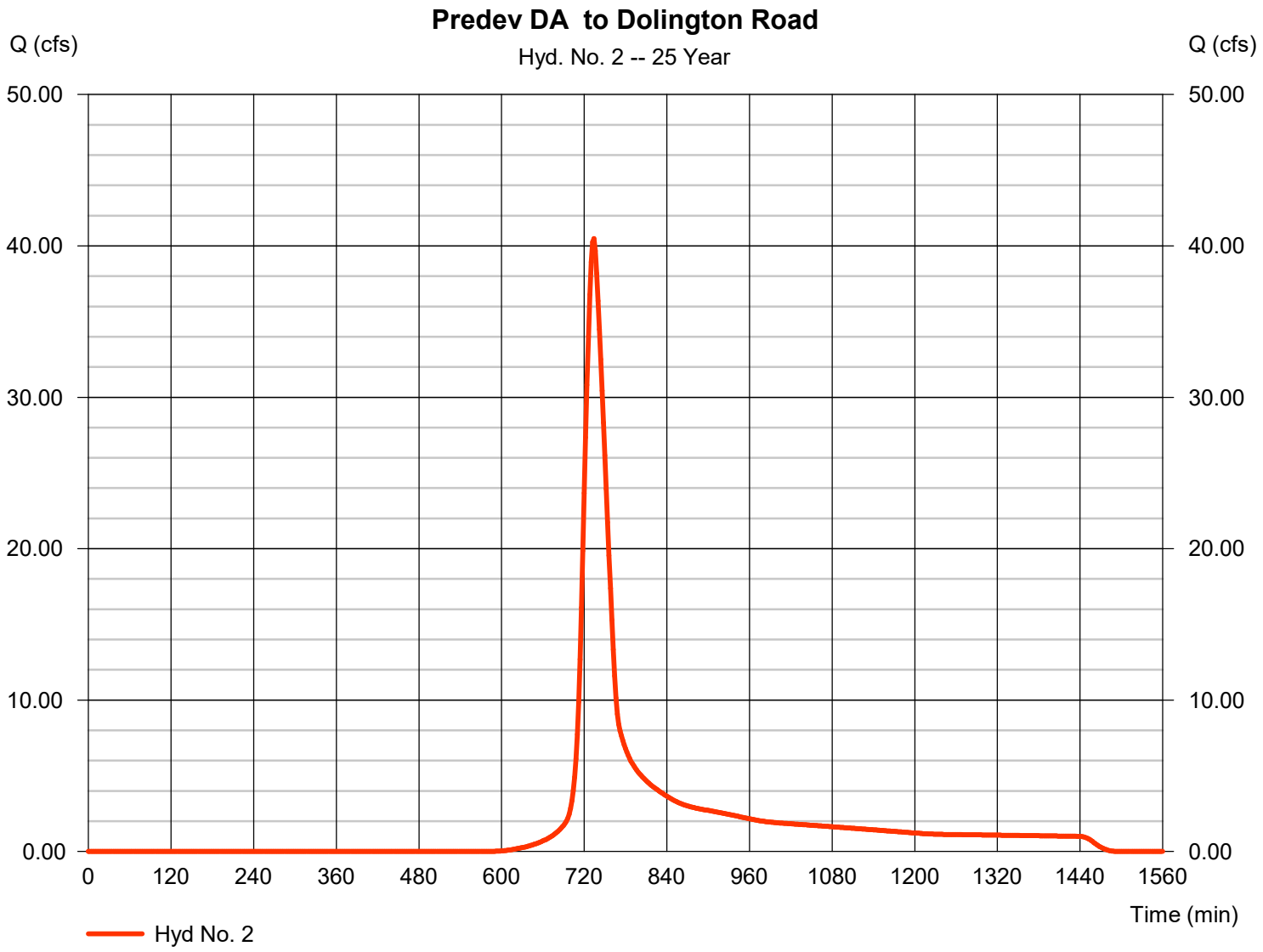


Hydrograph Report

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

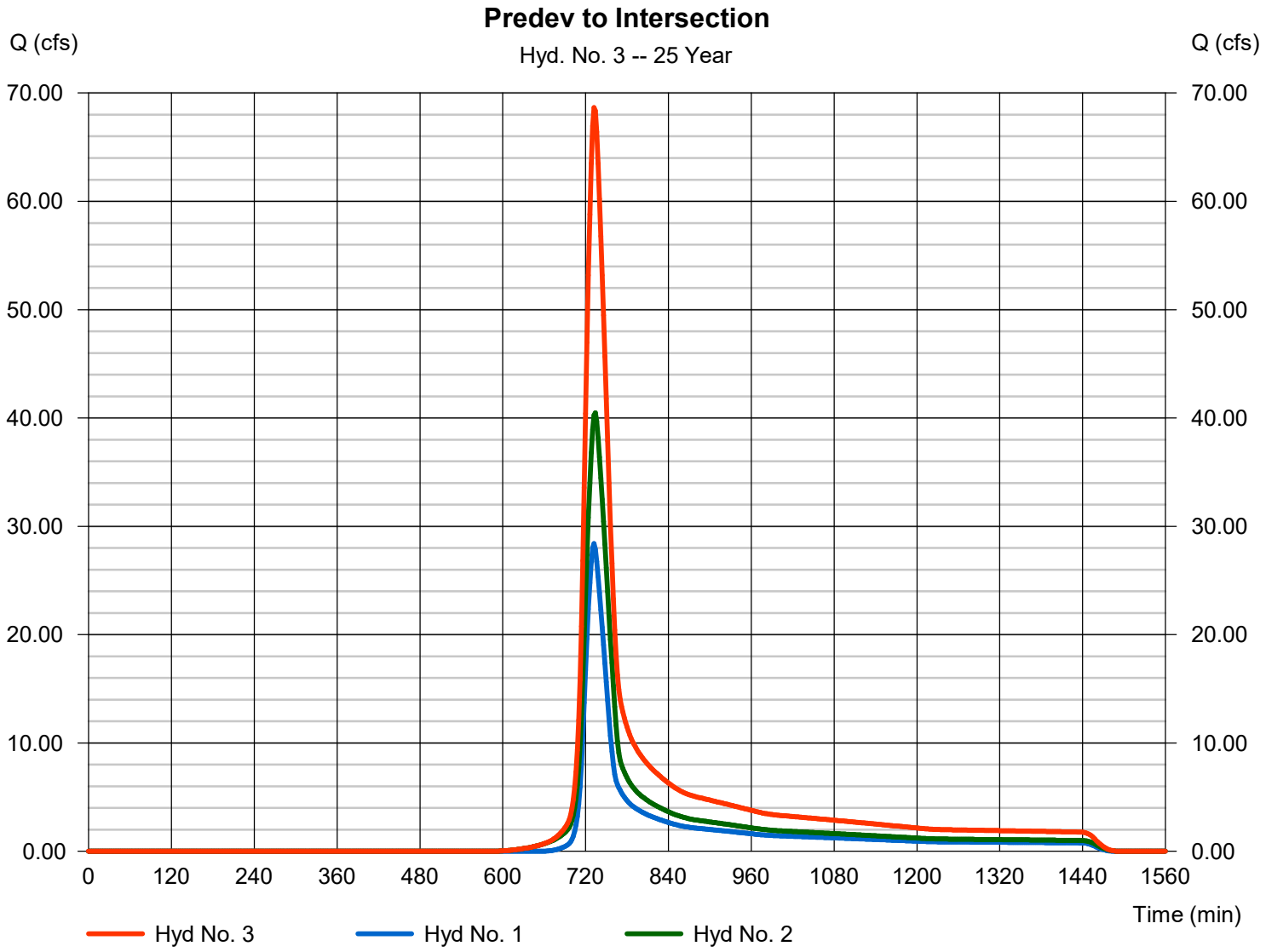


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 68.65 cfs
Storm frequency	= 25 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 300,655 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

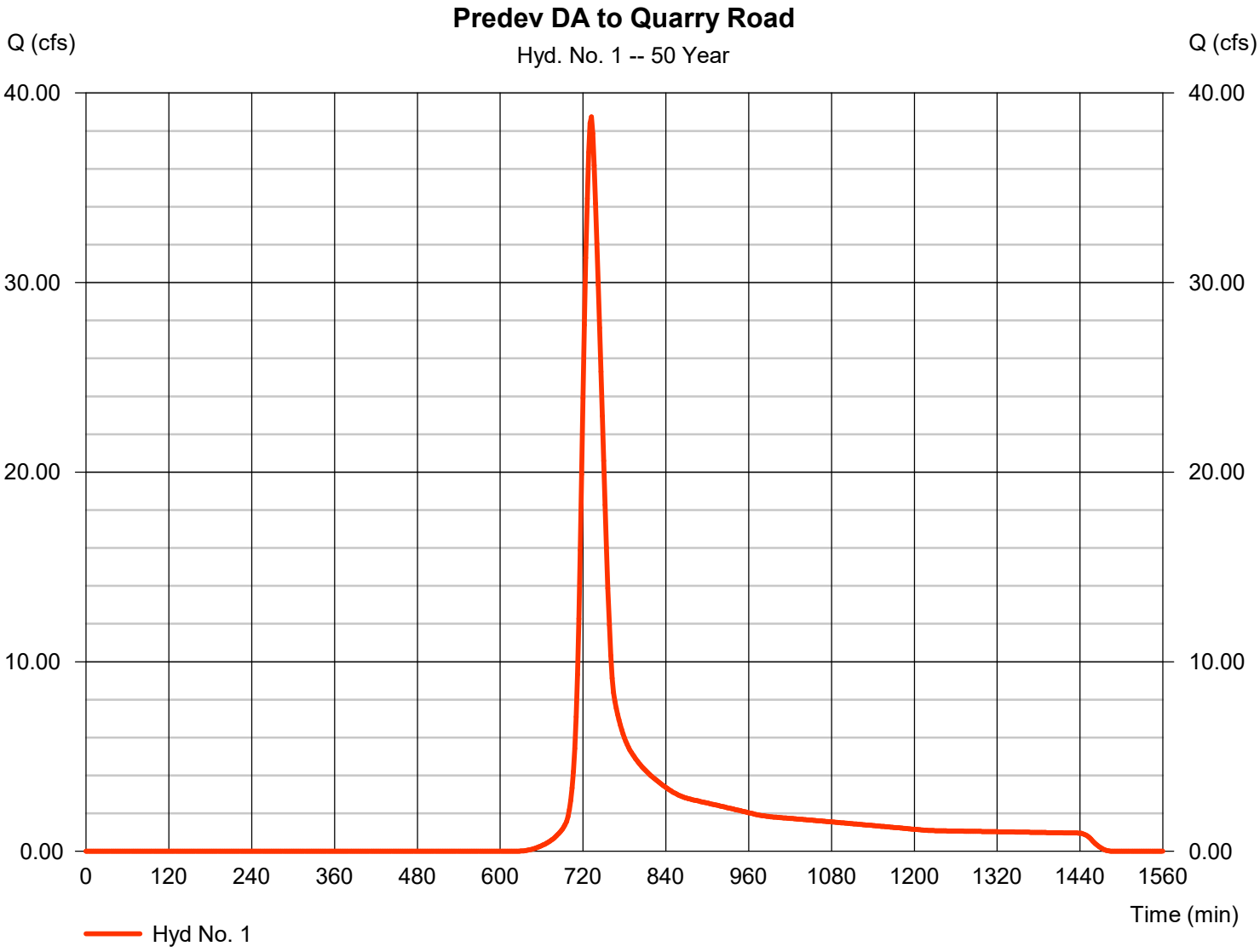
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	38.74	2	732	161,349	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	52.56	2	734	229,853	------	------	------	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

Hydrograph Report

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

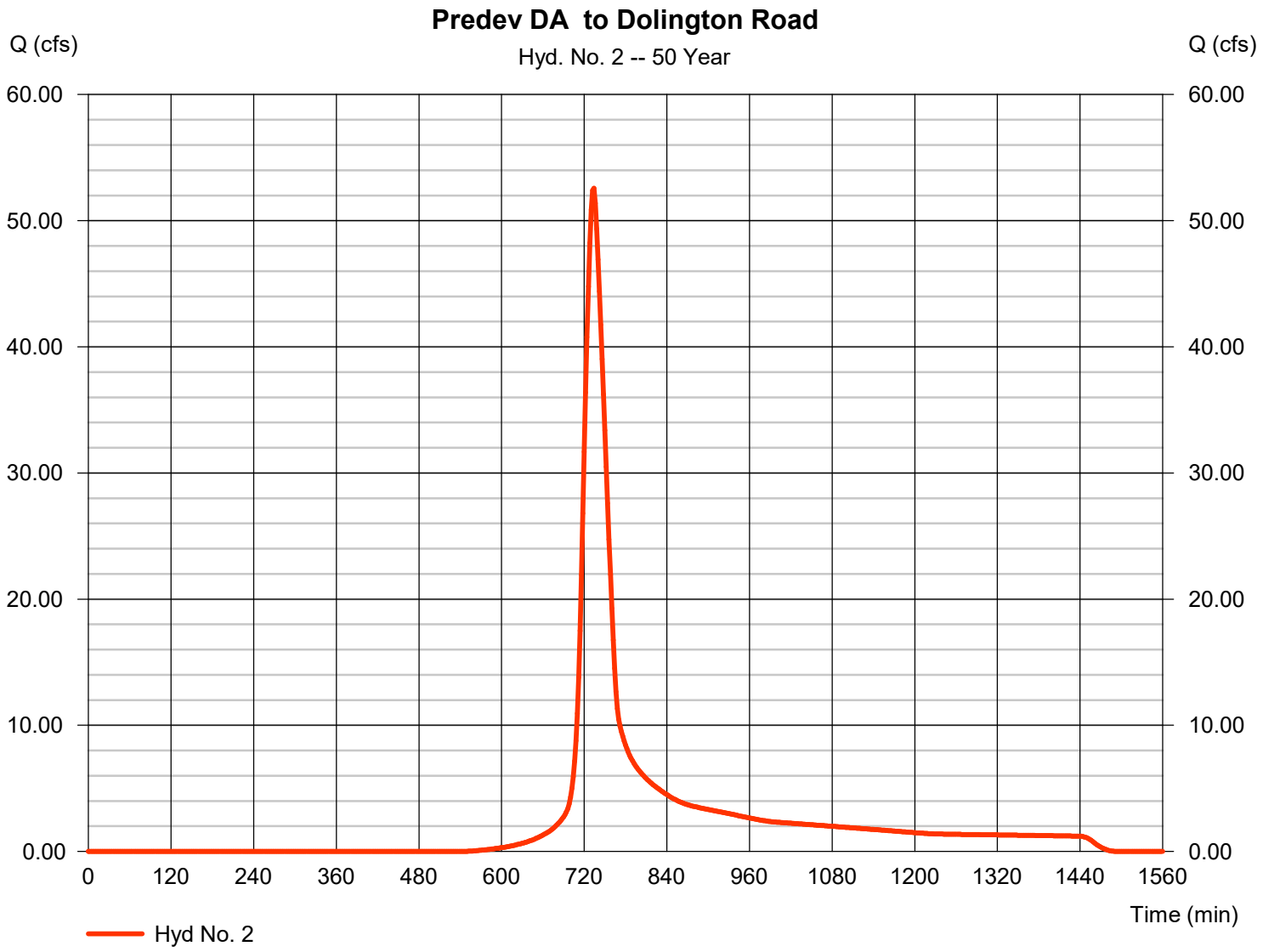


Hydrograph Report

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

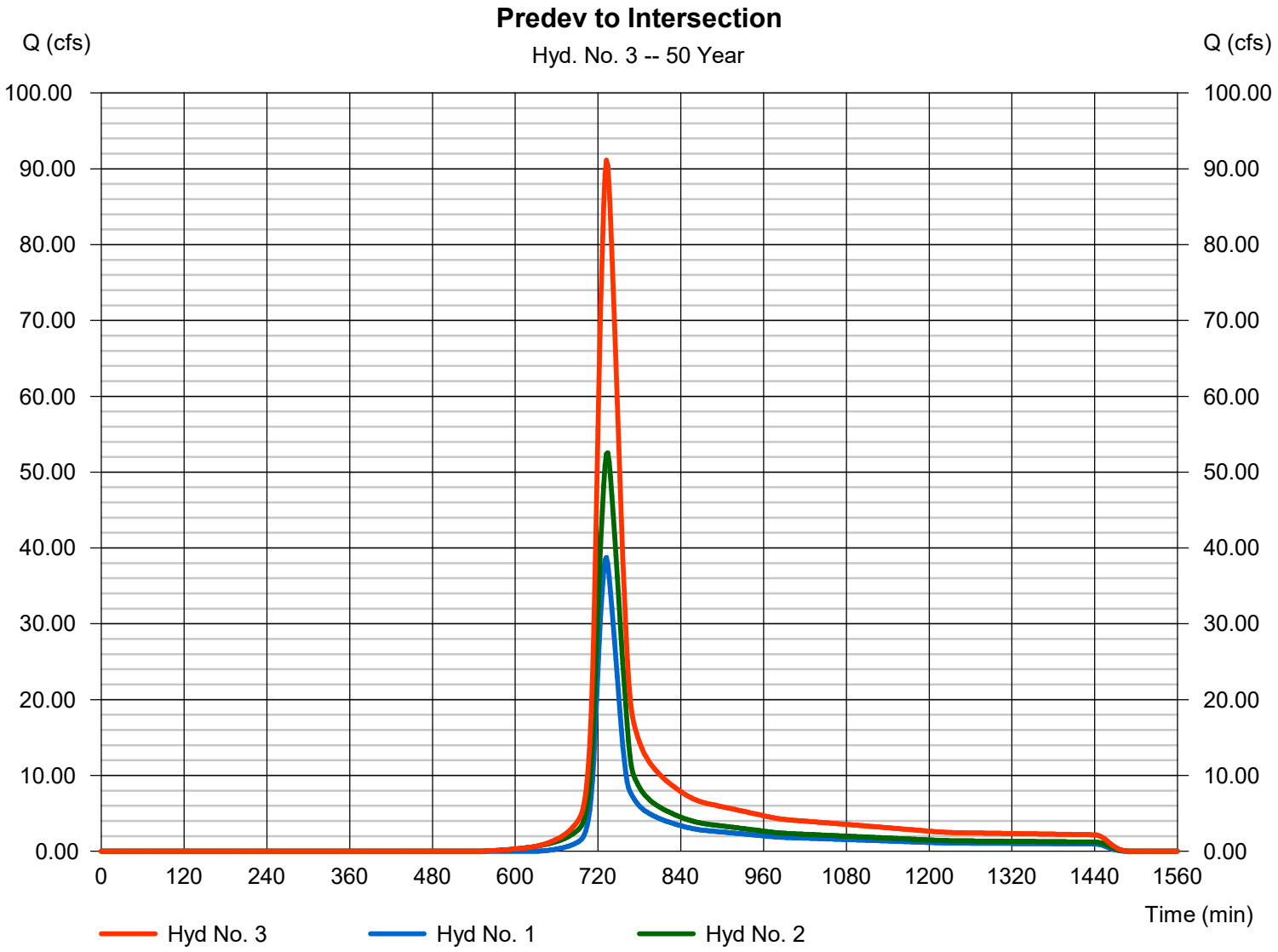


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 91.14 cfs
Storm frequency	= 50 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 391,201 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydrograph Summary Report

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

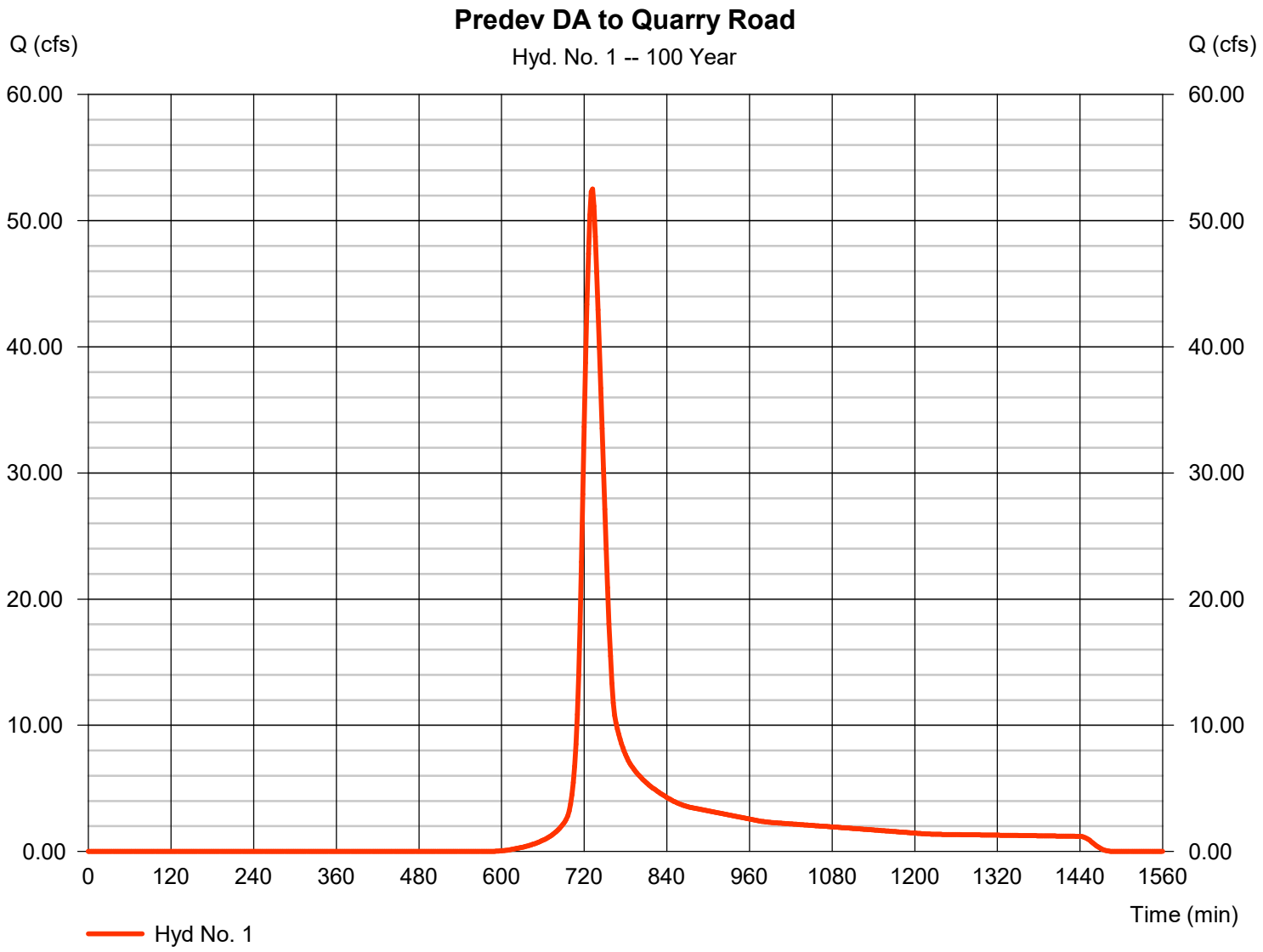
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	52.51	2	732	214,688	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	68.27	2	734	296,529	------	------	------	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

Hydrograph Report

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

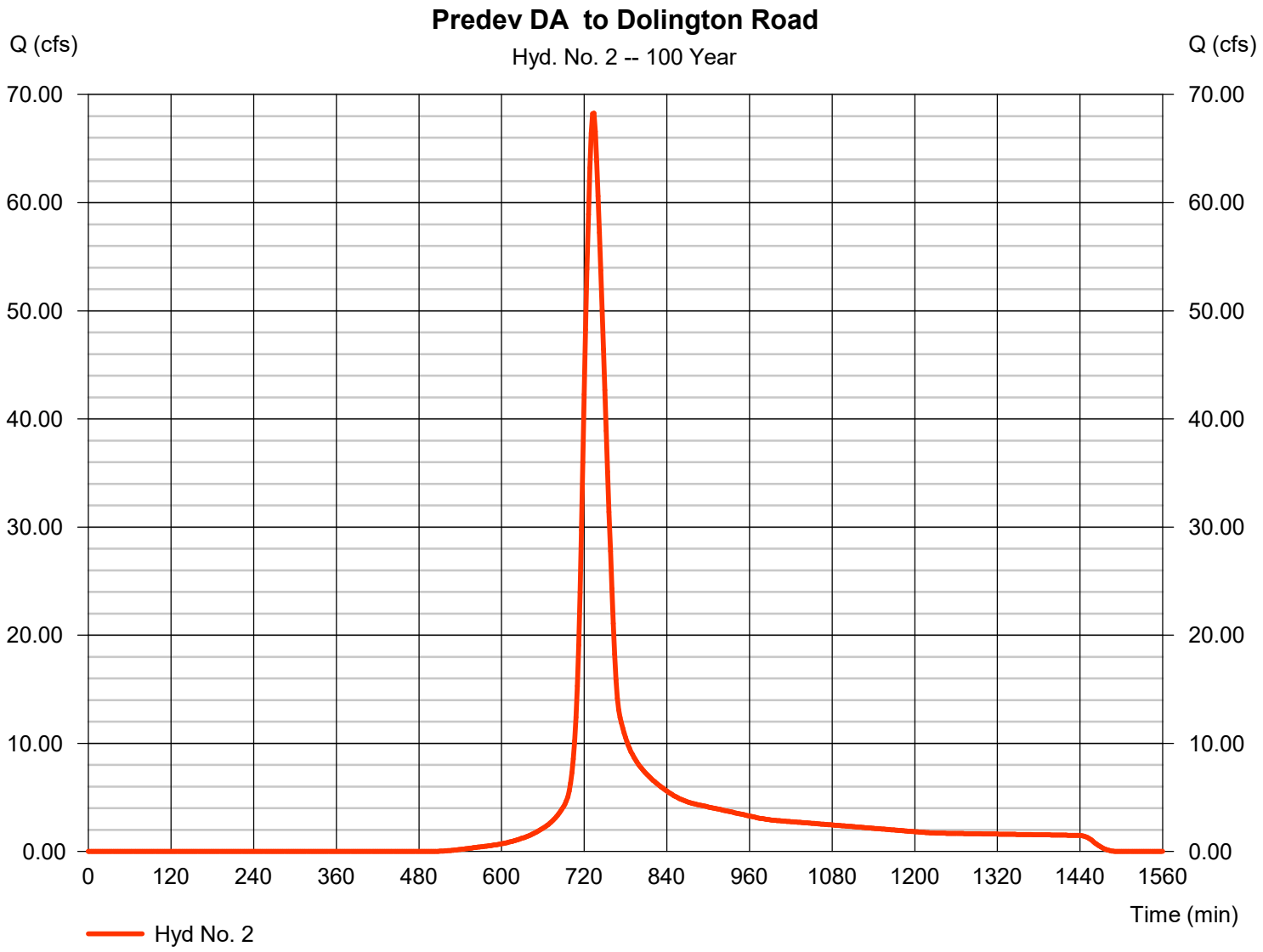


Hydrograph Report

Hyd. No. 2

Predev DA to Dolington Road

Hydrograph type	= SCS Runoff	Peak discharge	= 68.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 296,529 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.	= 8.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

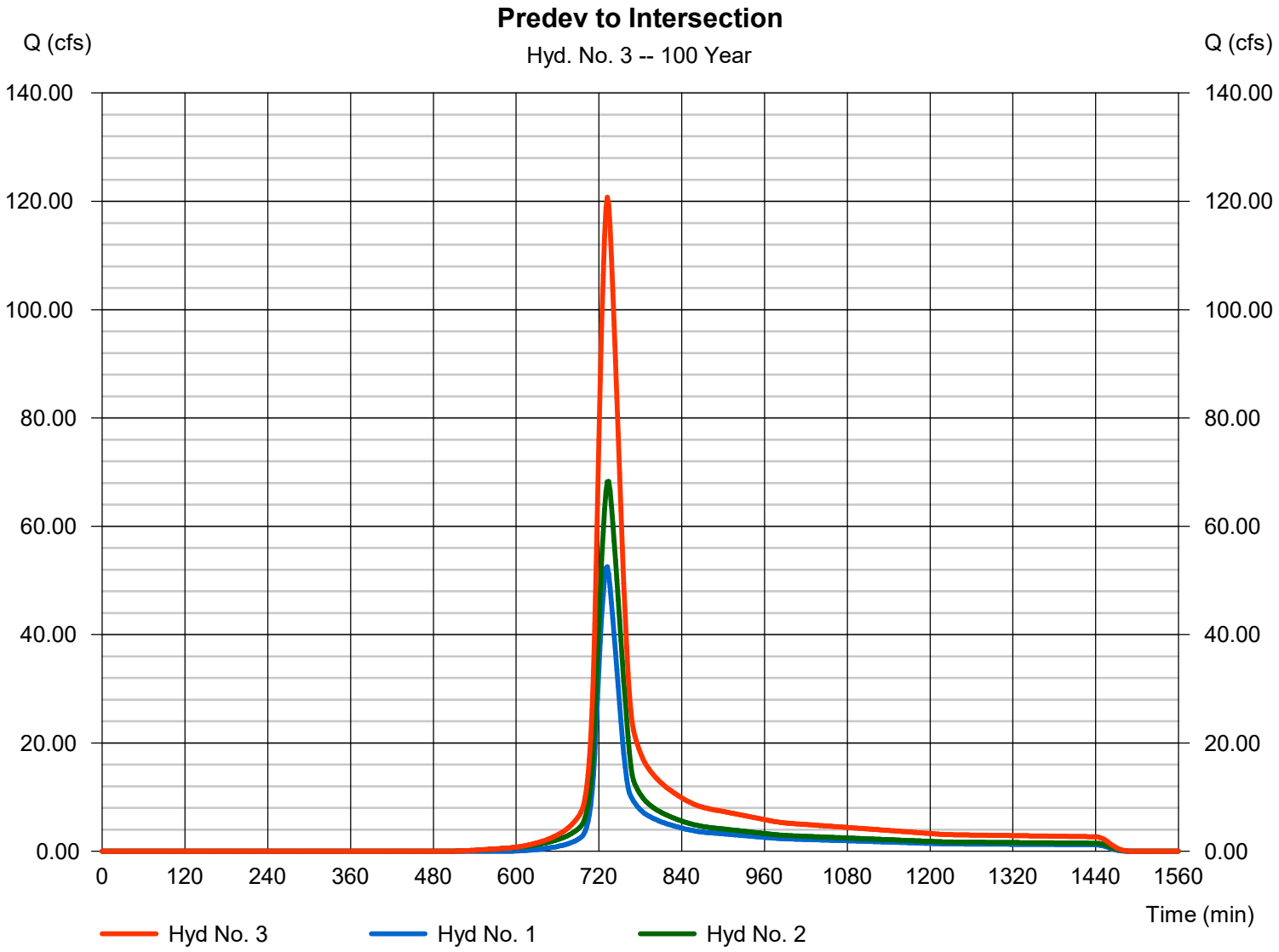


Hydrograph Report

Hyd. No. 3

Predev to Intersection

Hydrograph type	= Combine	Peak discharge	= 120.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 511,218 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 35.400 ac



Hydraflow Table of Contents

Basin design.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Friday, 07 / 14 / 2017

