Riverside Estates Subdivision
In La Center, Washington

PRELIMINARY DRAINAGE REPORT
March 28, 2017

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PLS ENGINEERING

TABLE OF CONTENTS

Precision Land Services, Inc.   *Riverside Estates Subdivision*
Job #2641   Preliminary Hydrology Report
Page 1

Technical Appendix

Hydrology and Hydraulics Analysis

Description

Appendix A   Design Criteria
- Curve Numbers
- Manning's "n" Values
- Isopluvial Maps (2-, 10-, and 100-year)
- NRCS Soils Maps

Appendix B   Stormwater Models
- Pre-Developed
- Post-Developed
- Water Quality

Appendix C   Basin Maps
- Pre-Developed
- Post-Developed

CERTIFICATE OF ENGINEER

Riverside Estates Subdivision
Preliminary Hydrology Report

The technical information and data contained in this report were prepared by the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.
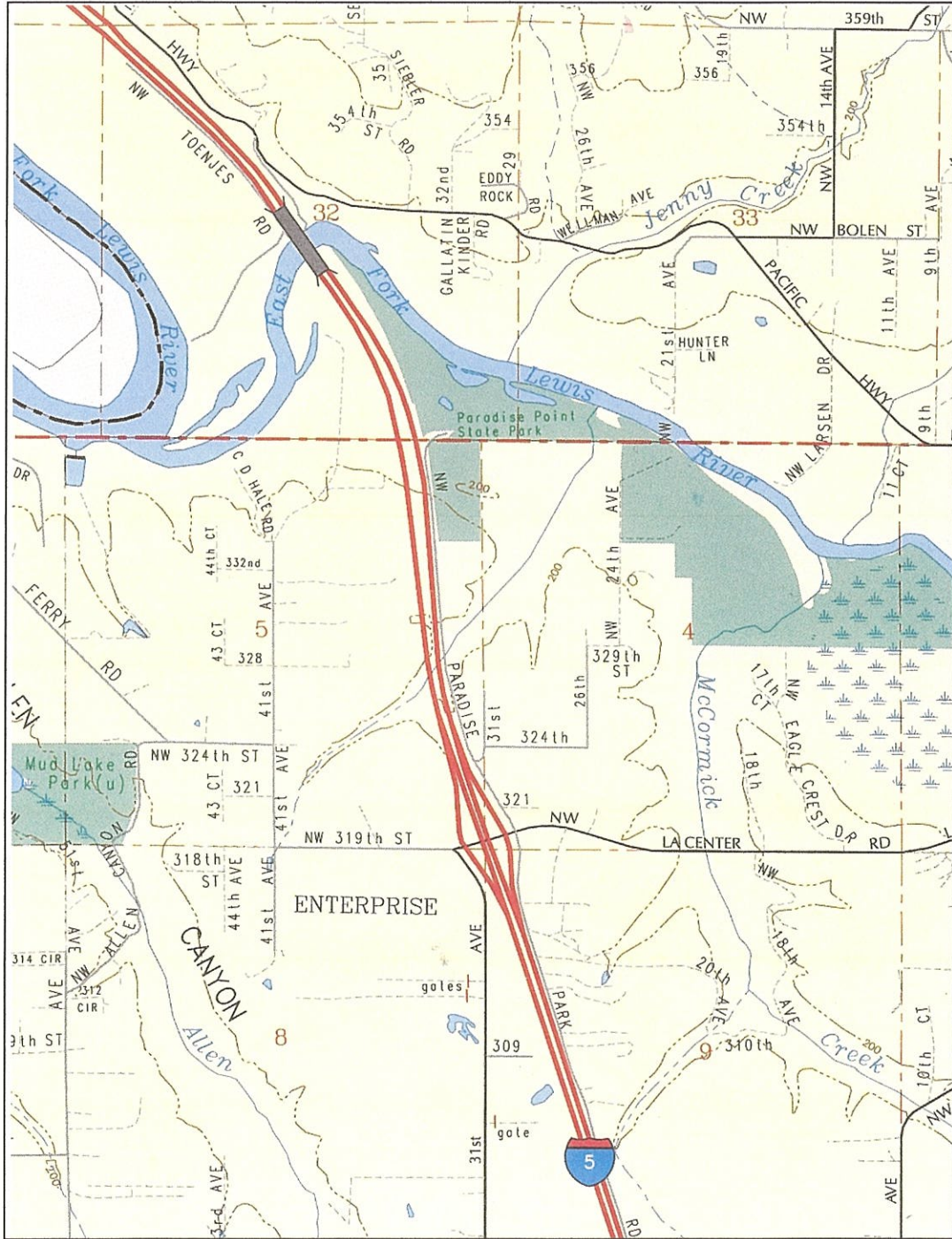
This document was:

Prepared by: _____3/28/17_____

Tim Wines, P.E.

VICINITY MAPS

(a) Site Location Map

Clark County Atlas
Sec 33, T5N, R1E, W.M.

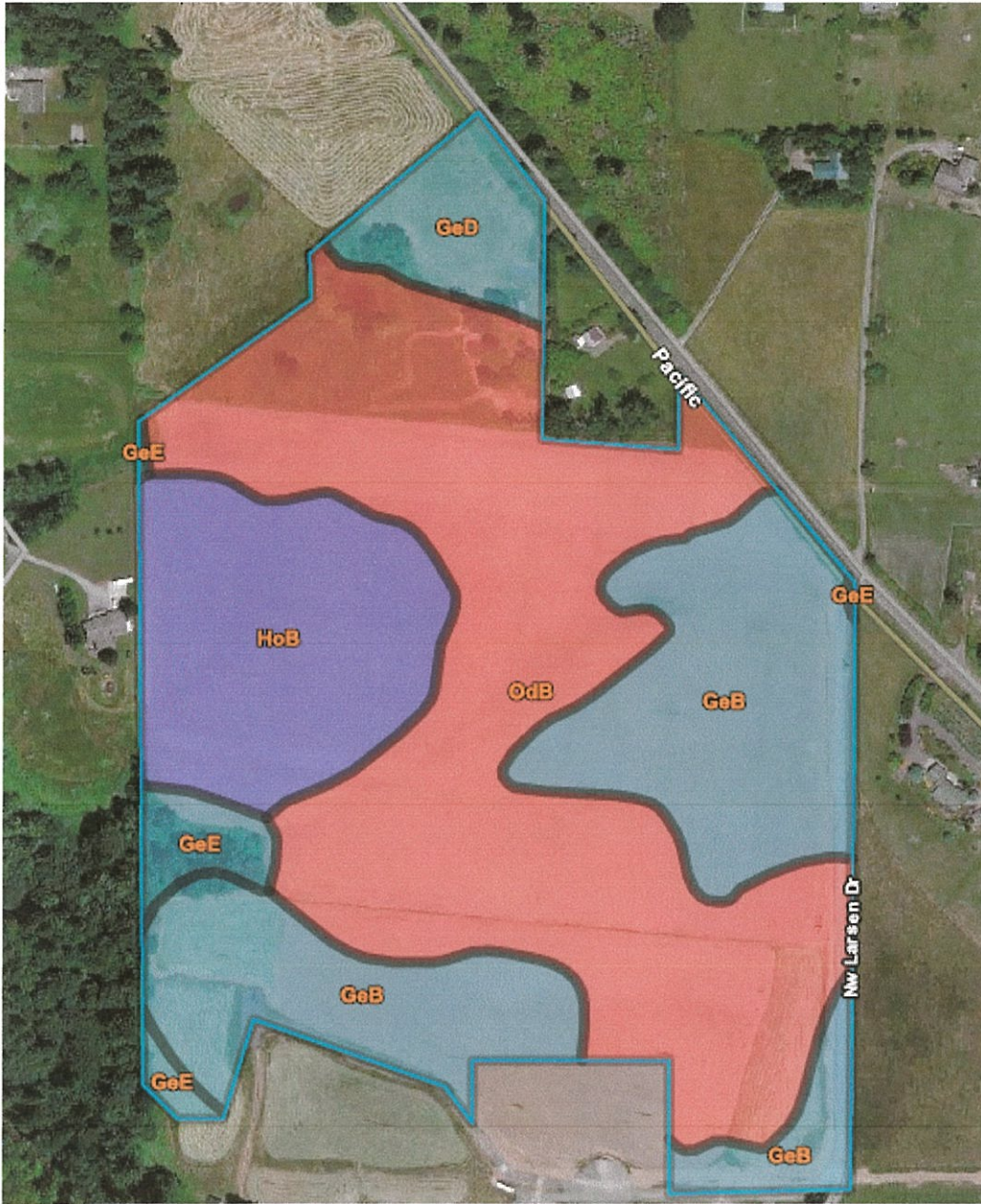## (b). Soils Map

USDA SCS Map 1" = 3550'
Site Soils Include: Gee silt loam, Hydrologic soils group (HSG) C;
Hillsboro silt loam, HSG B; and Odne silt loam, HSG D

SECTION A – PROJECT OVERVIEW

The Riverside Estates Subdivision is a 43.24 acre site located on the southwest side of Old Pacific Highway directly west of Larson Road in La Center, WA. The site address is 1514 NW 339th St and 34508 NW Pacific Highway and is located in the SE ¼ of Section 33, T5N, R1E, Willamette Meridian. It is identified as Parcel Numbers 986028830, 986030201, 986030202, 986028825, and 986030206 per the Clark County Assessor's records. It is the remainder lot of the East Fork Estates Short Plat coupled with an additional 2 lots directly to its north and a 3rd lot along the western property line. The majority of the site currently consists of an agricultural field used for growing oats, along with some vacant fields, and a stock watering pond. There is also a small portion of the site that consists of the headwaters to a small drainage way that has brush and native vegetation around it. In addition, the northern portion of the site was previously used for residential purposes with an existing home having recently been removed. Finally, Larson Road (Private) traverses the eastern side of the site.

The projects propose the construction of 99 single family residences, 72 townhouse lots, and a 222 unit apartment complex. The single family and the majority of the townhouse lots will be located throughout the southern portion of the site. The apartment units will be located on the northern portion of the site. It should be noted that 12 of the townhouse lots will also be located on the northern end of the site.

Old Pacific Highway is an existing 26' paved road within a 60' right-of-way. Half-width frontage improvements will be completed along the southwestern side of Old Pacific Highway along with a network of interior local access roads for circulation throughout the subdivision. In addition, various travel lanes and parking facilities will be constructed for access to the multi-family units and the 12 townhouses to the north. The site will also have a network of sidewalks that will provide pedestrian access to Old Pacific Highway. The stormwater runoff generated from the site will be treated utilizing a system of biofiltration swales and bioretention facilities. Water quantity control will be accomplished utilizing two separate detention facilities. The existing stock pond will be utilized for detention of the northern portion of the project and an underground detention vault will be designed and constructed east of the headwaters of the habitat and drainage channel. This detention facility will discharge the stormwater along its natural drainage path into the headwaters of the drainage way. A portion of the stormwater runoff from the apartment complex will be discharged without detention. In addition, a small portion of the southwest corner of the site will be collected in curb inlets and discharged into an existing ditch inlet located on the adjoining property to the south. Finally, the southeast portion of the site that cannot be conveyed to the proposed detention facility will be routed through an existing detention facility that was constructed for the improvements to the East Fork Estates Short Plat. It should be noted that the

quantity of stormwater runoff flowing to this existing facility will be decreased following development of the property. In addition, stormwater will be overdetained in the proposed detention facilities to mitigate for the portion of the site that will be discharged without passing through the facilities.

SECTION B – QUANTITY CONTROL ANALYSIS AND DESIGN

Per Chapter 18.320 of the La Center Municipal Code (LCMC), the subdivision will be required to mitigate for stormwater runoff impacts generated as a result of the proposed improvements. The hydrologic analysis of this site was performed in accordance with the guidelines contained in LCMC and Chapters III-1 and III-2 of the Puget Sound Manual. The 2, 10, and 100-year storm events were analyzed for the design of the stormwater detention facilities. The storm events were assumed to have a 24-hour duration and follow a Type 1A storm distribution. Rainfall depth for the 2, 10, and 100-year 24-hour storm events are 2.4, 3.4, and 4.80 inches respectively, as obtained from the Isopluvial maps for Clark County. The detention facilities have been designed to produce release rates for the entire site equivalent to the pre-developed 2-, 10- and 100-year storm events. In addition, the facilities have been designed utilizing Figure III-1.1 Volume Correction Factor from the Puget Sound Manual. This resulted in a correction factor of 1.24 for Detention Facility 1 and a correction factor of 1.32 for Detention Facility 2.

The live storage area of the stormwater facilities were assumed to be empty at the beginning of the design storm event. The hydrological analysis was completed using HydroCAD v 10.0, which allows the SCS TR-20 method of hydrograph routing to be utilized and the TR-55 method to determine the times of concentration. The soil characteristics were obtained from USDA NRCS website. As can be seen on the soils map located in the appendix of this report, there are multiple soil types covering this site. These soil types consist of hydrologic soil groups (HSG) B, C, and D. The Runoff Curve Numbers (RCNs) that were used in the design of the project were taken from Table III-1.3 of the Puget Sound Manual.

Because of the multiple soil types, five separate RCN values were used for modeling the pre-developed conditions for the pervious areas of the site. RCN values of 78, 85, and 89 were used respectively for the HSG B, C, and D soils covered in pasture. RCN's of 86 and 90 were selected for the HSG C and D soils covered by lawn. In addition, RCN numbers of 89 and 91 were used to model the existing gravel driveways in the HSG C and D soils. Finally, the existing stock pond was assigned a RCN of 100. Impervious surfaces for both the pre- and post-developed conditions were modeled using a RCN of 98 for pavement and roofs.

The pre-developed site was analyzed as a single basin consisting of 1,731,278 sq-ft of pasture, 10,103 sq-ft of gravel road, 12,103 sq-ft of existing

pond, and 19,400 sq-ft of pavement. In addition, there is a substantial amount of offsite runoff entering the site. This offsite runoff has been modeled as three separate basins. Basin O1 consists of 14,682 sq-ft of existing asphalt from Old Pacific Highway, Basin O2 consists of the runoff from the portion of the parcel to the north that flows into the existing stock pond, and Basin O3 consists of the runoff from Parcel 258669250 which is west of Old Pacific Highway but surrounded by the proposed development.

Table 1 below shows a tabulation of the project site areas for pre- and post-developed conditions.

Table 1- Summary of Pre- and Post-Developed Areas

	Basin	Impervious (sq-ft)	Pervious (sq-ft)	Total (sq-ft)	Total (acres)
Pre-Developed Area					
	Onsite				
	Pre B1	41,606	1,731,278	1,772,884	40.7
	Offsite				
	O1	14,682	0	14,682	0.3371
	O2	3,471	45,658	49,129	1.1278
	O3	2,505	52,843	55,348	1.2706
Post-Developed Area					
	B1	83,374	91,945	175,319	4.0248
	B2	0	2,783	2,783	0.0639
	A B1	70,725	40,704	111,429	2.5581
	A B2	26,871	17,952	44,823	1.029
	A B3	43,562	15,740	59,302	1.3614
	A B 4	43,680	23,018	66,698	1.5312
	A B5	24,194	32,440	56,634	1.3001
	B3	240,948	175,358	416,306	9.5571
	B4	200,131	167,521	367,652	8.4401
	B5	44,675	46,045	90,720	2.0826
	B6	0	13,411	13,411	0.3079
	B7	46,570	75,014	121,584	2.7912
	B8	58,605	58,285	116,890	2.6834
	B9	64,000	64,850	128,850	2.958
	B8WQ	43,245	0	43,245	0.9928

Table 2 below shows descriptions for pre- and post-developed basins.

Table 2- Basin Descriptions

	Basin	Description
Pre-Developed Area		
	Onsite	
	Pre B1	The contributing area flowing to Detention Facility 1
	Offsite	
	O1	The existing asphalt flowing onto the site from Old Pacific Highway
	O2	The contributing area flowing to Detention Facility 1 from the parcel to the north
	O3	Parcel 258669250 which is west of Old Pacific Highway and surrounded by the proposed Development

	Basin	Description
Post-Developed Area		
	B1	The northern portion of the development flowing to Detention Facility 1
	B2	The portion of Tract A flowing to Detention Facility 1
	A B1	The northern portion of the apartment complex to be released
	A B2	The southeastern portion of the apartment complex to be released
	A B3	The southwestern portion of the apartment complex to be released
	A B 4	The western portion and all of the buildings from A B1, A B2, and A B3 to be released
	A B5	The southern portion of the apartment complex to be routed to Detention Facility 2
	B3	The central portion of the site flowing to Detention Facility 2
	B4	The southern portion of the site flowing to Detention Facility 2
	B5	The portion of the site encompassing Detention Facility 2 and Bioretention Facility 1

	B6	The western portion of the neighborhood park area to be released
	B7	The southwestern portion of the site encompassing the cul-de-sac to be released
	B8	The southeastern corner of the site to continue to be routed through the existing detention facility
	B9	The homes and landscape areas to be collected and routed through the existing detention facility
	B8WQ	The impervious area to be routed into Bioretention Facility 3 for water quality

Please refer to the HydroCAD stormwater models, located in Appendix B, for tabulated acreage, imperviousness, curve numbers, length and grade of overland flow, and other hydrological parameters used in completing the analysis.

As previously stated water quantity control for the development will be accomplished utilizing two separate detention facilities.

Detention Facility 1 will be constructed to collect and detain the stormwater from the northern portion of the site. It will be constructed by incorporating the existing stock pond as dead storage. During grading of the site, a 2.5' berm will be constructed around the perimeter of the existing stock pond. An outlet structure will be designed with an 8" orifice to be set at the elevation of the ordinary high water mark of the existing pond. This will create a permanent dead storage area which will mimic the existing conditions during low flow periods. It will also allow for the pond to be incorporated into the landscape plan to provide an esthetically pleasing facility that will benefit both the residents and habitat.

Also as previously stated, Detention Facility 2 will be constructed between NW 12th Street and NW 13th Street, behind the lots located on the western side of NW 17th Avenue, and just to the east of the habitat conservation area. The facility was placed in this location to allow stormwater to be discharged into the headwaters of the natural drainage channel. This will help the developments stormwater runoff mimic the original hydrology of the site prior to development. The facility has been designed as a 56'x80' underground detention vault that will be 8' deep from the bottom of the facility to the bottom of the concrete lid. It has been designed with a three orifice outlet structure. The bottom orifice will be constructed at the bottom of the facility and will be 12" in diameter. The second orifice will be located 0.71' above the bottom of the facility and will be 2.9" in diameter. The final orifice will be 6.6" in diameter and will be located 3.05' above the bottom of the facility. Total depth during

the 100-year storm event will be 6.55'. This will allow for 1' of freeboard and the installation of an overflow pipe capable of passing the entirety of the 100-year storm.

The post-developed stormwater model consists of fourteen basins that encompass the entirety of the development along with the same three offsite basins used to model the predevelopment conditions. As previously discussed, basins O1, O2, and O3 account for the offsite runoff flowing onto the site. These three basins, along with Basins B1 and B2 will be routed through Detention Facility 1. Basin B1 represents the northern portion of the site. It includes the 12 northernmost townhouse lots; 3 of the 12-plex apartment buildings; the associated driveway, parking, and travel lanes; the landscape areas around these structures; and the pond itself. It is modeled with RCN values of 86 for the landscape area, 98 for the impervious areas, and 100 for the pond area. Basin B2 is comprised of a small portion of Tract A located along Old Pacific Highway north of the entrance to the site. It will be entirely landscaped, and as such, will also be modeled with a RCN value of 86.

Detention Facility 1 has been designed to detain as much stormwater runoff as possible. This enabled the free release of a substantial amount of the stormwater runoff generated from the apartment complex along with the southern portion of the site that could not be collected and routed into Detention Facility 2.

Detention Facility 2 has been designed to collect the stormwater runoff generated from Basin B3, B4, B5, and A B5. Basin 3 consists of the central portion of the site. Basin B4 encompasses the southern portion of the site that can be collected and routed into the detention facility. Basin B5 includes the area containing Bioretention Facility 1, Detention Facility 2, and the neighborhood park area. Finally, Basin A B5 is comprised of the southern portion of the apartment complex that was economically feasible to collect and convey to Detention Facility 2. The pre- and post-developed basin maps can be found in the appendix of this report.

Due to the size of the site, the existing site topography, and the complexity of the development, pond release rates were calculated in a holistic approach. First, pre- and post-developed flows for the 2-, 10-, and 100-year storm events were established for the entire site along with the offsite basins. Next, because portions of the site were going to be released without detention, Detention Facility 1 was designed to maximize the storage capacity of the facility. The release rates from this facility were then added to the flows rates of the basins that are going to be released without detention. This includes the flow rates from the basins conveyed through Pipe 2 (Basins A B1, A B2, A B3, and A B4) along with the flow rates from Basins B6, B7, B8, and B9. Adding the release rates from all of these basins or facilities established total flow

leaving the site prior to the design of Detention Facility 2. This total release rate was then subtracted from the total pre-developed flow rates to establish the allowable release rate for Detention Facility 2. Detention Facility 2 was then designed to meet these parameters. This methodology allowed for the most cost effective detention vault to be designed while still meeting the water quantity control requirements of the LCMC. Table 3 below gives a breakdown of both detention facilities while Table 4 shows the release rate calculations.

All other pertinent information for the design of this system will be included in the final design of the construction drawings. As previously discussed, stormwater calculations have been shown in Appendix B.

Table 3- Detention Facility Design Results

	Storm Event	Allowable Release Rate (cfs)	Actual Release Rate (cfs)	Depth (ft)	Total Storage (cu-ft)
Detention Facility 1					
	2-year	N/A	0.98	0.68	6,891
	10-year	N/A	1.82	1.04	10,890
	100-year	N/A	3.26	1.45	15,597
Detention Facility 2					
	2-year	3.03	2.28	0.71	2,398
	10-year	6.93	6.93	3.04	10,268
	100-year	12.35	12.35	6.55	22,125

Table 4- Release Rate Calculations

	Basin	Storm Event Release Rate (cfs)		
Storm Events				
Pre-Developed		2-year	10-year	100-year
	B1	8.75	16.41	27.96
	O1	0.19	0.27	0.39
	O2	0.31	0.57	0.95
	O3	0.42	0.72	1.16
Totals		**9.67**	**17.97**	**30.46**

Post-Developed				
	Pond 1	0.98	1.82	3.26
	P2	2.27	3.65	6.19
	B6	0.11	0.19	0.30
	B7	0.82	1.47	2.45
	B8	1.17	1.86	2.81
	B9	1.29	2.05	3.10
Totals		**6.64**	**11.04**	**18.11**
Pond 2				
	Pre-Dev	9.67	17.97	30.46
	Post-Dev	6.64	11.04	18.11
Totals		**3.03**	**6.93**	**12.35**

SECTION C – CONVEYANCE SYSTEMS ANALYSIS AND DESIGN

The pipes for the conveyance system will be designed for the 100-year storm event and will be sized to carry flows from the contributing drainage areas upon full buildout while operating in an open flow regime. The actual sizing of the conveyance pipes will be completed with the final design of the subdivision.

SECTION D – RUNOFF WATER QUALITY TREATMENT

Water quality treatment meeting LCMC Section 18.320.210 will be mitigated for utilizing both biofiltration swales and bioretention facilities. The two biofiltration swales have been designed using a Manning's number of 0.2 with a minimum 9 minute time of concentration and a maximum 4" depth during the 6 month, 24-hr storm event. Both swales will have a maximum of 3:1 sideslopes.

As can be seen on the preliminary utility plan, the stormwater runoff from Basins B1, B2, a portion of O1, and all of O3 will be collected and conveyed to Biofiltration Swale 1 located on the east end of the existing pond. This swale will be 175' long with a 9' bottom width and a longitudinal slope of 1%.

Stormwater runoff generated from Basin A B1 will be routed to Biofiltration Swale 2. This swale is located on the south side of the existing pond and will have a 6' bottom width, a 175' length, and a longitudinal slope of 1%.

The remainder of the water quality facilities for this site have been designed as bioretention facilities. These type of facilities have been classified as a Low

Impact Development (LID) Best Management Practice (BMP) by the Washington State Department of Ecology and are a preferred method of water quality treatment. There are three proposed bioretention facilities and all of them have been designed with a maximum depth of 1' during the water quality event while assuming a 1.5" infiltration rate. Each facility will have 1' high overflow standpipes located throughout that will allow storm events larger than the water quality event to be safely routed downstream.

Bioretention Facility 2 will consist of stormwater runoff from Basins A B2 and A B3. This water quality facility will be located between the apartment buildings and will be incorporated into the landscape plan. It will be 230' long and 2' deep with a flat bottom that is 5' wide.

Bioretention Facility 1 will be located north and east of the detention vault and will also be incorporated into the landscape plan. This facility has been sized to treat the stormwater runoff from Basins B3 and B4. It is "L" shaped in design and will have a flat bottom that is 35' wide. The facility was sized based on a total bottom area of 14,150 sq-ft.

Finally, Bioretention Facility 3 will be located on the southern end of the site directly north of NW 339th St (P). This facility has been design to treat the stormwater runoff from the roads and driveways in Basin 8. However, as can be seen in the calculations, the basin used to size this facility has been labeled as Basin B8WQ. This additional basin was created because the homes and landscape areas will be collected in a separate conveyance system and routed around the water quality facility. Therefore, while Basin B8 contains the entirety of the basin to generate a release rate, the B8WQ basin was modeled specifically to size Bioretention Facility 3 for the road and driveways in Basin 8.

It should be noted that Basin B7, which includes the westernmost portion of NW 12th Street and the cul-de-sac, will be released without water quality treatment. This will be mitigated for by collecting the existing asphalt on Old Pacific Highway and routing it through either Biofiltration Swale 1 or Bioretention Facility 1.

SECTION E – SOILS EVALUATION

As previously stated, there are multiple soil types located on this site. A soils map, obtained from USDA NRCS website, is located in the appendix of this report. The soil types onsite consist of Gee silt loam, 0 to 8% slopes (GeB); Gee silt loam, 8 to 20% slopes (GeD); Gee silt loam, 20 to 30% slopes (GeE); Hillsboro silt loam, 3 to 8% slopes (HoB); Hillsboro silt loam, 30 to 65% slopes (HoG); and Odne silt loam, 0 to 5% slopes (OdB). The hydrologic soil groups (HSG) for these soils are C, C, C, B, B, and D respectively.

SECTION F – SPECIAL REPORTS AND STUDIES

A geotechnical report, a wetland and habitat report, and an archeological report were all completed for this site. There are no improvements proposed within the areas of the steep slopes and, based on information provided by the wetland consultant, the Critical Areas Ordinance allows for the detention facility to be designed in the wetland. It should be noted that it is debatable whether or not the existing stock pond is actually a wetland due to the fact that it was man made and created for farming purposes. Regardless, by designing it into the stormwater landscape plan, it will actually be enhanced and, as previously stated, will provide a benefit for both the residents and habitat. All of these reports have been included as part of the subdivision application.

SECTION G – MAINTENANCE AND OPERATIONS MANUAL

A maintenance and operations manual will be completed as part of the final engineering design.

APPENDIX A

Design Criteria

Curve Numbers
Manning's "n" Values
Isopluvial Maps (2-, 10-, and 100-Year)
NRCS Soils Map

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 17

Table III-1.3   SCS Western Washington Runoff Curve Numbers
(Published by SCS in 1982)   Runoff curve numbers for selected agricultural,
suburban and urban
land use for Type 1A rainfall distribution, 24-hour storm duration.

LAND USE DESCRIPTION		CURVE NUMBERS BY HYDROLOGIC SOIL GROUP			
		A	B	C	D
Cultivated land(1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush & grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemeteries, landscaping. Good condition:	grass cover on ≥75% of the area	68	80	86	90
Fair condition:	grass cover on 50-75% of the area	77	85	90	92
Gravel roads & parking lots:		76	85	89	91
Dirt roads & parking lots:		72	82	87	89
Impervious surfaces, pavement, roofs etc.		98	98	98	98
Open water bodies:	lakes, wetlands, ponds etc.	100	100	100	100

Single family residential(2):
 	
Dwelling Unit/Gross Acre   %Impervious(3)
  1.0 DU/GA   15
  1.5 DU/GA   20
  2.0 DU/GA   25
  2.5 DU/GA   30
  3.0 DU/GA   34
  3.5 DU/GA   38
  4.0 DU/GA   42
  4.5 DU/GA   46
  5.0 DU/GA   48
  5.5 DU/GA   50
  6.0 DU/GA   52
  6.5 DU/GA   54
  7.0 DU/GA   56
 	
PUD's, condos, apartments,   %impervious
commercial businesses &   must be
industrial areas   computed
		Separate curve number shall be selected for pervious & impervious portions of the site or basin			

(1)   For a more detailed description of agricultural land use curve numbers refer
      to National Engineering Handbook, Sec. 4, Hydrology, Chapter 9, August 1972.
(2)   Assumes roof and driveway runoff is directed into street/storm system.
(3)   The remaining pervious areas (lawn) are considered to be in good
      condition for these curve numbers.

Table III-1.4   "n" AND "k" Values Used in Time Calculations for Hydrographs

"n_s" Sheet Flow Equation Manning's Values (for the initial 300 ft. of travel) n_s

	n_s
Smooth surfaces (concrete, asphalt, gravel, or bare hand packed soil)	0.011
Fallow fields or loose soil surface (no residue)	0.05
Cultivated soil with residue cover (s≤ 0.20 ft/ft)	0.06
Cultivated soil with residue cover (s> 0.20 ft/ft)	0.17
Short prairie grass and lawns	0.15
Dense grasses	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods or forest with light underbrush	0.40
Woods or forest with dense underbrush	0.80

*Manning values for sheet flow only, from Overton and Meadows 1976 (See TR-55, 1986)

"k" Values Used in Travel Time/Time of Concentration Calculations

Shallow Concentrated Flow (After the initial 300 ft. of sheet flow, R = 0.1) k_s

	k_s
1. Forest with heavy ground litter and meadows (n = 0.10)	3
2. Brushy ground with some trees (n = 0.060)	5
3. Fallow or minimum tillage cultivation (n = 0.040)	8
4. High grass (n = 0.035)	9
5. Short grass, pasture and lawns (n = 0.030)	11
6. Nearly bare ground (n = 0.25)	13
7. Paved and gravel areas (n = 0.012)	27

Channel Flow (intermittent) (At the beginning of visible channels R = 0.2) k_c

	k_c
1. Forested swale with heavy ground litter (n = 0.10)	5
2. Forested drainage course/ravine with defined channel bed (n = 0.050)	10
3. Rock-lined waterway (n = 0.035)	15
4. Grassed waterway (n = 0.030)	17
5. Earth-lined waterway (n = 0.025)	20
6. CMP pipe (n = 0.024)	21
7. Concrete pipe (0.012)	42
8. Other waterways and pipe 0.508/n	

Channel Flow (Continuous stream, R = 0.4) k_c

	k_c
9. Meandering stream with some pools (n = 0.040)	20
10. Rock-lined stream (n = 0.035)	23
11. Grass-lined stream (n = 0.030)	27
12. Other streams, man-made channels and pipe 0.807/n**	

Exhibit C
Isopluvial Maps for Design Storms in Clark County

2-Year, 24-Hour Isopluvials

Page 1
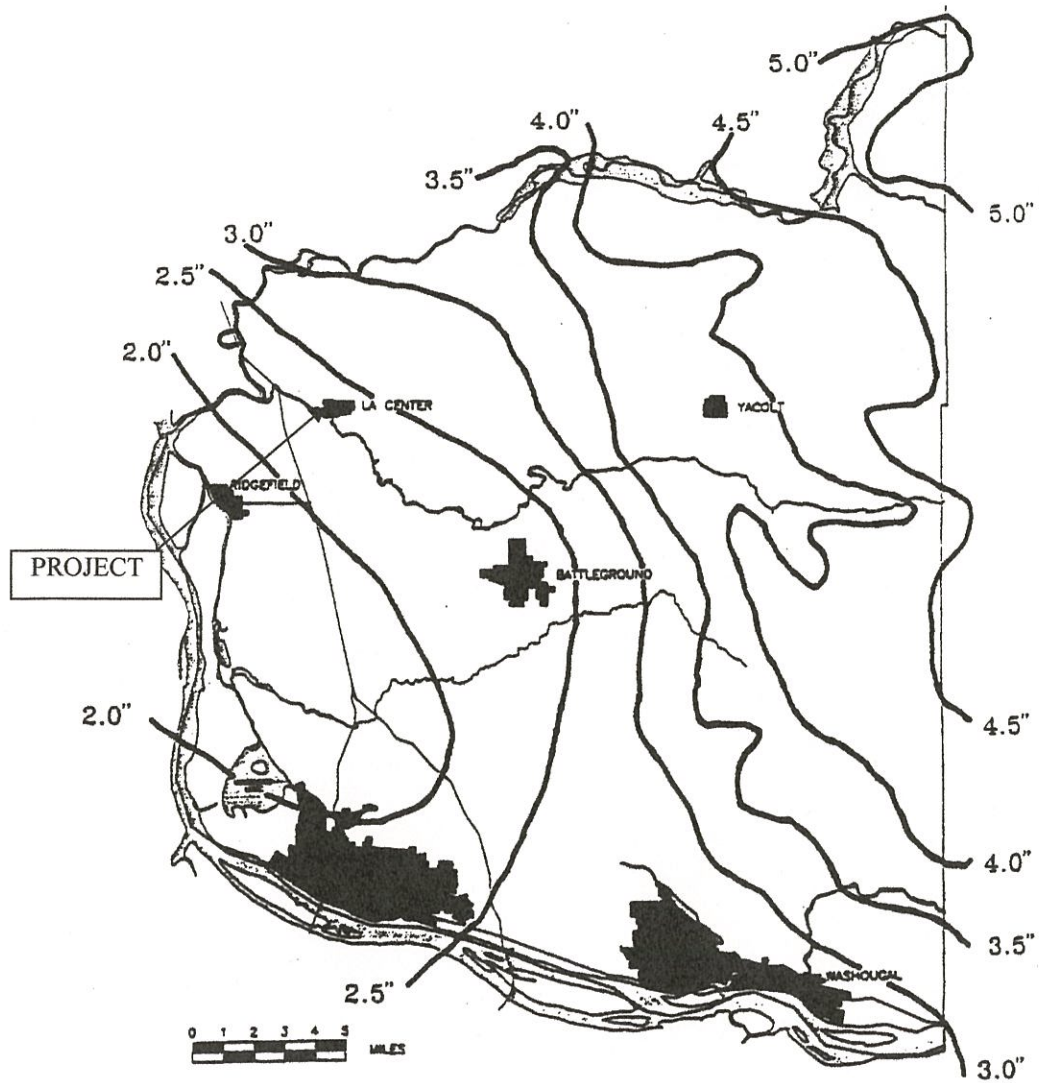
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Exhibit C
Isopluvial Maps for Design Storms in Clark County

10-Year, 24-Hour Isopluvials

Page 2
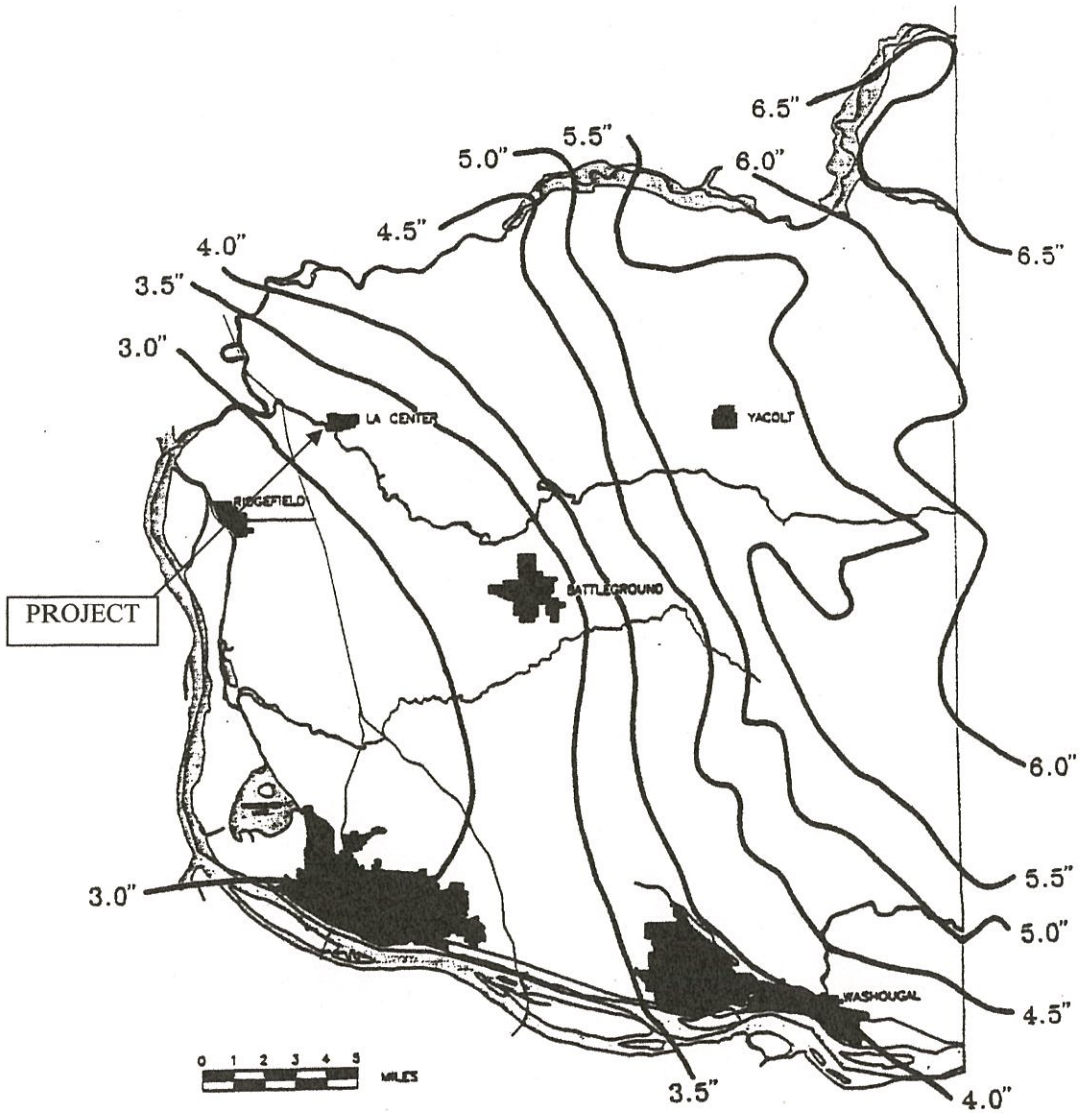
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Exhibit C
Isopluvial Maps for Design Storms in Clark County

100-Year, 24-Hour Isopluvials

Page 4
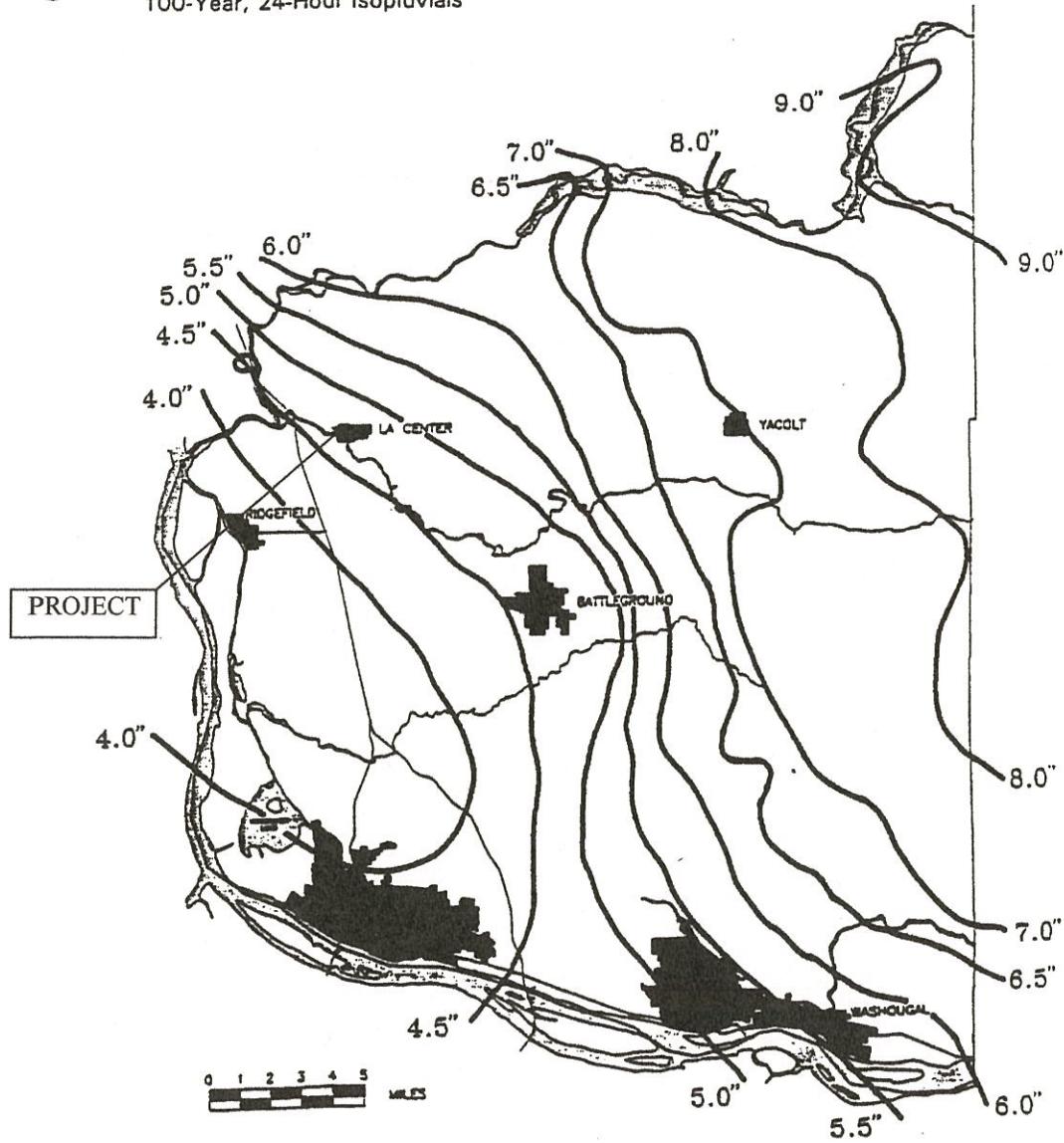
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Soil Map—Clark County, Washington
(Riverside Estates)

Warning: Soil Map may not be valid at this scale.

Map Scale: 1:3,660 if printed on A portrait (8.5" x 11") sheet.

Meters
0   50   100   200   300

Feet
0   150   300   600   900

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

USDA **Natural Resources**   Web Soil Survey   10/12/2016
        Conservation Service   National Cooperative Soil Survey   Page 1 of 3

MAP LEGEND

MAP INFORMATION

Area of Interest (AOI)

☐ Area of Interest (AOI)

Soils

☐ Soil Map Unit Polygons

〰 Soil Map Unit Lines

■ Soil Map Unit Points

Special Point Features

◌ Blowout

⊠ Borrow Pit

✖ Clay Spot

◇ Closed Depression

✕ Gravel Pit

∴ Gravelly Spot

◉ Landfill

⋏ Lava Flow

⚓ Marsh or swamp

⚒ Mine or Quarry

◎ Miscellaneous Water

○ Perennial Water

∨ Rock Outcrop

+ Saline Spot

∵ Sandy Spot

◈ Severely Eroded Spot

◇ Sinkhole

⋏ Slide or Slip

⌀ Sodic Spot

▦ Spoil Area

◔ Stony Spot

⬮ Very Stony Spot

⬭ Wet Spot

△ Other

⸱⸱ Special Line Features

Water Features

〰 Streams and Canals

Transportation

�꛷ Rails

〰 Interstate Highways

〰 US Routes

〰 Major Roads

〰 Local Roads

Background

▦ Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Clark County, Washington
Survey Area Data: Version 13, Sep 14, 2015

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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

Map Unit Legend

Clark County, Washington (WA011)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GeB	Gee silt loam, 0 to 8 percent slopes	14.1	30.4%
GeD	Gee silt loam, 8 to 20 percent slopes	2.2	4.8%
GeE	Gee silt loam, 20 to 30 percent slopes	2.0	4.3%
HoB	Hillsboro silt loam, 3 to 8 percent slopes	6.5	14.1%
HoG	Hillsboro silt loam, 30 to 65 percent slopes	0.0	0.1%
OdB	Odne silt loam, 0 to 5 percent slopes	21.5	46.3%
Totals for Area of Interest		46.4	100.0%

USDA **Natural Resources**
        Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/12/2016
Page 3 of 3

Warning: Soil Map may not be valid at this scale.

