



WILLIAMS CREEK

CONSULTING

SNRC Building Indiana Masonic Home

Stormwater Drainage Technical Report

Franklin, Indiana

Prepared For:

Indiana Masonic Homes at Compass
Park

690 State Street

Franklin, Indiana 46131

Date: 19 January 2017



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1.0 INTRODUCTION

Indiana Masonic Homes at Compass Park (OWNER) is development called **Skilled Nursing and Rehabilitation Center (PROJECT)** to replace an existing nursing facility of the same type on the Indiana Masonic Homes (IMH) campus located in Franklin, Indiana. Refer to **Figure 1** for a SITE location map.

This report describes the design and function of the stormwater management strategy for the PROJECT and demonstrates compliance with applicable City of Franklin stormwater ordinances and with a prior Master Stormwater Management Report (**MSMR**) approved in April 2010.

This report accompanies Construction Documents prepared by Williams Creek Consulting, Inc. (**WILLIAMS CREEK**) and dated 19 January 2017.

2.0 EXISTING CONDITIONS

The SITE is located north of Freemason Parkway in Franklin, Indiana on the Indiana Masonic Home campus. The SITE encompasses property adjacent to an existing assisted living facility that includes associated facilities such as a playground area, landscaped areas, parking lots and access drives. The total area of the IMH campus, approximately 226 acres, includes developed and undeveloped area. It is assumed that approximately 6.48 acres of the campus will be disturbed as part of this PROJECT.

The existing soil conditions, as shown in **Figure 2** and **Appendix A**, indicate that the SITE predominantly has Brookston silty clay loam (Br), followed by Ockley loam (ObaA) and Crosby silt loam (CrA). Hydrological classification of Brookston, Ockley and Crosby soils are “B/D”, “B”, and “C/D” respectively.

The campus has a PUD classification within the City of Franklin zoning district. It is bound by single family platted lot to the west, and commercial parcels to the north, south and east per the City of Franklin Zoning map.

Per Johnson County FEMA FIRM number 18081C0231D, effective date 2 August 2007, the proposed PROJECT area lies outside of zone AE of the adjacent Young’s Creek, as shown in **Figure 3**.

The SITE currently drains via sheet flow and shallow-concentrated flow into an existing stormwater system that routes the runoff into an existing detention pond southwest of PROJECT prior to discharging into Young’s Creek. Refer to **Figure 4** for a watershed map showing pre-developed conditions. The South Basin, identified in **Figure 4**, conveys runoff via a storm network to the detention pond. Per the approved MSMR, the South Basin has a net area of 31.7 ac, with a curve number of 82 and a time of concentration of 10.8 minutes.

3.0 DEVELOPED CONDITIONS

The PROJECT consists of a new building with associated parking and other infrastructure to serve the development. The PROJECT lies within the South Basin identified in the revised MSMR. The net increase in the impervious area due to the PROJECT is 1.97 acres above what was assumed as part of the approved master plan. The composite Curve Number of the South Basin due to the PROJECT in a developed condition is 83. **Figure 5** shows location of the PROJECT on SITE. **Appendix B** contains calculations for times of concentration and the weighted curve numbers used for pipe calculations and detention calculations.

Due to the increase in curve number from what was originally designed as part of the approved master plan, the peak flow from the watershed to the detention pond is increased. As such, a small amount of detention will be required to offset the increase in peak flow to the existing detention pond to ensure the performance of the pond is not negatively affected. This detention is provided in a single BMP on the PROJECT located in a depressed island in the center of the proposed parking lot. All stormwater discharge, including runoff accounted for upstream of the PROJECT, will ultimately discharge to an existing 42" storm sewer and ultimately into the existing detention pond. The governing design criteria, the water quantity and water quality requirements and design for the PROJECT are described in greater detail below.

4.0 GOVERNING DESIGN CRITERIA

There are three (3) main governing criteria for design of the stormwater management system for this PROJECT. They are the existing capacity of the receiving storm infrastructure, the approved performance of the existing detention pond, and the existing performance of the downstream water quality treatment unit.

There is an existing 42" storm sewer between master plan structures 706 and 705 that is the receiving infrastructure for this PROJECT. It has an as-built slope of 0.22% and a full flow capacity of 31.0 cfs. The approved 10-year and 100-year design storm flows, as indicated by the master plan, to this storm sewer are 27.34 cfs and 39.53 cfs respectively, as indicated by Exhibit C-1 (**Appendix C**). A governing design criteria for this proposed PROJECT is to limit the 10-year proposed storm discharge to less than the full flow capacity of the existing 42" storm sewer.