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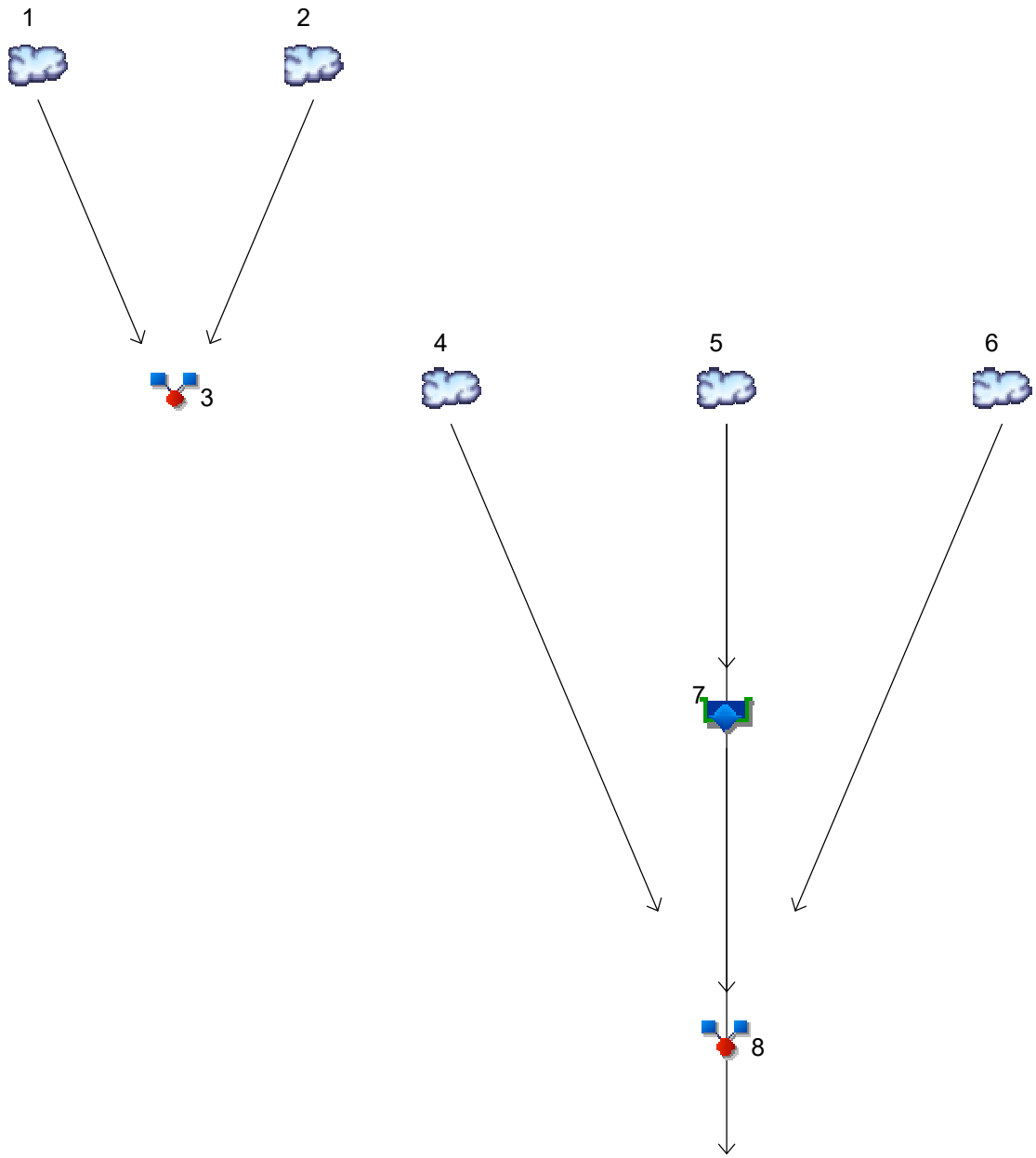
APPENDIX C:

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

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

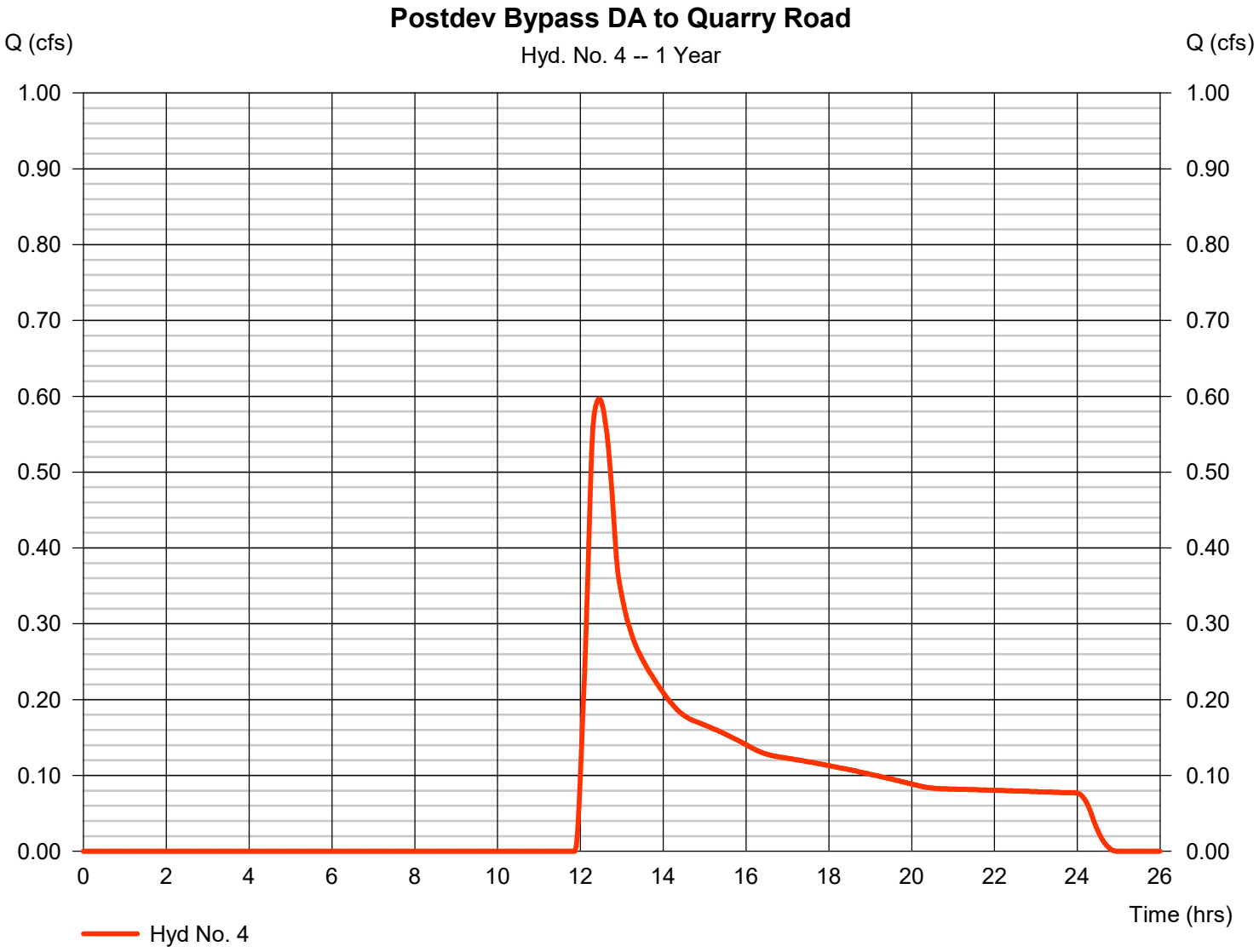
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.010	2	744	11,616	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	3.939	2	736	26,190	------	------	------	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

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



TR55 Tc Worksheet

Hyd. No. 4

Postdev Bypass DA to Quarry Road

Description	A		B		C		Totals
Sheet Flow							
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		
Travel Time (min)	**= 25.82**	**+**	**0.00**	**+**	**0.00**	**=**	**25.82**
Shallow Concentrated Flow							
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		
Travel Time (min)	**= 3.16**	**+**	**6.81**	**+**	**0.00**	**=**	**9.97**
Channel Flow							
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

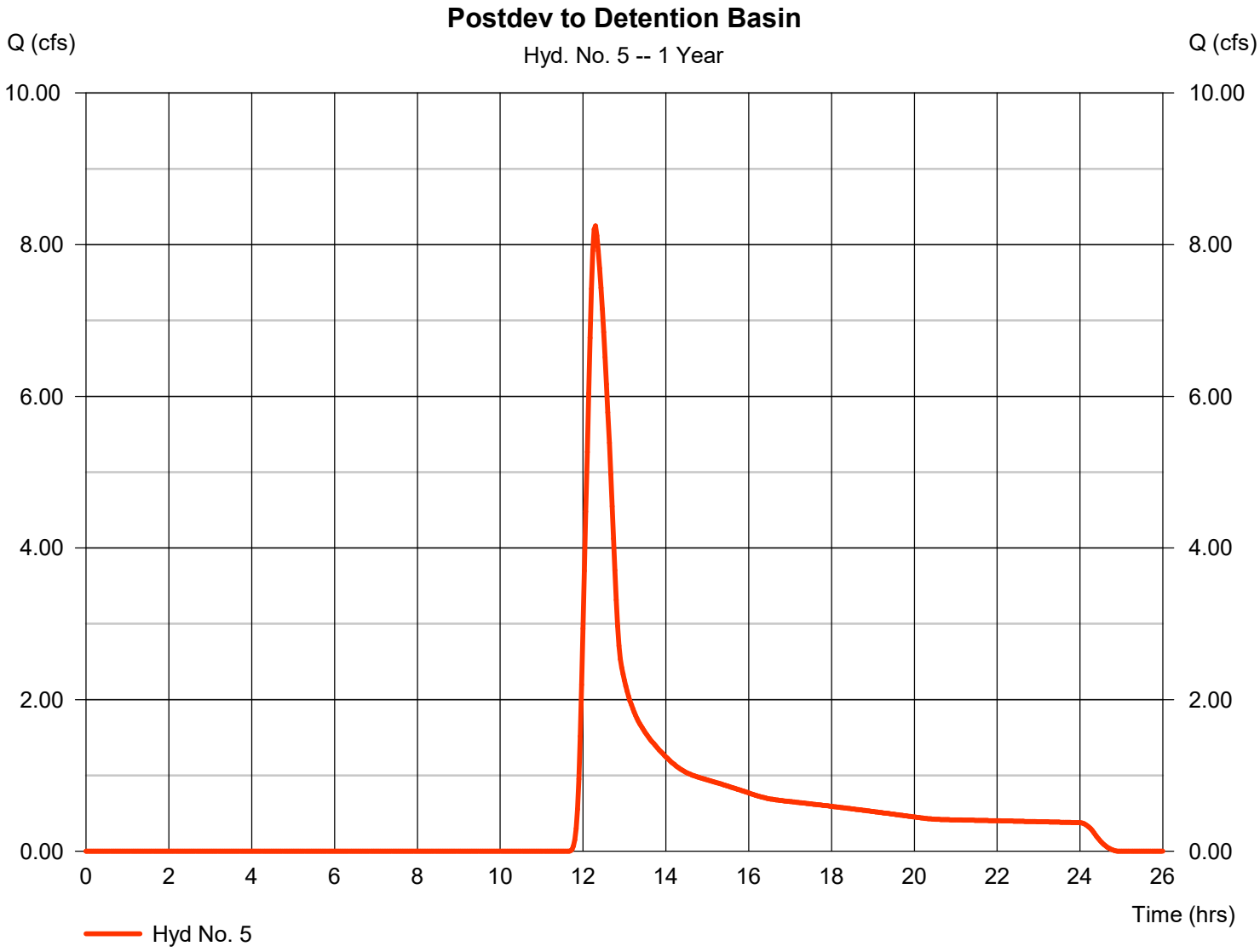
Total Travel Time, Tc ..... 35.80 min

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

Hyd. No. 5

Postdev to Detention Basin

Description	A		B		C		Totals
Sheet Flow							
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		
Travel Time (min)	**= 27.90**	**+**	**0.00**	**+**	**0.00**	**=**	**27.90**
Shallow Concentrated Flow							
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		
Travel Time (min)	**= 5.23**	**+**	**2.65**	**+**	**0.55**	**=**	**8.42**
Channel Flow							
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

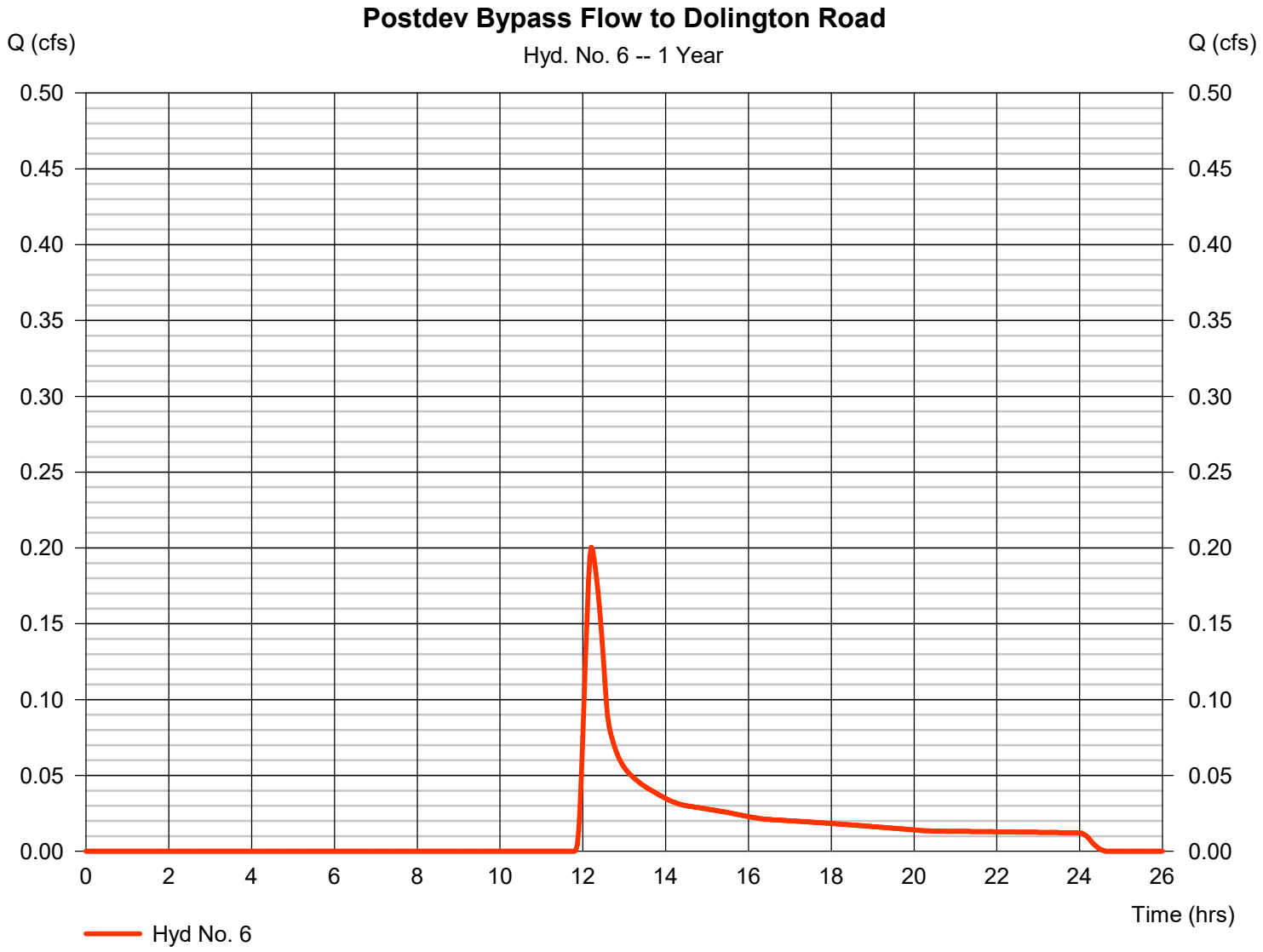
Total Travel Time, Tc ..... 36.30 min

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



TR55 Tc Worksheet

Hyd. No. 6

Postdev Bypass Flow to Dolington Road

Description	A		B		C		Totals
Sheet Flow							
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		
Travel Time (min)	**= 22.91**	**+**	**0.00**	**+**	**0.00**	**=**	**22.91**
Shallow Concentrated Flow							
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		
Travel Time (min)	**= 1.97**	**+**	**0.00**	**+**	**0.00**	**=**	**1.97**
Channel Flow							
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**24.90 min**

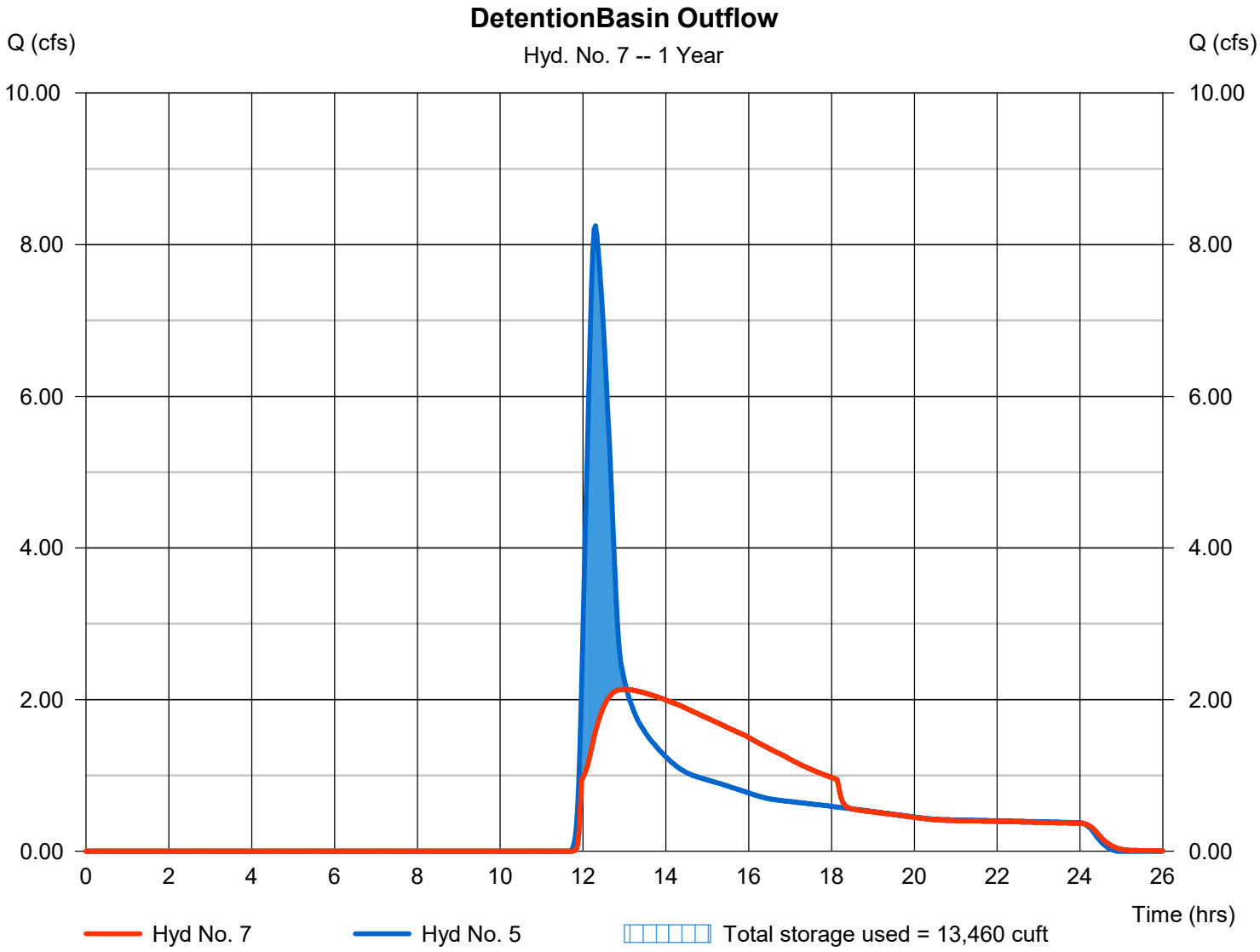
Hydrograph Report

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 Report

Pond No. 1 - Basin No. 1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining 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

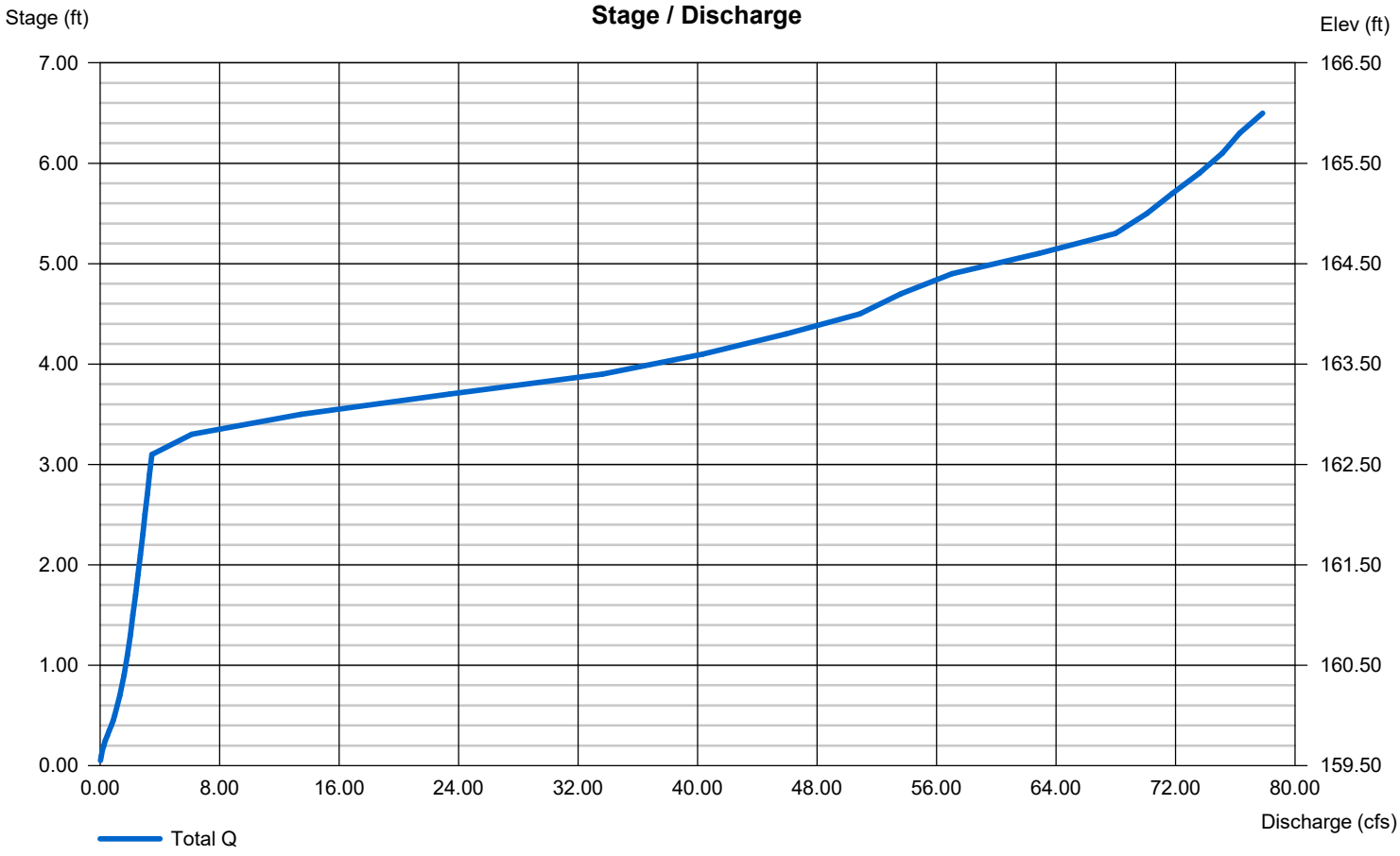
Weir Structures

	[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).

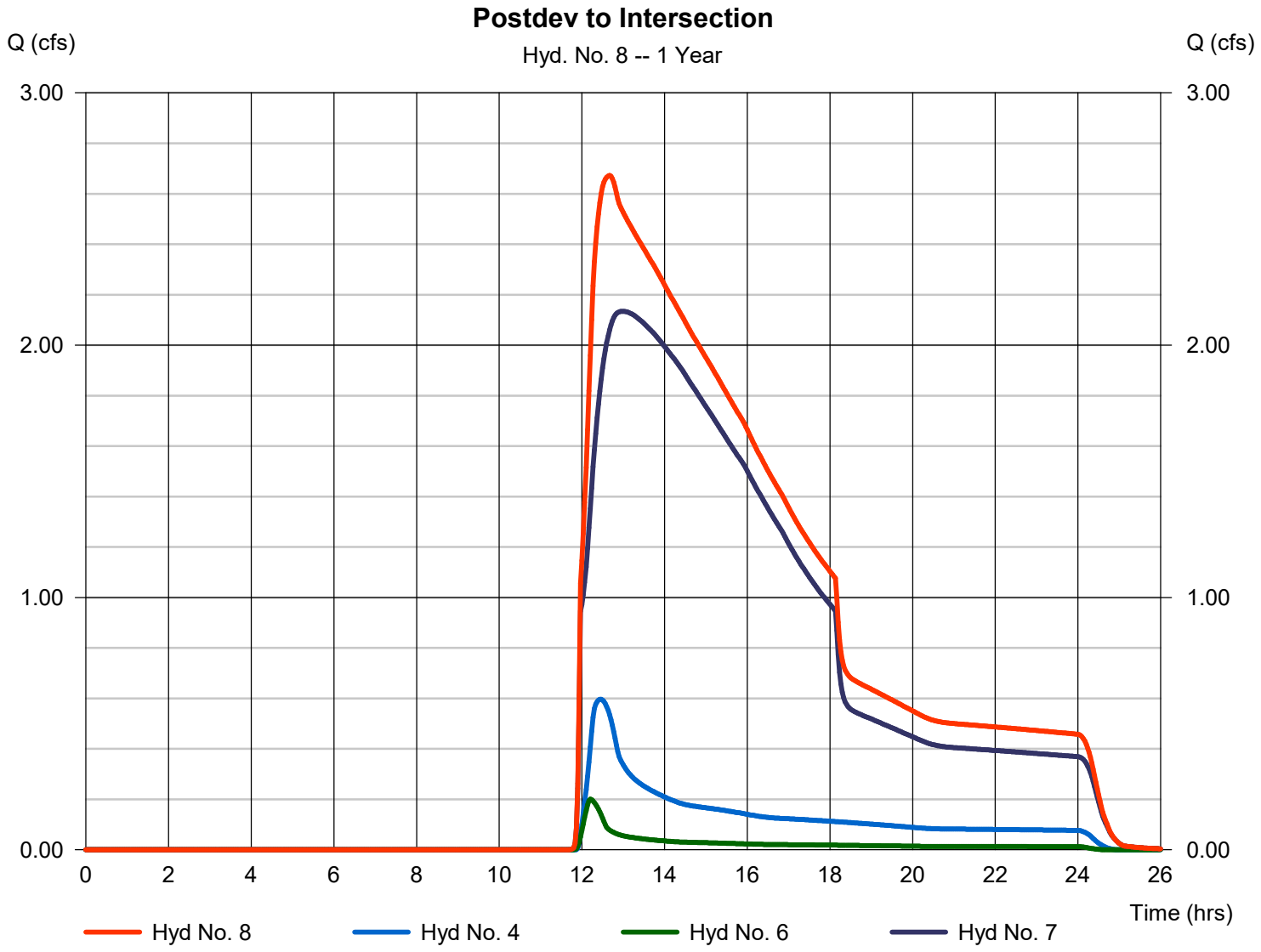


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 2.673 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.67 hrs
Time interval	= 2 min	Hyd. volume	= 53,967 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

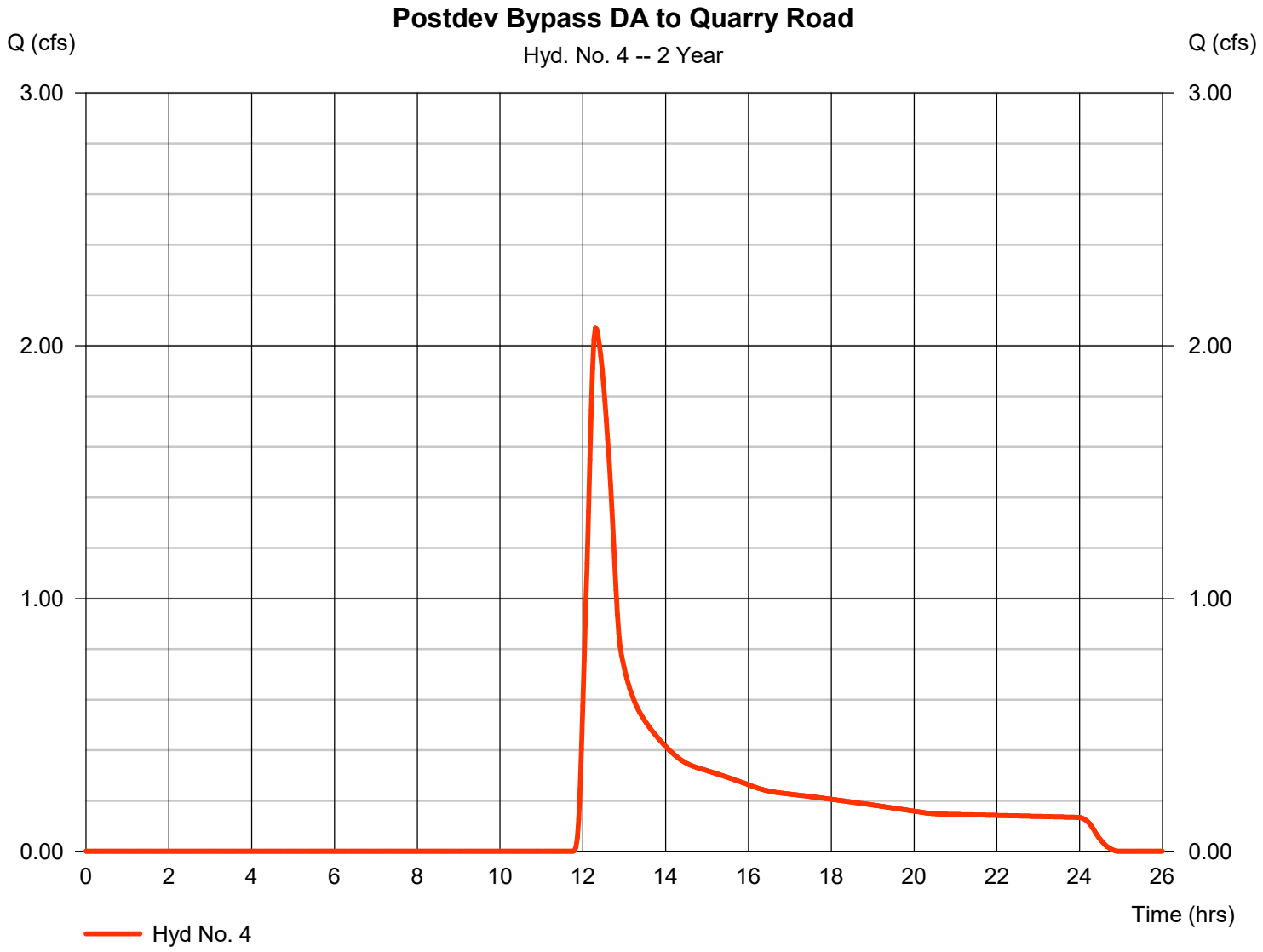
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.002	2	734	26,520	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	9.282	2	736	49,595	------	------	------	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