Map Scale: 1:3,660 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

USDA   **Natural Resources**
        Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/12/2016
Page 1 of 4

Hydrologic Soil Group—Clark County, Washington
(Riverside Estates)

MAP LEGEND

Area of Interest (AOI)
- ☐ Area of Interest (AOI)

Soils

Soil Rating Polygons
- ▣ A
- ▣ A/D
- ▣ B
- ▣ B/D
- ▣ C
- ▣ C/D
- ▣ D
- ☐ Not rated or not available

Soil Rating Lines
- ⌇ A
- ⌇ A/D
- ⌇ B
- ⌇ B/D
- ⌇ C
- ⌇ C/D
- ⌇ D
- ⌇ Not rated or not available

Soil Rating Points
- ▪ A
- ▪ A/D
- ▪ B
- ▪ B/D

- ▪ C
- ▪ C/D
- ▪ D
- ☐ Not rated or not available

Water Features
- ⌇ Streams and Canals

Transportation
- ┼┼┼ Rails
- ⌇ Interstate Highways
- ⌇ US Routes
- ⌇ Major Roads
- ⌇ Local Roads

Background
- ▣ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Clark County, Washington
Survey Area Data: Version 13, Sep 14, 2015

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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

USDA Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/12/2016
Page 2 of 4

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Clark County, Washington (WA011)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GeB	Gee silt loam, 0 to 8 percent slopes	C	14.1	30.4%
GeD	Gee silt loam, 8 to 20 percent slopes	C	2.2	4.8%
GeE	Gee silt loam, 20 to 30 percent slopes	C	2.0	4.3%
HoB	Hillsboro silt loam, 3 to 8 percent slopes	B	6.5	14.1%
HoG	Hillsboro silt loam, 30 to 65 percent slopes	B	0.0	0.1%
OdB	Odne silt loam, 0 to 5 percent slopes	D	21.5	46.3%
Totals for Area of Interest			**46.4**	**100.0%**

USDA **Natural Resources**
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/12/2016
Page 3 of 4

APPENDIX B

Stormwater Models

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 18

Pre-Developed

2-year Event
10-year Event
100-year Event

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 19

P1
Pre Dev Basin 1

O1
OPH

O2
Adj Parcel (N)

O3
Adj Parcel (E)

Subcat   Reach   Pond   Link

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.639	78	Pasture (HSG B) (P1)
13.928	85	Pasture (HSG C) (O2, P1)
0.447	86	Lawn (HSG C) (O3)
0.232	89	Gravel Road (HSG C) (P1)
20.070	89	Pasture (HSG D) (P1)
0.766	90	Lawn (HSG D) (O3)
0.034	91	Driveway (O3)
0.080	98	Impervious OPH (O2)
0.445	98	Larson Road (P1)
0.024	98	Pavement & Structures (O3)
0.337	98	Pavement OPH (O1)
0.278	100	Pond (P1)

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Prepared by PLS Engineering
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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 3

Summary for Subcatchment O1: OPH

Runoff   =   0.19 cfs @   7.88 hrs, Volume=   0.061 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	14,682	98	Pavement OPH
	14,682		100.00% Impervious Area

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

Subcatchment O1: OPH

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=14,682 sf
Runoff Volume=0.061 af
Runoff Depth>2.17"
Tc=6.0 min
CN=98

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Prepared by PLS Engineering
Printed 4/18/2017
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Page 4

Summary for Subcatchment O2: Adj Parcel (N)

Runoff   =   0.31 cfs @   7.99 hrs, Volume=   0.109 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
7.8	425	Total			

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=49,129 sf
Runoff Volume=0.109 af
Runoff Depth>1.16"
Flow Length=425'
Tc=7.8 min
CN=86

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 5

Summary for Subcatchment O3: Adj Parcel (E)

Runoff   =   0.42 cfs @   8.04 hrs, Volume=   0.144 af, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O3: Adj Parcel (E)

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=55,348 sf
Runoff Volume=0.144 af
Runoff Depth>1.36"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 6

Summary for Subcatchment P1: Pre Dev Basin 1

Runoff   =   8.75 cfs @   8.32 hrs, Volume=   3.860 af, Depth> 1.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	874,246	89	Pasture (HSG D)
*	561,028	85	Pasture (HSG C)
*	289,216	78	Pasture (HSG B)
*	10,103	89	Gravel Road (HSG C)
*	12,103	100	Pond
*	19,400	98	Larson Road
	1,766,096	86	Weighted Average
	1,734,593		98.22% Pervious Area
	31,503		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	300	0.0520	0.19		**Sheet Flow, Sheet Flow**
					Grass: Dense n= 0.240 P2= 2.54"
9.5	865	0.0470	1.52		**Shallow Concentrated Flow, Shallow Flow**
					Short Grass Pasture Kv= 7.0 fps
35.8	1,165	Total			

Subcatchment P1: Pre Dev Basin 1

Hydrograph

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
Printed 4/18/2017
Page 7

Summary for Subcatchment O1: OPH

Runoff   =   0.27 cfs @   7.87 hrs, Volume=   0.089 af, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	14,682	98	Pavement OPH
	14,682		100.00% Impervious Area

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

Subcatchment O1: OPH

Hydrograph — Type IA 24-hr 10-yr Storm Rainfall=3.40" Runoff Area=14,682 sf Runoff Volume=0.089 af Runoff Depth>3.16" Tc=6.0 min CN=98

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
Printed 4/18/2017
Page 8

Summary for Subcatchment O2: Adj Parcel (N)

Runoff   =   0.57 cfs @   7.98 hrs, Volume=   0.188 af, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
7.8	425				Total

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=49,129 sf
Runoff Volume=0.188 af
Runoff Depth>2.00"
Flow Length=425'
Tc=7.8 min
CN=86

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
Printed 4/18/2017
Page 9

Summary for Subcatchment O3: Adj Parcel (E)

Runoff   =   0.72 cfs @   8.03 hrs, Volume=   0.239 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O3: Adj Parcel (E)

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=55,348 sf
Runoff Volume=0.239 af
Runoff Depth>2.25"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
Printed 4/18/2017
Page 10

Summary for Subcatchment P1: Pre Dev Basin 1

Runoff   =   16.41 cfs @   8.30 hrs, Volume=   6.688 af, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	874,246	89	Pasture (HSG D)
*	561,028	85	Pasture (HSG C)
*	289,216	78	Pasture (HSG B)
*	10,103	89	Gravel Road (HSG C)
*	12,103	100	Pond
*	19,400	98	Larson Road
	1,766,096	86	Weighted Average
	1,734,593		98.22% Pervious Area
	31,503		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	300	0.0520	0.19		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 2.54"
9.5	865	0.0470	1.52		**Shallow Concentrated Flow, Shallow Flow** Short Grass Pasture Kv= 7.0 fps
35.8	1,165	Total			

Subcatchment P1: Pre Dev Basin 1

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=1,766,096 sf
Runoff Volume=6.688 af
Runoff Depth>1.98"
Flow Length=1,165'
Tc=35.8 min
CN=86

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
Printed 4/18/2017
Page 11

Summary for Subcatchment O1: OPH

Runoff   =   0.39 cfs @   7.87 hrs, Volume=   0.128 af, Depth> 4.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	14,682	98	Pavement OPH
	14,682		100.00% Impervious Area

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

Subcatchment O1: OPH

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=14,682 sf
Runoff Volume=0.128 af
Runoff Depth>4.56"
Tc=6.0 min
CN=98

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
Printed 4/18/2017
Page 12

Summary for Subcatchment O2: Adj Parcel (N)

Runoff   =   0.95 cfs @   7.95 hrs, Volume=   0.308 af, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
7.8	425				Total

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=49,129 sf
Runoff Volume=0.308 af
Runoff Depth>3.27"
Flow Length=425'
Tc=7.8 min
CN=86

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
Printed 4/18/2017
Page 13

Summary for Subcatchment O3: Adj Parcel (E)

Runoff = 1.16 cfs @ 8.02 hrs, Volume= 0.377 af, Depth> 3.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O3: Adj Parcel (E)

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=55,348 sf
Runoff Volume=0.377 af
Runoff Depth>3.57"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
Printed 4/18/2017
Page 14

Summary for Subcatchment P1: Pre Dev Basin 1

Runoff   =   27.96 cfs @   8.29 hrs, Volume=   10.931 af, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	874,246	89	Pasture (HSG D)
*	561,028	85	Pasture (HSG C)
*	289,216	78	Pasture (HSG B)
*	10,103	89	Gravel Road (HSG C)
*	12,103	100	Pond
*	19,400	98	Larson Road
	1,766,096	86	Weighted Average
	1,734,593		98.22% Pervious Area
	31,503		1.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.3	300	0.0520	0.19		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 2.54"
9.5	865	0.0470	1.52		**Shallow Concentrated Flow, Shallow Flow** Short Grass Pasture Kv= 7.0 fps
35.8	1,165	Total			

Subcatchment P1: Pre Dev Basin 1

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=1,766,096 sf
Runoff Volume=10.931 af
Runoff Depth>3.24"
Flow Length=1,165'
Tc=35.8 min
CN=86

Post-Developed

2-year Event
10-year Event
100-year Event

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 20

Routing Diagram for 2641 Riverside Estates Post
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.722	80	Landscaping (B7)
1.048	85	Pasture (HSG C) (O2)
2.111	86	Landscaping (B1)
0.511	86	Lawn (HSG C) (B2, O1)
6.852	88	Landscaping (B3, B8, B9)
8.192	90	Landscaping (A B1, A B2, A B3, A B4, A B5, B4, B5, B6)
0.766	90	Lawn (HSG D) (O1)
0.034	91	Driveway (O1)
3.027	98	Buildings (A B4, A B5, B9)
0.514	98	Homes & DW (B7)
0.184	98	Houses (B8)
12.788	98	Impervious (B1, B3, B4, B5)
0.080	98	Impervious OPH (O2)
3.412	98	Pavement (A B1, A B2, A B3, O3)
0.024	98	Pavement & Structures (O1)
0.555	98	Road & SW (B7)
1.162	98	Roads & DW (B8)
0.278	100	Pond (B1)

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 3

Summary for Subcatchment A B1: Apt Basin 1

Runoff   =   1.25 cfs @   7.90 hrs, Volume=   0.397 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	70,725	98	Pavement
*	40,704	90	Landscaping
	111,429	95	Weighted Average
	40,704		36.53% Pervious Area
	70,725		63.47% Impervious Area

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

Subcatchment A B1: Apt Basin 1

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=111,429 sf
Runoff Volume=0.397 af
Runoff Depth>1.86"
Tc=6.0 min
CN=95

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 4

Summary for Subcatchment A B2: Apt Basin 2

Runoff   =   0.50 cfs @   7.90 hrs, Volume=   0.160 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	26,871	98	Pavement
*	17,952	90	Landscaping
	44,823	95	Weighted Average
	17,952		40.05% Pervious Area
	26,871		59.95% Impervious Area

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

Subcatchment A B2: Apt Basin 2

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=44,823 sf
Runoff Volume=0.160 af
Runoff Depth>1.86"
Tc=6.0 min
CN=95

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 5

Summary for Subcatchment A B3: Apt Basin 3

Runoff   =   0.70 cfs @   7.89 hrs, Volume=   0.222 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	43,562	98	Pavement
*	15,740	90	Landscaping
	59,302	96	Weighted Average
	15,740		26.54% Pervious Area
	43,562		73.46% Impervious Area

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

Subcatchment A B3: Apt Basin 3

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=59,302 sf
Runoff Volume=0.222 af
Runoff Depth>1.96"
Tc=6.0 min
CN=96

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 6

Summary for Subcatchment A B4: Apt Basin 4

Runoff   =   0.75 cfs @   7.90 hrs, Volume=   0.238 af, Depth> 1.86"
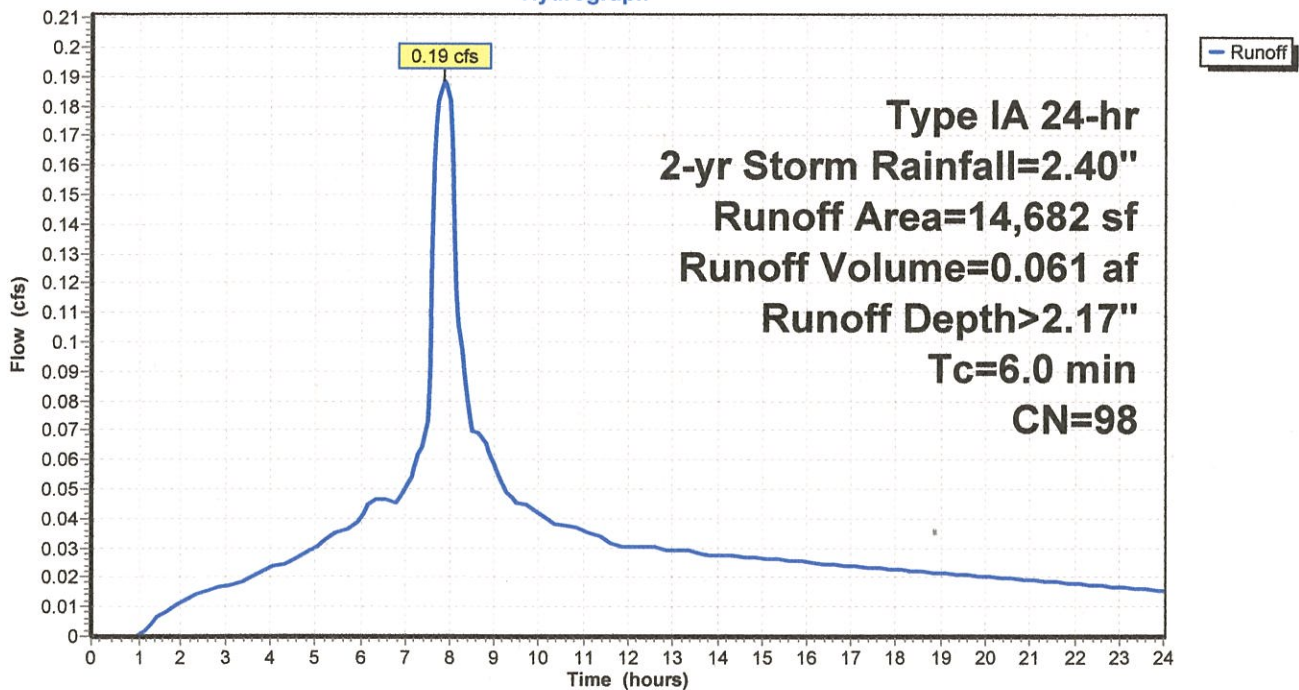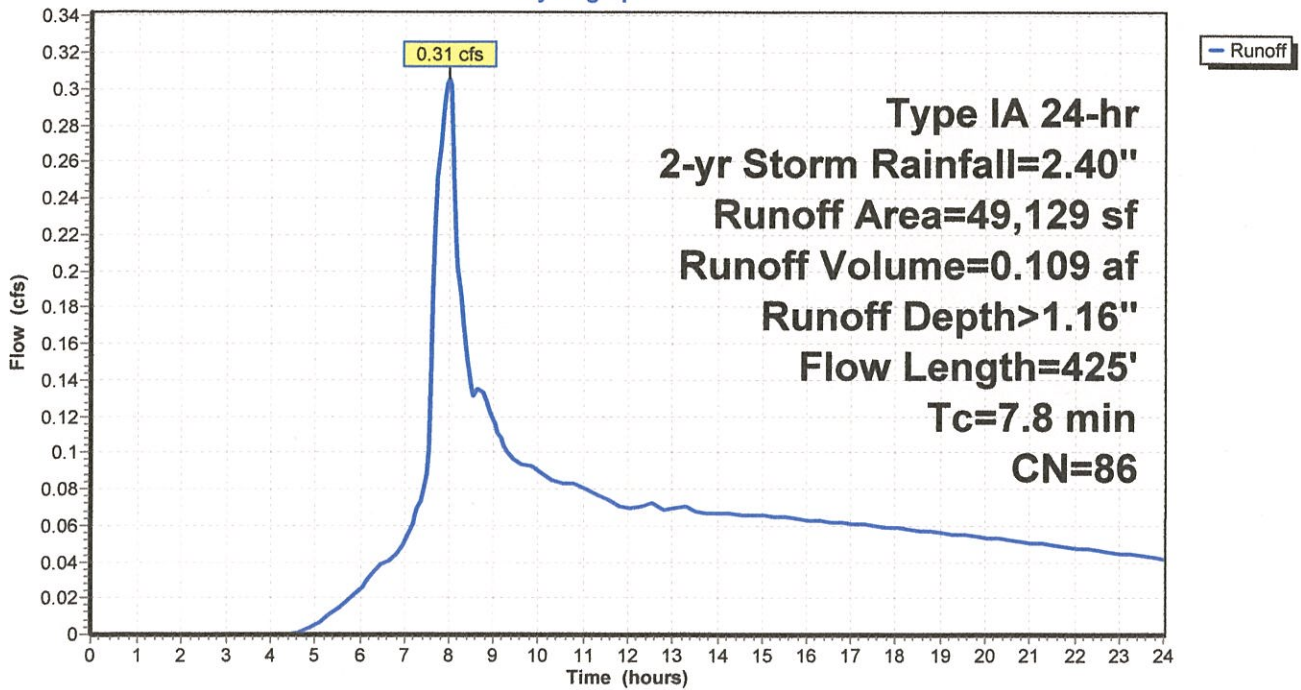
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	43,680	98	Buildings
*	23,018	90	Landscaping
	66,698	95	Weighted Average
	23,018		34.51% Pervious Area
	43,680		65.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
					Direct Entry, Sheet
6.0					

Subcatchment A B4: Apt Basin 4

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=66,698 sf
Runoff Volume=0.238 af
Runoff Depth>1.86"
Tc=6.0 min
CN=95

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 7

Summary for Subcatchment A B5: Apt Basin 5

Runoff   =   0.57 cfs @   7.92 hrs, Volume=   0.182 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	24,194	98	Buildings
*	32,440	90	Landscaping
	56,634	93	Weighted Average
	32,440		57.28% Pervious Area
	24,194		42.72% Impervious Area

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

Subcatchment A B5: Apt Basin 5

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=56,634 sf
Runoff Volume=0.182 af
Runoff Depth>1.68"
Tc=6.0 min
CN=93

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 8

Summary for Subcatchment B1: North Basin

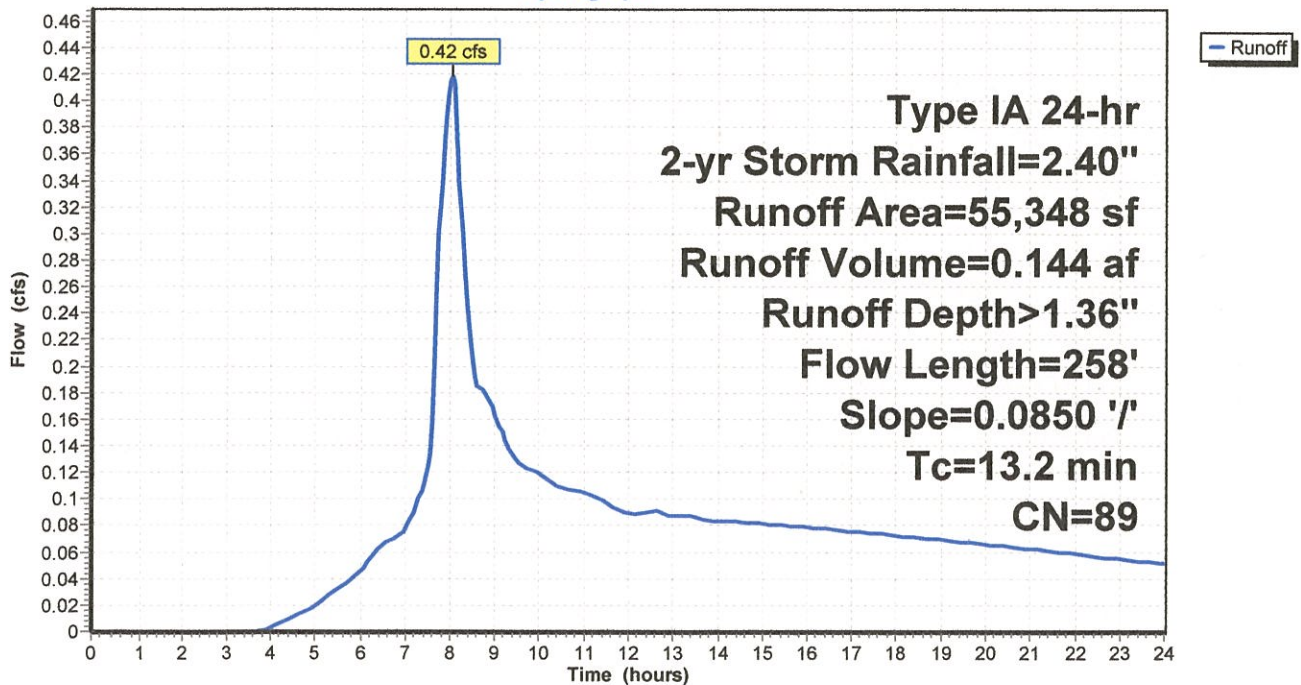Runoff   =   1.62 cfs @   8.02 hrs, Volume=   0.535 af, Depth> 1.59"
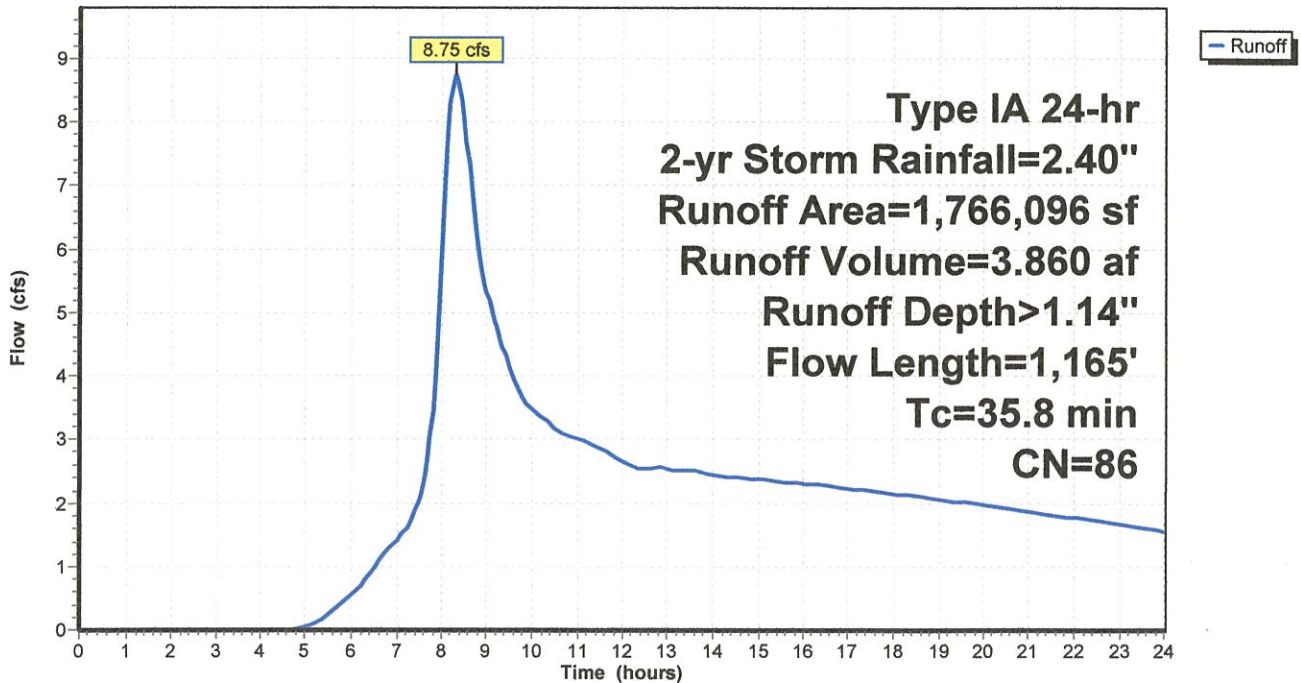
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	91,945	86	Landscaping
*	71,271	98	Impervious
*	12,103	100	Pond
	175,319	92	Weighted Average
	91,945		52.44% Pervious Area
	83,374		47.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	190	0.0950	0.32		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.1	22	0.2500	3.50		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
1.7	107	0.0230	1.06		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
0.9	144	0.0070	2.59	0.51	**Pipe Channel, Pipe**
					6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13'
					n= 0.012
12.6	463	Total			

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 9

Subcatchment B1: North Basin

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=175,319 sf
Runoff Volume=0.535 af
Runoff Depth>1.59"
Flow Length=463'
Tc=12.6 min
CN=92

1.62 cfs

— Runoff

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 10

Summary for Subcatchment B2: Tract A

Runoff   =   0.02 cfs @   7.98 hrs, Volume=   0.006 af, Depth> 1.16"
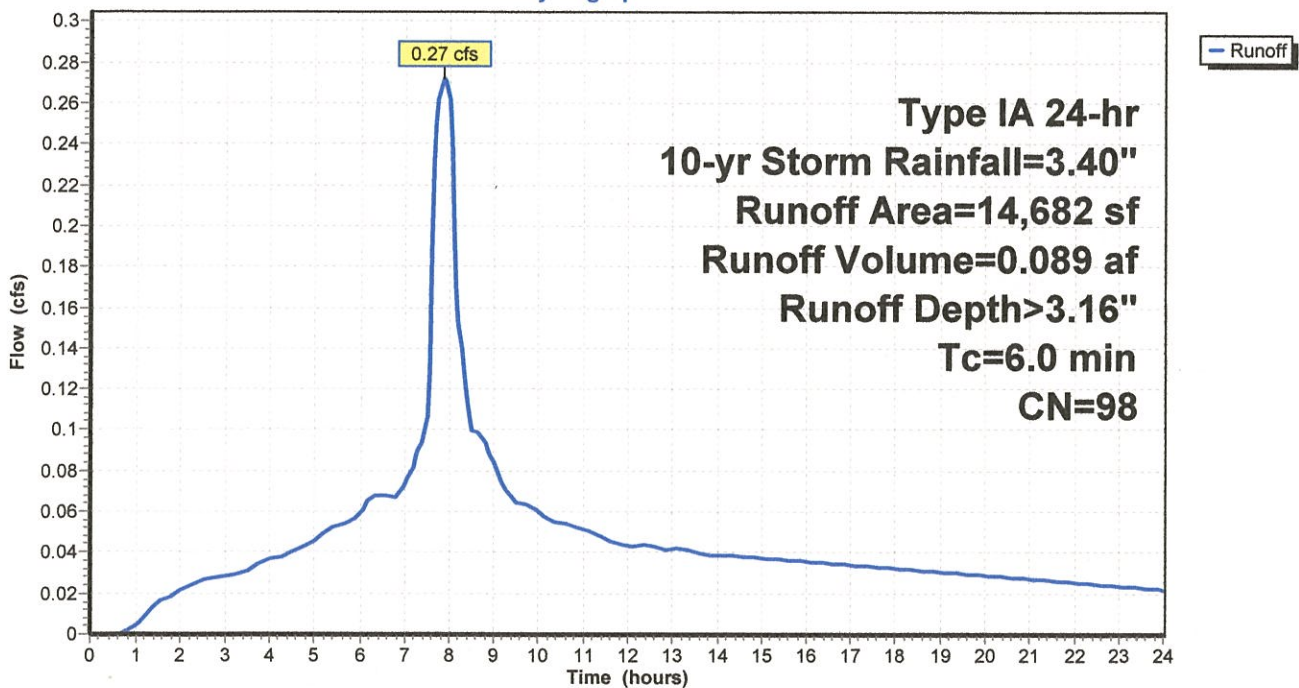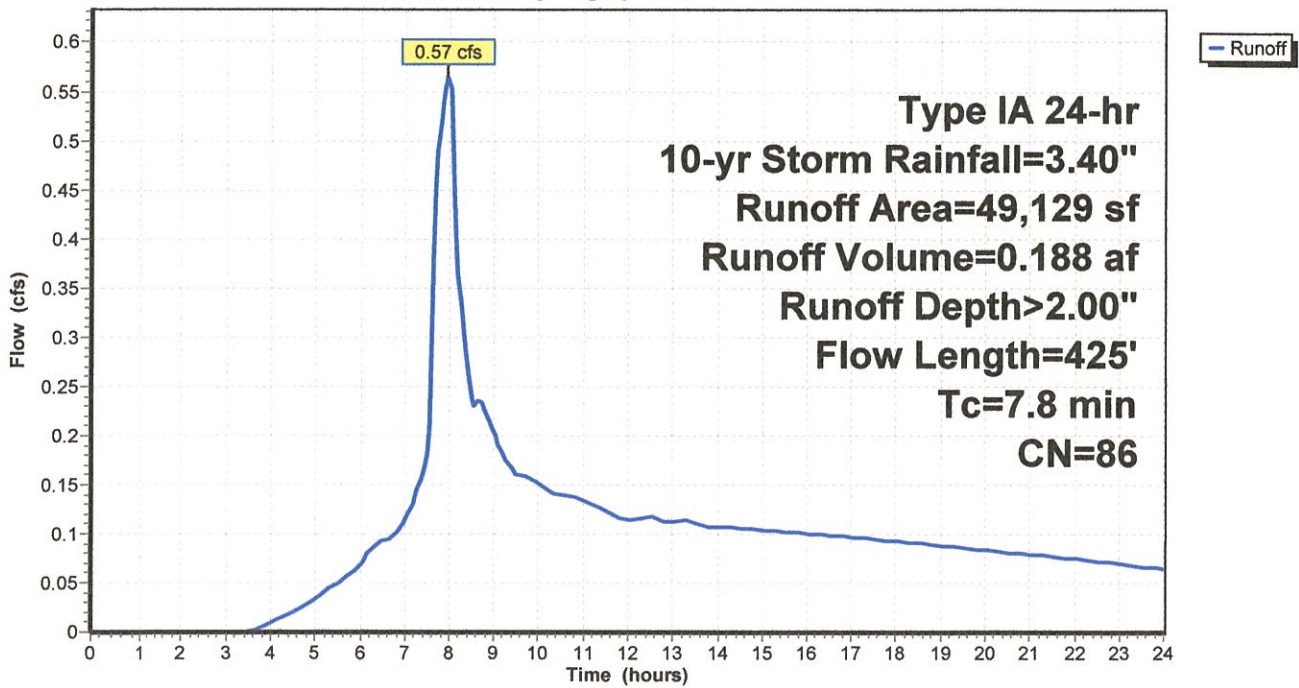
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description		
*	2,783	86	Lawn (HSG C)		
	2,783		100.00% Pervious Area		

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	109	0.0910	0.28		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.54"

Subcatchment B2: Tract A

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=2,783 sf
Runoff Volume=0.006 af
Runoff Depth>1.16"
Flow Length=109'
Slope=0.0910 '/'
Tc=6.4 min
CN=86

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 11

Summary for Subcatchment B3: Central Basin

Runoff   =   4.42 cfs @   7.94 hrs, Volume=   1.410 af, Depth> 1.77"
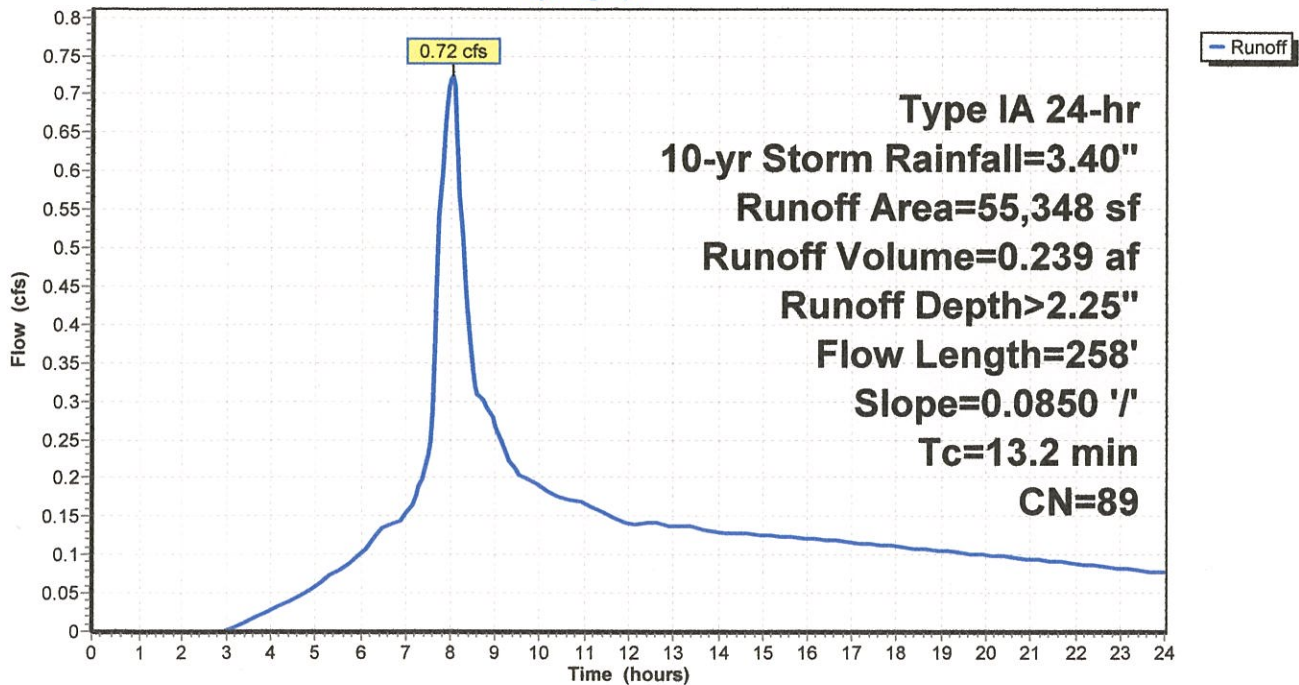
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	240,948	98	Impervious
*	175,358	88	Landscaping
	416,306	94	Weighted Average
	175,358		42.12% Pervious Area
	240,948		57.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter** Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B3: Central Basin

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=416,306 sf
Runoff Volume=1.410 af
Runoff Depth>1.77"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 12

Summary for Subcatchment B4: South Basin

Runoff   =   3.90 cfs @   7.94 hrs, Volume=   1.245 af, Depth> 1.77"
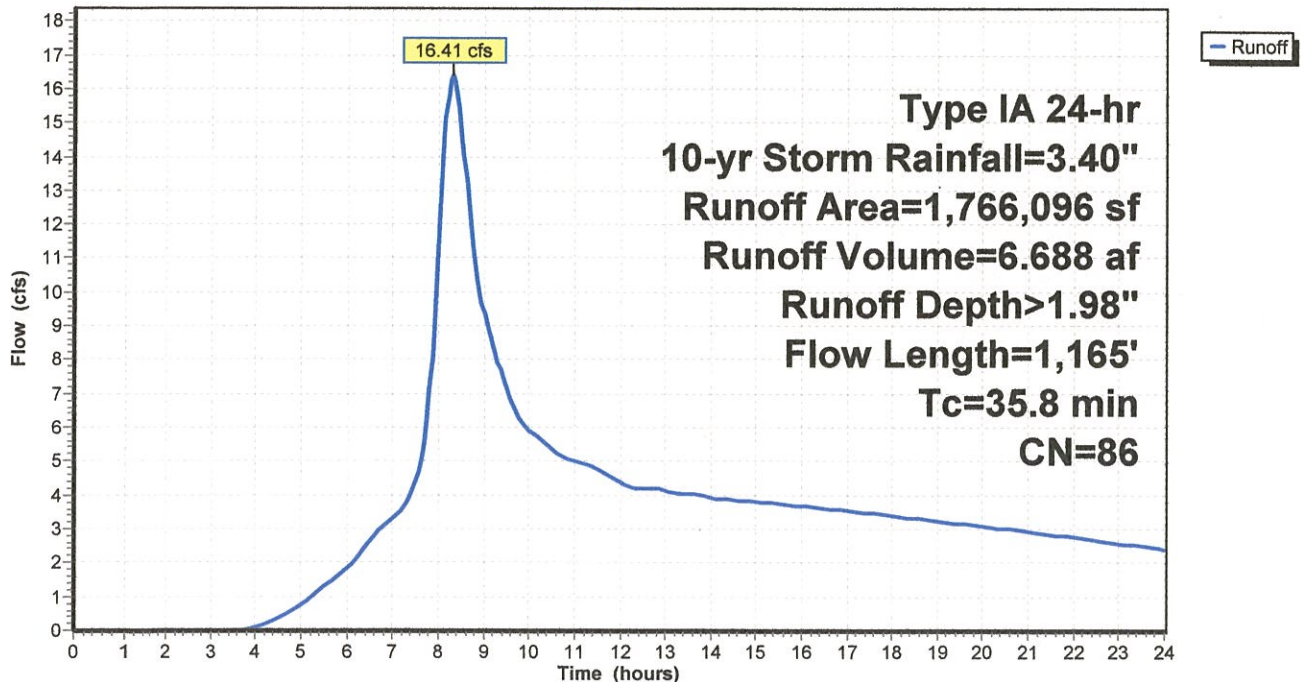
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	200,131	98	Impervious
*	167,521	90	Landscaping
	367,652	94	Weighted Average
	167,521		45.57% Pervious Area
	200,131		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B4: South Basin

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=367,652 sf
Runoff Volume=1.245 af
Runoff Depth>1.77"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 13

Summary for Subcatchment B5: Pond Area

Runoff   =   0.97 cfs @   7.91 hrs, Volume=   0.307 af, Depth> 1.77"
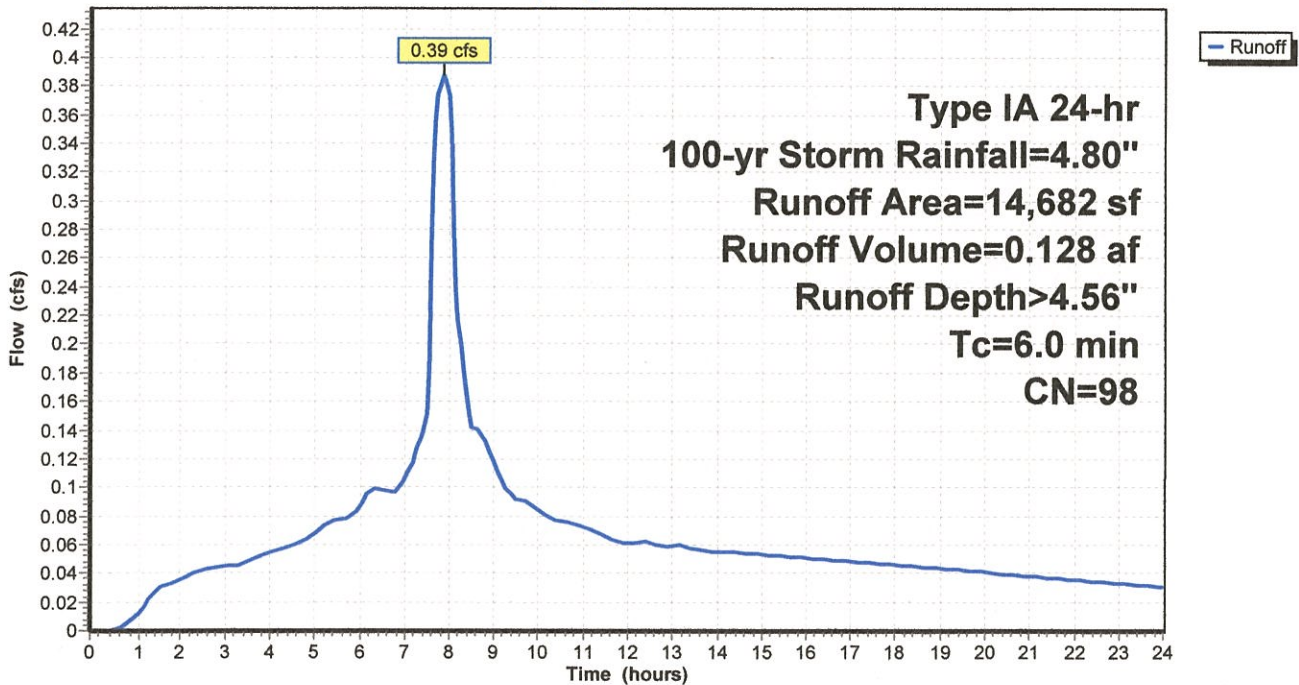
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	44,675	98	Impervious
*	46,045	90	Landscaping
	90,720	94	Weighted Average
	46,045		50.76% Pervious Area
	44,675		49.24% Impervious Area

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

Subcatchment B5: Pond Area

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=90,720 sf
Runoff Volume=0.307 af
Runoff Depth>1.77"
Tc=6.0 min
CN=94

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 14

Summary for Subcatchment B6: Open Space

Runoff   =   0.11 cfs @   7.95 hrs, Volume=   0.037 af, Depth> 1.44"
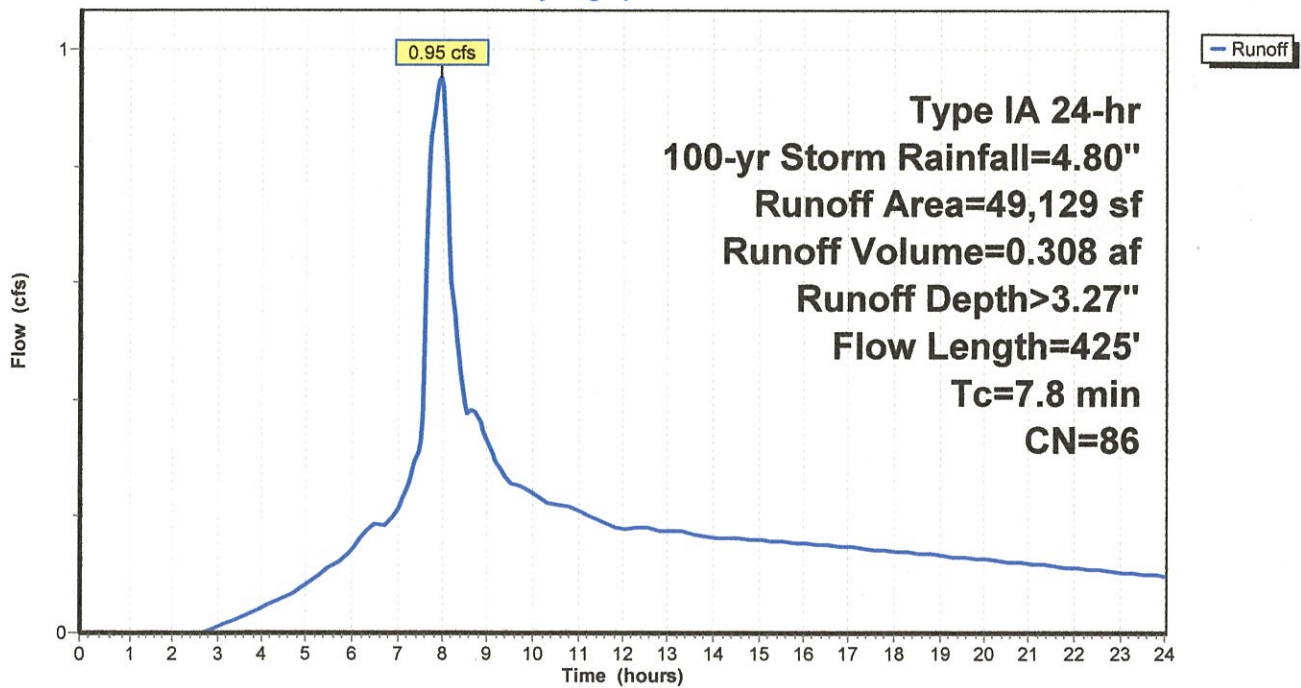
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	13,411	90	Landscaping
	13,411		100.00% Pervious Area

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

Subcatchment B6: Open Space

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 15
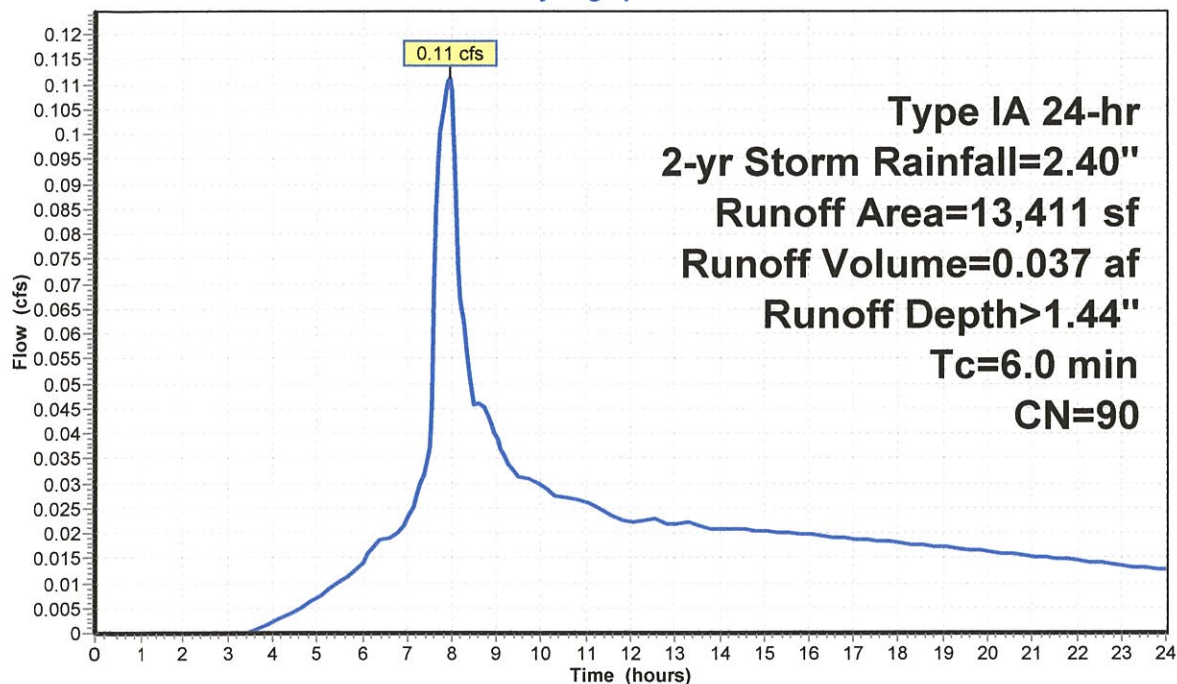
Summary for Subcatchment B7: Cul-de-Sac

Runoff   =   0.82 cfs @   7.97 hrs, Volume=   0.285 af, Depth> 1.23"
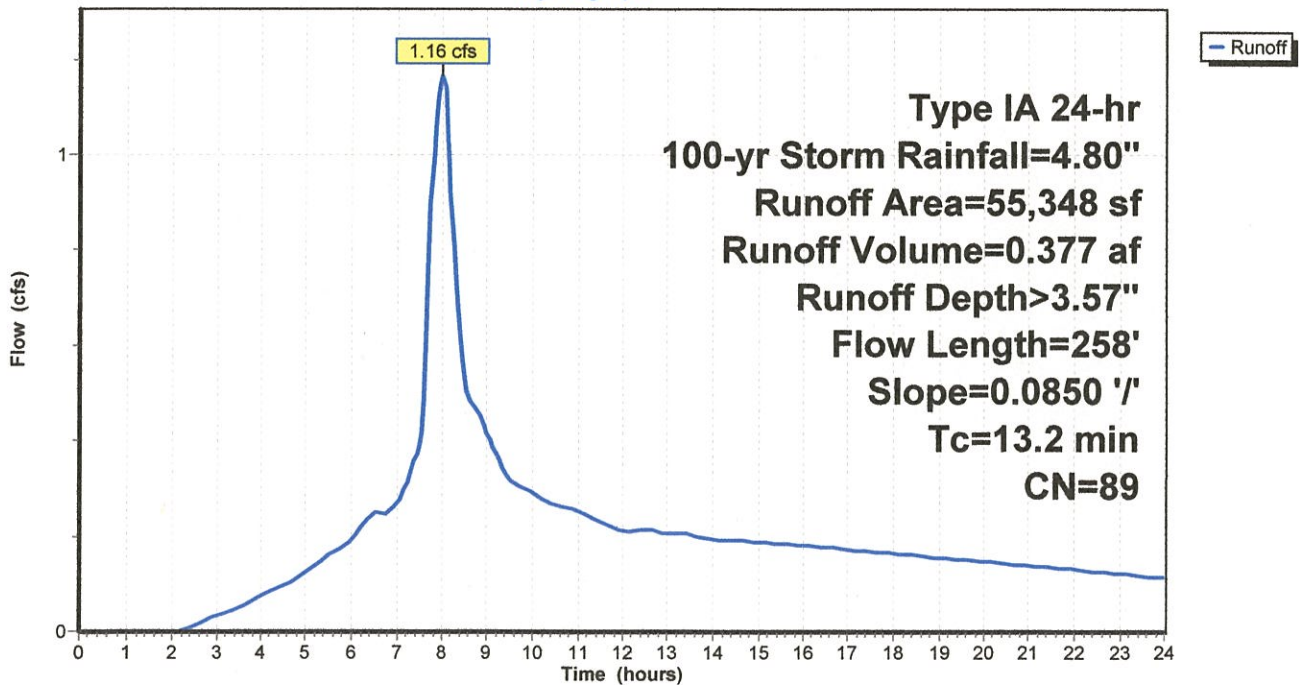
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	75,014	80	Landscaping
*	24,170	98	Road & SW
*	22,400	98	Homes & DW
	121,584	87	Weighted Average
	75,014		61.70% Pervious Area
	46,570		38.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Swale 1**

Subcatchment B7: Cul-de-Sac

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=121,584 sf
Runoff Volume=0.285 af
Runoff Depth>1.23"
Tc=6.0 min
CN=87

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 16

Summary for Subcatchment B8: 11th Street

Runoff   =   1.17 cfs @   7.92 hrs, Volume=   0.376 af, Depth> 1.68"
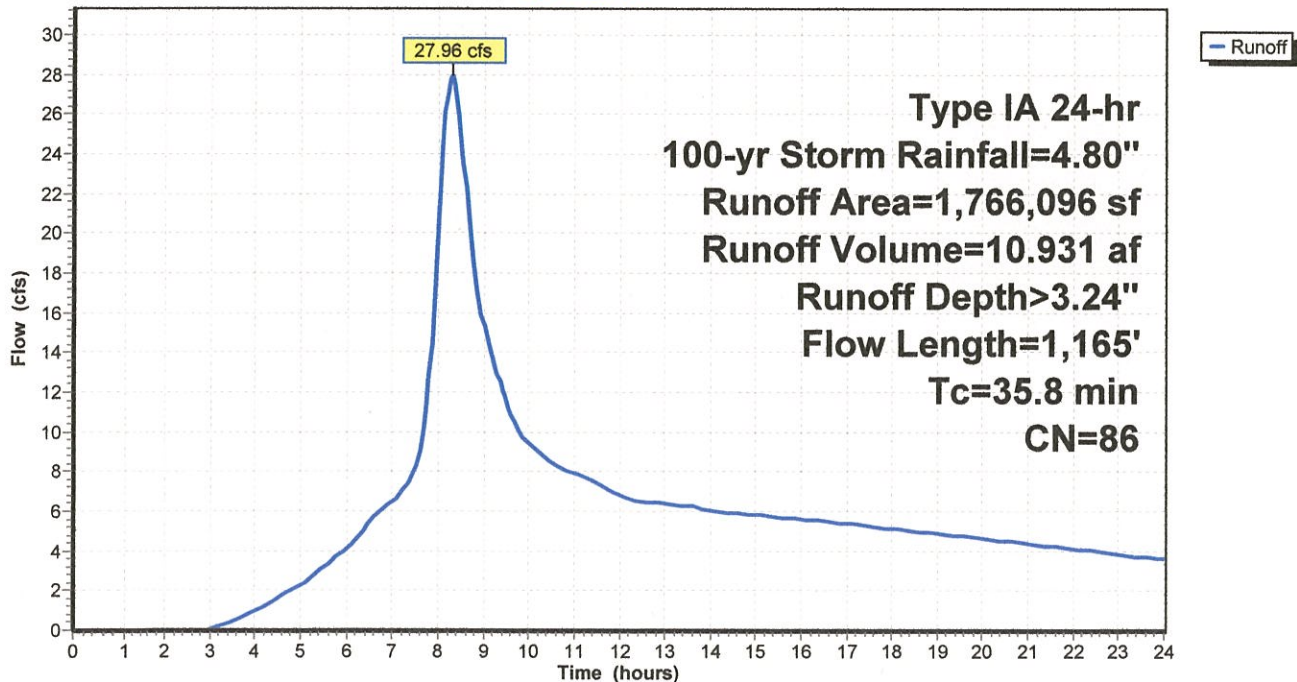
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	58,285	88	Landscaping
*	50,605	98	Roads & DW
*	8,000	98	Houses
	116,890	93	Weighted Average
	58,285		49.86% Pervious Area
	58,605		50.14% Impervious Area

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

Subcatchment B8: 11th Street

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=116,890 sf
Runoff Volume=0.376 af
Runoff Depth>1.68"
Tc=6.0 min
CN=93

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 17

Summary for Subcatchment B9: 13th Homes

Runoff   =   1.29 cfs @   7.92 hrs, Volume=   0.415 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	64,850	88	Landscaping
*	64,000	98	Buildings
	128,850	93	Weighted Average
	64,850		50.33% Pervious Area
	64,000		49.67% Impervious Area

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

Subcatchment B9: 13th Homes

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=128,850 sf
Runoff Volume=0.415 af
Runoff Depth>1.68"
Tc=6.0 min
CN=93

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 18

Summary for Subcatchment O1: Adj Parcel (E)

Runoff   =   0.42 cfs @   8.04 hrs, Volume=   0.144 af, Depth> 1.36"
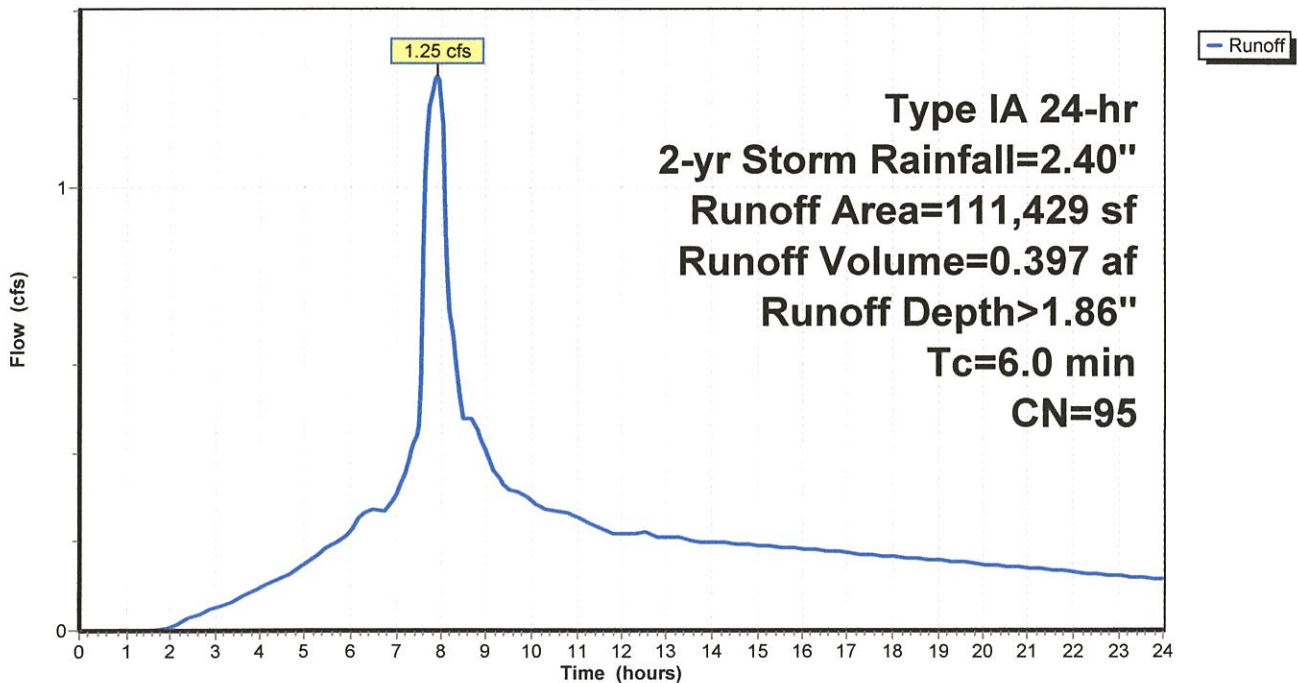
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O1: Adj Parcel (E)

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=55,348 sf
Runoff Volume=0.144 af
Runoff Depth>1.36"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 19

Summary for Subcatchment O2: Adj Parcel (N)