The aforementioned South Basin has peak runoff rates of 34.55 cfs and 75.07 cfs for 10-year and 100-year design storms respectively, as approved per the MSMR. Due to the increased impervious area within the PROJECT, the peak runoff rates for the South Basin were computed to be 37.33 cfs and 79.51 cfs for 10-year and 100-year design storms respectively. **Appendix C** contains a HydroCAD report showing the existing master plan constraints and all watershed parameters match the approved master plan. It also contains a report showing the effect of revising the south basin to reflect the proposed conditions from the PROJECT. The governing design criteria for the developed PROJECT due to the approved performance of the existing detention pond is to limit the discharges from 10-year and 100-year storm events to be less than or equal to those approved in the MSMR..

Table 4.1 below summarizes these constraints.

Table 4.1: Peak Flow Constraints for South Basin			
Design Storm	MSMR Approved Rate (cfs)	Peak due to PROJECT (cfs)	Amount of Reduction required (cfs)
10 year	34.55	37.40	2.85
100 year	75.07	80.30	5.23

As part of the Assisted Living Facility, a mechanical BMP was installed to treat water quality for the portion of the South Watershed that encompasses this PROJECT. The water quality flow rate approved in the MSMR for that structure is 9.52 cfs. Similarly to the impact of adding more impervious than was previously master-planned, the peak flow during the water quality event due to the PROJECT is increased. The water quality flow rate due to the proposed PROJECT is 10.70 cfs. The minimum required reduction, therefore, is 1.18 cfs during the water quality storm event. **Table 4.2** below summarizes the constraint. Refer to **Appendix C** for both approved and proposed calculations.

Table 4.2: Peak Flow Constraints for the BMP

Design Storm 1", 24-HR, Type-II	MSMR Approved Rate (cfs)	Peak due to PROJECT (cfs)	Amount of Reduction required (cfs)
	9.52	10.70	1.18 cfs

5.0 PROPOSED STORMWATER SYSTEM PERFORMANCE

WILLIAMS CREEK has implemented sustainable infrastructure principles to treat stormwater runoff as prescribed by Section 4 of this report. Runoff from the contributing watershed is conveyed via sheet and shallow-concentrated flow to the surface of a depressed island that is designed similarly to a rain garden. Within this BMP, runoff infiltrates through a soil medium into a perforated underdrain and ultimately discharges to the stormsewer infrastructure proposed as part of this PROJECT. This infiltration mechanism is the only outlet for runoff due to the water quality event. During larger storm events, i.e. 10-Year and 100-Year, the infiltrative capacity of the soil is unable to pass the peak flows. As such, weir flow restricts the discharge to the storm infrastructure and creates the reduction in peak flow from the system.

The contributing watershed to the BMP, if left untreated, has peak runoff rates of 1.24 cfs, 4.36 cfs and 7.56 cfs for the WQ Event, 10-year and 100-year design storms respectively. The BMP is sized to have enough detention volume to limit the peak flows from the contributing watershed by the constraint prescribed in **Table 4.1**. **Table 5.1** below summarizes the BMP performance related to that constraint. The BMP is also designed to restrict the water quality peak flow per the constraint prescribed in **Table 4.2**. **Table 5.2** below summarizes the BMP performance related to that constraint. Refer to **Appendix D** for all applicable calculations related to this section.

Table 5.1: Peak Flow Comparison

Design Storm	Quantity Untreated (cfs)	Quantity Treated (cfs)	Net Reduction Achieved (cfs)	Minimum Reduction required from Table 4.1 (cfs)
10 year	4.36	0.89	3.47	2.83
100 year	7.56	2.33	5.23	5.09

Table 5.2: Peak Flow Comparison

Design Storm	Quantity Untreated (cfs)	Quantity Treated (cfs)	Net Reduction Achieved (cfs)	Minimum Reduction required from Table 4.1 (cfs)
WQ Event	1.24	0.04	1.20	1.18

6.0 WATER CONVEYANCE

This PROJECT also includes a proposed stormsewer system that conveys runoff through and around the PROJECT to the existing downstream infrastructure. This system is designed utilizing Manning's Equation for a 10-Year storm event per the City of Franklin standards.