Hydrograph Report

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

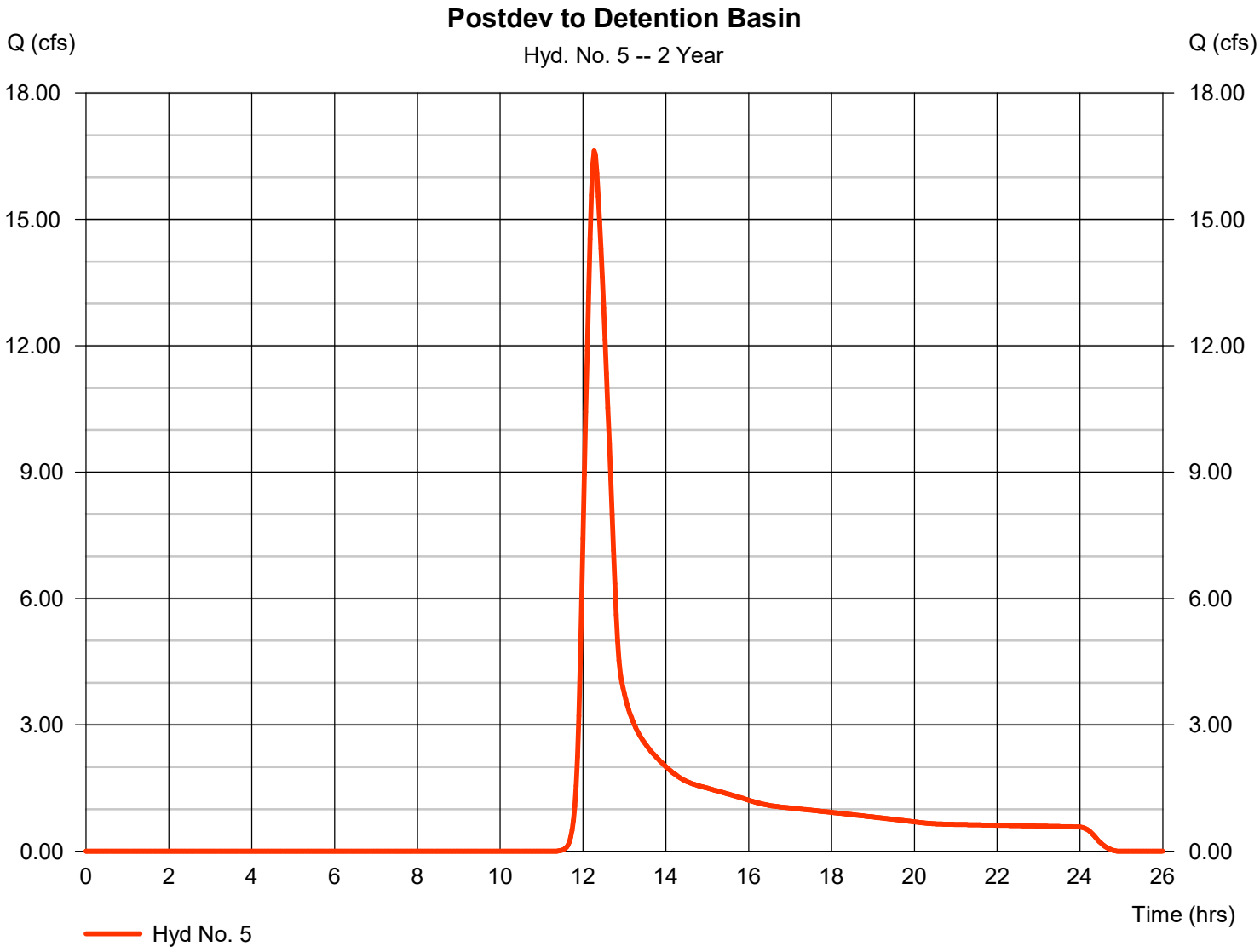


Hydrograph Report

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

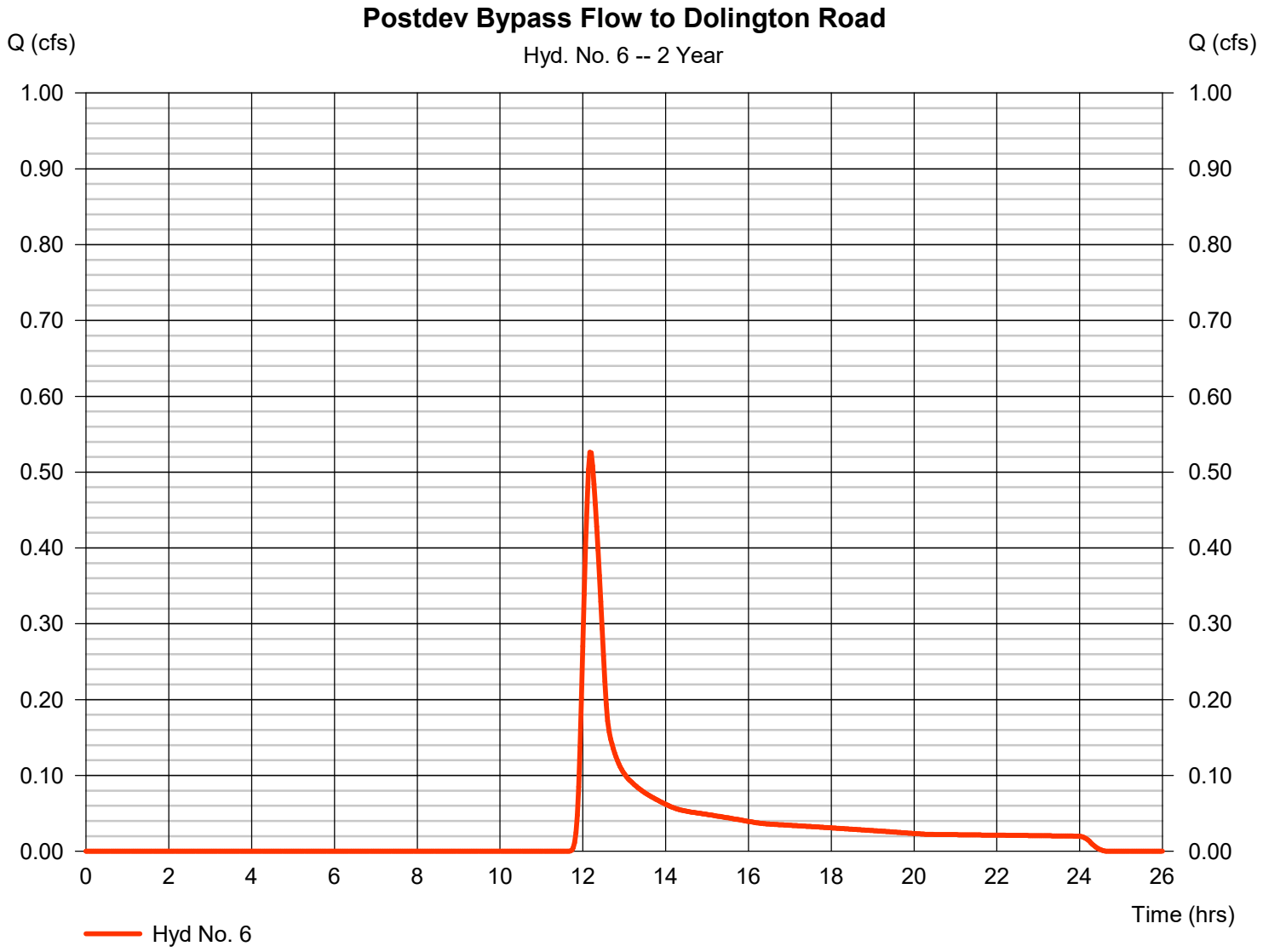


Hydrograph Report

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



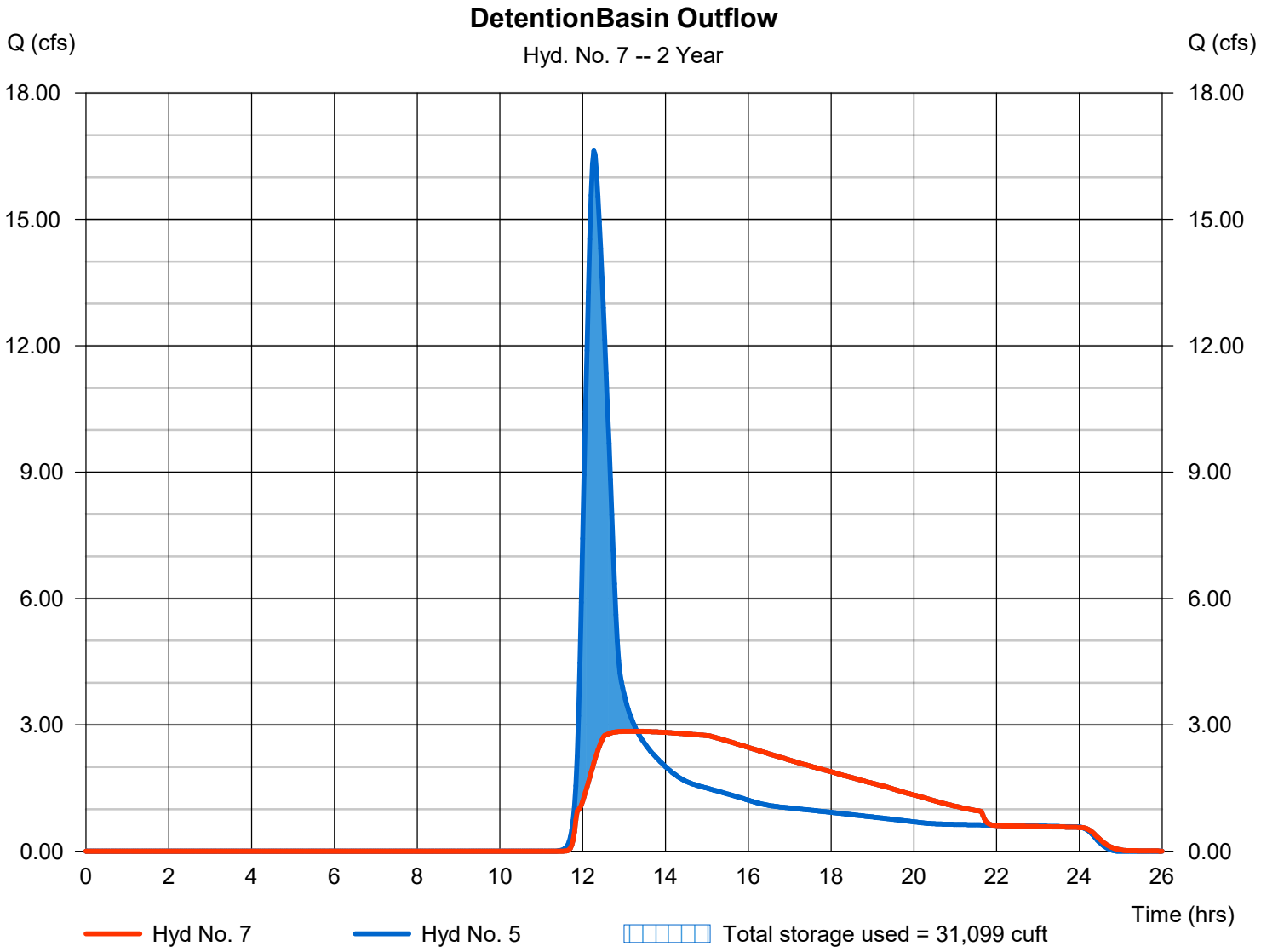
Hydrograph Report

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.

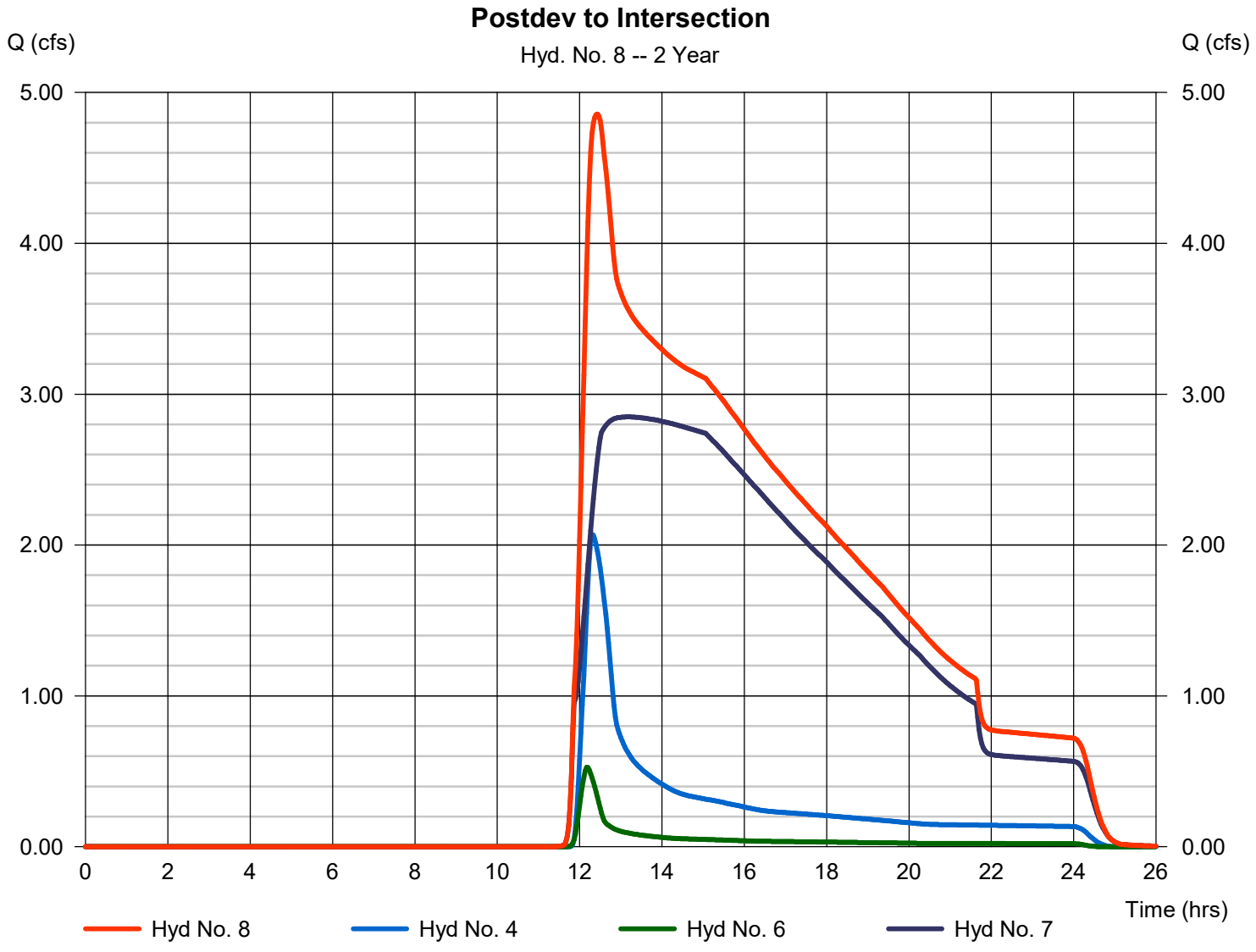


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 4.858 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 96,430 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

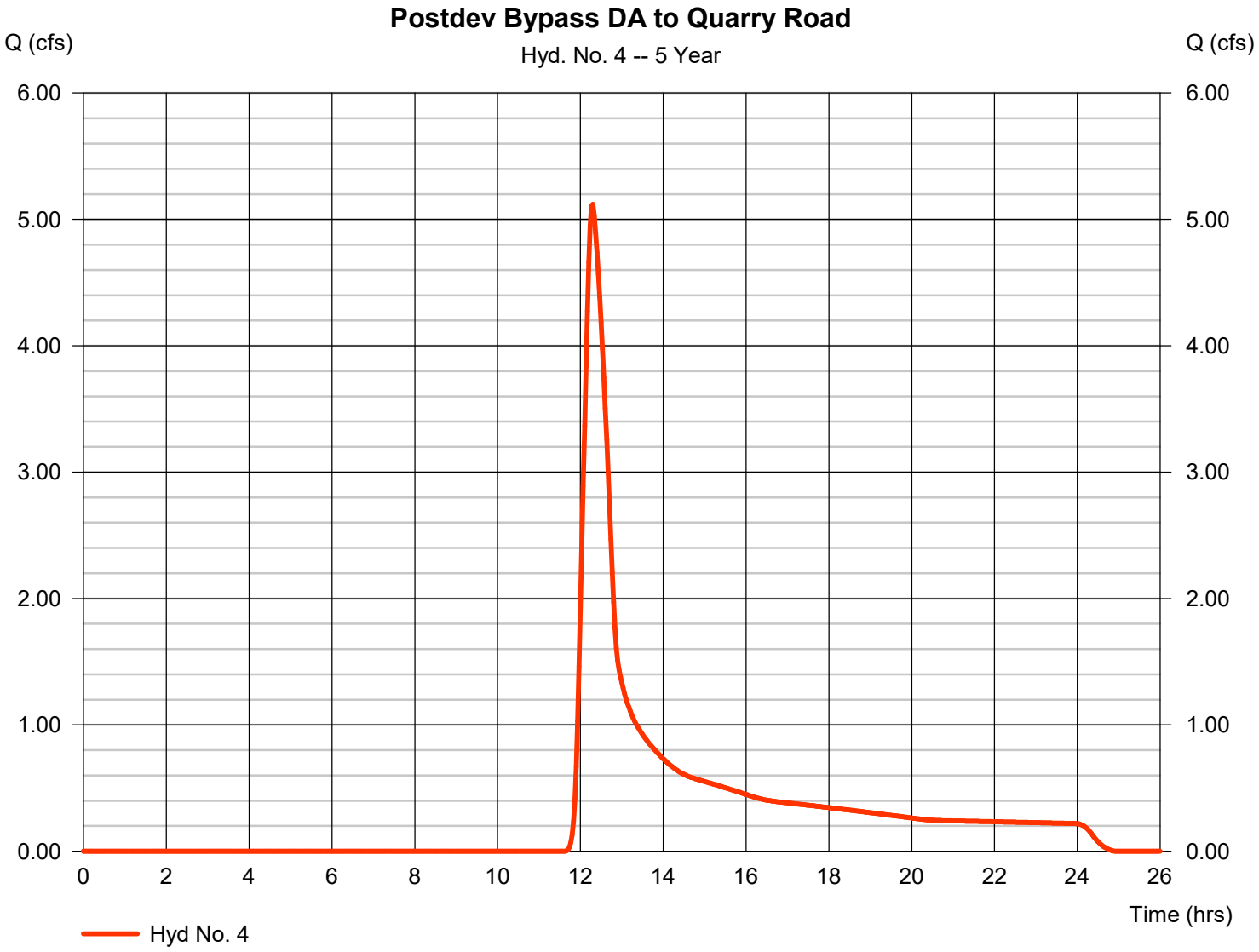
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.45	2	734	52,999	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	18.50	2	734	87,644	------	------	------	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

Hydrograph Report

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

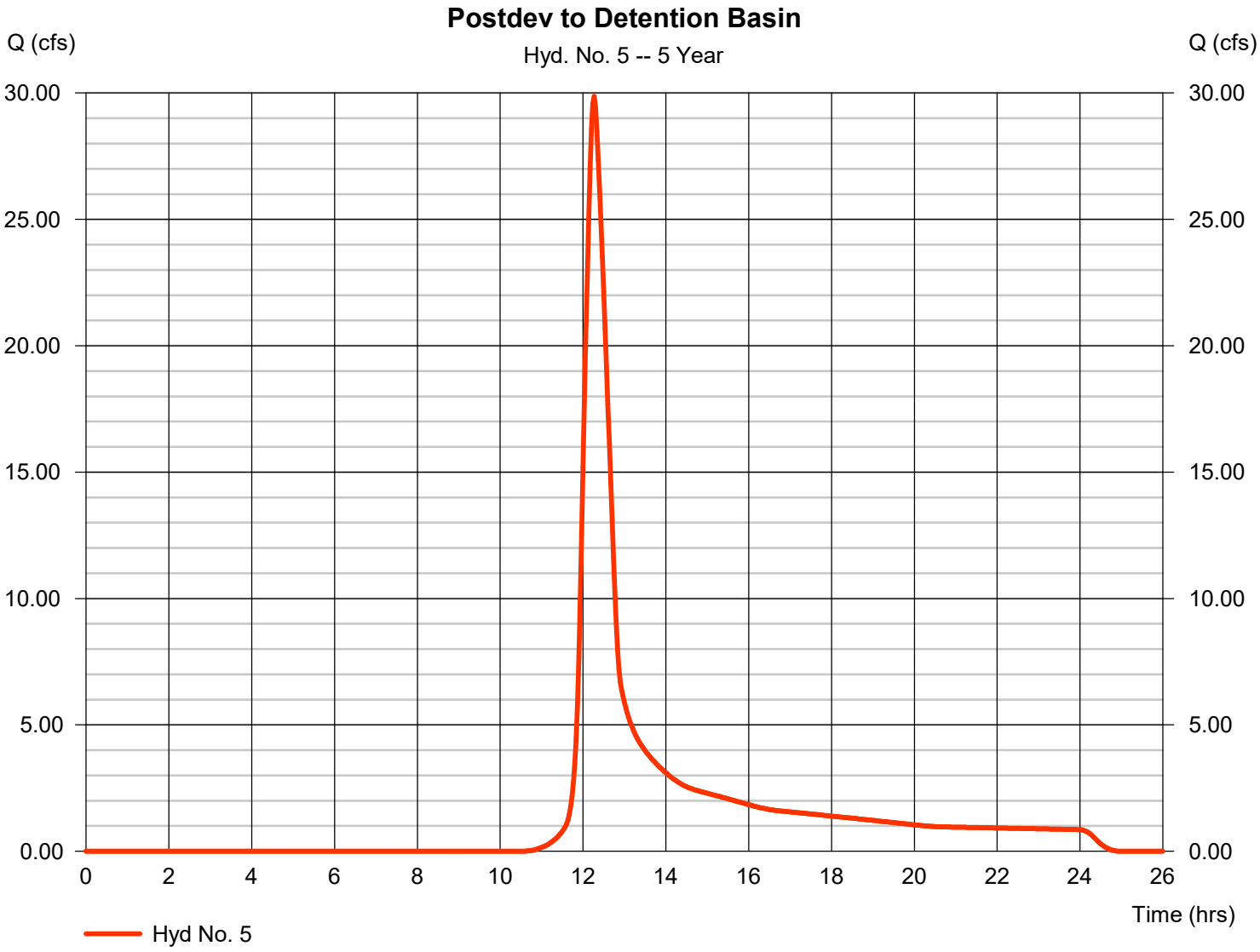


Hydrograph Report

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

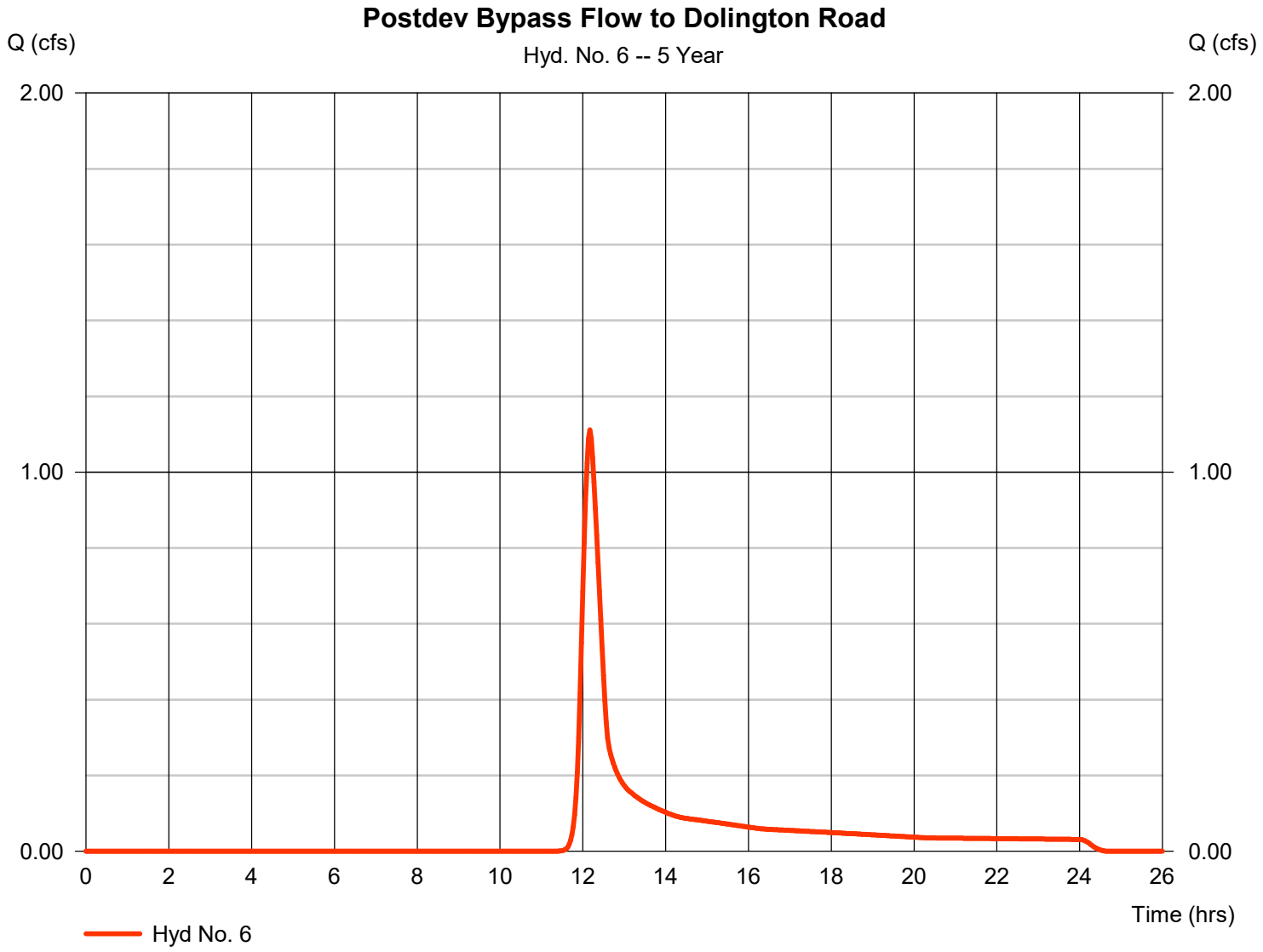


Hydrograph Report

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



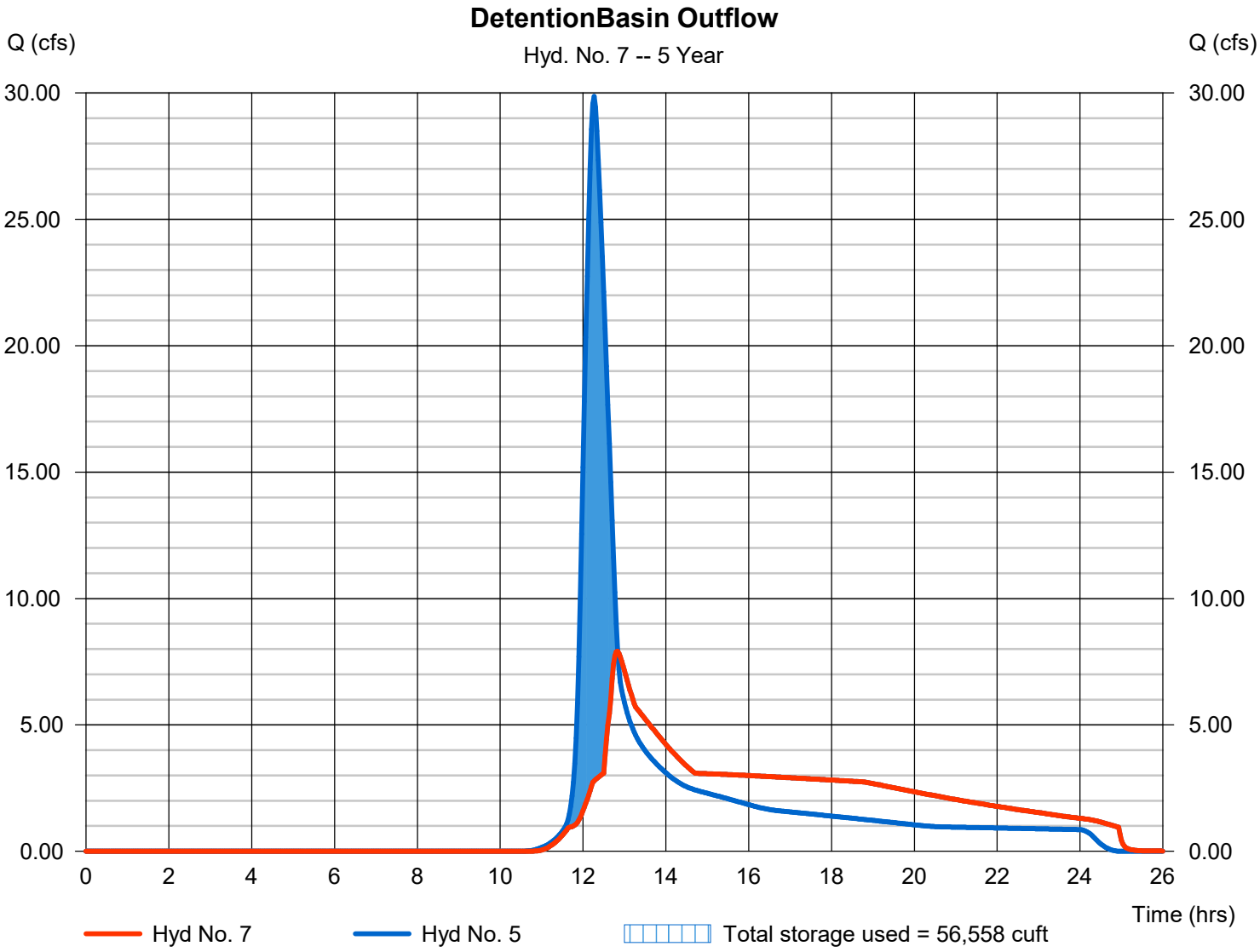
Hydrograph Report

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.