Runoff   =   0.31 cfs @   7.99 hrs, Volume=   0.109 af, Depth> 1.16"
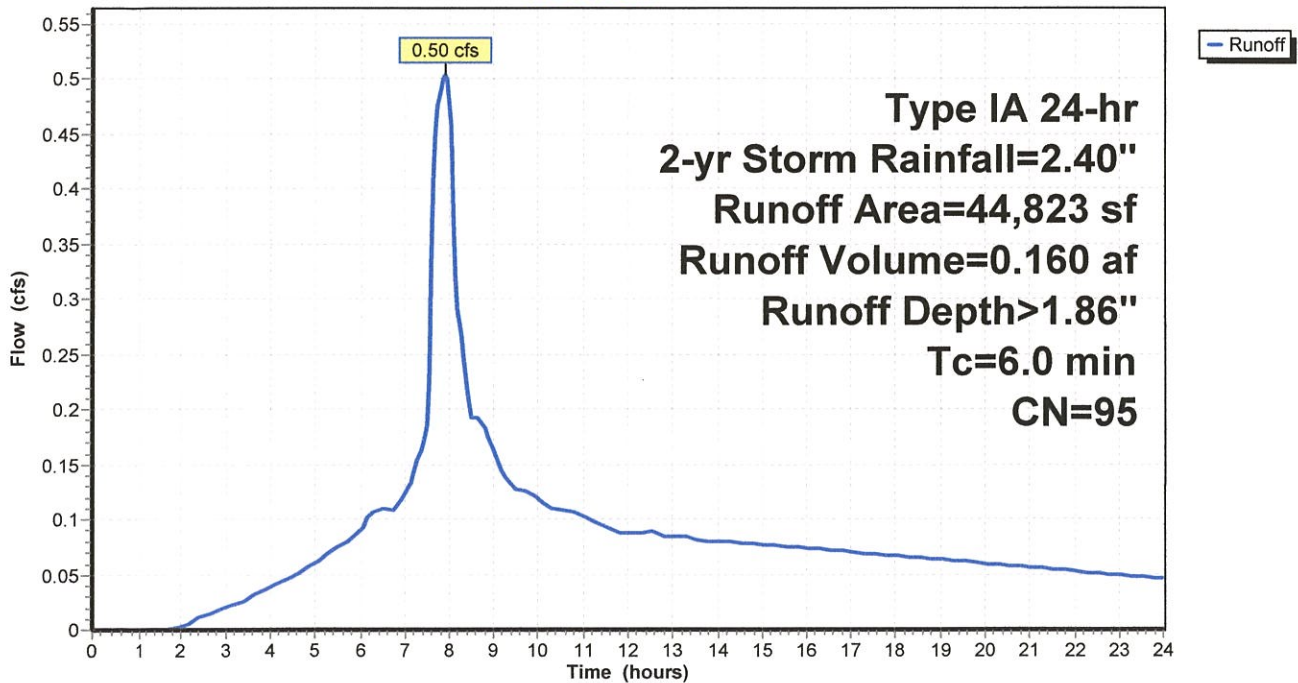
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
7.8	425	Total			

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
2-yr Storm Rainfall=2.40"
Runoff Area=49,129 sf
Runoff Volume=0.109 af
Runoff Depth>1.16"
Flow Length=425'
Tc=7.8 min
CN=86

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 20

Summary for Subcatchment O3: OPH North

Runoff   =   0.10 cfs @   7.88 hrs, Volume=   0.031 af, Depth> 2.17"
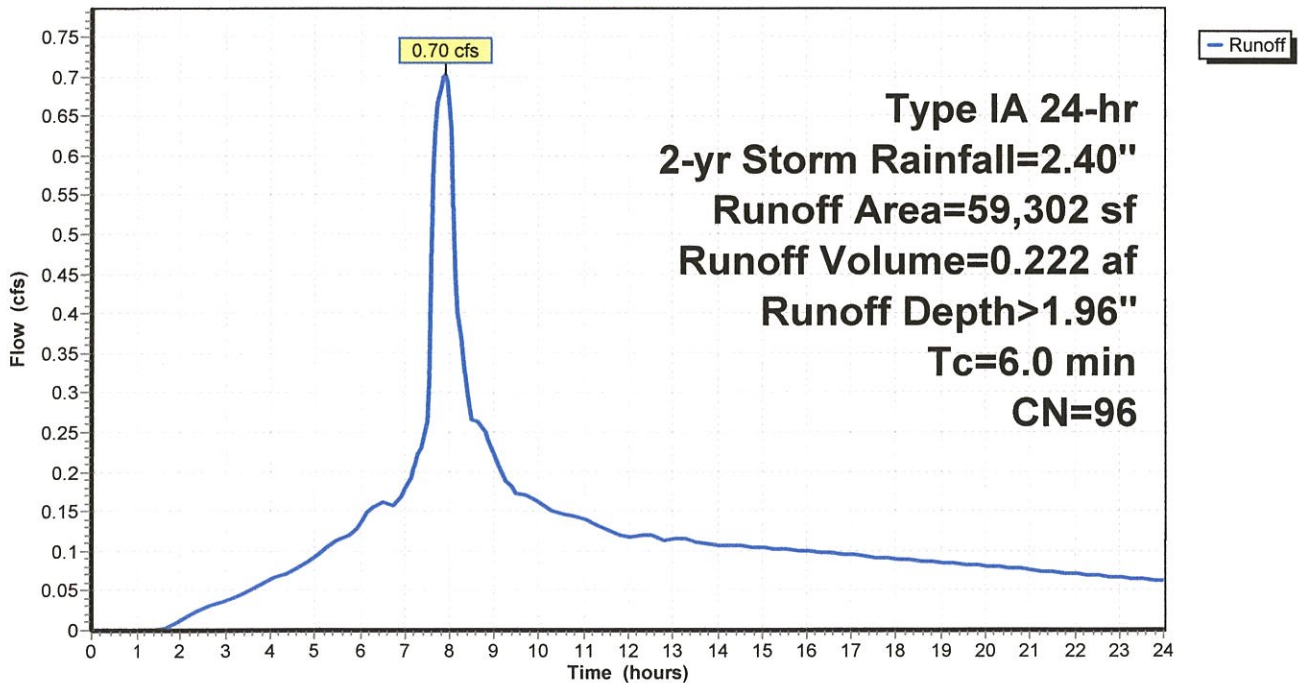
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-yr Storm Rainfall=2.40"

	Area (sf)	CN	Description
*	7,465	98	Pavement
	7,465		100.00% Impervious Area

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

Subcatchment O3: OPH North

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 21

Summary for Reach P1: Pipe 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 1.55"   for 2-yr Storm event
Inflow   =   2.15 cfs @   8.02 hrs, Volume=   0.716 af
Outflow   =   2.15 cfs @   8.03 hrs, Volume=   0.715 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.39 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.46 fps, Avg. Travel Time= 1.0 min

Peak Storage= 70 cf @ 8.02 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.83 cfs

15.0" Round Pipe
n= 0.012
Length= 144.0' Slope= 0.0069 '/'
Inlet Invert= 181.00', Outlet Invert= 180.00'

Reach P1: Pipe 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.52'
Max Vel=4.39 fps
15.0"
Round Pipe
n=0.012
L=144.0'
S=0.0069 '/'
Capacity=5.83 cfs

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Printed 4/18/2017
Page 22
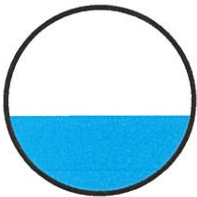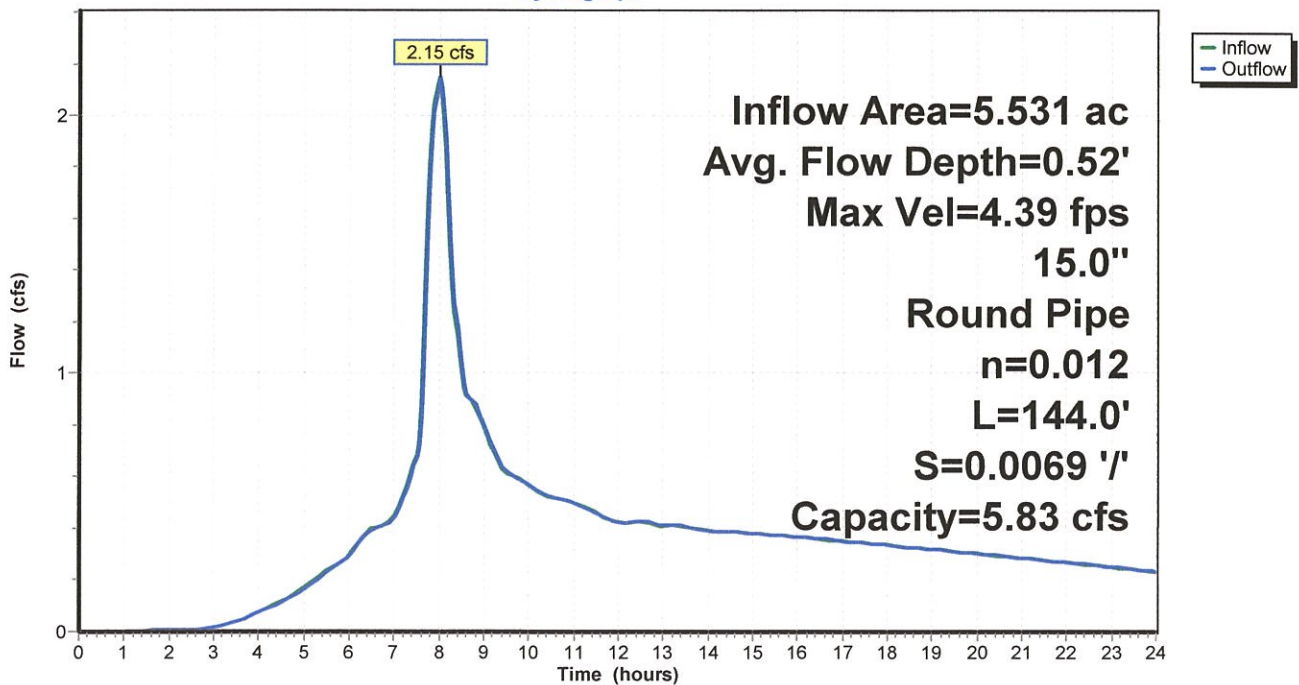
Summary for Reach P2: Pipe 2

Inflow Area =   6.480 ac, 65.49% Impervious, Inflow Depth > 1.31"   for 2-yr Storm event
Inflow   =   2.31 cfs @   8.05 hrs, Volume=   0.705 af
Outflow   =   2.27 cfs @   8.14 hrs, Volume=   0.703 af, Atten= 2%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.22 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 4.07 fps, Avg. Travel Time= 5.2 min

Peak Storage= 402 cf @ 8.09 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.13 cfs

12.0" Round Pipe
n= 0.012
Length= 1,279.0'   Slope= 0.0252 '/'
Inlet Invert= 170.25', Outlet Invert= 138.00'

Reach P2: Pipe 2

Hydrograph

Inflow Area=6.480 ac
Avg. Flow Depth=0.42'
Max Vel=7.22 fps
12.0"
Round Pipe
n=0.012
L=1,279.0'
S=0.0252 '/'
Capacity=6.13 cfs

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Printed 4/18/2017
Page 23
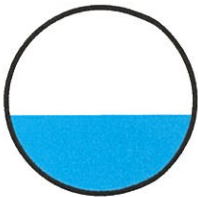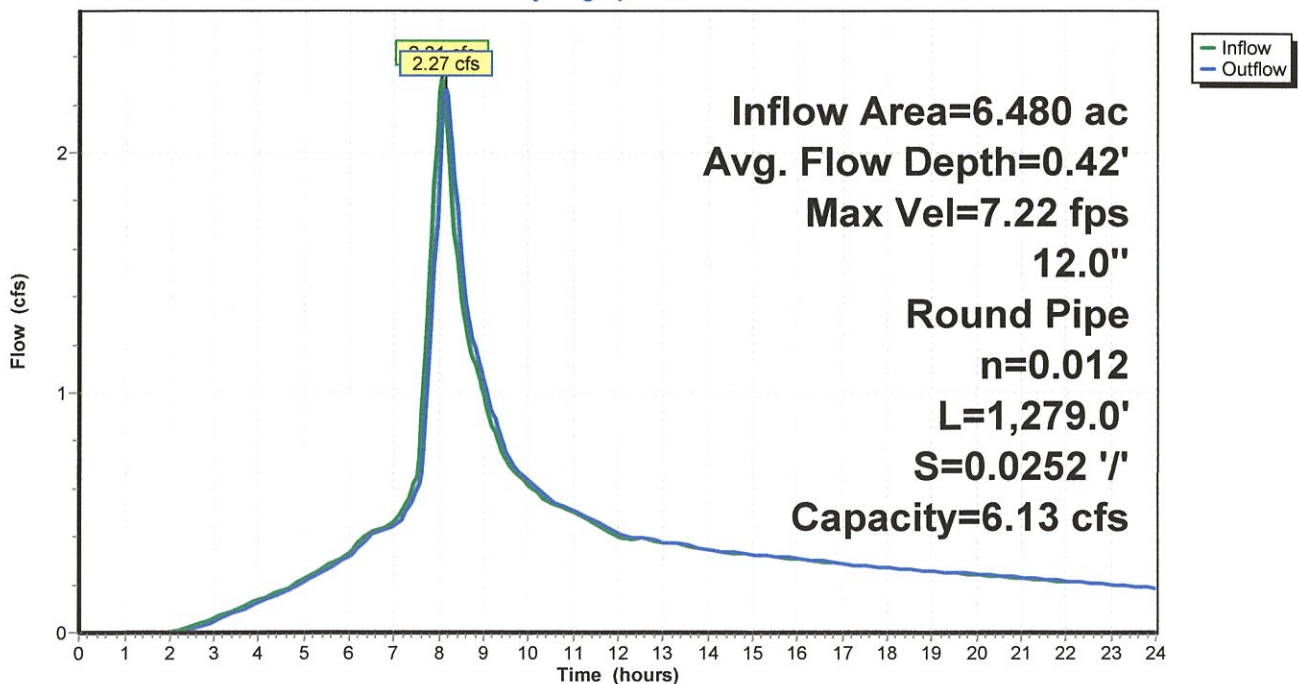
Summary for Reach P3: Pipe 3

Inflow Area = 9.557 ac, 57.88% Impervious, Inflow Depth > 1.77"   for 2-yr Storm event
Inflow   = 4.42 cfs @   7.94 hrs, Volume=   1.410 af
Outflow   = 4.41 cfs @   7.99 hrs, Volume=   1.406 af, Atten= 0%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.29 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 5.30 fps, Avg. Travel Time= 3.3 min

Peak Storage= 493 cf @ 7.96 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.67' Flow Area= 2.2 sf, Capacity= 27.69 cfs

20.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P3: Pipe 3

Hydrograph

Inflow Area=9.557 ac
Avg. Flow Depth=0.45'
Max Vel=9.29 fps
20.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=27.69 cfs

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Printed 4/18/2017
Page 24
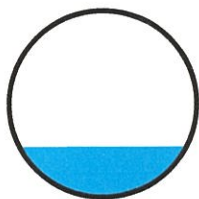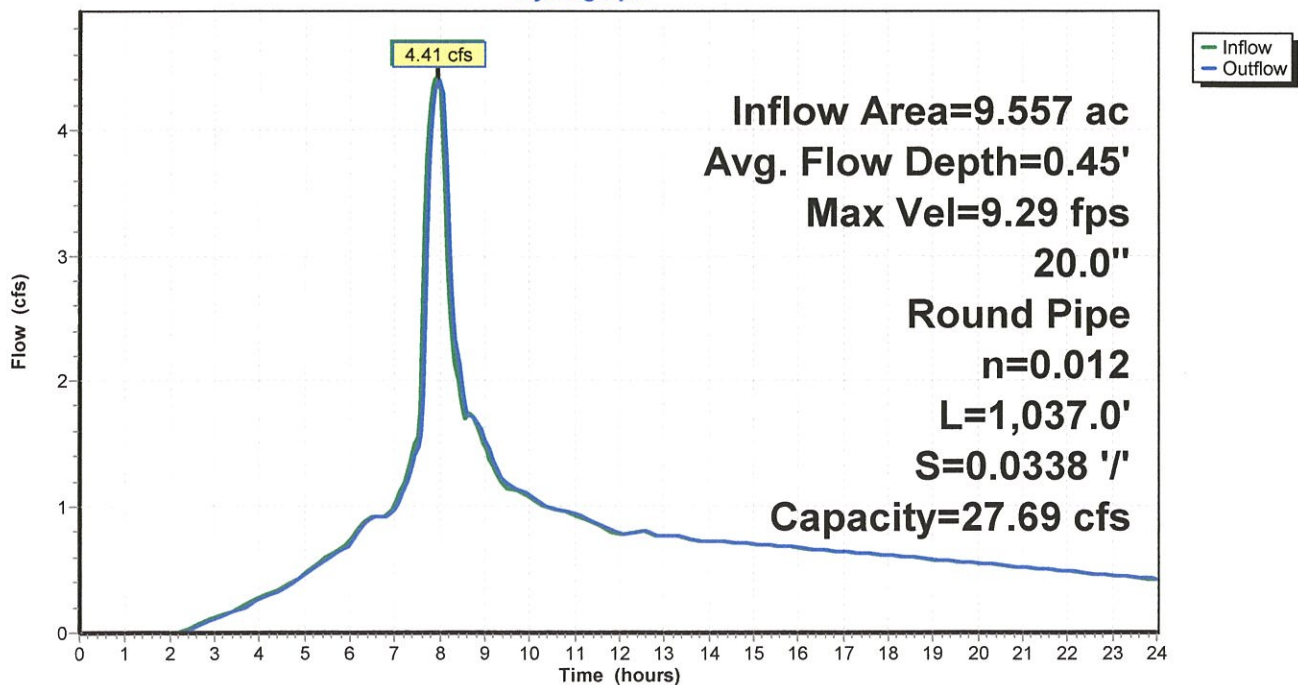
Summary for Reach P4: Pipe 4

Inflow Area =   8.440 ac, 54.43% Impervious, Inflow Depth > 1.77"   for 2-yr Storm event
Inflow   =   3.90 cfs @   7.94 hrs, Volume=   1.245 af
Outflow   =   3.89 cfs @   7.99 hrs, Volume=   1.242 af, Atten= 0%, Lag= 3.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.05 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 5.18 fps, Avg. Travel Time= 3.3 min

Peak Storage= 446 cf @ 7.96 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 20.91 cfs

18.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P4: Pipe 4

Hydrograph

Inflow Area=8.440 ac
Avg. Flow Depth=0.44'
Max Vel=9.05 fps
18.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=20.91 cfs

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 25
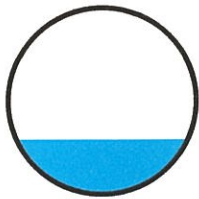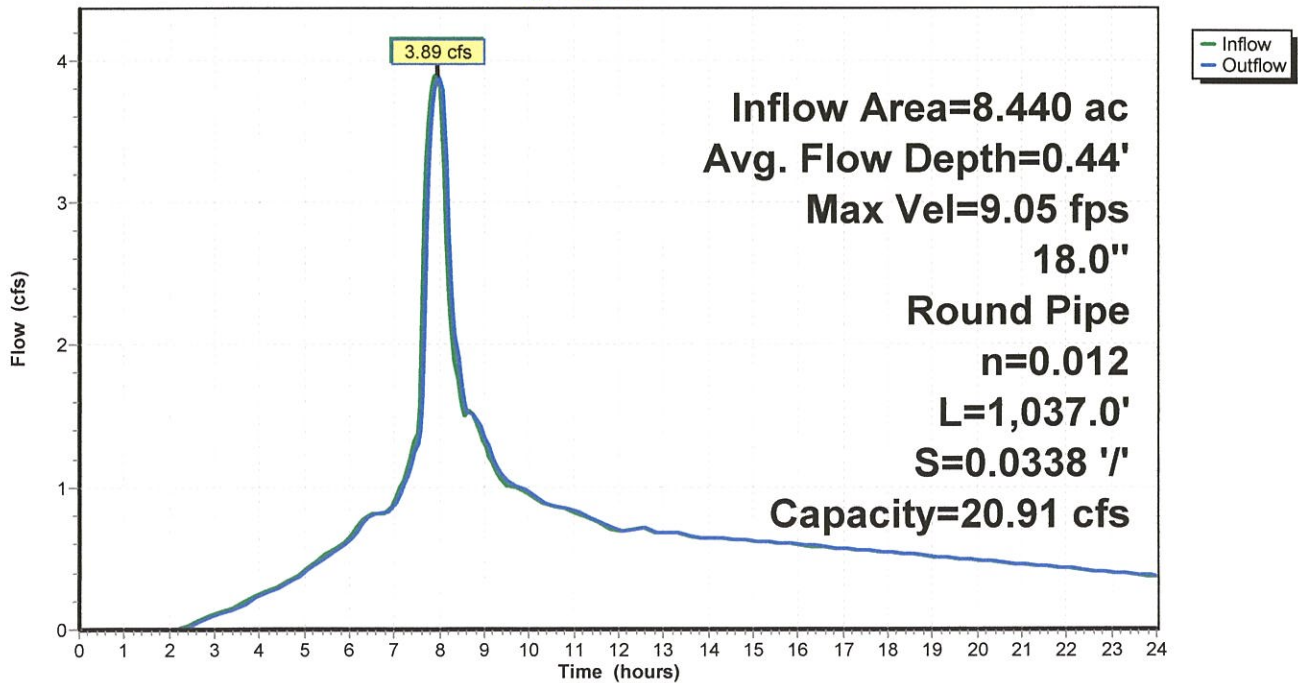
Summary for Reach S1: Bioswale 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 1.55"   for 2-yr Storm event
Inflow   =   2.15 cfs @   8.03 hrs, Volume=   0.715 af
Outflow   =   2.08 cfs @   8.21 hrs, Volume=   0.708 af, Atten= 3%, Lag= 10.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.42 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 14.4 min

Peak Storage= 881 cf @ 8.09 hrs
Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00' Flow Area= 12.0 sf, Capacity= 7.57 cfs

9.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 15.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 180.00', Outlet Invert= 178.25'

‡

Reach S1: Bioswale 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.48'
Max Vel=0.42 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=7.57 cfs

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Printed 4/18/2017
Page 26
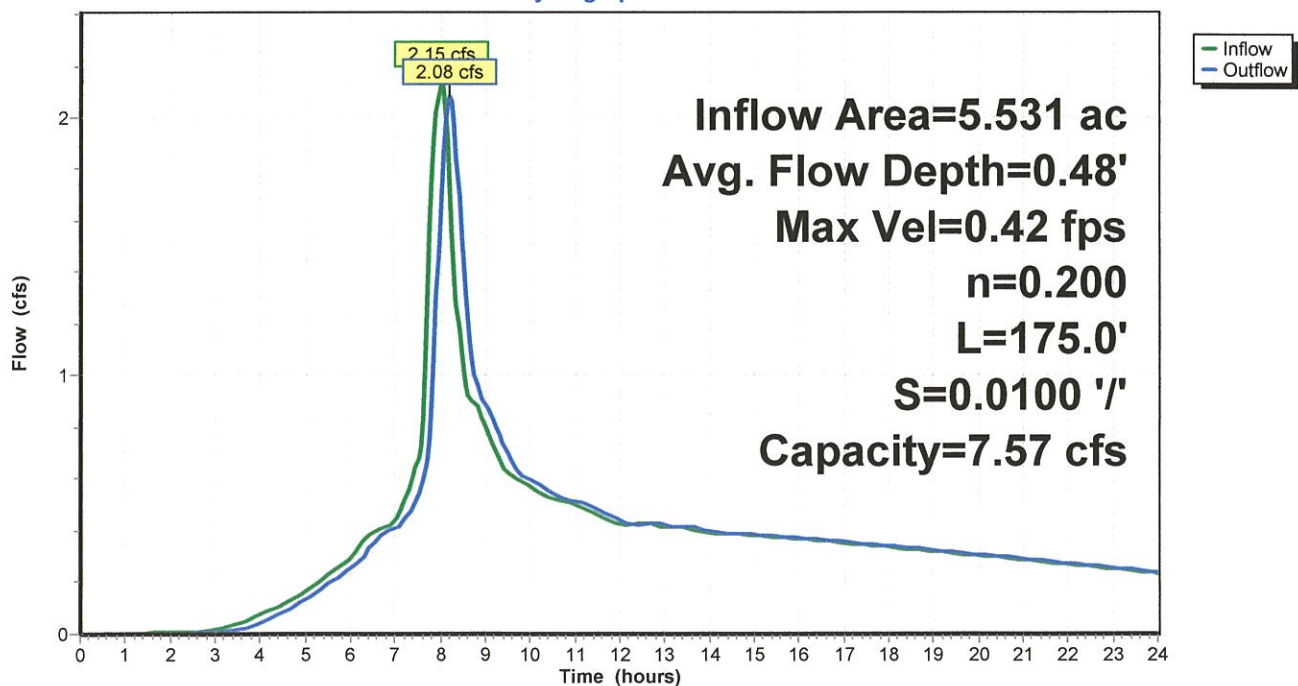
Summary for Reach S2: Bioswale 2

Inflow Area =	2.558 ac,	63.47% Impervious,	Inflow Depth > 1.86"	for 2-yr Storm event
Inflow =	1.25 cfs @	7.90 hrs,	Volume=	0.397 af
Outflow =	1.22 cfs @	8.12 hrs,	Volume=	0.393 af, Atten= 2%, Lag= 12.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.38 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 14.9 min

Peak Storage= 563 cf @ 7.99 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 5.42 cfs

6.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/' Top Width= 12.00'
Length= 175.0' Slope= 0.0100 '/'
Inlet Invert= 172.00', Outlet Invert= 170.25'

‡

Reach S2: Bioswale 2

Hydrograph

Inflow Area=2.558 ac
Avg. Flow Depth=0.44'
Max Vel=0.38 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=5.42 cfs

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Printed 4/18/2017
Page 27
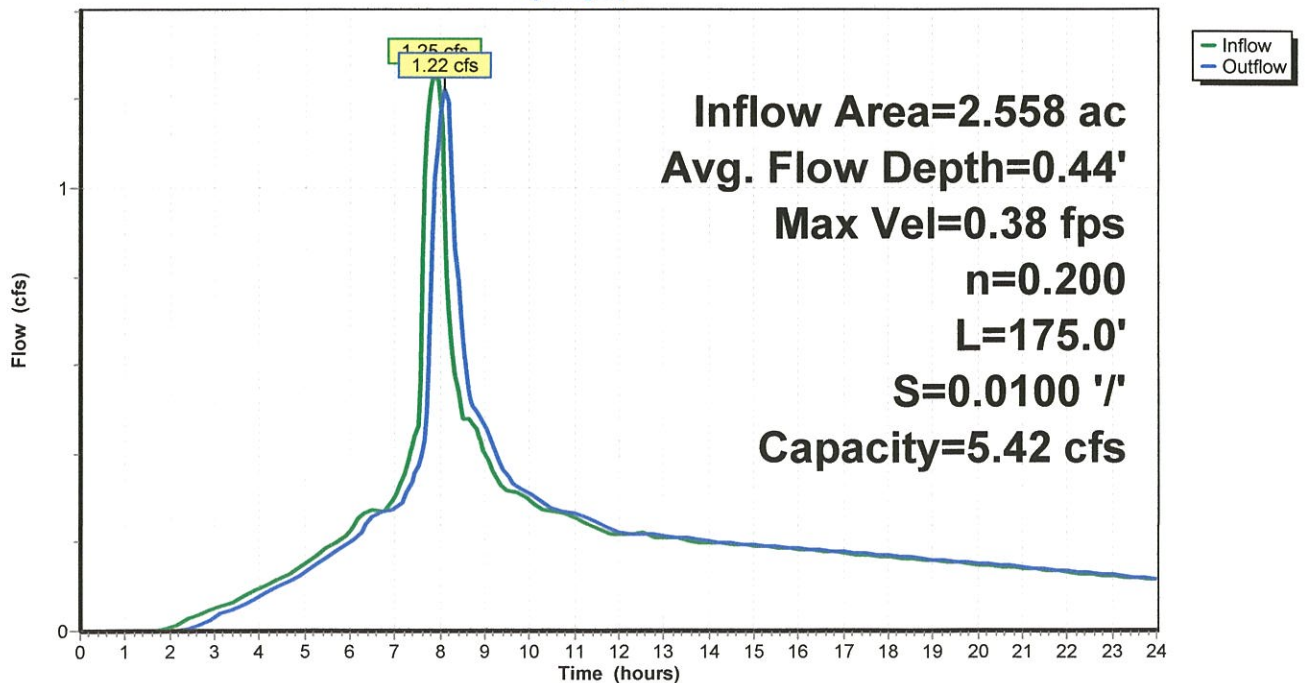
Summary for Pond 1P: Pond 1

Inflow Area =	6.658 ac, 32.88% Impervious, Inflow Depth > 1.47" for 2-yr Storm event			
Inflow =	2.29 cfs @ 8.19 hrs, Volume=	0.817 af		
Outflow =	0.98 cfs @ 9.04 hrs, Volume=	0.745 af, Atten= 57%, Lag= 51.3 min		
Primary =	0.98 cfs @ 9.04 hrs, Volume=	0.745 af		

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 178.18' @ 9.04 hrs Surf.Area= 13,209 sf Storage= 6,891 cf

Plug-Flow detention time= 130.3 min calculated for 0.745 af (91% of inflow)
Center-of-Mass det. time= 74.5 min (848.7 - 774.2)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	16,135 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 20,019 cf Overall x 80.6% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.50	12,066	0	0	12,066
177.75	12,482	3,068	3,068	12,493
178.00	12,906	3,173	6,242	12,929
178.25	13,336	3,280	9,522	13,371
178.50	13,773	3,388	12,910	13,820
178.75	14,216	3,498	16,409	14,275
179.00	14,667	3,610	20,019	14,738

Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	**12.0" Round Culvert** L= 35.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.50' / 173.00' S= 0.1286 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	177.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.18'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.55'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.98 cfs @ 9.04 hrs HW=178.18'   (Free Discharge)
└─**1=Culvert** (Passes 0.98 cfs of 1.40 cfs potential flow)
    ├─**2=Orifice/Grate** (Orifice Controls 0.98 cfs @ 2.82 fps)
    ├─**3=Orifice/Grate** (Controls 0.00 cfs)
    └─**4=Orifice/Grate** (Controls 0.00 cfs)

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Printed 4/18/2017
Page 28

Pond 1P: Pond 1

Hydrograph

Inflow Area=6.658 ac
Peak Elev=178.18'
Storage=6,891 cf

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 29
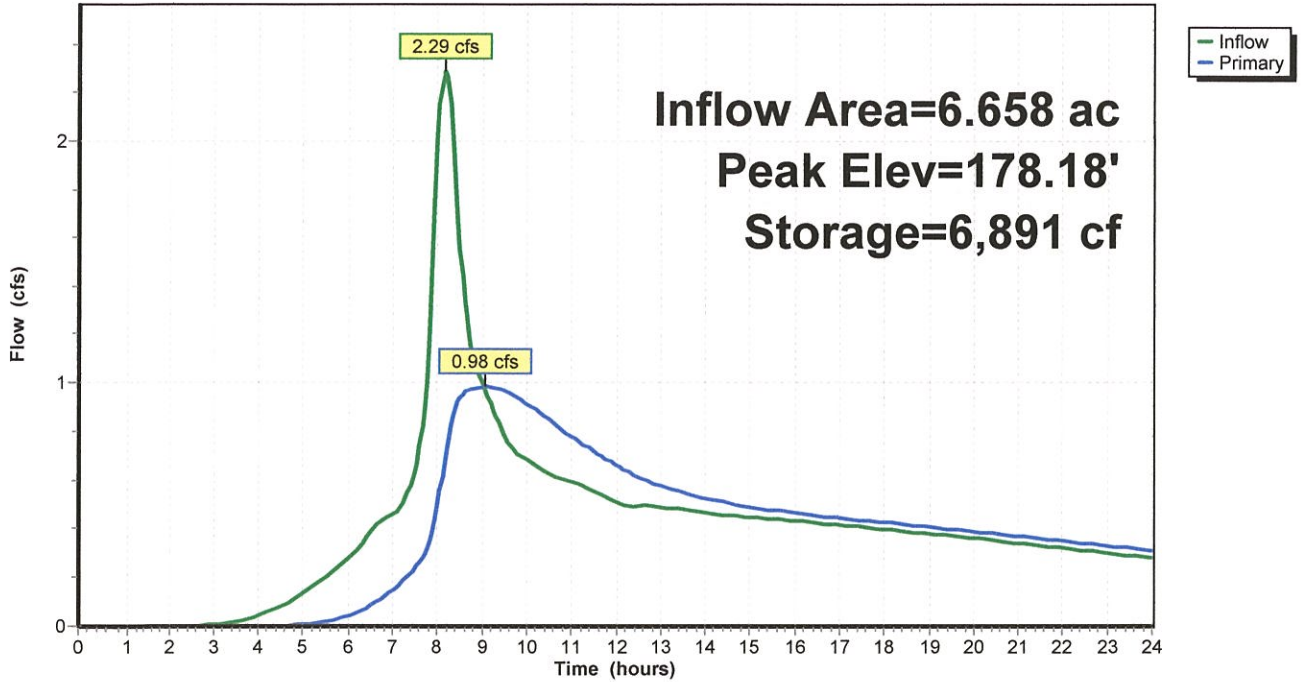
Summary for Pond 2P: Pond 2

Inflow Area =   21.380 ac, 54.76% Impervious, Inflow Depth > 0.54"   for 2-yr Storm event
Inflow   =   2.36 cfs @   8.89 hrs, Volume=   0.955 af
Outflow   =   2.28 cfs @   9.07 hrs, Volume=   0.941 af, Atten= 3%, Lag= 10.7 min
Primary   =   2.28 cfs @   9.07 hrs, Volume=   0.941 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 136.71' @ 9.07 hrs   Surf.Area= 0.103 ac   Storage= 0.055 af

Plug-Flow detention time= 30.5 min calculated for 0.939 af (98% of inflow)
Center-of-Mass det. time= 20.5 min (722.6 - 702.1)

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	0.620 af	**56.00'W x 80.00'L x 8.00'H Prismatoid**
			0.823 af Overall x 75.4% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	136.00'	**24.0" Round Culvert**
			L= 10.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 136.00' / 135.00' S= 0.1000 '/' Cc= 0.900
			n= 0.012, Flow Area= 3.14 sf
#2	Device 1	136.00'	**12.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Device 1	136.71'	**2.9" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	139.05'	**6.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.28 cfs @ 9.07 hrs HW=136.71'   (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.28 cfs @ 2.27 fps)
  ├─**2=Orifice/Grate** (Passes < 3.19 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 0.00 cfs potential flow)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)
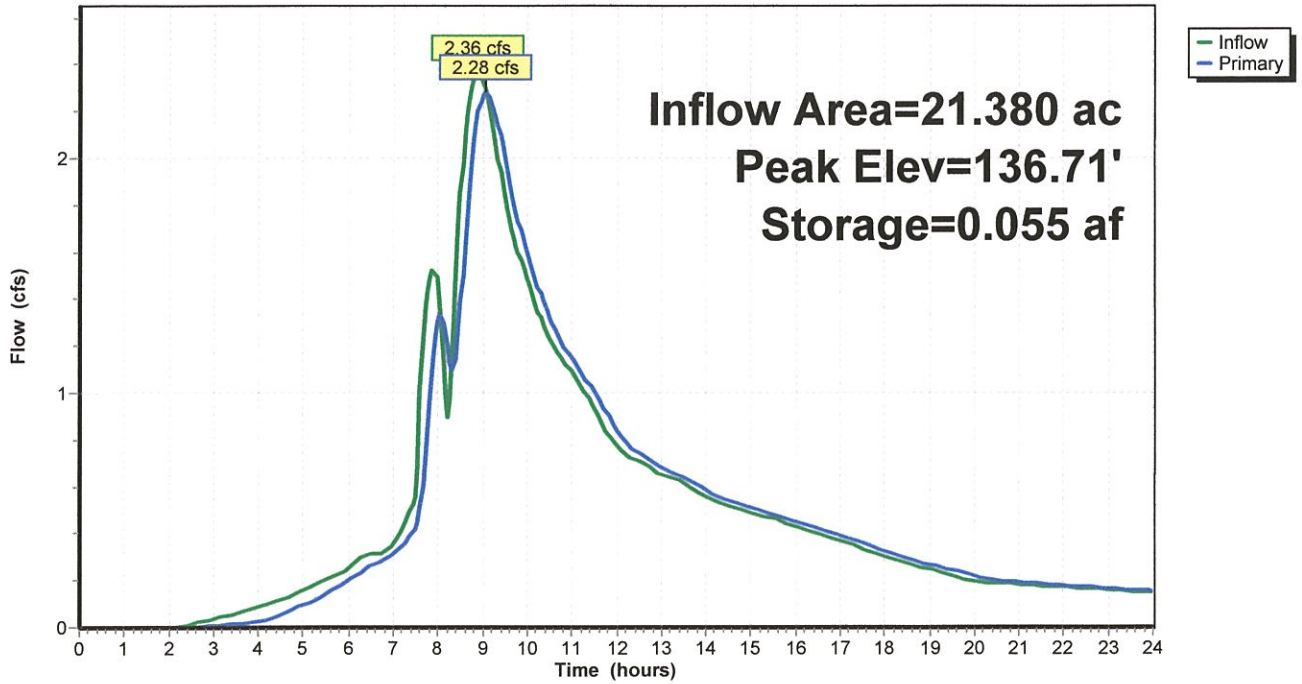
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Printed 4/18/2017
Page 30

Pond 2P: Pond 2

Hydrograph

Inflow Area=21.380 ac
Peak Elev=136.71'
Storage=0.055 af

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Printed 4/18/2017
Page 31

Summary for Pond BR1: Bioretention 1

Inflow Area =   17.997 ac,   56.26% Impervious,   Inflow Depth >   1.77"   for 2-yr Storm event
Inflow   =   8.30 cfs @   7.99 hrs,   Volume=   2.648 af
Outflow   =   2.96 cfs @   8.95 hrs,   Volume=   2.161 af,   Atten= 64%,   Lag= 57.7 min
Discarded =   1.12 cfs @   8.95 hrs,   Volume=   1.696 af
Primary   =   1.83 cfs @   8.95 hrs,   Volume=   0.465 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 142.70' @ 8.95 hrs   Surf.Area= 31,757 sf   Storage= 27,223 cf

Plug-Flow detention time= 217.8 min calculated for 2.157 af (81% of inflow)
Center-of-Mass det. time= 101.7 min (833.7 - 732.0)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	8,792 cf	**50.00'W x 283.00'L x 1.50'H Prismatoid Z=1.0**
			21,979 cf Overall x 40.0% Voids
#2	141.50'	32,392 cf	**50.00'W x 283.00'L x 2.00'H Prismatoid Z=3.0**
		41,184 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	**24.0" Round Culvert**
			L= 10.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0500 '/' Cc= 0.900
			n= 0.012, Flow Area= 3.14 sf
#2	Device 1	142.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Discarded	140.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow   Max=1.12 cfs @ 8.95 hrs   HW=142.70'   (Free Discharge)
└—**3=Exfiltration**   (Exfiltration Controls 1.12 cfs)

Primary OutFlow   Max=1.83 cfs @ 8.95 hrs   HW=142.70'   (Free Discharge)
└—**1=Culvert**   (Passes 1.83 cfs of 15.57 cfs potential flow)
   └—**2=Orifice/Grate**   (Weir Controls 1.83 cfs @ 1.46 fps)

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Type IA 24-hr 2-yr Storm Rainfall=2.40"
Printed 4/18/2017
Page 32

Pond BR1: Bioretention 1

Hydrograph

Inflow Area=17.997 ac
Peak Elev=142.70'
Storage=27,223 cf

8.30 cfs

2.96 cfs

1.83 cfs

1.12 cfs

Legend:
- Inflow
- Outflow
- Discarded
- Primary

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Printed 4/18/2017
Page 33

Summary for Pond BR2: Bioretention 2

Inflow Area =   2.390 ac, 67.64% Impervious, Inflow Depth > 1.92"   for 2-yr Storm event
Inflow   =   1.21 cfs @   7.90 hrs, Volume=   0.382 af
Outflow   =   0.65 cfs @   8.24 hrs, Volume=   0.334 af, Atten= 46%, Lag= 20.5 min
Discarded =   0.18 cfs @   8.24 hrs, Volume=   0.260 af
Primary   =   0.47 cfs @   8.24 hrs, Volume=   0.074 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 154.75' @ 8.24 hrs   Surf.Area= 4,826 sf   Storage= 3,452 cf

Plug-Flow detention time= 177.8 min calculated for 0.333 af (87% of inflow)
Center-of-Mass det. time= 93.4 min (801.8 - 708.4)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	903 cf	**5.00'W x 230.00'L x 1.50'H Prismatoid Z=1.0** 2,258 cf Overall x 40.0% Voids
#2	153.50'	5,216 cf	**5.00'W x 230.00'L x 2.00'H Prismatoid Z=3.0**
		6,119 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	152.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.00' / 151.90' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	154.50'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	152.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.18 cfs @ 8.24 hrs HW=154.75'   (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.47 cfs @ 8.24 hrs HW=154.75'   (Free Discharge)
└─**1=Culvert** (Passes 0.47 cfs of 4.47 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.47 cfs @ 2.38 fps)
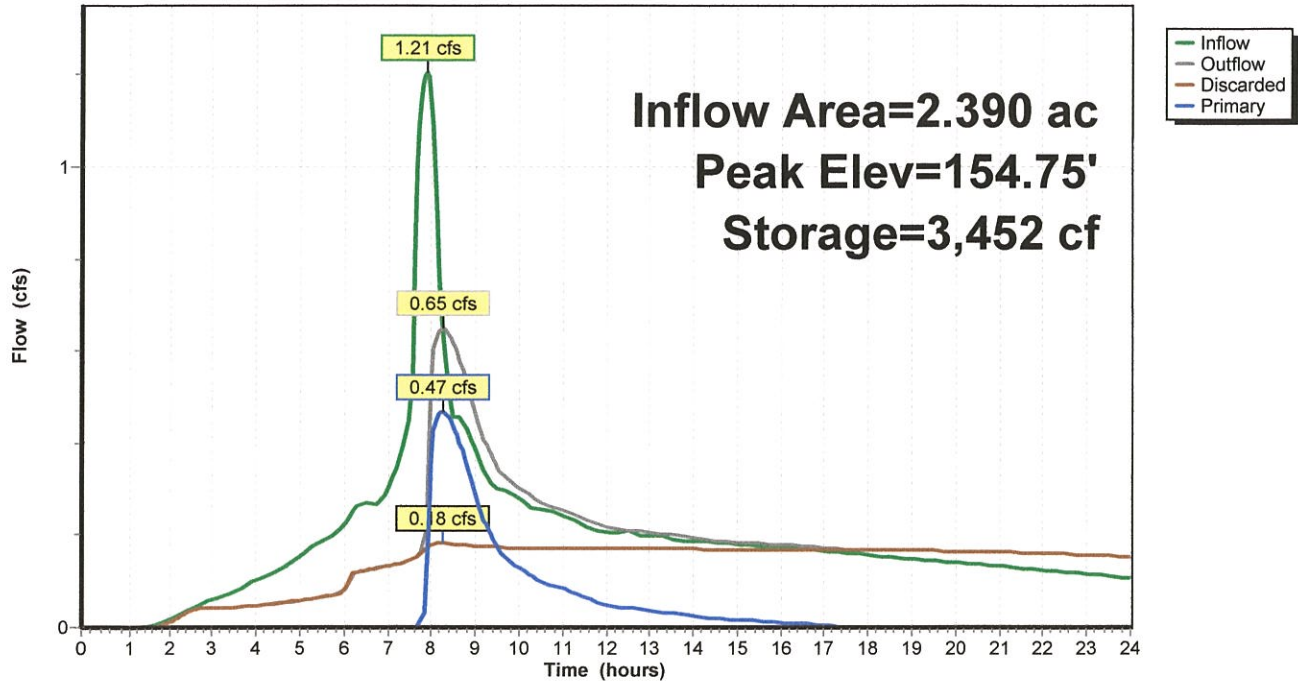
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Type IA 24-hr 2-yr Storm Rainfall=2.40"
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Page 34

Pond BR2: Bioretention 2

Hydrograph

Inflow Area=2.390 ac
Peak Elev=154.75'
Storage=3,452 cf

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Page 35

Summary for Subcatchment A B1: Apt Basin 1

Runoff   =   1.90 cfs @   7.89 hrs, Volume=   0.605 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	70,725	98	Pavement
*	40,704	90	Landscaping
	111,429	95	Weighted Average
	40,704		36.53% Pervious Area
	70,725		63.47% Impervious Area

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

Subcatchment A B1: Apt Basin 1

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=111,429 sf
Runoff Volume=0.605 af
Runoff Depth>2.84"
Tc=6.0 min
CN=95

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 36

Summary for Subcatchment A B2: Apt Basin 2

Runoff   =   0.77 cfs @   7.89 hrs, Volume=   0.243 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	26,871	98	Pavement
*	17,952	90	Landscaping
	44,823	95	Weighted Average
	17,952		40.05% Pervious Area
	26,871		59.95% Impervious Area

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

Subcatchment A B2: Apt Basin 2

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=44,823 sf
Runoff Volume=0.243 af
Runoff Depth>2.84"
Tc=6.0 min
CN=95

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 37

Summary for Subcatchment A B3: Apt Basin 3

Runoff   =   1.05 cfs @   7.88 hrs, Volume=   0.334 af, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	43,562	98	Pavement
*	15,740	90	Landscaping
	59,302	96	Weighted Average
	15,740		26.54% Pervious Area
	43,562		73.46% Impervious Area

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

Subcatchment A B3: Apt Basin 3

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=59,302 sf
Runoff Volume=0.334 af
Runoff Depth>2.94"
Tc=6.0 min
CN=96

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 38

Summary for Subcatchment A B4: Apt Basin 4

Runoff   =   1.14 cfs @   7.89 hrs, Volume=   0.362 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	43,680	98	Buildings
*	23,018	90	Landscaping
	66,698	95	Weighted Average
	23,018		34.51% Pervious Area
	43,680		65.49% Impervious Area

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

Subcatchment A B4: Apt Basin 4

Hydrograph

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 39

Summary for Subcatchment A B5: Apt Basin 5

Runoff   =   0.90 cfs @   7.90 hrs, Volume=   0.285 af, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	24,194	98	Buildings
*	32,440	90	Landscaping
	56,634	93	Weighted Average
	32,440		57.28% Pervious Area
	24,194		42.72% Impervious Area

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

Subcatchment A B5: Apt Basin 5

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=56,634 sf
Runoff Volume=0.285 af
Runoff Depth>2.63"
Tc=6.0 min
CN=93

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 40

Summary for Subcatchment B1: North Basin

Runoff   =   2.62 cfs @   8.01 hrs, Volume=   0.849 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	91,945	86	Landscaping
*	71,271	98	Impervious
*	12,103	100	Pond
	175,319	92	Weighted Average
	91,945		52.44% Pervious Area
	83,374		47.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	190	0.0950	0.32		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.1	22	0.2500	3.50		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
1.7	107	0.0230	1.06		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
0.9	144	0.0070	2.59	0.51	**Pipe Channel, Pipe**
					6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13'
					n= 0.012
12.6	463	Total			

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 41

Subcatchment B1: North Basin

Hydrograph

**Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=175,319 sf
Runoff Volume=0.849 af
Runoff Depth>2.53"
Flow Length=463'
Tc=12.6 min
CN=92**

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 42

Summary for Subcatchment B2: Tract A

Runoff   =   0.03 cfs @   7.95 hrs, Volume=   0.011 af, Depth> 2.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	2,783	86	Lawn (HSG C)
	2,783		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	109	0.0910	0.28		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.54"

Subcatchment B2: Tract A

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=2,783 sf
Runoff Volume=0.011 af
Runoff Depth>2.01"
Flow Length=109'
Slope=0.0910 '/'
Tc=6.4 min
CN=86

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 43

Summary for Subcatchment B3: Central Basin

Runoff   =   6.85 cfs @   7.92 hrs, Volume=   2.176 af, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	240,948	98	Impervious
*	175,358	88	Landscaping
	416,306	94	Weighted Average
	175,358		42.12% Pervious Area
	240,948		57.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B3: Central Basin

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=416,306 sf
Runoff Volume=2.176 af
Runoff Depth>2.73"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 44

Summary for Subcatchment B4: South Basin

Runoff   =   6.05 cfs @   7.92 hrs, Volume=   1.922 af, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	200,131	98	Impervious
*	167,521	90	Landscaping
	367,652	94	Weighted Average
	167,521		45.57% Pervious Area
	200,131		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B4: South Basin

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=367,652 sf
Runoff Volume=1.922 af
Runoff Depth>2.73"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 45

Summary for Subcatchment B5: Pond Area

Runoff   =   1.50 cfs @   7.90 hrs, Volume=   0.474 af, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	44,675	98	Impervious
*	46,045	90	Landscaping
	90,720	94	Weighted Average
	46,045		50.76% Pervious Area
	44,675		49.24% Impervious Area

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

Subcatchment B5: Pond Area

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=90,720 sf
Runoff Volume=0.474 af
Runoff Depth>2.73"
Tc=6.0 min
CN=94

