DRAINAGE STUDY

for

Alvamar, Lots 1 - 4 and Tract

Final Development Plan

Lawrence, Kansas

February 2016

LPE Project No. 20142015

Prepared for:

Gene Fritzel Construction

Prepared by:

Landplan Engineering, P.A.

Lawrence, KS

Christopher M. Storm, PE
Kansas License 17277

LANDPLAN ENGINEERING PA

CONTENTS **PAGE**

TABLES

FIGURES

APPENDICES

GENERAL

The Alvamar site is located south of Bob Billings Parkway along both sides of Crossgate Drive. Pending zoning for the 63.5 acres is multi-family residential with a planned development overlay district (RM-24) which will allow other land uses (fitness, banquet, restaurant, and office). The site is located within the Quail Creek and Hidden Valley Tributary drainage basins.

EXISTING CONDITIONS

The existing site is a golf course with a club house, accessory buildings and parking. Currently the site runoff flows either east to Quail Creek or west to Hidden Valley Tributary with Crossgate Drive generally dividing the two basins. Runoff from approximately 132 acres north of Bob Billings Parkway is conveyed to Hidden Valley Tributary immediately northwest of the development. The area's soil types north and south of Bob Billings Parkway include Sogn-Vinland complex (4752), Kennebec silt loam (7051), Martin silty clay loam (7302), Oska silty clay loam (7460), Pawnee clay loam (7500), Vinland complex (7651), Viland-Martin complex (7657) and Vinland-Rock outcrop complex (7658) and Woodson silt loam (8962). These soils are all classified as hydrologic group D soils with the exception of Kennebec silt loam. Refer to Figures 1 and 2 for the area's soil maps from the USDA Websoil Survey website.

PROPOSED IMPROVEMENTS

Proposed improvements include remodeling of the existing club house on Lot 1 to a banquet facility; multi-dwelling residential on Lots 2A, 2B and 4; and restaurant, pool and office uses on Lot 3. Refer to Figure 3 for the developed drainage area map.

The proposed detention pond for the west basin is located upstream of the proposed development. This detention pond will detain stormwater runoff from north of Bob Billings Parkway to compensate for the additional runoff from the development. The 100-year peak developed stormwater runoff from Lot 1, Lot 2A, and portions of 2B, 3 and 4 is 166 cfs (Appendix A, Hydrograph #5). The allowable site runoff from this area is about 39 cfs (21.6 acres at 1.8 cfs/ac). At a minimum, the proposed detention should result in a decrease peak flow of 127 cfs (peak developed minus allowable). The modeled 100-year peak flow to the proposed west detention pond is 781 cfs (Appendix B, Hydrograph #6). The proposed riser and 42" diameter outlet structure limit the detention pond's 100-year peak flow to 161 cfs (Appendix B, Hydrograph #7), resulting in a 620 cfs reduction in peak basin flow.

The proposed detention pond for the east basin is more conventional with the majority of the developed runoff conveyed to the pond. The existing pond will be regraded and enlarged to provide adequate detention for the east basin. The allowable site runoff from this area is about 74 cfs (41.9 acres at 1.8 cfs/ac) plus offsite detainable flow (67 cfs, Appendix B, Hydrograph 12). The proposed 30" diameter outlet pipe limit the detention pond's 100-year peak flow to 62 cfs and total site discharge of 87 cfs (Appendix B, Hydrograph #15 and #16).

ANALYSIS

All storm routing calculations were performed using Hydraflow® hydraulic modeling software. Times of concentration were calculated per Lawrence's Stormwater Management Criteria (SWMC) using overland, shallow concentrated, and hydraulic routing through the proposed channel and storm system. CNs for each drainage area are based on proposed land use and adjusted for D soils. The peak flows for the 100, 10 and 2-year storm events were modeled for a 12 hour hypothetical storm using KDOT's rainfall information for Douglas County.

CONCLUSION

This report indicates that the proposed detention ponds will provide adequate detention for the increased runoff resulting from the proposed site development. The detention ponds and outlet structures have been sized to limit Alvamar's developed stormwater discharge below the allowable release rates of the Lawrence Stormwater Management Criteria.

TABLE 1A - DEVELOPED CONDITION CN CALCULATIONS - WEST BASIN

		CURVE NUMBER								COMP.
		80	84	86	91	94	96	98	AREA	CN
1	Lot 1 (West)						3.4 ac		3.4 ac	96.0
2	Lot 2A, ROW, Lot 2B (West)				14.1 ac				14.1 ac	91.0
3	Tract (West)	1.0 ac							1.0 ac	80.0
4	Lot 3 & 4 (West)				2.3 ac	0.8 ac			3.1 ac	91.8
								West Developed Area =	21.6 ac	
1	Pond N. of BBP		66.3 ac	42.4 ac				5.0 ac	113.7 ac	85.4
2	North of BBP		17.9 ac						17.9 ac	84.0
3	South of BBP	17.0 ac	13.7 ac					2.2 ac	32.9 ac	82.9
								Area to West Detention Pond =	164.50 ac	

TABLE 1B - DEVELOPED CONDITION CN CALCULATIONS - EAST BASIN

		CURVE NUMBER								COMP.
		80	84	86	91	94	96	98	AREA	CN
8	Offsite (East)	6.7 ac	5.5 ac						12.2 ac	81.8
9	Tract (East)	11.6 ac							11.6 ac	80.0
10	Lot 2B (East)				1.9 ac				1.9 ac	91.0
11	Lot 3 (East)					12.2 ac			12.2 ac	94.0
12	Lot 4 (East)				9.6 ac				9.6 ac	91.0
13	Lot 3 & 4 D/S East Pond	6.4 ac							6.4 ac	80.0
								Area to East Detention Pond =	53.90 ac	

TABLE 2 - DEVELOPED CONDITION TIME OF CONCENTRATION CALCULATIONS

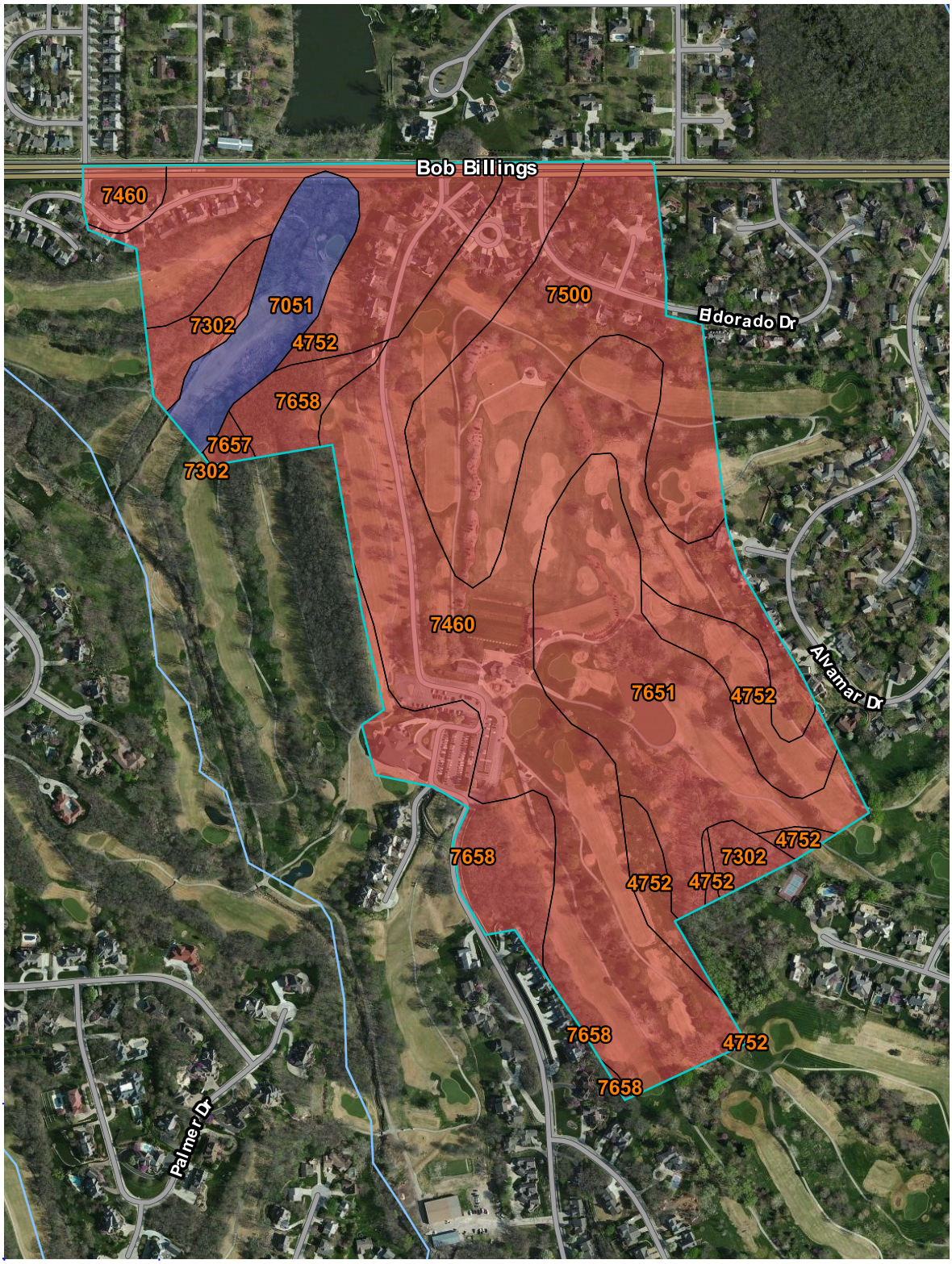
		OVERLAND FLOW				SHALLOW CONCENTRATED FLOW				CHANNEL/SYSTEM FLOW				TIME OF
		C	D	S	T(OLF)		D	S	T(SCF)	D	S	V	T(C/S)	CONC.
1	Lot 1 (West)	0.9	50 ft	4%	1.6 min	Paved	200 ft	2%	1.2 min	760 ft	9%	8 fps	1.6 min	5.0 min
2	Lot 2A, ROW, Lot 2B (West)	0.4	50 ft	6%	5.0 min	Unpaved	200 ft	4%	0.9 min	1260 ft	6%	6 fps	3.5 min	9.4 min
3	Tract (West)	0.4	200 ft	5%	10.4 min	Unpaved	170 ft	7%	0.7 min	610 ft	8%	7 fps	1.5 min	12.6 min
4	Lot 3 & 4 (West)	0.4	50 ft	4%	5.6 min	Unpaved	280 ft	12%	0.7 min	540 ft	7%	8 fps	1.1 min	7.4 min
1	Pond N. of BBP	0.4	100 ft	4%	8.3 min	Unpaved	200 ft	3%	1.2 min	4150 ft	2%	5 fps	13.8 min	23.3 min
2	North of BBP	0.4	100 ft	2%	11.0 min	Unpaved	180 ft	4%	2.0 min	920 ft	3%	5 fps	3.1 min	16.1 min
3	South of BBP	0.4	100 ft	1%	12.9 min	Unpaved	170 ft	4%	2.0 min	2060 ft	4%	6 fps	5.7 min	20.6 min
8	Offsite (East)	0.4	115 ft	2%	10.6 min	Unpaved	220 ft	3%	1.2 min	1750 ft	3%	5 fps	5.8 min	17.6 min
9	Tract (East)	0.4	200 ft	2%	13.3 min	Unpaved	400 ft	4%	2.0 min	730 ft	3%	5 fps	2.4 min	17.7 min
10	Lot 2B (East)	0.4	150 ft	5%	9.0 min	Unpaved	250 ft	4%	1.2 min	500 ft	4%	6 fps	1.4 min	11.6 min
11	Lot 3 (East)	0.4	50 ft	3%	6.2 min	Unpaved	150 ft	1%	1.6 min	560 ft	5%	6 fps	1.6 min	9.4 min
12	Lot 4 (East)	0.4	50 ft	2%	7.1 min	Unpaved	140 ft	3%	0.9 min	1230 ft	1%	5 fps	4.1 min	12.1 min
13	Lot 3 & 4 D/S East Pond	0.4	80 ft	5%	6.6 min	Unpaved	100 ft	7%	0.6 min	300 ft	3%	5 fps	1.0 min	8.2 min

TABLE 3 - DEVELOPED SUMMARY OF HYDROLOGICAL MODELING

	Hydrograph	100-YR	10-YR	2-YR
West Basin Developed	5*	165.9 cfs	110.9 cfs	72.9 cfs
Q to West Detention Pond	6	780.7 cfs	214.3 cfs	87.6 cfs
West Detention Pond	7	161.5 cfs	115.4 cfs	51.2 cfs
West Detention W/S Elev.	7	908.9	903.1	900.8
Reduction in Peak Discharge [1]		-619.2	-98.9	-36.4
Offsite (East)	8	69.1 cfs	40.9 cfs	21.4 cfs
Q to East Detention Pond	14	287.3 cfs	180.9 cfs	108.1 cfs
East Detention Pond	15	62.3 cfs	46.6 cfs	30.3 cfs
East Detention W/S Elev.	15	926.2	923.1	920.9
East Basin Q	16	86.9 cfs	56.3 cfs	32.9 cfs
Allowable Site Discharge [2]		144.5 cfs	91.2 cfs	48.64 ac
[1] West Basin Allowable Discharge		1.8 cfs/ac	1.2 cfs/ac	0.7 cfs/ac
West Onsite Area	21.6 ac	38.9 cfs	25.9 cfs	14.0 cfs
Calculated Peak Q		165.9 cfs	110.9 cfs	72.9 cfs
Target Reduction in Peak Discharge		-127.0 cfs	-85.0 cfs	-58.9 cfs
[2] East Basin Allowable Discharge		1.8 cfs/ac	1.2 cfs/ac	0.7 cfs/ac
East Onsite Area	41.9 ac	75.4 cfs	50.3 cfs	27.2 cfs
Offsite		69.1 cfs	40.9 cfs	21.4 cfs
Allowable Site Discharge		144.5 cfs	91.2 cfs	48.6 cfs

Hydrologic Soil Group—Douglas County, Kansas
(Alvamar South of Bob Billings Parkway)

95° 17' 49" W
95° 17' 5" W
38° 57' 31" N
38° 56' 45" N



Map Scale: 1:6,920 if printed on A portrait (8.5" x 11") sheet.

N

0 100 200 400 600 Meters

0 300 600 1200 1800 Feet

Map projection: Web Mercator Corner coordinates: WGS84

Hydrologic Soil Group

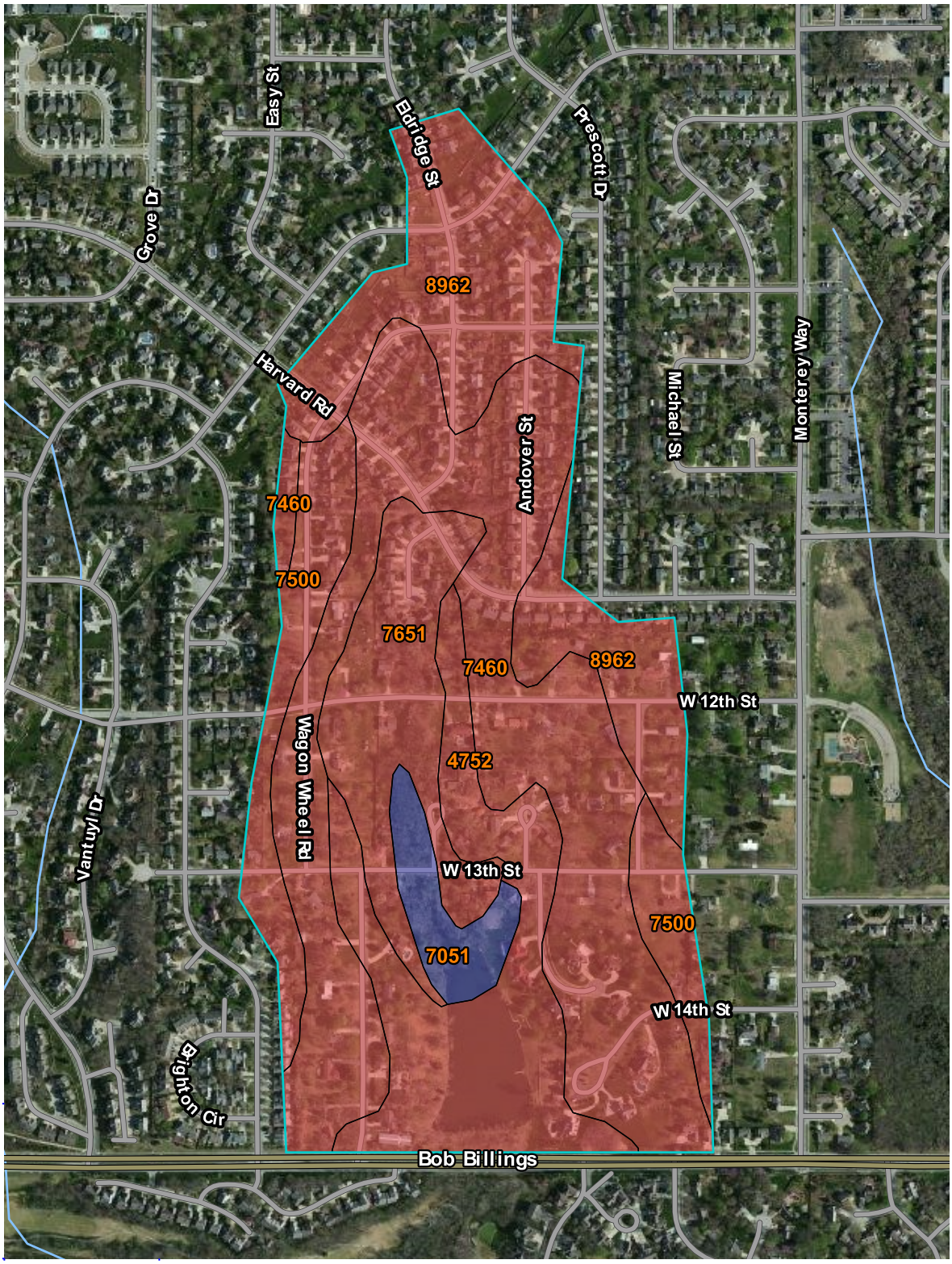
Hydrologic Soil Group— Summary by Map Unit — Douglas County, Kansas (KS045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
4752	Sogn-Vinland complex, 3 to 25 percent slopes	D	18.9	16.1%
7051	Kennebec silt loam, frequently flooded	B	6.0	5.1%
7302	Martin silty clay loam, 3 to 7 percent slopes	D	3.6	3.1%
7460	Oska silty clay loam, 3 to 6 percent slopes	D	42.6	36.4%
7500	Pawnee clay loam, 1 to 4 percent slopes	D	18.9	16.1%
7651	Vinland complex, 3 to 7 percent slopes	D	16.8	14.3%
7657	Vinland-Martin complex, 7 to 15 percent slopes	D	0.5	0.4%
7658	Vinland-Rock outcrop complex, 15 to 45 percent slopes	D	9.9	8.4%
Totals for Area of Interest			**117.0**	**100.0%**

95° 17' 59" W

95° 17' 10" W

38° 58' 11" N

38° 57' 21" N



Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

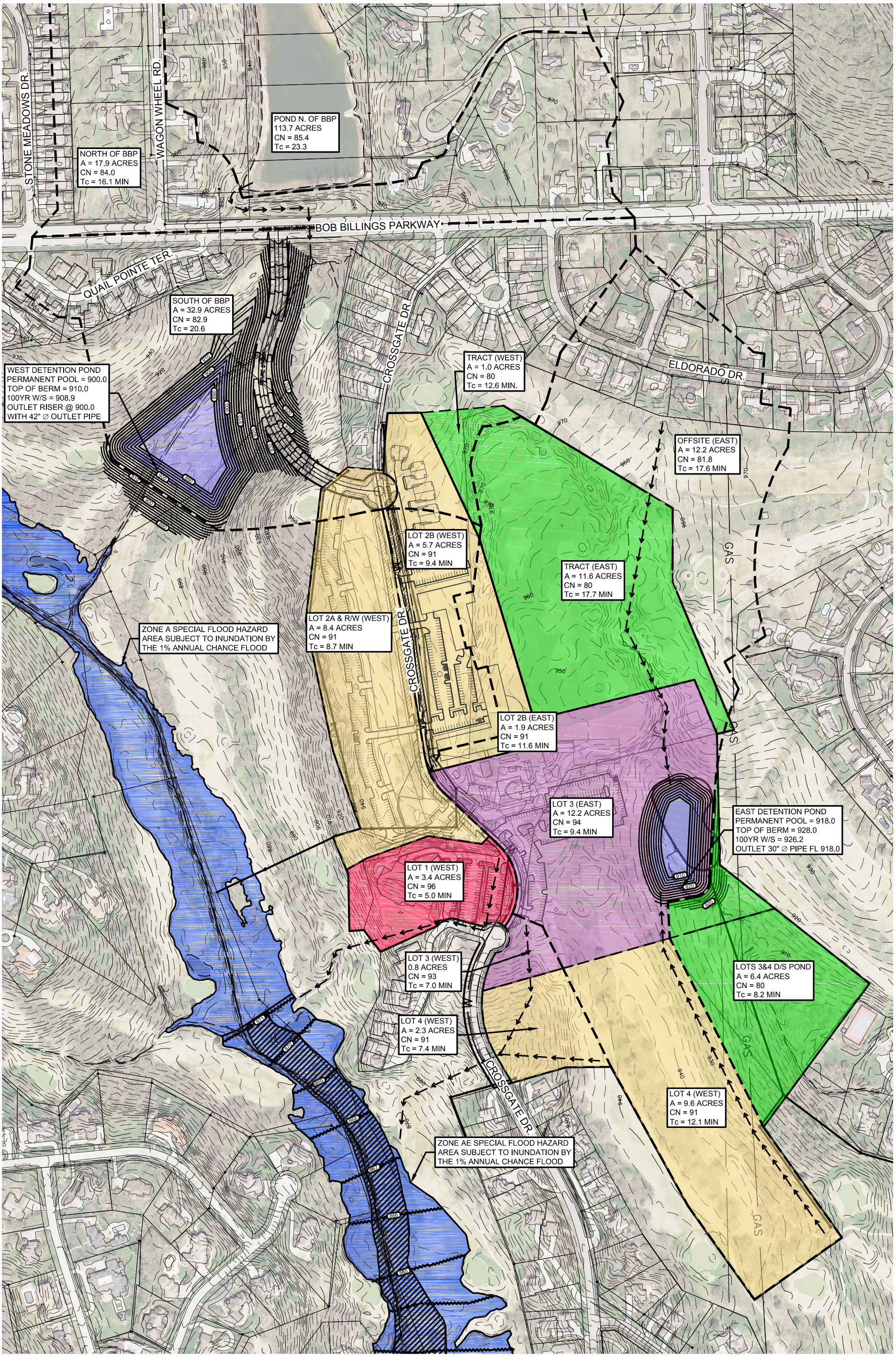
Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Douglas County, Kansas (KS045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
4752	Sogn-Vinland complex, 3 to 25 percent slopes	D	21.8	16.7%
7051	Kennebec silt loam, frequently flooded	B	4.9	3.7%
7460	Oska silty clay loam, 3 to 6 percent slopes	D	50.0	38.3%
7500	Pawnee clay loam, 1 to 4 percent slopes	D	12.9	9.9%
7651	Vinland complex, 3 to 7 percent slopes	D	15.0	11.5%
8962	Woodson silt loam, 1 to 3 percent slopes	D	26.1	20.0%
Totals for Area of Interest			**130.6**	**100.0%**