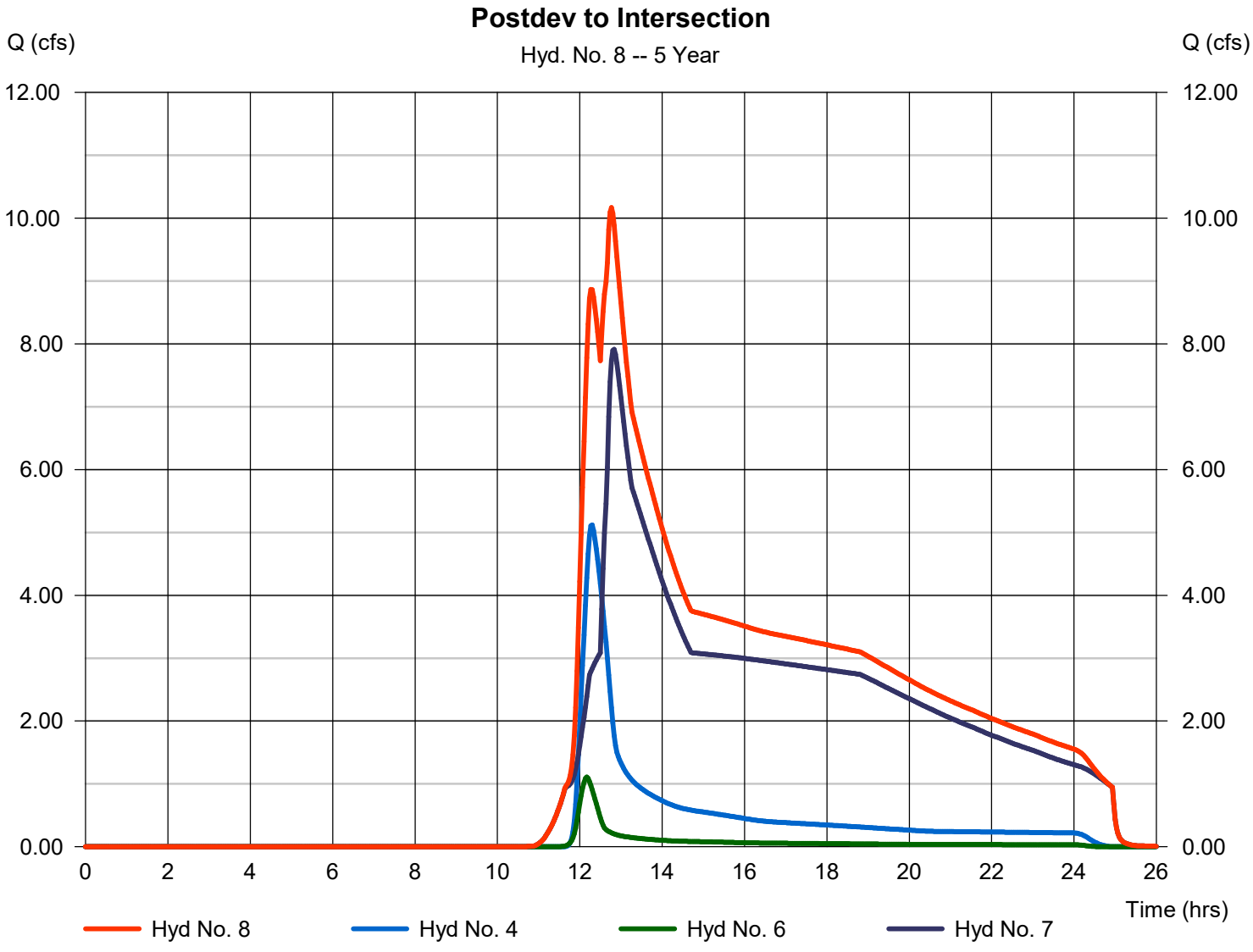


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 10.17 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 164,800 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

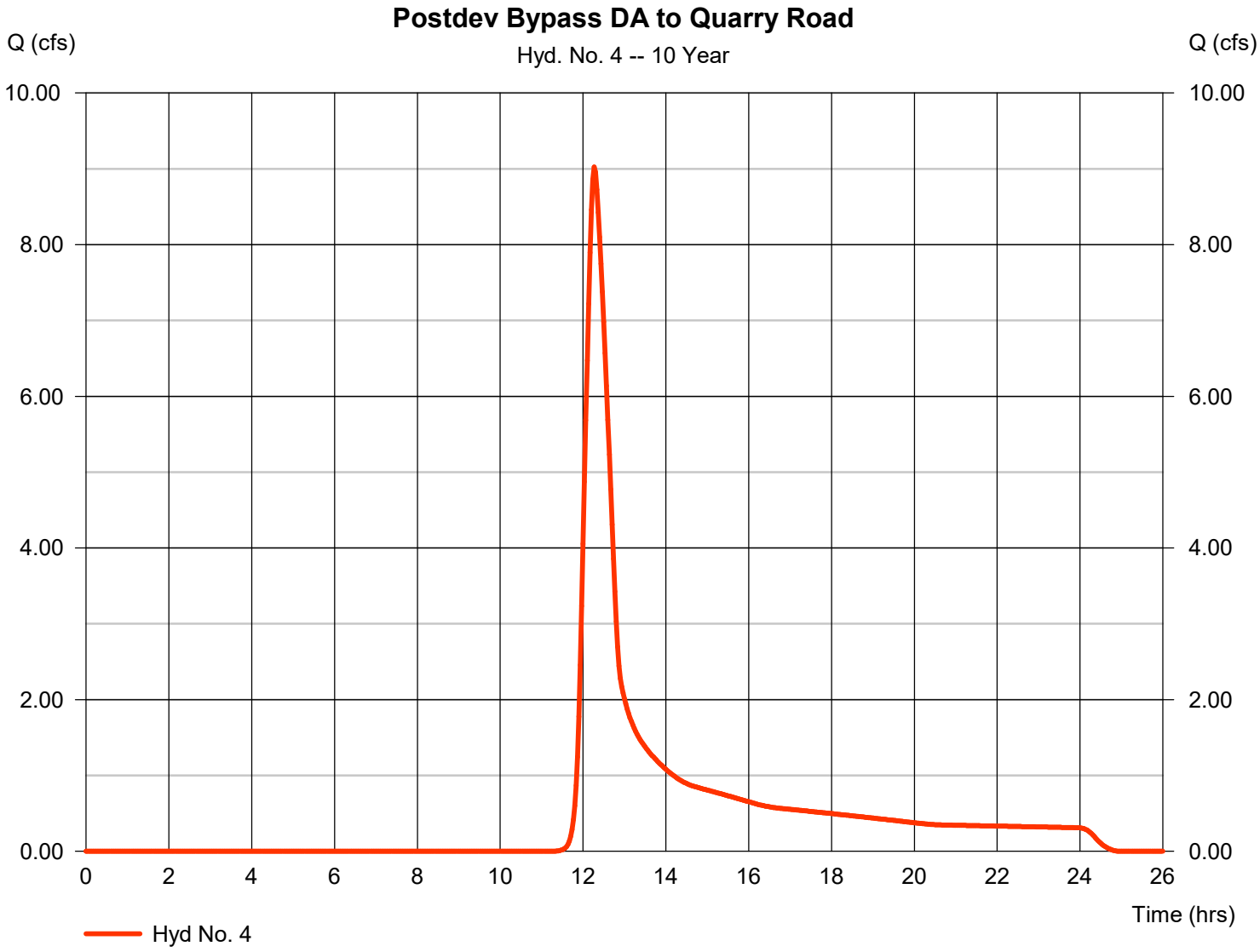
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	18.86	2	732	85,143	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	29.05	2	734	131,325	------	------	------	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

Hydrograph Report

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

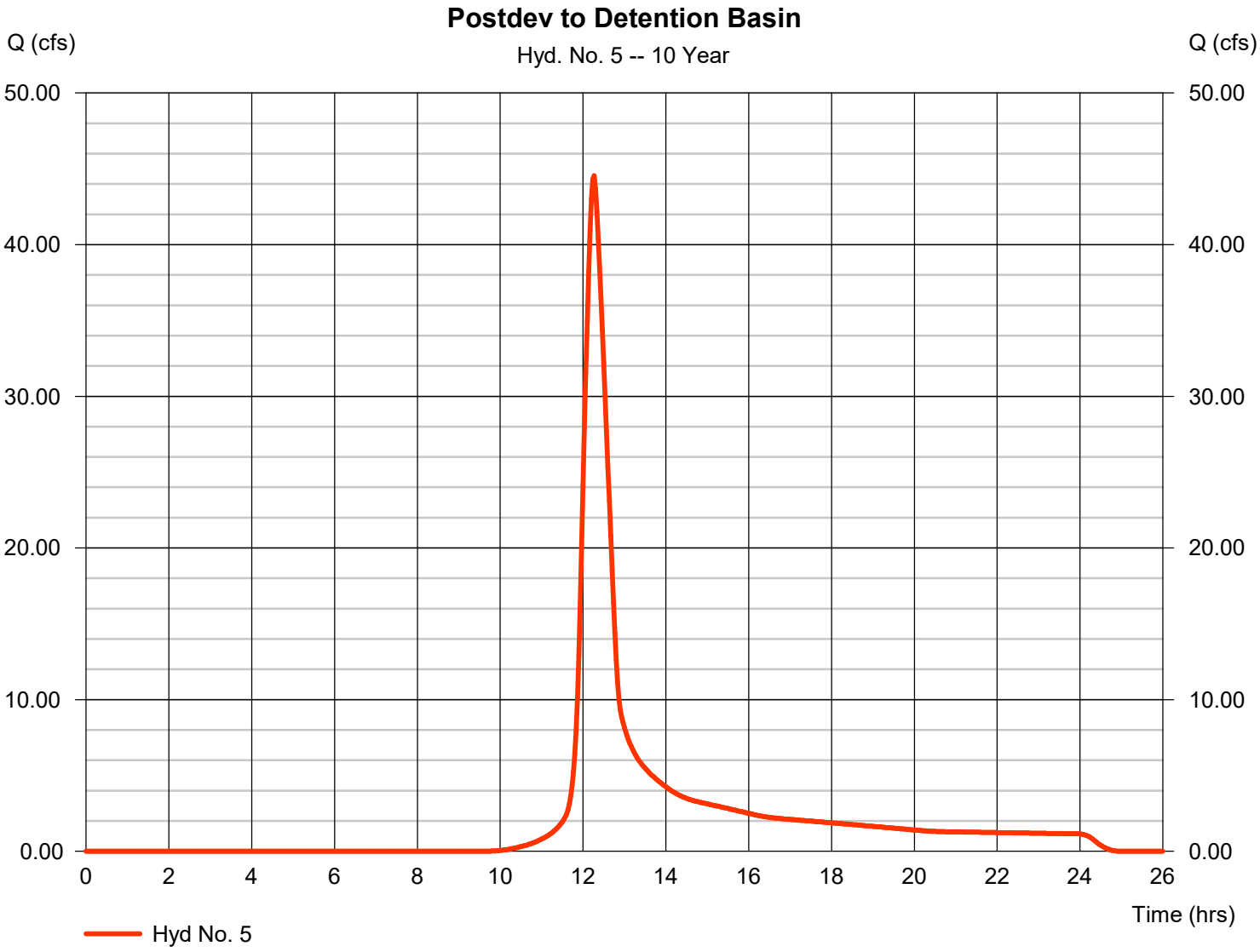


Hydrograph Report

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

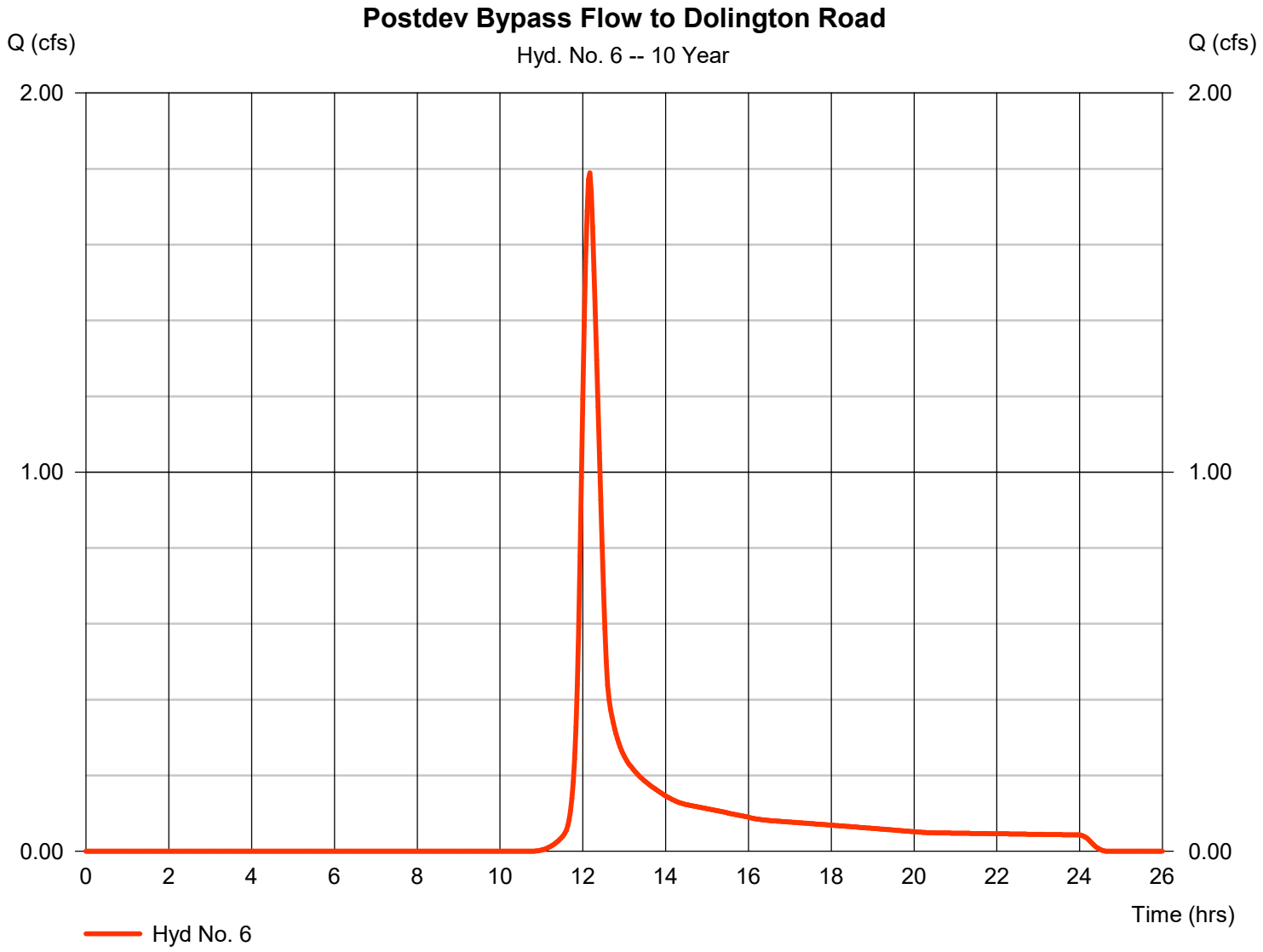


Hydrograph Report

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



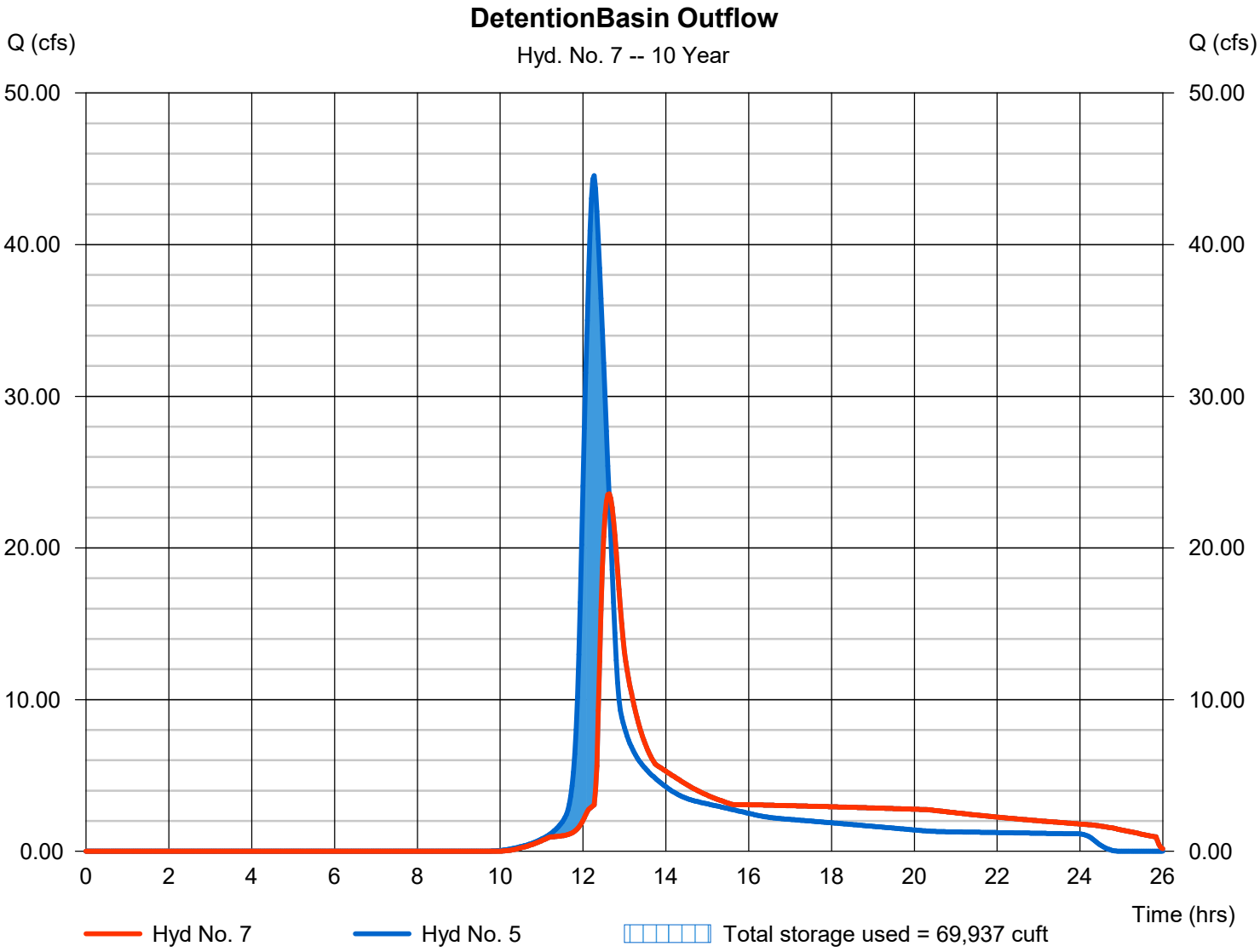
Hydrograph Report

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.

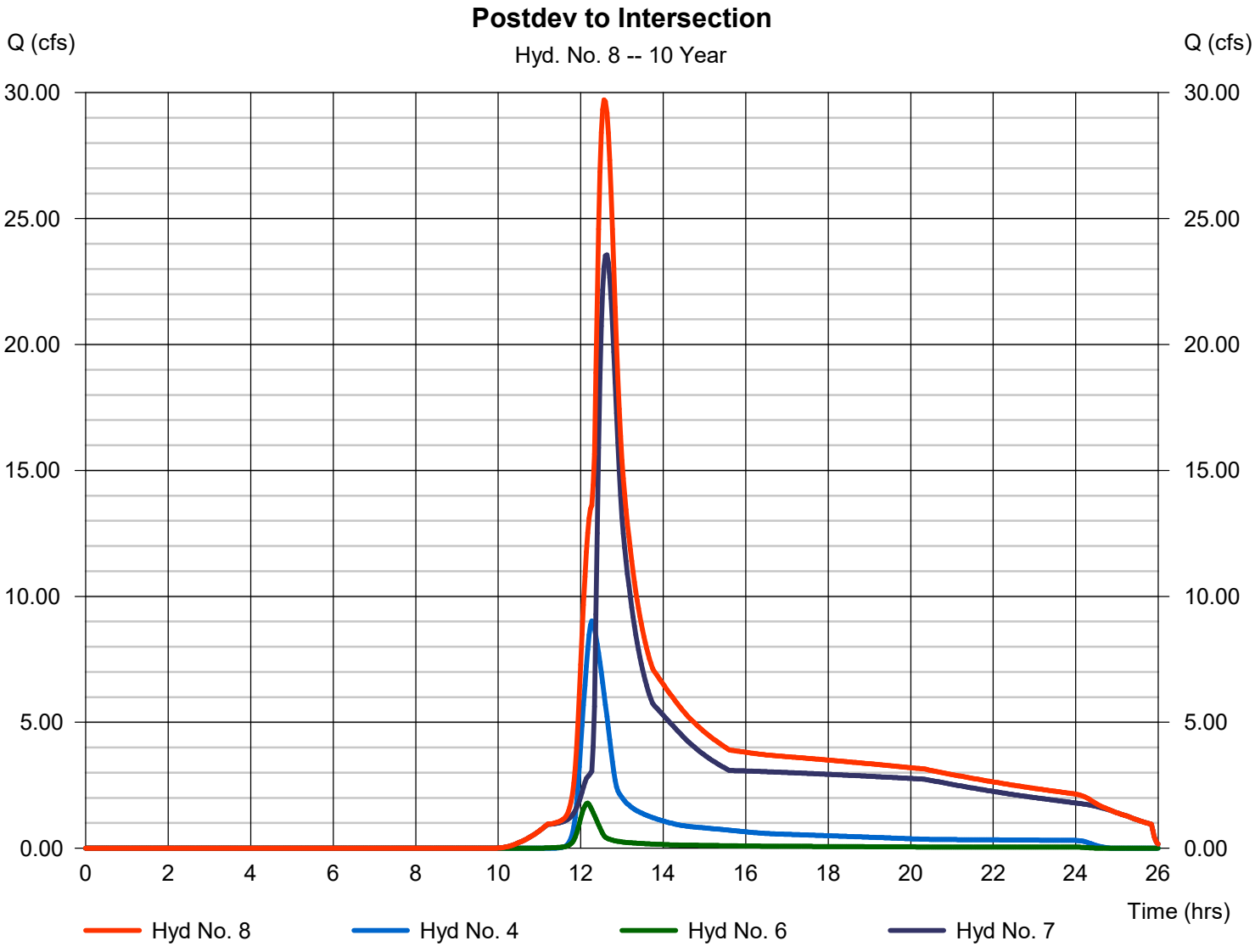


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 29.71 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.57 hrs
Time interval	= 2 min	Hyd. volume	= 245,892 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

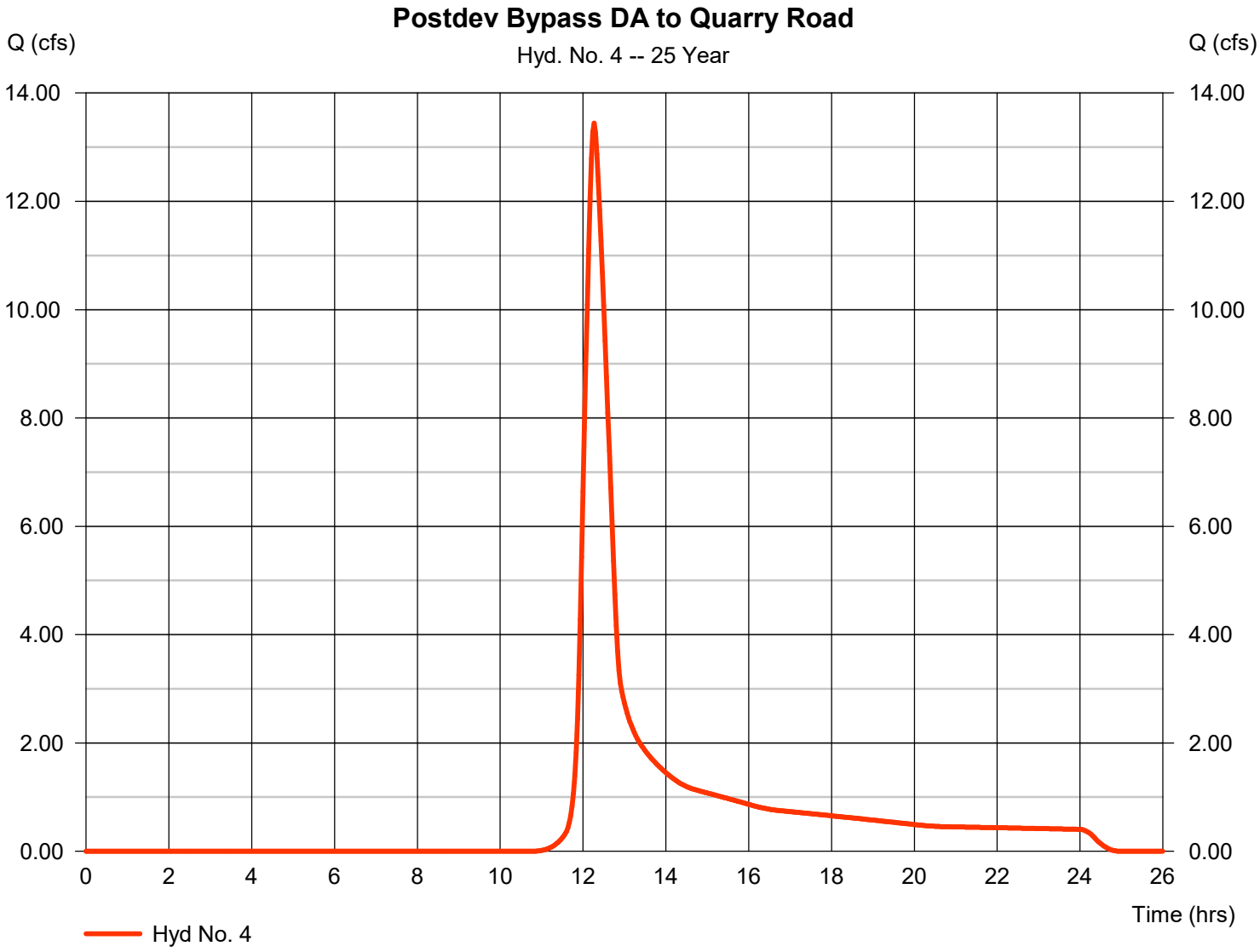
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	28.40	2	732	121,583	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	40.49	2	734	179,073	------	------	------	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