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 46

Summary for Subcatchment B6: Open Space

Runoff   =   0.19 cfs @   7.92 hrs, Volume=   0.060 af, Depth> 2.35"
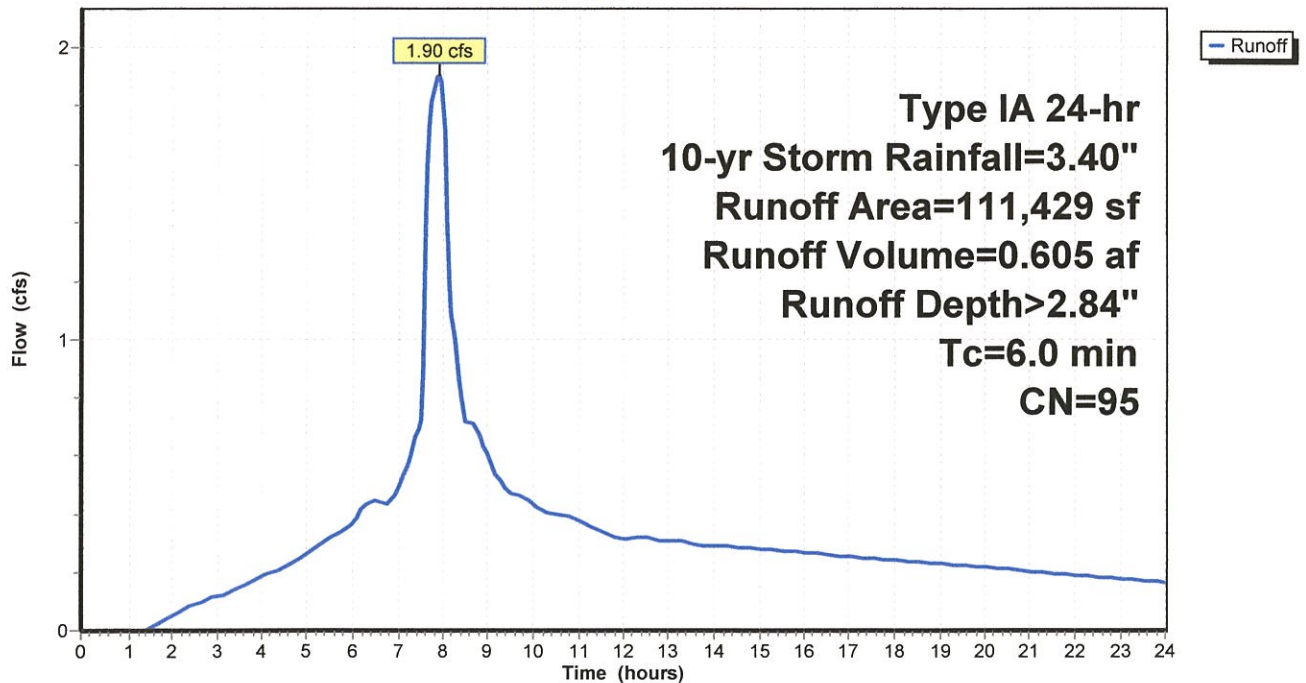
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	13,411	90	Landscaping
	13,411		100.00% Pervious Area

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

Subcatchment B6: Open Space

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=13,411 sf
Runoff Volume=0.060 af
Runoff Depth>2.35"
Tc=6.0 min
CN=90
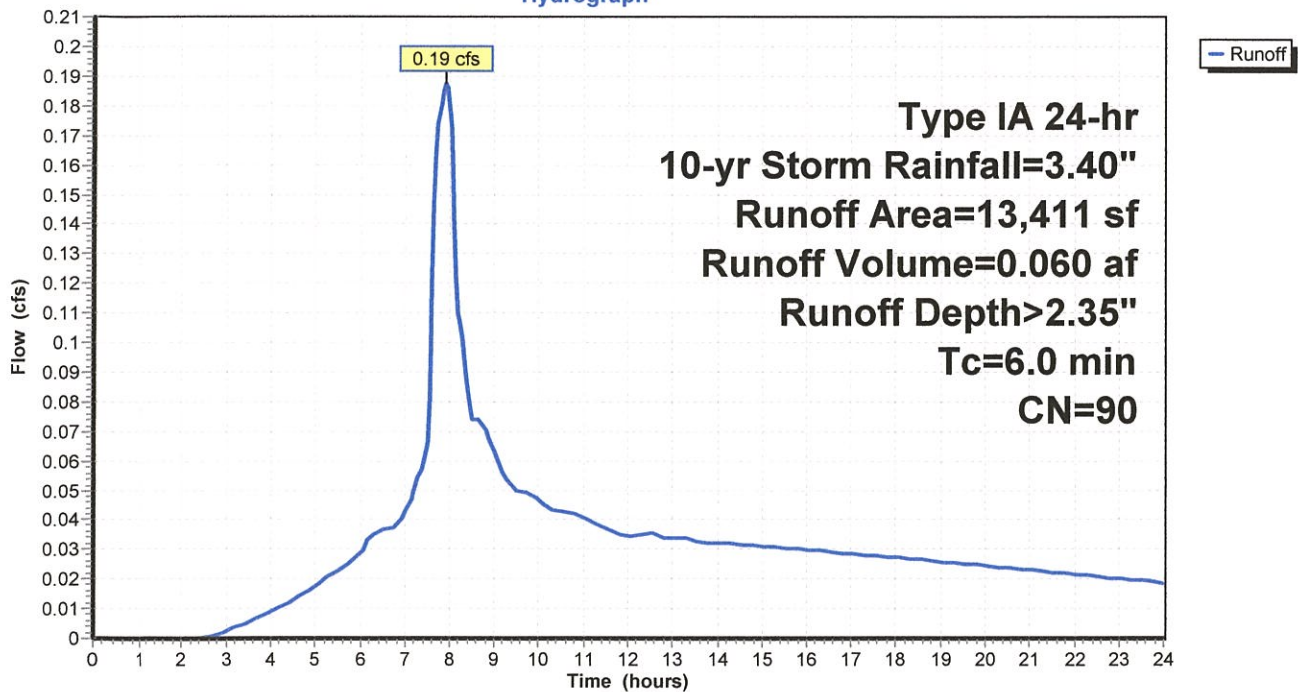
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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 47

Summary for Subcatchment B7: Cul-de-Sac

Runoff   =   1.47 cfs @   7.94 hrs, Volume=   0.486 af, Depth> 2.09"
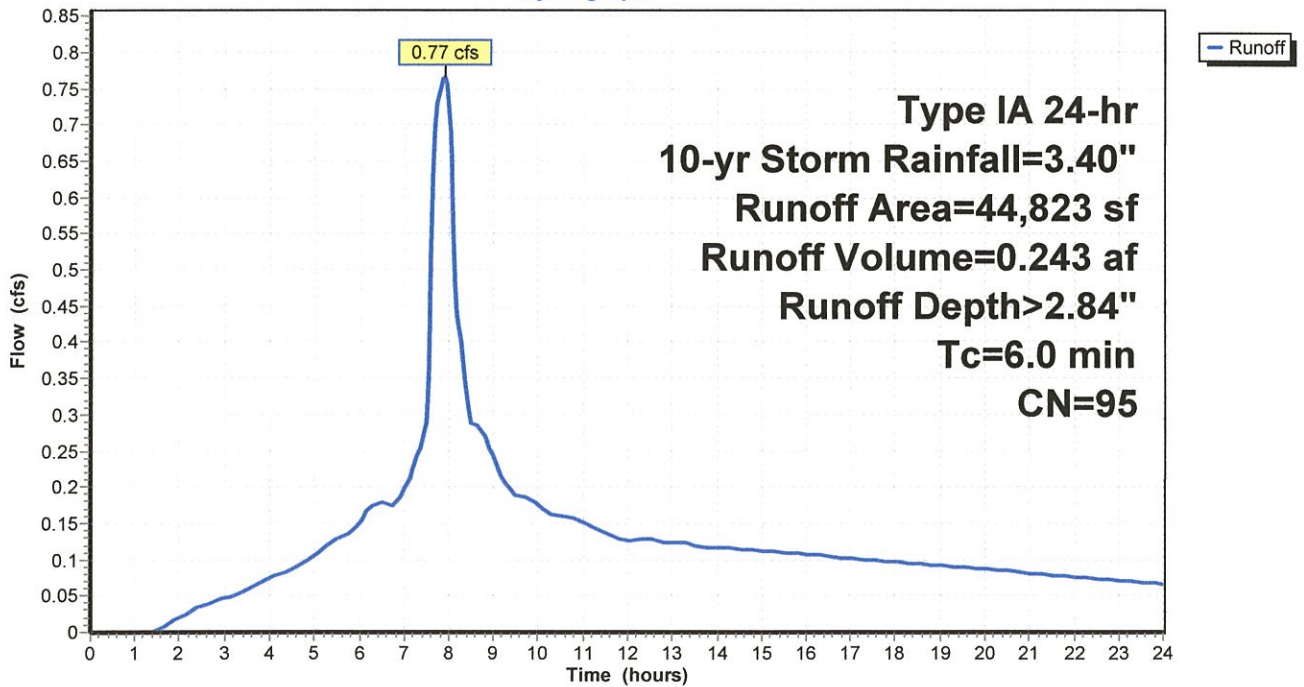
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	75,014	80	Landscaping
*	24,170	98	Road & SW
*	22,400	98	Homes & DW
	121,584	87	Weighted Average
	75,014		61.70% Pervious Area
	46,570		38.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Swale 1**

Subcatchment B7: Cul-de-Sac

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=121,584 sf
Runoff Volume=0.486 af
Runoff Depth>2.09"
Tc=6.0 min
CN=87

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 48

Summary for Subcatchment B8: 11th Street

Runoff   =   1.86 cfs @   7.90 hrs, Volume=   0.589 af, Depth> 2.63"
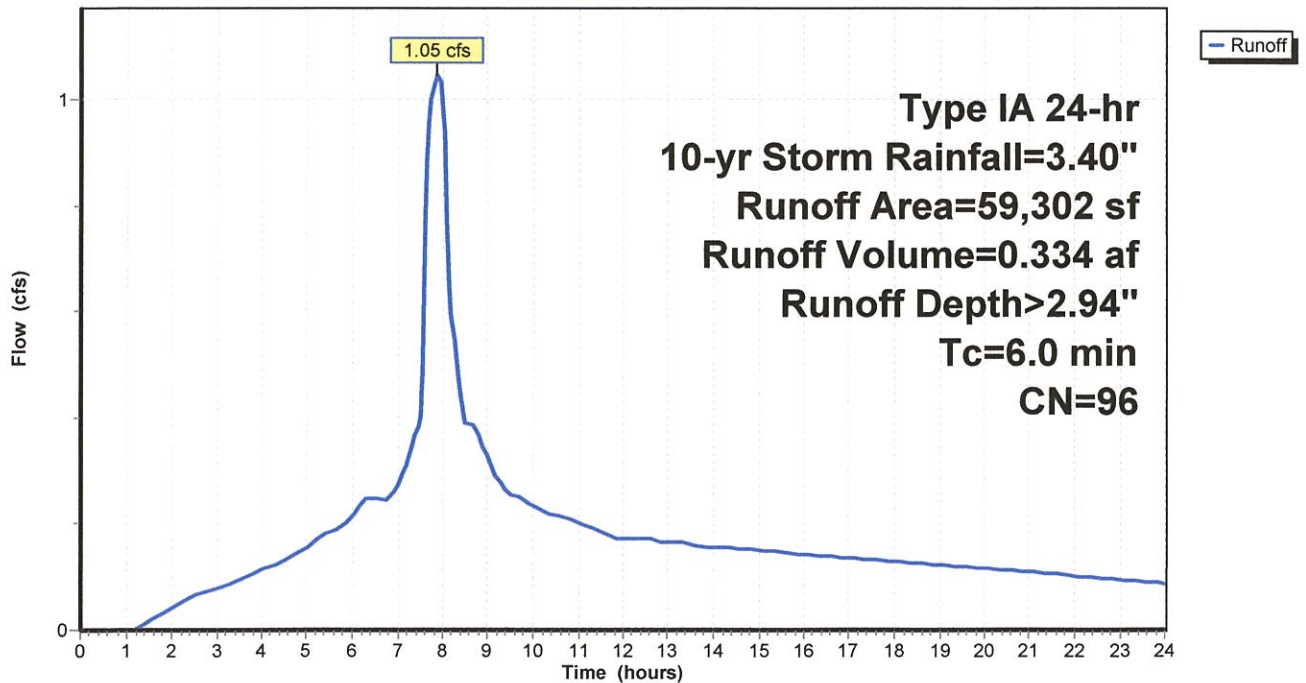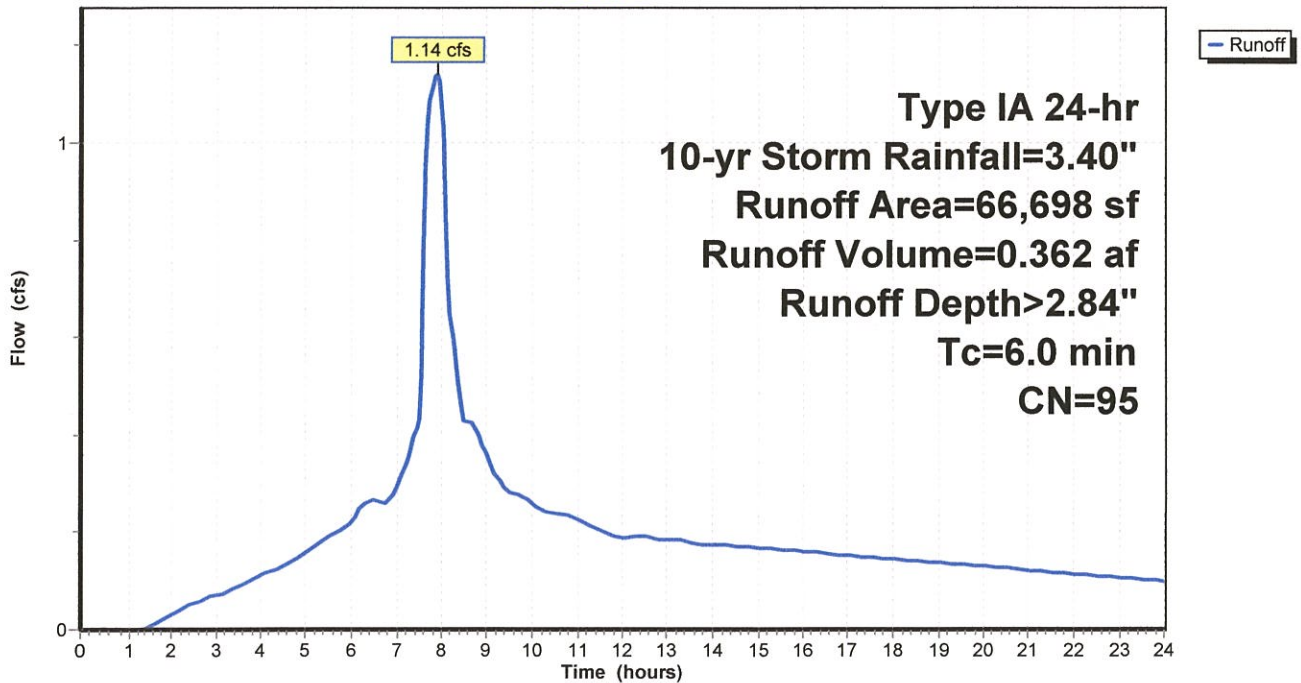
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	58,285	88	Landscaping
*	50,605	98	Roads & DW
*	8,000	98	Houses
	116,890	93	Weighted Average
	58,285		49.86% Pervious Area
	58,605		50.14% Impervious Area

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

Subcatchment B8: 11th Street

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=116,890 sf
Runoff Volume=0.589 af
Runoff Depth>2.63"
Tc=6.0 min
CN=93

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 49

Summary for Subcatchment B9: 13th Homes

Runoff   =   2.05 cfs @   7.90 hrs, Volume=   0.649 af, Depth> 2.63"
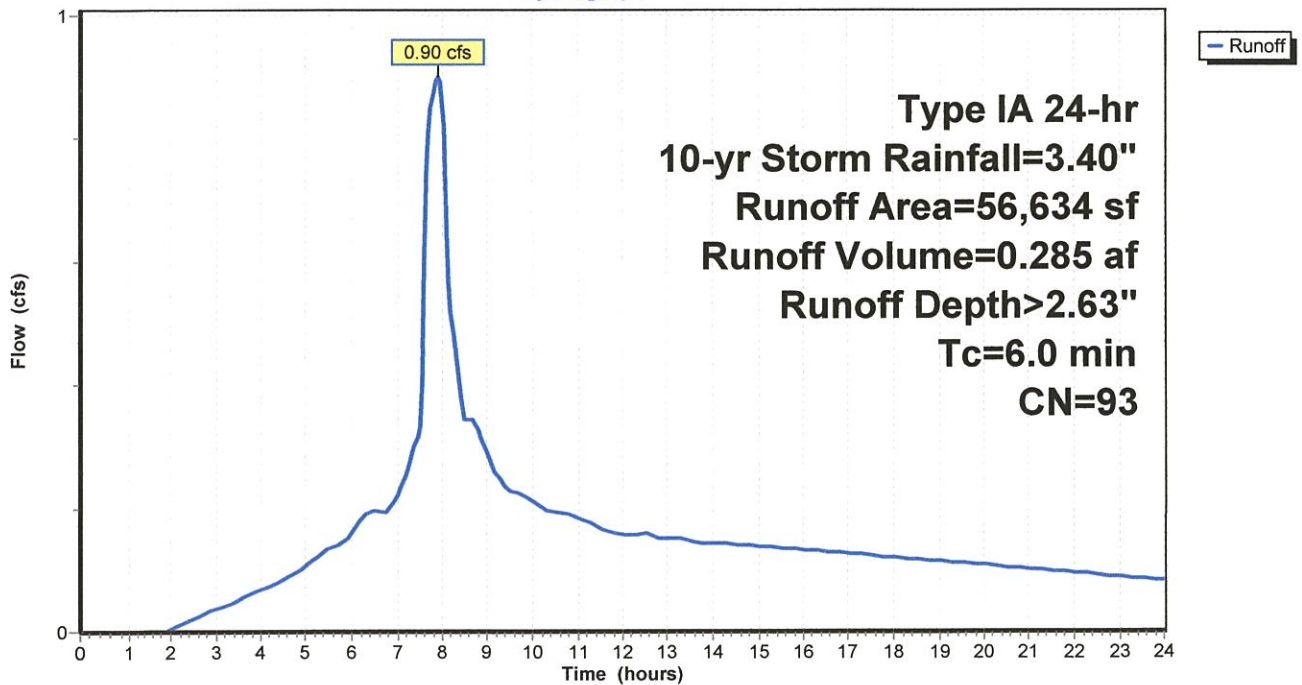
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	64,850	88	Landscaping
*	64,000	98	Buildings
	128,850	93	Weighted Average
	64,850		50.33% Pervious Area
	64,000		49.67% Impervious Area

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

Subcatchment B9: 13th Homes

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=128,850 sf
Runoff Volume=0.649 af
Runoff Depth>2.63"
Tc=6.0 min
CN=93

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Page 50

Summary for Subcatchment O1: Adj Parcel (E)

Runoff   =   0.72 cfs @   8.03 hrs, Volume=   0.239 af, Depth> 2.25"
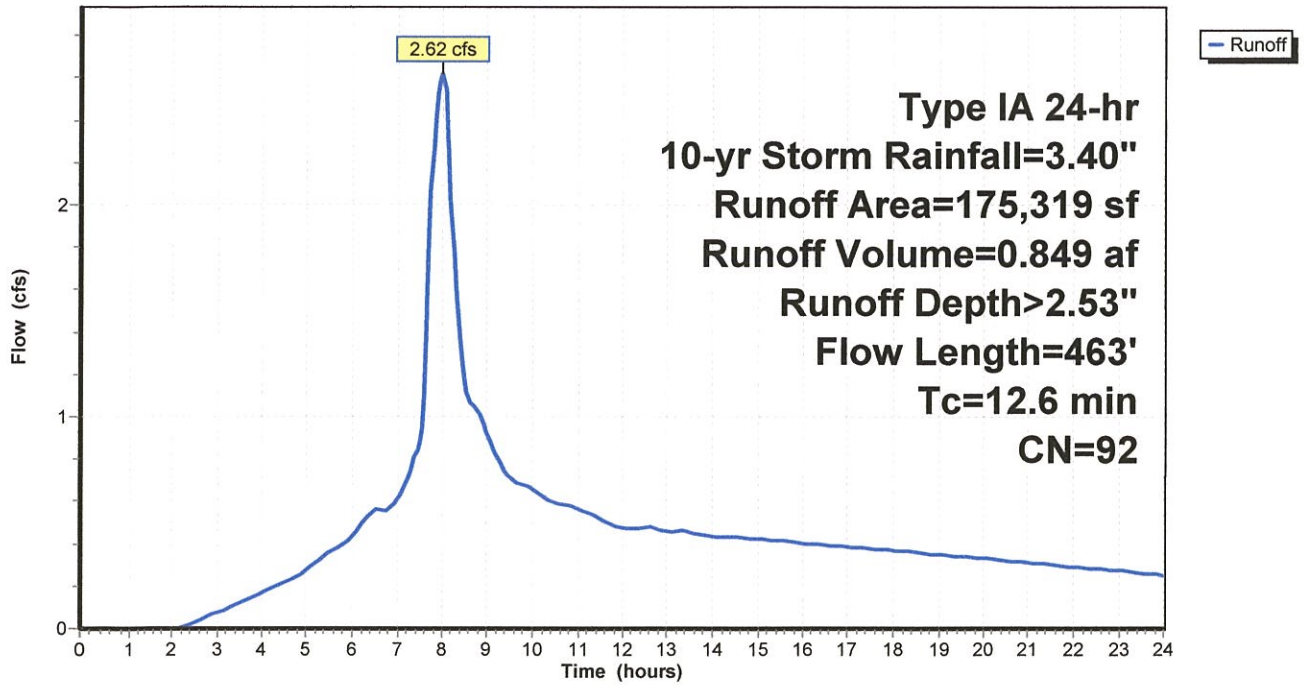
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"

Subcatchment O1: Adj Parcel (E)

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=55,348 sf
Runoff Volume=0.239 af
Runoff Depth>2.25"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Page 51

Summary for Subcatchment O2: Adj Parcel (N)

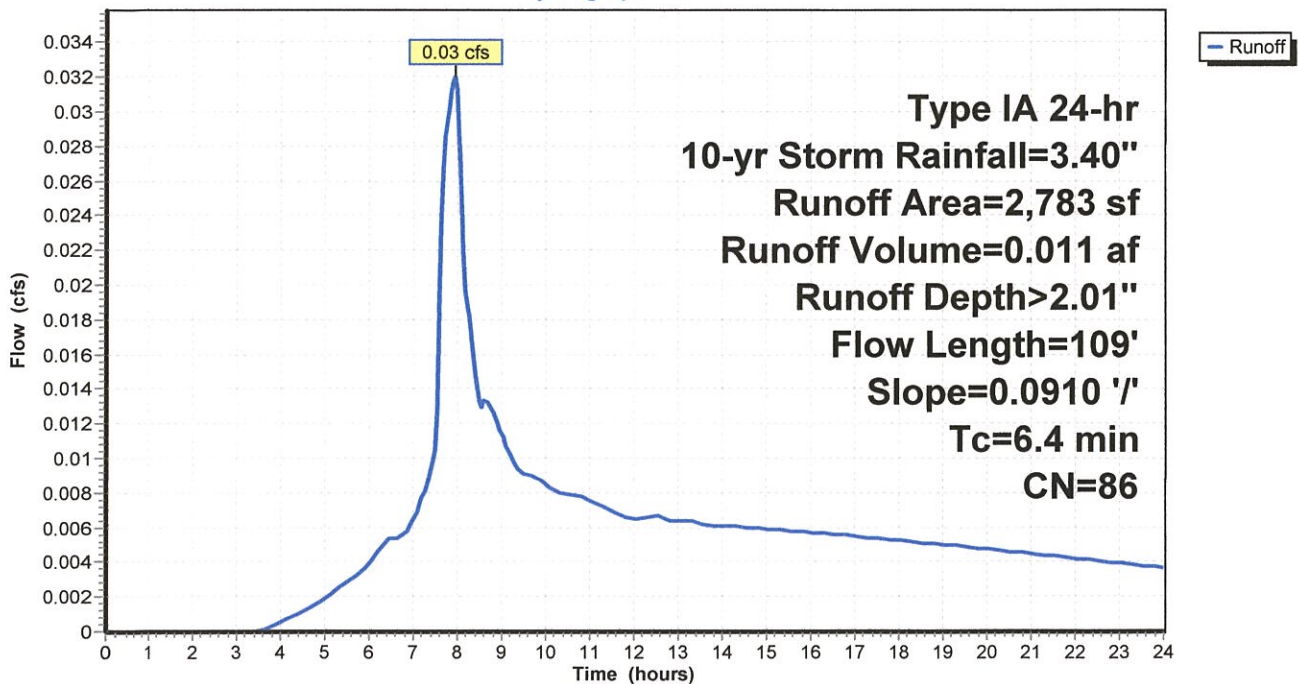Runoff   =   0.57 cfs @   7.98 hrs, Volume=   0.188 af, Depth> 2.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description			
*	45,658	85	Pasture (HSG C)			
*	3,471	98	Impervious OPH			
	49,129	86	Weighted Average			
	45,658		92.93% Pervious Area			
	3,471		7.07% Impervious Area			

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
7.8	425	Total			

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=49,129 sf
Runoff Volume=0.188 af
Runoff Depth>2.00"
Flow Length=425'
Tc=7.8 min
CN=86

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 52

Summary for Subcatchment O3: OPH North

Runoff   =   0.14 cfs @   7.87 hrs, Volume=   0.045 af, Depth> 3.16"
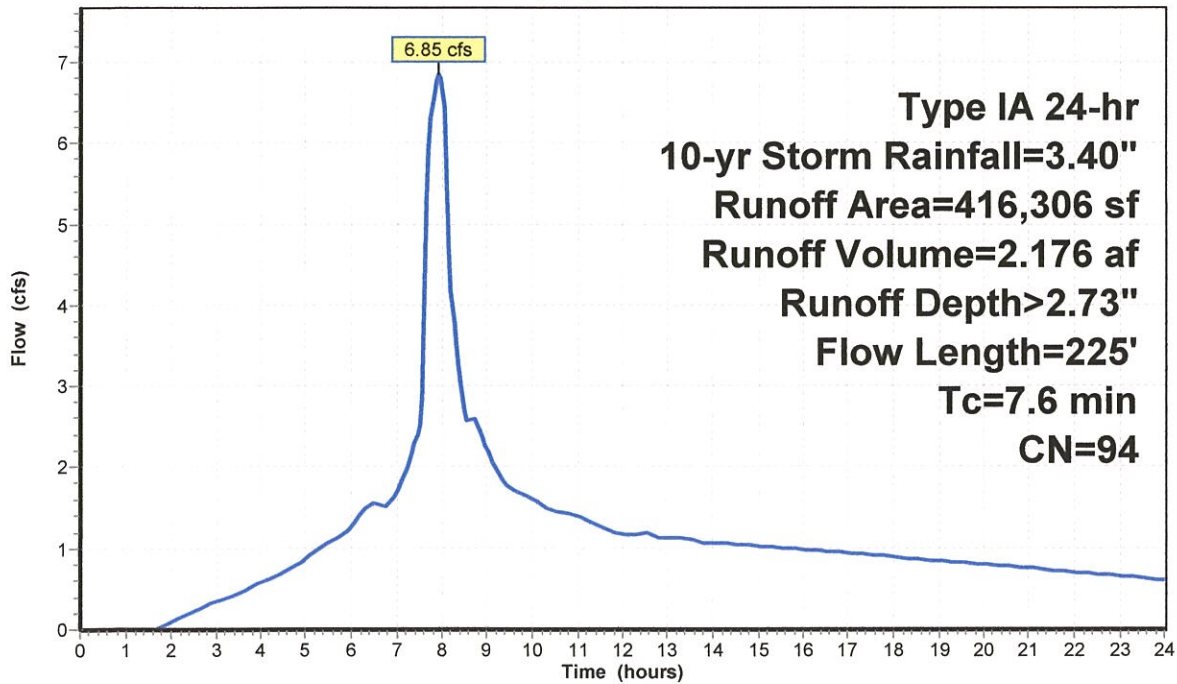
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-yr Storm Rainfall=3.40"

	Area (sf)	CN	Description
*	7,465	98	Pavement
	7,465		100.00% Impervious Area

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

Subcatchment O3: OPH North

Hydrograph

Type IA 24-hr
10-yr Storm Rainfall=3.40"
Runoff Area=7,465 sf
Runoff Volume=0.045 af
Runoff Depth>3.16"
Tc=6.0 min
CN=98

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Type IA 24-hr 10-yr Storm Rainfall=3.40"
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Page 53

Summary for Reach P1: Pipe 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 2.48"   for 10-yr Storm event
Inflow   =   3.51 cfs @   8.00 hrs, Volume=   1.143 af
Outflow   =   3.50 cfs @   8.02 hrs, Volume=   1.143 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.97 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.82 fps, Avg. Travel Time= 0.8 min

Peak Storage= 102 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.70'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.83 cfs

15.0" Round Pipe
n= 0.012
Length= 144.0'   Slope= 0.0069 '/'
Inlet Invert= 181.00', Outlet Invert= 180.00'

Reach P1: Pipe 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.70'
Max Vel=4.97 fps
15.0"
Round Pipe
n=0.012
L=144.0'
S=0.0069 '/'
Capacity=5.83 cfs

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Page 54
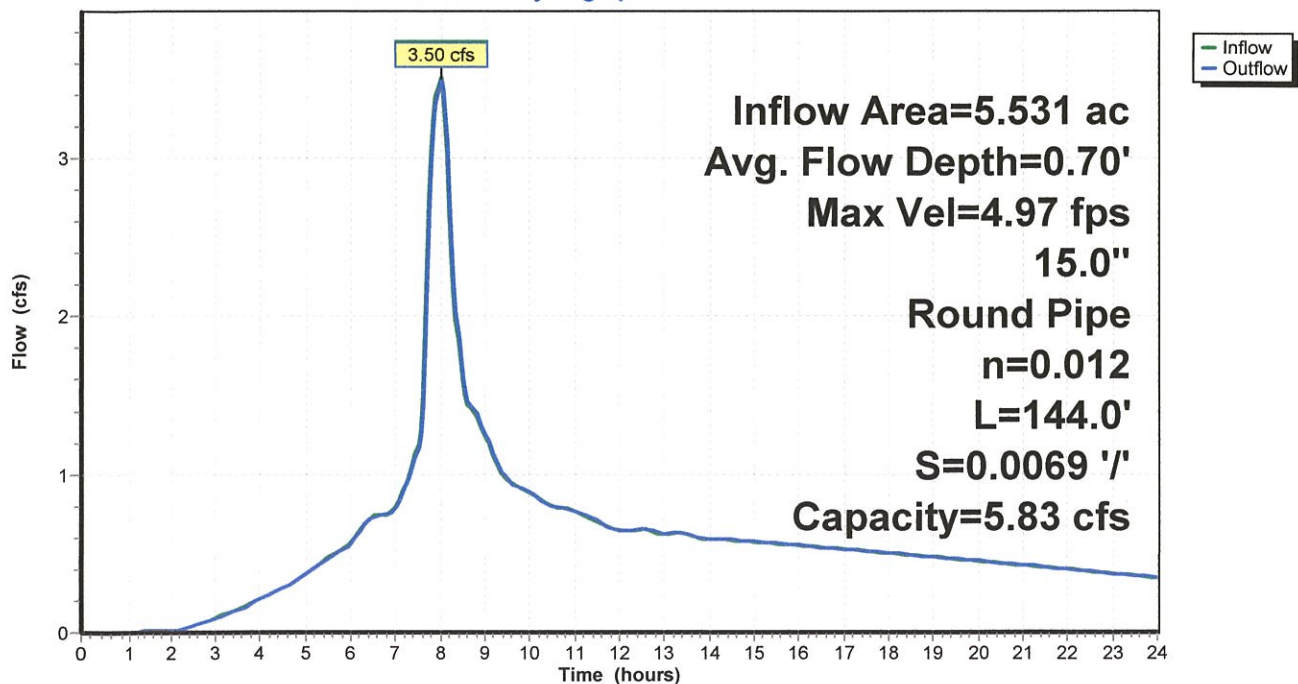
Summary for Reach P2: Pipe 2

Inflow Area =	6.480 ac, 65.49% Impervious, Inflow Depth > 2.20" for 10-yr Storm event
Inflow =	3.67 cfs @ 8.01 hrs, Volume=	1.190 af
Outflow =	3.65 cfs @ 8.09 hrs, Volume=	1.187 af, Atten= 1%, Lag= 4.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.14 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 4.71 fps, Avg. Travel Time= 4.5 min

Peak Storage= 574 cf @ 8.04 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.13 cfs

12.0" Round Pipe
n= 0.012
Length= 1,279.0'   Slope= 0.0252 '/'
Inlet Invert= 170.25', Outlet Invert= 138.00'

Reach P2: Pipe 2

Hydrograph

Inflow Area=6.480 ac
Avg. Flow Depth=0.56'
Max Vel=8.14 fps
12.0"
Round Pipe
n=0.012
L=1,279.0'
S=0.0252 '/'
Capacity=6.13 cfs

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Page 55
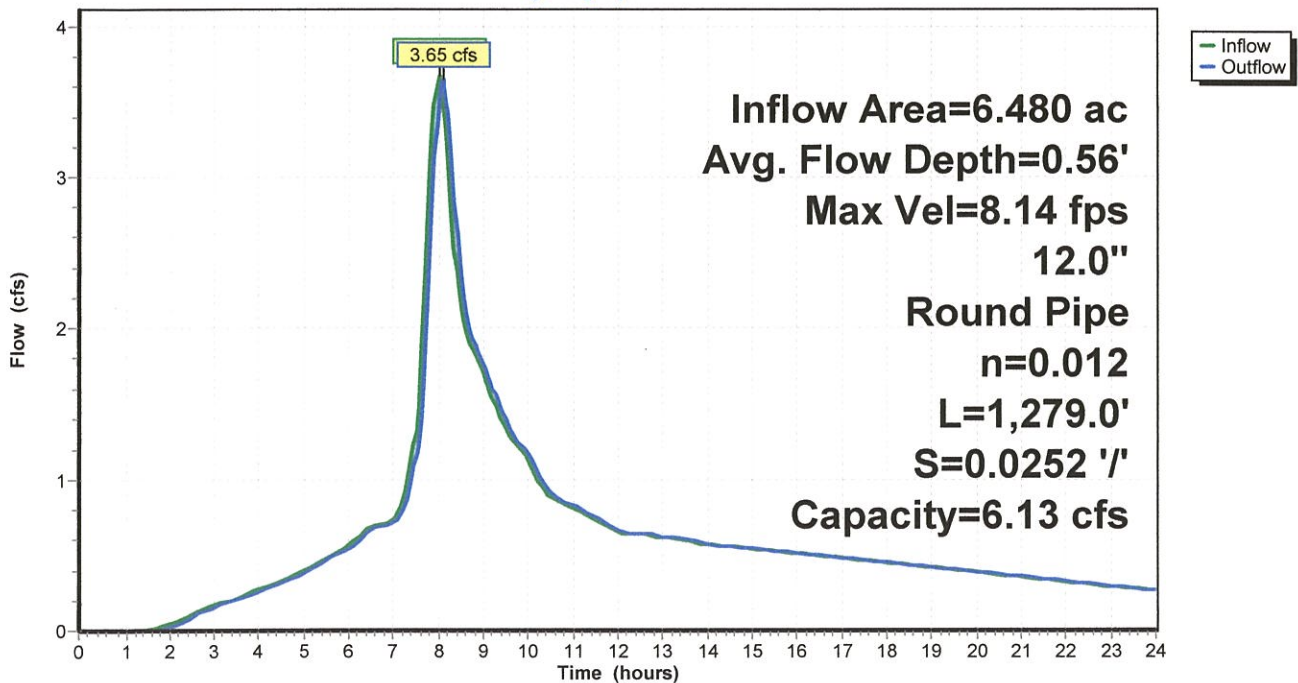
Summary for Reach P3: Pipe 3

Inflow Area =   9.557 ac, 57.88% Impervious, Inflow Depth > 2.73"   for 10-yr Storm event
Inflow   =   6.85 cfs @   7.92 hrs, Volume=   2.176 af
Outflow   =   6.83 cfs @   7.97 hrs, Volume=   2.172 af, Atten= 0%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.52 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 6.00 fps, Avg. Travel Time= 2.9 min

Peak Storage= 675 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.67' Flow Area= 2.2 sf, Capacity= 27.69 cfs

20.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P3: Pipe 3

Hydrograph

Inflow Area=9.557 ac
Avg. Flow Depth=0.56'
Max Vel=10.52 fps
20.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=27.69 cfs

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Page 56
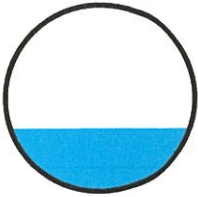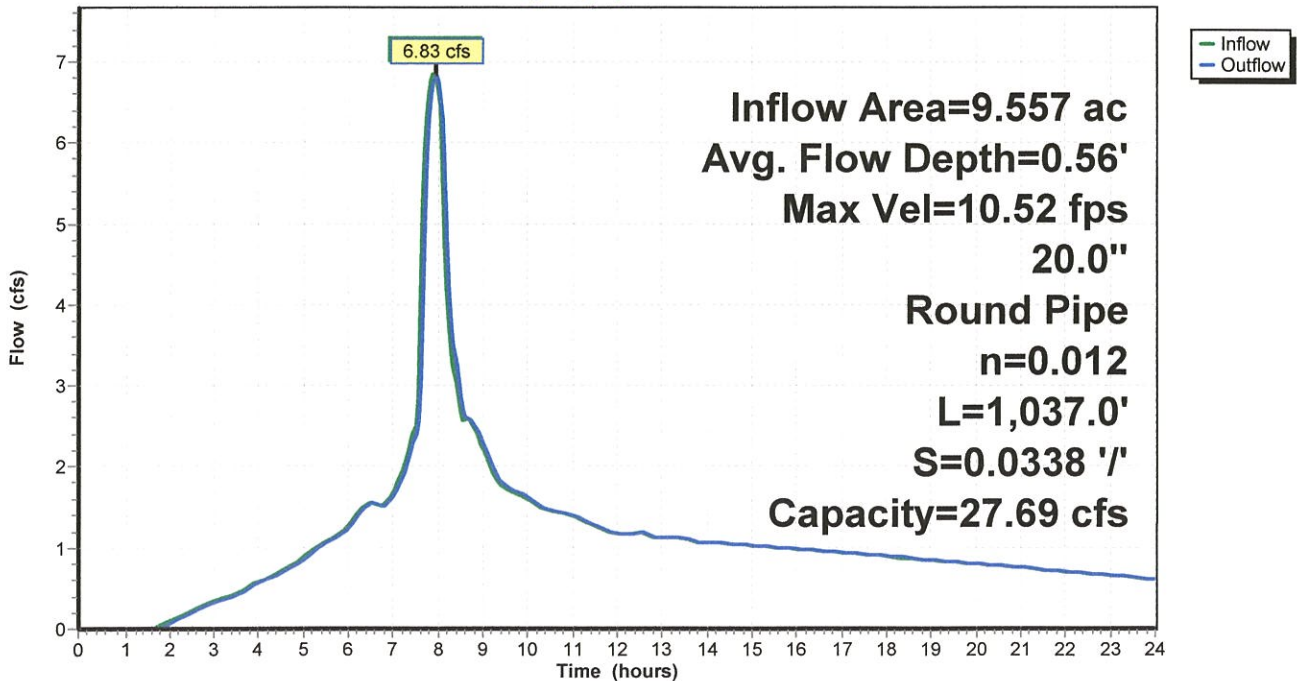
Summary for Reach P4: Pipe 4

Inflow Area =   8.440 ac, 54.43% Impervious, Inflow Depth > 2.73"   for 10-yr Storm event
Inflow   =   6.05 cfs @   7.92 hrs, Volume=   1.922 af
Outflow   =   6.03 cfs @   7.97 hrs, Volume=   1.918 af, Atten= 0%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.24 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 5.86 fps, Avg. Travel Time= 3.0 min

Peak Storage= 612 cf @ 7.94 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 20.91 cfs

18.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P4: Pipe 4

Hydrograph

Inflow Area=8.440 ac
Avg. Flow Depth=0.55'
Max Vel=10.24 fps
18.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=20.91 cfs

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Printed 4/18/2017
Page 57
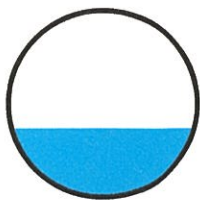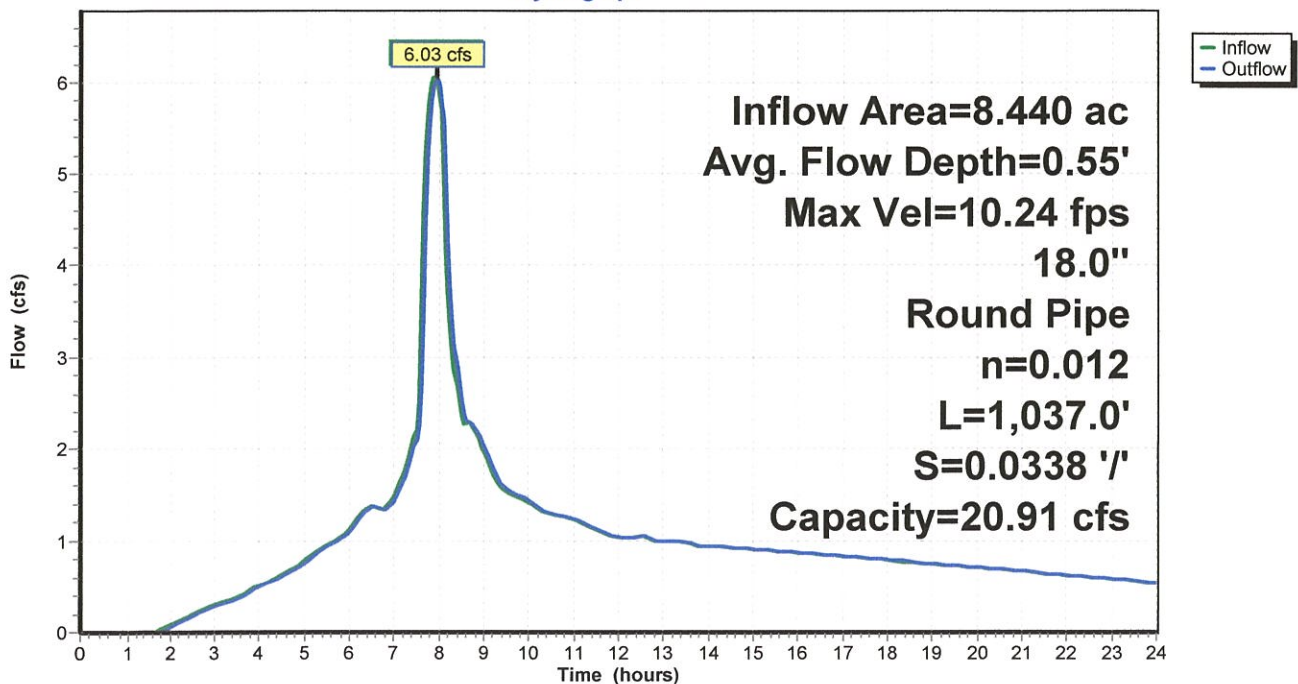
Summary for Reach S1: Bioswale 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 2.48"   for 10-yr Storm event
Inflow   =   3.50 cfs @   8.02 hrs, Volume=   1.143 af
Outflow   =   3.44 cfs @   8.17 hrs, Volume=   1.133 af, Atten= 2%, Lag= 9.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.49 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 12.0 min

Peak Storage= 1,227 cf @ 8.07 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.00' Flow Area= 12.0 sf, Capacity= 7.57 cfs

9.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 15.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 180.00', Outlet Invert= 178.25'

‡

Reach S1: Bioswale 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.64'
Max Vel=0.49 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=7.57 cfs

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Printed 4/18/2017
Page 58
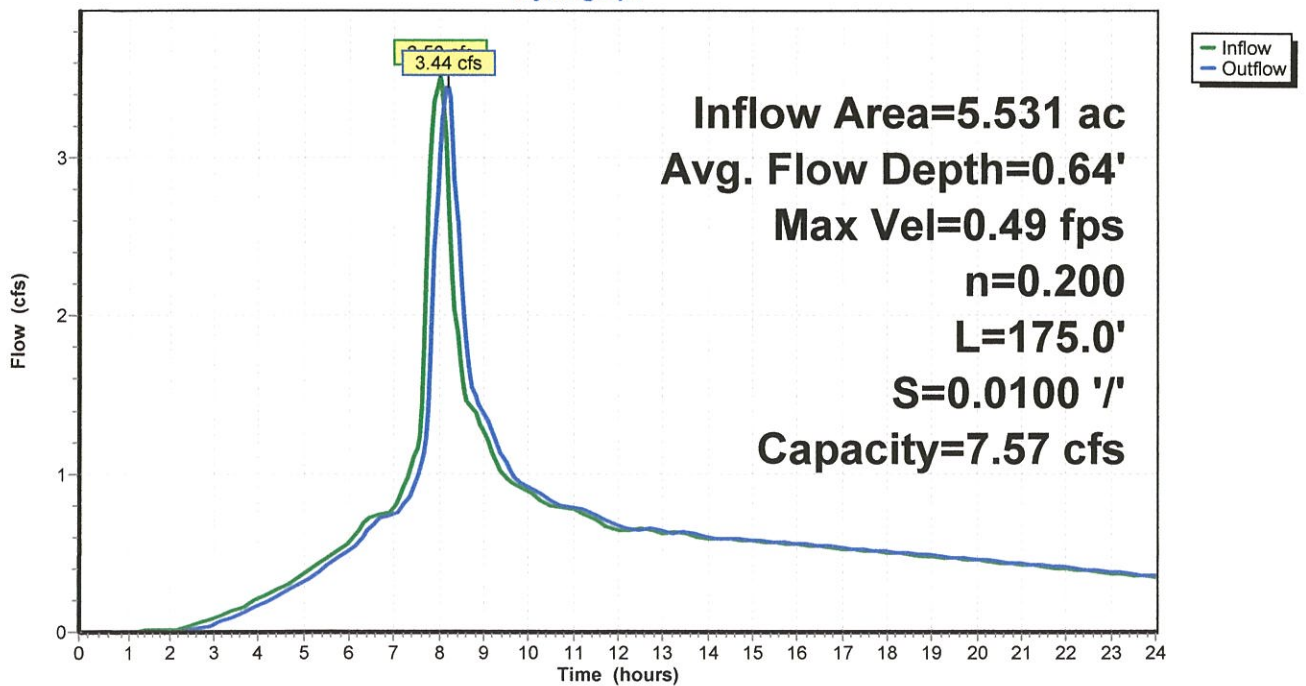
Summary for Reach S2: Bioswale 2

Inflow Area =   2.558 ac, 63.47% Impervious, Inflow Depth > 2.84"   for 10-yr Storm event
Inflow   =   1.90 cfs @   7.89 hrs, Volume=   0.605 af
Outflow   =   1.87 cfs @   8.08 hrs, Volume=   0.600 af, Atten= 2%, Lag= 11.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.44 fps, Min. Travel Time= 6.7 min
Avg. Velocity = 0.23 fps, Avg. Travel Time= 12.9 min

Peak Storage= 751 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.56'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 5.42 cfs

6.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 12.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 172.00', Outlet Invert= 170.25'

‡

Reach S2: Bioswale 2

Hydrograph

Inflow Area=2.558 ac
Avg. Flow Depth=0.56'
Max Vel=0.44 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=5.42 cfs

1.87 cfs

- Inflow
- Outflow

Flow (cfs)

Time (hours)

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Printed 4/18/2017
Page 59
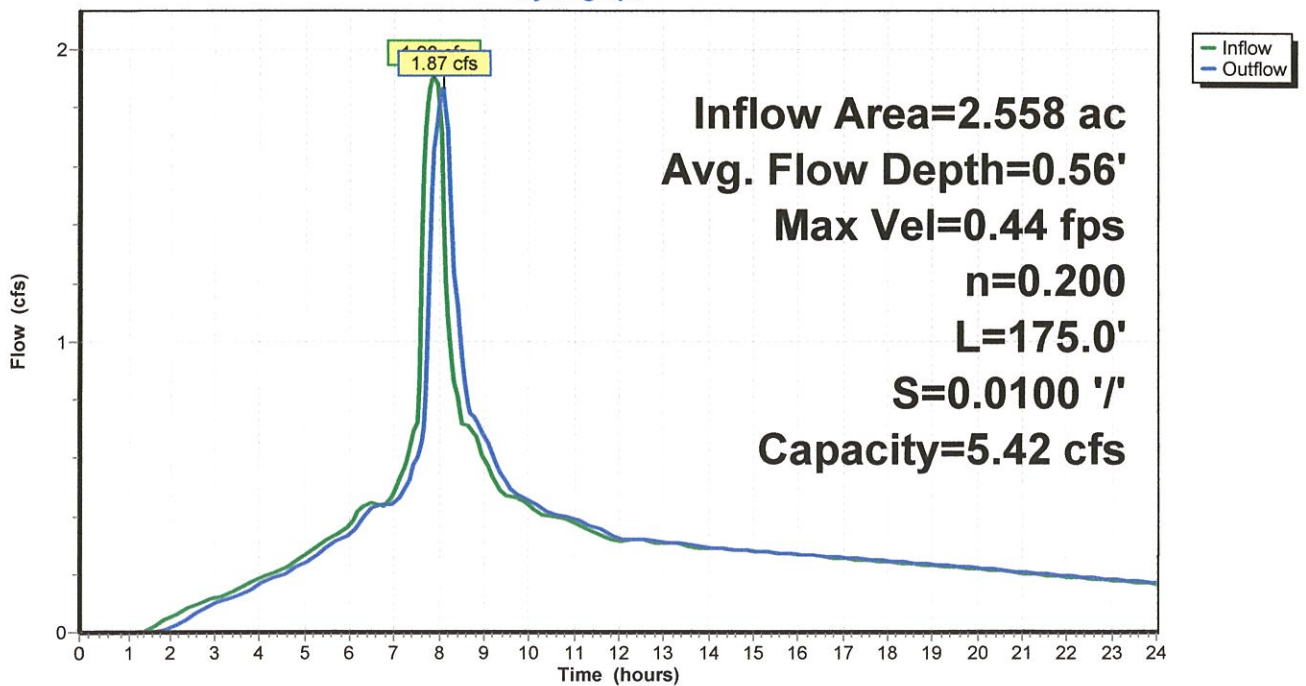
Summary for Pond 1P: Pond 1

Inflow Area =   6.658 ac, 32.88% Impervious, Inflow Depth > 2.38"   for 10-yr Storm event
Inflow   =   3.85 cfs @   8.13 hrs, Volume=   1.322 af
Outflow   =   1.82 cfs @   8.72 hrs, Volume=   1.232 af, Atten= 53%, Lag= 35.6 min
Primary   =   1.82 cfs @   8.72 hrs, Volume=   1.232 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 178.54' @ 8.72 hrs Surf.Area= 13,850 sf Storage= 10,890 cf

Plug-Flow detention time= 115.7 min calculated for 1.229 af (93% of inflow)
Center-of-Mass det. time= 70.5 min (818.4 - 747.9)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	16,135 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 20,019 cf Overall x 80.6% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.50	12,066	0	0	12,066
177.75	12,482	3,068	3,068	12,493
178.00	12,906	3,173	6,242	12,929
178.25	13,336	3,280	9,522	13,371
178.50	13,773	3,388	12,910	13,820
178.75	14,216	3,498	16,409	14,275
179.00	14,667	3,610	20,019	14,738

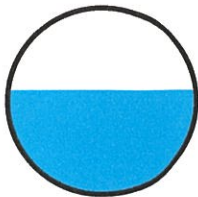| Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	**12.0" Round Culvert** L= 35.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.50' / 173.00' S= 0.1286 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	177.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.18'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.55'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.82 cfs @ 8.72 hrs HW=178.54'   (Free Discharge)
└─**1=Culvert** (Passes 1.82 cfs of 2.46 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 1.42 cfs @ 4.06 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.40 cfs @ 2.05 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