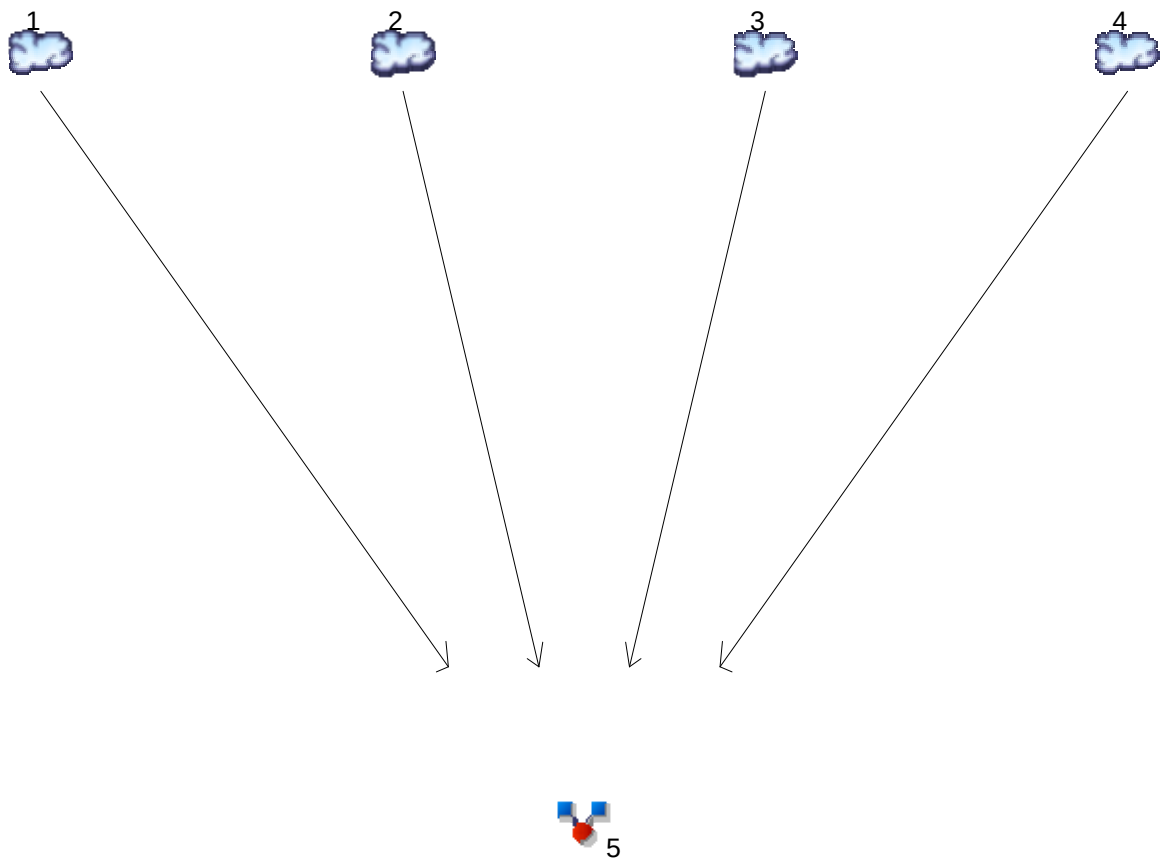


Alvamar Drainage Study
Figure 3: Drainage Area Map
February 11, 2016

NORTH
SCALE: 1" = 300'

LANDPLAN ENGINEERING PA

Watershed Model Schematic

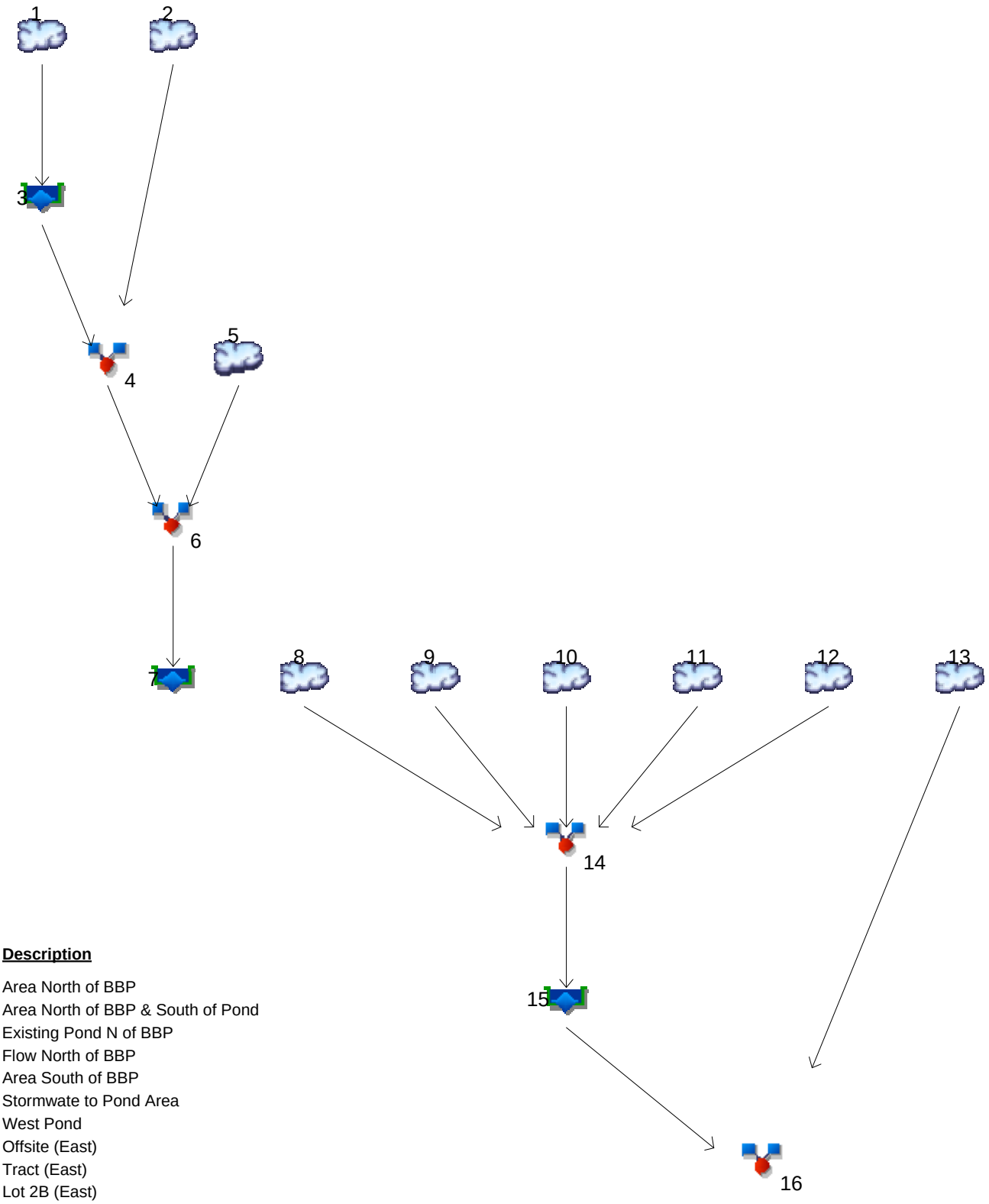


Legend

Hyd.	Origin	Description
1	SCS Runoff	Lot 1 (West)
2	SCS Runoff	Lot 2A, ROW, Lot 2B (West)
3	SCS Runoff	Tract (West)
4	SCS Runoff	Lot 3 & 4 (West)
5	Combine	West Basin Developed

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area North of BBP
2	SCS Runoff	Area North of BBP & South of Pond
3	Reservoir	Existing Pond N of BBP
4	Combine	Flow North of BBP
5	SCS Runoff	Area South of BBP
6	Combine	Stormwate to Pond Area
7	Reservoir	West Pond
8	SCS Runoff	Offsite (East)
9	SCS Runoff	Tract (East)
10	SCS Runoff	Lot 2B (East)
11	SCS Runoff	Lot 3 (East)
12	SCS Runoff	Lot 4 (East)
13	SCS Runoff	Lots 3 & 4 D/S East Pond
14	Combine	Flow to East Pond
15	Reservoir	East Pond
16	Combine	East Basin

APPENDIX A

100, 10, 2-YEAR STORM EVENTS
DEVELOPED LOTS WEST BASIN

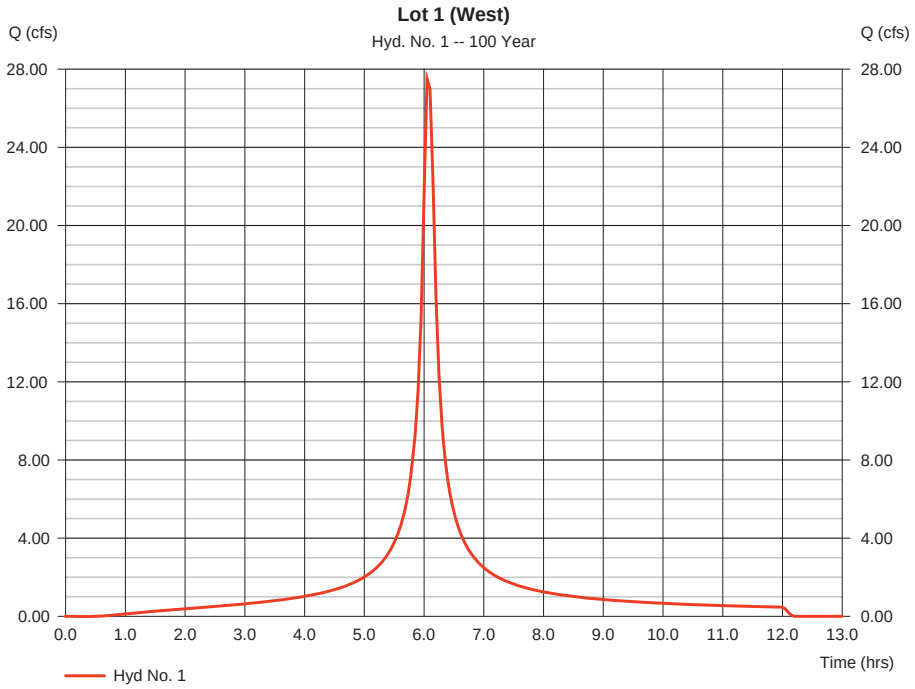
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 1

Lot 1 (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 27.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 80,702 cuft
Drainage area	= 3.400 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



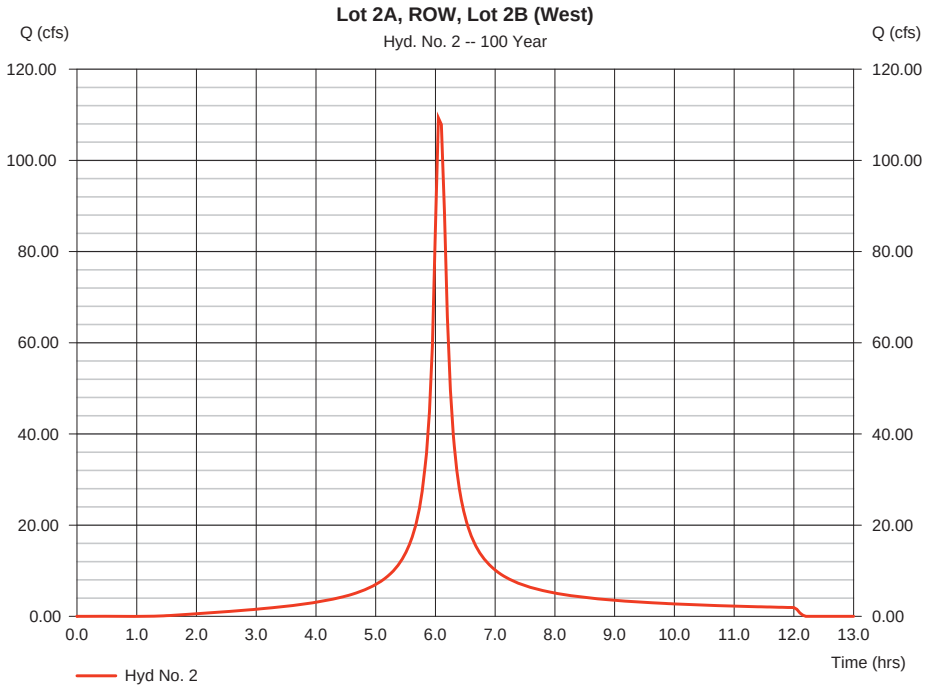
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 2

Lot 2A, ROW, Lot 2B (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 109.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 306,343 cuft
Drainage area	= 14.100 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



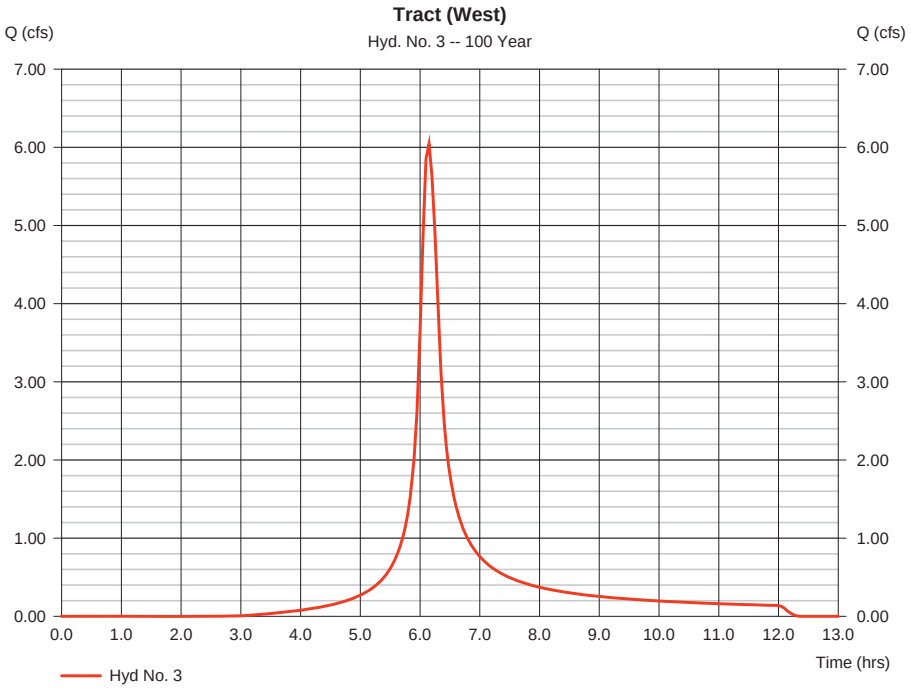
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 3

Tract (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 6.043 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 18,562 cuft
Drainage area	= 1.000 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.60 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



Hydrograph Report

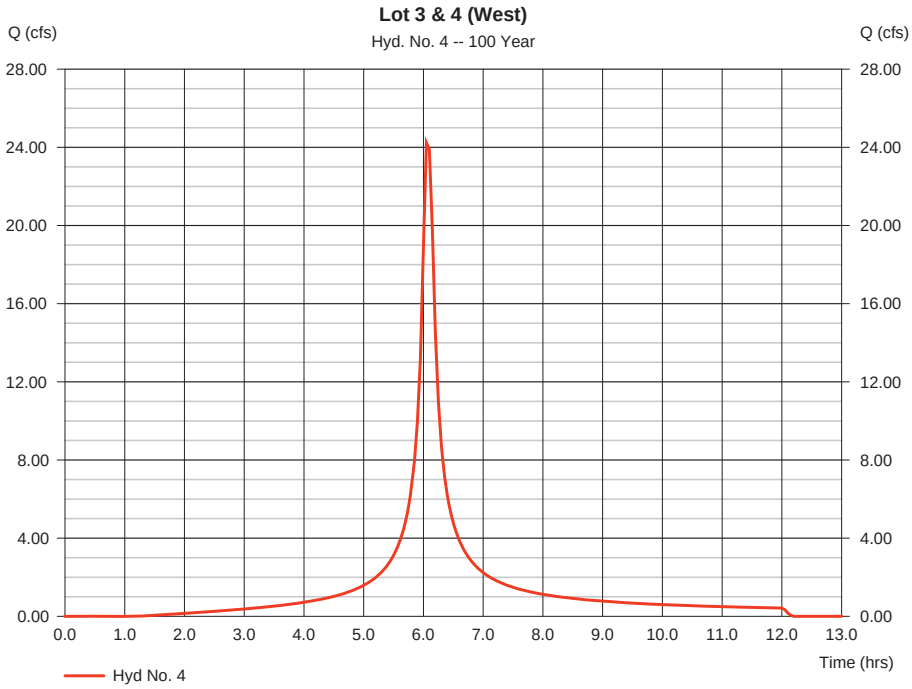
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 4

Lot 3 & 4 (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 24.24 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 68,343 cuft
Drainage area	= 3.100 ac	Curve number	= 91.8*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 7.40 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.800 x 94) + (2.300 x 91)] / 3.100



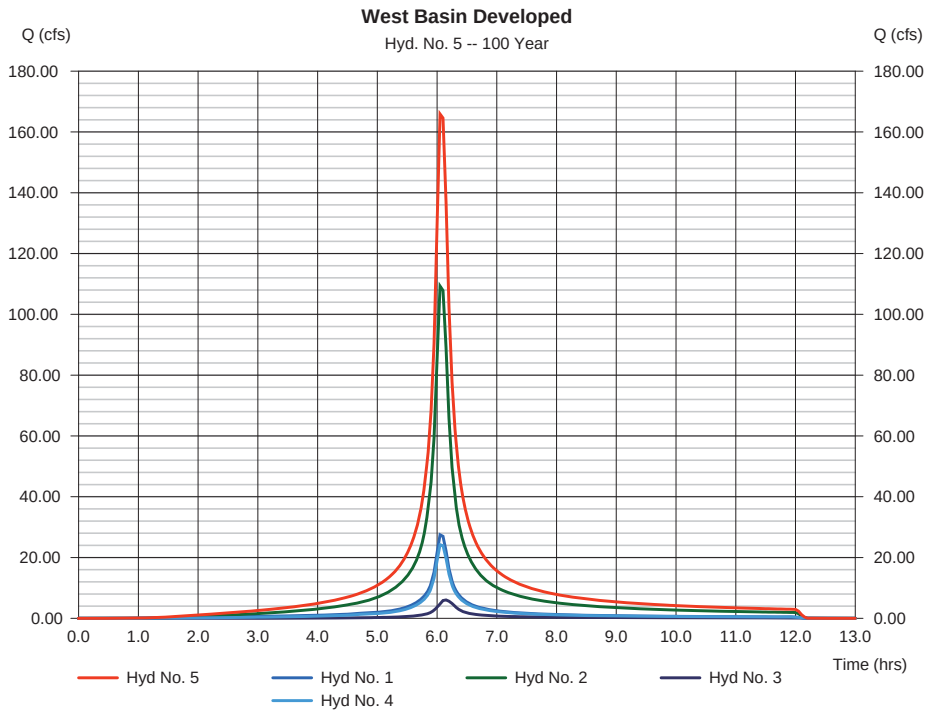
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 5

West Basin Developed

Hydrograph type	= Combine	Peak discharge	= 165.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 473,951 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 21.600 ac

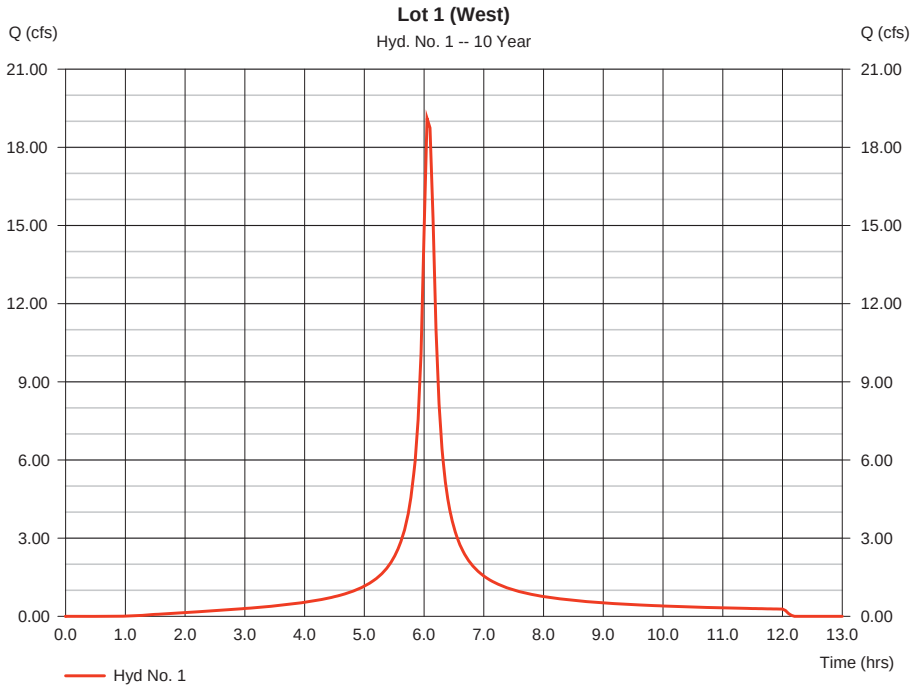


Hydrograph Report

Hyd. No. 1

Lot 1 (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 19.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 50,236 cuft
Drainage area	= 3.400 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



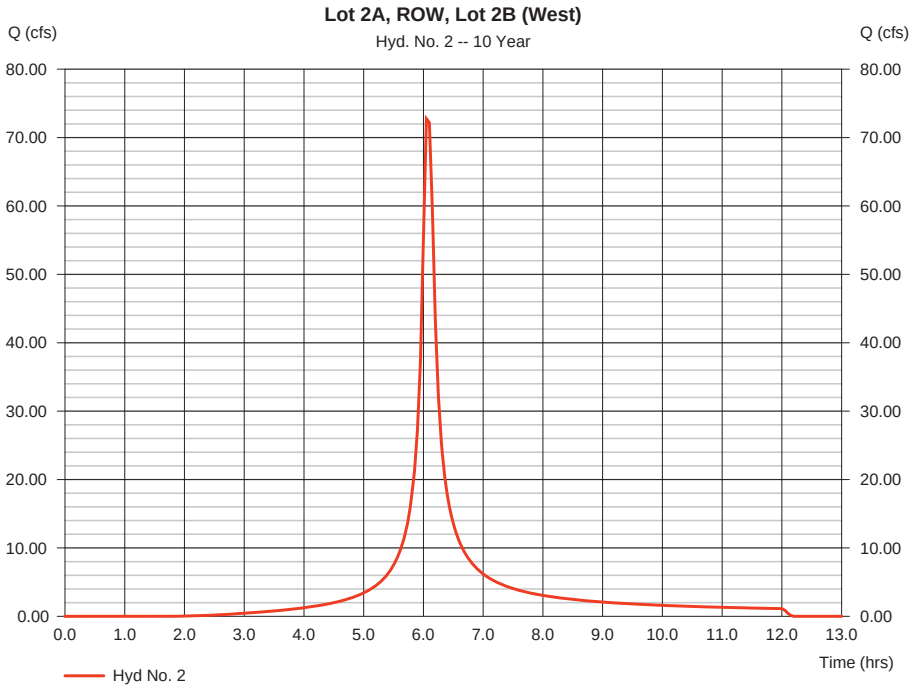
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 2

Lot 2A, ROW, Lot 2B (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 72.76 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 182,139 cuft
Drainage area	= 14.100 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



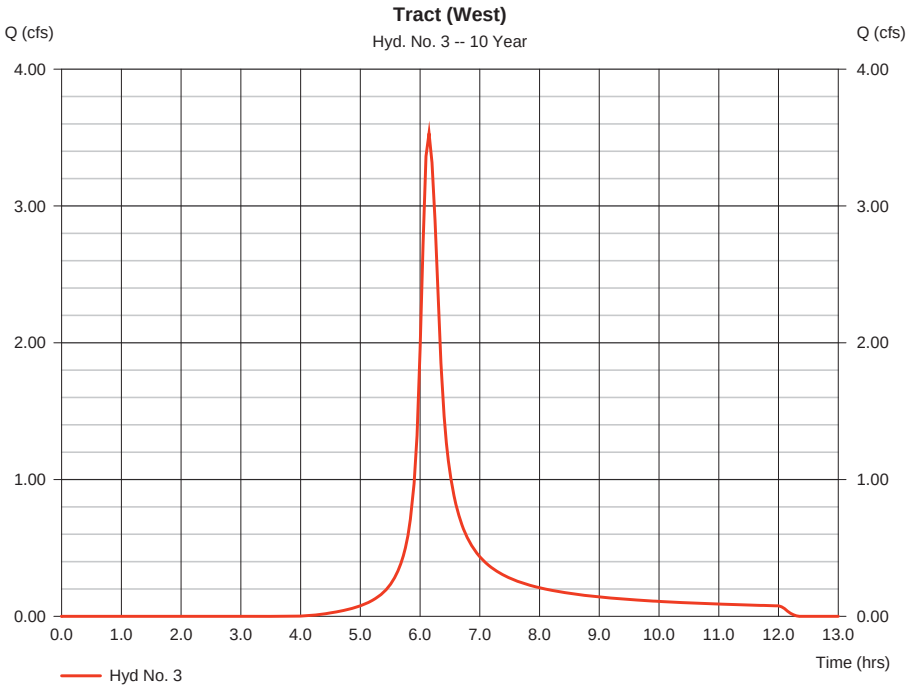
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 3