As prescribed in **Section 4.0** above, the allowable 10-YR discharge from the PROJECT is 31.0 cfs. As shown in Appendix D, the proposed discharge from this PROJECT is 30.79 cfs and meets the required criteria. It should also be noted that with the inclusion of detention in the system, the watershed contributing to the BMP will not contribute to the peak storm discharge due to the lag in peak flow times. To be conservative, the 10-year discharge has been included in the storm sewer sizing. Refer to **Appendix E** for all applicable stormsewer sizing calculations and summaries.

7.0 STATE OR FEDERAL WATER QUALITY PERMITS

This project will require a Rule 5 Notice of Intent to be filed with the Indiana Department of Environmental Management.



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FIGURE 1 SITE LOCATION MAP

SNRC BUILDING INDIANA MASONIC HOMES
Franklin, Indiana

Prepared for:
INDIANA MASONIC HOMES AT COMPASS PARK

Project No.
01.1115.A.1

Date:
19 JANUARY 2017



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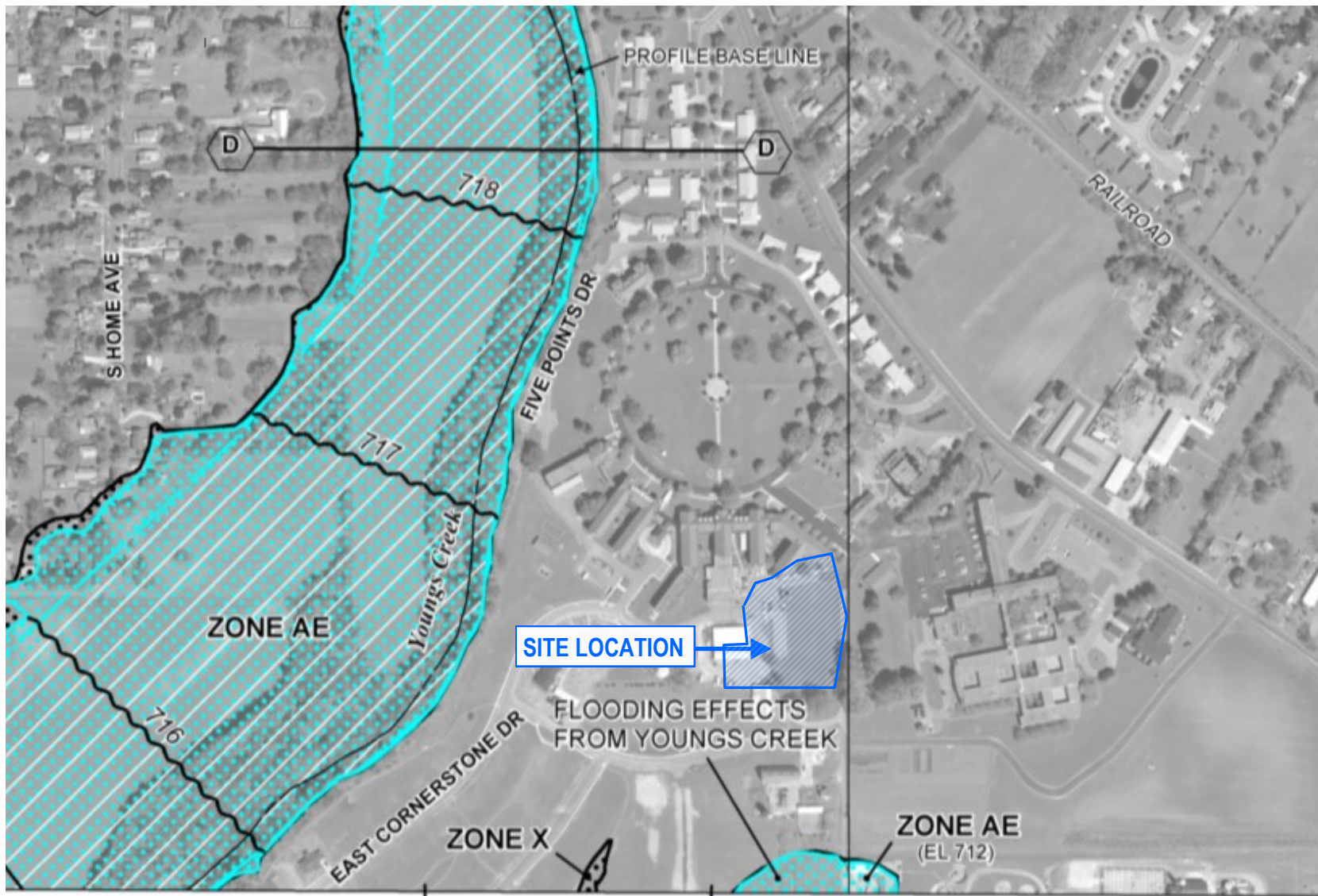
FIGURE 2 Soils Map