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Page 60

Pond 1P: Pond 1

Hydrograph

Inflow Area=6.658 ac
Peak Elev=178.54'
Storage=10,890 cf

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Printed 4/18/2017
Page 61
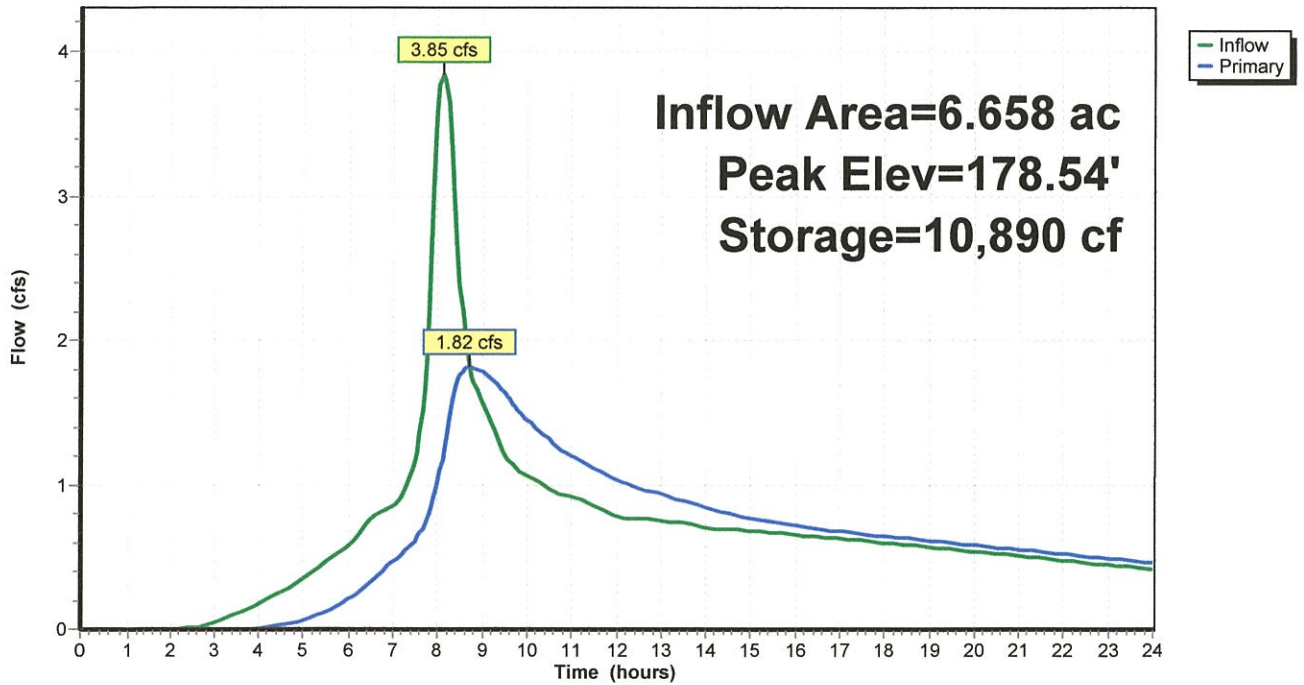
Summary for Pond 2P: Pond 2

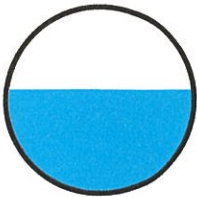Inflow Area =   21.380 ac, 54.76% Impervious, Inflow Depth > 1.39"   for 10-yr Storm event
Inflow   =   10.45 cfs @   8.13 hrs, Volume=   2.476 af
Outflow   =   6.93 cfs @   8.52 hrs, Volume=   2.455 af, Atten= 34%, Lag= 23.4 min
Primary   =   6.93 cfs @   8.52 hrs, Volume=   2.455 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 139.04' @ 8.52 hrs   Surf.Area= 0.103 ac   Storage= 0.236 af

Plug-Flow detention time= 23.2 min calculated for 2.450 af (99% of inflow)
Center-of-Mass det. time= 17.3 min (722.7 - 705.4)

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	0.620 af	**56.00'W x 80.00'L x 8.00'H Prismatoid** 0.823 af Overall x 75.4% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	136.00'	**24.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.00' / 135.00' S= 0.1000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	136.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	136.71'	**2.9" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	139.05'	**6.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.93 cfs @ 8.52 hrs HW=139.04'   (Free Discharge)
└─**1=Culvert** (Passes 6.93 cfs of 17.04 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 6.59 cfs @ 8.39 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.34 cfs @ 7.34 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)
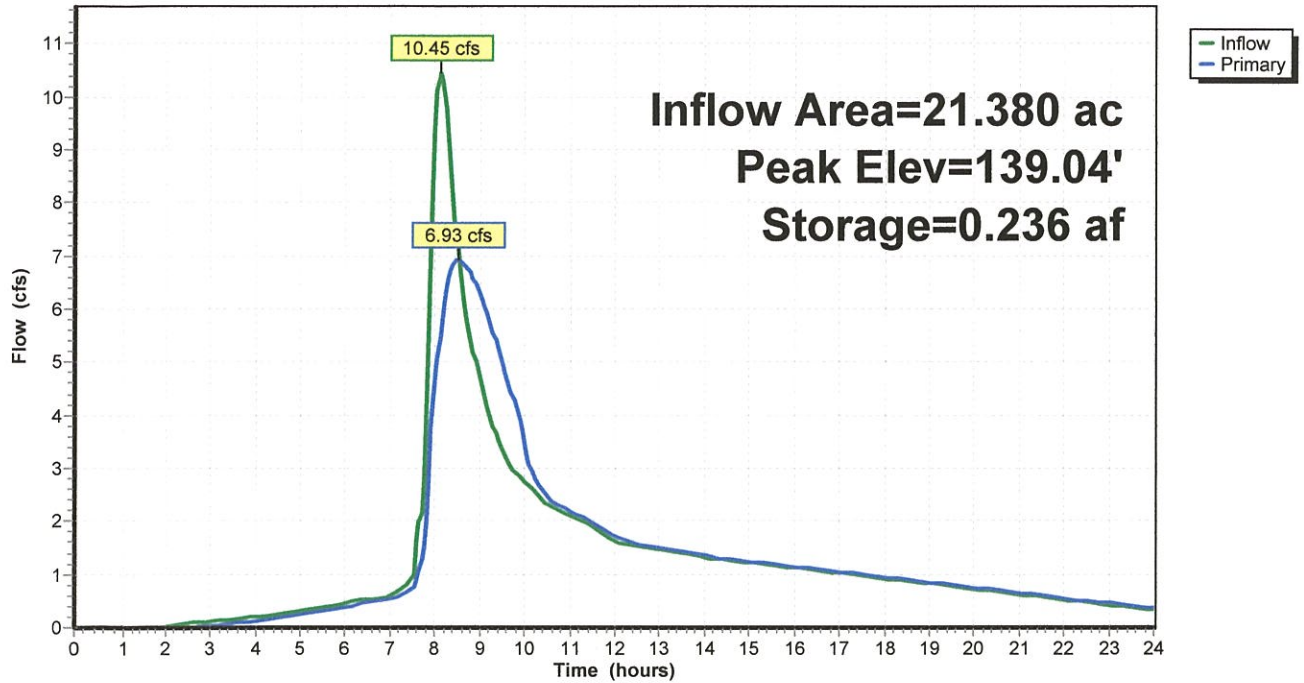
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Page 62

Pond 2P: Pond 2

Hydrograph

Inflow Area=21.380 ac
Peak Elev=139.04'
Storage=0.236 af

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Printed 4/18/2017
Page 63

Summary for Pond BR1: Bioretention 1

Inflow Area =   17.997 ac, 56.26% Impervious, Inflow Depth > 2.73"   for 10-yr Storm event
Inflow   =   12.87 cfs @   7.97 hrs, Volume=   4.090 af
Outflow   =   10.08 cfs @   8.17 hrs, Volume=   3.530 af, Atten= 22%, Lag= 11.7 min
Discarded =   1.15 cfs @   8.17 hrs, Volume=   1.814 af
Primary   =   8.93 cfs @   8.17 hrs, Volume=   1.716 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 143.07' @ 8.17 hrs   Surf.Area= 32,542 sf   Storage= 33,581 cf

Plug-Flow detention time= 156.1 min calculated for 3.530 af (86% of inflow)
Center-of-Mass det. time= 65.1 min (776.2 - 711.1)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	8,792 cf	**50.00'W x 283.00'L x 1.50'H Prismatoid Z=1.0**
			21,979 cf Overall x 40.0% Voids
#2	141.50'	32,392 cf	**50.00'W x 283.00'L x 2.00'H Prismatoid Z=3.0**
		41,184 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	**24.0" Round Culvert**
			L= 10.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0500 '/' Cc= 0.900
			n= 0.012, Flow Area= 3.14 sf
#2	Device 1	142.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Discarded	140.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.15 cfs @ 8.17 hrs HW=143.07'   (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 1.15 cfs)

Primary OutFlow Max=8.89 cfs @ 8.17 hrs HW=143.07'   (Free Discharge)
└─**1=Culvert** (Passes 8.89 cfs of 17.19 cfs potential flow)
 └─**2=Orifice/Grate** (Weir Controls 8.89 cfs @ 2.47 fps)

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Page 64

Pond BR1: Bioretention 1

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Page 65
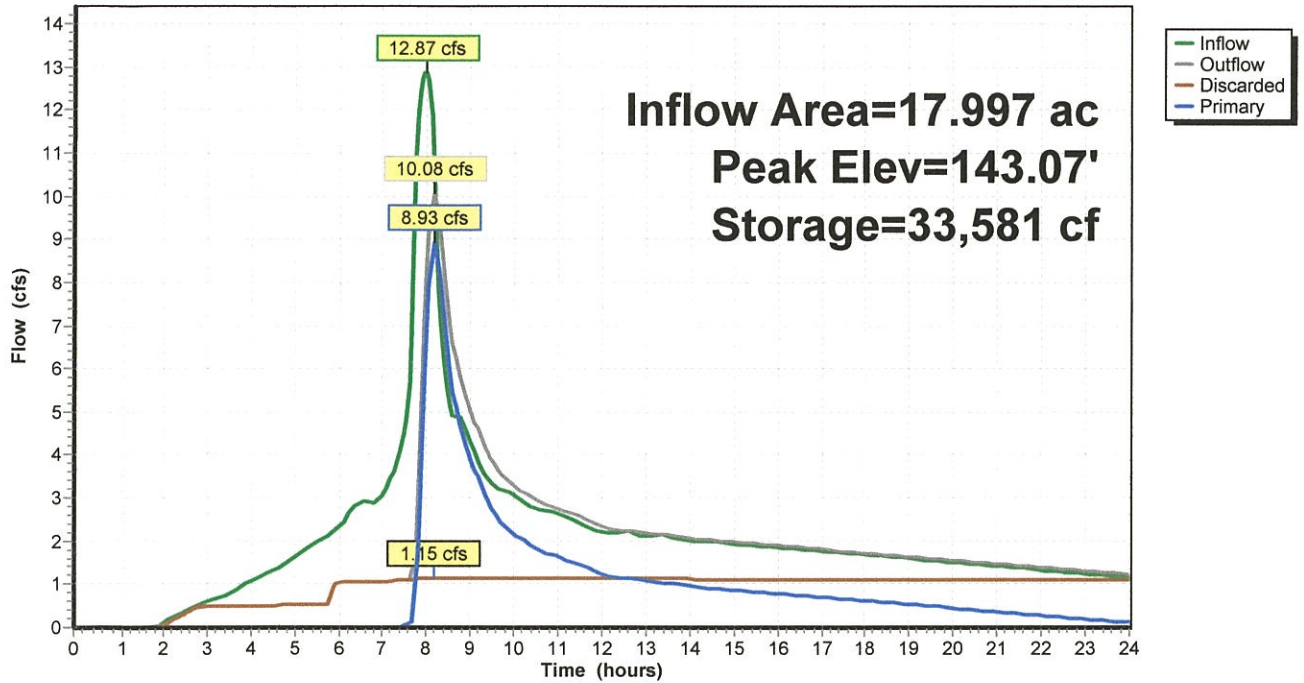
Summary for Pond BR2: Bioretention 2

Inflow Area =   2.390 ac, 67.64% Impervious, Inflow Depth > 2.90"   for 10-yr Storm event
Inflow   =   1.81 cfs @   7.89 hrs, Volume=   0.577 af
Outflow   =   0.99 cfs @   8.22 hrs, Volume=   0.514 af, Atten= 45%, Lag= 20.2 min
Discarded =   0.21 cfs @   8.22 hrs, Volume=   0.285 af
Primary   =   0.78 cfs @   8.22 hrs, Volume=   0.229 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 155.19' @ 8.22 hrs Surf.Area= 5,496 sf Storage= 4,911 cf

Plug-Flow detention time= 137.4 min calculated for 0.513 af (89% of inflow)
Center-of-Mass det. time= 62.0 min (753.3 - 691.3)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	903 cf	**5.00'W x 230.00'L x 1.50'H Prismatoid Z=1.0** 2,258 cf Overall x 40.0% Voids
#2	153.50'	5,216 cf	**5.00'W x 230.00'L x 2.00'H Prismatoid Z=3.0**
		6,119 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	152.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 152.00' / 151.90' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	154.50'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	152.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.21 cfs @ 8.22 hrs HW=155.19'   (Free Discharge)
└—**3=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.78 cfs @ 8.22 hrs HW=155.19'   (Free Discharge)
└—**1=Culvert** (Passes 0.78 cfs of 4.89 cfs potential flow)
  └—**2=Orifice/Grate** (Orifice Controls 0.78 cfs @ 3.99 fps)

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Page 66

Pond BR2: Bioretention 2

Hydrograph

Inflow Area=2.390 ac
Peak Elev=155.19'
Storage=4,911 cf

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Page 67
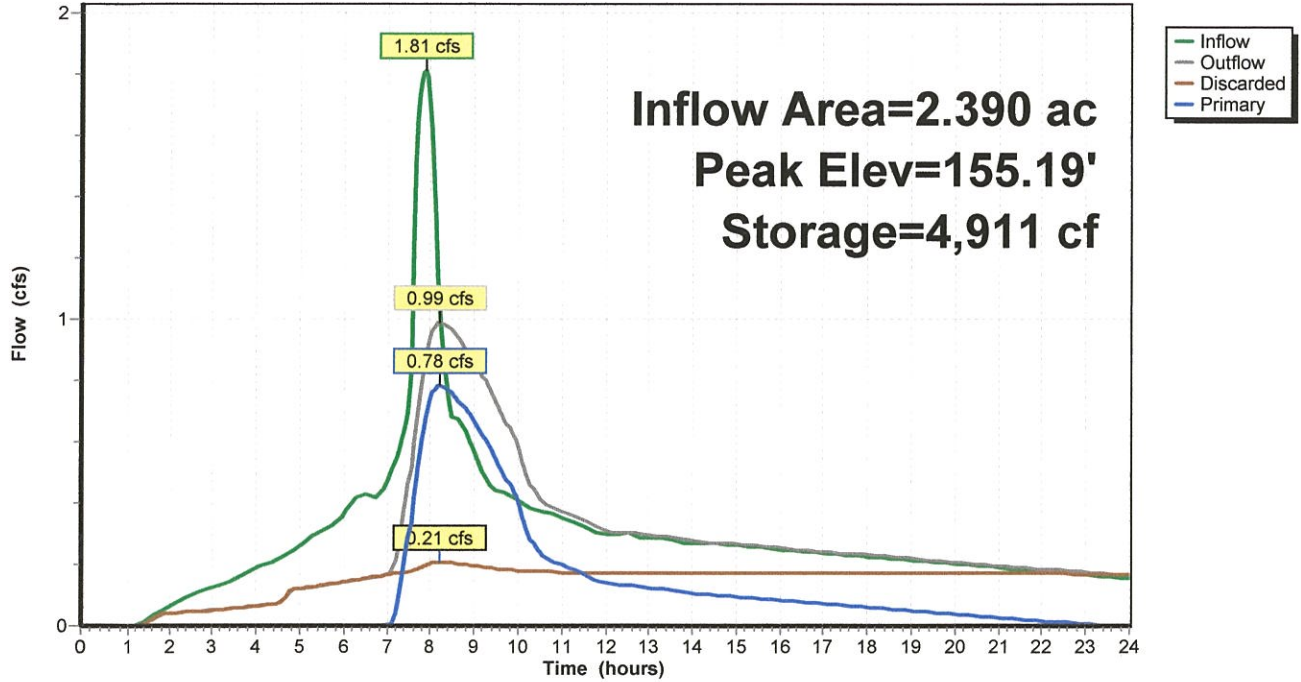
Summary for Subcatchment A B1: Apt Basin 1

Runoff   =   2.81 cfs @   7.88 hrs, Volume=   0.899 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	70,725	98	Pavement
*	40,704	90	Landscaping
	111,429	95	Weighted Average
	40,704		36.53% Pervious Area
	70,725		63.47% Impervious Area

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

Subcatchment A B1: Apt Basin 1

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=111,429 sf
Runoff Volume=0.899 af
Runoff Depth>4.22"
Tc=6.0 min
CN=95

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 68

Summary for Subcatchment A B2: Apt Basin 2

Runoff   =   1.13 cfs @   7.88 hrs, Volume=   0.361 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	26,871	98	Pavement
*	17,952	90	Landscaping
	44,823	95	Weighted Average
	17,952		40.05% Pervious Area
	26,871		59.95% Impervious Area

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

Subcatchment A B2: Apt Basin 2

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=44,823 sf
Runoff Volume=0.361 af
Runoff Depth>4.22"
Tc=6.0 min
CN=95

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 69

Summary for Subcatchment A B3: Apt Basin 3

Runoff   =   1.52 cfs @   7.88 hrs, Volume=   0.491 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	43,562	98	Pavement
*	15,740	90	Landscaping
	59,302	96	Weighted Average
	15,740		26.54% Pervious Area
	43,562		73.46% Impervious Area

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

Subcatchment A B3: Apt Basin 3

Hydrograph

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 70

Summary for Subcatchment A B4: Apt Basin 4

Runoff   =   1.68 cfs @   7.88 hrs, Volume=   0.538 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	43,680	98	Buildings
*	23,018	90	Landscaping
	66,698	95	Weighted Average
	23,018		34.51% Pervious Area
	43,680		65.49% Impervious Area

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

Subcatchment A B4: Apt Basin 4

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=66,698 sf
Runoff Volume=0.538 af
Runoff Depth>4.22"
Tc=6.0 min
CN=95

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 71

Summary for Subcatchment A B5: Apt Basin 5

Runoff   =   1.36 cfs @   7.89 hrs, Volume=   0.433 af, Depth> 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	24,194	98	Buildings
*	32,440	90	Landscaping
	56,634	93	Weighted Average
	32,440		57.28% Pervious Area
	24,194		42.72% Impervious Area

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

Subcatchment A B5: Apt Basin 5

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=56,634 sf
Runoff Volume=0.433 af
Runoff Depth>4.00"
Tc=6.0 min
CN=93

Summary for Subcatchment B1: North Basin

Runoff   =   4.04 cfs @   8.00 hrs, Volume=   1.301 af, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	91,945	86	Landscaping
*	71,271	98	Impervious
*	12,103	100	Pond
	175,319	92	Weighted Average
	91,945		52.44% Pervious Area
	83,374		47.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	190	0.0950	0.32		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.1	22	0.2500	3.50		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
1.7	107	0.0230	1.06		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
0.9	144	0.0070	2.59	0.51	**Pipe Channel, Pipe**
					6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13'
					n= 0.012
12.6	463				Total

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 73

Subcatchment B1: North Basin

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=175,319 sf
Runoff Volume=1.301 af
Runoff Depth>3.88"
Flow Length=463'
Tc=12.6 min
CN=92

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 74

Summary for Subcatchment B2: Tract A

Runoff   =   0.05 cfs @   7.93 hrs, Volume=   0.017 af, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description			
*	2,783	86	Lawn (HSG C)			
	2,783		100.00% Pervious Area			

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	109	0.0910	0.28		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.54"

Subcatchment B2: Tract A

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=2,783 sf
Runoff Volume=0.017 af
Runoff Depth>3.27"
Flow Length=109'
Slope=0.0910 '/'
Tc=6.4 min
CN=86

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 75

Summary for Subcatchment B3: Central Basin

Runoff   =   10.23 cfs @   7.91 hrs, Volume=   3.267 af, Depth> 4.10"
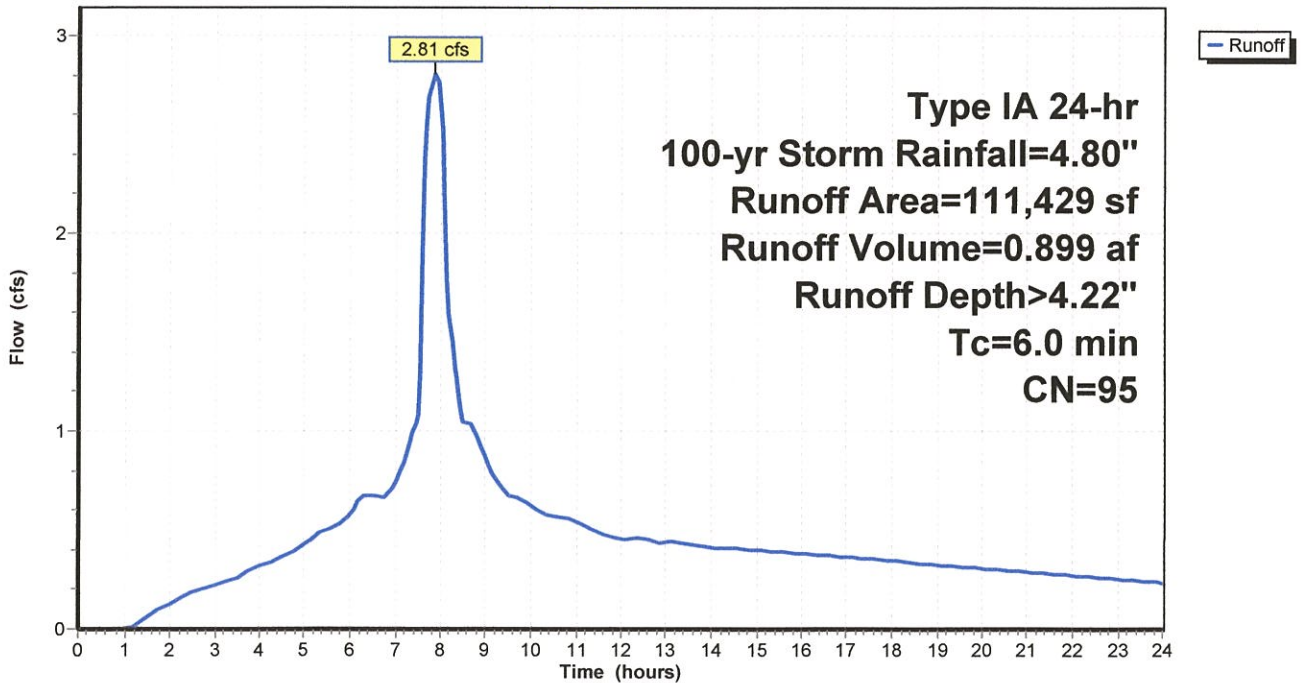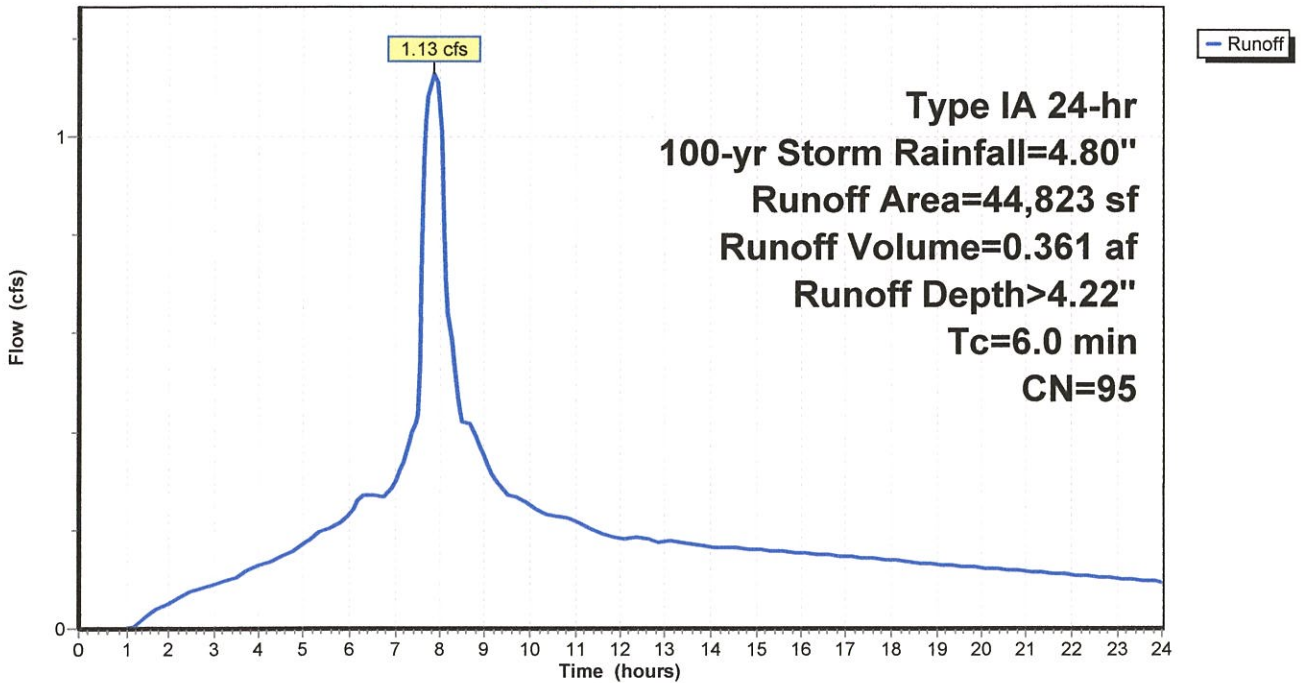
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	240,948	98	Impervious
*	175,358	88	Landscaping
	416,306	94	Weighted Average
	175,358		42.12% Pervious Area
	240,948		57.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B3: Central Basin

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=416,306 sf
Runoff Volume=3.267 af
Runoff Depth>4.10"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 76

Summary for Subcatchment B4: South Basin

Runoff   =   9.04 cfs @   7.91 hrs, Volume=   2.885 af, Depth> 4.10"
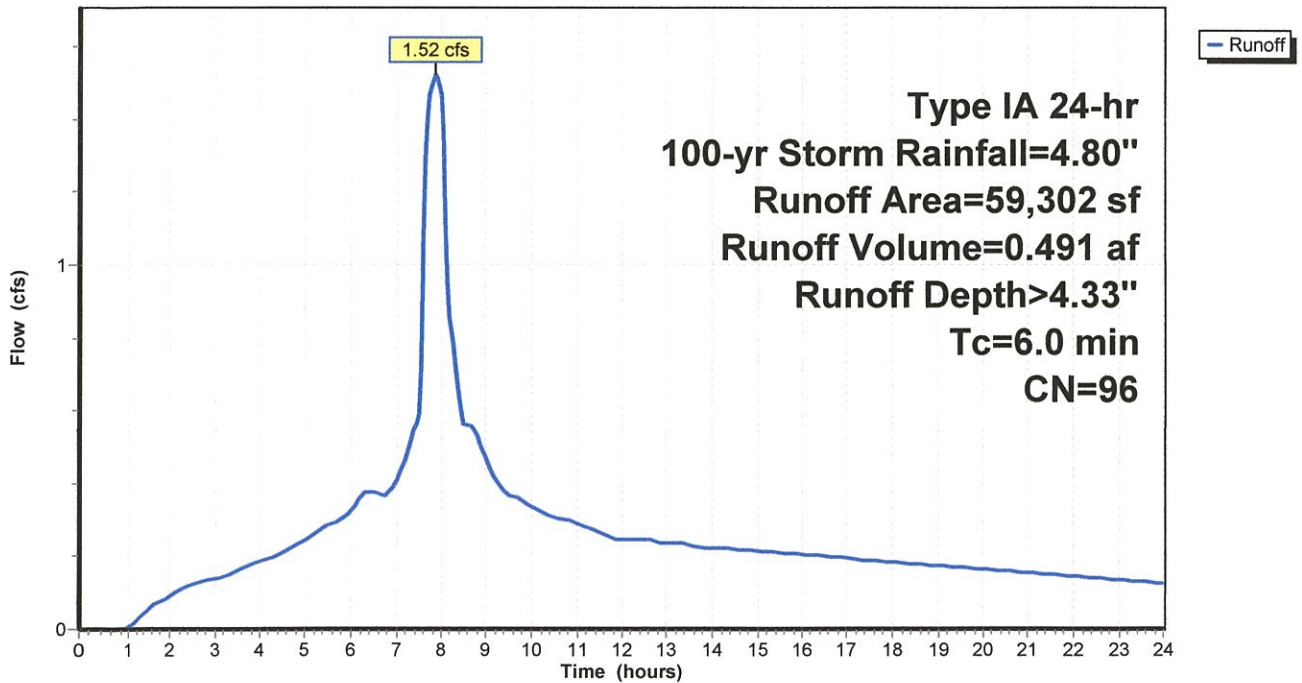
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	200,131	98	Impervious
*	167,521	90	Landscaping
	367,652	94	Weighted Average
	167,521		45.57% Pervious Area
	200,131		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B4: South Basin

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=367,652 sf
Runoff Volume=2.885 af
Runoff Depth>4.10"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 77

Summary for Subcatchment B5: Pond Area

Runoff   =   2.24 cfs @   7.89 hrs, Volume=   0.712 af, Depth> 4.10"
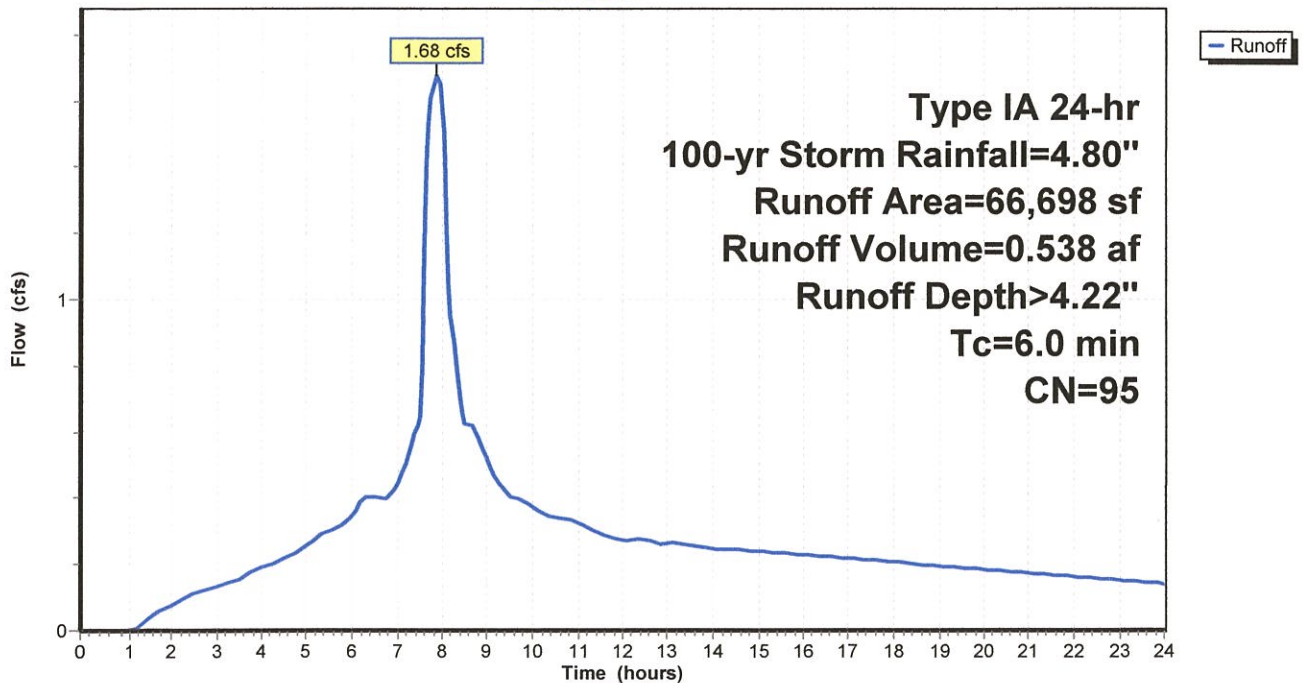
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	44,675	98	Impervious
*	46,045	90	Landscaping
	90,720	94	Weighted Average
	46,045		50.76% Pervious Area
	44,675		49.24% Impervious Area

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

Subcatchment B5: Pond Area

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=90,720 sf
Runoff Volume=0.712 af
Runoff Depth>4.10"
Tc=6.0 min
CN=94

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 78

Summary for Subcatchment B6: Open Space

Runoff   =   0.30 cfs @   7.90 hrs, Volume=   0.094 af, Depth> 3.68"
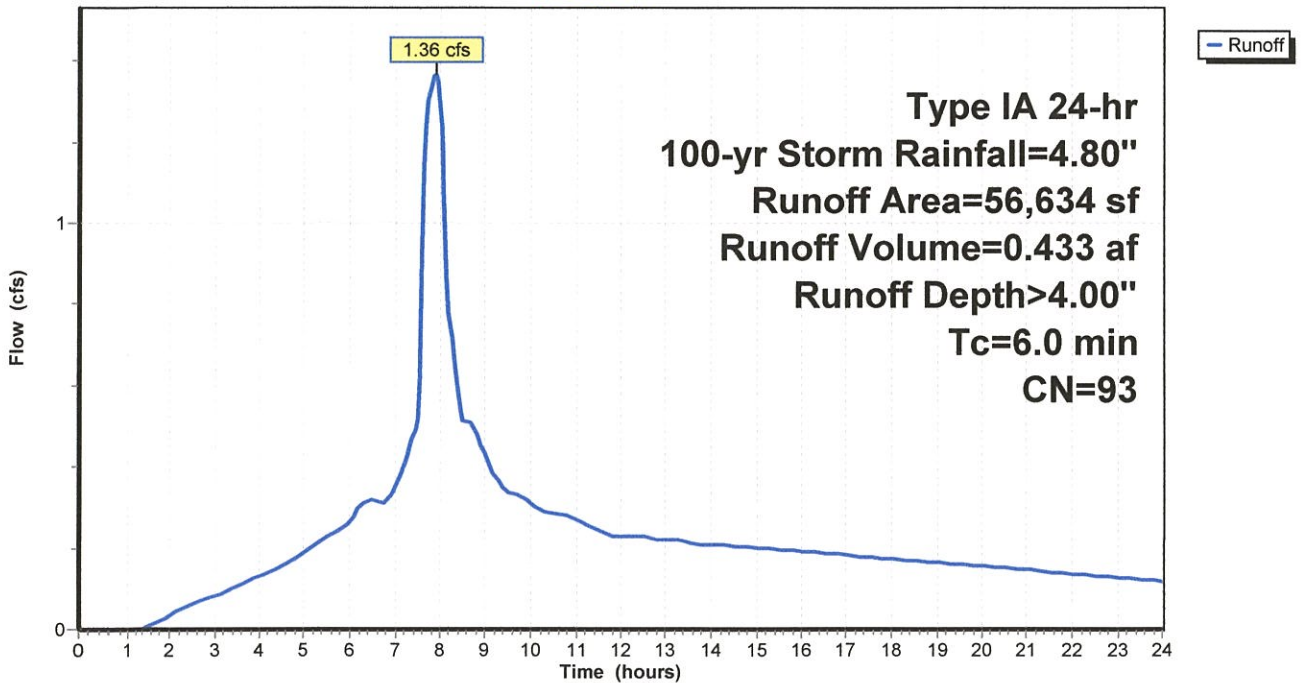
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	13,411	90	Landscaping
	13,411		100.00% Pervious Area

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

Subcatchment B6: Open Space

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=13,411 sf
Runoff Volume=0.094 af
Runoff Depth>3.68"
Tc=6.0 min
CN=90

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 79

Summary for Subcatchment B7: Cul-de-Sac

Runoff   =   2.45 cfs @   7.92 hrs, Volume=   0.785 af, Depth> 3.37"
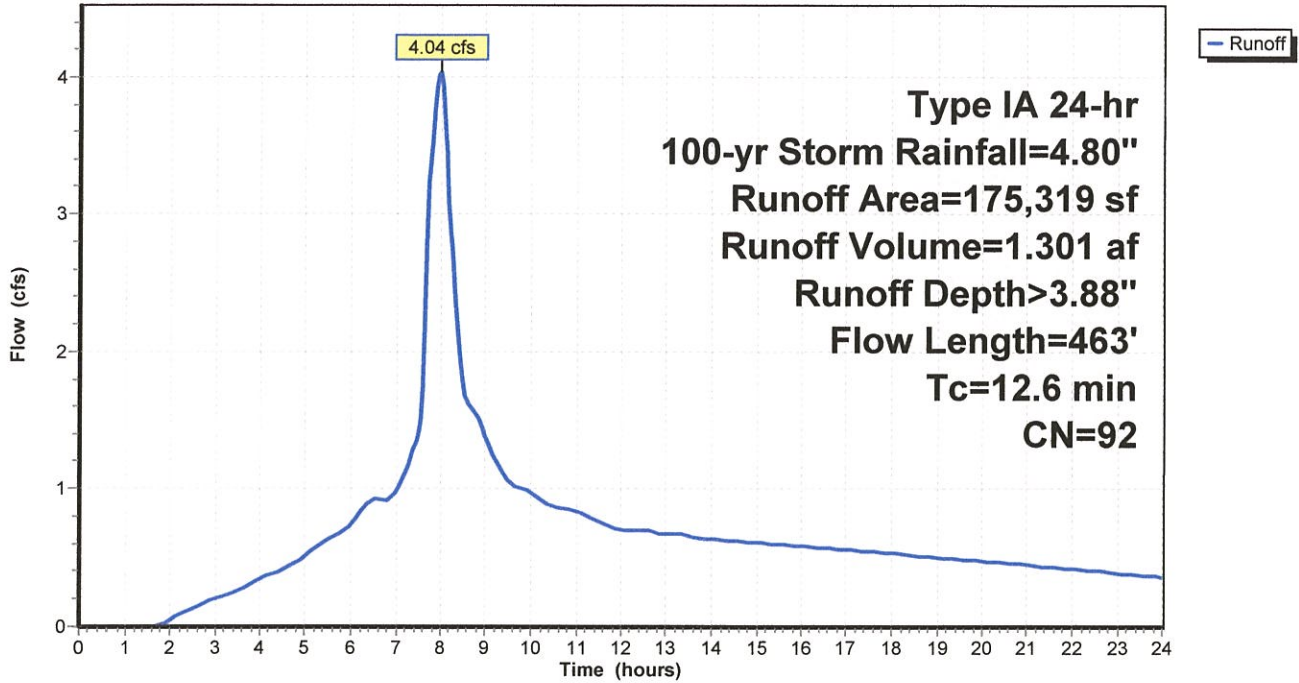
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	75,014	80	Landscaping
*	24,170	98	Road & SW
*	22,400	98	Homes & DW
	121,584	87	Weighted Average
	75,014		61.70% Pervious Area
	46,570		38.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Swale 1**

Subcatchment B7: Cul-de-Sac

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=121,584 sf
Runoff Volume=0.785 af
Runoff Depth>3.37"
Tc=6.0 min
CN=87

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 80

Summary for Subcatchment B8: 11th Street

Runoff   =   2.81 cfs @   7.89 hrs, Volume=   0.893 af, Depth> 4.00"
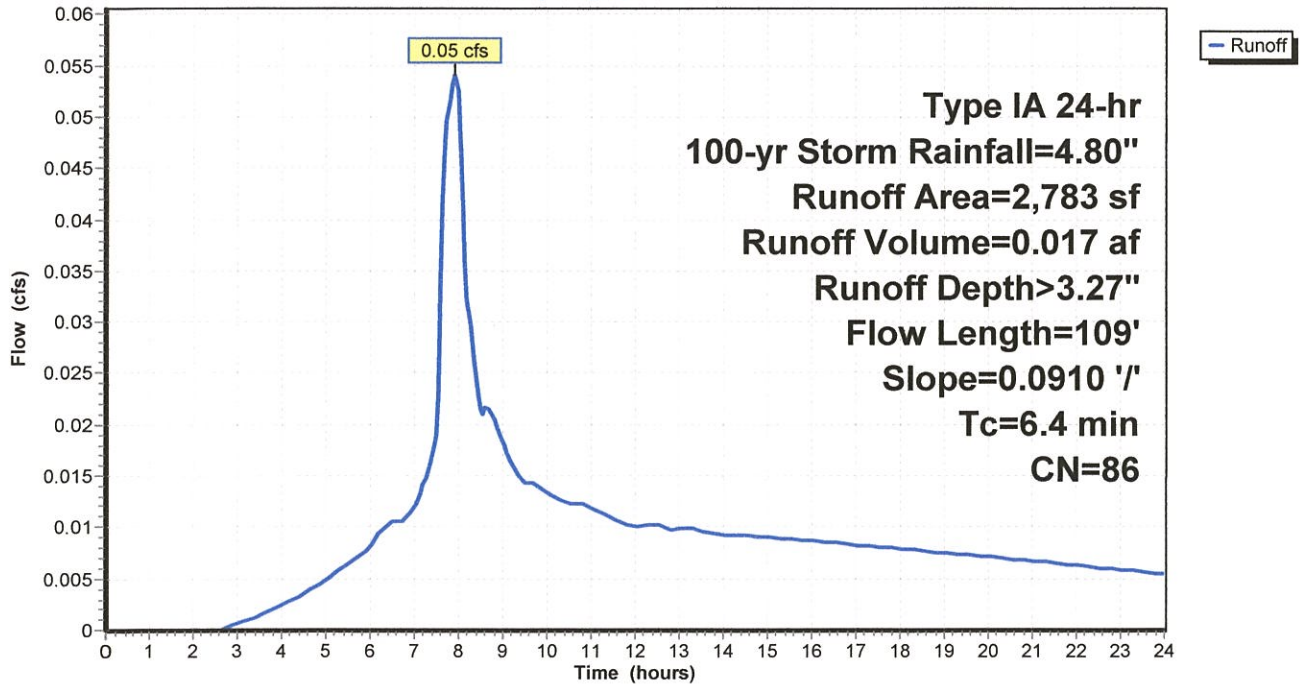
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	58,285	88	Landscaping
*	50,605	98	Roads & DW
*	8,000	98	Houses
	116,890	93	Weighted Average
	58,285		49.86% Pervious Area
	58,605		50.14% Impervious Area

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

Subcatchment B8: 11th Street

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=116,890 sf
Runoff Volume=0.893 af
Runoff Depth>4.00"
Tc=6.0 min
CN=93

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Page 81

Summary for Subcatchment B9: 13th Homes

Runoff   =   3.10 cfs @   7.89 hrs, Volume=   0.985 af, Depth> 4.00"
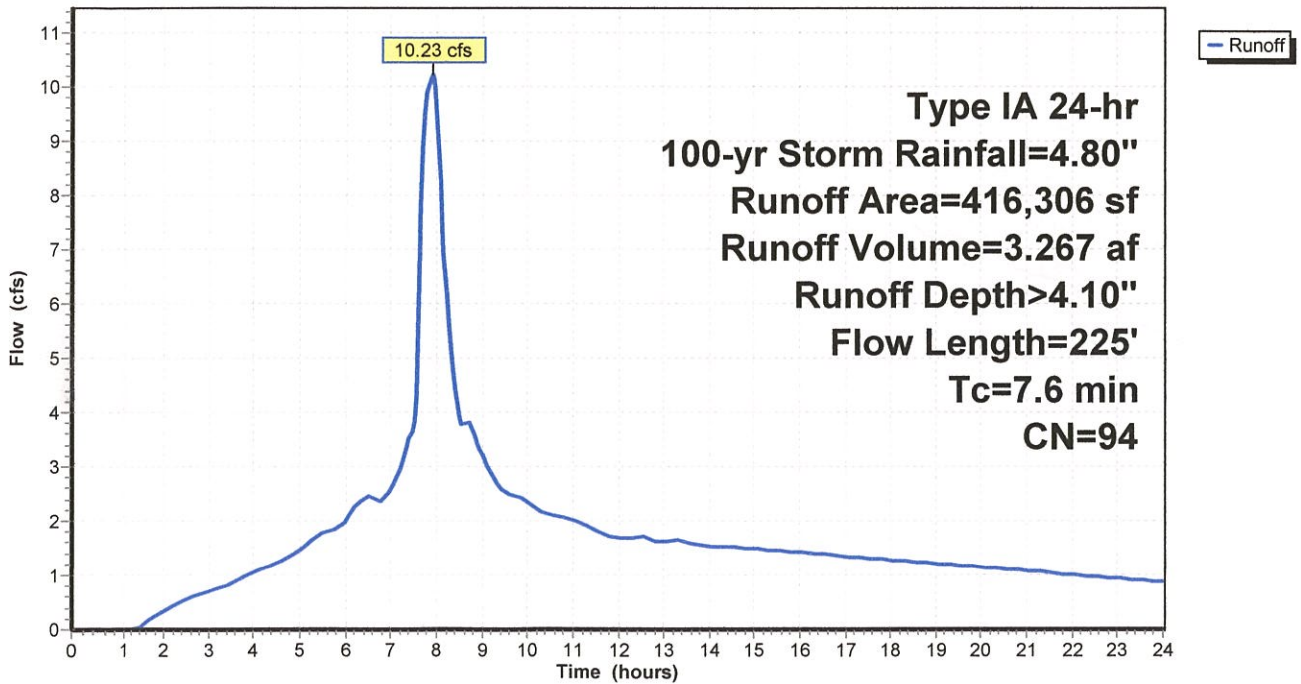
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	64,850	88	Landscaping
*	64,000	98	Buildings
	128,850	93	Weighted Average
	64,850		50.33% Pervious Area
	64,000		49.67% Impervious Area

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

Subcatchment B9: 13th Homes

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=128,850 sf
Runoff Volume=0.985 af
Runoff Depth>4.00"
Tc=6.0 min
CN=93

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Page 82

Summary for Subcatchment O1: Adj Parcel (E)

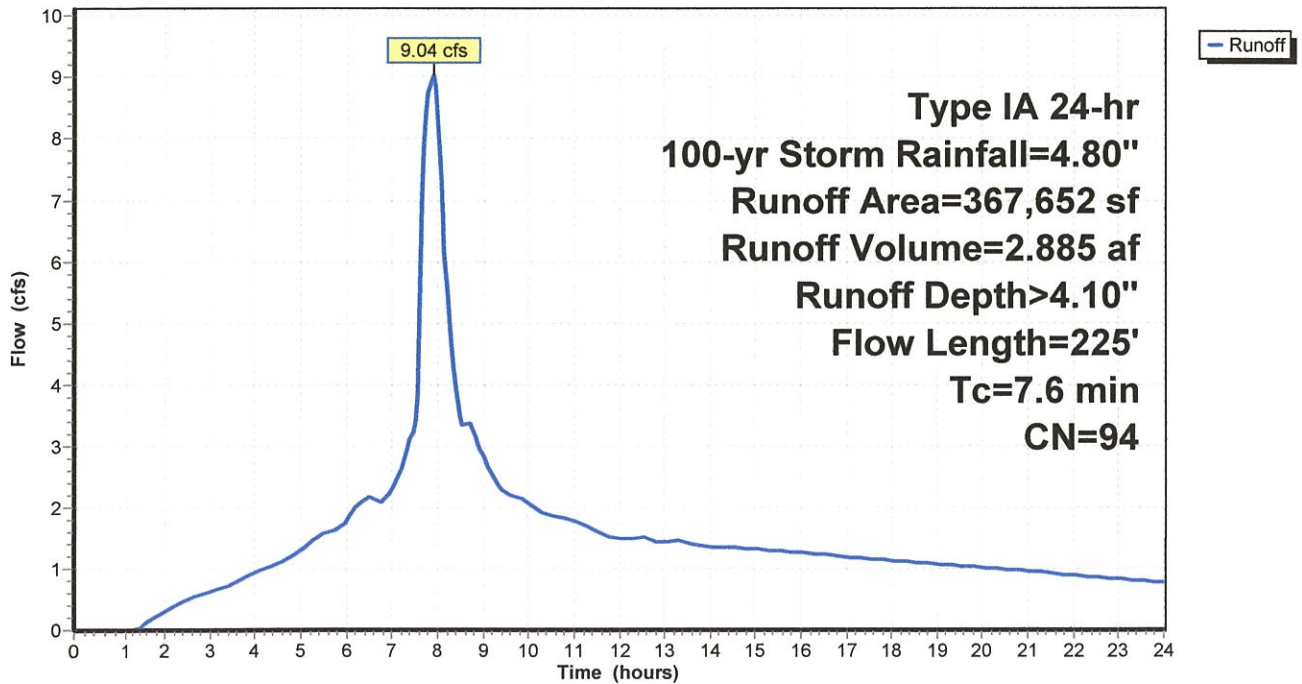Runoff   =   1.16 cfs @   8.02 hrs, Volume=   0.377 af, Depth> 3.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O1: Adj Parcel (E)

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Page 83

Summary for Subcatchment O2: Adj Parcel (N)