Tract (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.532 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 9,895 cuft
Drainage area	= 1.000 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.60 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



Hydrograph Report

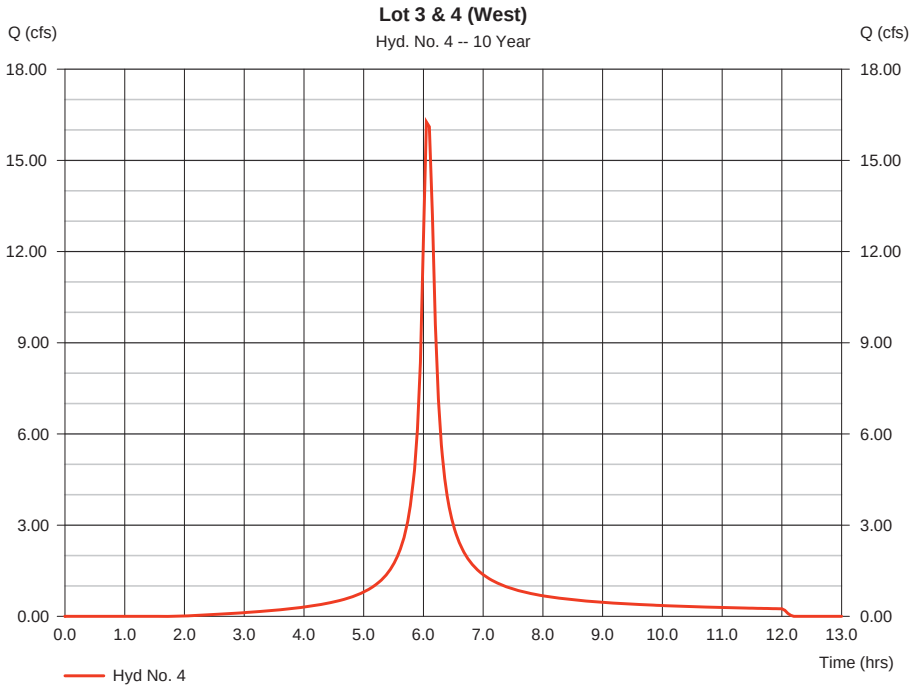
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 4

Lot 3 & 4 (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 16.26 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 40,938 cuft
Drainage area	= 3.100 ac	Curve number	= 91.8*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 7.40 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.800 x 94) + (2.300 x 91)] / 3.100



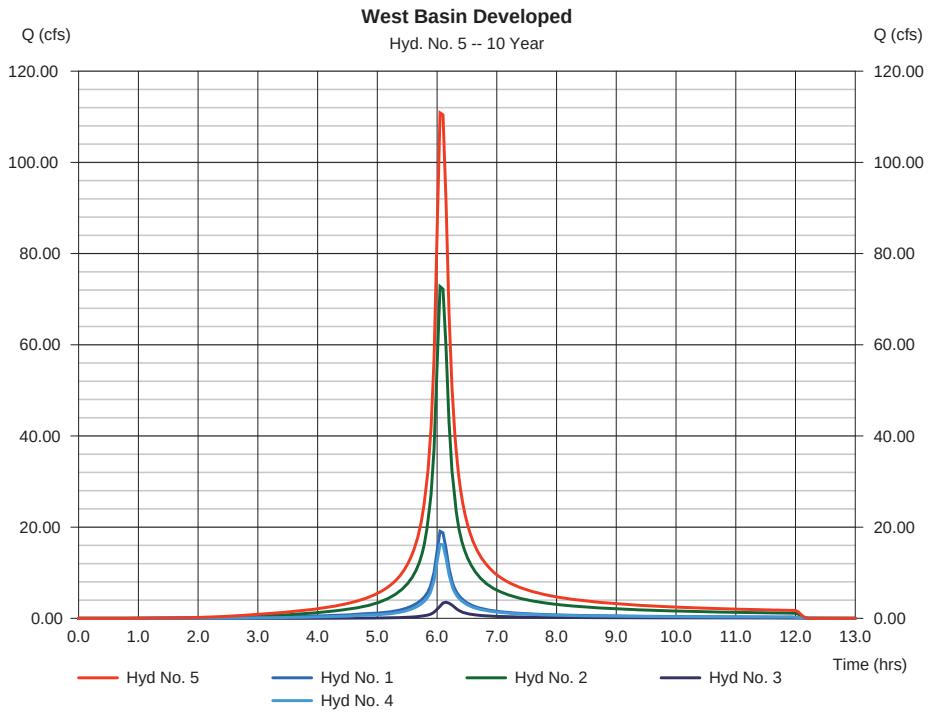
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 5

West Basin Developed

Hydrograph type	= Combine	Peak discharge	= 110.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 283,209 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 21.600 ac

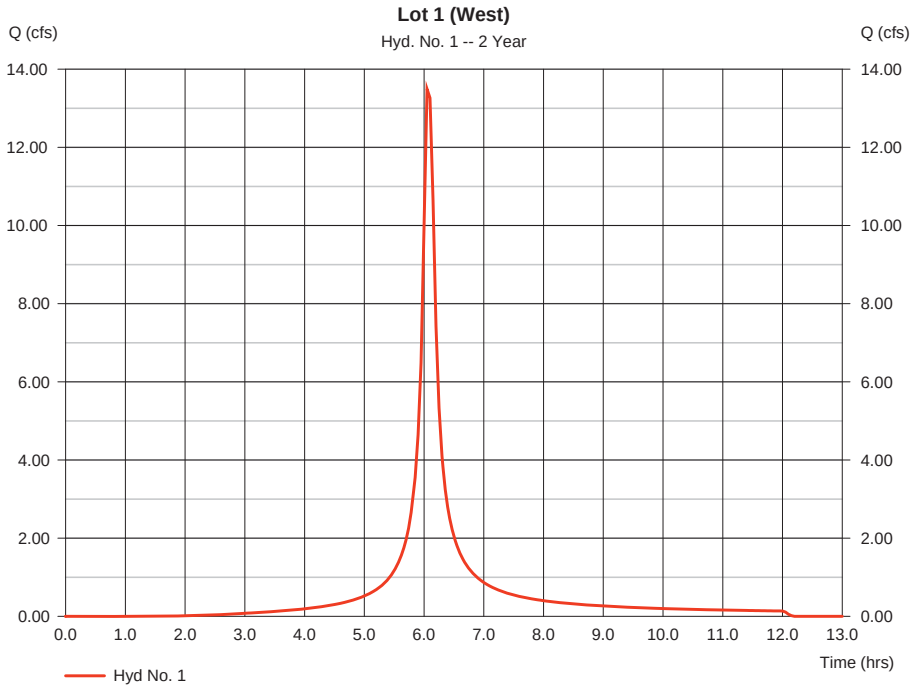


Hydrograph Report

Hyd. No. 1

Lot 1 (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.49 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 28,906 cuft
Drainage area	= 3.400 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



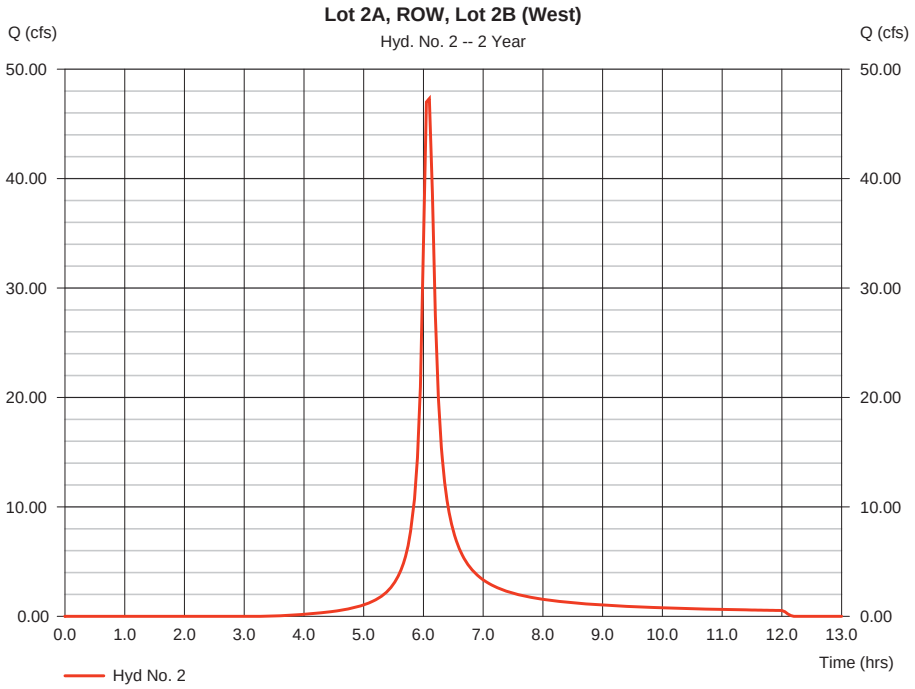
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 2

Lot 2A, ROW, Lot 2B (West)

Hydrograph type	= SCS Runoff	Peak discharge	= 47.32 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 96,940 cuft
Drainage area	= 14.100 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



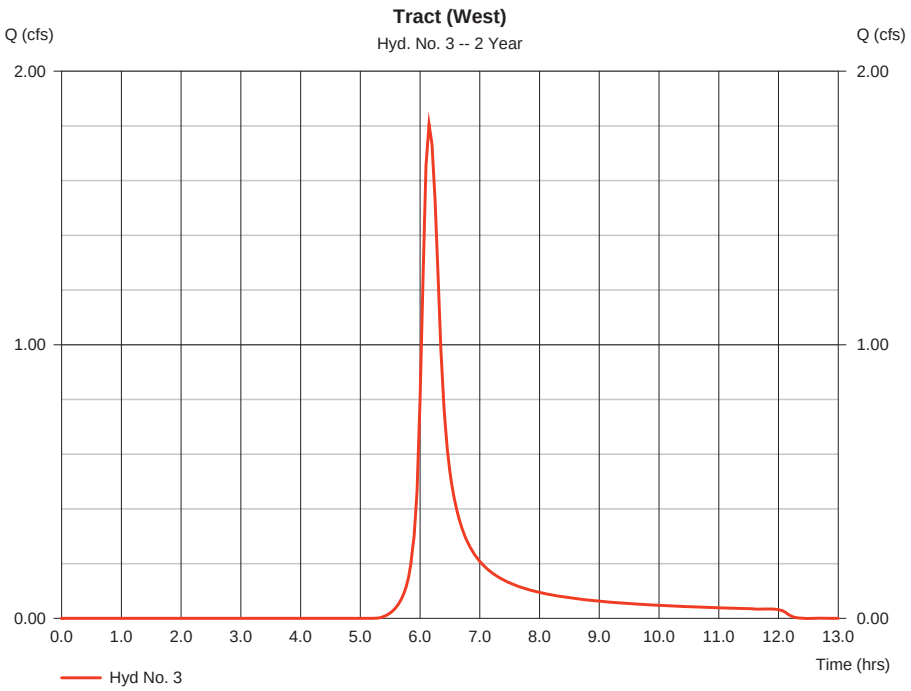
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 3

Tract (West)

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.806 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.15 hrs
Time interval	=	3 min	Hyd. volume	=	4,389 cuft
Drainage area	=	1.000 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.60 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



Hydrograph Report

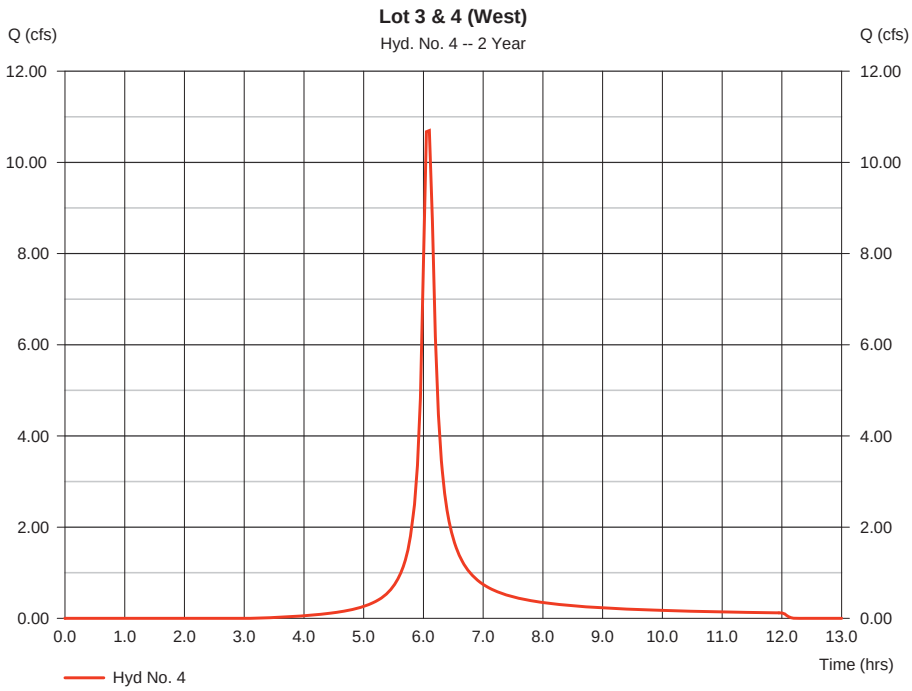
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 4

Lot 3 & 4 (West)

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.70 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.10 hrs
Time interval	=	3 min	Hyd. volume	=	22,064 cuft
Drainage area	=	3.100 ac	Curve number	=	91.8*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.40 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.800 x 94) + (2.300 x 91)] / 3.100

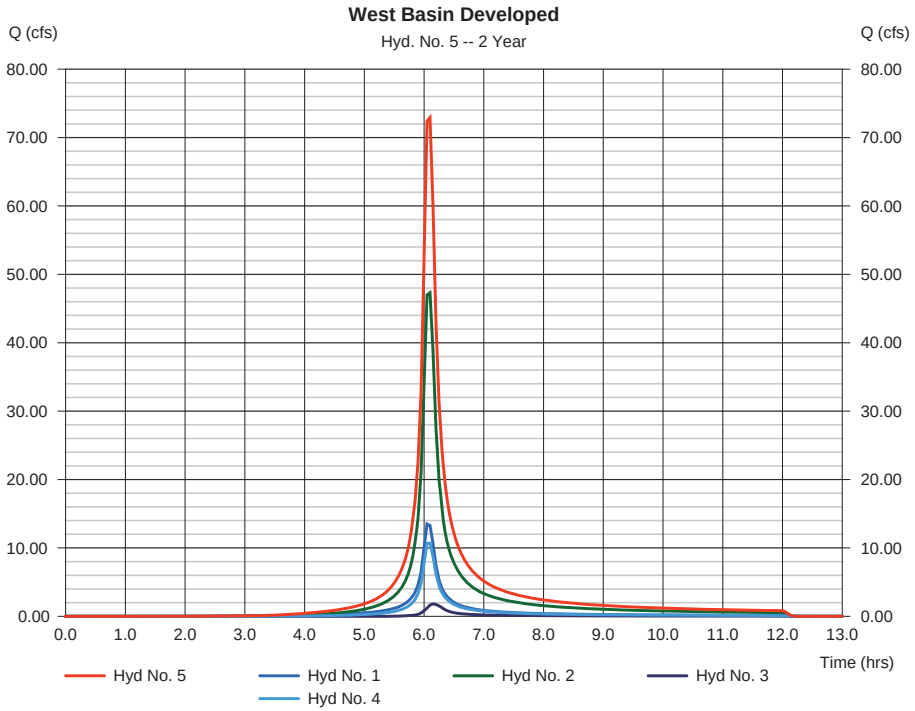


Hydrograph Report

Hyd. No. 5

West Basin Developed

Hydrograph type	= Combine	Peak discharge	= 72.93 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 152,299 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 21.600 ac



APPENDIX B

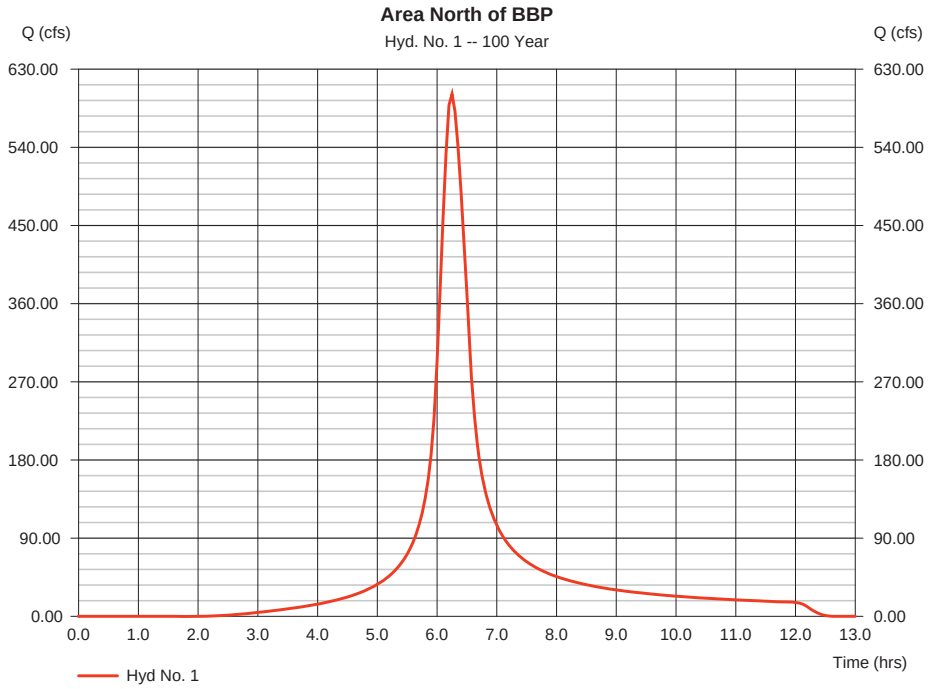
100-YEAR STORM EVENT
EAST AND WEST BASINS

Hydrograph Report

Hyd. No. 1

Area North of BBP

Hydrograph type	=	SCS Runoff	Peak discharge	=	601.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.25 hrs
Time interval	=	3 min	Hyd. volume	=	2,306,742 cuft
Drainage area	=	113.700 ac	Curve number	=	85.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.30 min
Total precip.	=	7.45 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



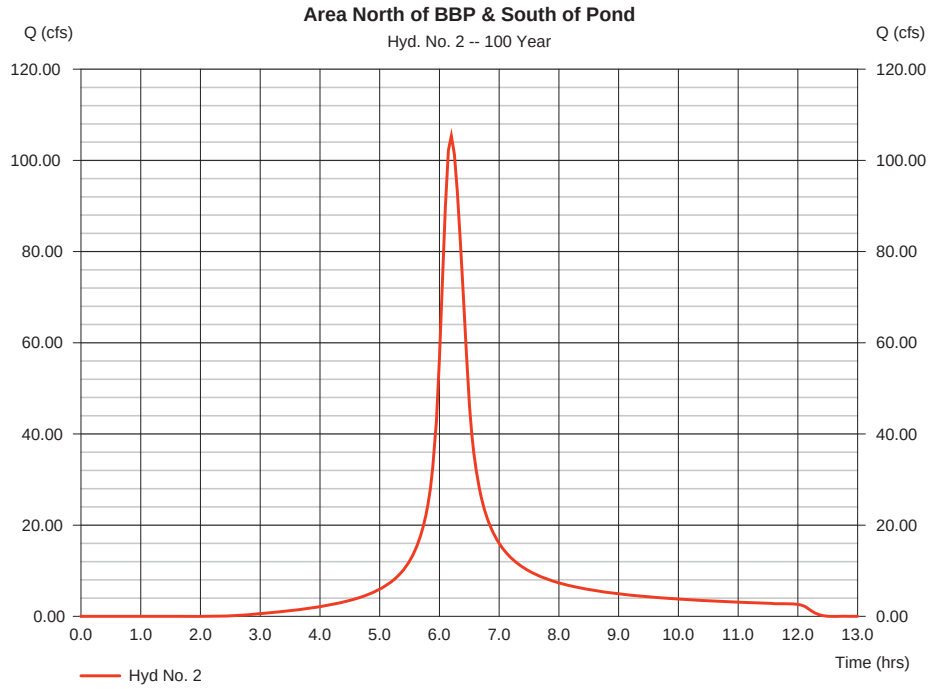
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 2

Area North of BBP & South of Pond

Hydrograph type	=	SCS Runoff	Peak discharge	=	105.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.20 hrs
Time interval	=	3 min	Hyd. volume	=	373,292 cuft
Drainage area	=	17.900 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.10 min
Total precip.	=	7.45 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



Hydrograph Report

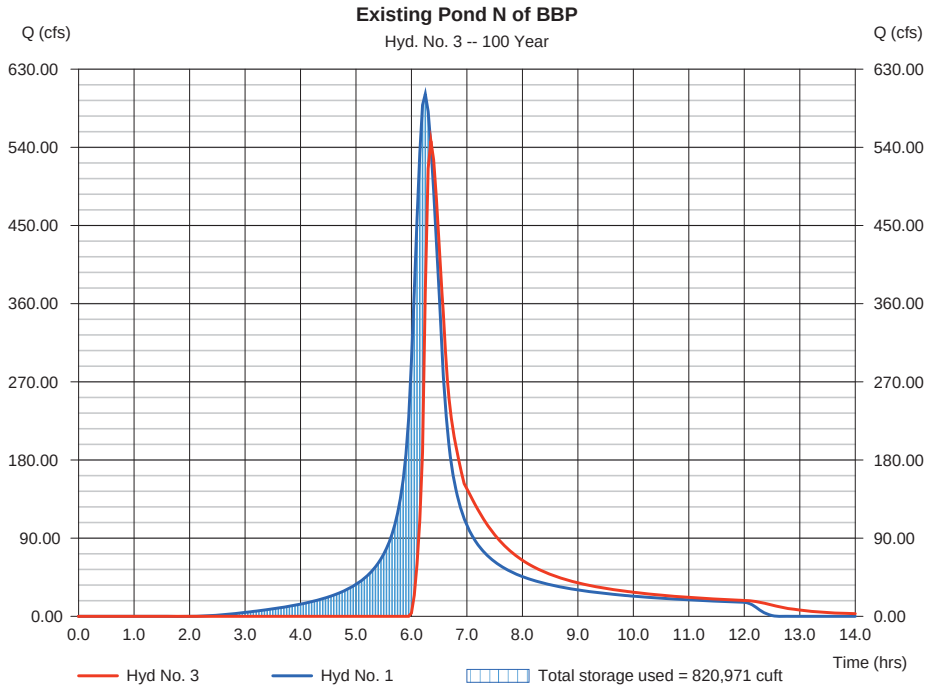
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 3

Existing Pond N of BBP

Hydrograph type	=	Reservoir	Peak discharge	=	547.30 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.35 hrs
Time interval	=	3 min	Hyd. volume	=	1,867,688 cuft
Inflow hyd. No.	=	1 - Area North of BBP	Max. Elevation	=	937.89 ft
Reservoir name	=	Existing Pond	Max. Storage	=	820,971 cuft

Storage Indication method used.