SNRC BUILDING INDIANA MASONIC HOMES
Franklin, Indiana
Indianapolis, Indiana

Prepared for:
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FIGURE 3 FEMA FIRM MAP EXHIBIT

SNRC BUILDING INDIANA MASONIC HOMES
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Image courtesy of USGS Image courtesy of the IndianaMap Earthstar Geographics SIO © 2017 Microsoft Corporation © 2017 HERE © AND

INDIANA MASONIC HOMES AT COMPASS PARK
690 STATE STREET
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DWN BY: NDS
CHKD BY: DAM
SCALE: NOT TO SCALE
DATE: 01/19/2017

REVISIONS	

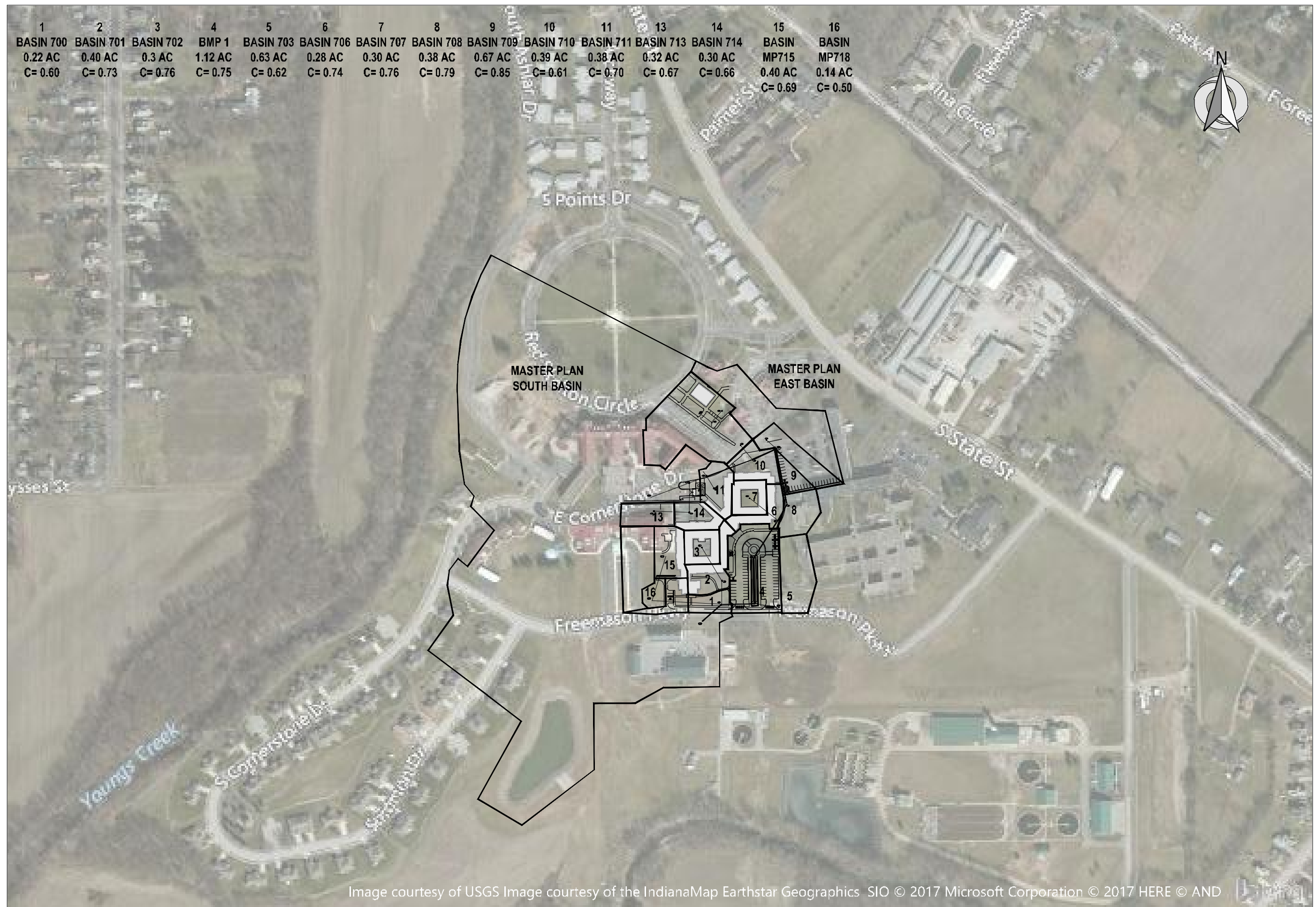
SNRC BUILDING INDIANA MASONIC HOME
690 STATE STREET
FRANKLIN, INDIANA

EXISTING CONDITION DELINEATION

PROJECT NUMBER
01.1151.A.1

DRAWING NUMBER
FIGURE 4

1	2	3	4	5	6	7	8	9	10	11	13	14	15	16
BASIN 700	BASIN 701	BASIN 702	BMP 1	BASIN 703	BASIN 706	BASIN 707	BASIN 708	BASIN 709	BASIN 710	BASIN 711	BASIN 713	BASIN 714	BASIN	BASIN
0.22 AC	0.40 AC	0.3 AC	1.12 AC	0.63 AC	0.28 AC	0.30 AC	0.38 AC	0.67 AC	0.39 AC	0.38 AC	0.32 AC	0.30 AC	MP715	MP718
C= 0.60	C= 0.73	C= 0.76	C= 0.75	C= 0.62	C= 0.74	C= 0.76	C= 0.79	C= 0.85	C= 0.61	C= 0.70	C= 0.67	C= 0.66	0.40 AC	0.14 AC
													C= 0.69	C= 0.50



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690 STATE STREET
FRANKLIN, INDIANA 46131



WILLIAMS CREEK
CONSULTING

DWN BY:	NDS
CHKD. BY:	DAM
SCALE:	NOT TO SCALE
DATE:	01/19/2017

[illegible]