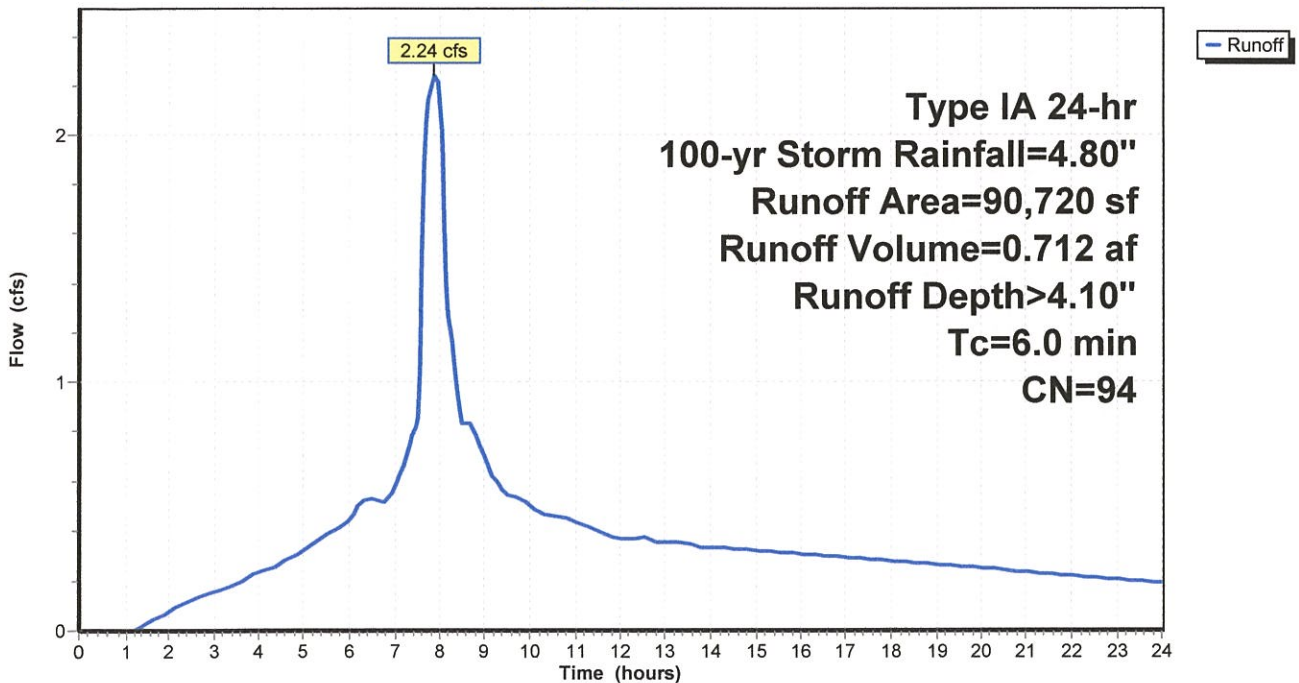Runoff   =   0.95 cfs @   7.95 hrs, Volume=   0.308 af, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow**
					Short Grass Pasture Kv= 7.0 fps
7.8	425	Total			

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=49,129 sf
Runoff Volume=0.308 af
Runoff Depth>3.27"
Flow Length=425'
Tc=7.8 min
CN=86

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Page 84

Summary for Subcatchment O3: OPH North

Runoff   =   0.20 cfs @   7.87 hrs, Volume=   0.065 af, Depth> 4.56"
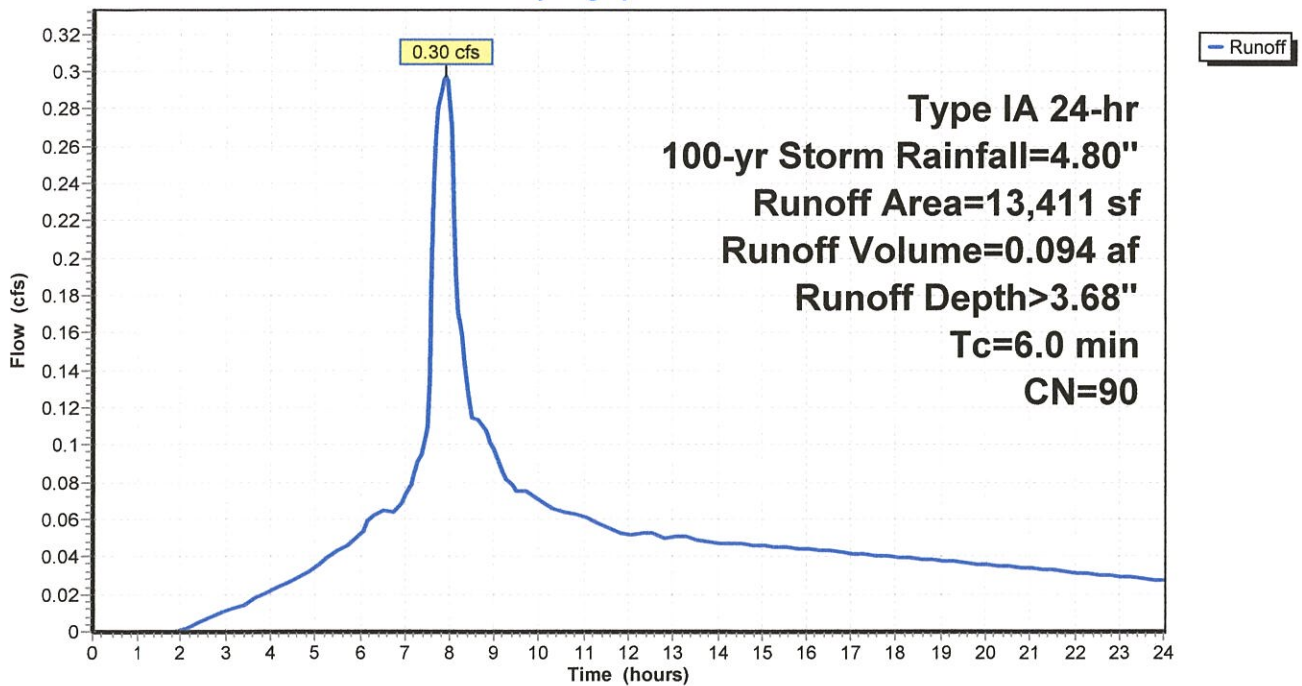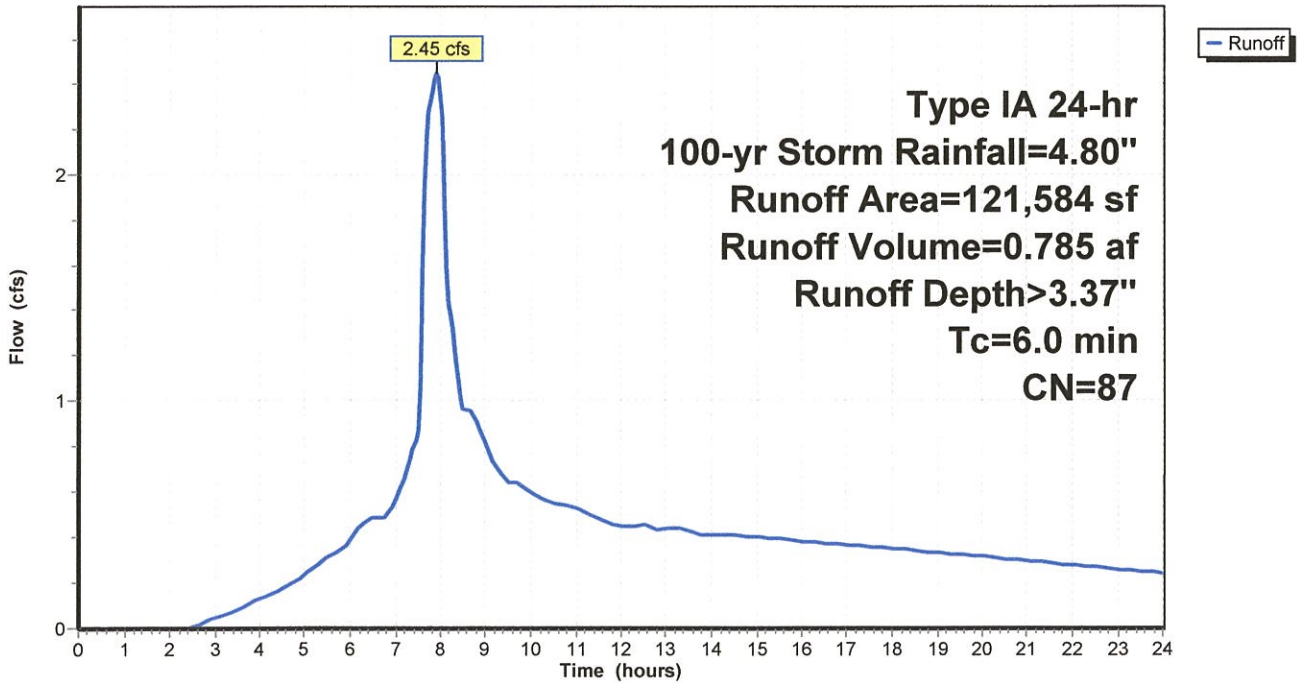
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-yr Storm Rainfall=4.80"

	Area (sf)	CN	Description		
*	7,465	98	Pavement		
	7,465		100.00% Impervious Area		

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

Subcatchment O3: OPH North

Hydrograph

Type IA 24-hr
100-yr Storm Rainfall=4.80"
Runoff Area=7,465 sf
Runoff Volume=0.065 af
Runoff Depth>4.56"
Tc=6.0 min
CN=98

0.20 cfs

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Printed 4/18/2017
Page 85
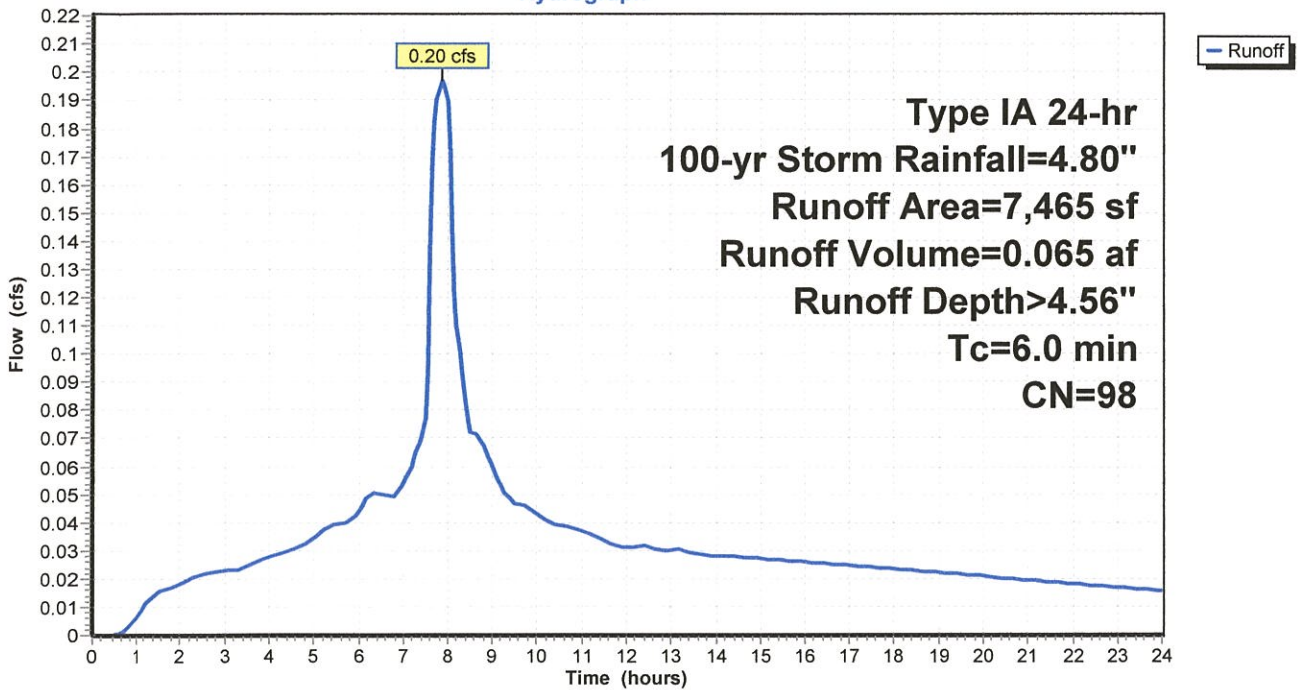
Summary for Reach P1: Pipe 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 3.82"   for 100-yr Storm event
Inflow   =   5.44 cfs @   8.00 hrs, Volume=   1.761 af
Outflow   =   5.43 cfs @   8.01 hrs, Volume=   1.760 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.40 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.21 fps, Avg. Travel Time= 0.7 min

Peak Storage= 145 cf @ 8.00 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.83 cfs

15.0" Round Pipe
n= 0.012
Length= 144.0' Slope= 0.0069 '/'
Inlet Invert= 181.00', Outlet Invert= 180.00'

Reach P1: Pipe 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.96'
Max Vel=5.40 fps
15.0"
Round Pipe
n=0.012
L=144.0'
S=0.0069 '/'
Capacity=5.83 cfs

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Page 86

Summary for Reach P2: Pipe 2

Inflow Area =   6.480 ac, 65.49% Impervious, Inflow Depth > 3.53"   for 100-yr Storm event
Inflow   =   7.38 cfs @   8.05 hrs, Volume=   1.908 af
Outflow   =   6.19 cfs @   8.12 hrs, Volume=   1.903 af, Atten= 16%, Lag= 4.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.90 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 5.41 fps, Avg. Travel Time= 3.9 min

Peak Storage= 895 cf @ 8.08 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.13 cfs

12.0" Round Pipe
n= 0.012
Length= 1,279.0'   Slope= 0.0252 '/'
Inlet Invert= 170.25', Outlet Invert= 138.00'

Reach P2: Pipe 2

Hydrograph

Inflow Area=6.480 ac
Avg. Flow Depth=0.83'
Max Vel=8.90 fps
12.0"
Round Pipe
n=0.012
L=1,279.0'
S=0.0252 '/'
Capacity=6.13 cfs

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Page 87

Summary for Reach P3: Pipe 3

Inflow Area =   9.557 ac, 57.88% Impervious, Inflow Depth > 4.10"   for 100-yr Storm event
Inflow   =   10.23 cfs @   7.91 hrs, Volume=   3.267 af
Outflow   =   10.21 cfs @   7.95 hrs, Volume=   3.262 af, Atten= 0%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.73 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 6.74 fps, Avg. Travel Time= 2.6 min

Peak Storage= 904 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.70'
Bank-Full Depth= 1.67' Flow Area= 2.2 sf, Capacity= 27.69 cfs

20.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P3: Pipe 3

Hydrograph

Inflow Area=9.557 ac
Avg. Flow Depth=0.70'
Max Vel=11.73 fps
20.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=27.69 cfs

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Type IA 24-hr 100-yr Storm Rainfall=4.80"
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Page 88
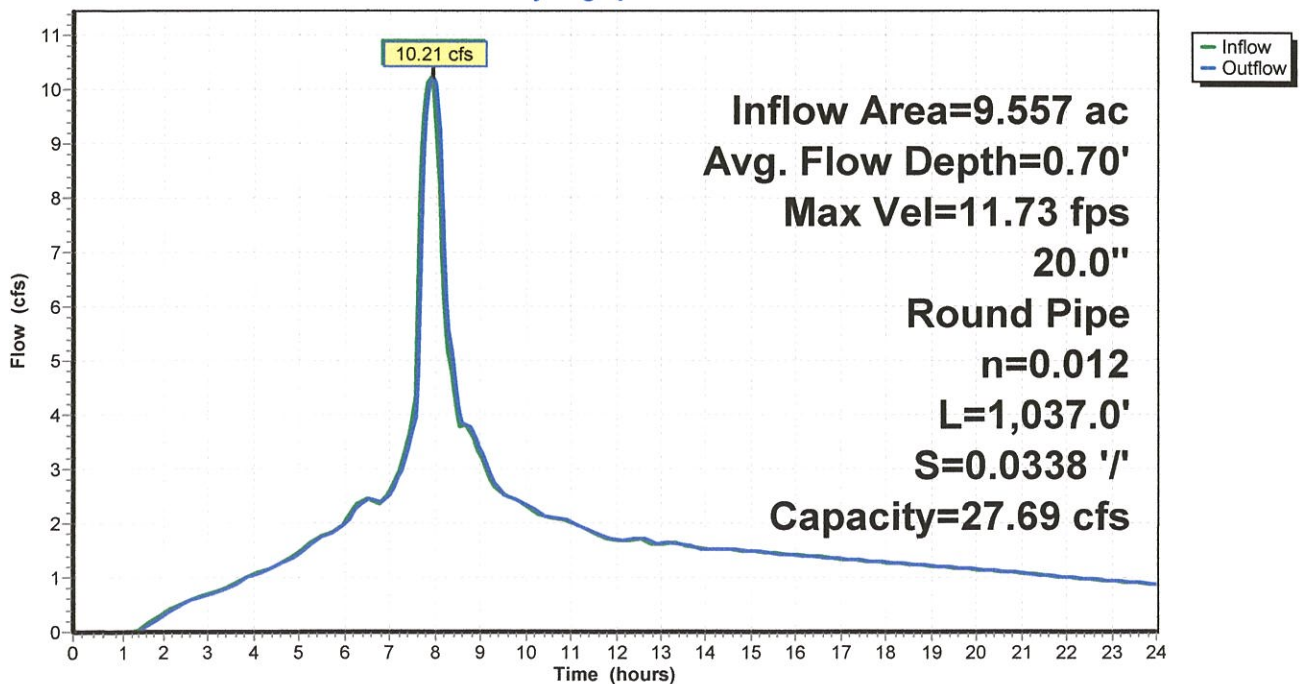
Summary for Reach P4: Pipe 4

Inflow Area =   8.440 ac, 54.43% Impervious, Inflow Depth > 4.10"   for 100-yr Storm event
Inflow   =   9.04 cfs @   7.91 hrs, Volume=   2.885 af
Outflow   =   9.02 cfs @   7.96 hrs, Volume=   2.881 af, Atten= 0%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.40 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 6.58 fps, Avg. Travel Time= 2.6 min

Peak Storage= 822 cf @ 7.93 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 20.91 cfs

18.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P4: Pipe 4

Hydrograph

Inflow Area=8.440 ac
Avg. Flow Depth=0.69'
Max Vel=11.40 fps
18.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=20.91 cfs

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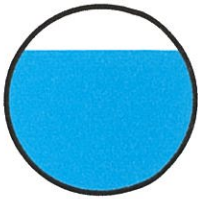Printed 4/18/2017
Page 89
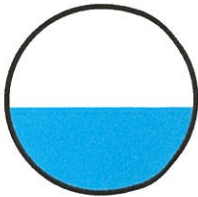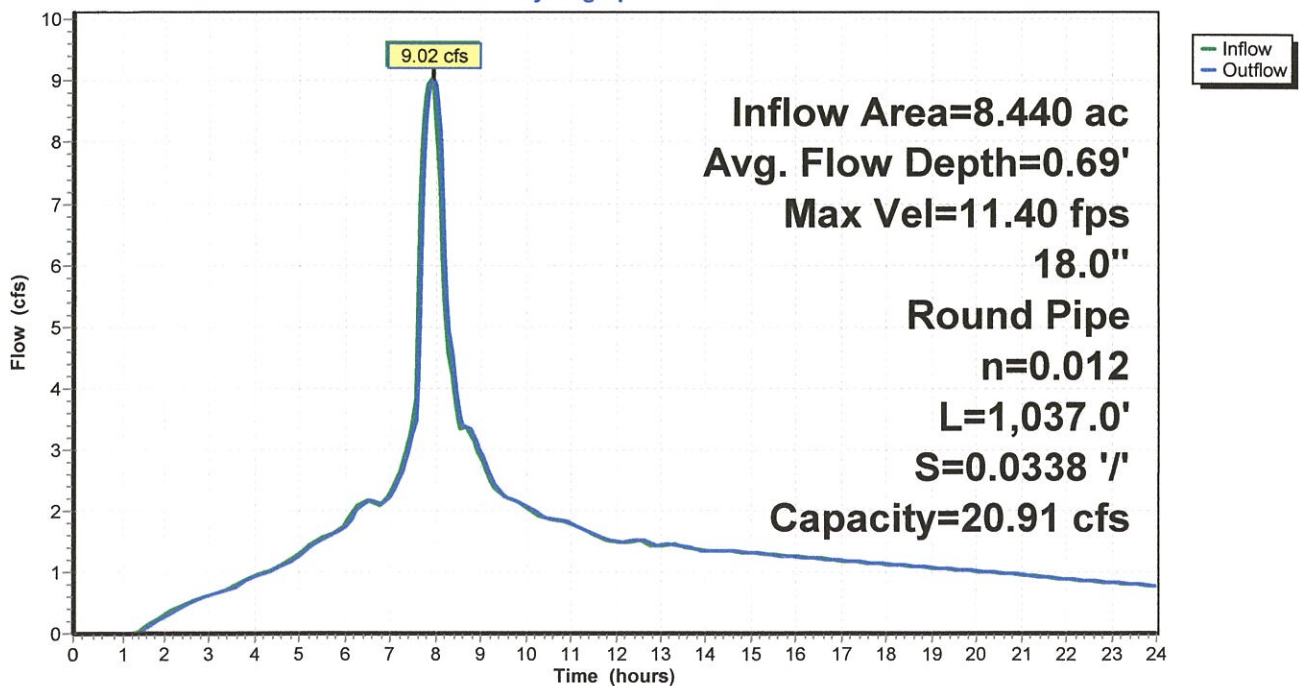
Summary for Reach S1: Bioswale 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 3.82"   for 100-yr Storm event
Inflow   =   5.43 cfs @   8.01 hrs, Volume=   1.760 af
Outflow   =   5.35 cfs @   8.14 hrs, Volume=   1.749 af, Atten= 1%, Lag= 8.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.57 fps, Min. Travel Time= 5.1 min
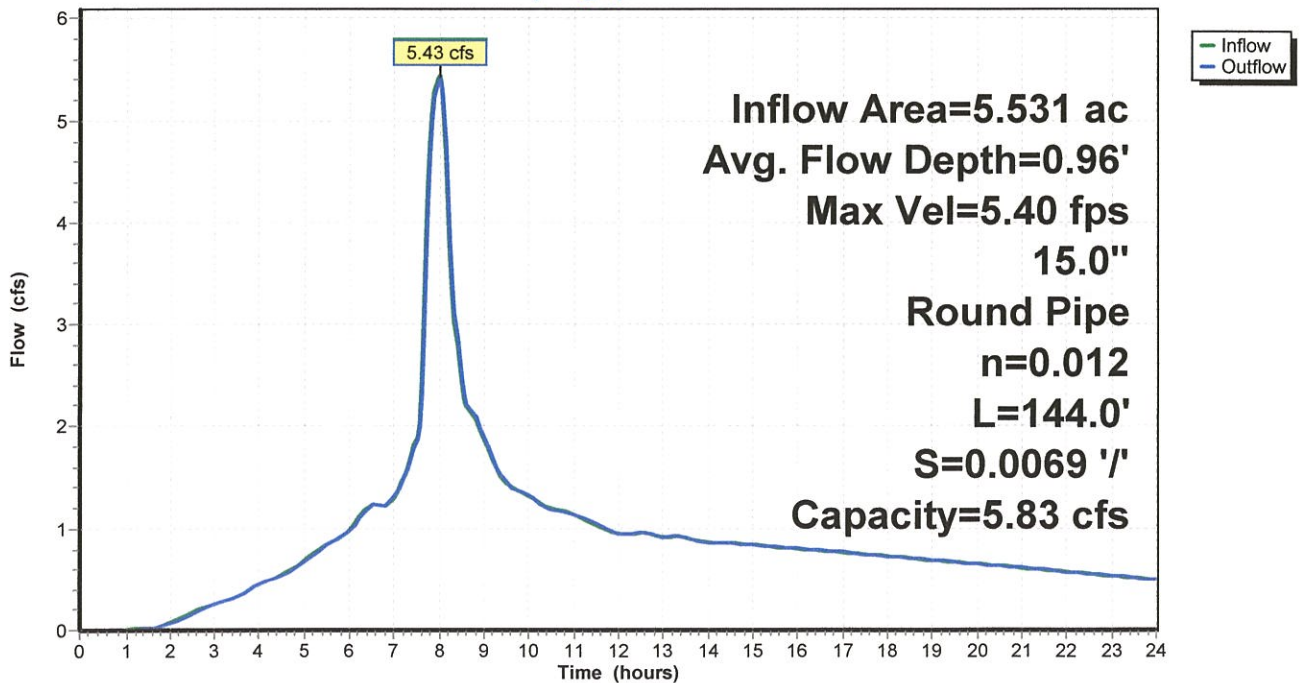Avg. Velocity = 0.28 fps, Avg. Travel Time= 10.3 min

Peak Storage= 1,657 cf @ 8.06 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 1.00' Flow Area= 12.0 sf, Capacity= 7.57 cfs

9.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 15.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 180.00', Outlet Invert= 178.25'

‡

Reach S1: Bioswale 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.83'
Max Vel=0.57 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=7.57 cfs

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Page 90
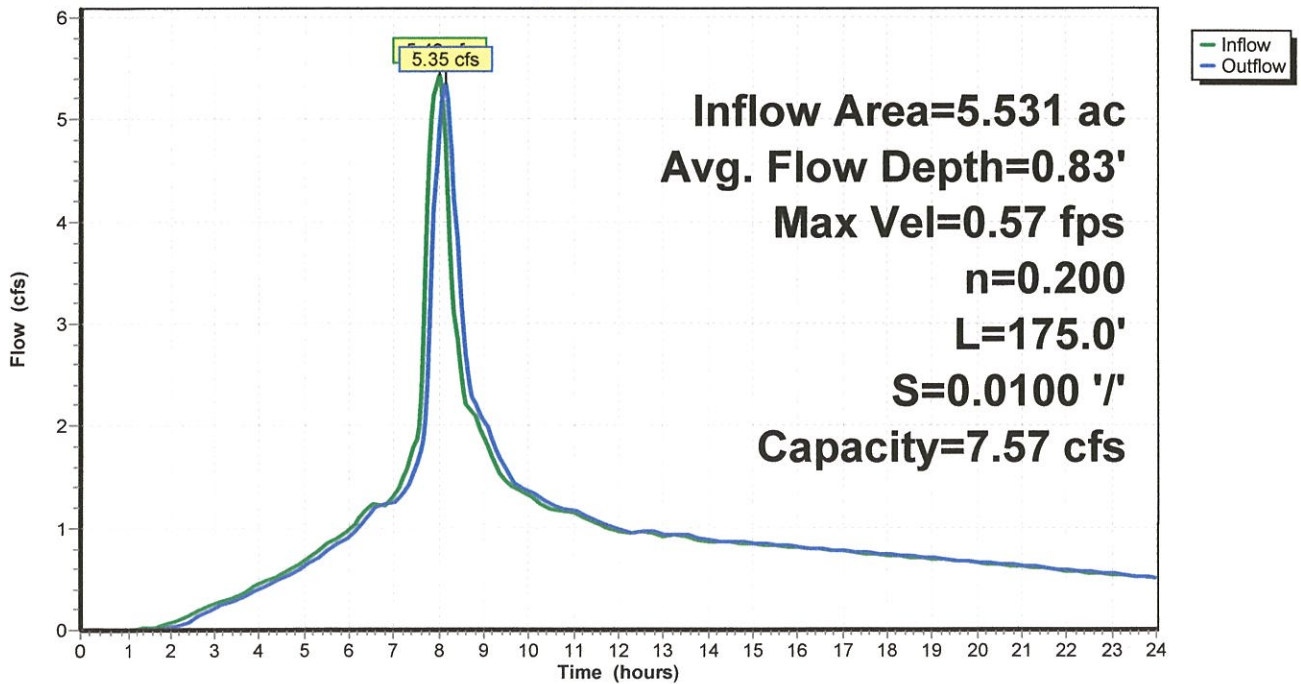
Summary for Reach S2: Bioswale 2

Inflow Area =		2.558 ac, 63.47% Impervious, Inflow Depth > 4.22" for 100-yr Storm event			
Inflow	=	2.81 cfs @	7.88 hrs, Volume=	0.899 af	
Outflow	=	2.77 cfs @	8.06 hrs, Volume=	0.892 af,	Atten= 1%, Lag= 10.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.49 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 11.2 min

Peak Storage= 983 cf @ 7.96 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 5.42 cfs

6.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 12.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 172.00', Outlet Invert= 170.25'

‡

Reach S2: Bioswale 2

Hydrograph

Inflow Area=2.558 ac
Avg. Flow Depth=0.69'
Max Vel=0.49 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=5.42 cfs

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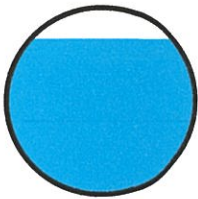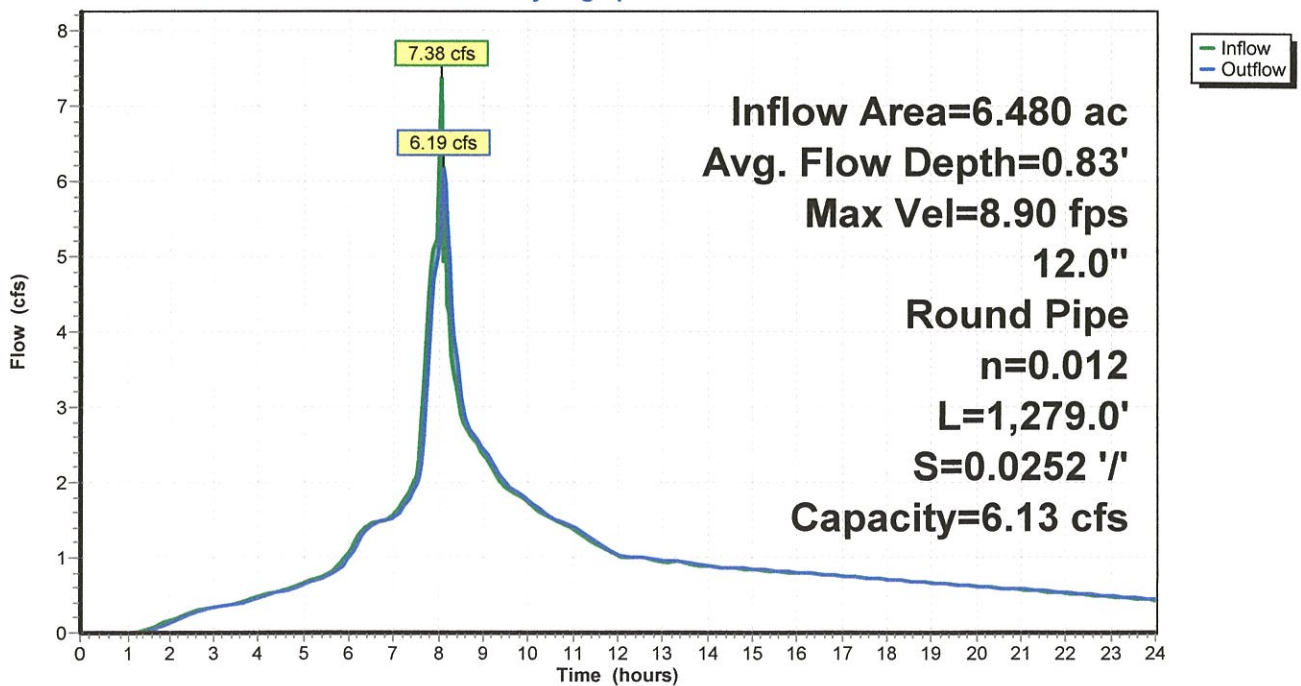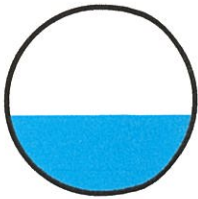Printed 4/18/2017
Page 91
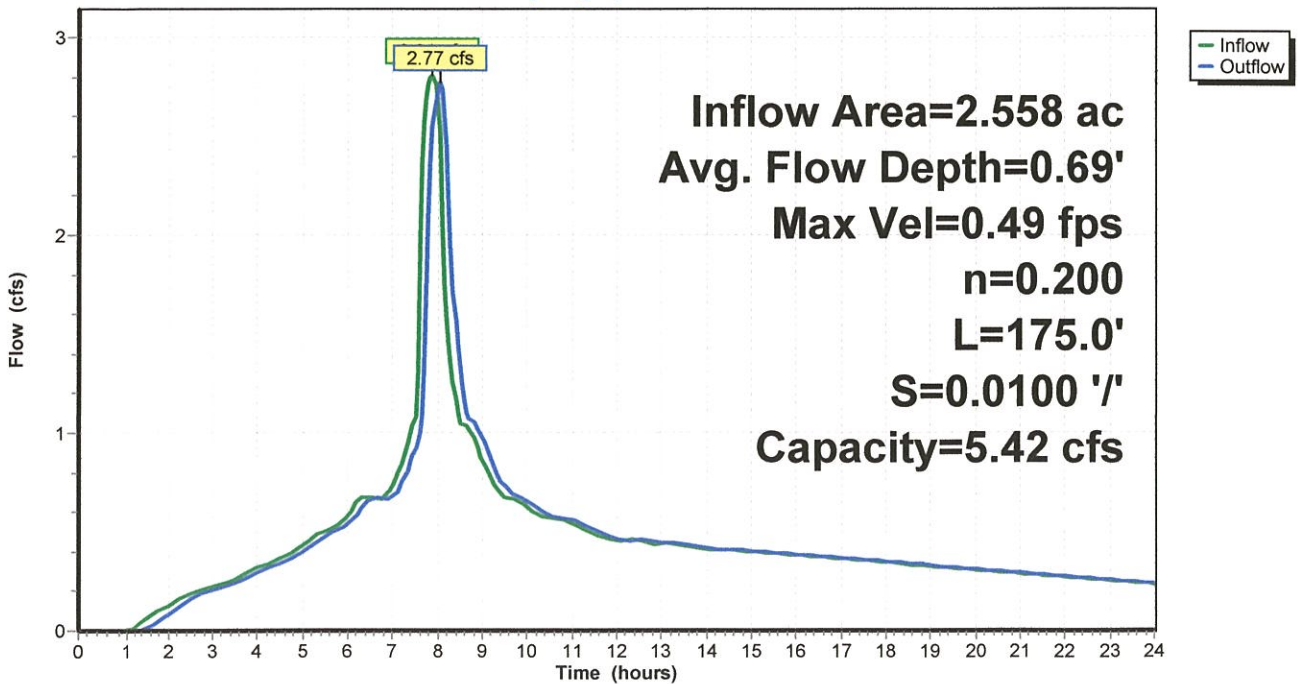
Summary for Pond 1P: Pond 1

Inflow Area =   6.658 ac, 32.88% Impervious, Inflow Depth > 3.71"   for 100-yr Storm event
Inflow   =   6.11 cfs @   8.09 hrs, Volume=   2.056 af
Outflow   =   3.26 cfs @   8.56 hrs, Volume=   1.942 af, Atten= 47%, Lag= 28.1 min
Primary   =   3.26 cfs @   8.56 hrs, Volume=   1.942 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 178.95' @ 8.56 hrs   Surf.Area= 14,584 sf   Storage= 15,597 cf

Plug-Flow detention time= 102.5 min calculated for 1.938 af (94% of inflow)
Center-of-Mass det. time= 64.4 min (790.2 - 725.8)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	16,135 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 20,019 cf Overall x 80.6% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.50	12,066	0	0	12,066
177.75	12,482	3,068	3,068	12,493
178.00	12,906	3,173	6,242	12,929
178.25	13,336	3,280	9,522	13,371
178.50	13,773	3,388	12,910	13,820
178.75	14,216	3,498	16,409	14,275
179.00	14,667	3,610	20,019	14,738

Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	**12.0" Round Culvert** L= 35.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.50' / 173.00' S= 0.1286 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	177.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.18'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.55'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.26 cfs @ 8.56 hrs HW=178.95'   (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.26 cfs @ 4.15 fps)
　├─**2=Orifice/Grate** (Passes < 1.78 cfs potential flow)
　├─**3=Orifice/Grate** (Passes < 1.12 cfs potential flow)
　└─**4=Orifice/Grate** (Passes < 3.30 cfs potential flow)

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Page 92

Pond 1P: Pond 1

Hydrograph

Inflow Area=6.658 ac
Peak Elev=178.95'
Storage=15,597 cf

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Page 93
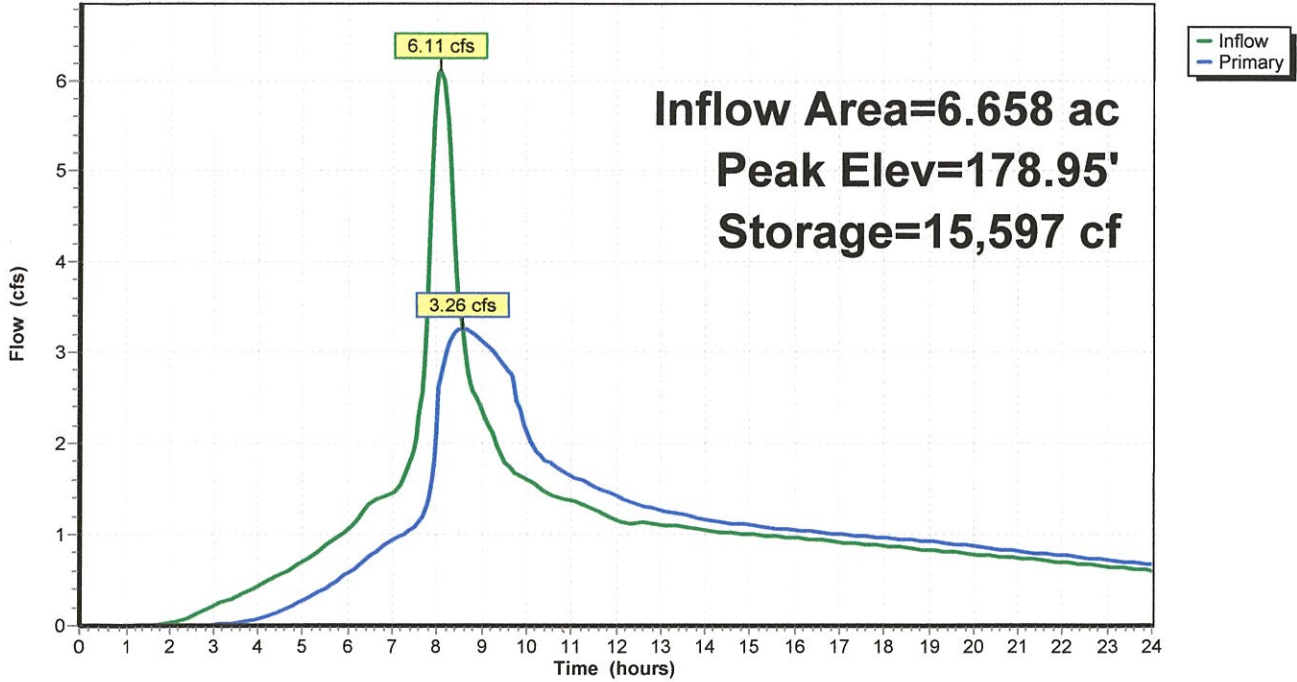
Summary for Pond 2P: Pond 2

Inflow Area =   21.380 ac, 54.76% Impervious, Inflow Depth > 2.69"   for 100-yr Storm event
Inflow   =   17.44 cfs @   8.03 hrs, Volume=   4.785 af
Outflow   =   12.35 cfs @   8.48 hrs, Volume=   4.751 af, Atten= 29%, Lag= 27.1 min
Primary   =   12.35 cfs @   8.48 hrs, Volume=   4.751 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 142.55' @ 8.48 hrs   Surf.Area= 0.103 ac   Storage= 0.508 af

Plug-Flow detention time= 22.0 min calculated for 4.741 af (99% of inflow)
Center-of-Mass det. time= 16.9 min (721.4 - 704.6)

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	0.620 af	**56.00'W x 80.00'L x 8.00'H Prismatoid** 0.823 af Overall x 75.4% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	136.00'	**24.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.00' / 135.00' S= 0.1000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	136.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	136.71'	**2.9" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	139.05'	**6.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=12.34 cfs @ 8.48 hrs HW=142.54'   (Free Discharge)
└─**1=Culvert** (Passes 12.34 cfs of 28.11 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 9.67 cfs @ 12.31 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.53 cfs @ 11.62 fps)
  └─**4=Orifice/Grate** (Orifice Controls 2.14 cfs @ 8.99 fps)
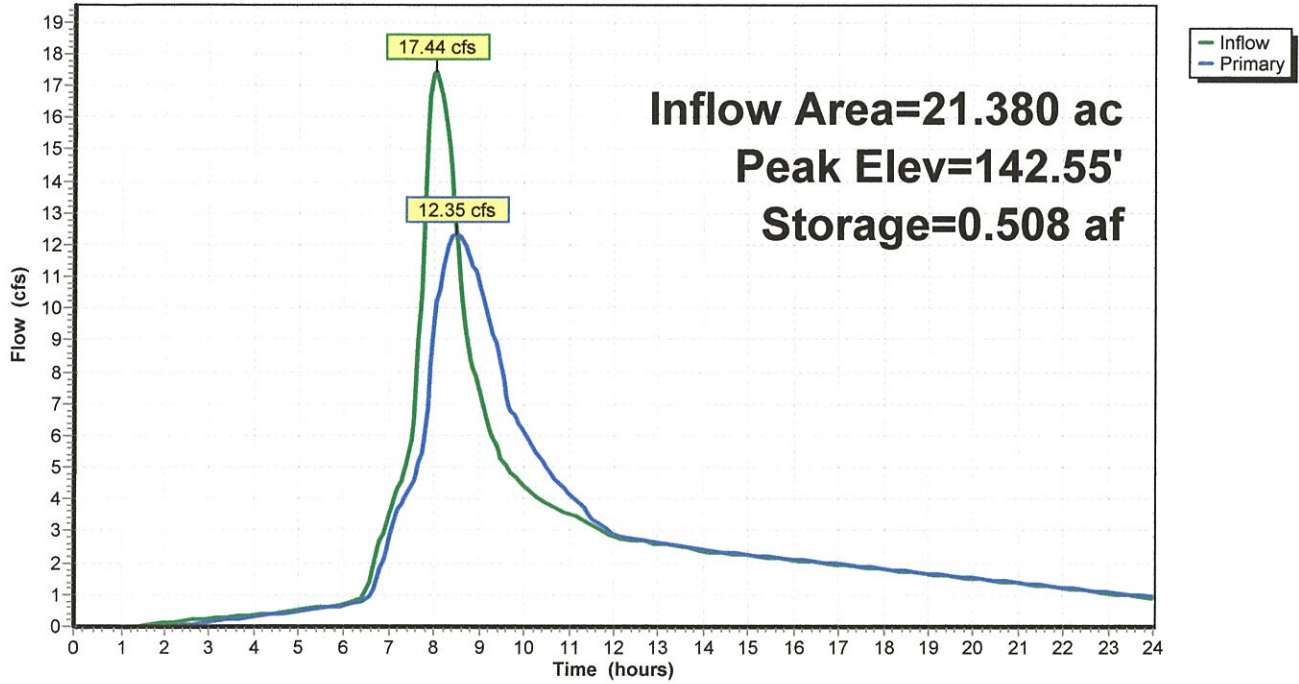
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Page 94

Pond 2P: Pond 2

Hydrograph

Inflow Area=21.380 ac
Peak Elev=142.55'
Storage=0.508 af

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Page 95

Summary for Pond BR1: Bioretention 1

Inflow Area =   17.997 ac, 56.26% Impervious, Inflow Depth > 4.10"   for 100-yr Storm event
Inflow   =   19.23 cfs @   7.96 hrs, Volume=   6.143 af
Outflow   =   15.62 cfs @   8.14 hrs, Volume=   5.558 af, Atten= 19%, Lag= 11.3 min
Discarded =   1.18 cfs @   8.14 hrs, Volume=   1.919 af
Primary   =   14.45 cfs @   8.14 hrs, Volume=   3.639 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 143.41' @ 8.14 hrs   Surf.Area= 33,260 sf   Storage= 39,584 cf

Plug-Flow detention time= 117.7 min calculated for 5.558 af (90% of inflow)
Center-of-Mass det. time= 51.6 min (745.6 - 694.1)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	8,792 cf	**50.00'W x 283.00'L x 1.50'H Prismatoid Z=1.0**
			21,979 cf Overall x 40.0% Voids
#2	141.50'	32,392 cf	**50.00'W x 283.00'L x 2.00'H Prismatoid Z=3.0**
		41,184 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	**24.0" Round Culvert**
			L= 10.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0500 '/' Cc= 0.900
			n= 0.012, Flow Area= 3.14 sf
#2	Device 1	142.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Discarded	140.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.18 cfs @ 8.14 hrs HW=143.41'   (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 1.18 cfs)

Primary OutFlow Max=14.44 cfs @ 8.14 hrs HW=143.41'   (Free Discharge)
└─**1=Culvert** (Passes 14.44 cfs of 18.54 cfs potential flow)
   └─**2=Orifice/Grate** (Orifice Controls 14.44 cfs @ 4.60 fps)

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Page 96

Pond BR1: Bioretention 1

Hydrograph

Inflow Area=17.997 ac
Peak Elev=143.41'
Storage=39,584 cf

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Page 98

Pond BR2: Bioretention 2

Hydrograph

Inflow Area=2.390 ac
Peak Elev=165.29'
Storage=6,119 cf

Water Quality Event

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 21

B1 — North Basin
B2 — Tract A
O1 — Adj Parcel (E)
P1 — Pipe 1
O3 — OPH North
S1 — Bioswale 1
O2 — Adj Parcel (N)
1P — Pond 1

A B1 — Apt Basin 1
A B2 — Apt Basin 2
A B3 — Apt Basin 3
S2 — Bioswale 2
BR2 — Bioretention 2
A B4 — Apt Basin 4
P2 — Pipe 2

B3 — Central Basin
B4 — South Basin
B6 — Open Space
B7 — Cul-de-Sac
B8 — 11th Street
B9 — 13th Homes
P3 — Pipe 3
P4 — Pipe 4
BR1 — Bioretention 1
A B5 — Apt Basin 5
2P — Pond 2
B5 — Pond Area
B8WQ — 11th Street
BR3 — Bioretention 3

Subcat Reach Pond Link

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.722	80	Landscaping (B7)
1.048	85	Pasture (HSG C) (O2)
2.111	86	Landscaping (B1)
0.511	86	Lawn (HSG C) (B2, O1)
6.852	88	Landscaping (B3, B8, B9)
8.192	90	Landscaping (A B1, A B2, A B3, A B4, A B5, B4, B5, B6)
0.766	90	Lawn (HSG D) (O1)
0.034	91	Driveway (O1)
3.027	98	Buildings (A B4, A B5, B9)
0.514	98	Homes & DW (B7)
0.184	98	Houses (B8)
13.780	98	Impervious (B1, B3, B4, B5, B8WQ)
0.080	98	Impervious OPH (O2)
3.412	98	Pavement (A B1, A B2, A B3, O3)
0.024	98	Pavement & Structures (O1)
0.555	98	Road & SW (B7)
1.162	98	Roads & DW (B8)
0.278	100	Pond (B1)

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Page 3

Summary for Subcatchment A B1: Apt Basin 1

Runoff   =   0.78 cfs @   7.92 hrs, Volume=   0.251 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	70,725	98	Pavement
*	40,704	90	Landscaping
	111,429	95	Weighted Average
	40,704		36.53% Pervious Area
	70,725		63.47% Impervious Area

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

Subcatchment A B1: Apt Basin 1

Hydrograph

Summary for Subcatchment A B2: Apt Basin 2

Runoff   =   0.32 cfs @   7.92 hrs, Volume=   0.101 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	26,871	98	Pavement
*	17,952	90	Landscaping
	44,823	95	Weighted Average
	17,952		40.05% Pervious Area
	26,871		59.95% Impervious Area

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

Subcatchment A B2: Apt Basin 2

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=44,823 sf
Runoff Volume=0.101 af
Runoff Depth>1.18"
Tc=6.0 min
CN=95

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Page 5

Summary for Subcatchment A B3: Apt Basin 3

Runoff   =   0.45 cfs @   7.91 hrs, Volume=   0.143 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	43,562	98	Pavement
*	15,740	90	Landscaping
	59,302	96	Weighted Average
	15,740		26.54% Pervious Area
	43,562		73.46% Impervious Area

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

Subcatchment A B3: Apt Basin 3

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=59,302 sf
Runoff Volume=0.143 af
Runoff Depth>1.26"
Tc=6.0 min
CN=96

0.45 cfs

Summary for Subcatchment A B4: Apt Basin 4

Runoff   =   0.47 cfs @   7.92 hrs, Volume=   0.150 af, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	43,680	98	Buildings
*	23,018	90	Landscaping
	66,698	95	Weighted Average
	23,018		34.51% Pervious Area
	43,680		65.49% Impervious Area

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

Subcatchment A B4: Apt Basin 4

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=66,698 sf
Runoff Volume=0.150 af
Runoff Depth>1.18"
Tc=6.0 min
CN=95

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 7

Summary for Subcatchment A B5: Apt Basin 5

Runoff   =   0.34 cfs @   7.94 hrs, Volume=   0.111 af, Depth> 1.02"
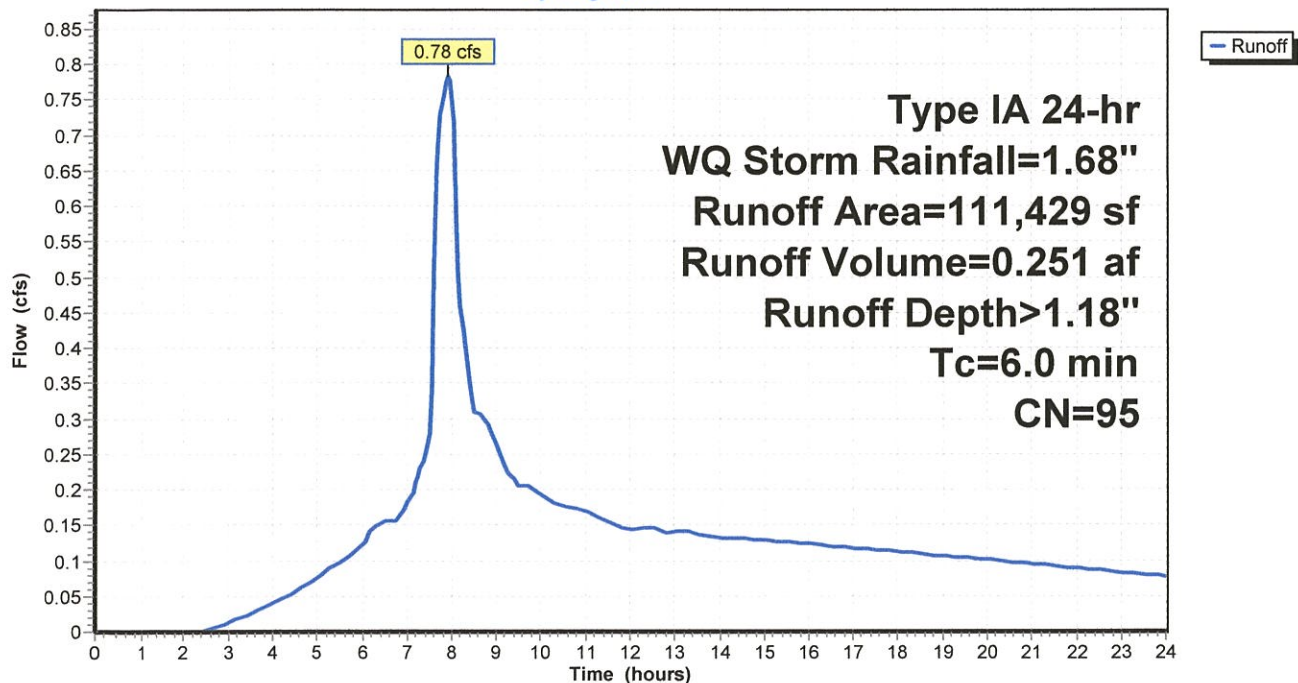
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	24,194	98	Buildings
*	32,440	90	Landscaping
	56,634	93	Weighted Average
	32,440		57.28% Pervious Area
	24,194		42.72% Impervious Area