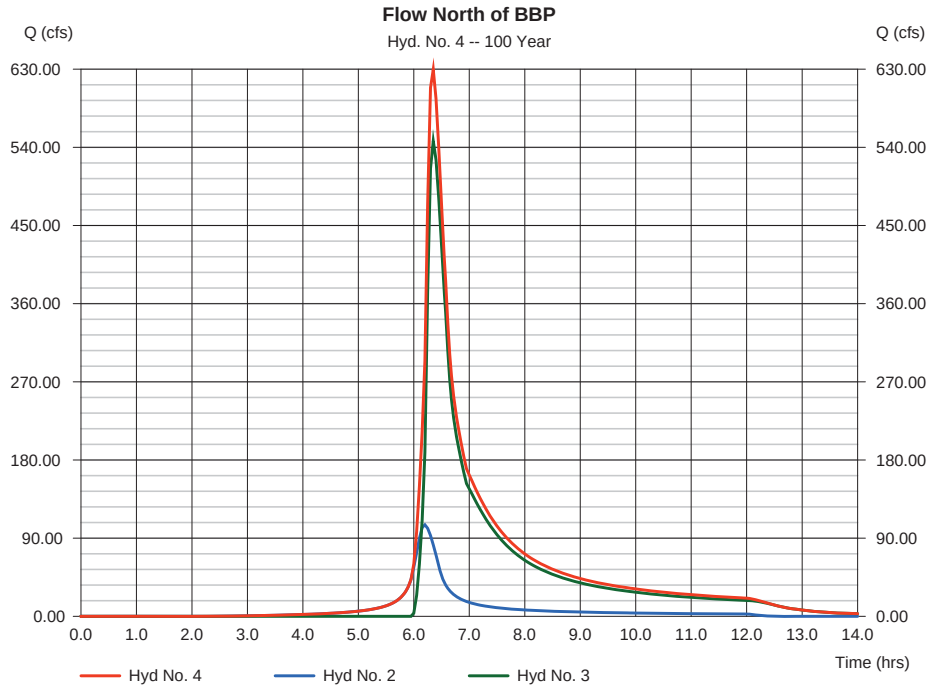
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 4

Flow North of BBP

Hydrograph type	=	Combine	Peak discharge	=	629.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.35 hrs
Time interval	=	3 min	Hyd. volume	=	2,240,979 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	17.900 ac



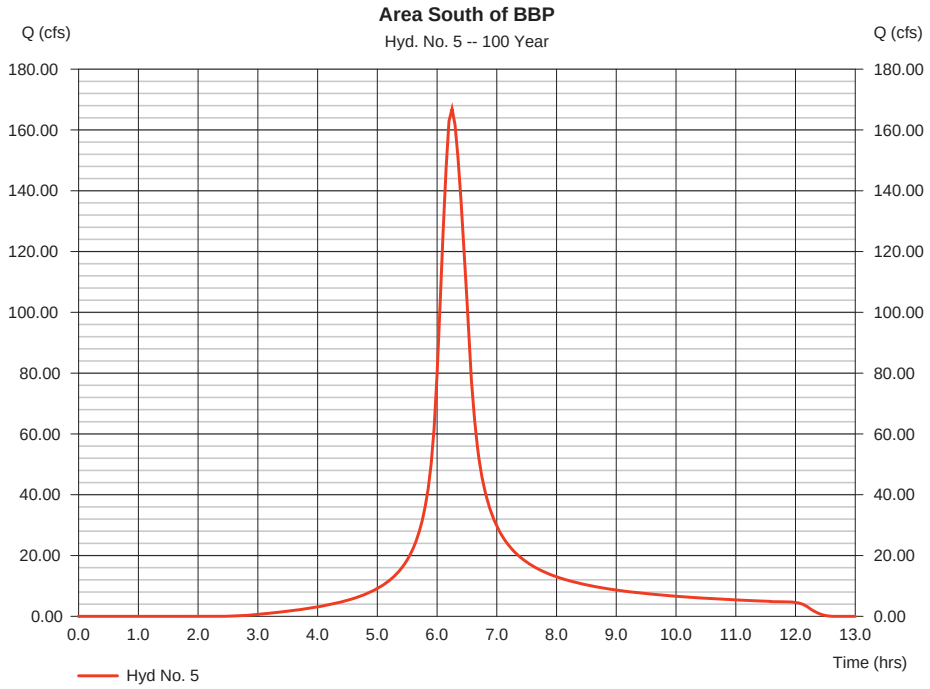
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 5

Area South of BBP

Hydrograph type	= SCS Runoff	Peak discharge	= 166.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.25 hrs
Time interval	= 3 min	Hyd. volume	= 633,974 cuft
Drainage area	= 32.900 ac	Curve number	= 82.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.60 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



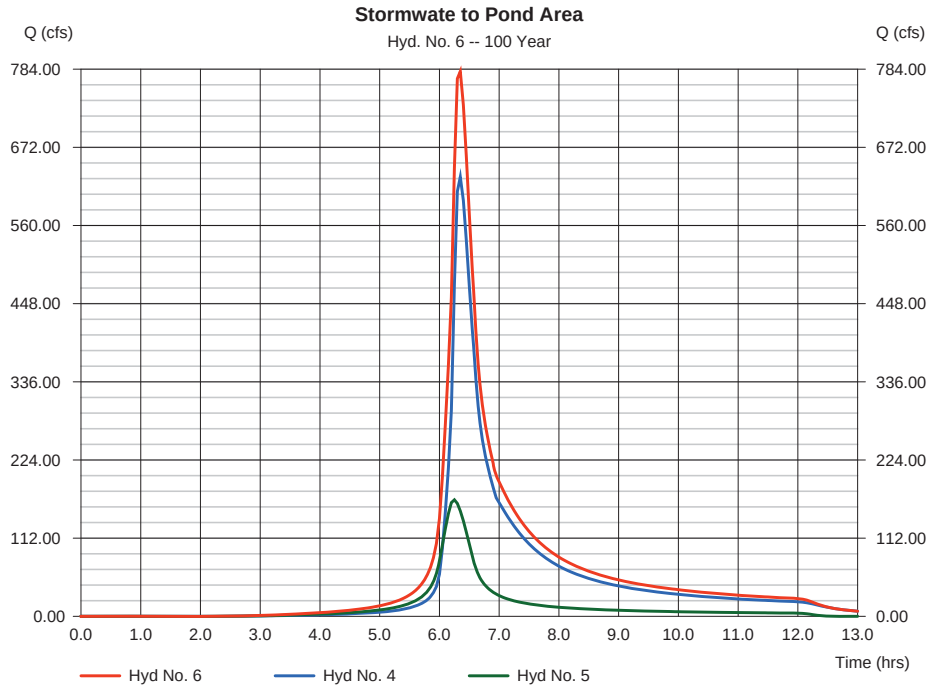
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 6

Stormwate to Pond Area

Hydrograph type	= Combine	Peak discharge	= 780.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.35 hrs
Time interval	= 3 min	Hyd. volume	= 2,874,953 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 32.900 ac



Hydrograph Report

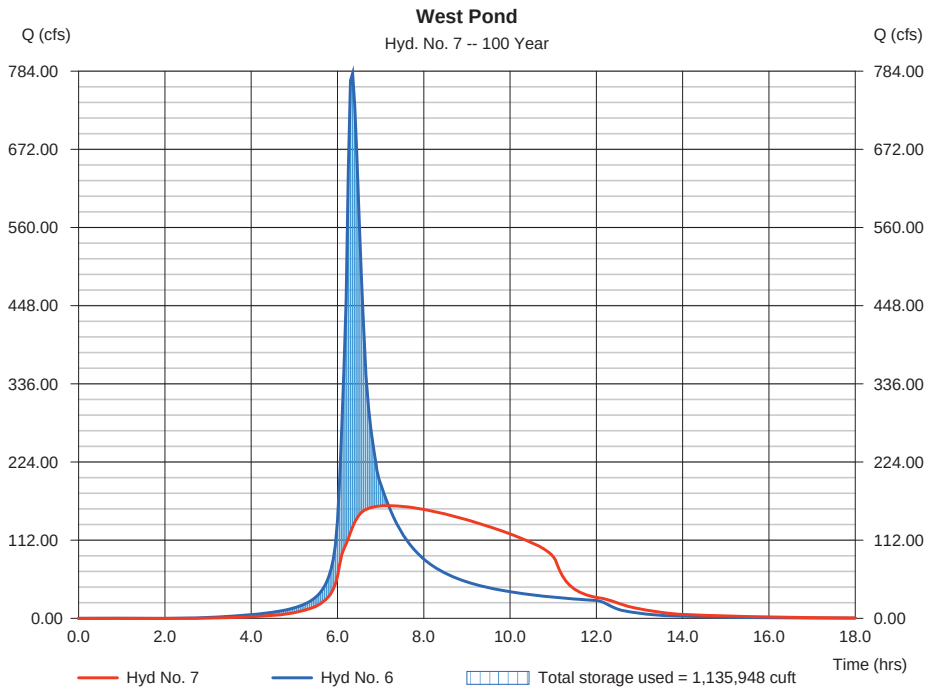
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 7

West Pond

Hydrograph type	=	Reservoir	Peak discharge	=	161.46 cfs
Storm frequency	=	100 yrs	Time to peak	=	7.20 hrs
Time interval	=	3 min	Hyd. volume	=	2,874,951 cuft
Inflow hyd. No.	=	6 - Stormwate to Pond Area	Max. Elevation	=	908.94 ft
Reservoir name	=	West Pond	Max. Storage	=	1,135,948 cuft

Storage Indication method used.



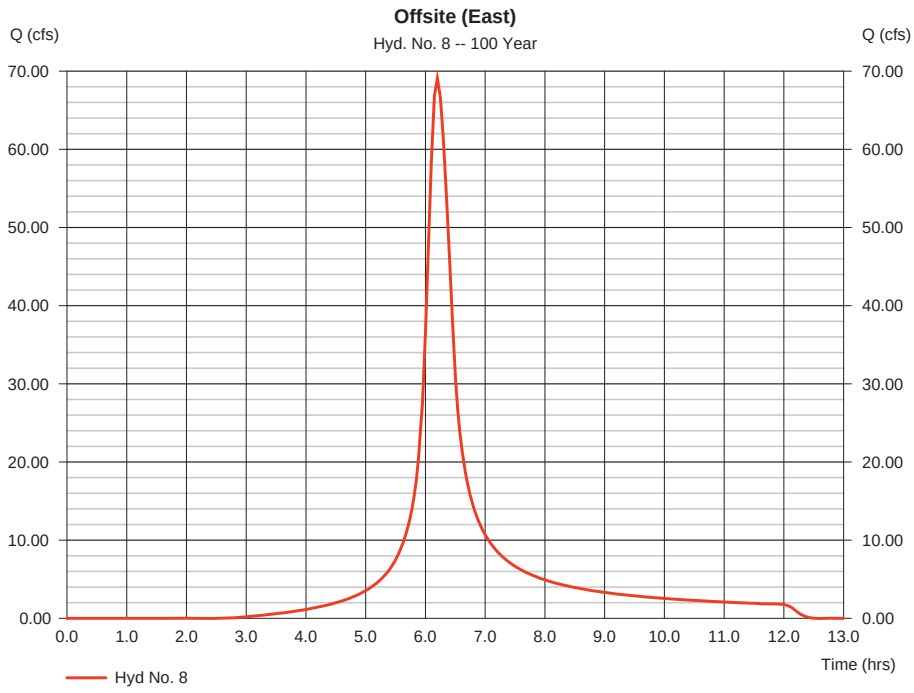
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 8

Offsite (East)

Hydrograph type	=	SCS Runoff	Peak discharge	=	69.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.20 hrs
Time interval	=	3 min	Hyd. volume	=	242,904 cuft
Drainage area	=	12.200 ac	Curve number	=	81.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	17.60 min
Total precip.	=	7.45 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



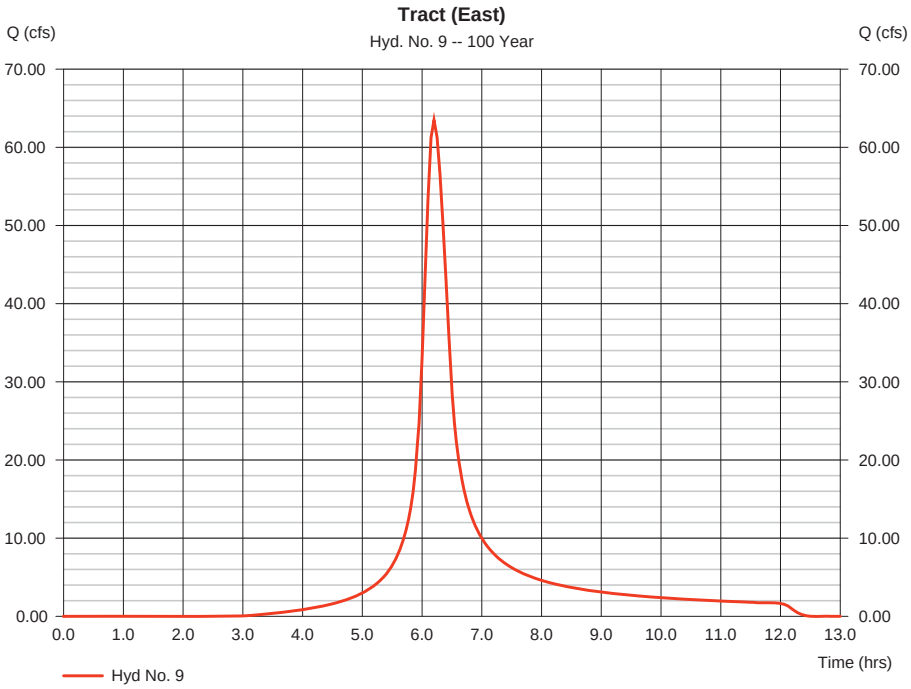
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 9

Tract (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 63.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.20 hrs
Time interval	= 3 min	Hyd. volume	= 222,054 cuft
Drainage area	= 11.600 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.70 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



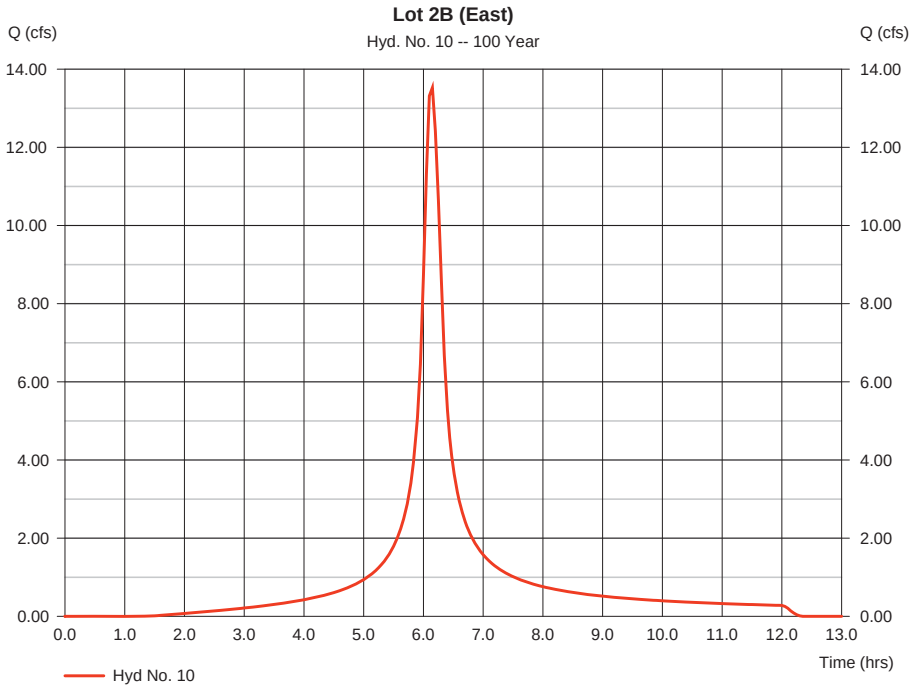
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 10

Lot 2B (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 44,032 cuft
Drainage area	= 1.900 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.60 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



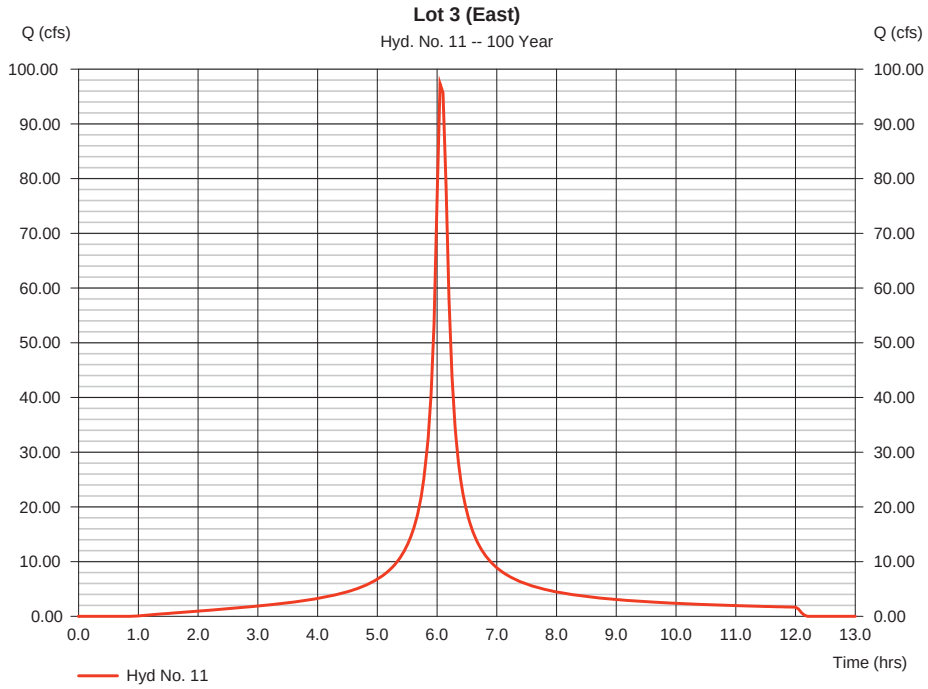
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 11

Lot 3 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 97.35 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 279,733 cuft
Drainage area	= 12.200 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



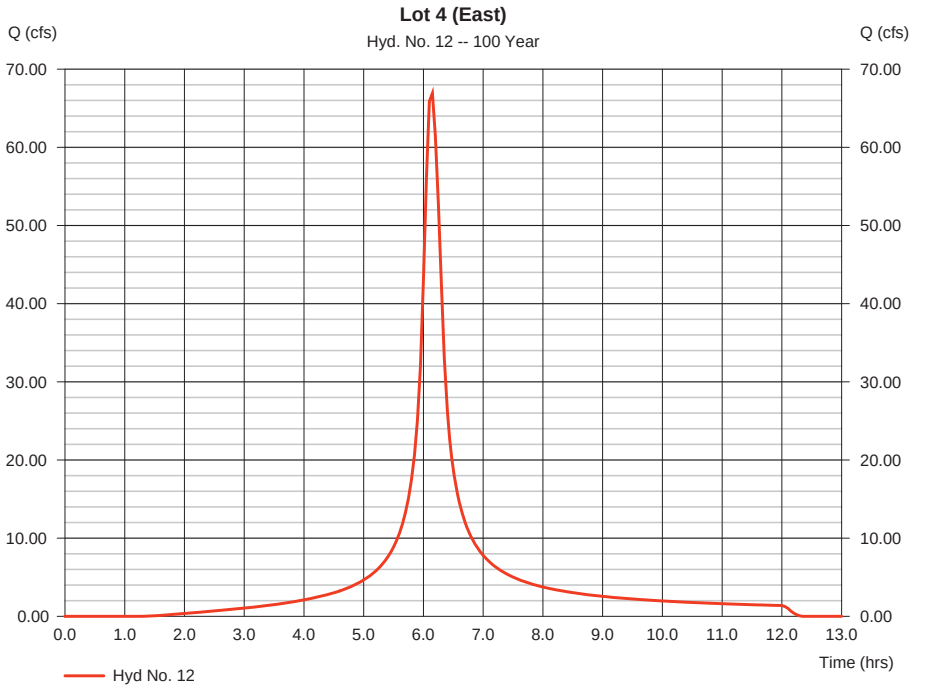
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 12

Lot 4 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 66.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 217,844 cuft
Drainage area	= 9.400 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.10 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



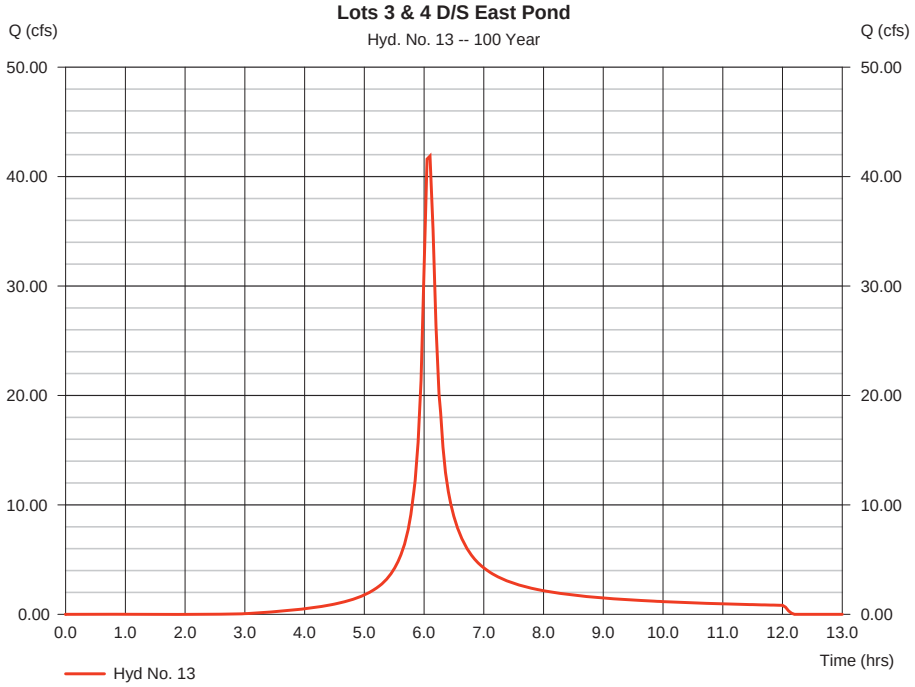
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 13

Lots 3 & 4 D/S East Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 41.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 111,375 cuft
Drainage area	= 6.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 7.45 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



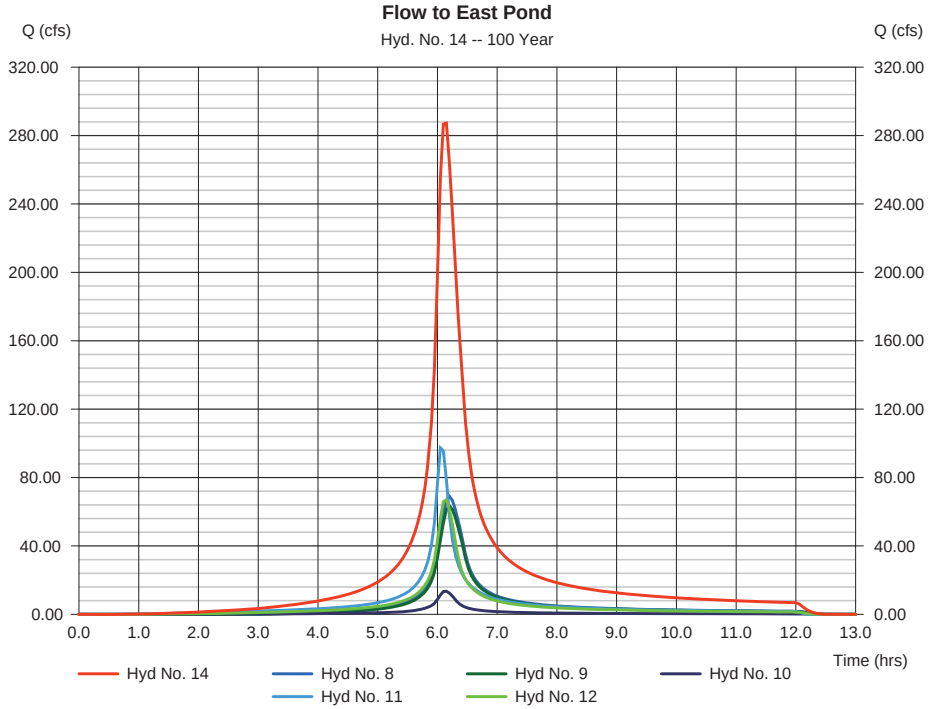
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 14

Flow to East Pond

Hydrograph type	= Combine	Peak discharge	= 287.29 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 1,006,567 cuft
Inflow hyds.	= 8, 9, 10, 11, 12	Contrib. drain. area	= 47.300 ac



Hydrograph Report

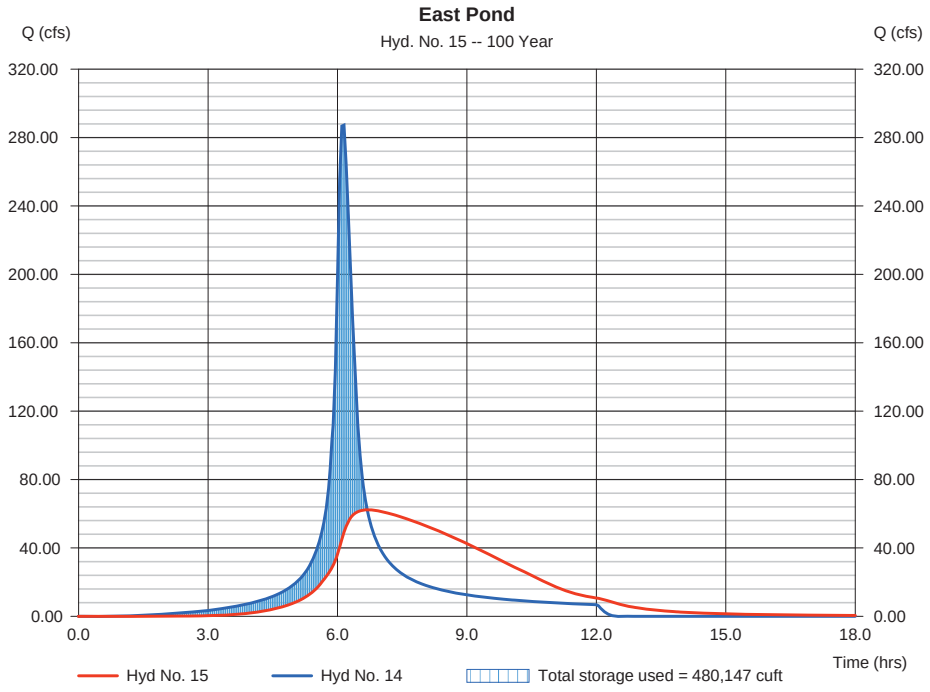
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	=	Reservoir	Peak discharge	=	62.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.70 hrs
Time interval	=	3 min	Hyd. volume	=	1,006,534 cuft
Inflow hyd. No.	=	14 - Flow to East Pond	Max. Elevation	=	926.19 ft
Reservoir name	=	East Pond	Max. Storage	=	480,147 cuft

Storage Indication method used.