SNRC BUILDING INDIANA MASONIC HOME
690 STATE STREET
FRANKLIN, INDIANA

PROPOSED CONDITION DELINEATION

PROJECT NUMBER
01.1151.A.1

DRAWING NUMBER
FIGURE 5

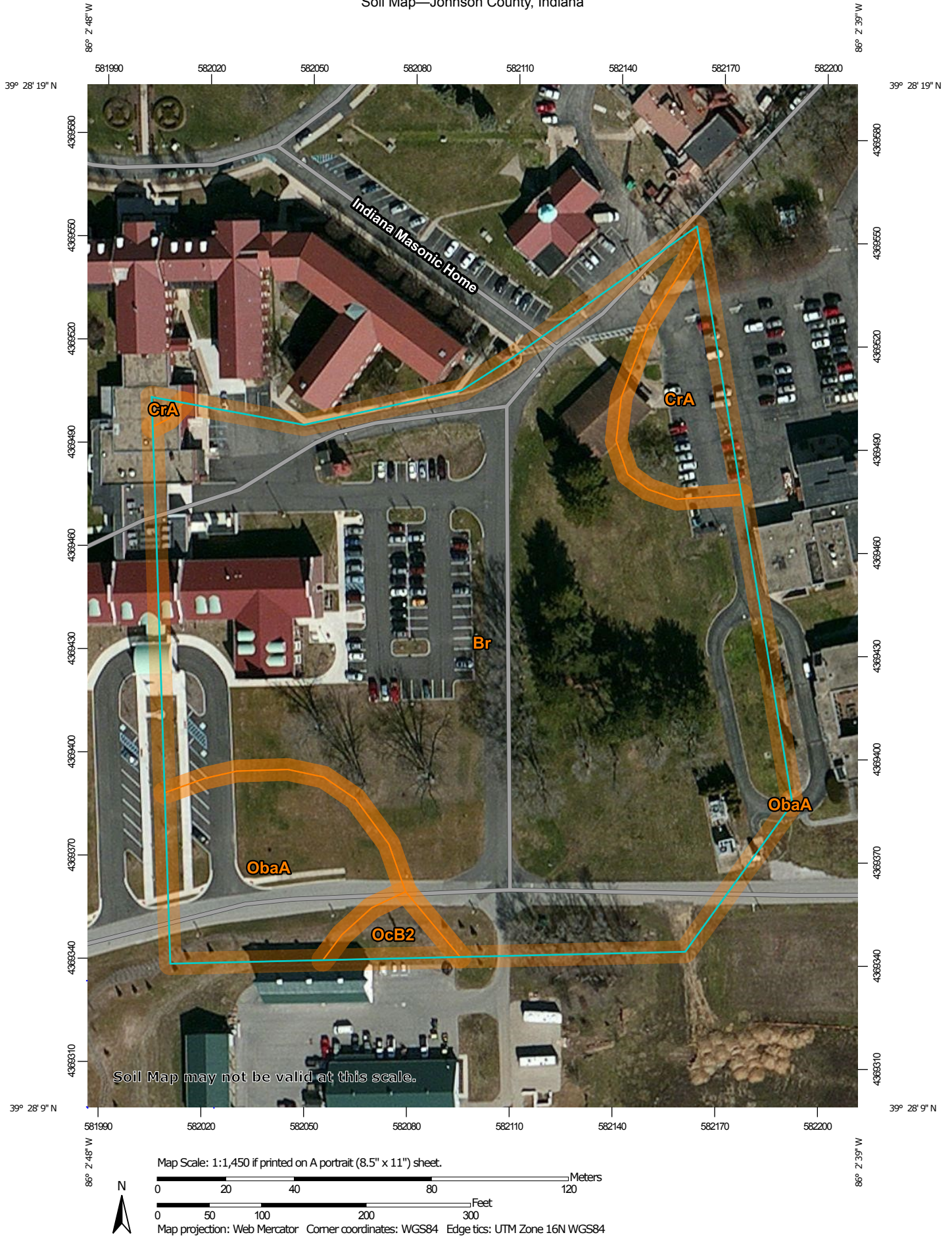
Appendix A

USDA Hydrologic Soil Group Information



WILLIAMS CREEK
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Soil Map—Johnson County, Indiana



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

1/19/2017
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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:

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: Johnson County, Indiana

Survey Area Data: Version 24, Sep 15, 2016

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

Date(s) aerial images were photographed: Sep 17, 2011—Mar 10, 2012

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

Johnson County, Indiana (IN081)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Br	Brookston silty clay loam, 0 to 2 percent slopes	6.1	82.1%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	0.4	5.7%
ObaA	Ockley loam, 0 to 2 percent slopes	0.8	10.6%
OcB2	Ockley loam, 2 to 6 percent slopes, eroded	0.1	1.5%
Totals for Area of Interest		7.4	100.0%

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk "*" denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Johnson County, Indiana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
Br—Brookston silty clay loam, 0 to 2 percent slopes														
Brookston	95	B/D	0-16	Silty clay loam	ML	A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	96-98-100	86-89-95	44-47-57	19-19-24
			16-32	Silty clay loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	87-90-95	39-45-49	19-23-25