Hydrograph Report

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

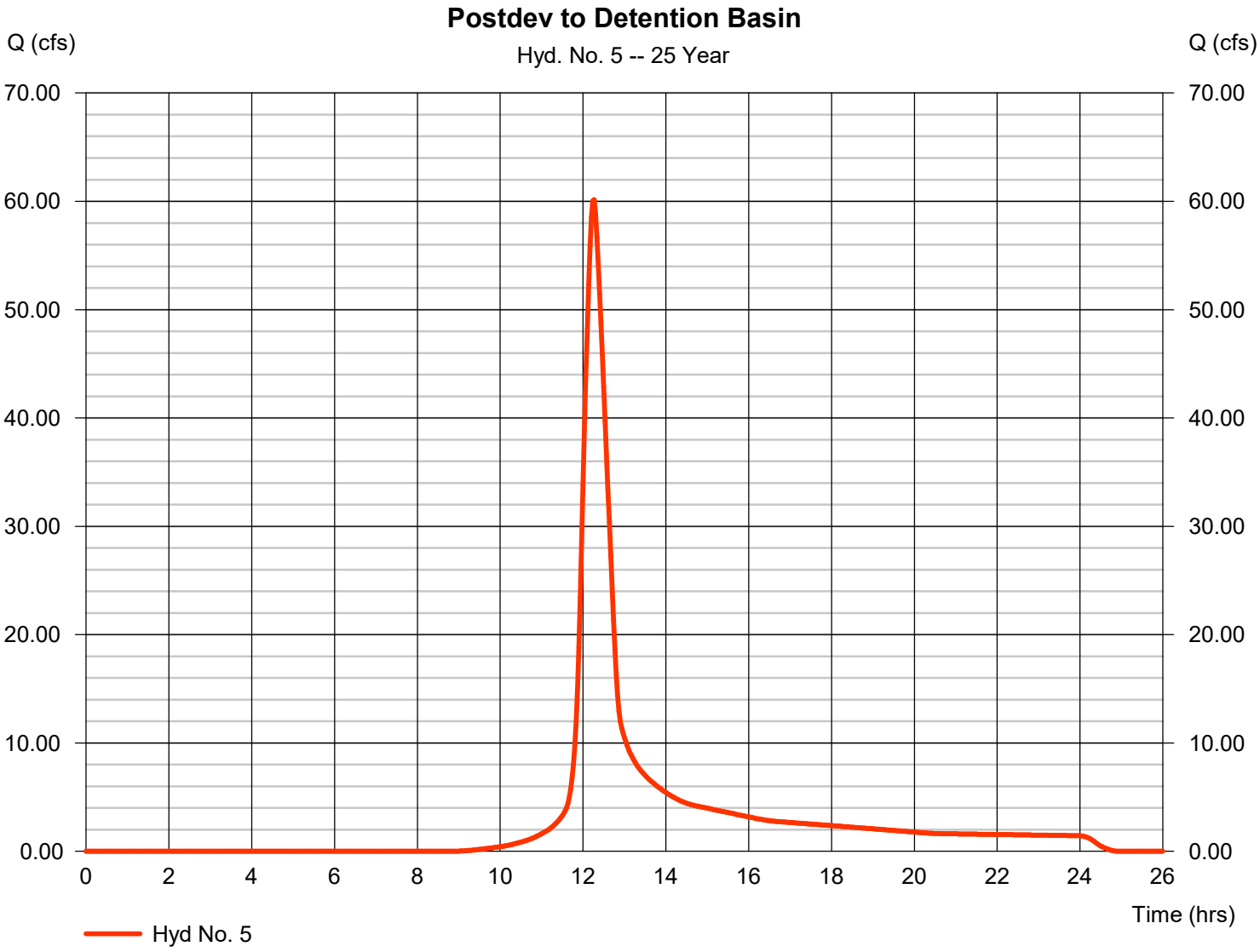


Hydrograph Report

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

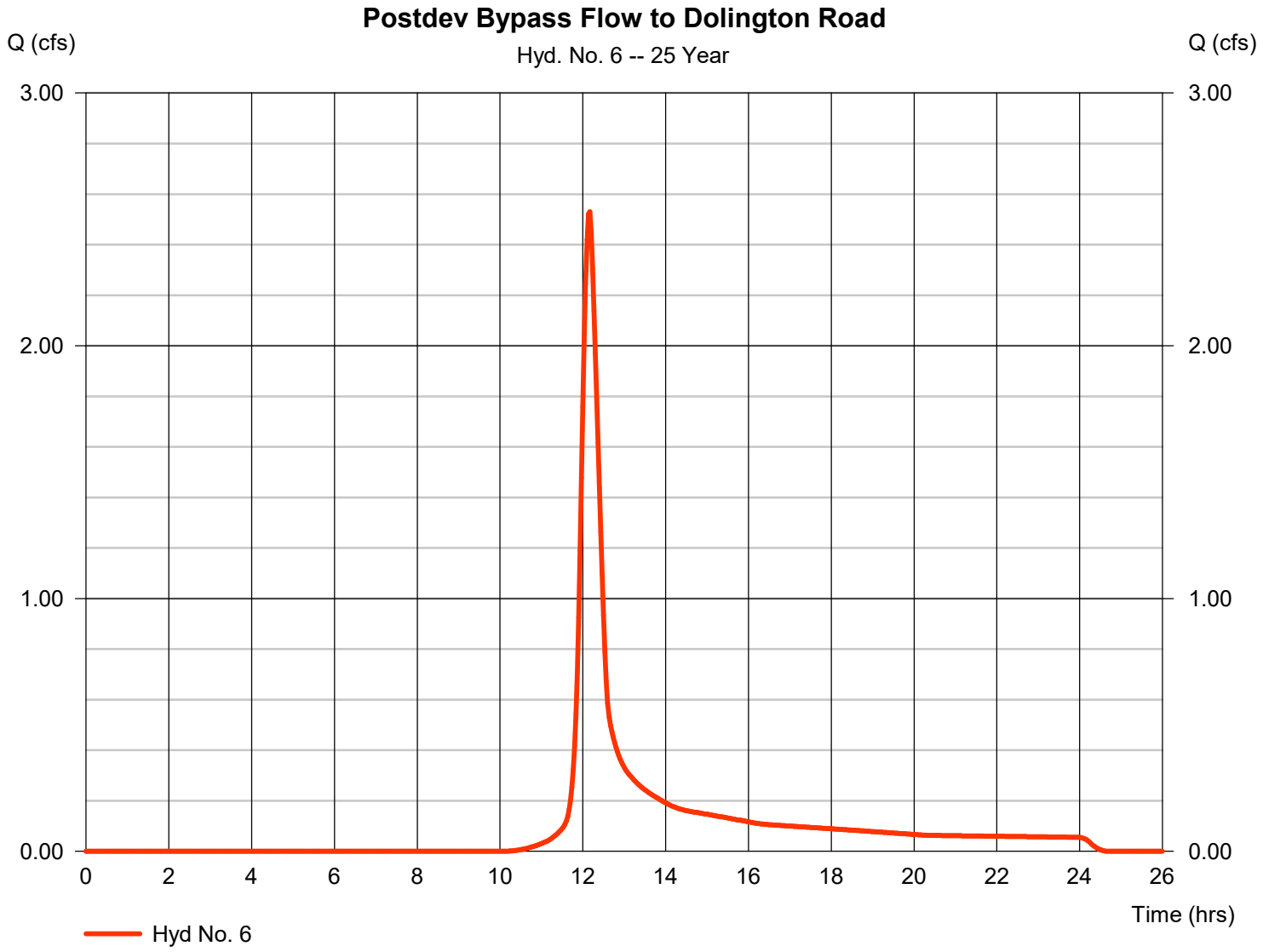


Hydrograph Report

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



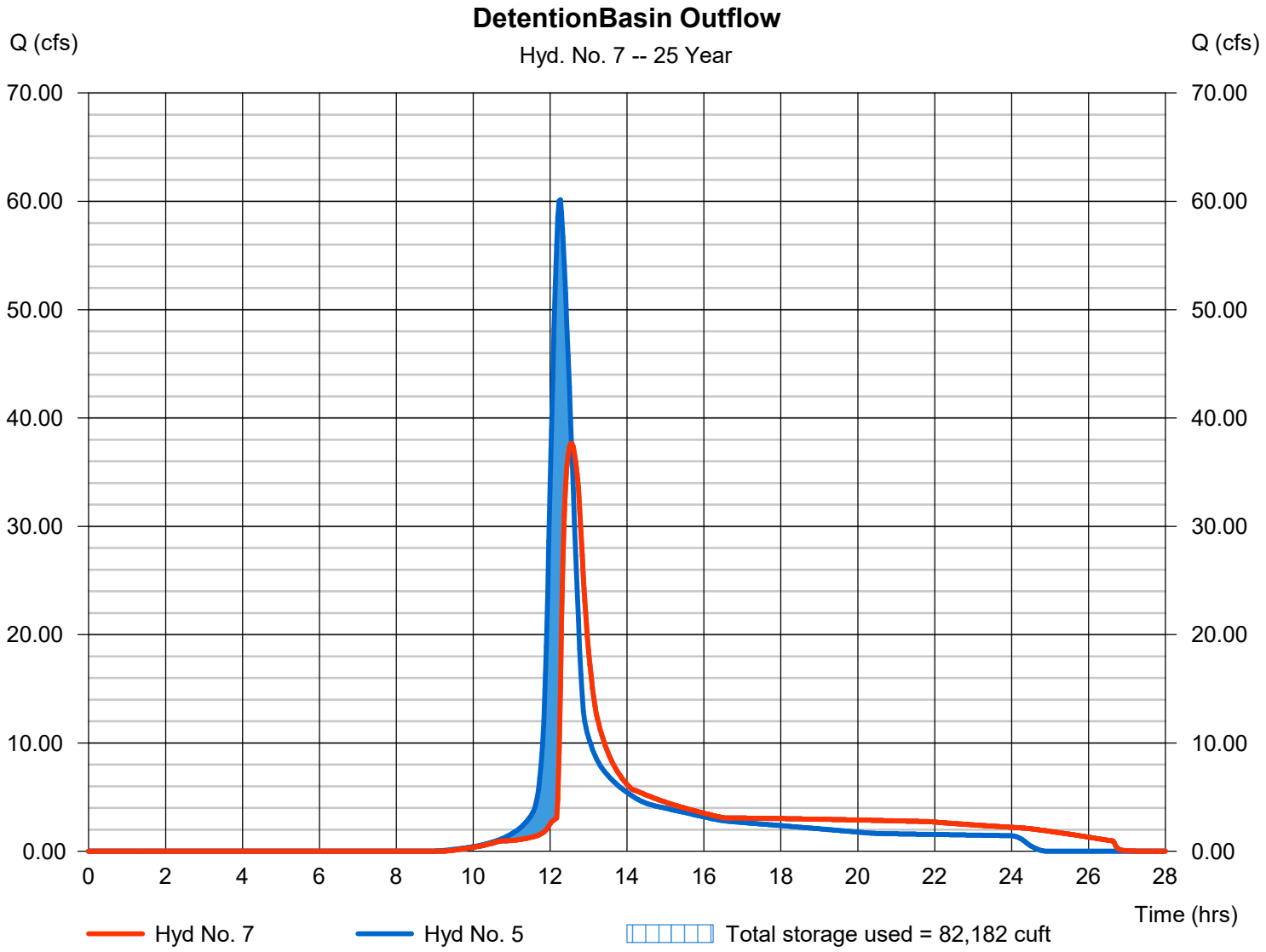
Hydrograph Report

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.

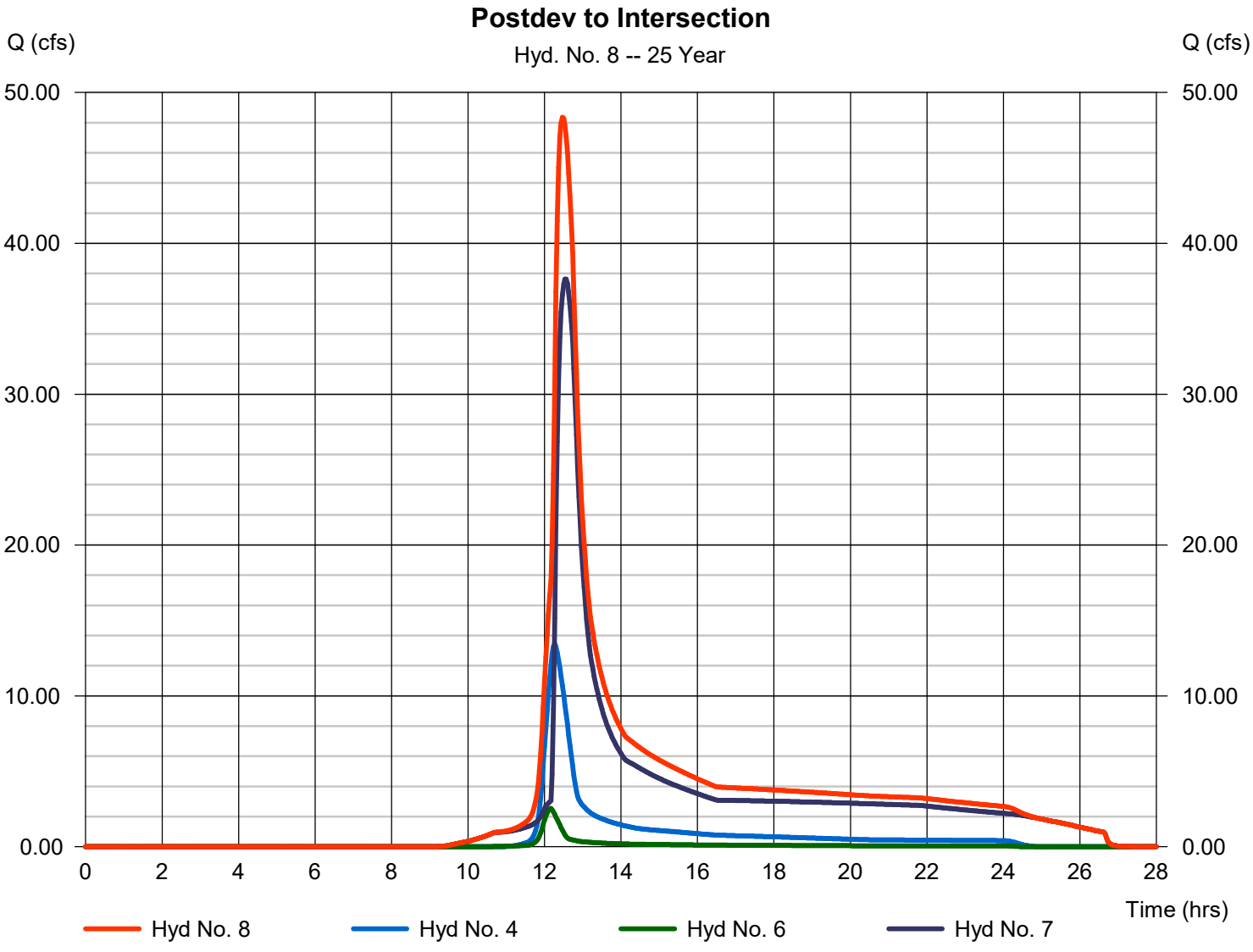


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 48.35 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 334,416 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

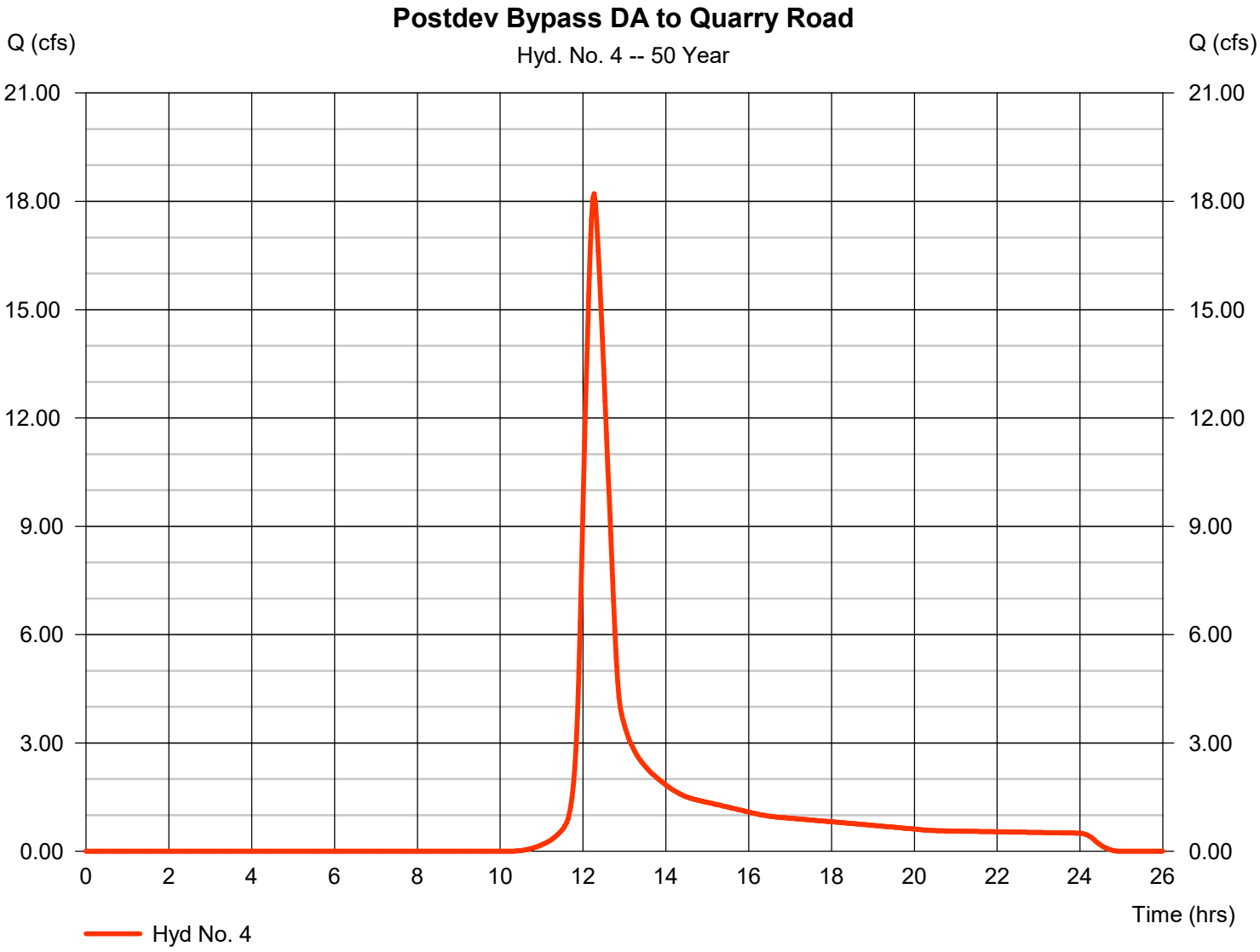
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	38.74	2	732	161,349	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	52.56	2	734	229,853	------	------	------	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

Hydrograph Report

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

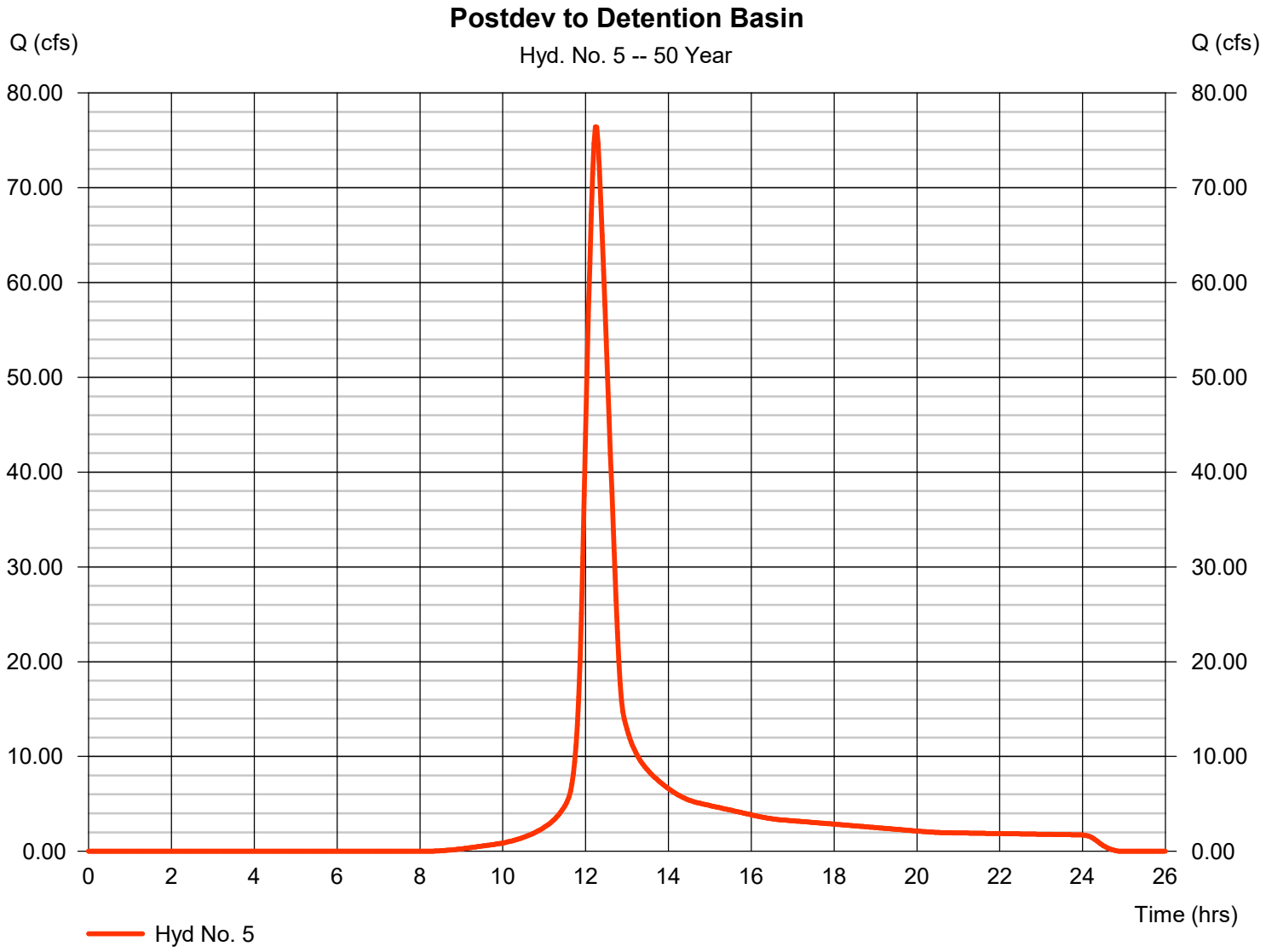


Hydrograph Report

Hyd. No. 5

Postdev to Detention Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	76.42 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.23 hrs
Time interval	=	2 min	Hyd. volume	=	347,759 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.	=	7.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

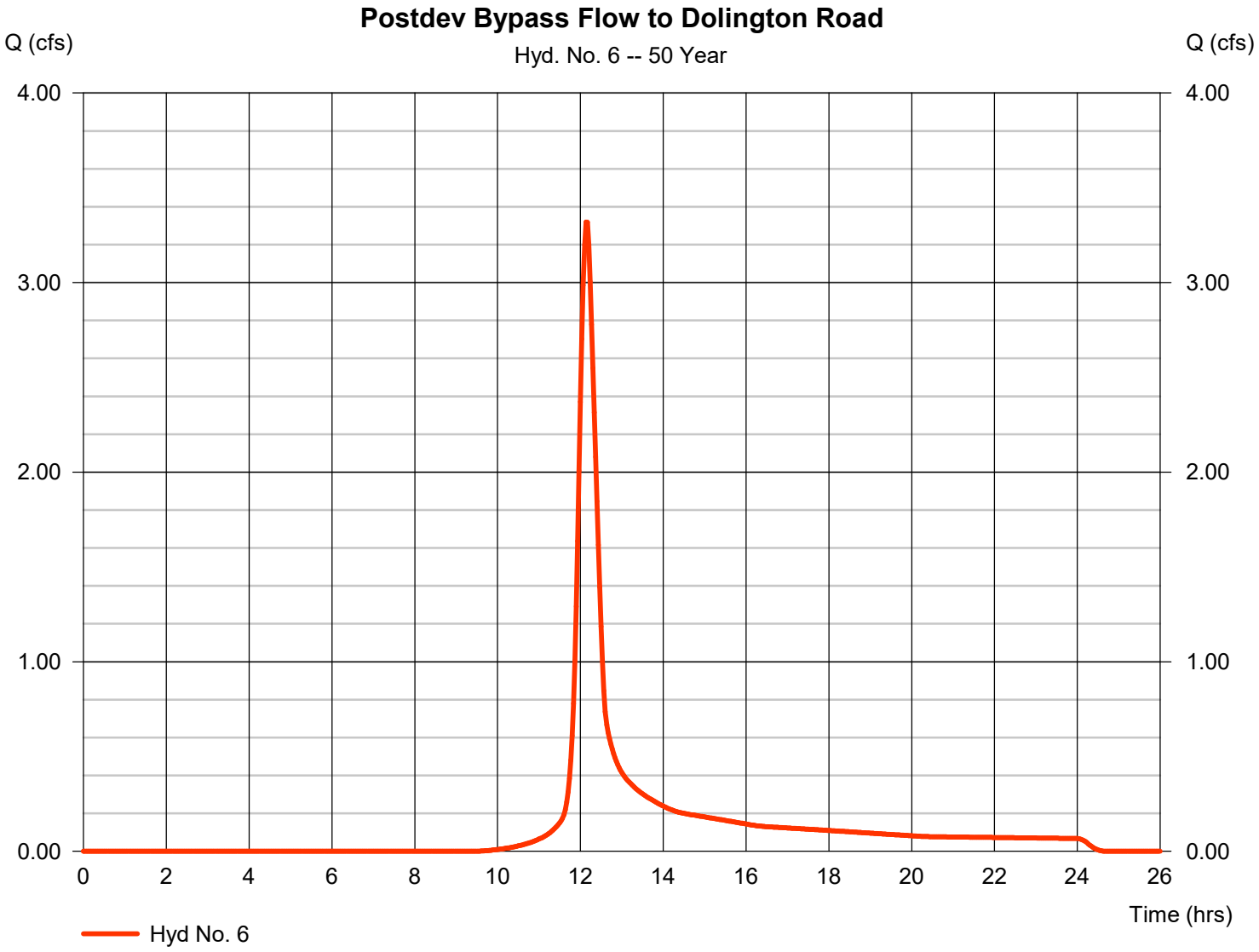


Hydrograph Report

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



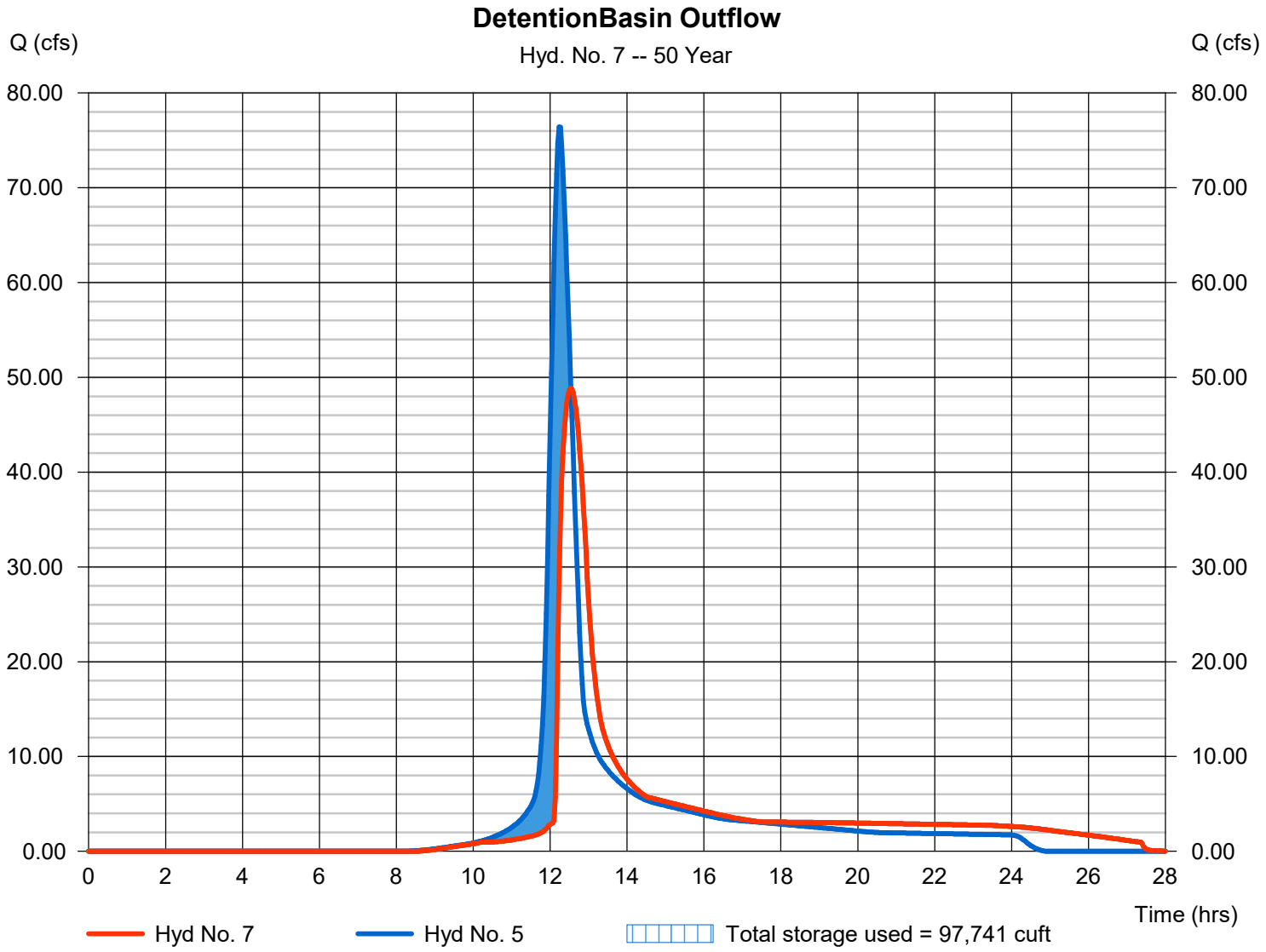
Hydrograph Report

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.

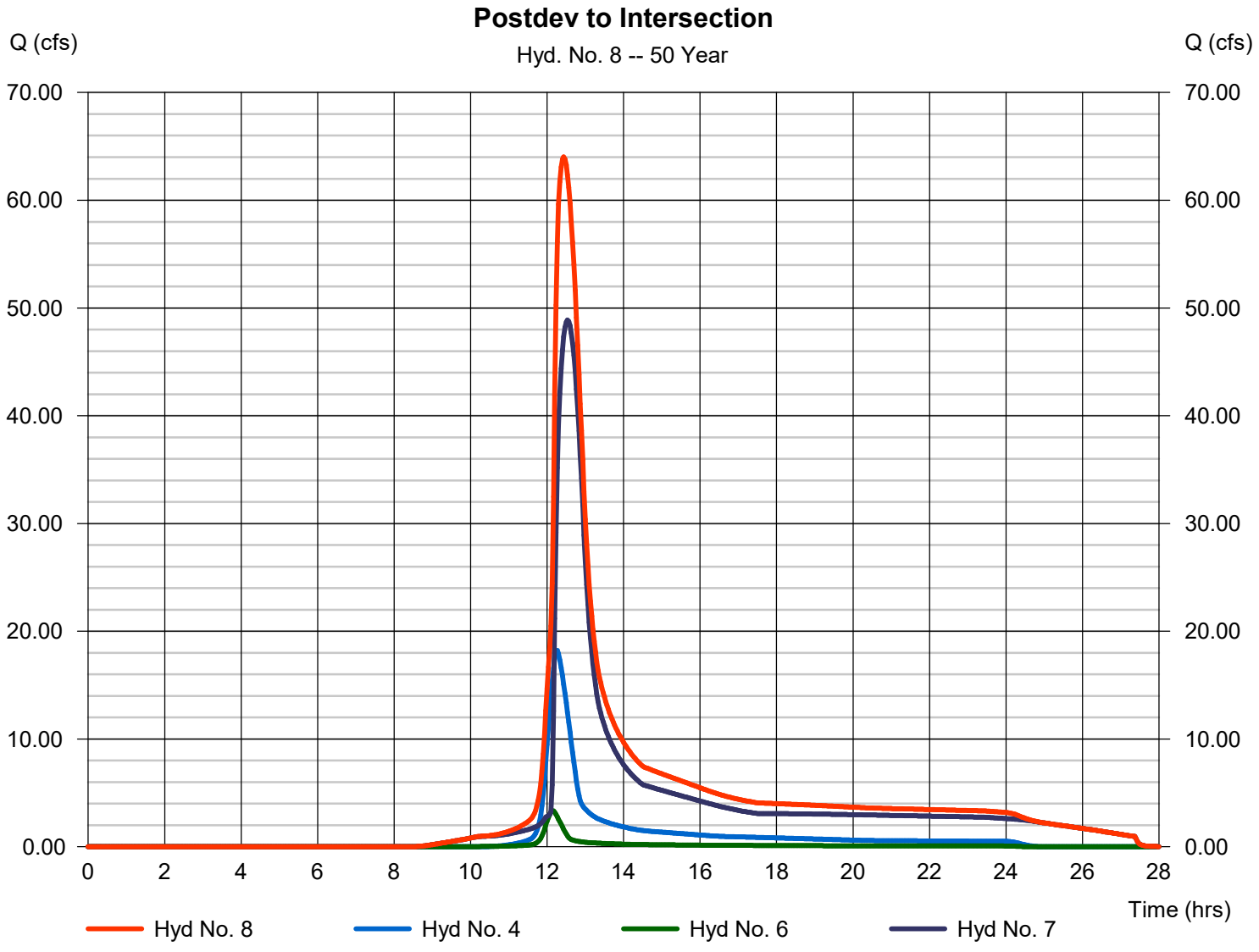


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 64.02 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 428,422 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydrograph Summary Report