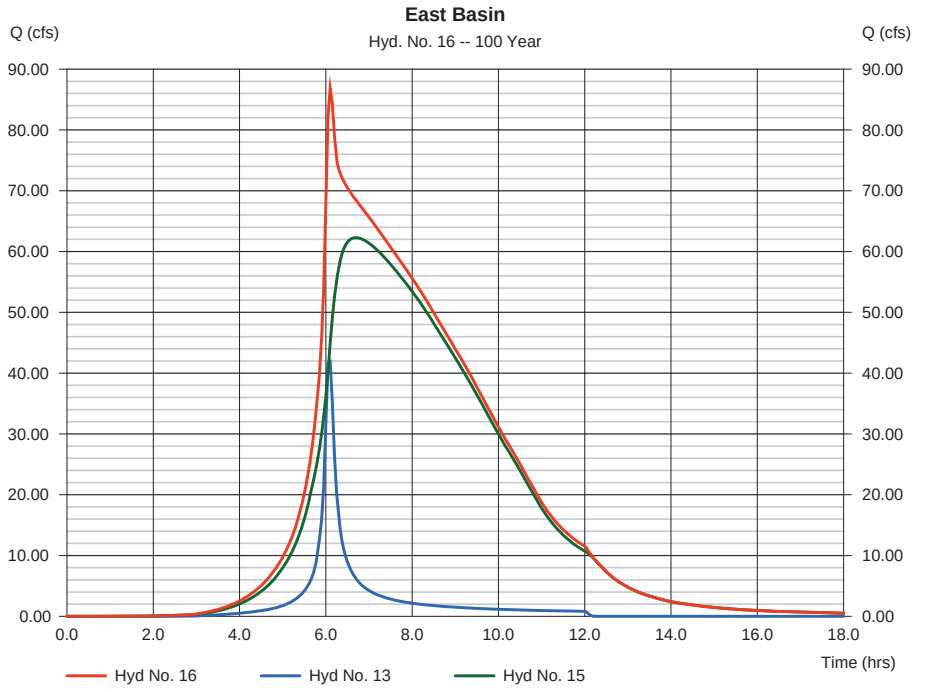
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 16

East Basin

Hydrograph type	=	Combine	Peak discharge	=	86.86 cfs
Storm frequency	=	100 yrs	Time to peak	=	6.10 hrs
Time interval	=	3 min	Hyd. volume	=	1,117,907 cuft
Inflow hyds.	=	13, 15	Contrib. drain. area	=	6.400 ac



APPENDIX C

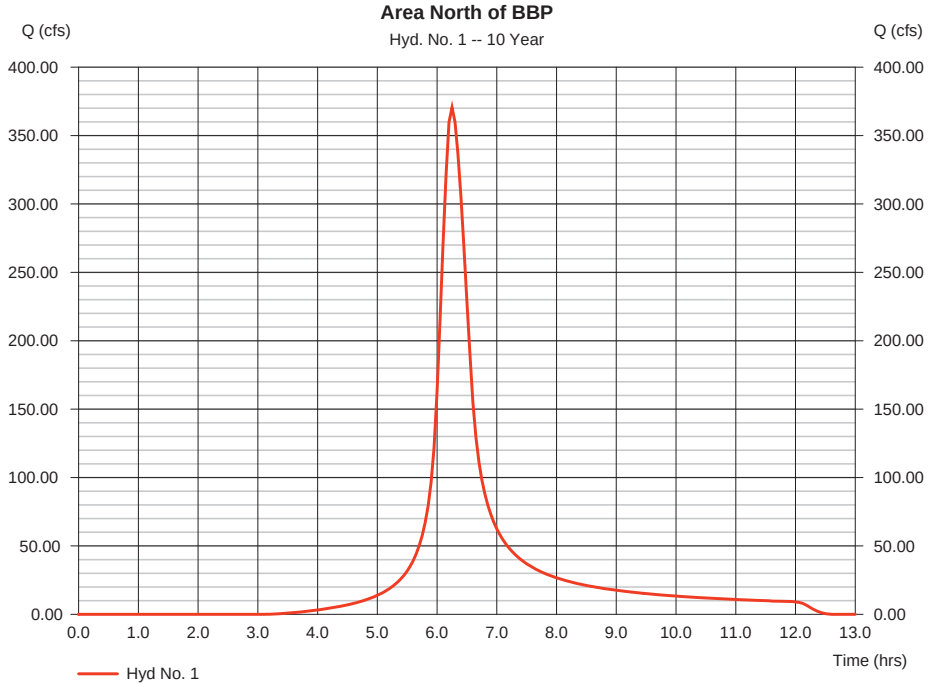
10-YEAR STORM EVENT
EAST AND WEST BASINS

Hydrograph Report

Hyd. No. 1

Area North of BBP

Hydrograph type	= SCS Runoff	Peak discharge	= 370.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.25 hrs
Time interval	= 3 min	Hyd. volume	= 1,299,668 cuft
Drainage area	= 113.700 ac	Curve number	= 85.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 23.30 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484

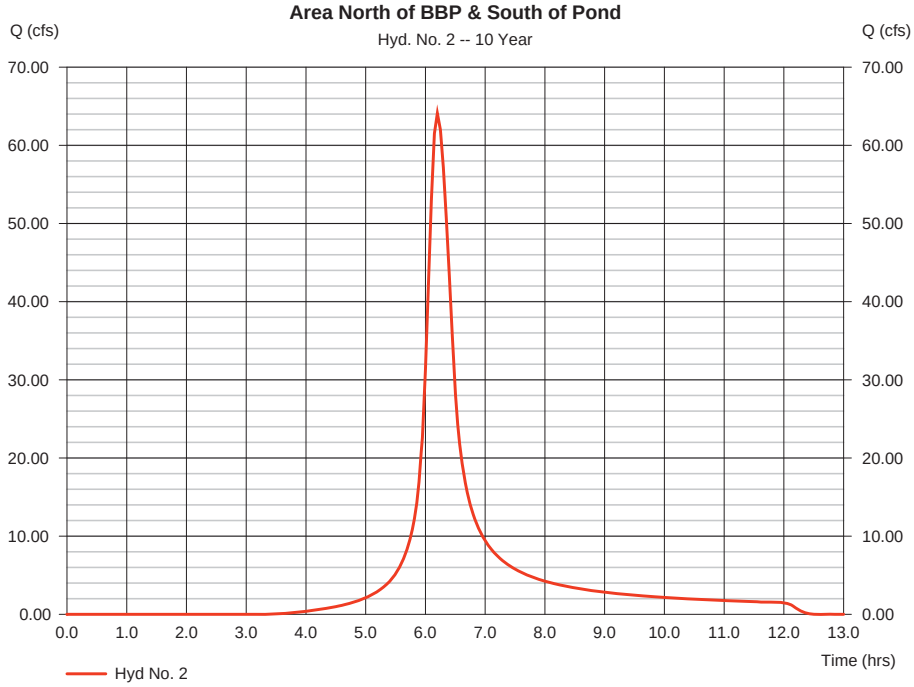


Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 2

Area North of BBP & South of Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 64.10 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.20 hrs
Time interval	= 3 min	Hyd. volume	= 207,403 cuft
Drainage area	= 17.900 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.10 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



Hydrograph Report

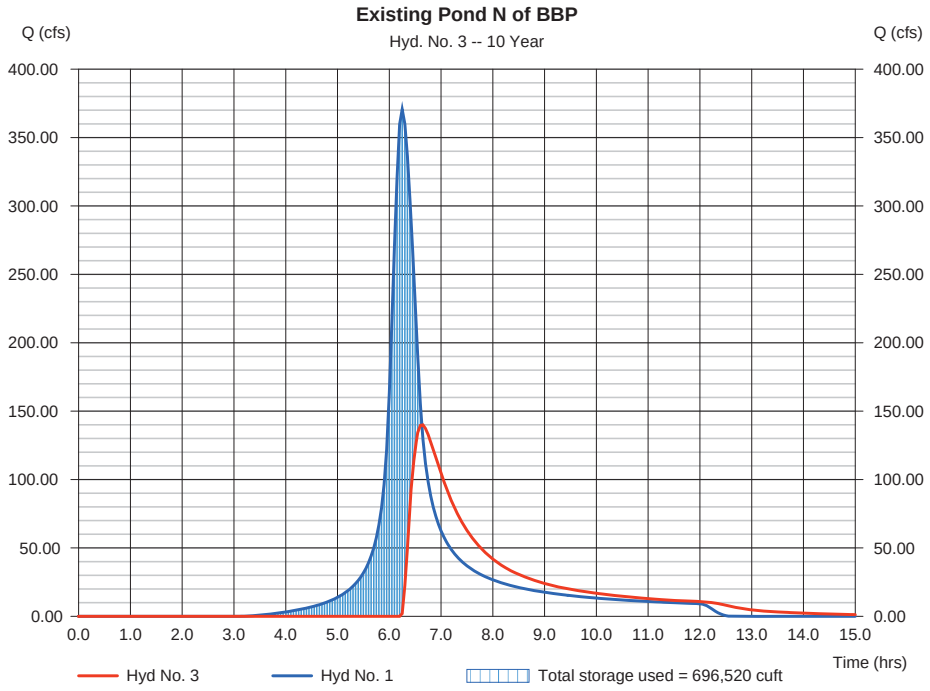
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 3

Existing Pond N of BBP

Hydrograph type	= Reservoir	Peak discharge	= 139.92 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.65 hrs
Time interval	= 3 min	Hyd. volume	= 860,614 cuft
Inflow hyd. No.	= 1 - Area North of BBP	Max. Elevation	= 936.94 ft
Reservoir name	= Existing Pond	Max. Storage	= 696,520 cuft

Storage Indication method used.



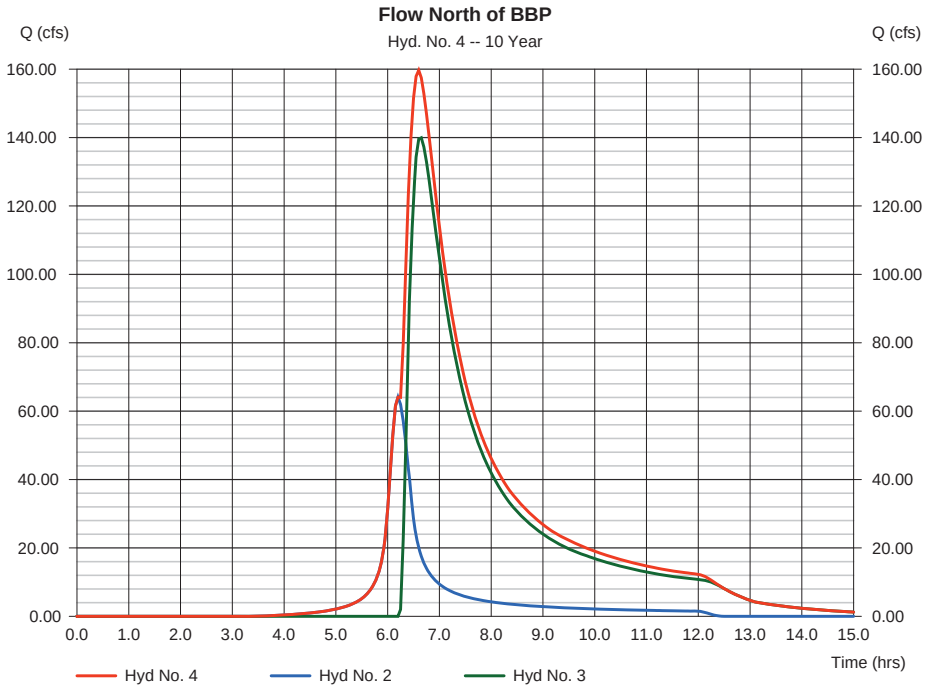
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 4

Flow North of BBP

Hydrograph type	= Combine	Peak discharge	= 159.67 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.60 hrs
Time interval	= 3 min	Hyd. volume	= 1,068,017 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 17.900 ac



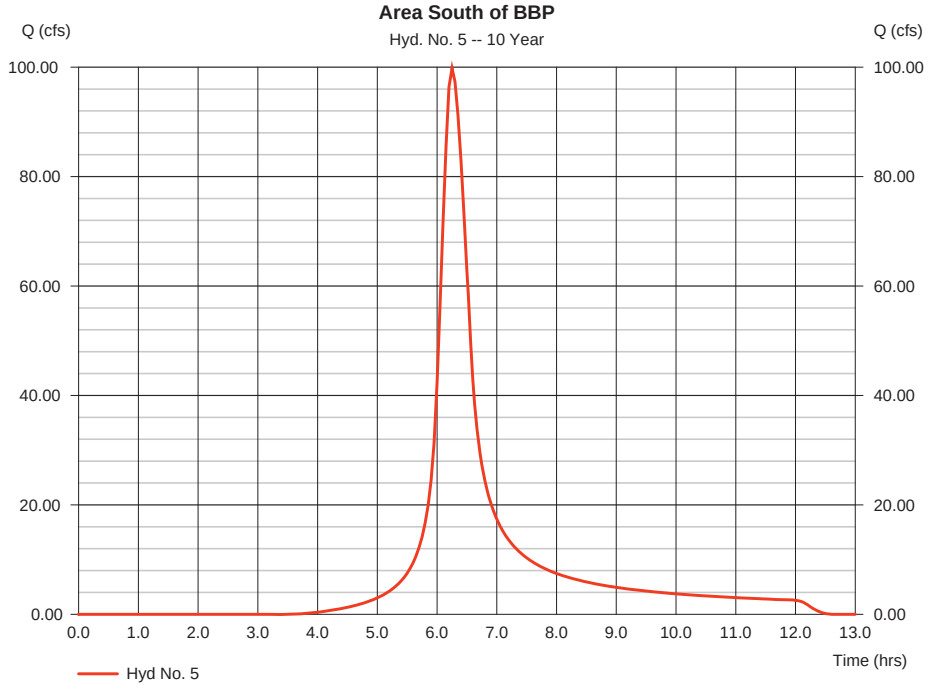
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 5

Area South of BBP

Hydrograph type	= SCS Runoff	Peak discharge	= 99.80 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.25 hrs
Time interval	= 3 min	Hyd. volume	= 348,335 cuft
Drainage area	= 32.900 ac	Curve number	= 82.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.60 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



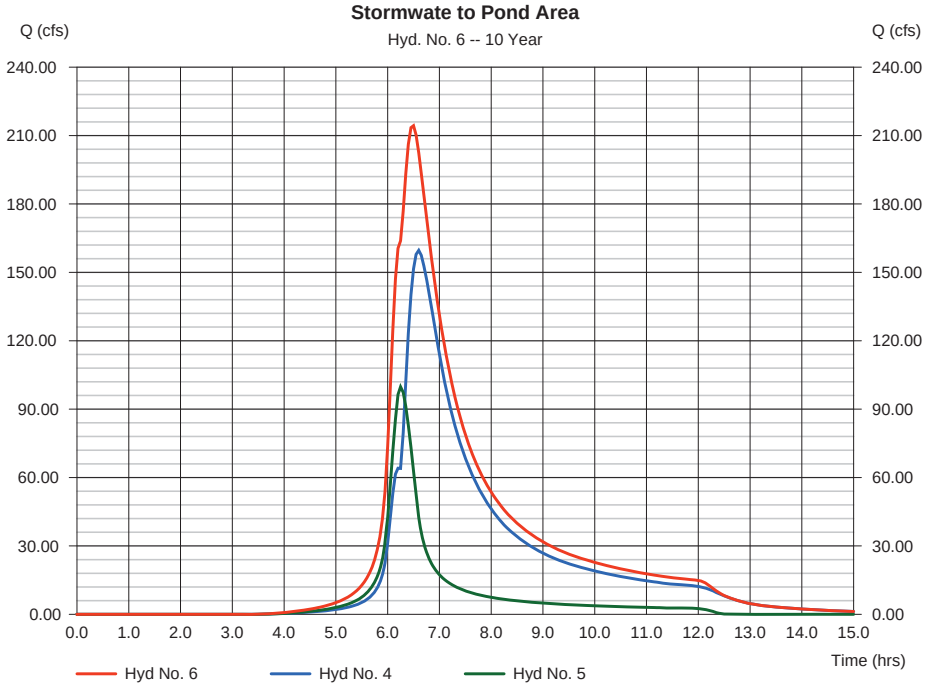
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 6

Stormwate to Pond Area

Hydrograph type	= Combine	Peak discharge	= 214.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.50 hrs
Time interval	= 3 min	Hyd. volume	= 1,416,352 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 32.900 ac



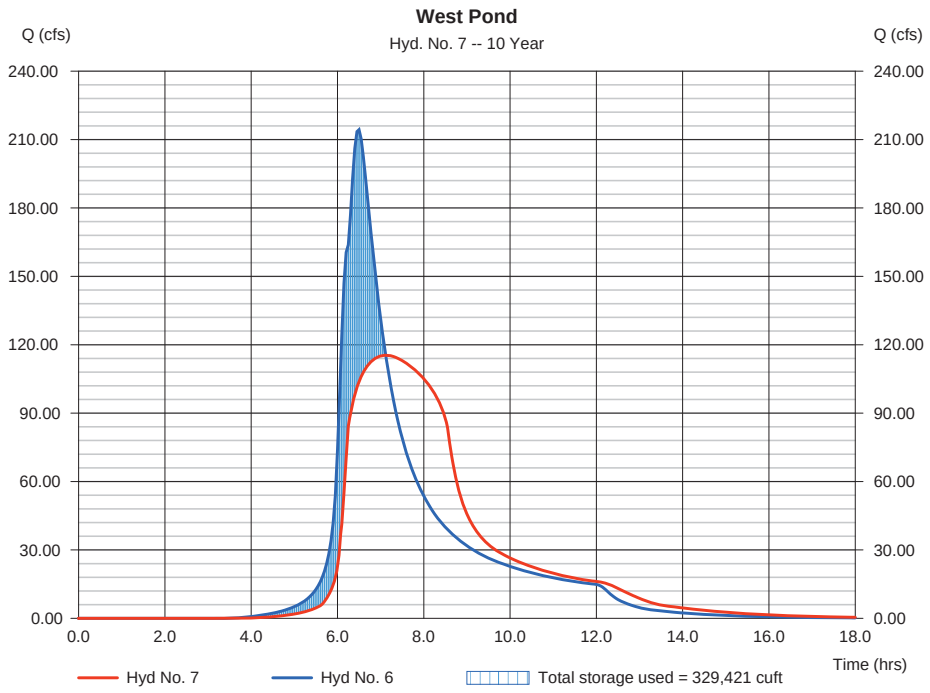
Hydrograph Report

Hyd. No. 7

West Pond

Hydrograph type	= Reservoir	Peak discharge	= 115.36 cfs
Storm frequency	= 10 yrs	Time to peak	= 7.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,416,349 cuft
Inflow hyd. No.	= 6 - Stormwate to Pond Area	Max. Elevation	= 903.07 ft
Reservoir name	= West Pond	Max. Storage	= 329,421 cuft

Storage Indication method used.