			32-44	Clay loam, loam	CL	A-7, A-6	0- 0- 0	0- 1- 1	91-95-100	77-87-100	67-81-100	49-62-84	31-37-49	13-17-25
			44-60	Loam, fine sandy loam	CL-ML, CL	A-6, A-4	0- 0- 0	0- 1- 1	92-95-100	79-88-100	64-77-97	47-61-83	23-27-30	6-9 -11

Engineering Properties--Johnson County, Indiana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
CrA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes														
Crosby	93	C/D	0-10	Silt loam	CL, CL-ML, ML	A-4, A-6	0- 0- 0	0- 0- 0	95-100-100	85-100-100	72-93-100	57-76-87	20-31-42	3-9 -18
			10-17	Silty clay loam, clay loam	CL, CL-ML, ML	A-7-6, A-6	0- 0- 0	0- 0- 0	95-100-100	85-100-100	72-96-100	61-83-99	30-41-57	12-20-32
			17-29	Clay loam	CL, CL-ML, ML	A-4, A-7-6	0- 0- 0	0- 0- 0	95-98-100	86-97-100	65-87-100	45-65-84	27-42-58	10-22-35
			29-36	Loam, clay loam, fine sandy loam	CL, ML	A-7-6, A-6	0- 0- 1	0- 1- 4	91-97-100	79-95-100	64-86-100	45-63-78	27-36-48	9-17-26
			36-79	Loam, fine sandy loam	CL, SC	A-4, A-6	0- 0- 0	0- 2- 4	89-94-99	75-90-99	64-77-99	46-56-81	25-27-47	9-10-26
ObaA—Ockley loam, 0 to 2 percent slopes														
Ockley	80	B	0-10	Loam	CL-ML, CL	A-4	0- 0- 0	0- 0- 0	91-98-100	83-94-100	66-81-87	43-55-61	22-26-30	5-8 -11
			10-24	Loam, clay loam, sandy clay loam	CL	A-6	0- 0- 0	0- 0- 0	92-97-100	85-94-100	68-80-91	44-54-65	30-38-44	11-17-22
			24-38	Clay loam, sandy clay loam, loam	SC	A-2-6	0- 0- 0	0- 0- 1	92-94-100	85-88-100	60-67-84	29-34-50	30-36-44	11-16-22
			38-44	Gravelly sandy clay loam, sandy loam, sandy clay loam, very gravelly sandy loam	SC	A-2-6, A-7	0- 0- 0	0- 1- 2	67-92-100	38-84-100	27-65-83	12-30-44	30-35-44	11-15-22
			44-79	Stratified extremely gravelly coarse sand to sand	SP, SP-SM	A-1-b	0- 0- 0	1- 2- 3	60-80-88	20-59-88	15-45-69	2- 5- 10	0-0 -0	NP