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

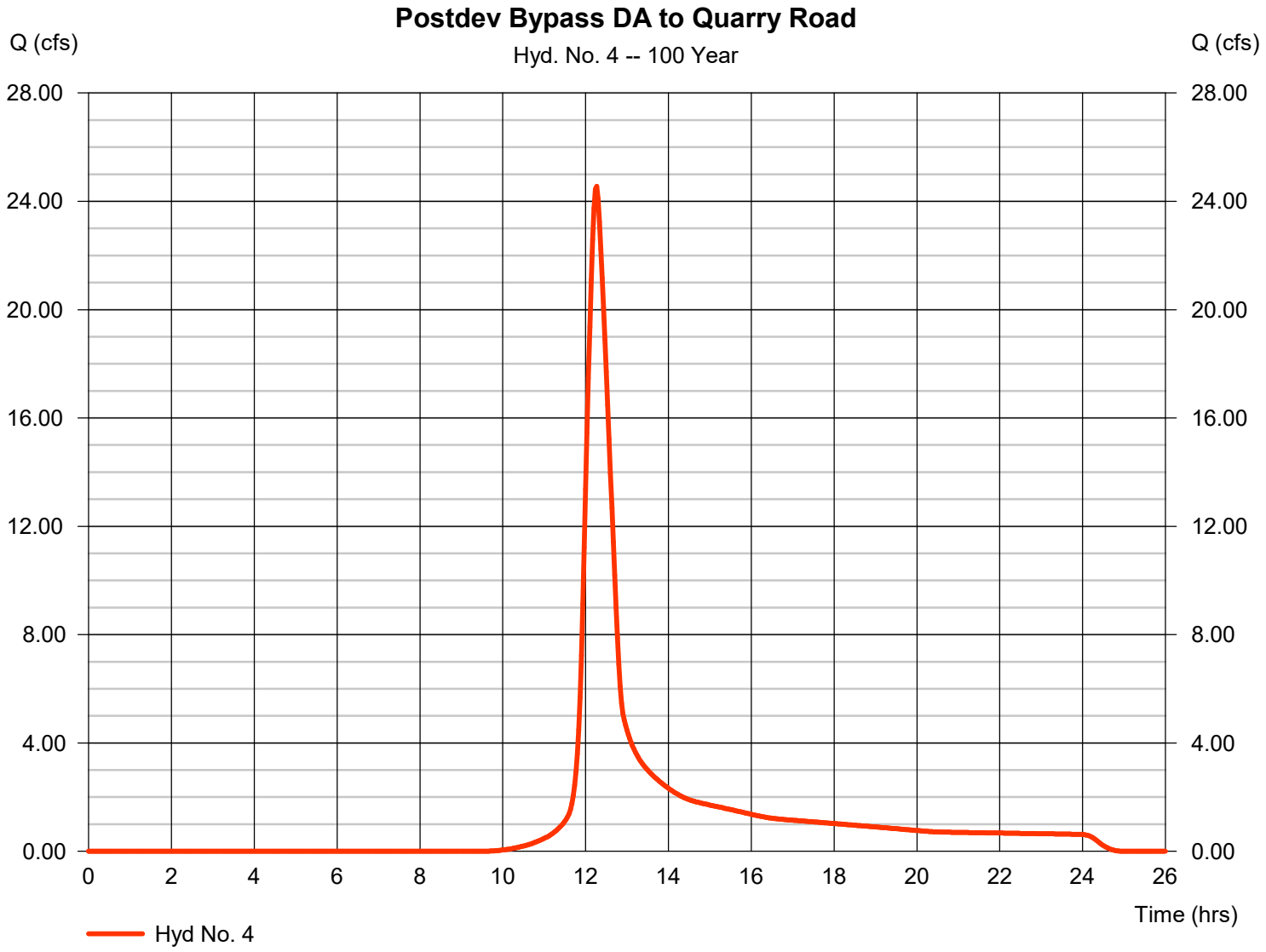
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	52.51	2	732	214,688	------	------	------	Predev DA to Quarry Road
2	SCS Runoff	68.27	2	734	296,529	------	------	------	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

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

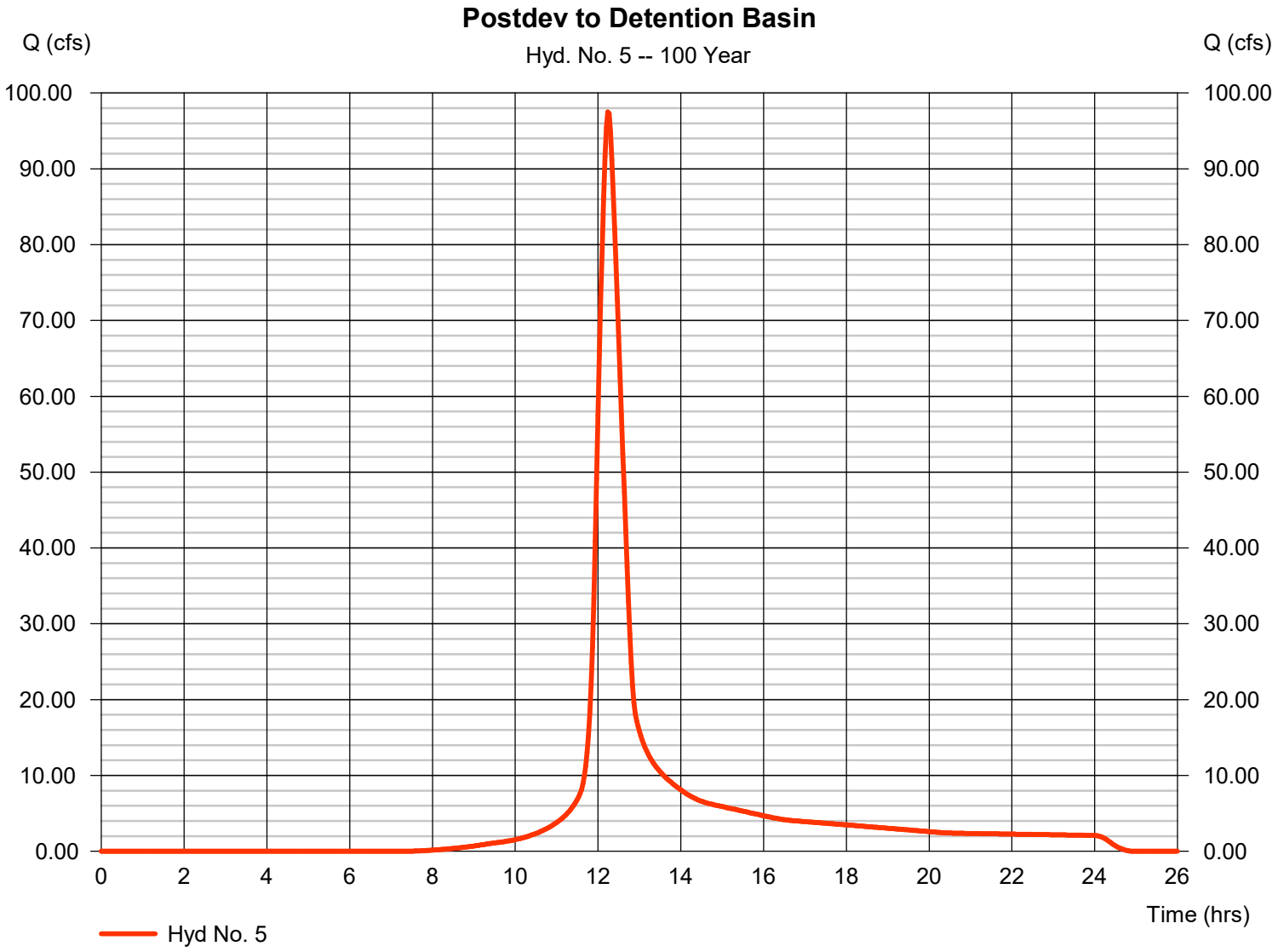


Hydrograph Report

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

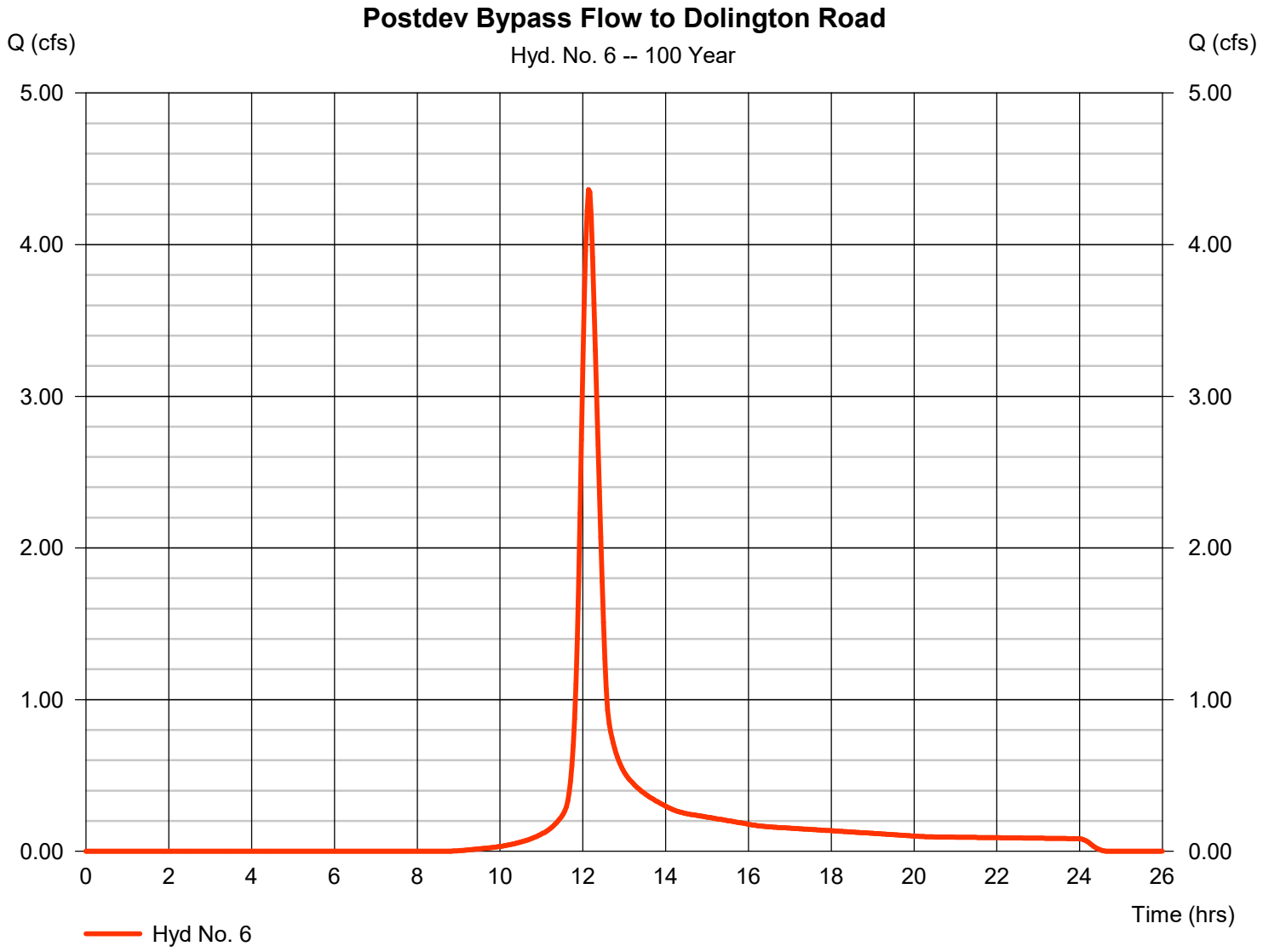


Hydrograph Report

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



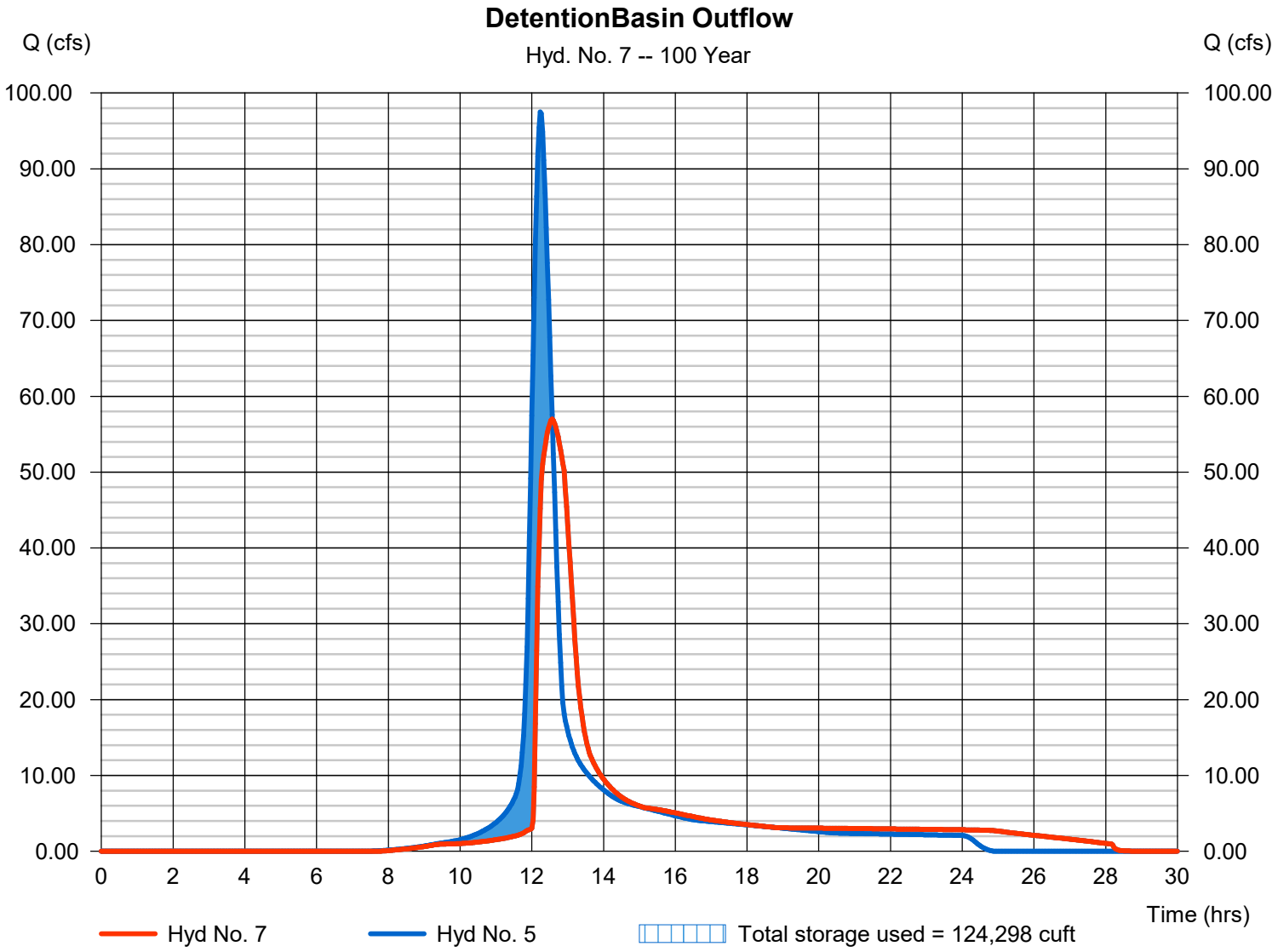
Hydrograph Report

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.

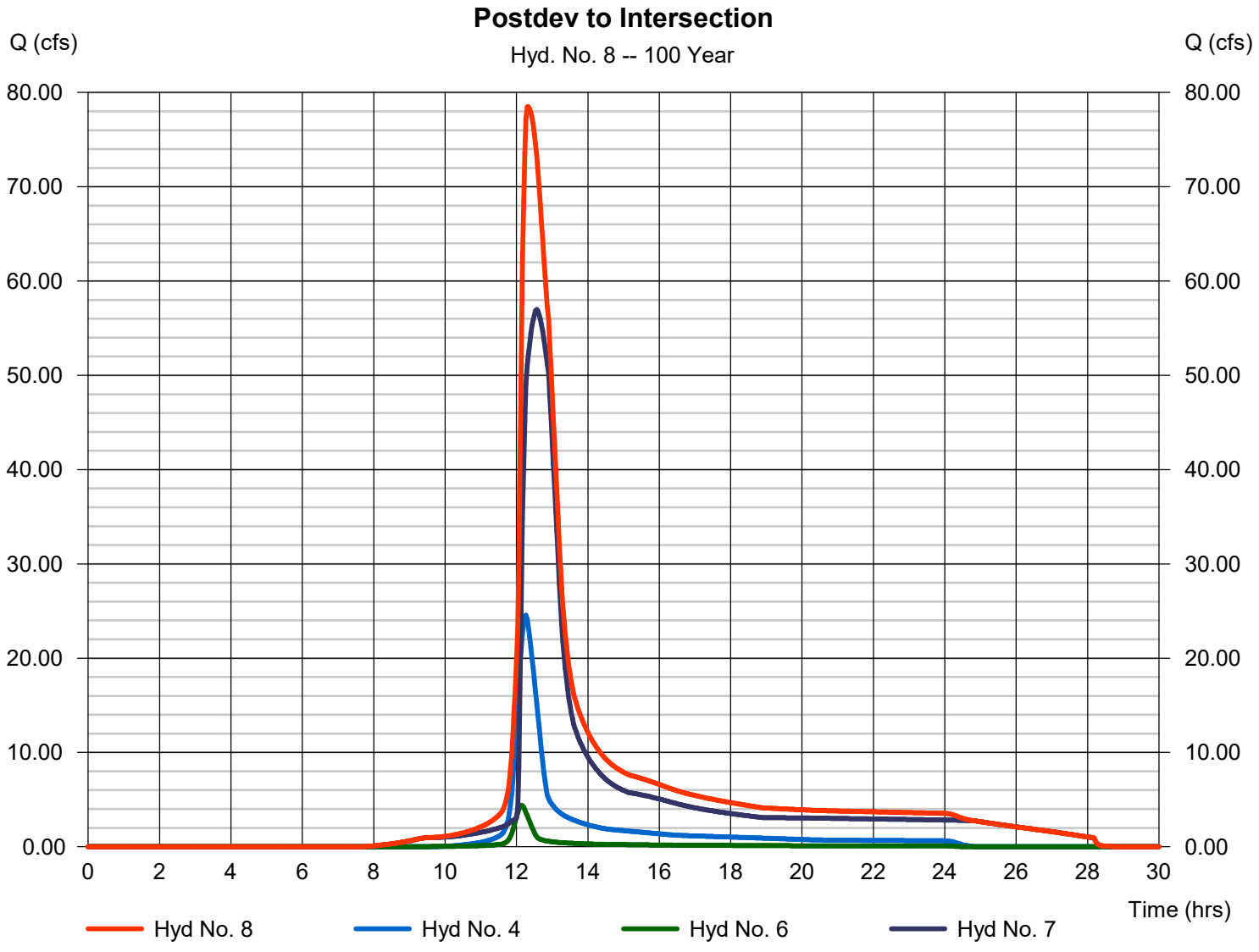


Hydrograph Report

Hyd. No. 8

Postdev to Intersection

Hydrograph type	= Combine	Peak discharge	= 78.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 551,870 cuft
Inflow hyds.	= 4, 6, 7	Contrib. drain. area	= 9.800 ac



Hydraflow Table of Contents

Basin design.gpw

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Friday, 07 / 14 / 2017

APPENDIX D:

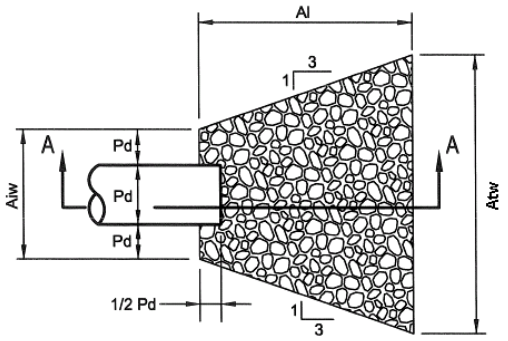
STORM SEWER

RIPRAP

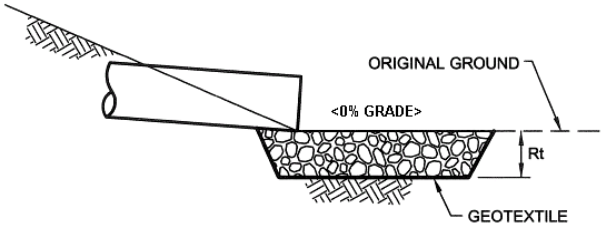
DESIGN CALCULATIONS

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 ≥ 0.05 ft/ft.**

Structure/ Facility	Soil Type	Ground Slope	Grass	C	Woods	C	Impervious	C	Total Area (SF)	Total Area AC	Weighted C
Basin	B	2-6%	112,269	0.19	-		9,920	0.96	122,189	2.805	0.25
Inlet 1	B	2-6%	9,071	0.19	-		670	0.96	9,741	0.224	0.24
Inlet 2	B	2-6%	15,242	0.19	-		15,786	0.96	31,028	0.712	0.58
Inlet 3	B	2-6%	4,626	0.19	-		1,063	0.96	5,689	0.131	0.33
Inlet 4	B	2-6%	3,485	0.19	-		404	0.96	3,889	0.089	0.27
Inlet 5	C	2-6%	240	0.23	-		555	0.96	795	0.018	0.74
Inlet 6	C	2-6%	9,514	0.23	-		556	0.96	10,070	0.231	0.27
Inlet 7	C	2-6%	1,442	0.23	-		50	0.96	1,492	0.034	0.25
Inlet 8	C	2-6%	10,621	0.23	1,634	0.16	6,549	0.96	18,804	0.432	0.48
Inlet 9	C	0-2%	8,439	0.18	19,662	0.12	-		28,101	0.645	0.14
Inlet 10	C	0-2%	46,908	0.18	78,778	0.12	3,354	0.95	129,040	2.962	0.16
Inlet 11	B	0-2%	51,464	0.14	-		6,178	0.95	57,642	1.323	0.23
Inlet 12	B	0-2%	14,746	0.14	-		4,208	0.95	18,954	0.435	0.32
Inlet 13	B	0-2%	63,772	0.14	-		10,765	0.95	74,537	1.711	0.26
Inlet 14	B	0-2%	16,236	0.14	-		2,619	0.95	18,855	0.433	0.25
Inlet 15	B	0-2%	81,565	0.14	31,659	0.10	16,233	0.95	129,457	2.972	0.23
Inlet 16	B	0-2%	13,190	0.14	-		8,875	0.95	22,065	0.507	0.47
Inlet 17	B	0-2%	11,243	0.14	-		1,766	0.95	13,009	0.299	0.25
Inlet 18	B	2-6%	19,579	0.19	-		13,107	0.96	32,686	0.750	0.50
Inlet 19	B	0-2%	43,534	0.14	-		393	0.95	43,927	1.008	0.15
Inlet 20	B	0-2%	22,614	0.14	-		12,782	0.95	35,396	0.813	0.43
Inlet 21	B	0-2%	49,062	0.14	-		981	0.95	50,043	1.149	0.16
Inlet 22	B	2-6%	1,654	0.19	1,985	0.14	1,859	0.96	5,498	0.126	0.43
Inlet 23	B	0-2%	34,697	0.14	19,688	0.10	6,205	0.95	60,590	1.391	0.21
Inlet 24	B	2-6%	4,332	0.19	-		6,479	0.96	10,811	0.248	0.65
Inlet 25	B	2-6%	1,992	0.19	-		3,650	0.96	5,642	0.130	0.69
Inlet 26	B	0-2%	29,441	0.19	-		4,100	0.95	33,541	0.770	0.28
Inlet 27	C	0-2%	87,102	0.20	-		11,910		99,012	2.273	0.18
Inlet 28	C	0-2%	59,646	0.20		0.10	2,340	0.95	61,986	1.423	0.23
New Undetained Imp		2-6%					11,167		11,167	0.256	0.00
TOTALS			**827,726**		**153,406**		**164,524**		**1,145,656**	**26.301**	

Total Impervious Undetained (Incl. Inlets 24 & 25) 21,296 sf

Impervious to Basin 143,228 sf

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:

INFILTRATION/GEOTECHNICAL REPORT

SOIL INFILTRATION TEST PIT RESULTS

AbB—Abbottstown silt loam, 3 to 8 percent slopes

Map Unit Setting

- *National map unit symbol:* l7n4
- *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:* l7nv
- *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):* Interfluve
- *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:* l7rv
- *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:* l7sm
- *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 artifically 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:* l7t9
- *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 artifically 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):* 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

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):* Footslope, 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:* l7tb
- *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 artifically 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):* 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

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

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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 14th and 26th, 2016 and May 10th 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

Test Pit # A

Additional Pits

Inches			Description of Horizon
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		

Depth to Limiting Zone
80 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 [x] 40 F or above [X] Dry Rain, Sleet, Snow (last 24 hours)

Soil Conditions: Wet [X] Dry Frozen 24 Hour Presoak Yes [X] No

Hole No.	*** Yes	*** 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
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)

Total of Minutes / Inch: 720.00 = **240.00** Minutes / Inch

Total Number of Holes: 3

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

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

Test Pit # B

Additional Pits

Inches			Description of Horizon
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		

Depth to Limiting Zone
70 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 [x] 40 F or above [X] Dry Rain, Sleet, Snow (last 24 hours)

Soil Conditions: Wet [X] Dry Frozen 24 Hour Presoak Yes [X] No

Hole No.	*** Yes	*** 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
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: 25.33 = **12.67** Minutes / Inch

Total Number of Holes: 2

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

* - Perc rate not used in calculation per BMP Guidance

DOUBLE RING INFILTROMETER 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 (I) (ml/min)	Infiltration Rate (I) (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

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

Lapse (Minutes)	Volume Added (ml)	Rate (I) (ml/min)	Infiltration Rate (I) (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 INFILTROMETER TEST

Site Name:	**Snipes Tract - Lower Makefield Township**	Head or Depth of Water (H):	6 Inches
Pit # / Location:	**E**	Outer Ring Diameter:	12 Inches
Date Soil Described:	**October 14, 2016**	Inner Ring Diameter:	8 Inches
Personnel:	**Mr. Terry Harris**	Depth of Test Below Grade:	48 Inches
Infiltration Date:	**October 26, 2016**	Soil Description:	Soil Type: PnB
Personnel:	**Mr. James Haklar**		

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

Date	Time	**INFILTRATION TEST 1** 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)
10/26/16	10:45 AM	---	---	---	---	---	---	---	---
10/26/16	11:00 AM	15	30	2.0	0.002	15	1,000	66.7	0.083
10/26/16	11:15 AM	15	30	2.0	0.002	15	850	56.7	0.070
10/26/16	11:30 AM	15	20	1.3	0.002	15	680	45.3	0.056
10/26/16	11:45 AM	15	20	1.3	0.002	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

Test Pit # F Additional Pits

Inches			Description of Horizon
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
> 90 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 [x] 40 F or above [X] Dry Rain, Sleet, Snow (last 24 hours)

Soil Conditions: Wet [X] Dry Frozen 24 Hour Presoak Yes [X] No

Hole No.	*** Yes	*** 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
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)

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)

Total of Minutes / Inch: 480.00 = **240.00** Minutes / Inch

Total Number of Holes: 2

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

* - Perc rate not used in calculation per BMP Guidance

DOUBLE RING INFILTROMETER 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

Date	Time

INFILTRATION TEST 1

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 INFILTROMETER TEST

Site Name:	**Snipes Tract - Lower Makefield Township**	Head or Depth of Water (H):	6 Inches
Pit # / Location:	**H**	Outer Ring Diameter:	12 Inches
Date Soil Described:	**October 14, 2016**	Inner Ring Diameter:	8 Inches
Personnel:	**Mr. Terry Harris**	Depth of Test Below Grade:	48 Inches
Infiltration Date:	**October 14, 2016**	Soil Description:	Soil Type: PnB
Personnel:	**Mr. Terry Harris**		

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

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 INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 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)
10/14/16	12:40 PM	---	---	---	---	---	---	---	---
10/14/16	12:55 PM	15	650	43.3	0.054	15	500	33.3	0.041
10/14/16	1:10 PM	15	700	46.7	0.058	15	460	30.7	0.038
10/14/16	1:25 PM	15	670	44.7	0.056	15	420	28.0	0.035
10/14/16	1:40 PM	15	680	45.3	0.056	15	470	31.3	0.039
10/14/16	1:55 PM	15	670	44.7	0.056	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 INFILTROMETER 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

Date	Time	**INFILTRATION TEST 1** 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 INFILTROMETER 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

Date	Time	**INFILTRATION TEST 1** 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)
10/26/16	8:25 AM	---	---	---	---	---	---	---	---
10/26/16	8:40 AM	15	850	56.7	0.070	15	3,450	230.0	0.286
10/26/16	8:55 AM	15	850	56.7	0.070	15	3,000	200.0	0.249
10/26/16	9:10 AM	15	820	54.7	0.068	15	3,000	200.0	0.249
10/26/16	9:25 AM	15	820	54.7	0.068	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 INFILTROMETER 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

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

INFILTRATION TEST 1

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 INFILTROMETER 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

Date	Time	**INFILTRATION TEST 1** 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 INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 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)
10/26/16	8:20 AM	---	---	---	---	---	---	---	---
10/26/16	8:35 AM	15	100	6.7	0.008	15	200	13.3	0.017
10/26/16	8:50 AM	15	50	3.3	0.004	15	150	10.0	0.012
10/26/16	9:05 AM	15	30	2.0	0.002	15	150	10.0	0.012
10/26/16	9:20 AM	15	20	1.3	0.002	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 INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 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

Test Pit # P Additional Pits

Inches			Description of Horizon
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 [x] 40 F or above [X] Dry Rain, Sleet, Snow (last 24 hours)

Soil Conditions: Wet [X] Dry Frozen 24 Hour Presoak Yes [X] No

Hole No.	*** Yes	*** 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
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: 360.00 = **180.00** Minutes / Inch
Total Number of Holes: 2

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

* - Perc rate not used in calculation per BMP Guidance

DOUBLE RING INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 2 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 3 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		TEST 2 INFILTRATION RATE		TEST 3 INFILTRATION RATE	
Inches per minute	0.00	Inches per minute	0.02	Inches per minute	0.01
Inches per hour	0.15	Inches per hour	1.24	Inches per hour	0.40
Inches per day	3.58	Inches per day	29.83	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 INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 2 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 3 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		TEST 2 INFILTRATION RATE		TEST 3 INFILTRATION RATE	
Inches per minute	0.00	Inches per minute	0.00	Inches per minute	0.00
Inches per hour	0.00	Inches per hour	0.00	Inches per hour	0.00
Inches per day	0.00	Inches per day	0.00	Inches per day	0.00

0.00 Inches per Hour

DOUBLE RING INFILTROMETER 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

Date	Time	INFILTRATION TEST 1 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 2 Lapse (min.)	Volume Added (ml)	Rate (I) (ml/ min)	Infiltration Rate (I) (in./min.)	INFILTRATION TEST 3 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		TEST 2 INFILTRATION RATE		TEST 3 INFILTRATION RATE	
Inches per minute	0.00	Inches per minute	0.00	Inches per minute	0.01
Inches per hour	0.00	Inches per hour	0.00	Inches per hour	0.85
Inches per day	0.00	Inches per day	0.00	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 F:

WORKSHEETS 1 THROUGH 5, 10

STORMWATER BMP INFORMATION
CHART 5.B

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

PROJECT: Snipes Tract Athletic Fields

35.40 **Ac.**

2-Year Rainfall: 3.36 **in.**

Total Site Area: 35.40 **acres**

Protected Site Area: 10.45 **acres**

Managed Area: 24.96 **acres**

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B	763,567	17.53	55	8.18	1.64	0.30	19,085
Woodland	C	56,278	1.29	70	4.29	0.86	0.92	4,328
Meadow	B	90,004	2.07	58	7.24	1.45	0.40	2,995
Meadow	C	101,815	2.34	71	4.08	0.82	0.98	8,279
Meadow	D	49,952	1.15	78	2.82	0.56	1.39	5,794
Impervious	B/D	25,718	0.59	98	0.20	0.04	3.13	6,702
TOTAL:		1,087,334	24.96				7.12	**47,182**

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Lawn	B	670,739	15.40	61	6.39	1.28	0.51	28,571
Lawn	C	77,164	1.77	74	3.51	0.70	1.14	7,358
Lawn	D	143,936	3.30	80	2.50	0.50	1.53	18,304
Woods	C	12,391	0.28	70	4.29	0.86	0.92	953
Impervious	B/C/D	183,104	4.20	98	0.20	0.04	3.13	47,713
TOTAL:		1,087,334	24.96				7.23	**102,899**

2-Year Volume Increase (ft^3): 55,717

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

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where

   P = 2-Year Rainfall (in)

   S = (1000/CN)-10

2. Runoff Volume (CF) = Q x Area x 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.

891,839

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"/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 hrs > 72 hrs , use 24 hrs**

- **Infiltration Volume = (24 hr)(0.76"/hr)(1ft/12")(7,650 sf) = 11,628 cf**

- **Storage Volume**

  Stone = 5.0(170 feet)(45 feet)(0.40 Voids Ratio) = 15,300 cf
  Pipe = .6(3.412 sf)(170 ft){(.5(0.4+1.9)/2.0} = 184 cf
  Total Storage = 15,484 cf

- **Managed Volume = 11,628 cf + 15,484 cf = 27,112 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 = $\frac{17{,}037 \text{ cf}}{(2.38\text{"/hr})(1 \text{ ft}/12\text{"})(6{,}400 \text{ sf})}$ = 14 hrs < 72 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	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
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
TOTAL:		0	0.00				7.12	**0**

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
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
TOTAL:		528,353	12.13				6.01	**44,345**

359,959

2-Year Volume Increase (ft^3): 44,345

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

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/CN)-10
2. Runoff Volume (CF) = Q x Area x 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	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
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
TOTAL:		0	0.00				7.12	**0**

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)	
Lawn	B	171,141	3.93	61	6.39	1.28	0.51	7,290	192,814
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	
TOTAL:		228,141	5.24				6.01	**17,037**	

2-Year Volume Increase (ft^3):	**17,037**

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

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/CN)-10
2. Runoff Volume (CF) = Q x Area x 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.