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

Subcatchment A B5: Apt Basin 5

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=56,634 sf
Runoff Volume=0.111 af
Runoff Depth>1.02"
Tc=6.0 min
CN=93

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Page 8

Summary for Subcatchment B1: North Basin

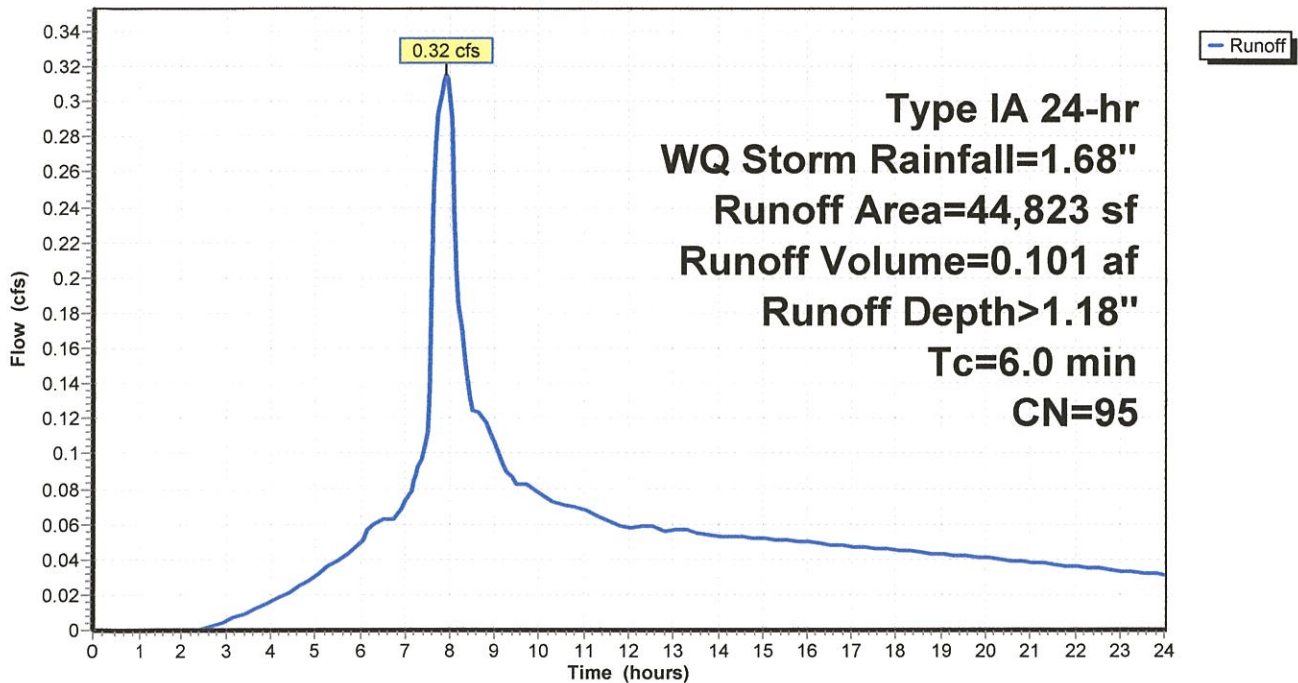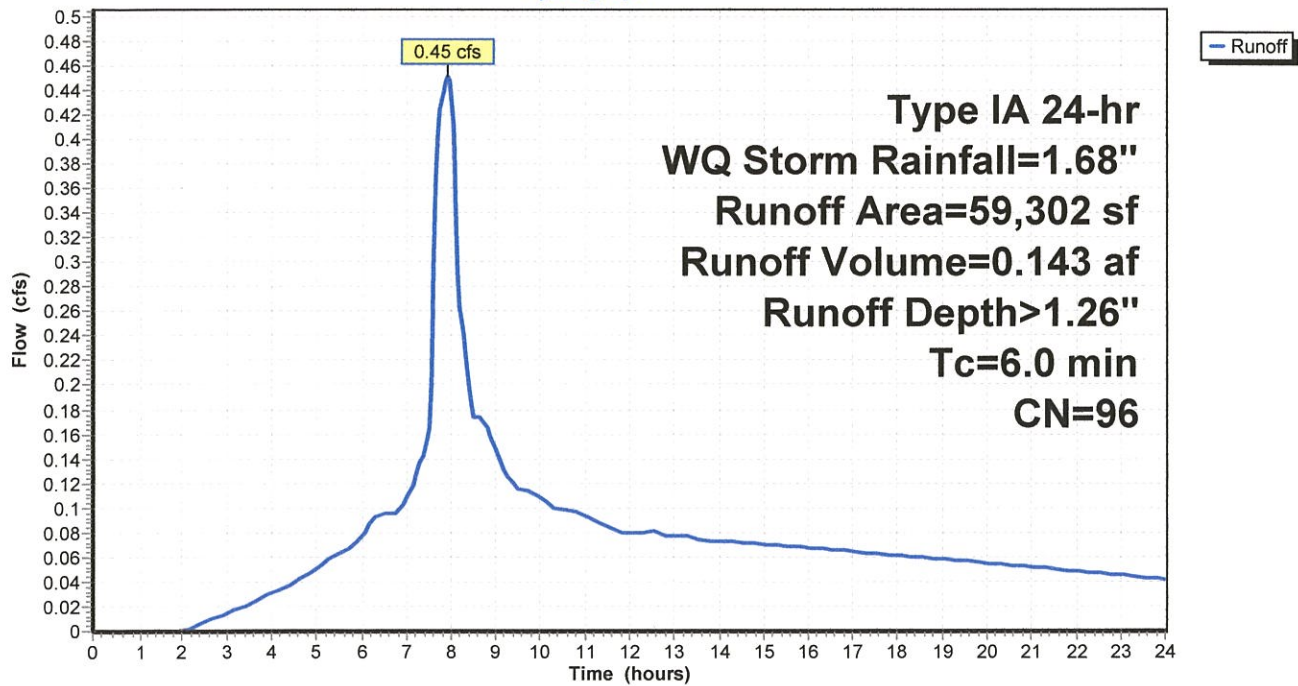Runoff   =   0.93 cfs @   8.03 hrs, Volume=   0.319 af, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

Area (sf)	CN	Description
* 91,945	86	Landscaping
* 71,271	98	Impervious
* 12,103	100	Pond
175,319	92	Weighted Average
91,945		52.44% Pervious Area
83,374		47.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	190	0.0950	0.32		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"
0.1	22	0.2500	3.50		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
1.7	107	0.0230	1.06		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
0.9	144	0.0070	2.59	0.51	**Pipe Channel, Pipe** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.012
12.6	463	Total			

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 9

Subcatchment B1: North Basin

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=175,319 sf
Runoff Volume=0.319 af
Runoff Depth>0.95"
Flow Length=463'
Tc=12.6 min
CN=92

0.93 cfs

— Runoff

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Page 10

Summary for Subcatchment B2: Tract A

Runoff   =   0.01 cfs @   7.99 hrs, Volume=   0.003 af, Depth> 0.61"
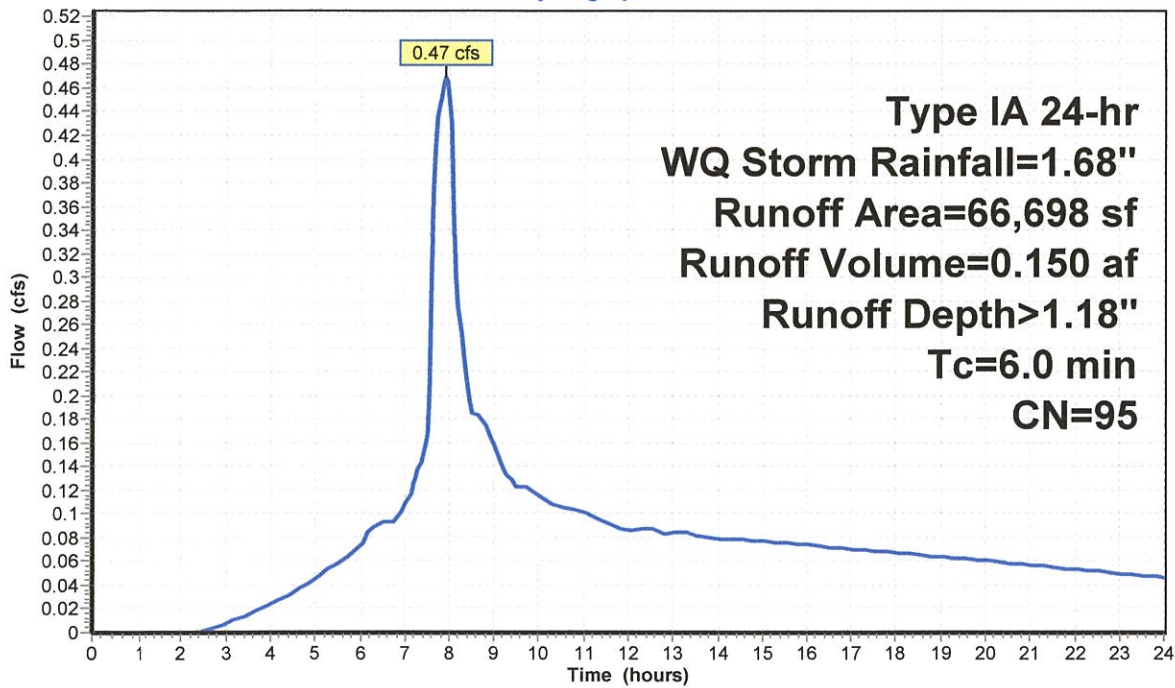
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	2,783	86	Lawn (HSG C)
	2,783		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.4	109	0.0910	0.28		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"

Subcatchment B2: Tract A

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=2,783 sf
Runoff Volume=0.003 af
Runoff Depth>0.61"
Flow Length=109'
Slope=0.0910 '/'
Tc=6.4 min
CN=86

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 11

Summary for Subcatchment B3: Central Basin

Runoff   =   2.68 cfs @   7.96 hrs, Volume=   0.874 af, Depth> 1.10"
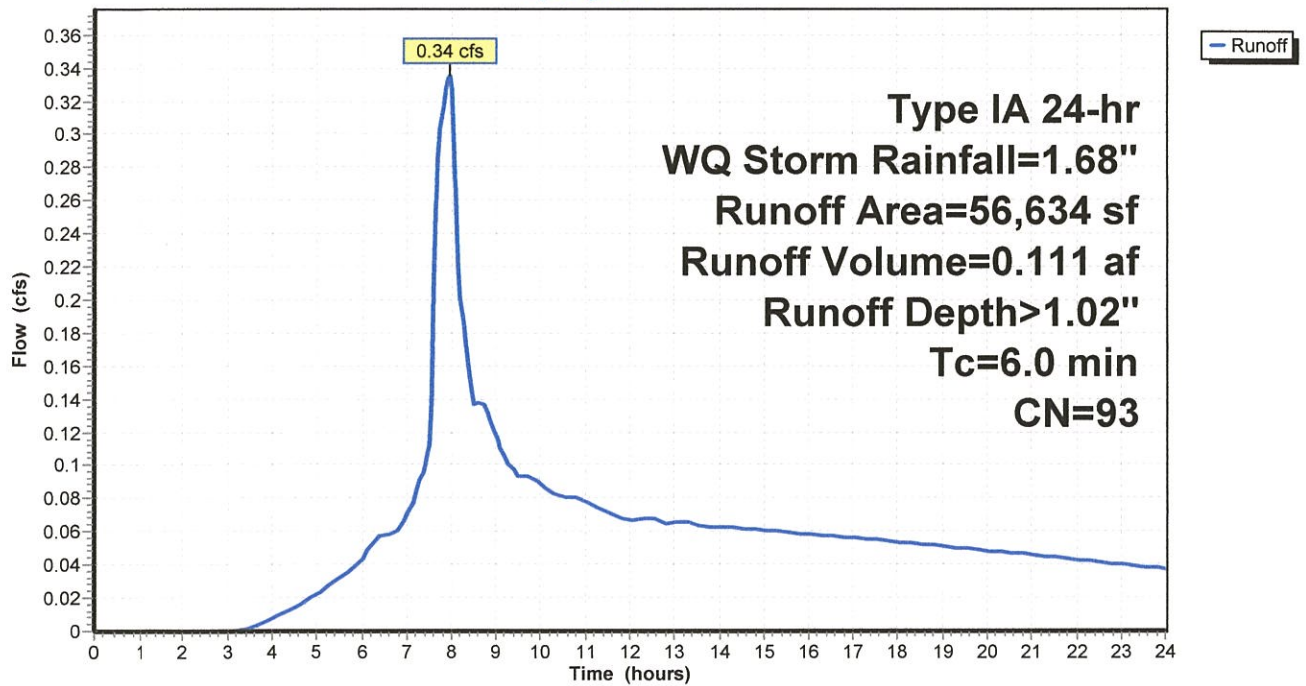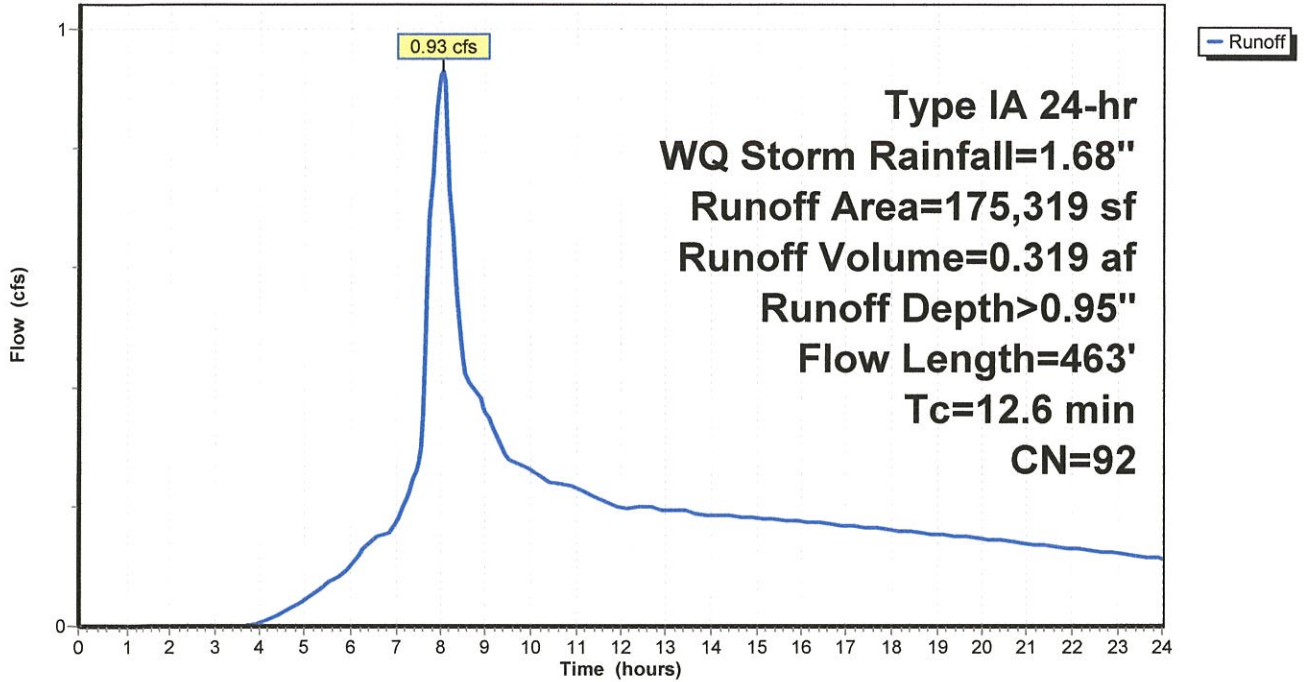
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	240,948	98	Impervious
*	175,358	88	Landscaping
	416,306	94	Weighted Average
	175,358		42.12% Pervious Area
	240,948		57.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow**
					Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter**
					Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B3: Central Basin

**Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=416,306 sf
Runoff Volume=0.874 af
Runoff Depth>1.10"
Flow Length=225'
Tc=7.6 min
CN=94**

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 12

Summary for Subcatchment B4: South Basin

Runoff   =   2.37 cfs @   7.96 hrs, Volume=   0.772 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	200,131	98	Impervious
*	167,521	90	Landscaping
	367,652	94	Weighted Average
	167,521		45.57% Pervious Area
	200,131		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0600	0.24		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.0360	3.85		**Shallow Concentrated Flow, Gutter** Paved Kv= 20.3 fps
7.6	225	Total			

Subcatchment B4: South Basin

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=367,652 sf
Runoff Volume=0.772 af
Runoff Depth>1.10"
Flow Length=225'
Tc=7.6 min
CN=94

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 13

Summary for Subcatchment B5: Pond Area

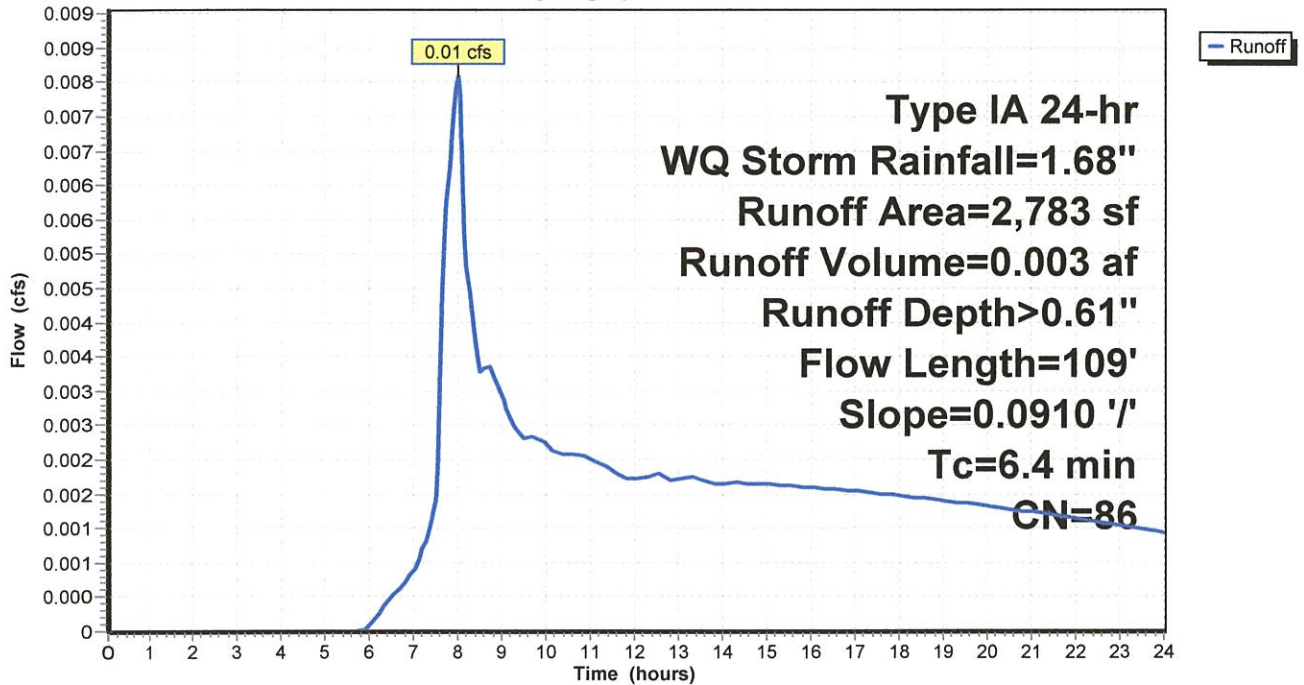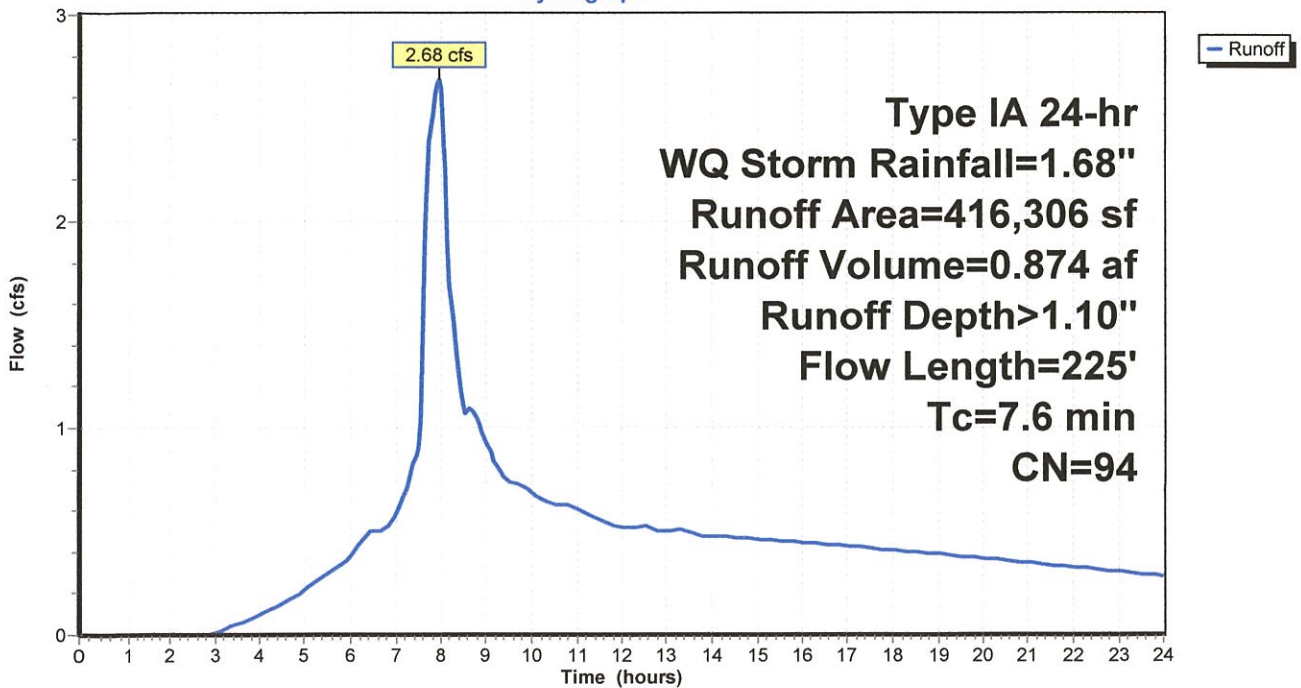Runoff   =   0.59 cfs @   7.93 hrs, Volume=   0.191 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	44,675	98	Impervious
*	46,045	90	Landscaping
	90,720	94	Weighted Average
	46,045		50.76% Pervious Area
	44,675		49.24% Impervious Area

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

Subcatchment B5: Pond Area

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=90,720 sf
Runoff Volume=0.191 af
Runoff Depth>1.10"
Tc=6.0 min
CN=94

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 14

Summary for Subcatchment B6: Open Space

Runoff   =   0.06 cfs @   7.98 hrs, Volume=   0.021 af, Depth> 0.83"
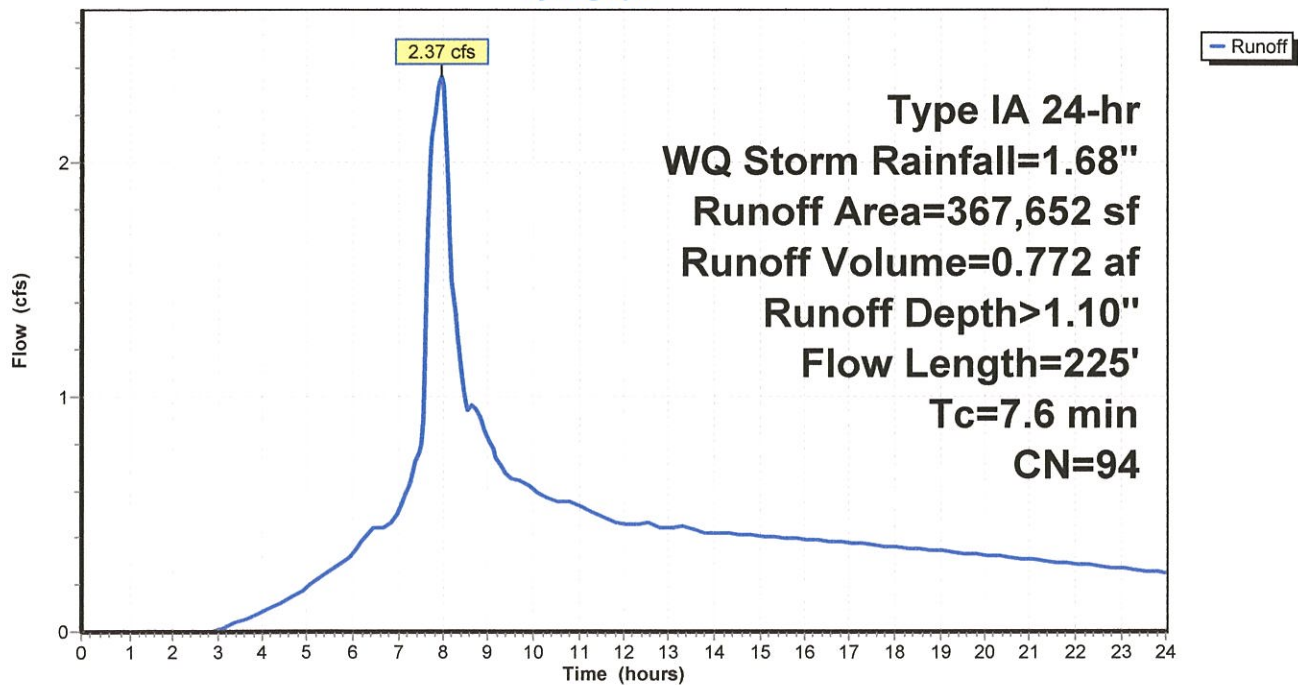
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	13,411	90	Landscaping
	13,411		100.00% Pervious Area

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

Subcatchment B6: Open Space

Hydrograph

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 15

Summary for Subcatchment B7: Cul-de-Sac

Runoff   =   0.40 cfs @   7.99 hrs, Volume=   0.154 af, Depth> 0.66"
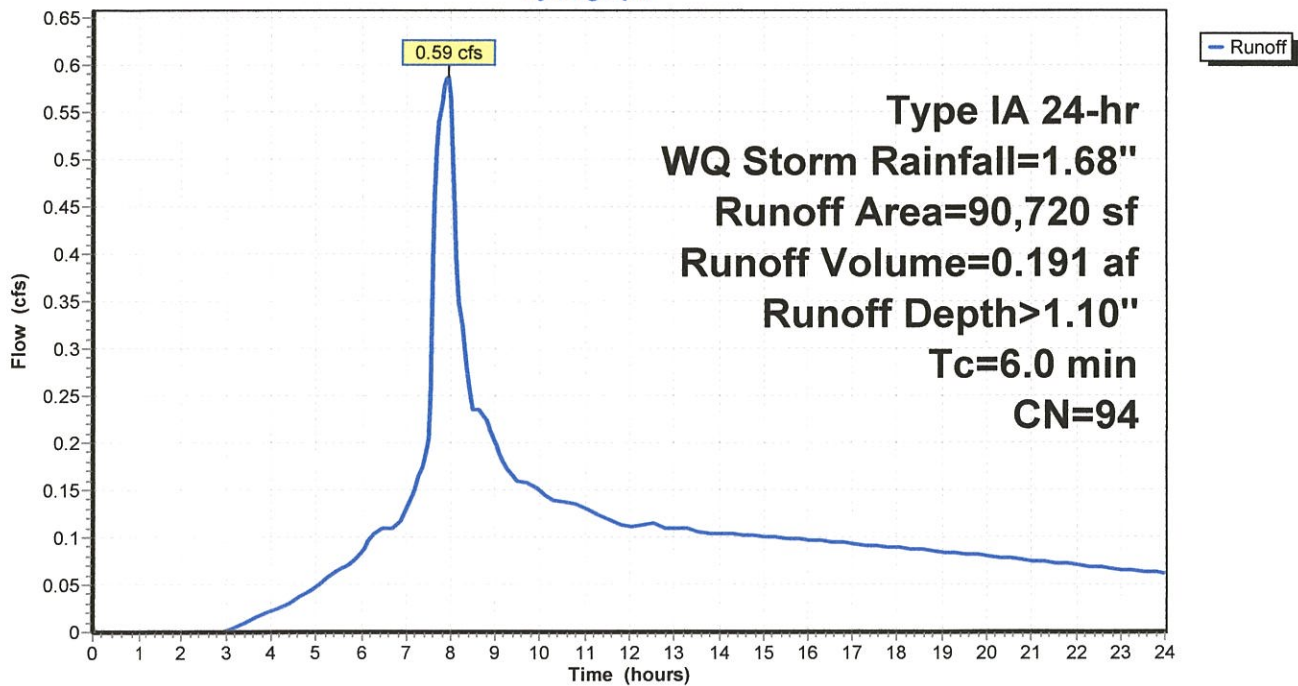
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	75,014	80	Landscaping
*	24,170	98	Road & SW
*	22,400	98	Homes & DW
	121,584	87	Weighted Average
	75,014		61.70% Pervious Area
	46,570		38.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Swale 1**

Subcatchment B7: Cul-de-Sac

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=121,584 sf
Runoff Volume=0.154 af
Runoff Depth>0.66"
Tc=6.0 min
CN=87

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 16

Summary for Subcatchment B8: 11th Street

Runoff   =   0.69 cfs @   7.94 hrs, Volume=   0.229 af, Depth> 1.02"
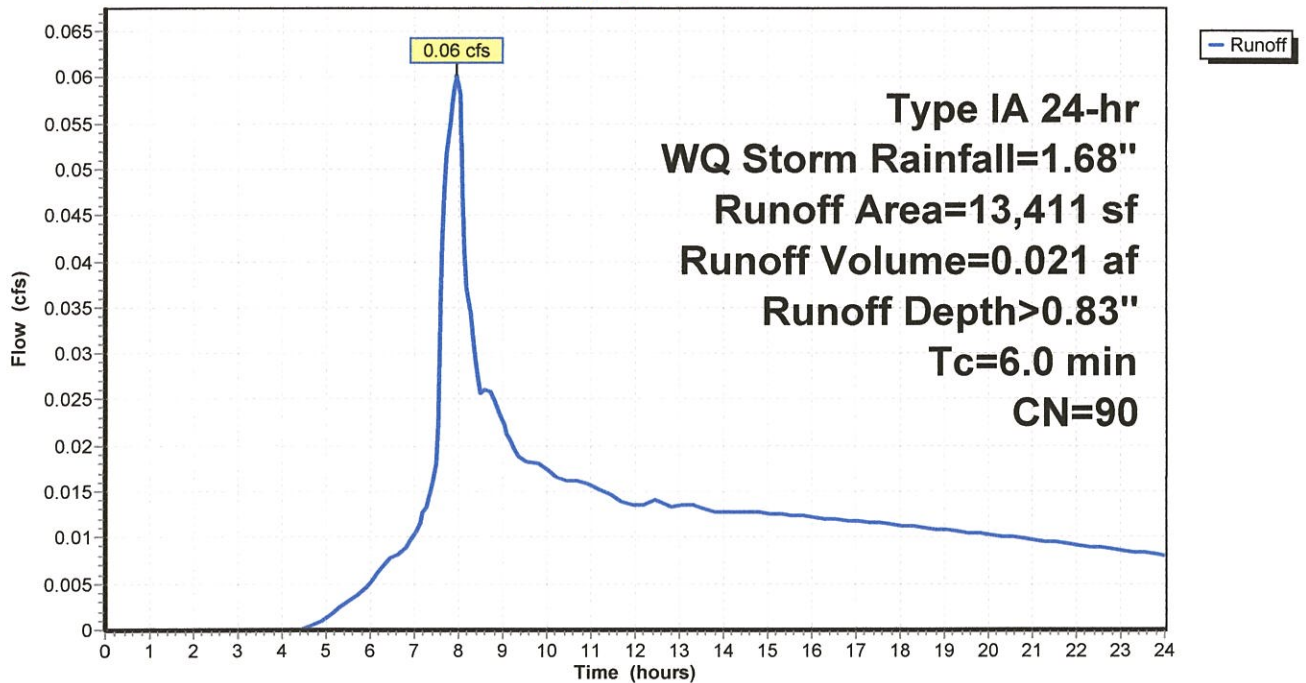
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	58,285	88	Landscaping
*	50,605	98	Roads & DW
*	8,000	98	Houses
	116,890	93	Weighted Average
	58,285		49.86% Pervious Area
	58,605		50.14% Impervious Area

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

Subcatchment B8: 11th Street

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=116,890 sf
Runoff Volume=0.229 af
Runoff Depth>1.02"
Tc=6.0 min
CN=93

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 17

Summary for Subcatchment B8WQ: 11th Street

Runoff   =   0.38 cfs @   7.88 hrs, Volume=   0.120 af, Depth> 1.46"
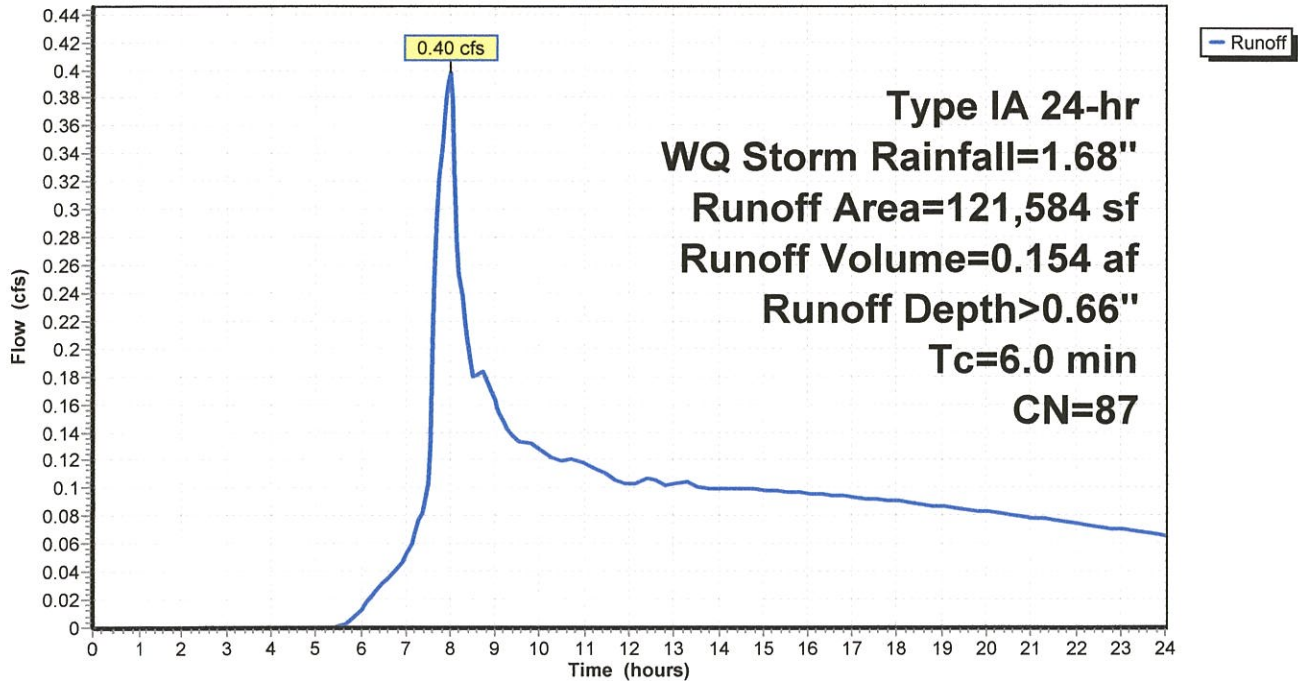
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	43,245	98	Impervious
	43,245		100.00% Impervious Area

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

Subcatchment B8WQ: 11th Street

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Type IA 24-hr WQ Storm Rainfall=1.68"
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Page 18

Summary for Subcatchment B9: 13th Homes

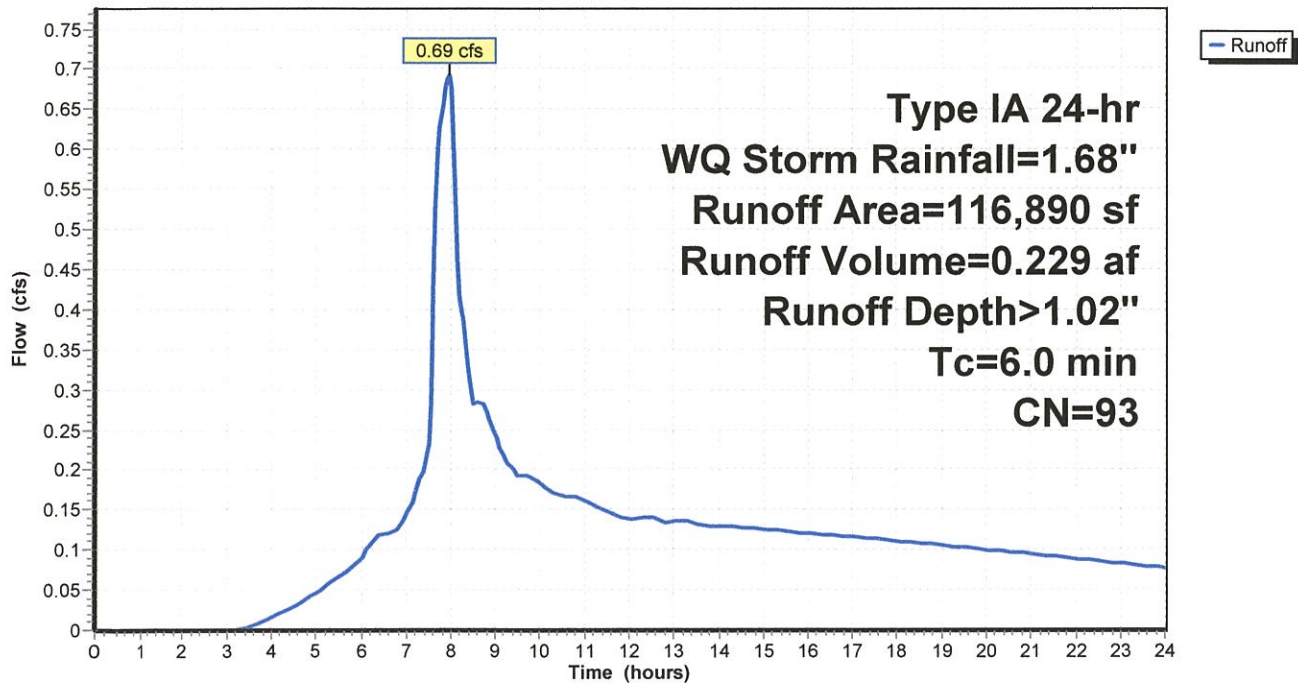Runoff   =   0.76 cfs @   7.94 hrs, Volume=   0.252 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	64,850	88	Landscaping
*	64,000	98	Buildings
	128,850	93	Weighted Average
	64,850		50.33% Pervious Area
	64,000		49.67% Impervious Area

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

Subcatchment B9: 13th Homes

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=128,850 sf
Runoff Volume=0.252 af
Runoff Depth>1.02"
Tc=6.0 min
CN=93

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Page 19

Summary for Subcatchment O1: Adj Parcel (E)

Runoff   =   0.22 cfs @   8.05 hrs, Volume=   0.081 af, Depth> 0.76"
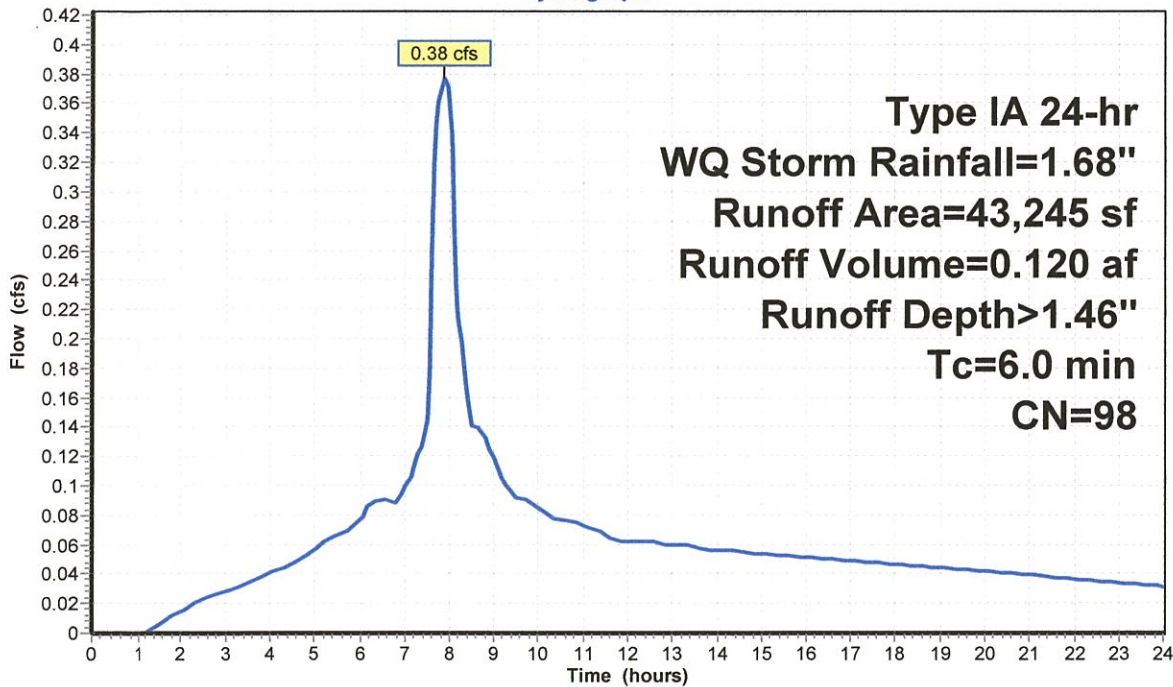
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	33,382	90	Lawn (HSG D)
*	19,461	86	Lawn (HSG C)
*	1,042	98	Pavement & Structures
*	1,463	91	Driveway
	55,348	89	Weighted Average
	54,306		98.12% Pervious Area
	1,042		1.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	258	0.0850	0.33		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"

Subcatchment O1: Adj Parcel (E)

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=55,348 sf
Runoff Volume=0.081 af
Runoff Depth>0.76"
Flow Length=258'
Slope=0.0850 '/'
Tc=13.2 min
CN=89

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Page 20

Summary for Subcatchment O2: Adj Parcel (N)

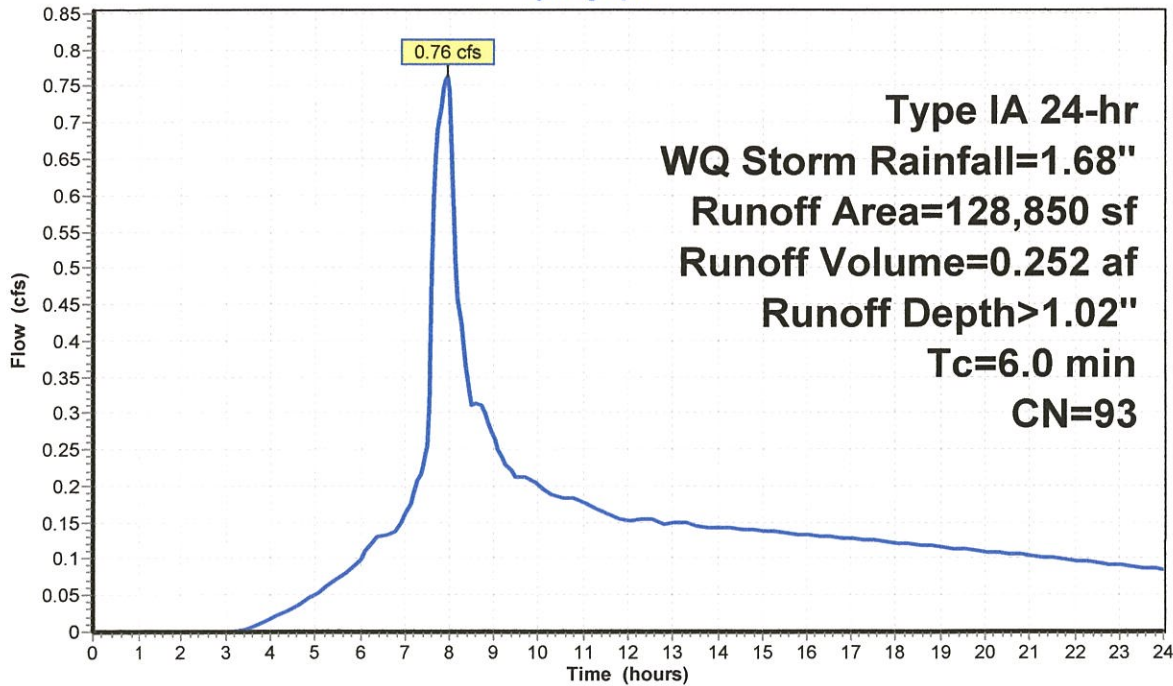Runoff   =   0.14 cfs @   8.01 hrs, Volume=   0.058 af, Depth> 0.61"
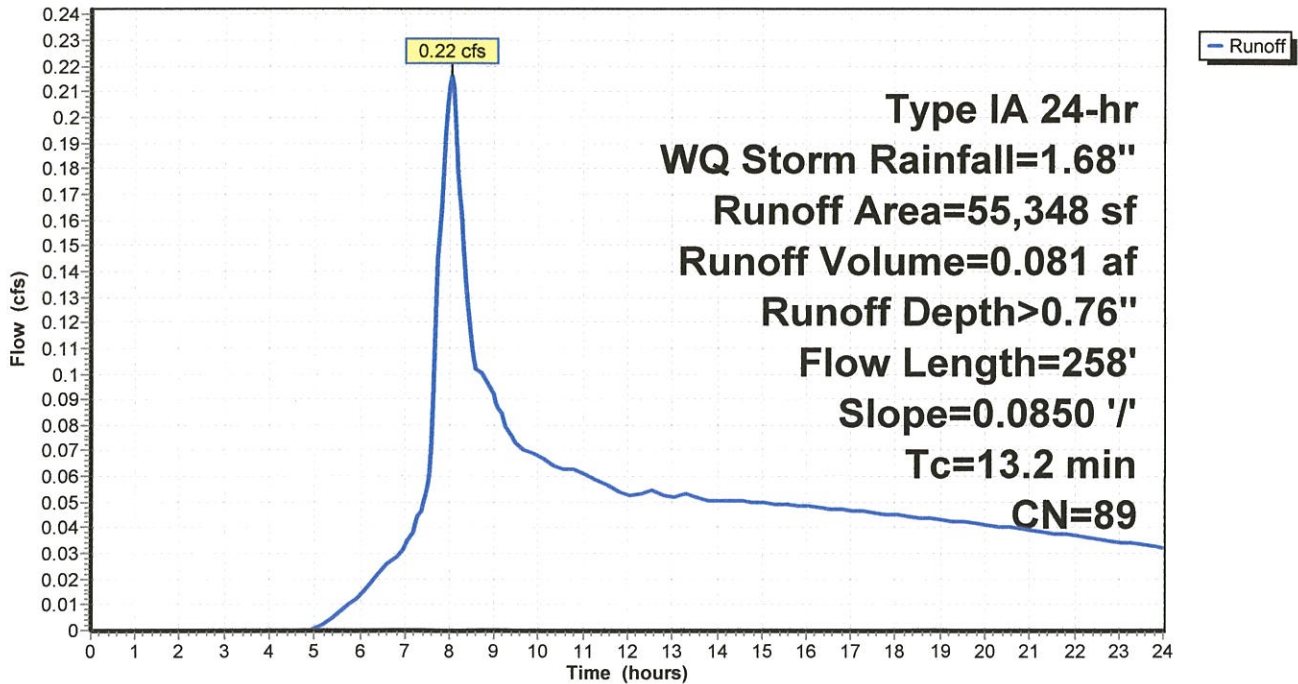
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	45,658	85	Pasture (HSG C)
*	3,471	98	Impervious OPH
	49,129	86	Weighted Average
	45,658		92.93% Pervious Area
	3,471		7.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	300	0.5000	0.68		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.54"
0.5	125	0.3000	3.83		**Shallow Concentrated Flow, Shallow** Short Grass Pasture Kv= 7.0 fps
7.8	425	Total			

Subcatchment O2: Adj Parcel (N)

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=49,129 sf
Runoff Volume=0.058 af
Runoff Depth>0.61"
Flow Length=425'
Tc=7.8 min
CN=86

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Page 21

Summary for Subcatchment O3: OPH North

Runoff   =   0.07 cfs @   7.88 hrs, Volume=   0.021 af, Depth> 1.46"
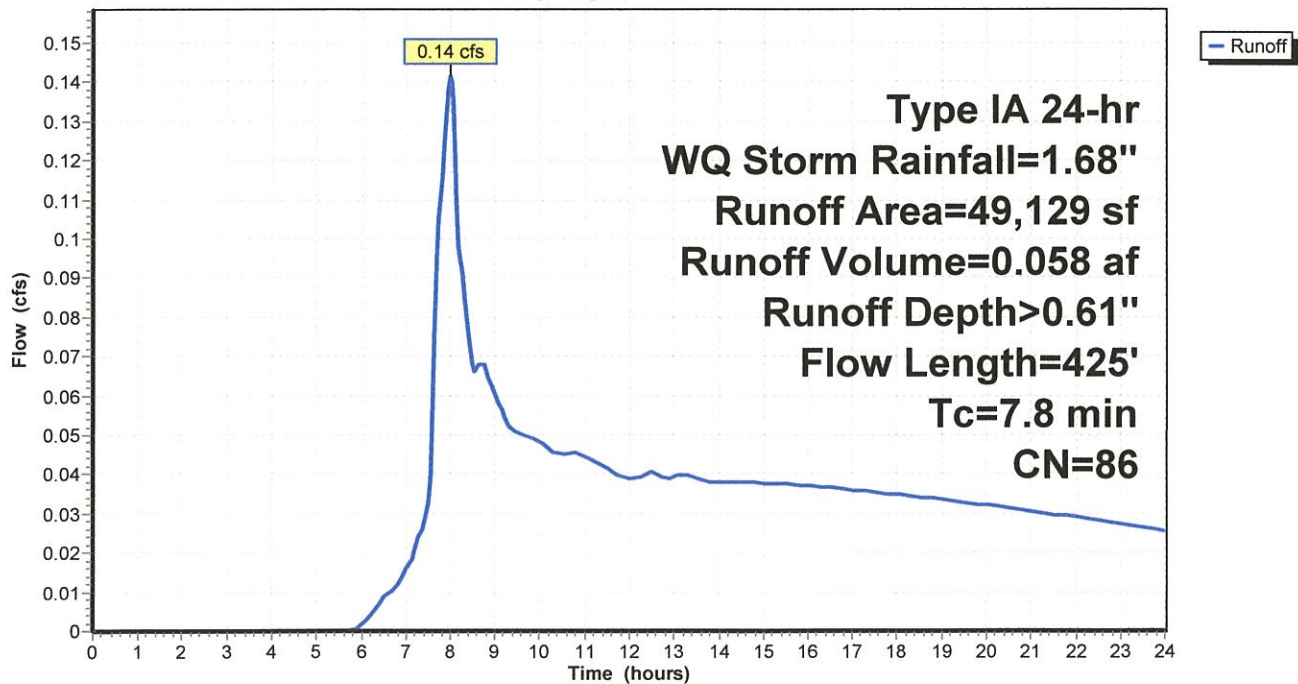
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IA 24-hr WQ Storm Rainfall=1.68"