Engineering Properties--Johnson County, Indiana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
OcB2--Ockley loam, 2 to 6 percent slopes, eroded														
Ockley	100	B	0-11	Loam	CL-ML	A-4	0- 0- 0	0- 0- 0	95-98-100	90-95-100	85-93-100	55-63-70	20-25-30	5-13-20
			11-22	Silty clay loam, clay loam, silt loam	CL	A-6	0- 0- 0	0- 0- 1	90-95-100	80-88-100	80-85-90	40-65-90	20-35-50	5-18-30
			22-50	Gravelly clay loam, sandy clay loam, gravelly sandy clay loam	SC	A-6	0- 0- 0	0- 1- 2	70-78-85	45-65-85	30-45-60	25-40-55	20-35-50	5-18-30
			50-60	Stratified gravelly sand to fine sand	SP-SM	A-1	0- 0- 0	1- 3- 5	30-50-70	20-38-55	10-25-40	2- 6- 10	0-0 -0	NP

Data Source Information

Soil Survey Area: Johnson County, Indiana
 Survey Area Data: Version 24, Sep 15, 2016



Appendix B

Supporting Calculations (Tc & Curve Number)



WILLIAMS CREEK
CONSULTING

Time of Concentration Worksheet
Based on TR-55

PROJECT: SNRC Building Indiana Masonic Home
JOB #: 01.1151.A.1

Typical values for Manning's n			
Overland Flow		Channel Flow	
short grass	0.150	grass	0.025
dense grass	0.240	concrete	0.015
pavement	0.011	rip-rap	0.035

2 year, 24 hour rainfall = 2.64 inches
minimum T_c = 5 minutes

Basin name	Overland flow seg. 1				Overland flow seg. 2				Shallow Concentrated Flow				Channel Flow								T _c (min)
	Length (ft)	S %	n	T _t (min)	Length (ft)	S %	n	T _t (min)	Length (ft)	S %	Paved/Un (P or U)	Vel. (ft/s)	T _t (min)	Length (ft)	a (s.f.)	Pw (ft)	r (ft)	S %	n	Vel. (ft/s)	T _t (min)
MP Pond DA (Approved)																					10.8
MP Pond DA (Proposed))																					10.8
MP 711																					17.4
BMP1																					5.0
700																					5.0
701																					5.0
702																					5.0
703																					5.0
706																					5.0
707																					5.0
708																					5.0
709																					5.0
710																					5.0
711																					5.0
713																					5.0
714																					5.0
715																					5.0
EX2																					5.0
EX3																					5.0
MP715																					5.0
MP718																					7.8

Taken from Previously Approved Master Plan
No Substantial Change Due to This Project
Taken from Previously Approved Master Plan

Taken from Previously Approved Master Plan
Taken from Previously Approved Master Plan

File: P:\1 Indiana\BDM\01.1151.P.1 BDM Indiana Masonic Home\Calculations\[Drainage Calculations Spreadsheet_2017-01-10.xlsx]C & CN
Project: SNRC Building Indiana Masonic Home
Design: DAM
Date: 9/26/2016
Revision:

Runoff Coefficients per Table 204-01	
Roof	0.9
Pavement	0.85
Gravel	0.85
Pervious soil with turf	0.45