Appendix D. Worksheets

Worksheet 1. General Site Information

INSTRUCTIONS: Fill out Worksheet 1 for each watershed

Date: November 16, 2016

Project Name: Snipes Tract Athletic Fields

Municipality: Lower Makefield Township

County: Bucks County

Total Area (acres): 36.26 acres

Major River Basin: Delaware River

Watershed: Delaware River South

Sub-Basin: Buck Creek

Nearest Surface Water(s) to Receive Runoff: Buck Creek

Chapter 93 – Designated Water Use/Existing Water Use: WWF (Warm Water Fishes, MF (Migratory Fishes)

Impaired according to Category 4 or 5 of the Integrated Water Quality Monitoring and Assessment Report? Yes ☐ No ☒

List Causes of Impairment:

Is there an established TMDL that applies: Yes ☐ No ☐

Total Maximum Daily Loads (TMDLS)

Is project subject to, or part of:

Municipal Separate Storm Sewer System (MS4) Requirements? Yes ☒ No ☐

Existing or planned drinking water supply? Yes ☐ No ☒

If yes, distance from proposed discharge (miles):

Approved Act 167 Plan? Yes ☒ No ☐

Existing River Conservation Plan? Yes ☐ No ☒

Worksheet 2. Sensitive Natural Resources from PA Stormwater Best Management Practices Chapter 5

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies			
Floodplains			
Riparian Areas			
Wetlands			
Woodlands			
Natural Drainage Ways			
Steep Slopes, 15% - 25%	Yes	0.16	0.08
Steep Slopes, over 25%			
Other: Steep slopes 8% to 15%	Yes	0.97	0.485
Other:			
TOTAL EXISTING:		1.13	0.565

Worksheet 3. Nonstructural BMP Credits from PA Stormwater Best Management Practices Manual (SW BMP Manual)

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0.57 **Ac.**

1.2 Area of Riparian Forest Buffer Protection (see WS 2) 0 **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading (See Chapter 8, page 21 – SW BMP Manual) 9.88 **Ac**

TOTAL 10.45 **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
35.4	-	10.45	=	24.96

This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	891,839 ft^2	x 1/4" x 1/12	=	18,580 ft^3
Meadow	ft^2	x 1/3" x 1/12	=	ft^3

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	12,391 ft^2	x 1/2" x 1/12	=	516 ft^3

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	ft^2	x 1/3" x 1/12	=	ft^3

For all other disconnected roof areas

Roof Area	5,425 ft^2	x 1/4" x 1/12	=	113 ft^3

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	ft^2	x 1/3" x 1/12	=	ft^3

For all other disconnected roof areas

Impervious Area	163,895 ft^2	x 1/4" x 1/12	=	3,414 ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* 22,624 ft

**For use on Worksheet 5*

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

PROJECT: Snipes Tract Athletic Fields
Drainage Area: _____
2-Year Rainfall: _____ in

Total Site Area: _____ acres
Protected Site Area: _____ acres
Managed Area: _____ acres

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland								
Meadow								
Impervious								
TOTAL:								

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
TOTAL:								

2-Year Volume Increase (ft3):

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

1. Runoff (in) = $Q = (P-0.2S)^2 / (P+0.8S)$ where
   P = 2-Year Rainfall (in)
   S = (1000/ CN)-10
2. Runoff Volume (CF) = Q x Area x 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 5. Structural BMP Volume Credits

PROJECT: Snipes Tract Athletic Fields
SUB-BASIN: Buck Creek/ Delaware River South

Required Control Volume (ft^3) – *from Worksheet 4*: 55,717 cf

Non-structural Volume Credit (ft^3) – *from Worksheet 3*: - 13,929 cf
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 41,788 cf

(Required Control Volume minus Non-structural Credit)

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6		Area (ft^2)	Volume Reduction Permanently Removed (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench	14,050 sf	44,149 cf
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well / Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond / Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other			

Total Structural Volume (ft^3): 44,149 cf
Structural Volume Requirement (ft^3): 41,788 cf
DIFFERENCE 2,361 cf

Worksheet 10 – Water Quality Compliance for Nitrate		
Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the equivalent) "provided across the site" is taken to mean the specifications for that BMP set forward in Sections 5 and 6 are satisfied. Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 5 & 6		
	Yes	**No**
Primary BMPs for Nitrate:	☒	☐
NS BMP 5.4.2 – Protect/Conserve/Enhance Riparian Buffers	☐	☒
NS BMP 5.5.4 – Cluster Uses at Each Site	☒	☐
NS BMP 5.6.1 – Minimize Total Disturbed Area	☒	☐
NS BMP 5.6.3 – Re-Vegetate/Re-Forest Disturbed Areas (Native Species)	☐	☒
NS BMP 5.9.1 – Street Sweeping/Vacuuming	☒	☐
Structural BMP 6.7.1 – Riparian Buffer Restoration	☐	☒
Structural BMP 6.7.2 – Landscape Restoration	☒	☐
	☐	☐
Secondary BMPs for Nitrate:	☒	☐
NS BMP 5.4.1 – Protect Sensitive/Special Value Features	☒	☐
NS BMP 5.4.3 – Protect/Utilize Natural Drainage Features	☒	☐
NS BMP 5.6.2 – Minimize Soil Compaction	☒	☐
Structural BMP 6.4.5 – Rain Garden/Bioretention	☐	☒
Structural BMP 6.4.8 – Vegetated Swale	☐	☒
Structural BMP 6.4.9 – Vegetated Filter Strip	☒	☐
Structural BMP 6.6.1 – Constructed Wetland	☐	☒
Structural BMP 6.7.1 – Riparian Buffer Restoration	☐	☒
Structural BMP 6.7.2 – Landscape Restoration	☒	☐
Structural BMP 6.7.3 – Soils Amendment/Restoration	☐	☒

Stormwater BMP Information Chart 5.B revised March 15, 2016

Proposed Structural BMPs (site specific)		Infiltration Information					Drainage Information						BMP Information					
		Measured Infiltration Rate[9]	Factor of Safety	Design Infiltration Rate	Dewatering Time[1]	Elevation of Limiting Zone - Water Table, Bedrock, etc.[2]	Total Drainage Area to BMP	Total Impervious Drainage Area to BMP	Infiltration BMP Surface Area	Total Drainage Area Loading Ratio[6]	Impervious Area Loading Ratio[7]	Volume of Runoff Tributary to BMP During the 2yr/24hr Design Storm[5]	Calculated Infiltration Volume (from storms up to and including 2yr/24hr)	Calculated Managed Volume (from storms up to and including 2yr/24hr)[8]	Maximum water surface elevation in BMP from 2yr storm[3]	Infiltration Elevation Bottom of Bed/ Basin[3]	Elevation of Infiltration Test[4]	Elevation of E&S Sediment Basin Bottom (if applies)
		in./hr.	*Min. of 2*	*in./hr.*	*hrs.*		*sq. ft*	*sq. ft.*	*sq. ft.*			*cf*	*cf*	*cf*				
BMP 6.4.1	**Pervious Pavement w/ Infiltration Bed**																	
BMP 6.4.2	**Infiltration Basin**																	
BMP 6.4.3	**Subsurface Infiltration Bed**																	
BMP 6.4.4	**Infiltration Trench**																	
	From Inlet #2 to #3	1.44	2	0.72	72	164.0	528,353	68,320	7,650	69	9	44,345	11,628	27,112	171.00	166.00	168.3	N/A
	From Inlet #18 to Inlet #22	4.75	2	2.38	14	167.5	228,140	35,327	6,400	36	6	17,037	17,037	17,037	174.00	173.00	173.0	N/A
BMP 6.4.5	**Rain Garden/Bioretention**																	
BMP 6.4.6	**Dry Well / Seepage Pit**																	
Other																		
Total									14,050				28,665	44,149				
BMP 6.4.7	**Constructed Filter**																	
BMP 6.4.8	**Vegetated Swale**																	
BMP 6.4.9	**Vegetated Filter Strip**																	
BMP 6.4.10	**Infilt. Berm & Ret. Grading**																	

All information should be based on the 2-year/24-hour storm
Provide page numbers from the stormwater narrative identifying the location of the above information.

[1] Can include active infiltration time - dewatering time should not exceed 72 hours after the 2-year/24-hour storm
[2] Depth to limiting zone is recommended to be at least 2 ft below infiltration testing elevation/proposed infiltration elevation.
[3] A maximum of 2 feet of Hydraulic head is recommended.
[4] Provide supporting field notes/documenation from soil evaluation.
[5] This value should be greater than or equal to the Volume to be Infiltrated or Managed by the BMP.
[6] A maximum of 8:1 is recommended.
[7] A maximum of 5:1 is recommended; however, in carbonate geology areas, a maximum of 3:1 is recommended.
[8] Calculated runoff volume that is managed in ways other than infiltration to address 25 PA Code Ch 102.8(g)(2)
[9] The infiltration testing information should be located on the plan view of the PCSM Plan and should include infiltration test elevation and rate.

Any deviations from the recommendations above should be adequately justified by a qualified professional and included with the application.

NOTE: This chart is for summary purposes only and should be consistent with all design calculations and worksheets.

APPENDIX G:

NOI REQUIRED DOCUMENTS

STANDARD E&S WORKSHEET # 22
PLAN PREPARER RECORD OF TRAINING AND EXPERIENCE IN EROSION AND SEDIMENT POLLUTION CONTROL METHODS AND TECHNIQUES
and Post Construction Stormwater Management (PCSM) design 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,MS4Permit 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

DATE:
PROJECT NAME: Snipes Tract Athletic Fields
TMP: 20-016-001-001, 20-016-002
TOWNSHIP: Lower Makefield Township

Pursuant to the EPA eReporting Rule of October 22, 2015, please provide the following list of required permit data:

1. ***Primary NAICS Code.*** *Provide the appropriate six-digit North American Industry Classification System (NAICS pronounced nākes) code that represents the primary economic activity of the project site. If choosing other, the most up-to-date list of NAICS codes can be found on the NAICS website (part of the US Census Bureau) at http://www.census.gov/eos/www/naics/ (find the "Downloads" list on the left side of the screen for the latest list of codes):*

   - ☐ *236115 New Single-Family Housing Construction (except For-Sale Builders)*
   - ☐ *236116 New Multifamily Housing Construction (except For-Sale Builders)*
   - ☐ *236117 New Housing For-Sale Builders*
   - ☐ *236210 Industrial Building Construction*
   - ☐ *236220 Commercial and Institutional Building Construction*
   - ☐ *237110 Water and Sewer Line and Related Construction*
   - ☐ *237120 Oil and Gas Pipeline and Related Structures Construction*
   - ☐ *237130 Power and Communication Line and Related Structures Construction*
   - ☐ *237310 Highway, Street, and Bridge Construction*
   - ☐ *237990 Other Heavy and Civil Engineering Construction*
   - ☒ ***Other NAICS code: NAICS Code 713940 Fitness and Recreational Sports Centers***

2. ***Additional NAICS Code(s).*** *Provide any additional six-digit North American Industry Classification System code(s) that represents the economic activity of the project site. More than one six-digit code may be provided.*
3. ***Type of Ownership.*** *Provide the type of facility located at the project site:*
   - ☐ *County Government*
   - ☐ *Federal Facility (U.S. Government)*
   - ☐ *Mixed Ownership (e.g. Public/Private)*
   - ☒ ***Municipality (local)***
   - ☐ *Non-Government*
   - ☐ *School District*
   - ☐ *State Government*

1. PROJECT INFORMATION

Project Name: **Snipes Athletic Fields**
Date of Review: **10/25/2016 11:10:50 AM**
Project Category: **Recreation, Campgrounds/parking lots, playgrounds**
Project Area: **40.34 acres**
County(s): **Bucks**
Township/Municipality(s): **LOWER MAKEFIELD**
ZIP Code: **19067**
Quadrangle Name(s): **LANGHORNE; TRENTON WEST**
Watersheds HUC 8: **Middle Delaware-Musconetcong**
Watersheds HUC 12: **Buck Creek-Delaware River**
Decimal Degrees: **40.247412, -74.873235**
Degrees Minutes Seconds: **40° 14' 50.6815" N, 74° 52' 23.6450" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

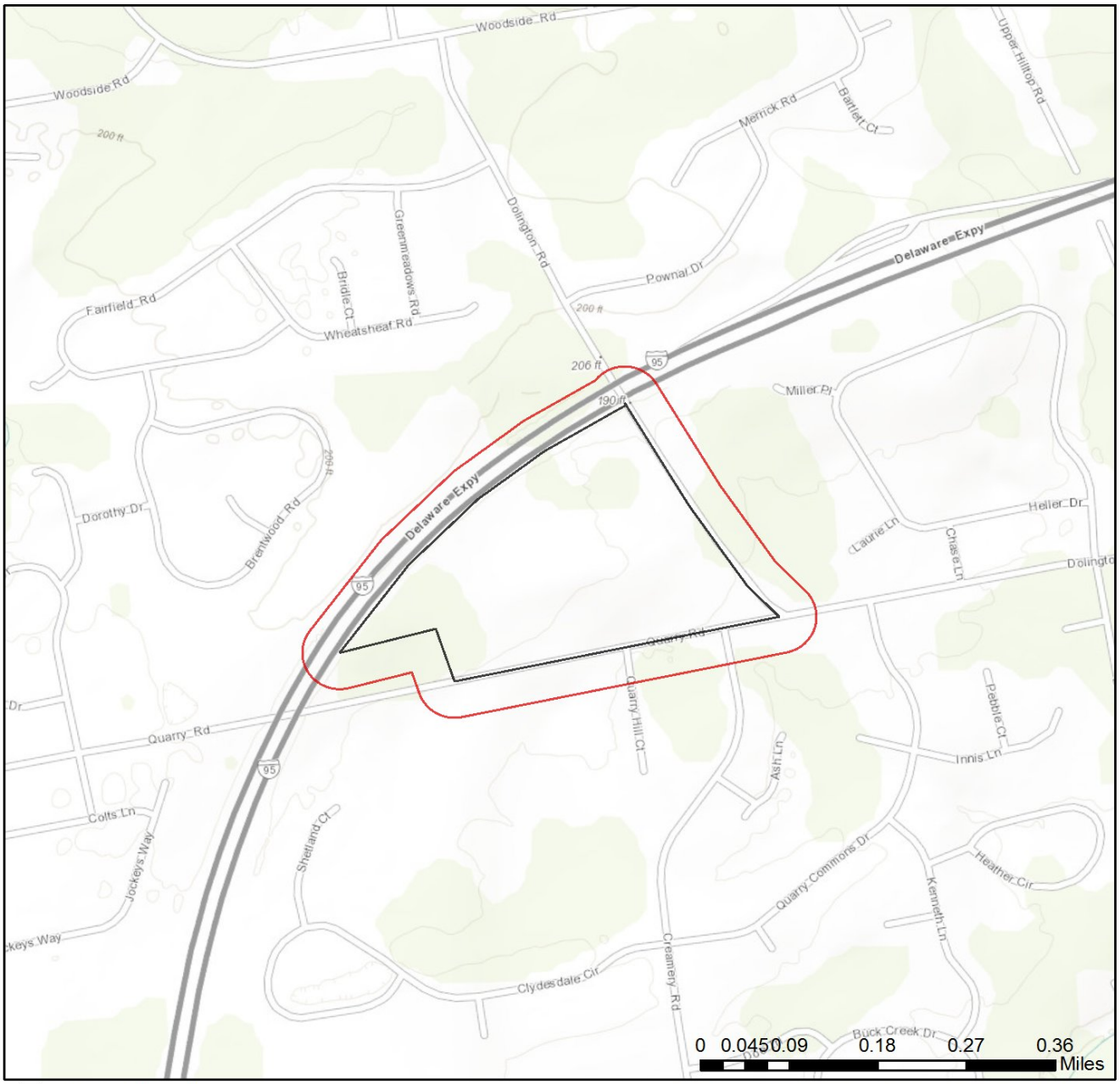
Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

Snipes Athletic Fields

Project Boundary

Buffered Project Boundary

Snipes Athletic Fields



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE:

No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Sensitive Species**		Endangered

U.S. Fish and Wildlife Service

RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictional agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, upload* or email* the following information to the agency(s). Instructions for uploading project materials can be found here. This option provides the applicant with the convenience of sending project materials to a single location accessible to all three state agencies. Alternatively, applicants may email or mail their project materials (see AGENCY CONTACT INFORMATION).
***Note:** U.S.Fish and Wildlife Service requires applicants to mail project materials to the USFWS PA field office (see AGENCY CONTACT INFORMATION). USFWS will not accept project materials submitted electronically (by upload or email).

Check-list of Minimum Materials to be submitted:
_x__Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
_x__A map with the project boundary and/or a basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
In addition to the materials listed above, USFWS REQUIRES the following
_x__**SIGNED** copy of a Final Project Environmental Review Receipt

The inclusion of the following information may expedite the review process.
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name: Maryellen Saylor, P.E.
Company/Business Name: Boucher & James, Inc.
Address: 1456 Ferry Road, Building 500,
City, State, Zip: Doylestown, PA 18901
Phone:(215) 345-9400 ext. 118 Fax:(215) 345-9401
Email: msaylor@bjengineers.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

_____ _____
applicant/project proponent signature date

Pennsylvania Fish & Boat Commission
established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823
814-359-5237

November 22, 2016

IN REPLY REFER TO
SIR# 46851

Boucher & James, Inc.
Kim Mcleod
1456 Ferry Road
Quakertown, Pennsylvania 18951

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 614582_2
Snipes Athletic Fields
BUCKS County: Lower Makefield Township

Dear Kim Mcleod:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search "potential conflict" or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

An element occurrence of a rare, candidate, threatened, or endangered species under our jurisdiction is known from the vicinity of the proposed project. However, given the nature of the proposed project, the immediate location, or the current status of the nearby element occurrence(s), no adverse impacts are expected to the species of special concern.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

If you have any questions regarding this review, please contact Kathy Gipe at 814-359-5186 and refer to the SIR # 46851. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/dn

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AN EMPLOYEE OWNED COMPANY
INNOVATIVE ENGINEERING

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Fax 215-345-9401

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Stroudsburg, PA 18360
570-629-0300
Fax 570-629-0306

559 Main Street, Suite 230
Bethlehem, PA 18018
610-419-9407
Fax 610-419-9408

www.bjengineers.com

February 1, 2017

Ms. Rene Moyer, Permits Coordinator
Bucks County Conservation District
1456 Ferry Road, Bldg. 704
Doylestown, PA 18901

SUBJECT: ACT 167 PLAN CONSISTENCY
PERMIT APPLICATION NOTICE OF INTENT FOR COVERAGE UNDER THE GENERAL (PAG-02) NPDES PERMIT
SNIPES TRACT ATHLETIC FIELDS
PRELIMINARY / FINAL LAND DEVELOPMENT PLAN
LOWER MAKEFIELD TOWNSHIP
TAX MAP PARCEL NO'S 20-016-001-001 & 20-016-002
PROJECT NO. 16-77-054L

Dear Rene:

The Post Construction Stormwater Management Plan for the above referenced project is consistent with the Lower Makefield Township Act 167 Plan (Chapter 173 Stormwater Management - Delaware River South Watershed, Ordinance No. 389).

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

Sincerely,

Mark W. Eisold, P.E.
Township Engineer

MWE/MESkam

CC: Terry Fedorchak, Township Manager
Steve Ware, Planning & Zoning Administrator

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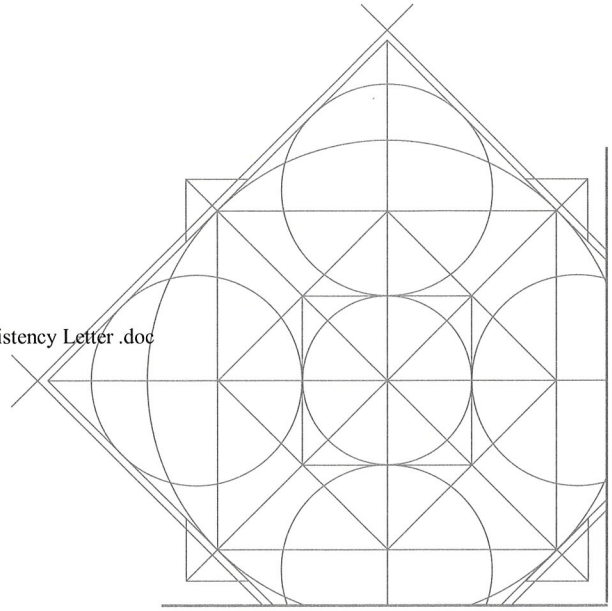

APPENDIX A

Land Use Information Questions

Responses to the following questions are required to determine applicability of DEP's Land Use Policy for Permitting of Infrastructure and Facilities.

Note: Applicants are encouraged to submit copies of local zoning approvals with their authorization application.

LAND USE INFORMATION		
1.	Is there an adopted county or multi-county comprehensive plan?	Yes ☒ No ☐
2.	Is there an adopted municipal or multi-municipal comprehensive plan?	Yes ☒ No ☐
3.	Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?	Yes ☒ No ☐
If the applicant answers NO to either Question 1, 2, or 3, the provisions of the PA MPC are not applicable and the applicant does not need to respond to questions 4 and 5 below. *If the applicant answers YES to questions 1, 2 and 3, the applicant should respond to questions 4 and 5 below.*		
4.	Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval? *If zoning approval has been received, attach documentation.*	Yes ☒ No ☐
5.	Have you attached Municipal and County Land Use Letters for the project?	Yes ☒ No ☐

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February 1, 2017

Mr. Steve Ware, Planning & Zoning Administrator
Lower Makefield Township
1100 Edgewood Road
Yardley, PA 19067

SUBJECT: ACT 67, 68 AND 127 NOTIFICATION
SNIPES TRACT ATHLETIC FIELDS
QUARRY ROAD AND DOLINGTON ROAD
LOWER MAKEFIELD TOWNSHIP
TAX MAP PARCEL NO. 20-016-001-001 & 20-016-002
PROJECT NO. 16-77-054L

Dear Steve:

We are in receipt of the Acts 14, 67, 68 and 127 notification letter, dated January 6, 2017, and the attached Appendix C Municipal Land Use Letter form (PADEP NPDES Permit application) for the above referenced project. The Lower Makefield Township Zoning Ordinance is generally consistent with the Municipal Comprehensive Plan and the County Comprehensive Plan. The project meets the provisions of the Lower Makefield Township Zoning Ordinance. We have completed the form on behalf of the Township and have enclosed it with this letter.

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

Sincerely,

Mark W. Eisold, P.E.
Township Engineer

MWE/MES/kam

CC: Terry Fedorchak, Township Manager
Lower Makefield Township Board of Supervisors
David Truelove, Esq., Township Solicitor

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APPENDIX C
SAMPLE MUNICIPAL LAND USE LETTER

Date: January 30, 2017

To: Terry Fedorchak, Township Manager(Name of Applicant)

From: Lower Makefield Township/[redacted]

Re: Lower Makefield Township Snipes Athletic Fields (Name of DEP Permittee)

The municipality of Lower Makefield states that it:
X has adopted a municipal or multi-municipal comprehensive plan.
If yes, please provide date of adoption: October 20, 2003

_____ has not adopted a municipal or multi-municipal comprehensive plan.

The municipality of Lower Makefield states that it:
X has adopted a county zoning ordinance, or a municipal or joint-municipal zoning ordinance.
_____ has not adopted a county zoning ordinance, or a municipal or joint-municipal zoning ordinance.

If applicable:

The municipality of Lower Makefield states that its zoning ordinance is generally consistent with its municipal comprehensive plan and the county comprehensive plan.

The above referenced proposed project
_____ meets the provisions of the local zoning ordinance

If zoning approval is required for the project to proceed, the above referenced project:
X has received zoning approval.
_____ has not received zoning approval.

If the proposed project has not received zoning approval:

What is the status of the zoning request for the proposed project? (e.g., Special Exception Approval from the Zoning Hearing Board required, Conditional Use approval from the Governing Body required)

Zoning Variances were granted to the Township by the Lower Makefield Township Zoning Hearing Board at their November 15, 2016 public Meeting.

Is there a legal challenge by the applicant with regard to zoning for the proposed project?

Name and Contact Information for Municipal Zoning Officer:

Additional Comments (attach additional sheets if necessary):

Submitted By:

Name	Mark W. Eisold, P.E.
Title	Township Engineer
Contact Information (Address & Phone)	Boucher & James, Inc. (215)345-9400 1456 Ferry Road, Bldg 500, Doylestown, PA 18901
Signature	Mark W. Eisold
Date	2-1-17

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Bethlehem, PA 18018
610-419-9407
Fax 610-419-9408

www.bjengineers.com

January 31, 2017

COUNTY LAND USE LETTER
CERTIFIED MAIL NO. 7015 1730 0002 1259 3750

Ms. Lynn T. Bush
Executive Director
Bucks County Planning Commission
1260 Almshouse Road
Doylestown, PA 18901

Dear Ms. Bush:

Acts 14, 67, 68 and 127, which amended the Municipalities Planning Code, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities and infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code. The Pennsylvania Department of Environmental Protection's Policy for Consideration of Local Comprehensive Plans and Zoning Ordinances in DEP Review of Permits for Facilities and Infrastructure (DEP's Land Use Policy) provides direction and guidance to DEP staff, permit applicants, and local and county governments for the implementation of Acts 67, 68 and 127 of 2000. This policy can be found at www.dep.pa.gov; keyword: Land Use.

In accordance with DEP's Land Use Policy, enclosed please find a County Land Use Letter that is to be submitted with our permit application to DEP for an NPDES Permit for Stormwater Discharges Associated with Construction Activities. Please complete the attached form and return within 30 days to:

Name of Applicant: Lower Makefield Township

Address of Applicant: 1100 Edgewood Road, Yardley, PA 19067

Project Location: Quarry Road and Dolington Road, Lower Makefield Township, Bucks Co., PA (Northwest and adjacent to the Intersection)

Project Description: Lower Makefield 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 and biking trail system, and stormwater management/ infiltration facilities on the site. The site is proposed to be served by public water and sewer service. The disturbance of trees will be minimized with the proposed project design. The property is zoned R-1 Residential Low-Density and a Public Recreational Facility is a permitted use within this zoning district.

Please do not send this form to DEP, as we must include the County Land Use Letter with our permit application. If we do not receive a response from you **within 30 days**, we shall proceed to submit our permit application to DEP without the County Land Use Letter. If the County Land Use Letter is not submitted with our permit application, and we provide proof to DEP that we attempted to obtain it, DEP will assume there are no substantive land use conflicts and proceed with the normal application review process.

If you have any questions, please do not hesitate to contact me at (215) 345-9400.

Sincerely,

Maryellen Saylor

Maryellen Saylor, P.E.
Project Engineer

MES/kam

Attachment – County Land Use Letter

cc: Bucks County Commissioners

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APPENDIX B
SAMPLE COUNTY LAND USE LETTER

Date: _____

To: Terry Fedorchak, Township Manager (Name of Applicant)

From: Bucks County Planning Agency/Commission

Re: Lower Makefield Township Snipes Tract Athletic Fields (Name of DEP Permittee)

The County of Bucks states that it:

_____ has adopted a county or multi-county comprehensive plan.
If yes, please provide date of adoption: December 21, 2011

_____ has not adopted a county or multi-county comprehensive plan.

If applicable:

The above referenced project:

___ is consistent with the adopted county or multi-county comprehensive plan.
___ is not consistent with the adopted county or multi-county comprehensive plan.

Additional Comments (attach additional sheets if necessary):

_____

_____

_____

_____

Submitted By:

Name	
Title	
Contact Information (Address & Phone)	
Signature	
Date	

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Bethlehem, PA 18018
610-419-9407
Fax 610-419-9408

www.bjengineers.com

January 31, 2017

MUNICIPAL LAND USE LETTER
CERTIFIED MAIL NO. 7015 1730 0002 1259 3743

Mr. Steve Ware
Planning & Zoning Administrator
Lower Makefield Township
1100 Edgewood Road
Yardley, PA 19067-1696

Dear Steve:

Acts 14, 67, 68 and 127, which amended the Municipalities Planning Code, direct state agencies to consider comprehensive plans and zoning ordinances when reviewing applications for permitting of facilities and infrastructure, and specify that state agencies may rely upon comprehensive plans and zoning ordinances under certain conditions as described in Sections 619.2 and 1105 of the Municipalities Planning Code. The Pennsylvania Department of Environmental Protection's Policy for Consideration of Local Comprehensive Plans and Zoning Ordinances in DEP Review of Permits for Facilities and Infrastructure (DEP's Land Use Policy) provides direction and guidance to DEP staff, permit applicants, and local and county governments for the implementation of Acts 67, 68 and 127 of 2000. This policy can be found at www.dep.pa.gov, keyword: Land Use.

In accordance with DEP's Land Use Policy, enclosed please find a Municipal Land Use Letter that is to be submitted with our permit application to DEP for an NPDES Permit for Stormwater Discharges Associated with Construction Activities. Please complete the attached form and return within 30 days to:

Name of Applicant: Lower Makefield Township

Address of Applicant: 1100 Edgewood Road, Yardley, PA 19067

Project Location: Quarry Road and Dolington Road, Lower Makefield Township, Bucks Co., PA (Northwest and adjacent to the Intersection)

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Please do not send this form to DEP, as we must include the Municipal Land Use Letter with our permit application. If we do not receive a response from you **within 30 days**, we shall proceed to submit our permit application to DEP without the Municipal Land Use Letter. If the Municipal Land Use Letter is not submitted with our permit application, and we provide proof to DEP that we attempted to obtain it, DEP will assume there are no substantive land use conflicts and proceed with the normal application review process.

If you have any questions, please do not hesitate to contact me at (215) 345-9400.