	Area (sf)	CN	Description
*	7,465	98	Pavement
	7,465		100.00% Impervious Area

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

Subcatchment O3: OPH North

Hydrograph

Type IA 24-hr
WQ Storm Rainfall=1.68"
Runoff Area=7,465 sf
Runoff Volume=0.021 af
Runoff Depth>1.46"
Tc=6.0 min
CN=98

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Page 22
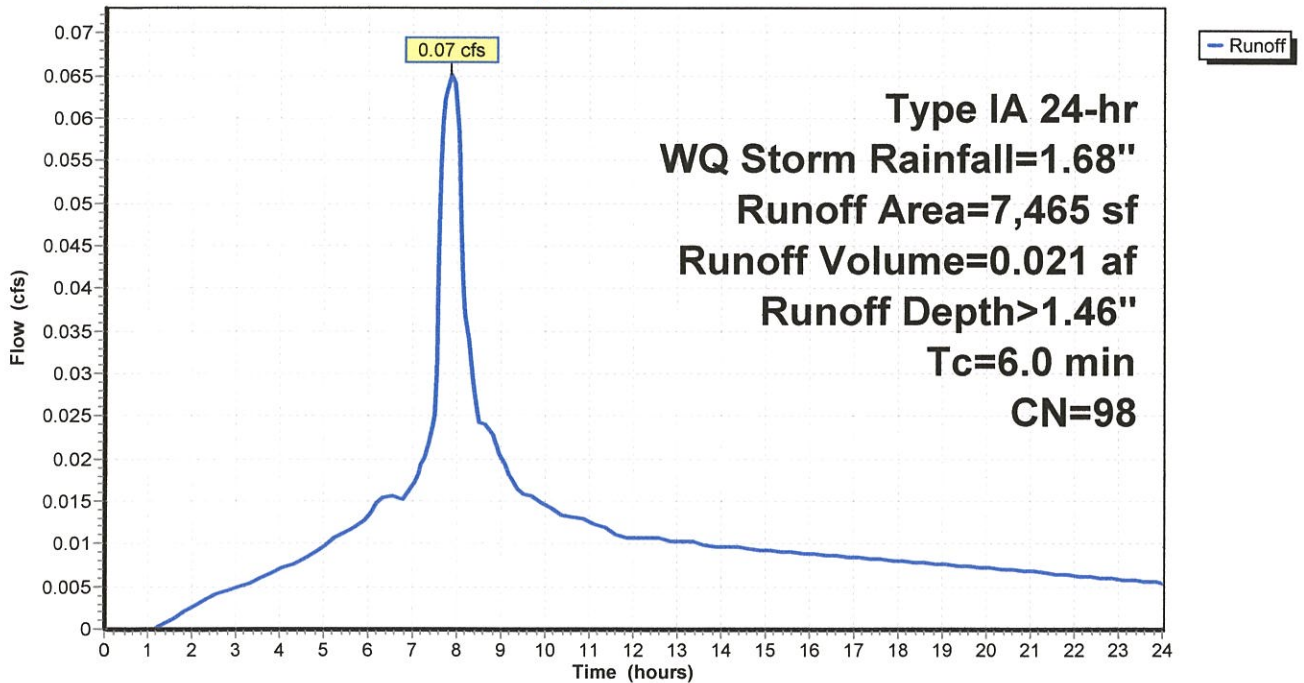
Summary for Reach P1: Pipe 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 0.92"   for WQ Storm event
Inflow   =   1.21 cfs @   8.03 hrs, Volume=   0.424 af
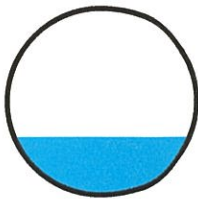Outflow   =   1.21 cfs @   8.04 hrs, Volume=   0.423 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.75 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 1.1 min

Peak Storage= 47 cf @ 8.03 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.83 cfs

15.0" Round Pipe
n= 0.012
Length= 144.0'   Slope= 0.0069 '/'
Inlet Invert= 181.00', Outlet Invert= 180.00'

Reach P1: Pipe 1

Hydrograph

Inflow Area=5.531 ac
Avg. Flow Depth=0.39'
Max Vel=3.75 fps
15.0"
Round Pipe
n=0.012
L=144.0'
S=0.0069 '/'
Capacity=5.83 cfs

1.21 cfs

Flow (cfs)

Time (hours)

Inflow
Outflow

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Page 23

Summary for Reach P2: Pipe 2

Inflow Area =   6.480 ac, 65.49% Impervious, Inflow Depth > 0.74"   for WQ Storm event
Inflow   =   1.16 cfs @   8.03 hrs, Volume=   0.398 af
Outflow   =   1.13 cfs @   8.13 hrs, Volume=   0.397 af, Atten= 2%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.97 fps, Min. Travel Time= 3.6 min
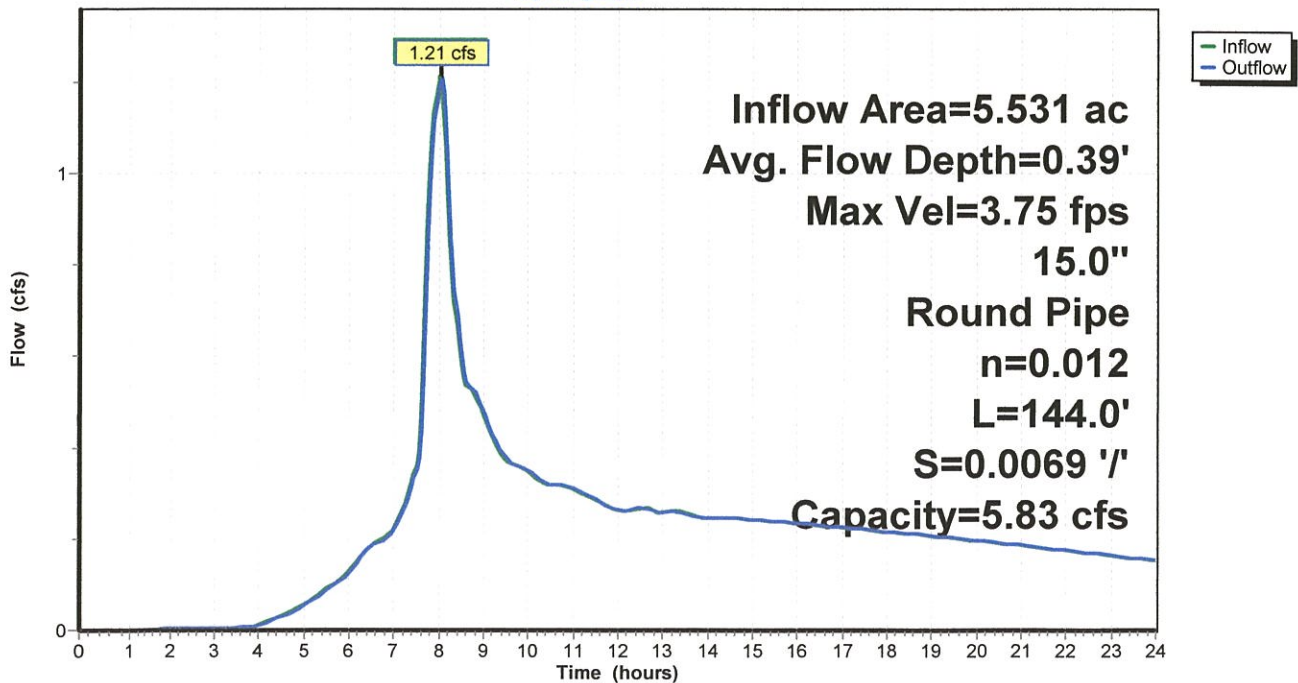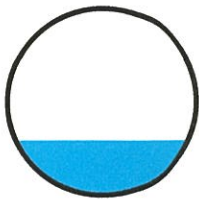Avg. Velocity = 3.50 fps, Avg. Travel Time= 6.1 min

Peak Storage= 244 cf @ 8.07 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 6.13 cfs

12.0" Round Pipe
n= 0.012
Length= 1,279.0' Slope= 0.0252 '/'
Inlet Invert= 170.25', Outlet Invert= 138.00'

Reach P2: Pipe 2

Hydrograph

Inflow Area=6.480 ac
Avg. Flow Depth=0.29'
Max Vel=5.97 fps
12.0"
Round Pipe
n=0.012
L=1,279.0'
S=0.0252 '/'
Capacity=6.13 cfs

1.13 cfs

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Page 24

Summary for Reach P3: Pipe 3

Inflow Area =   9.557 ac, 57.88% Impervious, Inflow Depth >   1.10"   for WQ Storm event
Inflow   =   2.68 cfs @   7.96 hrs, Volume=   0.874 af
Outflow   =   2.67 cfs @   8.01 hrs, Volume=   0.871 af, Atten= 0%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.03 fps, Min. Travel Time= 2.2 min
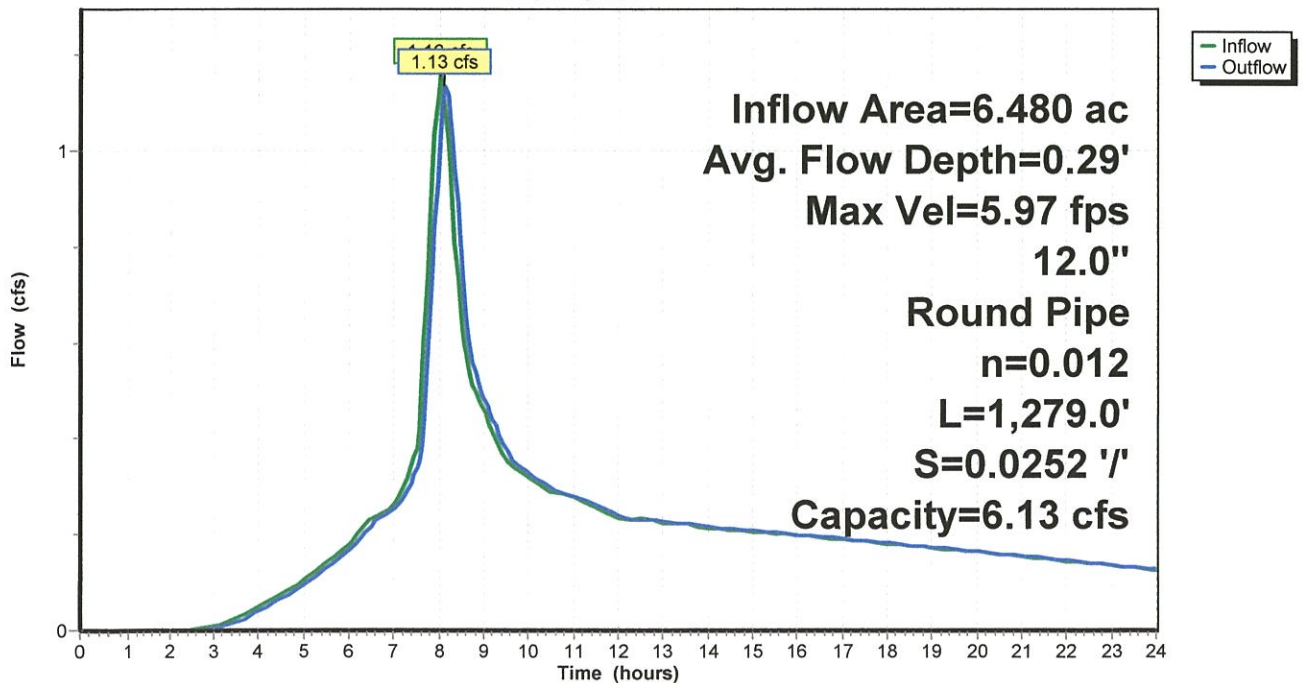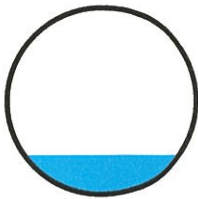Avg. Velocity = 4.65 fps, Avg. Travel Time= 3.7 min

Peak Storage= 346 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.67' Flow Area= 2.2 sf, Capacity= 27.69 cfs

20.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'

Reach P3: Pipe 3

Hydrograph

Inflow Area=9.557 ac
Avg. Flow Depth=0.35'
Max Vel=8.03 fps
20.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=27.69 cfs

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Page 25

Summary for Reach P4: Pipe 4

Inflow Area =   8.440 ac, 54.43% Impervious, Inflow Depth > 1.10"   for WQ Storm event
Inflow   =   2.37 cfs @   7.96 hrs, Volume=   0.772 af
Outflow   =   2.36 cfs @   8.01 hrs, Volume=   0.770 af, Atten= 0%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.84 fps, Min. Travel Time= 2.2 min
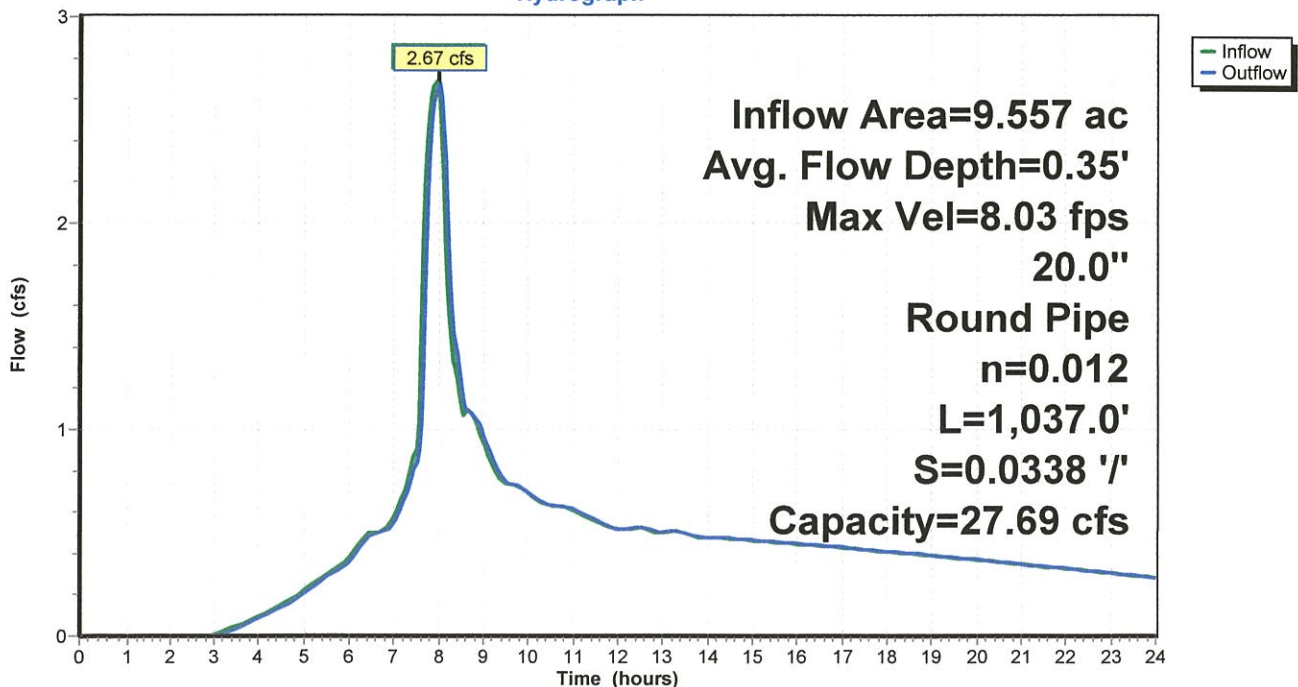Avg. Velocity = 4.54 fps, Avg. Travel Time= 3.8 min

Peak Storage= 313 cf @ 7.98 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 20.91 cfs

18.0" Round Pipe
n= 0.012
Length= 1,037.0'   Slope= 0.0338 '/'
Inlet Invert= 176.50', Outlet Invert= 141.50'
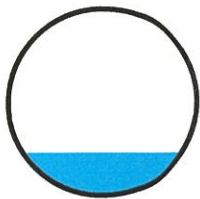
Reach P4: Pipe 4

Hydrograph

Inflow Area=8.440 ac
Avg. Flow Depth=0.34'
Max Vel=7.84 fps
18.0"
Round Pipe
n=0.012
L=1,037.0'
S=0.0338 '/'
Capacity=20.91 cfs

2.36 cfs

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Page 26

Summary for Reach S1: Bioswale 1

Inflow Area =   5.531 ac, 38.14% Impervious, Inflow Depth > 0.92"   for WQ Storm event
Inflow   =   1.21 cfs @   8.04 hrs, Volume=   0.423 af
Outflow   =   1.16 cfs @   8.26 hrs, Volume=   0.418 af, Atten= 4%, Lag= 13.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.34 fps, Min. Travel Time= 8.6 min
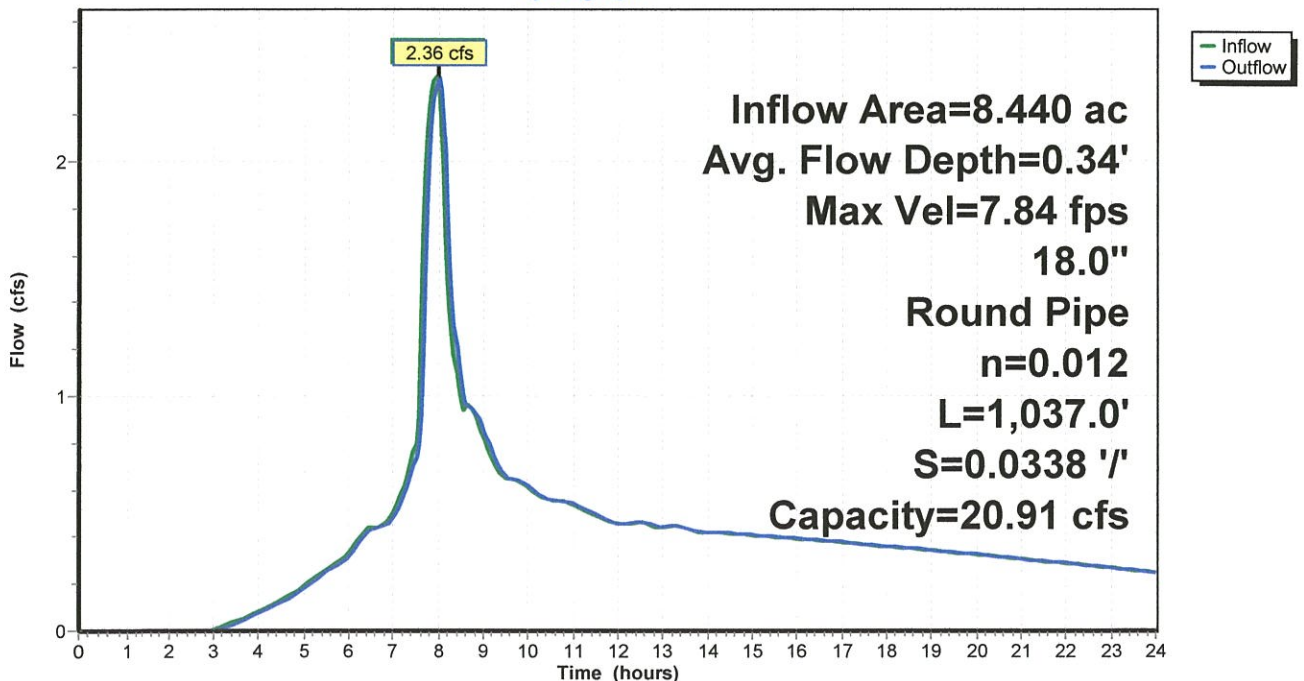Avg. Velocity = 0.17 fps, Avg. Travel Time= 17.5 min

Peak Storage= 600 cf @ 8.12 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 12.0 sf, Capacity= 7.57 cfs

9.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 15.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 180.00', Outlet Invert= 178.25'

‡

Reach S1: Bioswale 1

Hydrograph

1.21 cfs
1.16 cfs

— Inflow
— Outflow

Inflow Area=5.531 ac
Avg. Flow Depth=0.34'
Max Vel=0.34 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=7.57 cfs

Flow (cfs)

Time (hours)

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Page 27

Summary for Reach S2: Bioswale 2

Inflow Area =   2.558 ac, 63.47% Impervious, Inflow Depth > 1.18"   for WQ Storm event
Inflow   =   0.78 cfs @   7.92 hrs, Volume=   0.251 af
Outflow   =   0.76 cfs @   8.16 hrs, Volume=   0.248 af, Atten= 3%, Lag= 14.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.32 fps, Min. Travel Time= 9.0 min
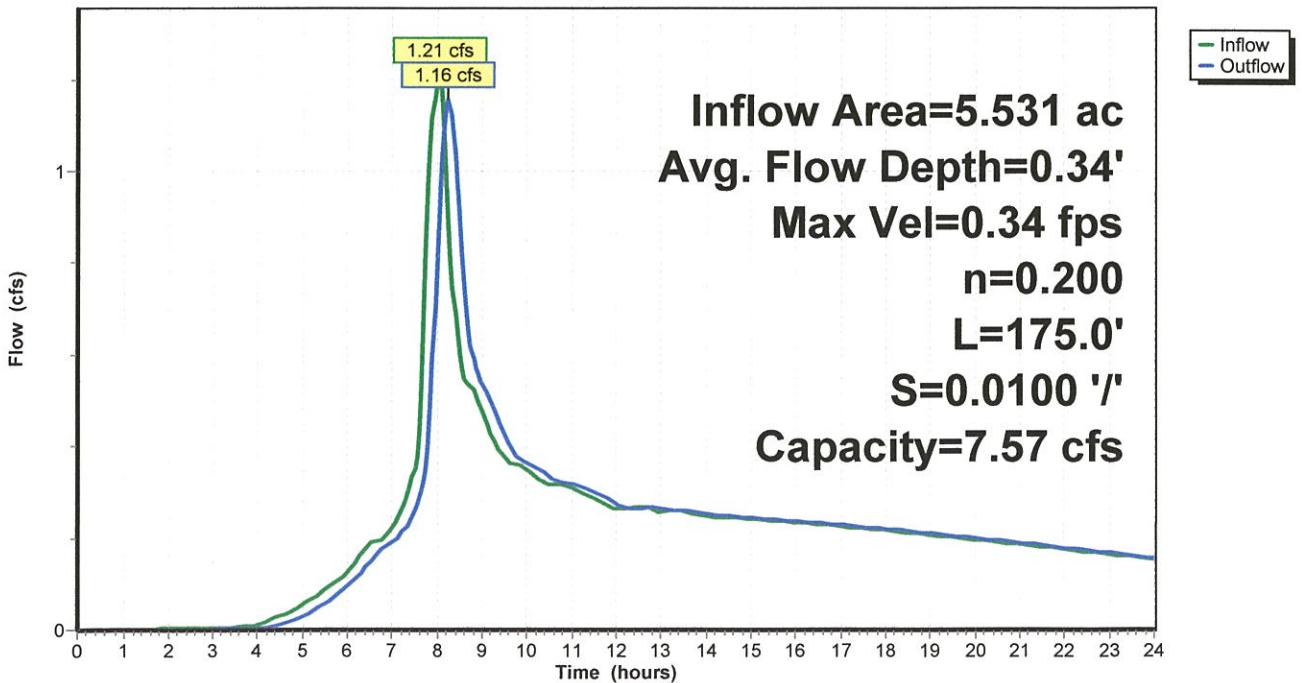Avg. Velocity = 0.17 fps, Avg. Travel Time= 17.5 min

Peak Storage= 409 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00' Flow Area= 9.0 sf, Capacity= 5.42 cfs

6.00' x 1.00' deep channel, n= 0.200
Side Slope Z-value= 3.0 '/'   Top Width= 12.00'
Length= 175.0'   Slope= 0.0100 '/'
Inlet Invert= 172.00', Outlet Invert= 170.25'

‡

Reach S2: Bioswale 2

Hydrograph

Inflow Area=2.558 ac
Avg. Flow Depth=0.33'
Max Vel=0.32 fps
n=0.200
L=175.0'
S=0.0100 '/'
Capacity=5.42 cfs

0.78 cfs
0.76 cfs
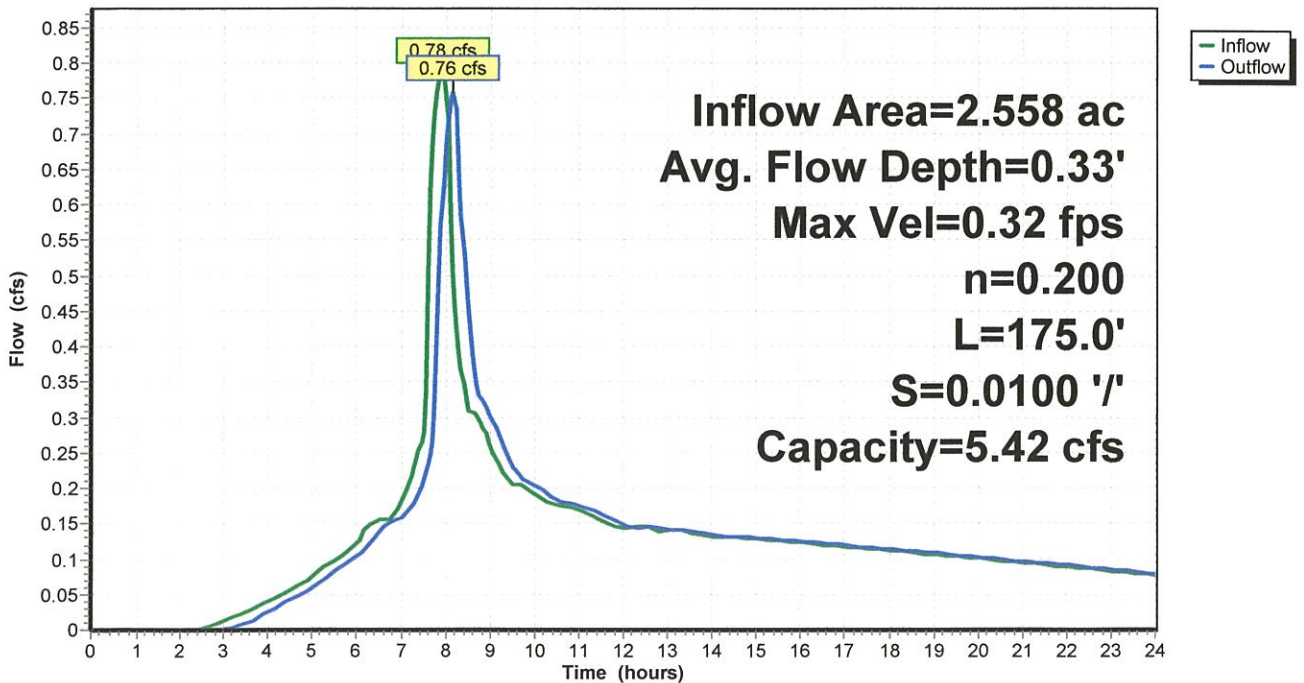
— Inflow
— Outflow

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Printed 4/18/2017
Page 28

Summary for Pond 1P: Pond 1

Inflow Area =   6.658 ac, 32.88% Impervious, Inflow Depth > 0.86"   for WQ Storm event
Inflow   =   1.25 cfs @   8.25 hrs, Volume=   0.475 af
Outflow   =   0.49 cfs @   9.41 hrs, Volume=   0.418 af, Atten= 60%, Lag= 69.7 min
Primary   =   0.49 cfs @   9.41 hrs, Volume=   0.418 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 177.91' @ 9.41 hrs Surf.Area= 12,755 sf Storage= 4,116 cf

Plug-Flow detention time= 156.2 min calculated for 0.418 af (88% of inflow)
Center-of-Mass det. time= 84.6 min (890.6 - 806.0)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	16,135 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 20,019 cf Overall x 80.6% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.50	12,066	0	0	12,066
177.75	12,482	3,068	3,068	12,493
178.00	12,906	3,173	6,242	12,929
178.25	13,336	3,280	9,522	13,371
178.50	13,773	3,388	12,910	13,820
178.75	14,216	3,498	16,409	14,275
179.00	14,667	3,610	20,019	14,738

Device	Routing	Invert	Outlet Devices
#1	Primary	177.50'	**12.0" Round Culvert** L= 35.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 177.50' / 173.00' S= 0.1286 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	177.50'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	178.18'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.55'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.49 cfs @ 9.41 hrs HW=177.91'   (Free Discharge)
└─**1=Culvert** (Passes 0.49 cfs of 0.59 cfs potential flow)
　├─**2=Orifice/Grate** (Orifice Controls 0.49 cfs @ 2.18 fps)
　├─**3=Orifice/Grate** (Controls 0.00 cfs)
　└─**4=Orifice/Grate** (Controls 0.00 cfs)

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Page 29

Pond 1P: Pond 1

Hydrograph

Inflow Area=6.658 ac
Peak Elev=177.91'
Storage=4,116 cf

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Page 30
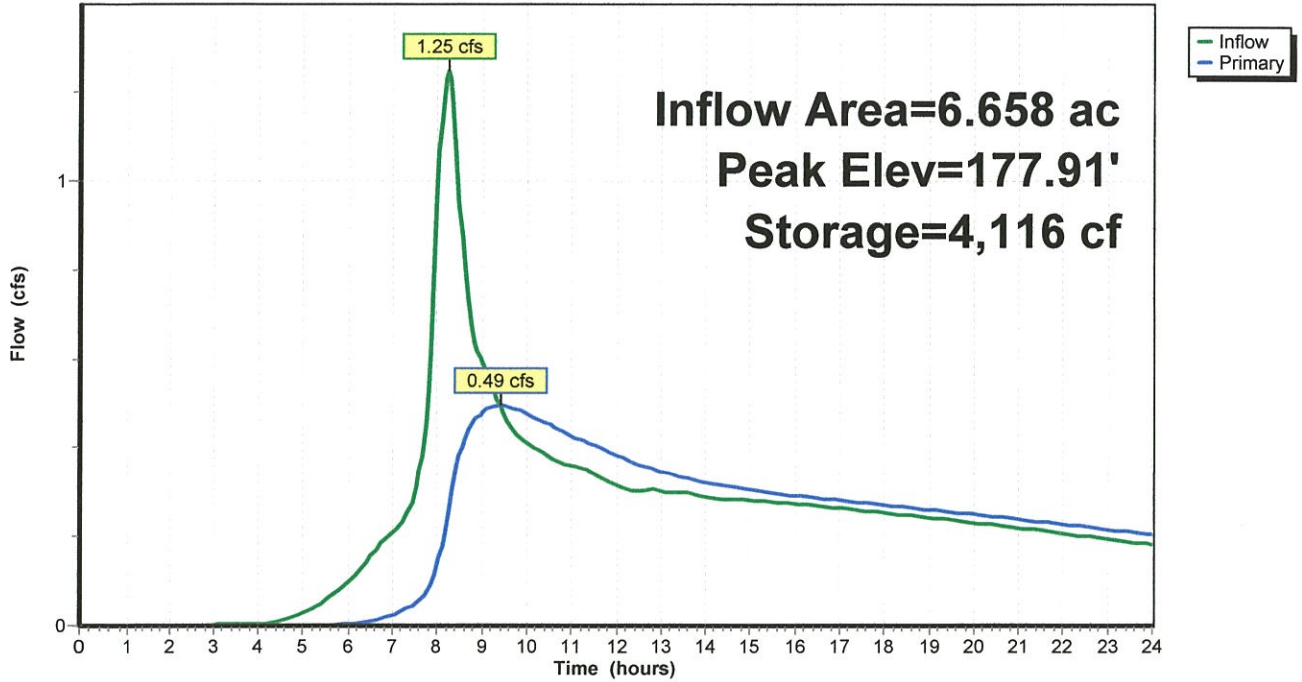
Summary for Pond 2P: Pond 2

Inflow Area =   21.380 ac, 54.76% Impervious, Inflow Depth > 0.17"   for WQ Storm event
Inflow   =   0.92 cfs @   7.94 hrs, Volume=   0.301 af
Outflow   =   0.74 cfs @   8.09 hrs, Volume=   0.290 af, Atten= 20%, Lag= 9.5 min
Primary   =   0.74 cfs @   8.09 hrs, Volume=   0.290 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 136.39' @ 8.09 hrs   Surf.Area= 0.103 ac   Storage= 0.030 af

Plug-Flow detention time= 55.0 min calculated for 0.290 af (96% of inflow)
Center-of-Mass det. time= 30.8 min (788.6 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	136.00'	0.620 af	**56.00'W x 80.00'L x 8.00'H Prismatoid** 0.823 af Overall x 75.4% Voids

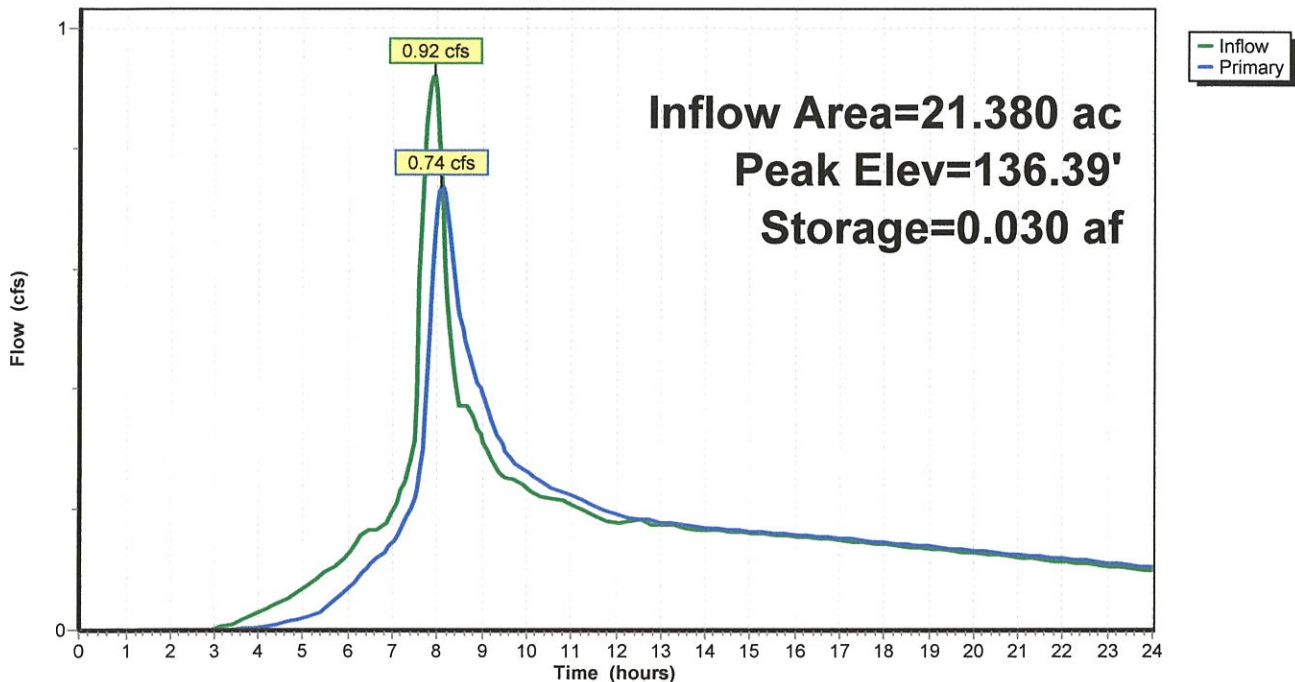| Device	Routing	Invert	Outlet Devices
#1	Primary	136.00'	**24.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 136.00' / 135.00' S= 0.1000 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Device 1	136.00'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	136.71'	**2.9" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	139.05'	**6.6" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.73 cfs @ 8.09 hrs HW=136.39'   (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.73 cfs @ 1.68 fps)
  ├─**2=Orifice/Grate** (Passes 0.73 cfs of 2.37 cfs potential flow)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

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Page 31

Pond 2P: Pond 2

Hydrograph

Inflow Area=21.380 ac
Peak Elev=136.39'
Storage=0.030 af

Summary for Pond BR1: Bioretention 1

Inflow Area =   17.997 ac, 56.26% Impervious, Inflow Depth > 1.09"   for WQ Storm event
Inflow   =   5.03 cfs @   8.01 hrs, Volume=   1.641 af
Outflow   =   1.07 cfs @ 11.43 hrs, Volume=   1.443 af, Atten= 79%, Lag= 205.2 min
Discarded   =   1.07 cfs @ 11.43 hrs, Volume=   1.443 af
Primary   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 142.05' @ 11.43 hrs   Surf.Area= 30,427 sf   Storage= 16,945 cf

Plug-Flow detention time= 190.5 min calculated for 1.443 af (88% of inflow)
Center-of-Mass det. time= 113.7 min (871.2 - 757.6)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	8,792 cf	**50.00'W x 283.00'L x 1.50'H Prismatoid Z=1.0**
			21,979 cf Overall x 40.0% Voids
#2	141.50'	32,392 cf	**50.00'W x 283.00'L x 2.00'H Prismatoid Z=3.0**
		41,184 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	**24.0" Round Culvert**
			L= 10.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0500 '/' Cc= 0.900
			n= 0.012, Flow Area= 3.14 sf
#2	Device 1	142.50'	**24.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Discarded	140.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.07 cfs @ 11.43 hrs HW=142.05'   (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 1.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00'   (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

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Page 33

Pond BR1: Bioretention 1

Hydrograph

Inflow Area=17.997 ac
Peak Elev=142.05'
Storage=16,945 cf
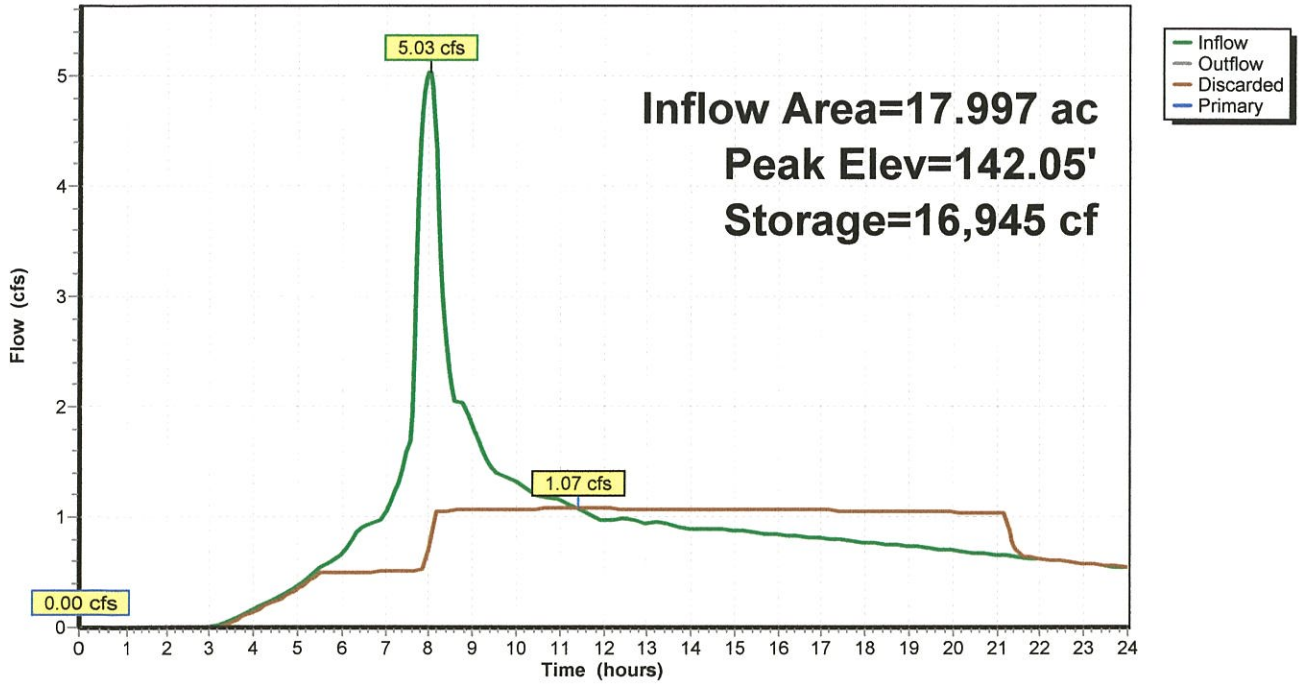
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Page 34

Summary for Pond BR2: Bioretention 2

Inflow Area =   2.390 ac, 67.64% Impervious, Inflow Depth > 1.23"   for WQ Storm event
Inflow   =   0.77 cfs @   7.91 hrs, Volume=   0.244 af
Outflow   =   0.17 cfs @ 10.79 hrs, Volume=   0.223 af, Atten= 78%, Lag= 172.3 min
Discarded =   0.17 cfs @ 10.79 hrs, Volume=   0.223 af
Primary   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 154.49' @ 10.79 hrs Surf.Area= 4,445 sf Storage= 2,743 cf

Plug-Flow detention time= 204.6 min calculated for 0.222 af (91% of inflow)
Center-of-Mass det. time= 144.9 min (874.6 - 729.7)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	903 cf	**5.00'W x 230.00'L x 1.50'H Prismatoid Z=1.0**
			2,258 cf Overall x 40.0% Voids
#2	153.50'	5,216 cf	**5.00'W x 230.00'L x 2.00'H Prismatoid Z=3.0**
		6,119 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	152.00'	**12.0" Round Culvert**
			L= 10.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 152.00' / 151.90' S= 0.0100 '/' Cc= 0.900
			n= 0.012, Flow Area= 0.79 sf
#2	Device 1	154.50'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Discarded	152.00'	**1.500 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.17 cfs @ 10.79 hrs HW=154.49' (Free Discharge)
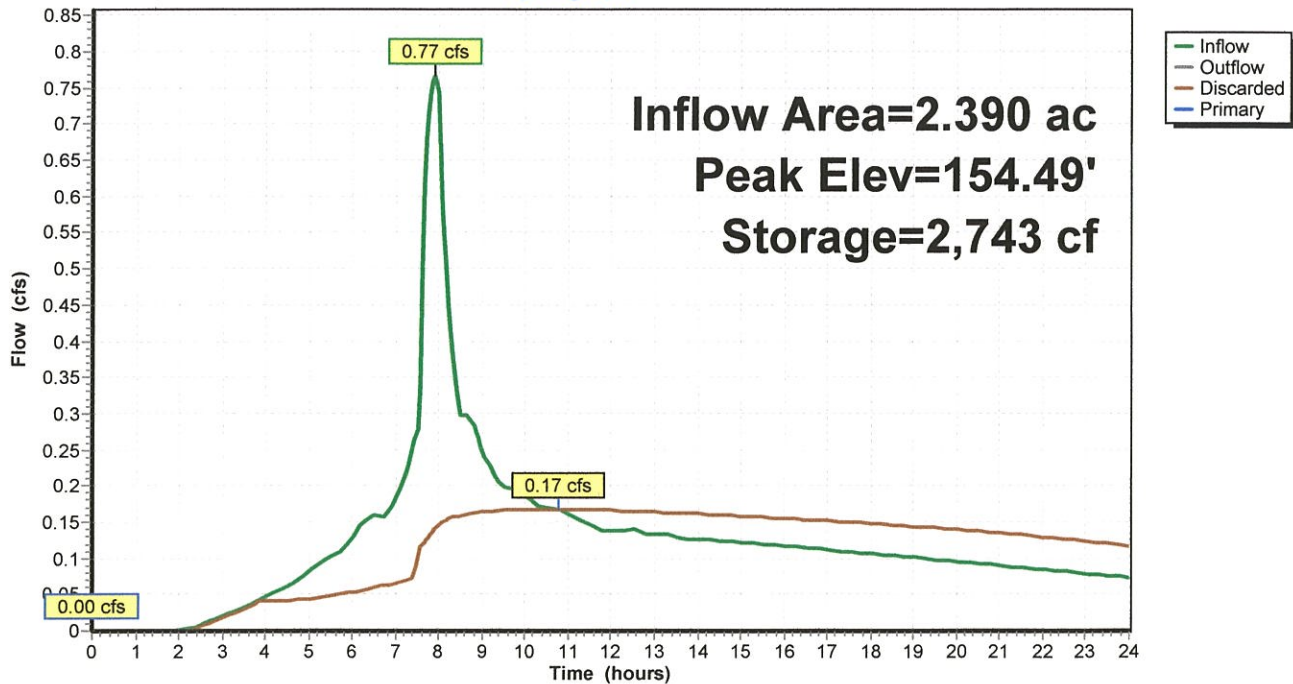└─**3=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=152.00' (Free Discharge)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)

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Page 35

Pond BR2: Bioretention 2

Hydrograph

Inflow Area=2.390 ac
Peak Elev=154.49'
Storage=2,743 cf

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Page 37

Pond BR3: Bioretention 3

Inflow Area=0.993 ac
Peak Elev=132.45'
Storage=1,391 cf

APPENDIX C

Basin Maps

Pre-Developed
Post-Developed

April 18, 2017
Precision Land Services, Inc.
Job #2641

Riverside Estates Subdivision
Preliminary Hydrology Report
Page 22

Basin Designation

BASIN
BOUNDARY
(TYP)

O2

P1

FL = 865'
@ SL = 4.7%

EXISTING
CONTOUR
(TYP)

O1

O3

FL = 300'
@ SL = 5.2%

OLD PACIFIC HIGHWAY
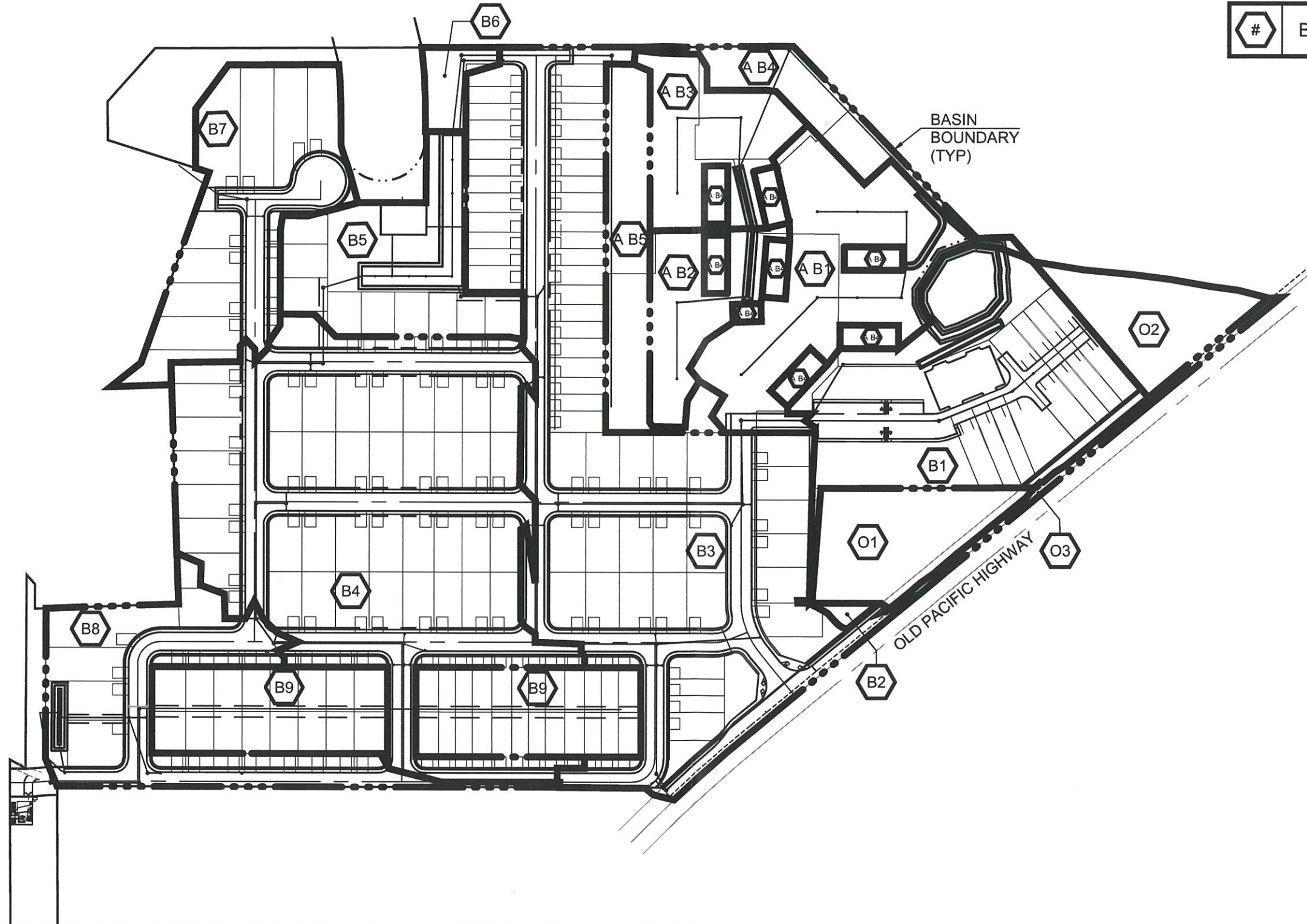
LARSON RD

Scale 1" = 200'
0   100   200

Pre-Developed Basin Map For:

Riverside Estates Subdivision

A Site Located In La Center, Washington

Consulting Engineers & Planners | 2008 C Street, Vancouver, WA 98663 | PH (360) 944-6519 | Fax (360) 944-6539

PLS ENGINEERING

DESIGNED:	TSW	SCALE H:	1" = 200'	SHEET
		V:	N/A	
DRAWN BY:	TSW	DATE:	April 17, 2017	1
CHECKED:	TSW	JOB NO.:	2641	2

Basin Designation

BASIN
BOUNDARY
(TYP)

OLD PACIFIC HIGHWAY

Scale 1" = 200'
0   100   200

Post-Developed Basin Map For:

Riverside Estates Subdivision

A Site Located In La Center, Washington

Consulting Engineers & Planners | 2008 C Street, Vancouver, WA 98663 | PH (360) 944-6519 | Fax (360) 944-6539

PLS ENGINEERING

DESIGNED:	TSW	SCALE	H: 1" = 200'	SHEET
---	---	---	V: N/A	2
DRAWN BY:	TSW	DATE: April 17, 2017		
CHECKED:	TSW	JOB NO.: 2641		2