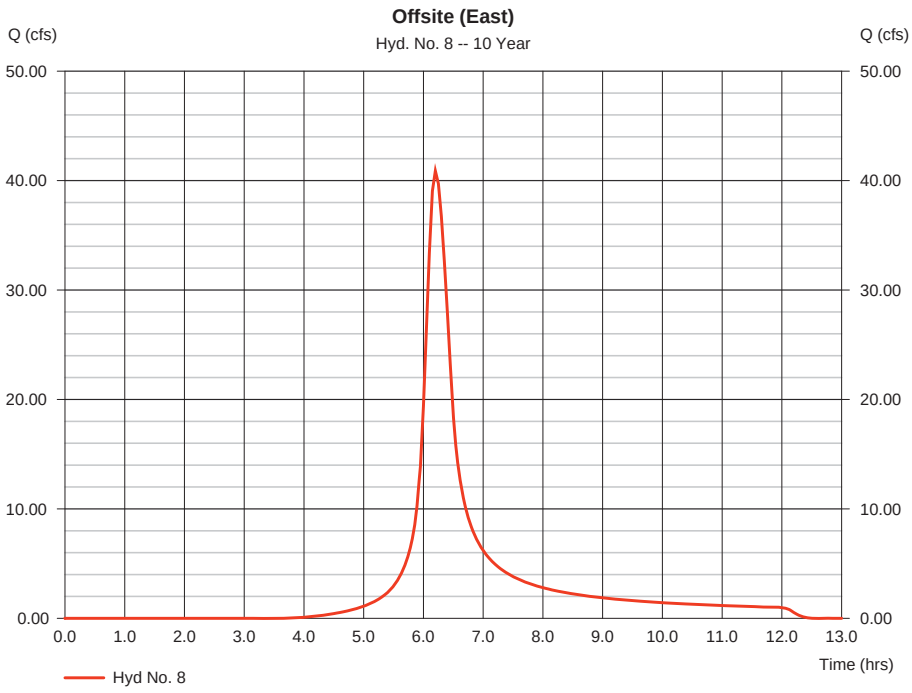
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 8

Offsite (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 40.89 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.20 hrs
Time interval	= 3 min	Hyd. volume	= 131,961 cuft
Drainage area	= 12.200 ac	Curve number	= 81.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.60 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



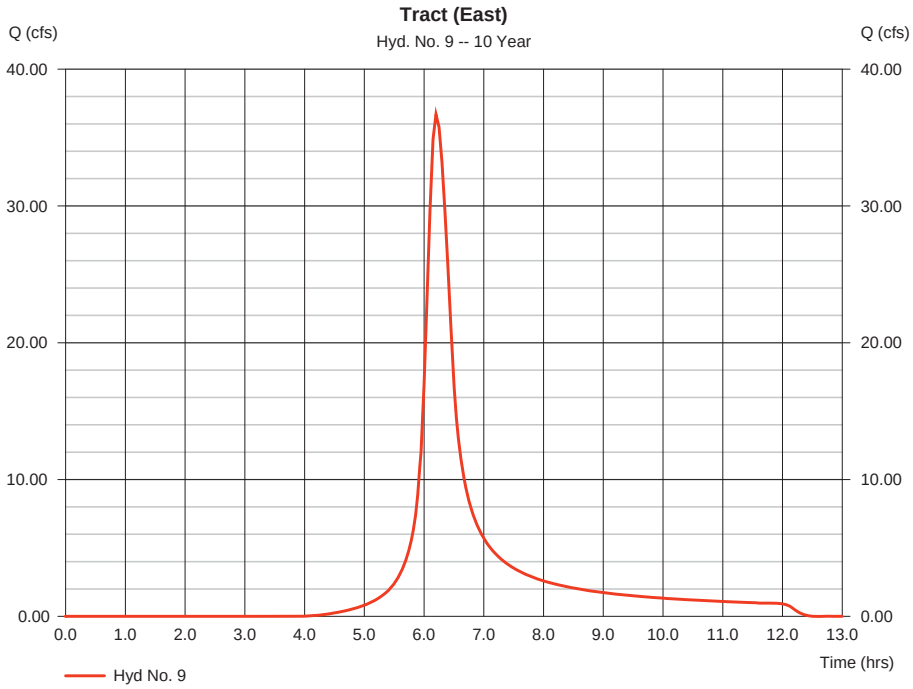
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 9

Tract (East)

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.69 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.20 hrs
Time interval	=	3 min	Hyd. volume	=	118,373 cuft
Drainage area	=	11.600 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	17.70 min
Total precip.	=	4.81 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



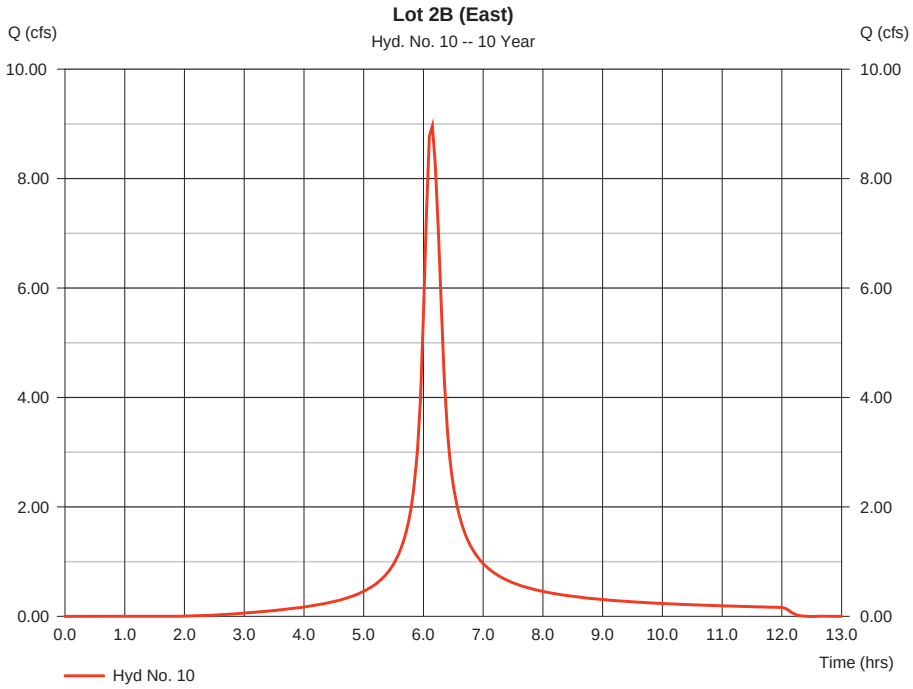
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 10

Lot 2B (East)

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.962 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.15 hrs
Time interval	=	3 min	Hyd. volume	=	26,180 cuft
Drainage area	=	1.900 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.60 min
Total precip.	=	4.81 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



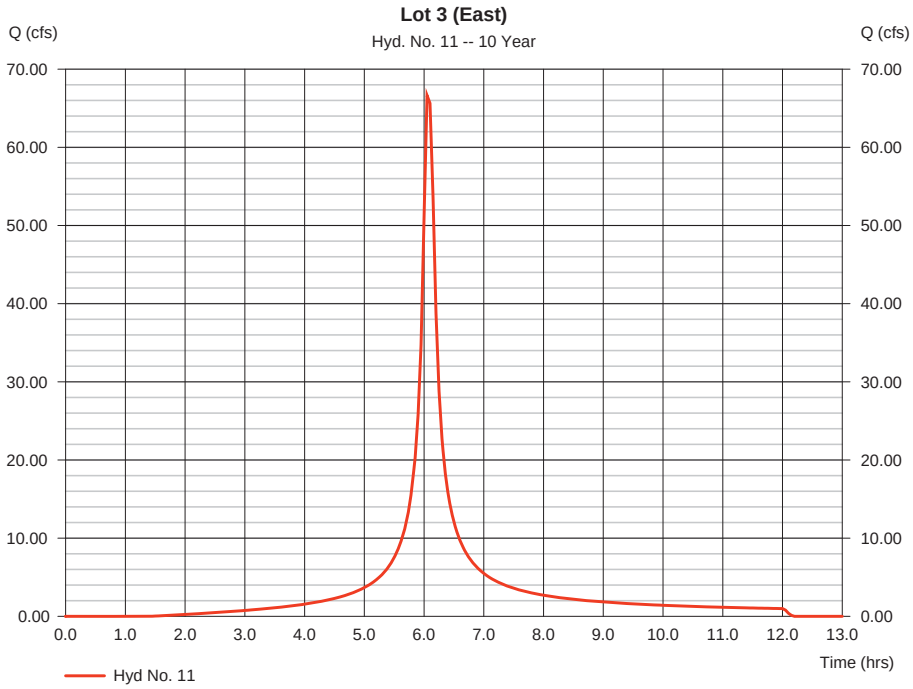
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 11

Lot 3 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 66.64 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 170,996 cuft
Drainage area	= 12.200 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



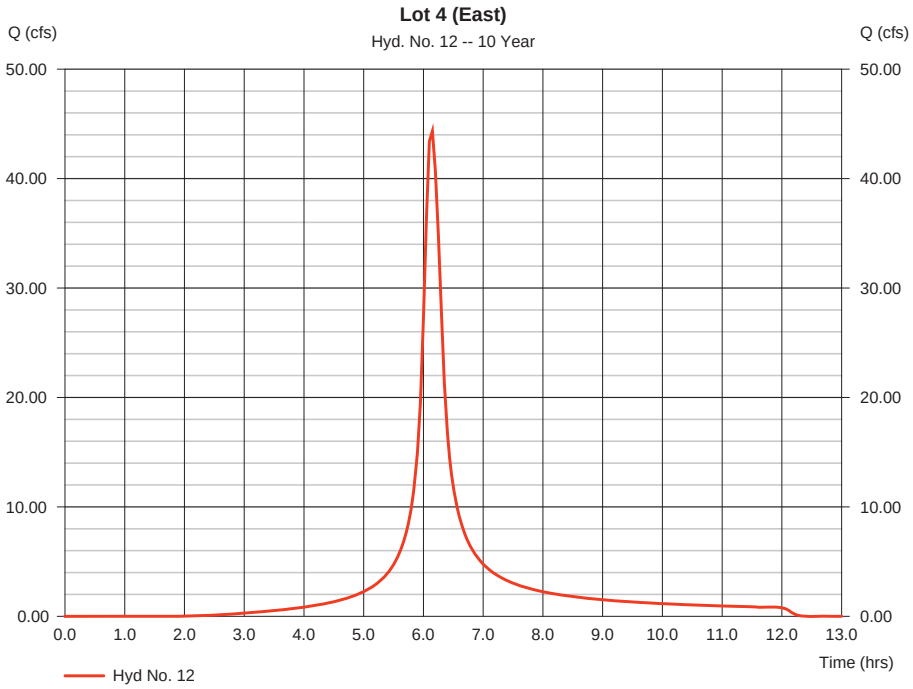
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 12

Lot 4 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 44.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 129,521 cuft
Drainage area	= 9.400 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.10 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



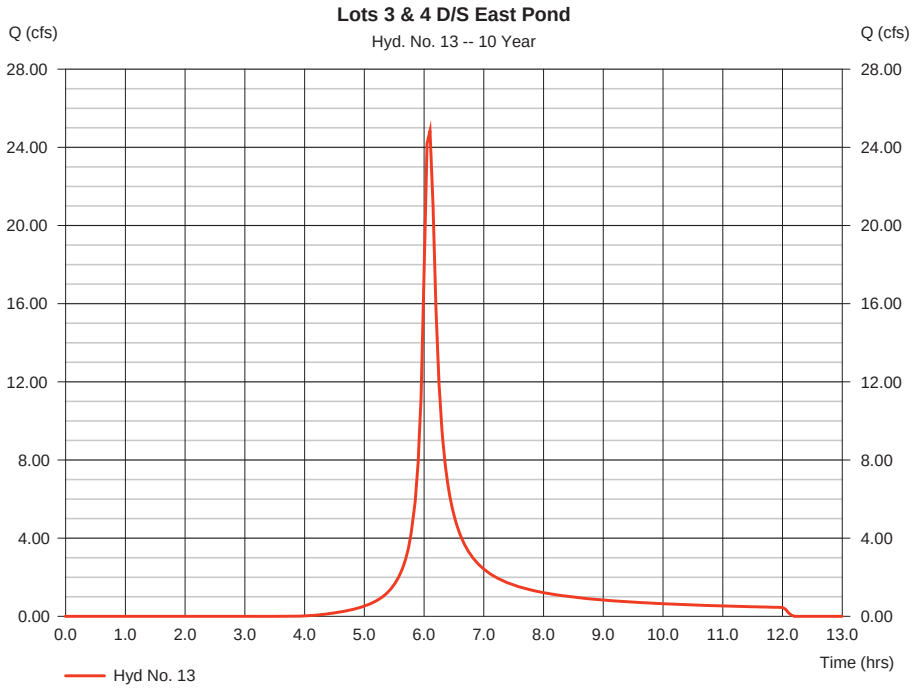
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 13

Lots 3 & 4 D/S East Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 24.84 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 59,372 cuft
Drainage area	= 6.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 4.81 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



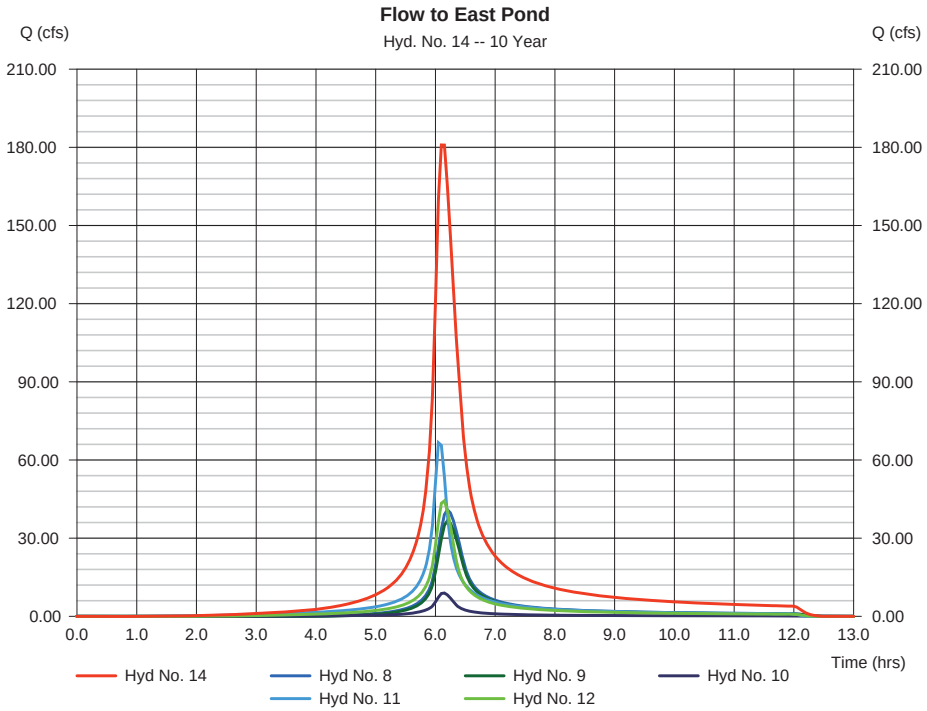
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 14

Flow to East Pond

Hydrograph type	= Combine	Peak discharge	= 180.92 cfs
Storm frequency	= 10 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 577,030 cuft
Inflow hyds.	= 8, 9, 10, 11, 12	Contrib. drain. area	= 47.300 ac



Hydrograph Report

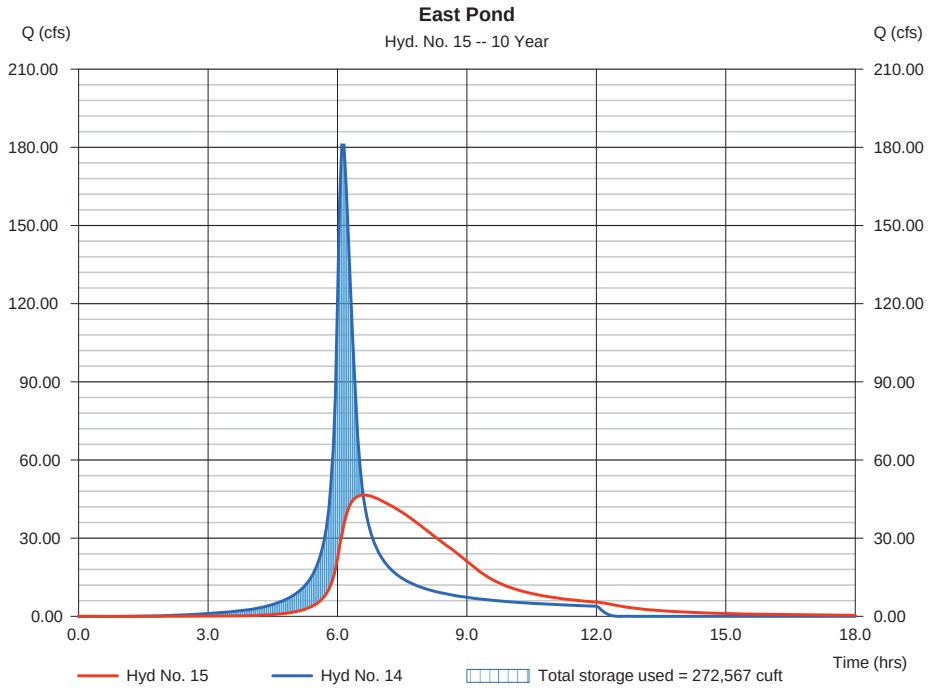
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	=	Reservoir	Peak discharge	=	46.57 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.60 hrs
Time interval	=	3 min	Hyd. volume	=	576,997 cuft
Inflow hyd. No.	=	14 - Flow to East Pond	Max. Elevation	=	923.13 ft
Reservoir name	=	East Pond	Max. Storage	=	272,567 cuft

Storage Indication method used.



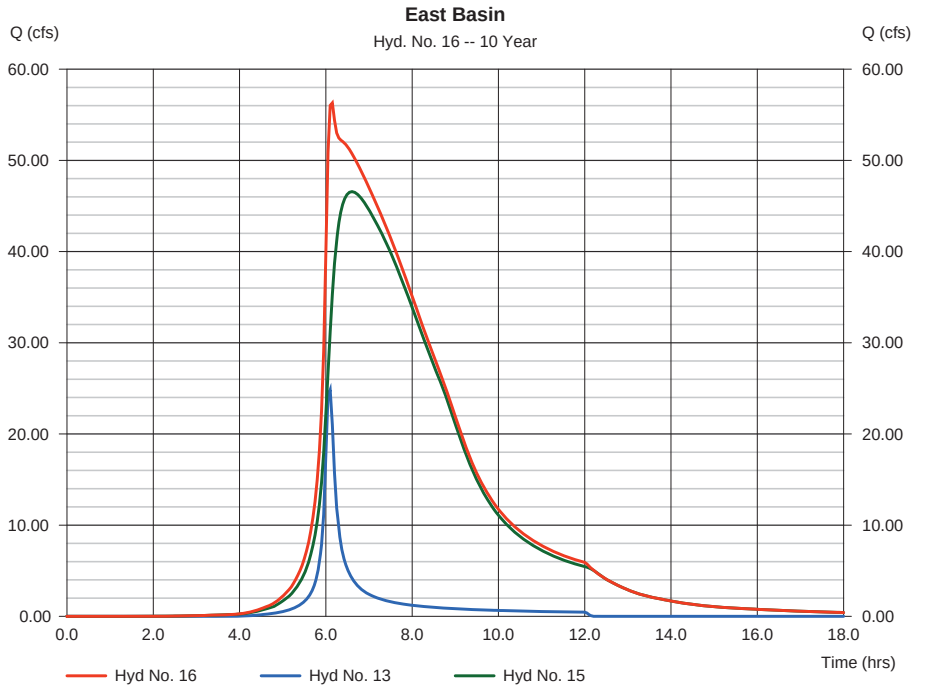
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 16

East Basin

Hydrograph type	=	Combine	Peak discharge	=	56.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.15 hrs
Time interval	=	3 min	Hyd. volume	=	636,369 cuft
Inflow hyds.	=	13, 15	Contrib. drain. area	=	6.400 ac



APPENDIX D

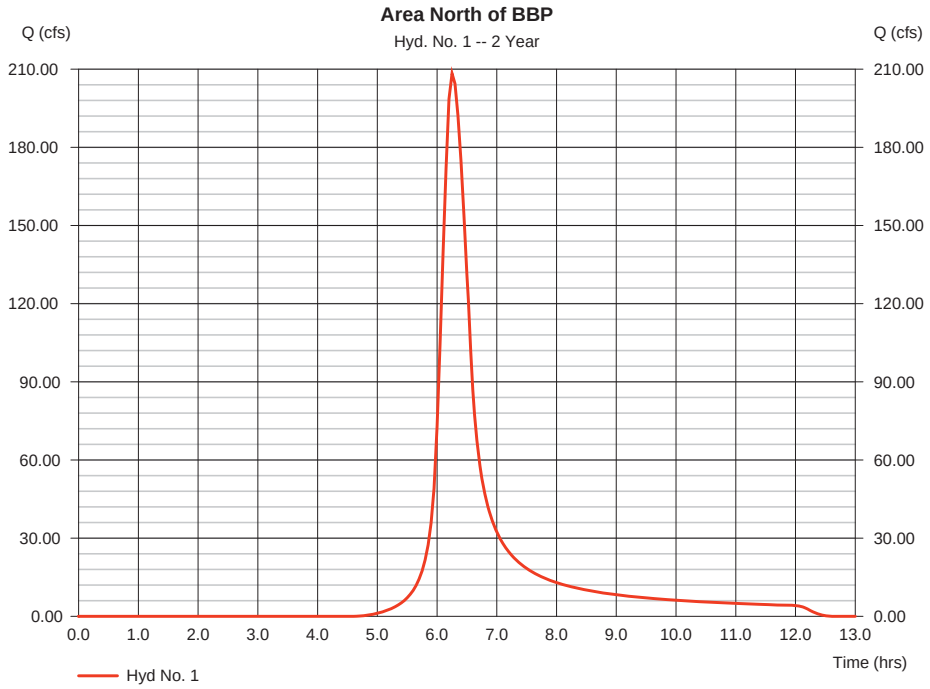
2-YEAR STORM EVENT
EAST AND WEST BASINS

Hydrograph Report

Hyd. No. 1

Area North of BBP

Hydrograph type	=	SCS Runoff	Peak discharge	=	208.35 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.25 hrs
Time interval	=	3 min	Hyd. volume	=	632,361 cuft
Drainage area	=	113.700 ac	Curve number	=	85.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.30 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



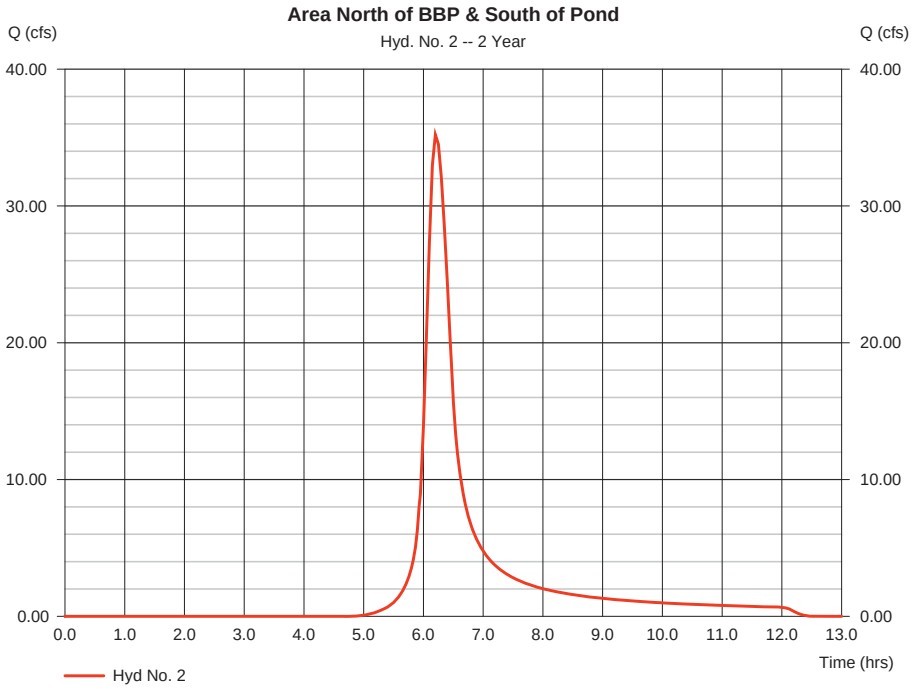
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 2

Area North of BBP & South of Pond

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.21 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.20 hrs
Time interval	=	3 min	Hyd. volume	=	98,594 cuft
Drainage area	=	17.900 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.10 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



Hydrograph Report

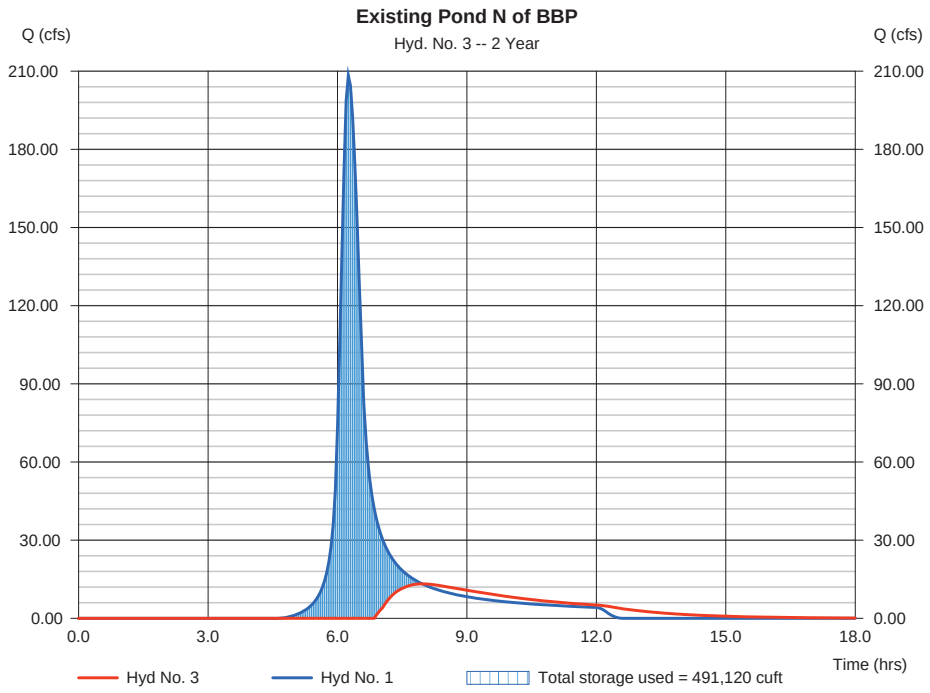
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 3

Existing Pond N of BBP

Hydrograph type	= Reservoir	Peak discharge	= 13.23 cfs
Storm frequency	= 2 yrs	Time to peak	= 7.95 hrs
Time interval	= 3 min	Hyd. volume	= 193,306 cuft
Inflow hyd. No.	= 1 - Area North of BBP	Max. Elevation	= 936.11 ft
Reservoir name	= Existing Pond	Max. Storage	= 491,120 cuft

Storage Indication method used.