Sincerely,

Maryellen Saylor

Maryellen Saylor, P.E.
Project Engineer

MES/kam

Attachment –Municipal Land Use Letter

cc: Jeffrey Benedetto, Chairman of the Board

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APPENDIX C
SAMPLE MUNICIPAL LAND USE LETTER

Date: January 30, 2017

To: Terry Fedorchak, Township Manager(Name of Applicant)

From: Lower Makefield Township/[redacted]

Re: Lower Makefield Township Snipes Athletic Fields (Name of DEP Permittee)

The municipality of Lower Makefield states that it:
X has adopted a municipal or multi-municipal comprehensive plan.
If yes, please provide date of adoption: October 20, 2003

_____ has not adopted a municipal or multi-municipal comprehensive plan.

The municipality of Lower Makefield states that it:
X has adopted a county zoning ordinance, or a municipal or joint-municipal zoning ordinance.
_____ has not adopted a county zoning ordinance, or a municipal or joint-municipal zoning ordinance.

If applicable:

The municipality of Lower Makefield states that its zoning ordinance is generally consistent with its municipal comprehensive plan and the county comprehensive plan.

The above referenced proposed project
_____ meets the provisions of the local zoning ordinance

If zoning approval is required for the project to proceed, the above referenced project:
X has received zoning approval.
_____ has not received zoning approval.

If the proposed project has not received zoning approval:

What is the status of the zoning request for the proposed project? (e.g., Special Exception Approval from the Zoning Hearing Board required, Conditional Use approval from the Governing Body required)

Zoning Variances were granted to the Township by the Lower Makefield Township Zoning Hearing Board at their November 15, 2016 public Meeting.

Is there a legal challenge by the applicant with regard to zoning for the proposed project?

Name and Contact Information for Municipal Zoning Officer:

Additional Comments (attach additional sheets if necessary):

Submitted By:

Name	Mark W. Eisold, P.E.
Title	Township Engineer
Contact Information (Address & Phone)	Boucher & James, Inc. (215) 345-9400 1456 Ferry Road, Bldg 500, Doylestown, PA 18901
Signature	
Date	

APPENDIX H:

PCSM COMPLETENESS REVIEW CHECKLIST

Item Location: D = PCSM Drawings, N = PCSM Narrative, D or N = Drawings or Narrative
D & N = Drawings and Narrative

General PCSM planning and design 102.8(b)

PCSM Plan - General

Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14 PCSM N 4	☐	☐	The PCSM Plan is separate from the E&S Plan and labeled ‘‘PCSM’’ or ‘‘Post Construction Stormwater Management Plan’’ and is the final plan for construction.	D & N
☒	PCSM N G-11	☐	☐	Municipal or county engineer consistency letter provided	N
☒	PCSM N 6	☐	☐	Act 167 plan is dated January 2005 or later	N
☒	PCSM N G-1	☐	☐	Documentation provided that PCSM Plan was prepared by person trained and experienced in PCSM design methods and techniques applicable to the size and scope of the project	N
☒	PCSM N 4	☐	☐	Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream	D or N
☒	PCSM N 4	☐	☐	Prevent an increase in the rate of stormwater runoff	D or N
☒	PCSM N 4	☐	☐	Minimize any increase in stormwater runoff volume	D or N
☒	D 11 of 14 PCSM N 4	☐	☐	Minimize impervious areas	D & N
☒	D 11 of 14 PCSM N 4	☐	☐	Maximize the protection of existing drainage features and existing vegetation	D & N
☒	D 11 of 14 PCSM N 4	☐	☐	Minimize land clearing and grading	D & N
☒	D 11 of 14	☐	☐	Minimize soil compaction	D or N
☒	D 11,12 of 14 PCSM N 4	☐	☐	Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff	D & N

Existing topographic features of the project site and the immediate surrounding area §102.8(f)(1)

Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14	☐	☐	Topographic map(s) of the project site provided	D
☒	D 11 of 14	☐	☐	Location map (USGS quadrangle) provided	D
☒	D 11 of 14	☐	☐	Type of cover	D

Types, depth, slope, locations and limitations of the soils and geologic formations §102.8(f)(2)

Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14	☐	☐	Soil map provided	D
☒	D 11 of 14	☐	☐	Soil use limitations and their resolutions provided	D or N
☒	D 11 of 14 PCSM N E-1 to E-21	☐	☐	Site characterization of soil and geology, including appropriate infiltration and geological studies that identify location, depths, and methodology	D & N
☒	PCSM N E-3	☐	☐	Geologic mapping features addressed where appropriate	D or N

Characteristics of the project site, including the past, present and proposed land uses and the proposed alteration to the project site §102.8(f)(3)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14	☐	☐	Permit boundaries	D
☒	D 11 of 14	☐	☐	Proposed limits of disturbance	D
☒	D 11 of 14	☐	☐	Proposed contours and grades	D
☒	D 11 of 14	☐	☐	Proposed improvements (i.e. roads, buildings, utilities etc.)	D
☒	PCSM N 3&4	☐	☐	Past, present and proposed land uses	N
☒	D 11 of 14	☐	☐	Proposed waterways and stormwater management facilities shown on the plan maps	D
☒	D 11 of 14	☐	☐	Proposed impervious areas minimized & shown on plan map(s)	D
Net change in volume and rate of stormwater §102.8(f)(4)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	PCSM N F-4	☐	☐	Design storm used for calculations identified *Worksheet 4	N
☒	PCSM N F-4	☐	☐	Pre- and post-construction hydrology runoff rate and volume are identified for the each drainage area of entire project site *Worksheet 4	N
☒	PCSM N F-4	☐	☐	The net change in runoff rate and volume are identified for each drainage area of the entire project site *Worksheet 4	N
☒	PCSM N B-2 C-2 & F-4	☐	☐	Summary table in NOI consistent with runoff calculations, when applicants have utilized the manual to meet design standards	N
☒	N/A	☐	☐	Documentation summarizing the PCSM requirements (rate, volume, and water quality) for a DEP approved Act 167 plan, if applicable	N
☒	N/A	☐	☐	Documentation summarizing the alternative approach's design criteria for rate, volume and water quality, if applicable	N
Receiving surface waters §102.8(f)(5)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14	☐	☐	Existing streams, wetlands, floodways, and watercourses shown on plan map(s)	D
☒	D 11 of 14	☐	☐	Existing and designated uses identified	D or N
☒	N/A	☐	☐	Boundaries for HQ or EV watersheds shown on plan map(s)	D
☒	N/A	☐	☐	Wetland boundaries consistent with delineation report	D
Written Description of the PCSM BMPs §102.8(f)(6)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11,12 of 14 PCSM N 5	☐	☐	All permanent PCSM BMPs identified in the narrative and shown on plan drawings	D & N
☒	D 12 of 14	☐	☐	Specifications for all permanent PCSM BMPs provided	D
☒	D 12 of 14	☐	☐	Proprietary BMP systems are illustrated on the drawings in accordance with their manufacturer's requirements	D
Sequence of PCSM BMP implementation or installation §102.8(f)(7)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 of 14	☐	☐	Complete and site specific sequence of BMP installations provided	D
☒	D 11 of 14	☐	☐	Construction sequence addresses all structural BMPs	D
☒	D 12 of 14	☐	☐	Sequence for individual BMP installation	D
☒	D 11 of 14	☐	☐	Critical stages of BMP installation are identified	D
☒	D 11 of 14	☐	☐	Protection provided for infiltration BMPs until drainage areas completely stabilized	D

Supporting calculations §102.8(f)(8)					
Applicant		Reviewer		*Worksheets 1-5 and 10 and Predev and Post Dev Hydrographs and Routing Calculations	
Included	Page Number	C	NC	Item	Item Location
☒	PCSM N F-1	☐	☐	Worksheets from the Stormwater BMP Manual provided when applicants have utilized the manual to meet design standards	N
☒	PCSM N B-2, C-2, F-4	☐	☐	Figures contained on worksheets consistent with those in NOI/application when applicants have utilized the manual to meet design standards	N
☒	PCSM N C-1, D-1, F-1 to 11	☐	☐	Calculations for all permanent BMPs and points of interest provided	N
☒	PCSM N 6 B-1 to B-32 C-1 to C-48, F-1 to 6	☐	☐	Methodology used for all calculations is identified. Calculations demonstrating that rate, volume, and water quality were met in accordance with 102.8(g)(2)(i-iii) and 102.8(g)(3)(i-ii) AND/OR a DEP approved Act 167 plan OR an alternative approach	N
☒	PCSM N C-1 to C-48	☐	☐	Routing analysis to demonstrate peak control for the 2-, 10-, 50-, and 100-year/24-hour storm events, which considers benefits of proposed BMPs provided	N
Plan drawings §102.8(f)(9)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 11 OF 14	☐	☐	Locations of all proposed BMPs shown along with tributary drainage areas	D
☒	D 11 OF 14	☐	☐	Existing and proposed discharges & points of interest shown	D
☒	D 11 OF 14	☐	☐	PCSM Plan drawings consistent with E&S Plan in relation to proposed contours, improvements, soils, wetlands, floodways, streams, discharge locations, etc.	D
☒	D 12 OF 14	☐	☐	Construction details provided for all PCSM BMPs	D
☒	D 11&12 OF 14 PCSM N C-1 to 48	☐	☐	Dimensions and elevations consistent with those used in supporting calculations	D & N
Long-term operation and maintenance schedule §102.8(f)(10)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 12 OF 14	☐	☐	Inspection schedule of each permanent BMP is provided	D
☒	D 12 OF 14	☐	☐	Directions for maintenance and/or replacement of each BMP provided	D
Recycling or disposal of materials §102.8(f)(11)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	D 12 OF 14	☐	☐	Project wastes identified	D
☒	D 12 OF 14	☐	☐	Directions for recycling /disposal of wastes provided	D
Geologic formations or soil conditions §102.8(f)(12)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	PCSM N 4 PCSM E-3	☐	☐	Potential for geologic or soil conditions to cause pollution during construction identified	N
☒	D 12 OF 14	☐	☐	Instructions for proper handling and/or disposal of all materials which could cause pollution are provided	D
☒	D 12 OF 14	☐	☐	Typical details & instructions provided for proper handling and/or disposal of all such materials	D
☒	D 12 OF 14	☐	☐	Locations of all such materials clearly shown on plan maps	D

Potential thermal impacts §102.8(f)(13)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	PCSM N 4	☐	☐	Description provided of how thermal impacts of stormwater runoff from project site were avoided, minimized, or mitigated	N

Riparian forest buffer management plan §102.8(f)(14)					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☐	N/A	☐	☐	Existing and/or proposed riparian forest buffers shown on plan map(s)	D
☐	N/A	☐	☐	Impairment and TMDL status of the receiving water(s) for the project indicated	N
☐	N/A	☐	☐	Riparian buffer offset areas shown, if necessary	D & N
☐	N/A	☐	☐	Riparian buffer or riparian forest buffer equivalency demonstration included, if necessary	D & N
☐	N/A	☐	☐	Checklist for functional equivalency of riparian buffers and riparian buffers included	N

COMPLETENESS ITEMS BY PERMIT TYPE

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

Item Location: D = E&S/PCSM Drawings, N = E&S/PCSM Narrative, D or N = Drawings or Narrative
D & N = Drawings and Narrative

CHECKLIST FOR NEW NPDES PERMITS					
Applicant		Reviewer			
Included	Page Number	C	NC	Item	Item Location
☒	Checklist 1-8 E&S N G-1 PCSM N H-1	☐	☐	1. All items included in the standard E&S and PCSM completeness review checklist	N

CHECKLIST FOR NPDES PERMIT RENEWALS					
Applicant		Reviewer		N/A	
Included	Page Number	C	NC	Item	Item Location
☐		☐	☐	1. If no changes have been made to the approved E & S and PCSM plan, the applicant does not need to submit these plans and letters again. However, if changes have been made to the plans, the revised plans must be resubmitted for approval and all letters must be reapplied for and included.	

CHECKLIST FOR PHASED NPDES PERMIT					
Applicant		Reviewer		N/A	
Included	Page Number	C	NC	Item	Item Location
☐		☐	☐	1. All items included in new NPDES permit application	
☐		☐	☐	2. Anticipated project plan for entire project	
☐		☐	☐	3. Estimated time frame for phases	

CHECKLIST FOR NPDES PERMIT MAJOR AMENDMENT					
Applicant		Reviewer		N/A	
Included	Page Number	C	NC	Item	Item Location
☐		☐	☐	1. All items included in new NPDES permit application.	

MAJOR SOIL PROPERTIES AND ESTIMATED DEGREE OF LIMITATION

MAP SYMBOL	SOIL	HYDROLOGIC SOIL GROUP	DEPTH TO		SOILS FEATURES THAT AFFECT:
			HWT (FT)	BEDROCK (IN)	SHALLOW EXCAVATIONS
AbB	ABBOTTSTOWN SILT LOAM – 3–8% SLOPES	D	0.5'–1.5'	40"–60"	VERY LIMITED DEPTH TO SATURATED ZONE
FoB	FOUNTAINVILLE SILT LOAM – 3–8% SLOPES	C	1.5'–2.5'	40"–60"	VERY LIMITED DEPTH TO SATURATED ZONE LIMITED DEPTH TO BEDROCK
PnB	PENN–LANSDALE COMPLEX – 3–8% SLOPES	B	>6.5'	20"–40"	NOT LIMITED

SOURCE: SOIL INFORMATION WERE OBTAINED FROM WEB SOIL SURVEY MAPS OF BUCKS COUNTY, PENNSYLVANIA DATED OCTOBER 14, 2013 BY THE NATURAL RESOURCES CONSERVATION SERVICE.

NOTES

BOUNDARY INFORMATION AND EXISTING FEATURES SHOWN HEREON BASED ON A SURVEY PERFORMED BY BOUCHER & JAMES INC IN JULY AND AUGUST OF 2016 AND REPRESENTS EXISTING CONDITIONS AT THAT TIME.

BEARINGS SHOWN HEREON BASED ON NAD 83 STATE PLANE COORDINATES.

THE SITE IS LOCATED IN ZONE X, OUTSIDE THE 100 FLOODPLAIN BASED ON THE FLOOD INSURANCE RATE MAP FOR LOWER MAKEFIELD TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA ON MAP #42017C0453J, PANEL 453 OF 532, EFFECTIVE DATE: MARCH 16, 2015 AS PUBLISHED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).

LEGEND

- ADJOINER LINE
- EXISTING BOUNDARY
- EXISTING BUILDINGS
- EXISTING CONTOUR
- EXISTING INDEX CONTOUR
- EXISTING CURBLINE
- EXISTING DRIVEWAY
- EXISTING ELECTRIC STRUCTURES
- EXISTING EDGE OF PAVEMENT
- EXISTING CHAINLINK FENCE
- EXISTING FIRE HYDRANT
- EXISTING GUIDE RAIL
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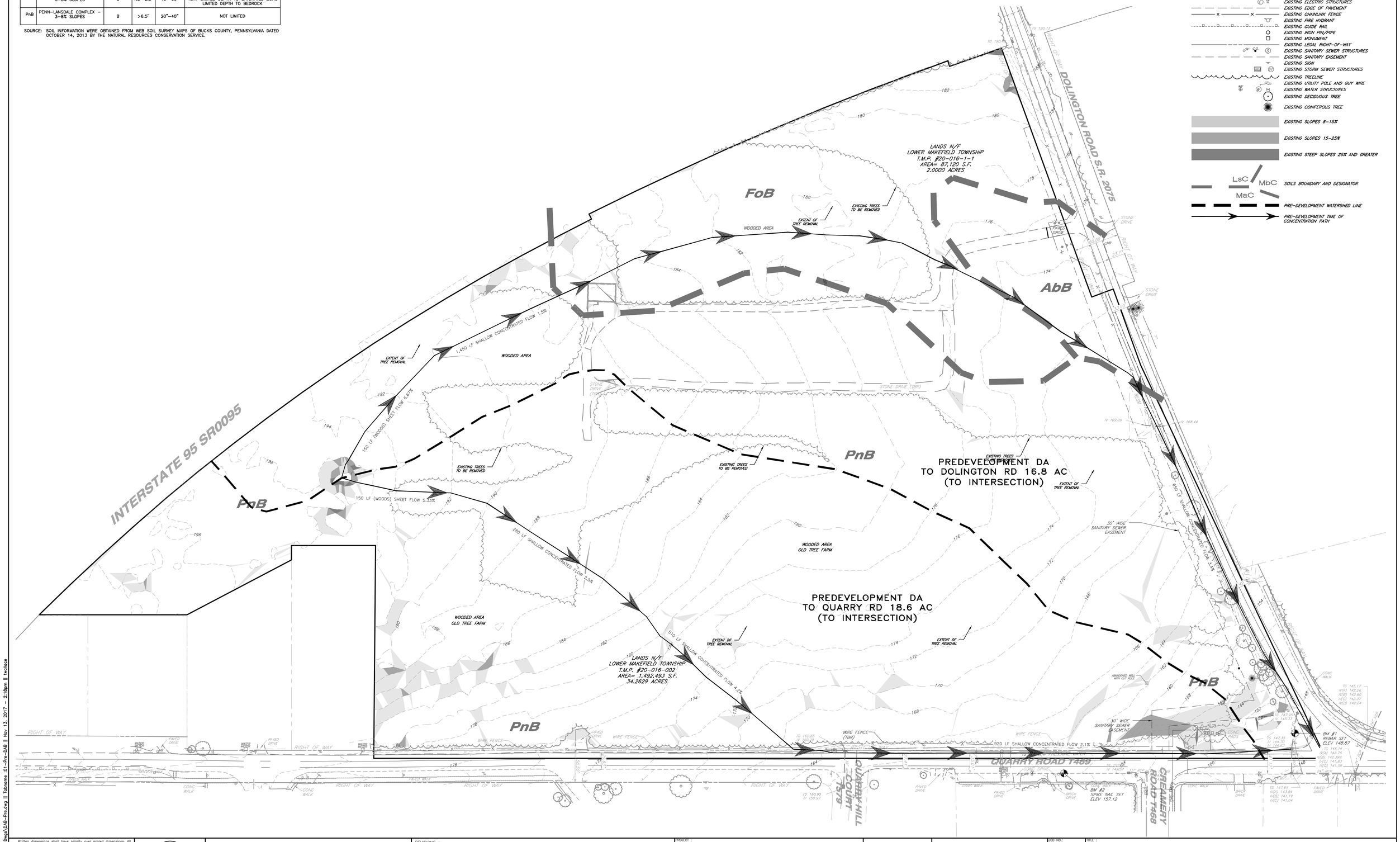
- EXISTING SANITARY SEWER STRUCTURES
- EXISTING SANITARY EASEMENT
- EXISTING SIGN
- EXISTING STORM SEWER STRUCTURES
- EXISTING TREELINE
- EXISTING UTILITY POLE AND GUY WIRE
- EXISTING WATER STRUCTURES
- EXISTING DECIDUOUS TREE
- EXISTING CONIFEROUS TREE
- EXISTING SLOPES 8–15%
- EXISTING SLOPES 15–25%
- EXISTING STEEP SLOPES 25% AND GREATER
- SOILS BOUNDARY AND DESIGNATOR (LsC, MbC, MaC)
- PRE-DEVELOPMENT WATERSHED LINE
- PRE-DEVELOPMENT TIME OF CONCENTRATION PATH



REVISIONS :			
DATE	DESCRIPTION	DATE	DESCRIPTION
01/31/17	PLANS UPDATED WITH INFILTRATION PIT LOCATIONS AND NPDES NOTES		
05/02/17	PER ENGINEER REVIEW LETTER		
05/16/17	PER ENGINEER & EAC REVIEW LETTERS		
05/19/17	REVISED INFILTRATION TRENCH INLET 2 TO 3		
06/07/17	REVISED PER CONDITIONS OF APPROVAL		
06/30/17	REVISED PER PRE-BID MEETING		
07/07/17	REVISED PER ADDENDUM 2		
10/20/17	REVISED EXISTING AND PROPOSED WATER LINE		

PROJECT :
SNIPES TRACT ATHLETIC FIELDS
LOWER MAKEFIELD TOWNSHIP
BUCKS COUNTY, PENNSYLVANIA

APPLICANT :
LOWER MAKEFIELD TOWNSHIP
1100 EDGEWOOD ROAD
YARDLEY, PA 19067

0 30 60 120 180
SCALE : 1"= 60'

JOB NO.: 1677054L
DRAWN BY: TMW
CHECKED BY: MES
SCALE: 1" = 60'
PLAN STATUS: PRELIMINARY

TITLE : PRE–DEVELOPMENT DRAINAGE AREA MAP

Boucher & James, Inc.
CONSULTING ENGINEERS
DOYLESTOWN ❖ STROUDSBURG ❖ LEHIGH VALLEY
CORPORATE HEADQUARTERS: 1456 FERRY RD, BUILDING 500, DOYLESTOWN, PA. 18901
VOICE: (215) 345-9400 FAX: (215) 345-9401
www.bjengineers.com

PROJECT NAME : SNIPES TRACT ATHLETIC FIELDS

DATE: NOVEMBER 14, 2016

P:\2016\1677054\Dwg\Final Dwgs\DA&B-Pre.dwg || Tahoma, .01-Pre-DAB || Nov. 13, 2017 - 2:18pm || twallace

B.M.P. OPERATIONS & MAINTENANCE NOTES

GENERAL

1. THE OWNER/APPLICANT, LOWER MAKEFIELD TOWNSHIP, SHALL BE RESPONSIBLE TO INSPECT AND MAINTAIN B.M.P. MEASURES AS DESCRIBED BELOW.
2. GENERAL INSPECTIONS SHALL BE PERFORMED ON AN ANNUAL BASIS, AND AFTER EACH RAIN EVENT EXCEEDING ONE (1) INCH OF RAINFALL.
3. INSPECT GRASS AREAS FOR EROSION, BARE AREAS OR RUTTING, AND REPAIR AND RE-SEED AS NECESSARY.
4. INSPECT AREAS WITH GEOTEXTILE STABILIZATION. RE-ANCHOR LOOSE AREAS AND STABILIZE.
5. THE CRITICAL STAGES OF IMPLEMENTATION OF THIS PCSM PLAN FOR WHICH A LICENSED PROFESSIONAL OR DESIGNEE SHALL BE PRESENT ONSITE INCLUDE:
   a. CONSTRUCTION OF DETENTION BASINS INFLOW AND OUTFLOW STRUCTURES AND RIP RAP APRONS.
   b. CONSTRUCTION OF INFILTRATION TRENCHES.
   c. CONSTRUCTION OF RIP RAP APRONS.

DETENTION BASINS

1. THE STORMWATER DETENTION BASINS AND THEIR OUTLET STRUCTURES AND PIPES SHALL BE VISUALLY INSPECTED ANNUALLY IN THE FALL OF THE YEAR. IF ANY SEDIMENT OR DEBRIS HAS COLLECTED IN THE BOTTOM OF THE BASIN, OUTLET STRUCTURES OR THE OUTLET PIPES, IT SHALL BE REMOVED AS SOON AS POSSIBLE.
2. THE STORMWATER DETENTION BASINS AND THEIR OUTLET STRUCTURES SHALL BE VISUALLY INSPECTED AFTER ANY MAJOR (10, 25, 50 OR 100-YEAR) STORM EVENT, AND ANY NECESSARY CLEANING OR REPAIRS SHALL BE DONE AS SOON AS POSSIBLE.
3. ALL STORM INLETS SHALL BE VISUALLY INSPECTED AT LEAST ONCE A YEAR AT THE END OF NOVEMBER AND THEY SHALL BE CLEANED OF ANY LEAVES OR DEBRIS.

RIPRAP APRONS

1. INSPECT RIPRAP APRONS ANNUALLY AND AFTER EACH RAINFALL EVENT EXCEEDING ONE (1) INCH OF RAINFALL.
2. REMOVE SEDIMENT AND ADD ADDITIONAL STONE AS NECESSARY.

INFILTRATION TRENCH

1. CATCH BASINS AND INLETS SHOULD BE INSPECTED AND CLEANED AT LEAST 2 TIMES PER YEAR.
2. THE VEGETATION ALONG THE SURFACE OF THE INFILTRATION TRENCH SHALL BE MAINTAINED IN GOOD CONDITION, AND ANY BARE SPOTS SHALL BE REVEGETATED AS SOON AS POSSIBLE.
3. VEHICLES SHOULD NOT BE PARKED OR DRIVEN ON A VEGETATED INFILTRATION TRENCH, AND CARE SHOULD BE TAKEN TO AVOID EXCESS COMPACTION BY MOWERS.

MAJOR SOIL PROPERTIES AND ESTIMATED DEGREE OF LIMITATION

MAP SYMBOL	SOIL	HYDROLOGIC SOIL GROUP	DEPTH TO		SOILS FEATURES THAT AFFECT:
			HWT (FT)	BEDROCK (IN)	SHALLOW EXCAVATIONS
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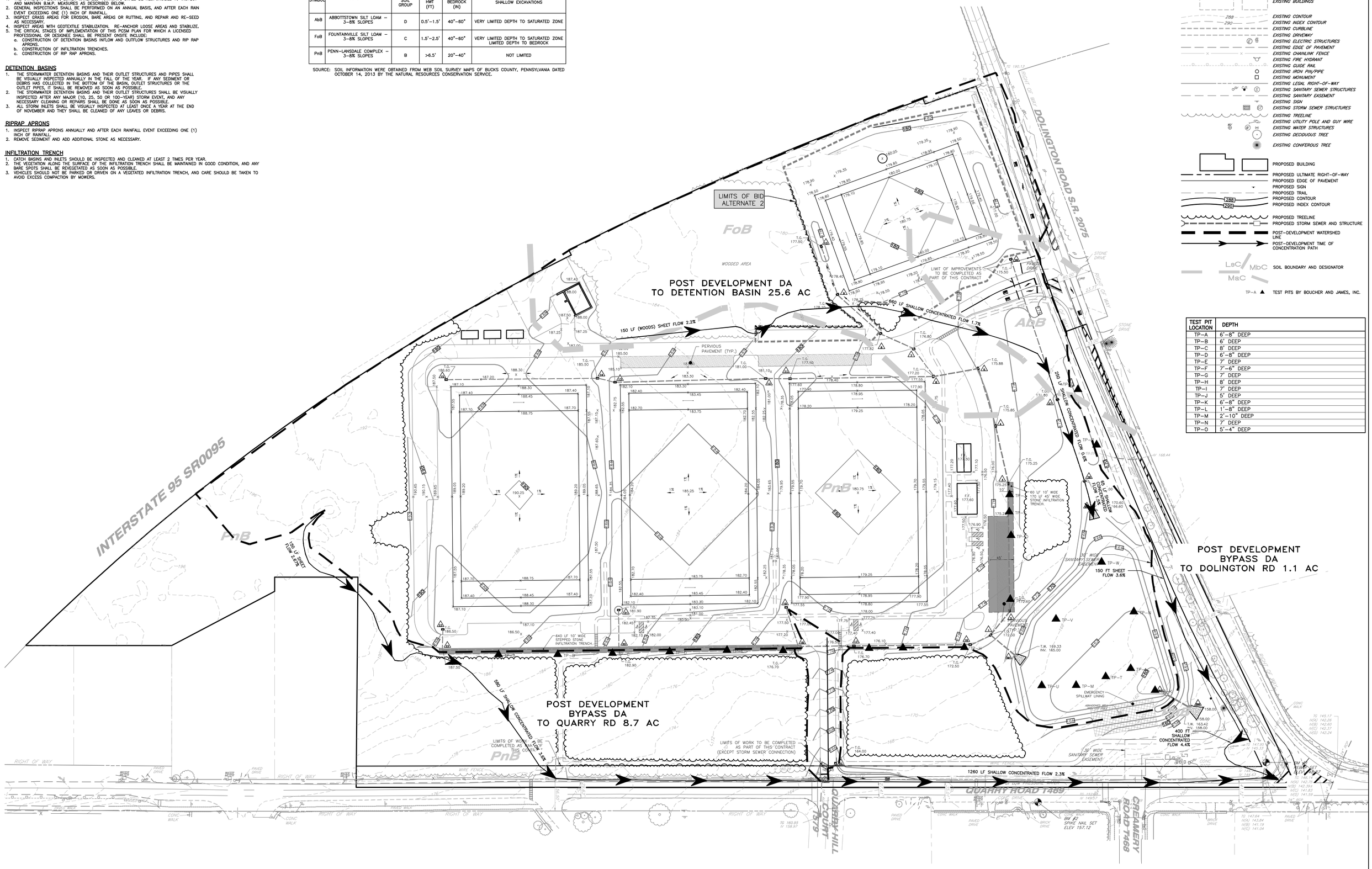
FoB	FOUNTAINVILLE SILT LOAM – 3–8% SLOPES	C	1.5'–2.5'	40"–60"	VERY LIMITED DEPTH TO SATURATED ZONE LIMITED DEPTH TO BEDROCK
PnB	PENN–LANSDALE COMPLEX – 3–8% SLOPES	B	>6.5'	20"–40"	NOT LIMITED

SOURCE: SOIL INFORMATION WERE OBTAINED FROM WEB SOIL SURVEY MAPS OF BUCKS COUNTY, PENNSYLVANIA DATED OCTOBER 14, 2013 BY THE NATURAL RESOURCES CONSERVATION SERVICE.



LEGEND

- ADJOINER LINE
- EXISTING BOUNDARY
- EXISTING BUILDINGS
- EXISTING CONTOUR (288)
- EXISTING INDEX CONTOUR (290)
- EXISTING CURBLINE
- EXISTING DRIVEWAY
- EXISTING ELECTRIC STRUCTURES
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- EXISTING CONIFEROUS TREE
- PROPOSED BUILDING
- PROPOSED ULTIMATE RIGHT-OF-WAY
- PROPOSED EDGE OF PAVEMENT
- PROPOSED SIGN
- PROPOSED TRAIL
- PROPOSED CONTOUR (288)
- PROPOSED INDEX CONTOUR (290)
- PROPOSED TREELINE
- PROPOSED STORM SEWER AND STRUCTURE
- POST-DEVELOPMENT WATERSHED LINE
- POST-DEVELOPMENT TIME OF CONCENTRATION PATH
- LaC, MbC, MaC — SOIL BOUNDARY AND DESIGNATOR
- TP-A ▲ — TEST PITS BY BOUCHER AND JAMES, INC.

TEST PIT LOCATION	DEPTH
TP–A	6'–8" DEEP
TP–B	6' DEEP
TP–C	8' DEEP
TP–D	6'–8" DEEP
TP–E	7' DEEP
TP–F	7'–6" DEEP
TP–G	7' DEEP
TP–H	8' DEEP
TP–I	7' DEEP
TP–J	5' DEEP
TP–K	6'–8" DEEP
TP–L	1'–8" DEEP
TP–M	2'–10" DEEP
TP–N	7' DEEP
TP–O	5'–4" DEEP

KNOW WHAT'S BELOW. CALL BEFORE YOU DIG!
PENNSYLVANIA ACT 287 OF 1974 (AS AMENDED) REQUIRES 3 WORKING DAYS NOTICE FOR EXCAVATION PHASE 3 WORKING DAYS NOTICE FOR DESIGN
PENNSYLVANIA ONE CALL SYSTEM, INC.
1-800-242-1776
PA ONE-CALL SERIAL No.
SERIAL NO. 20143291270
AUGUST 15, 2016

REVISIONS :

DATE	DESCRIPTION	DATE	DESCRIPTION
01/31/17	PLANS UPDATED WITH INFILTRATION PIT LOCATIONS AND NPDES NOTES		
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SHEET 2 OF 2

DATE: NOVEMBER 14, 2016

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