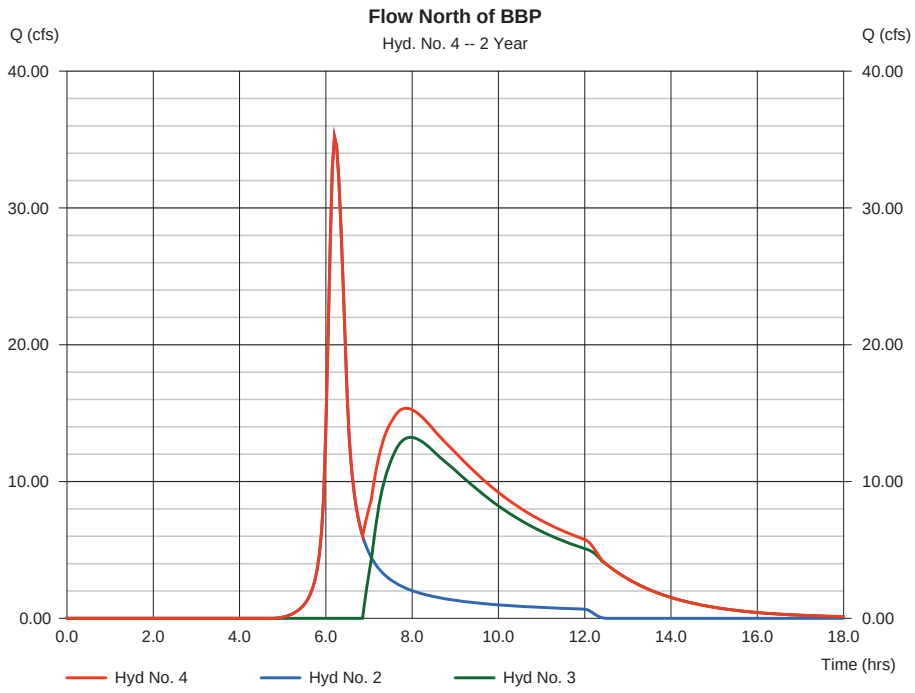
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 4

Flow North of BBP

Hydrograph type	= Combine	Peak discharge	= 35.21 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.20 hrs
Time interval	= 3 min	Hyd. volume	= 291,901 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 17.900 ac



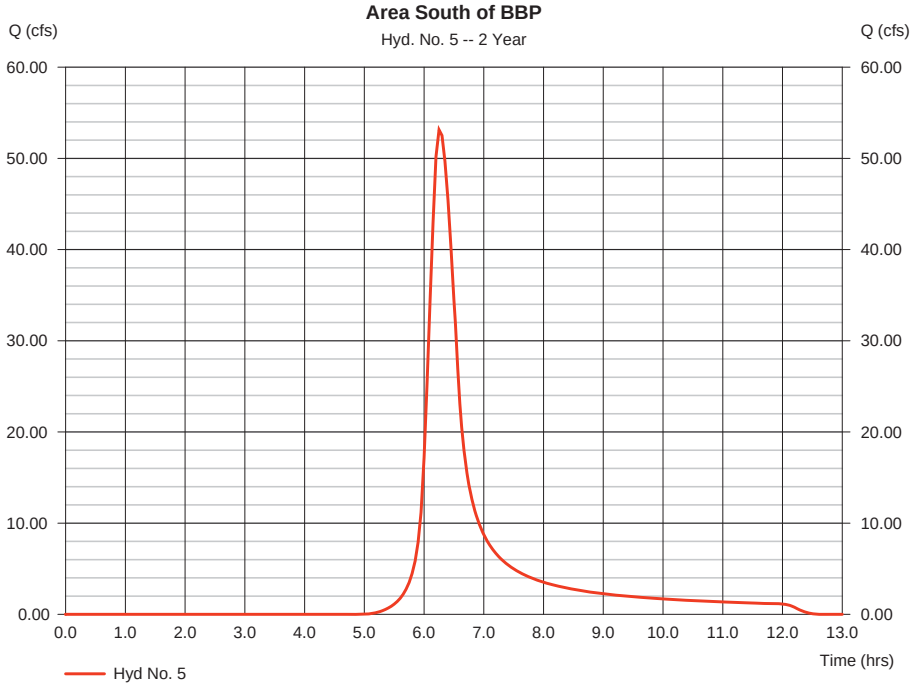
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 5

Area South of BBP

Hydrograph type	= SCS Runoff	Peak discharge	= 53.13 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.25 hrs
Time interval	= 3 min	Hyd. volume	= 162,539 cuft
Drainage area	= 32.900 ac	Curve number	= 82.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 20.60 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



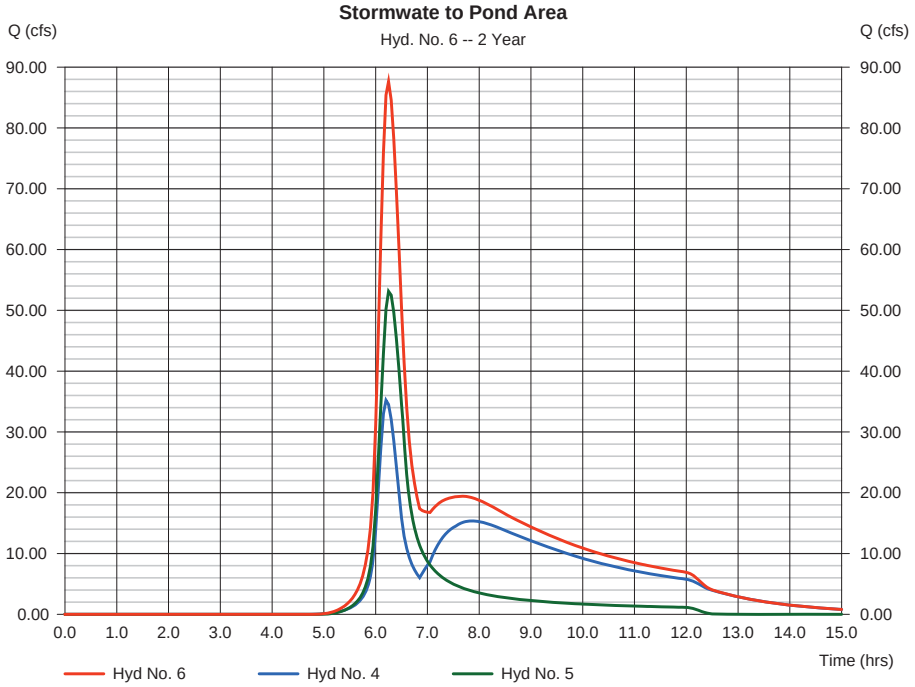
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 6

Stormwate to Pond Area

Hydrograph type	= Combine	Peak discharge	= 87.64 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.25 hrs
Time interval	= 3 min	Hyd. volume	= 454,440 cuft
Inflow hyds.	= 4, 5	Contrib. drain. area	= 32.900 ac



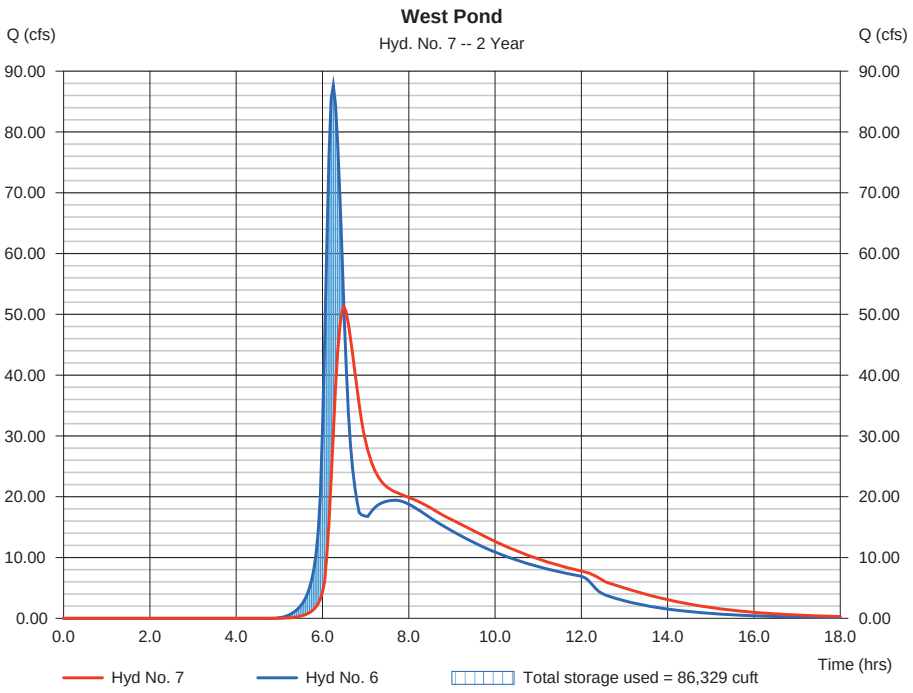
Hydrograph Report

Hyd. No. 7

West Pond

Hydrograph type	= Reservoir	Peak discharge	= 51.21 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.50 hrs
Time interval	= 3 min	Hyd. volume	= 454,436 cuft
Inflow hyd. No.	= 6 - Stormwate to Pond Area	Max. Elevation	= 900.84 ft
Reservoir name	= West Pond	Max. Storage	= 86,329 cuft

Storage Indication method used.

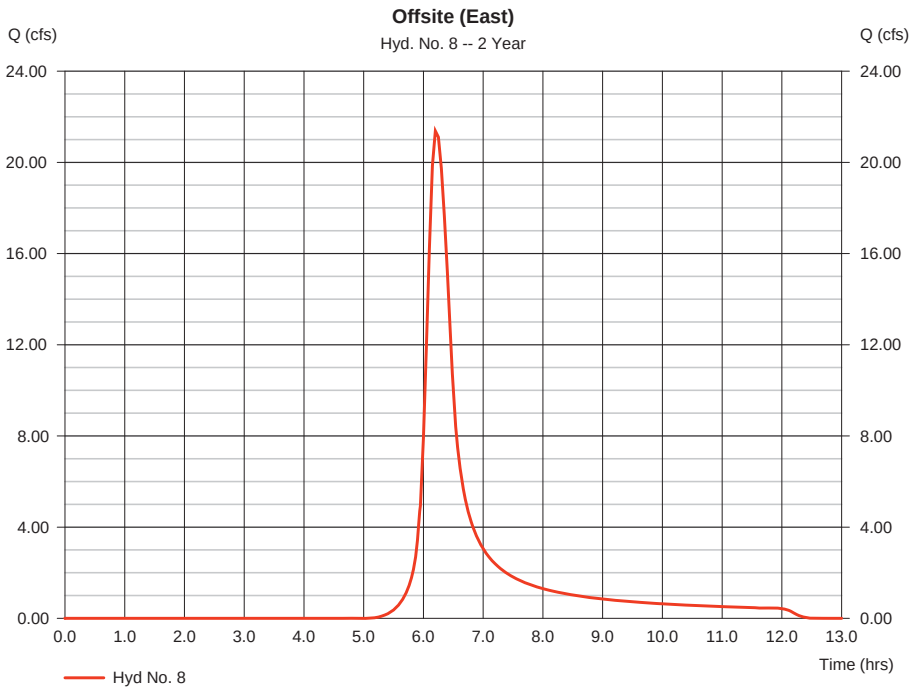


Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 8

Offsite (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 21.38 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.20 hrs
Time interval	= 3 min	Hyd. volume	= 60,421 cuft
Drainage area	= 12.200 ac	Curve number	= 81.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.60 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



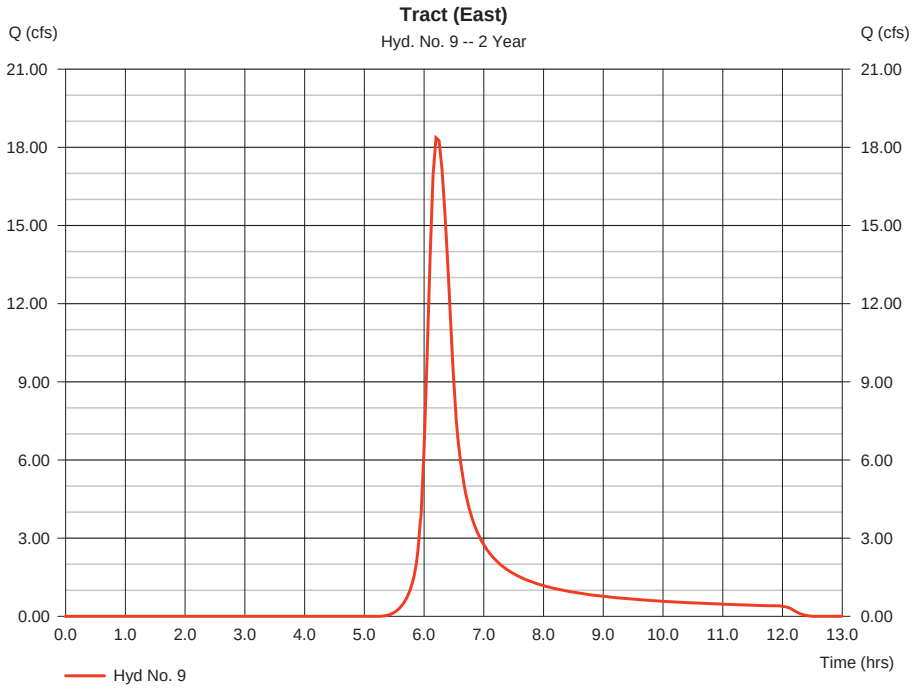
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 9

Tract (East)

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.37 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.20 hrs
Time interval	=	3 min	Hyd. volume	=	52,504 cuft
Drainage area	=	11.600 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	17.70 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



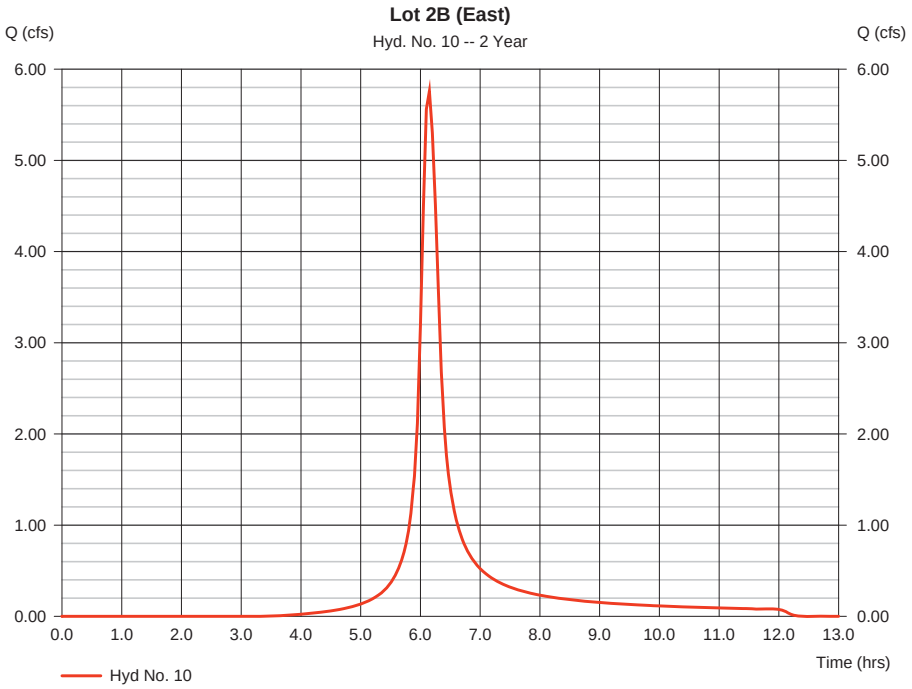
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 10

Lot 2B (East)

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.758 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.15 hrs
Time interval	=	3 min	Hyd. volume	=	13,934 cuft
Drainage area	=	1.900 ac	Curve number	=	91
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.60 min
Total precip.	=	2.95 in	Distribution	=	Synthetic
Storm duration	=	12.00 hrs	Shape factor	=	484



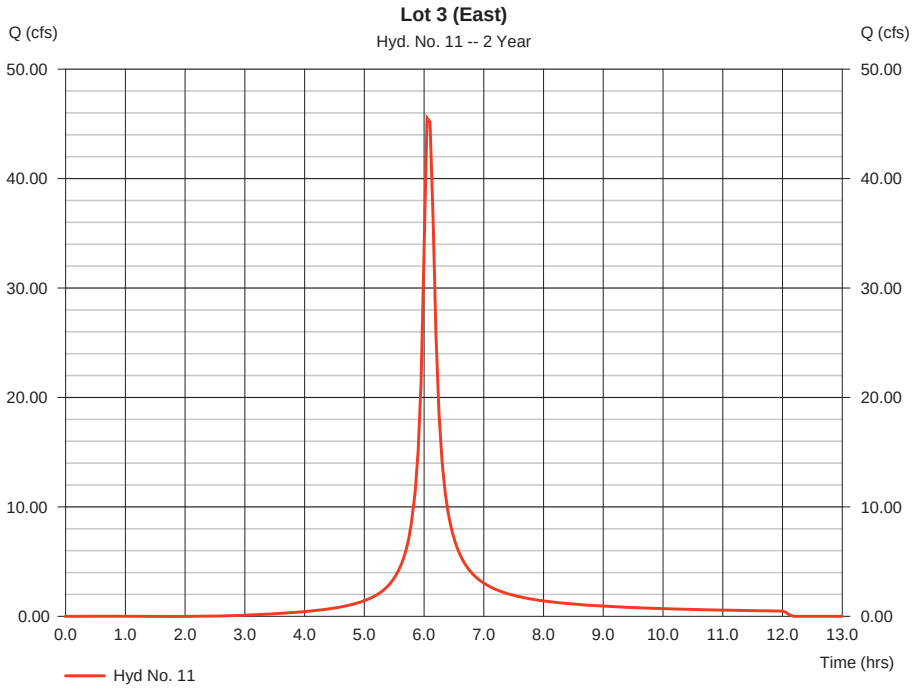
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 11

Lot 3 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 45.53 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.05 hrs
Time interval	= 3 min	Hyd. volume	= 95,376 cuft
Drainage area	= 12.200 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.40 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



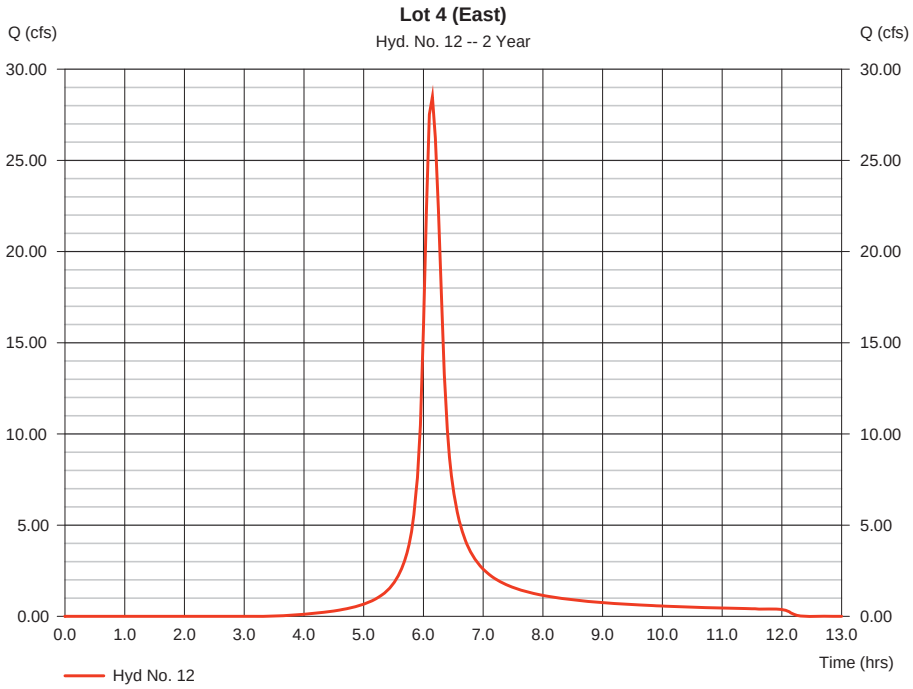
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 12

Lot 4 (East)

Hydrograph type	= SCS Runoff	Peak discharge	= 28.49 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.15 hrs
Time interval	= 3 min	Hyd. volume	= 68,935 cuft
Drainage area	= 9.400 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



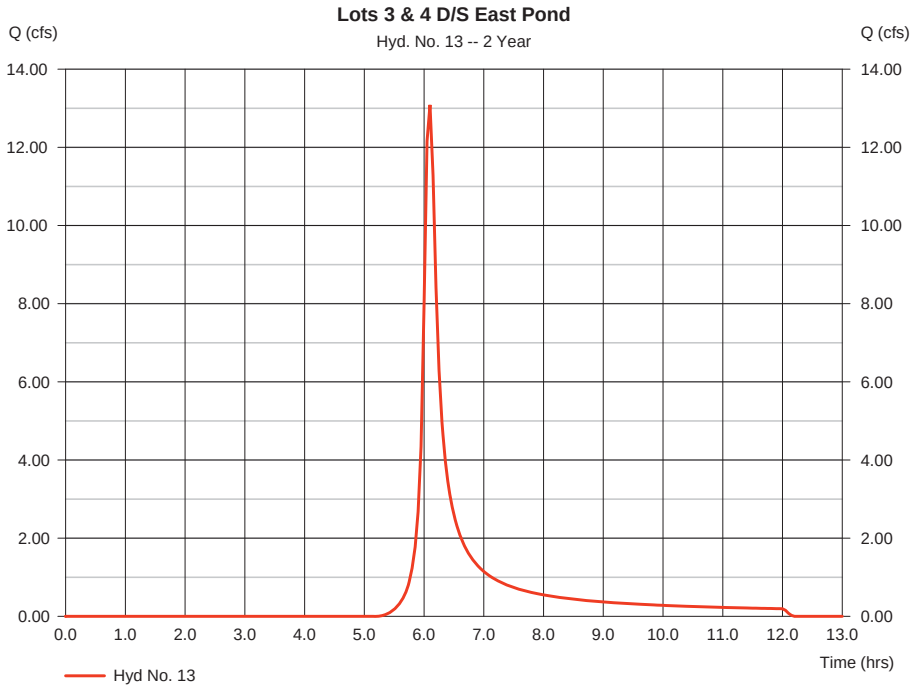
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 13

Lots 3 & 4 D/S East Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 13.09 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 26,334 cuft
Drainage area	= 6.400 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 2.95 in	Distribution	= Synthetic
Storm duration	= 12.00 hrs	Shape factor	= 484



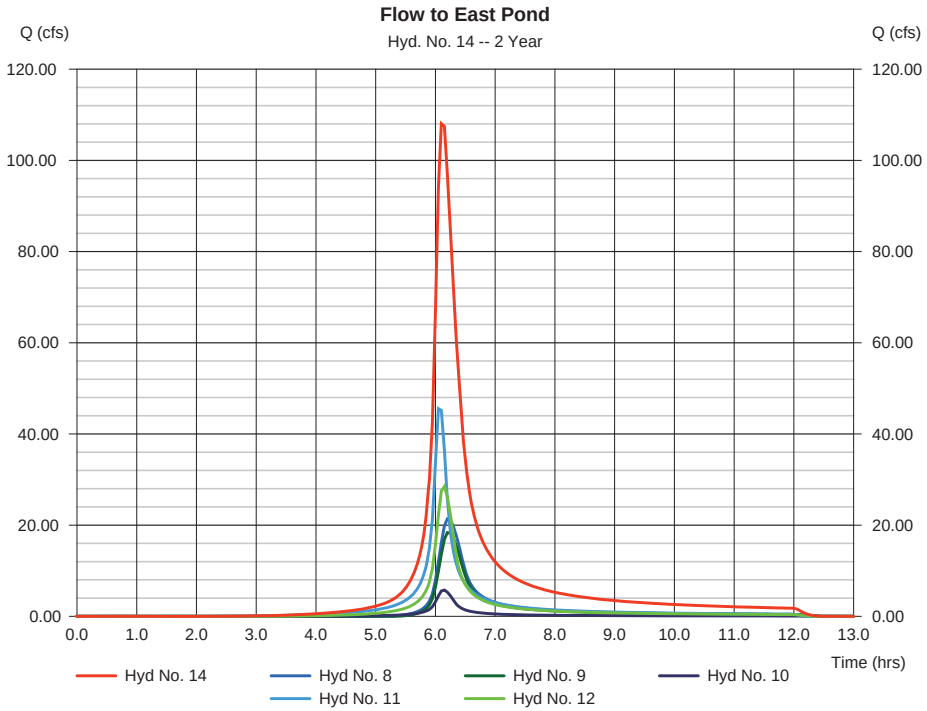
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 14

Flow to East Pond

Hydrograph type	= Combine	Peak discharge	= 108.05 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.10 hrs
Time interval	= 3 min	Hyd. volume	= 291,170 cuft
Inflow hyds.	= 8, 9, 10, 11, 12	Contrib. drain. area	= 47.300 ac



Hydrograph Report

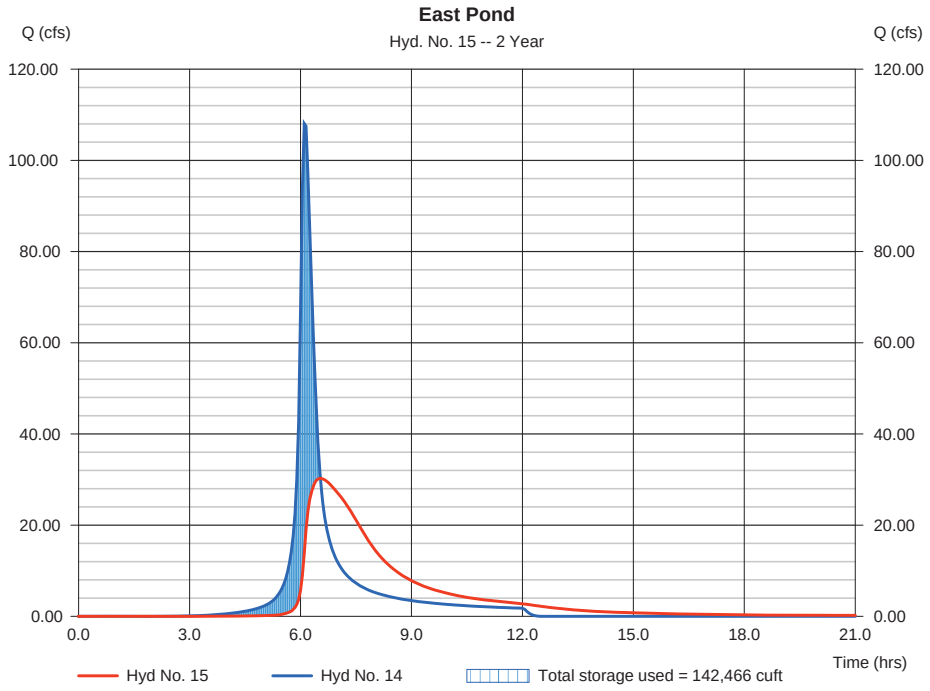
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	= Reservoir	Peak discharge	= 30.25 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.55 hrs
Time interval	= 3 min	Hyd. volume	= 291,137 cuft
Inflow hyd. No.	= 14 - Flow to East Pond	Max. Elevation	= 920.89 ft
Reservoir name	= East Pond	Max. Storage	= 142,466 cuft

Storage Indication method used.



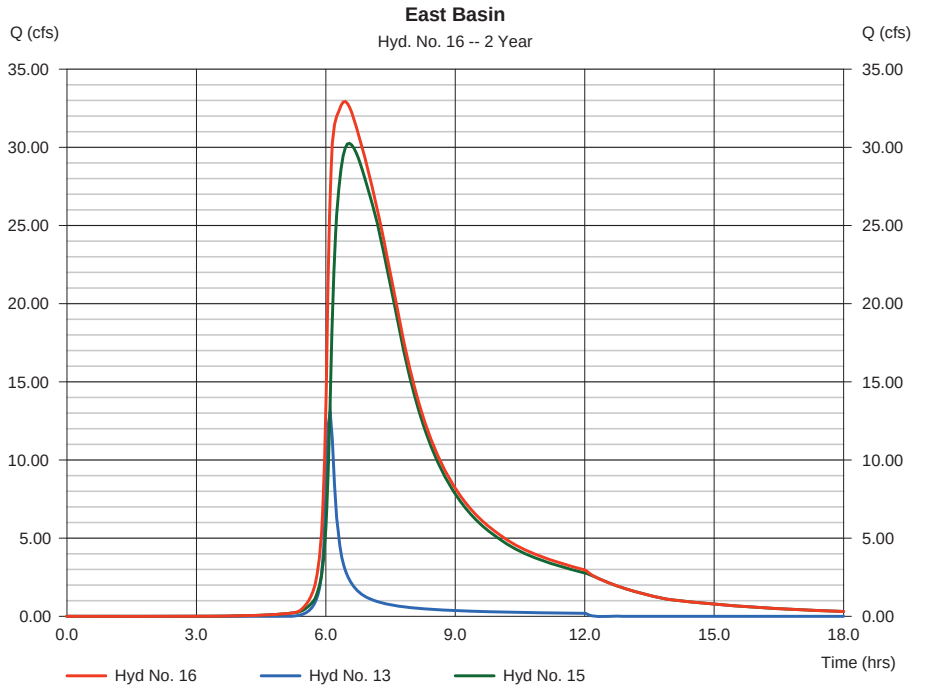
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 16

East Basin

Hydrograph type	= Combine	Peak discharge	= 32.93 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.45 hrs
Time interval	= 3 min	Hyd. volume	= 317,471 cuft
Inflow hyds.	= 13, 15	Contrib. drain. area	= 6.400 ac



APPENDIX E

RESERVOIR REPORTS

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Pond No. 3 - East Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 918.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	918.00	43,700	0	0
2.00	920.00	50,600	94,206	94,206
4.00	922.00	57,900	108,407	202,614
6.00	924.00	65,600	123,408	326,021
8.00	926.00	73,700	139,208	465,229
10.00	928.00	82,300	155,905	621,134

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	0.00	0.00	0.00
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 918.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 2.00	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	No	No	No

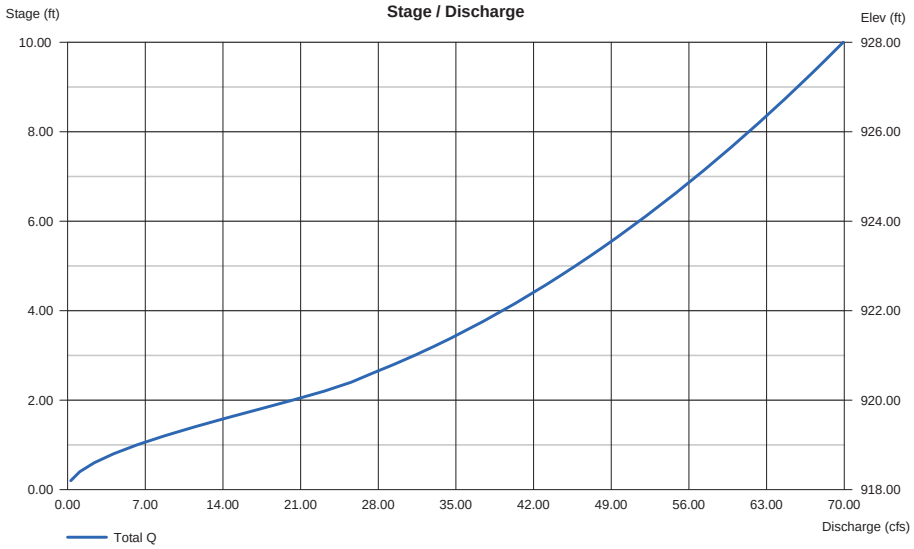
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

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



Hydrograph Report

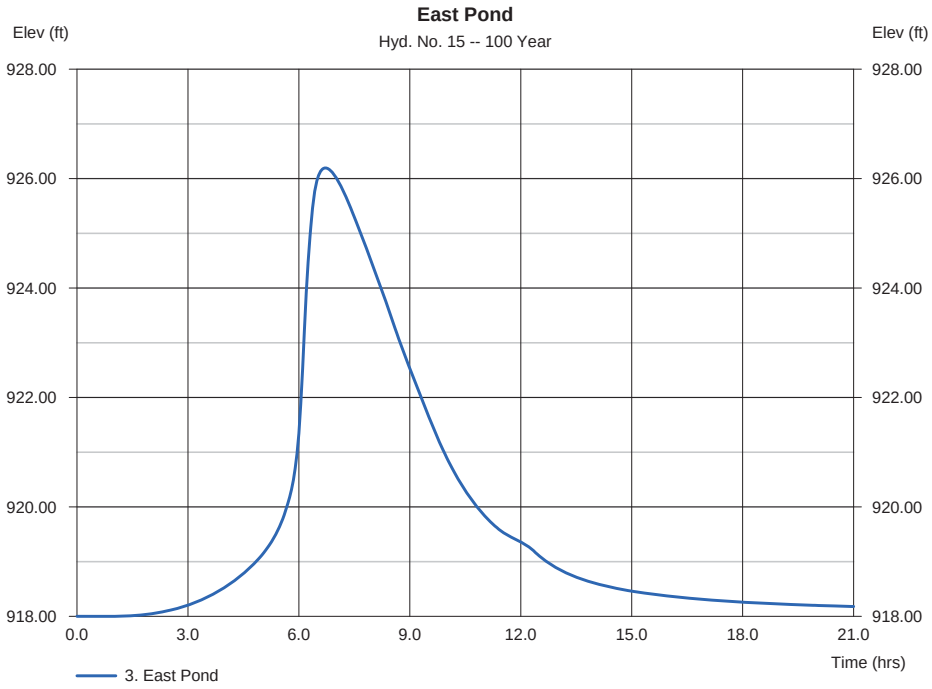
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	= Reservoir	Peak discharge	= 62.26 cfs
Storm frequency	= 100 yrs	Time to peak	= 6.70 hrs
Time interval	= 3 min	Hyd. volume	= 1,006,534 cuft
Inflow hyd. No.	= 14 - Flow to East Pond	Max. Elevation	= 926.19 ft
Reservoir name	= East Pond	Max. Storage	= 480,147 cuft

Storage Indication method used.



Hydrograph Report

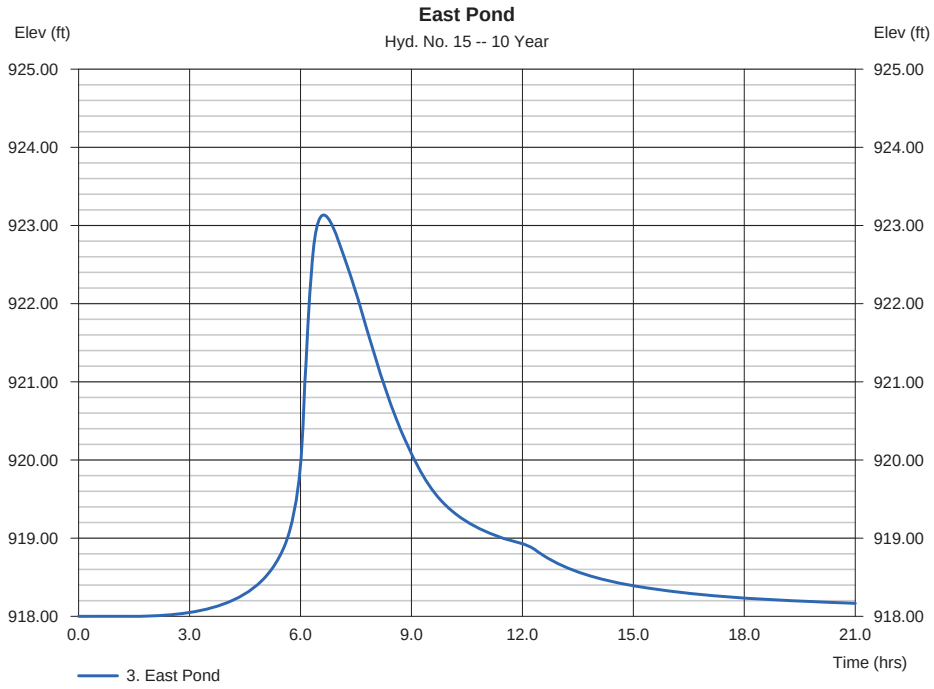
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	=	Reservoir	Peak discharge	=	46.57 cfs
Storm frequency	=	10 yrs	Time to peak	=	6.60 hrs
Time interval	=	3 min	Hyd. volume	=	576,997 cuft
Inflow hyd. No.	=	14 - Flow to East Pond	Max. Elevation	=	923.13 ft
Reservoir name	=	East Pond	Max. Storage	=	272,567 cuft

Storage Indication method used.



Hydrograph Report

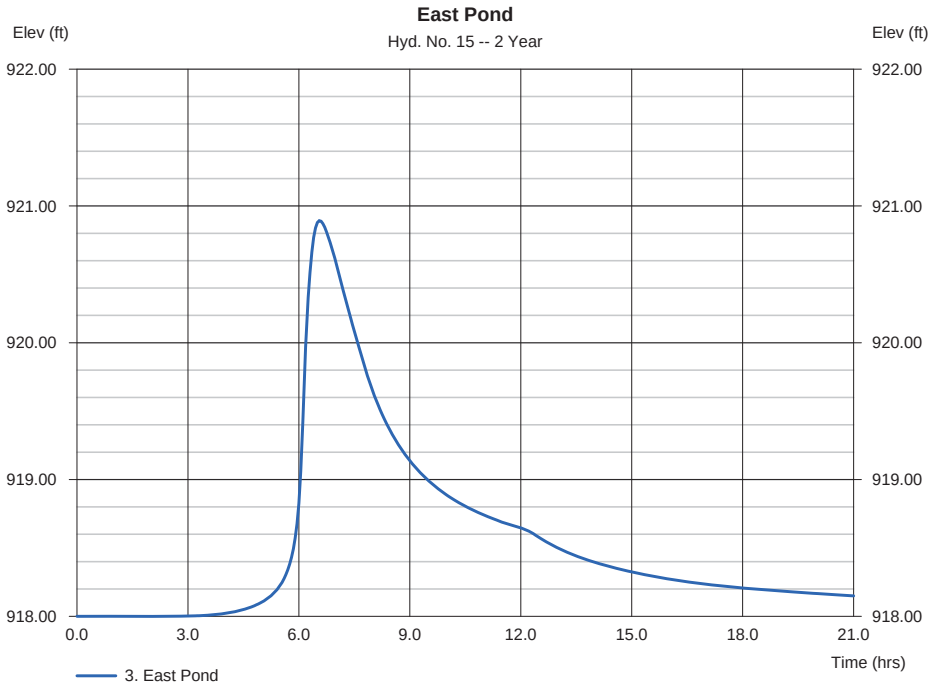
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 15

East Pond

Hydrograph type	=	Reservoir	Peak discharge	=	30.25 cfs
Storm frequency	=	2 yrs	Time to peak	=	6.55 hrs
Time interval	=	3 min	Hyd. volume	=	291,137 cuft
Inflow hyd. No.	=	14 - Flow to East Pond	Max. Elevation	=	920.89 ft
Reservoir name	=	East Pond	Max. Storage	=	142,466 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Pond No. 2 - West Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 900.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	900.00	97,200	0	0
2.00	902.00	109,100	206,165	206,165
4.00	904.00	122,200	231,153	437,318
6.00	906.00	136,800	258,837	696,155
8.00	908.00	152,600	289,227	985,382
10.00	910.00	169,500	321,920	1,307,302

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 895.00	0.00	0.00	0.00
Length (ft)	= 150.00	0.00	0.00	0.00
Slope (%)	= 2.50	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	No	No	No

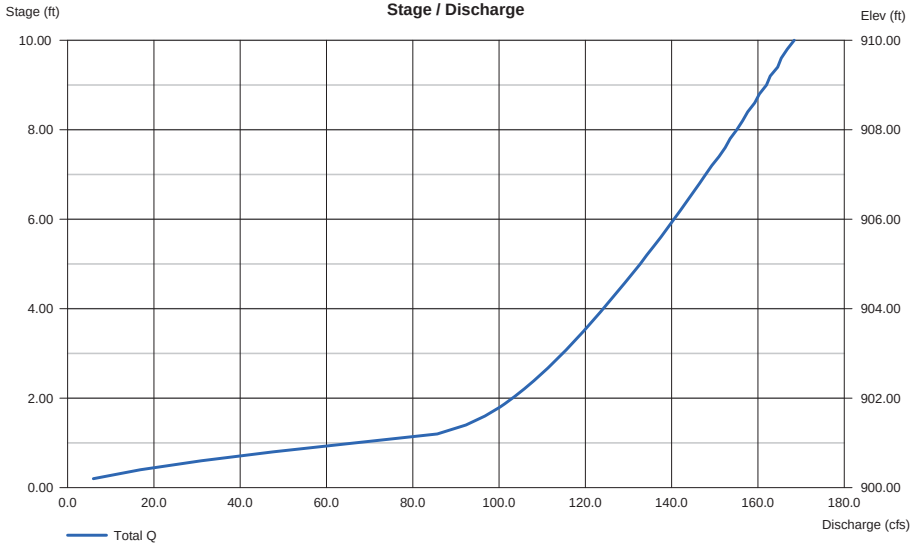
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 900.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

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



Hydrograph Report

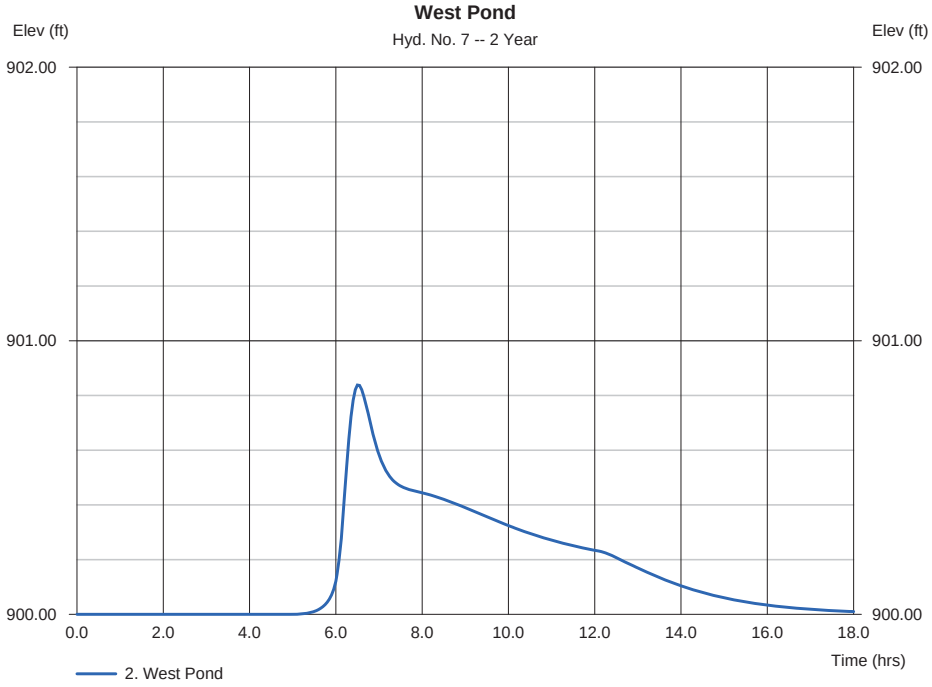
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Thursday, 02 / 11 / 2016

Hyd. No. 7

West Pond

Hydrograph type	= Reservoir	Peak discharge	= 51.21 cfs
Storm frequency	= 2 yrs	Time to peak	= 6.50 hrs
Time interval	= 3 min	Hyd. volume	= 454,436 cuft
Inflow hyd. No.	= 6 - Stormwate to Pond Area	Max. Elevation	= 900.84 ft
Reservoir name	= West Pond	Max. Storage	= 86,329 cuft

Storage Indication method used.



Hydrograph Report

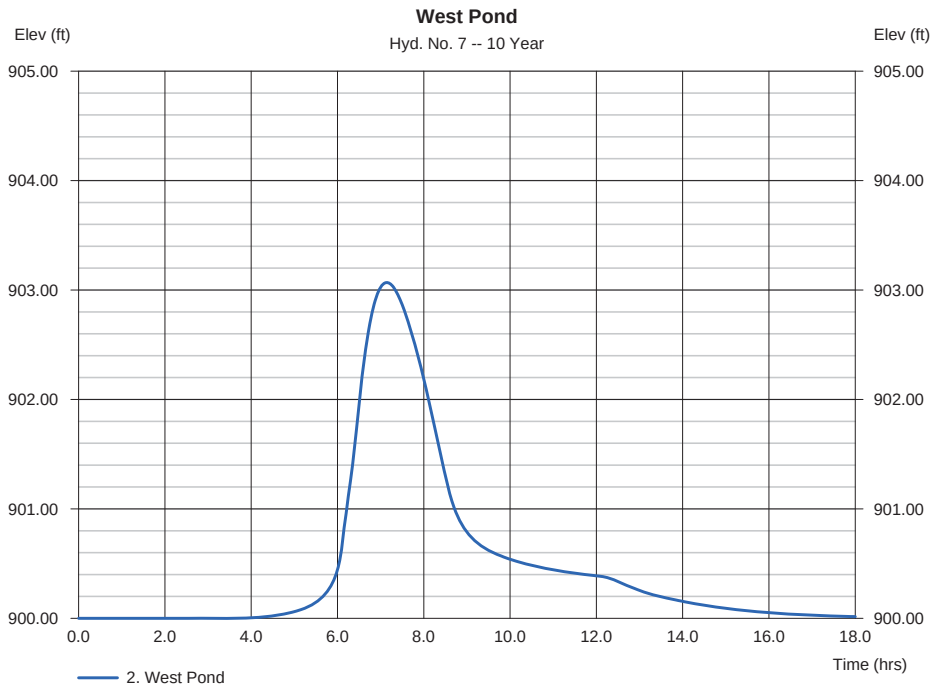
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 7

West Pond

Hydrograph type	=	Reservoir	Peak discharge	=	115.36 cfs
Storm frequency	=	10 yrs	Time to peak	=	7.10 hrs
Time interval	=	3 min	Hyd. volume	=	1,416,349 cuft
Inflow hyd. No.	=	6 - Stormwate to Pond Area	Max. Elevation	=	903.07 ft
Reservoir name	=	West Pond	Max. Storage	=	329,421 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 02 / 11 / 2016

Hyd. No. 7

West Pond

Hydrograph type	=	Reservoir	Peak discharge	=	161.46 cfs
Storm frequency	=	100 yrs	Time to peak	=	7.20 hrs
Time interval	=	3 min	Hyd. volume	=	2,874,951 cuft
Inflow hyd. No.	=	6 - Stormwate to Pond Area	Max. Elevation	=	908.94 ft
Reservoir name	=	West Pond	Max. Storage	=	1,135,948 cuft

Storage Indication method used.