WEIGHTED RATIONAL "C" CALCULATIONS

BASIN	MP Pond DA (Approved)					
	A. Total Area:	1,380,852 s.f.	=	31.70 acres		
	B. Breakdown				C	CA
	Impervious	632,927 s.f.				0
	Pervious	331,056 s.f.				0
	Pervious	416,869 s.f.				0
	Imp. Percentage:	0.46				
	C. Subtotal					0
	D. Weighted C					0.00
BASIN	MP Pond DA (Proposed)					
	A. Total Area:	1,380,852 s.f.	=	31.70 acres		
	B. Breakdown				C	CA
	Impervious	664,045 s.f.				0
	Pervious	299,938 s.f.				0
	Pervious	416,869 s.f.				0
	Imp. Percentage:	0.48				
	C. Subtotal					0
	D. Weighted C					0.00
BASIN	MP BMP DA (Approved)					
	A. Total Area:	683,021 s.f.	=	15.68 acres		
	B. Breakdown				C	CA
	Impervious	561,053 s.f.				0
	Pervious	94,525 s.f.				0
	Pervious	27,443 s.f.				0
	Imp. Percentage:	0.82				
	C. Subtotal					0
	D. Weighted C					0.00
BASIN	MP BMP DA (Proposed)					
	A. Total Area:	683,021 s.f.	=	15.68 acres		
	B. Breakdown				C	CA
	Impervious	592,171 s.f.				0
	Pervious	90,850 s.f.				0
	Pervious	0 s.f.				0
	Imp. Percentage:	0.87				
	C. Subtotal					0
	D. Weighted C					0.00

BASIN	BMP 1	48,866	0			
	A. Total Area:	48,866 s.f.		1.12 acres		
	B. Breakdown				C	CA
	Pervious		11,810 s.f.		0.45	5315
	Impervious		37,056 s.f.		0.85	31498
		Imp. Percentage:	0.76			
	C. Subtotal					36812
	D. Weighted C					0.75

BASIN	700					
	A. Total Area:	9,367 s.f.		0.22 acres		
	B. Breakdown				C	CA
	Pervious		5,967 s.f.		0.45	2685
	Impervious		3,400 s.f.		0.85	2890
		Imp. Percentage:	0.64			
	C. Subtotal					5575
	D. Weighted C					0.60

BASIN	701					
	A. Total Area:	17,503 s.f.		0.40 acres		
	B. Breakdown				C	CA
	Pervious		5,323 s.f.		0.45	2395
	Impervious		12,180 s.f.		0.85	10353
		Imp. Percentage:	0.30			
	C. Subtotal					12748
	D. Weighted C					0.73

BASIN	702					
	A. Total Area:	13,200 s.f.		0.30 acres		
	B. Breakdown				C	CA
	Pervious		3,000 s.f.		0.45	1350
	Impervious		10,200 sf		0.85	8701
		Imp. Percentage:	0.77			
	C. Subtotal					10051
	D. Weighted C					0.76

BASIN	703					
	A. Total Area:	27,165 s.f.		0.62 acres		
	B. Breakdown				C	CA
	Pervious		15,945 s.f.		0.45	7175
	Impervious		11,220 sf		0.85	9571
		Imp. Percentage:	0.41			
	C. Subtotal					16746
	D. Weighted C					0.62

BASIN	706					
	A. Total Area:	12,000 s.f.	0.28 acres			
	B. Breakdown			C	CA	
	Pervious		3,200 s.f.		0.45	1440
	Impervious		8,800 s.f.		0.85	7480
		Imp. Percentage:	0.73			
	C. Subtotal					8920
	D. Weighted C					0.74

BASIN	707					
	A. Total Area:	13,200 s.f.	0.30 acres			
	B. Breakdown			C	CA	
	Pervious		3,000 s.f.		0.45	1350
	Impervious		10,200		0.85	8670
		Imp. Percentage:	0.77			
	C. Subtotal					10020
	D. Weighted C					0.76

BASIN	708					
	A. Total Area:	16,700 s.f.	0.38 acres			
	B. Breakdown			C	CA	
	Pervious		2,320 s.f.		0.45	1044
	Impervious		14,380 s.f.		0.85	12223
		Imp. Percentage:	0.86			
	C. Subtotal					13267
	D. Weighted C					0.79

BASIN	709					
	A. Total Area:	29,400 s.f.	0.67 acres			
	B. Breakdown			C	CA	
	Pervious		0 s.f.		0.45	0
	Impervious		29,400 s.f.		0.85	24990
		Imp. Percentage:	1.00			
	C. Subtotal					24990
	D. Weighted C					0.85

BASIN	710					
	A. Total Area:	16,950 s.f.	0.39 acres			
	B. Breakdown			C	CA	
	Pervious		10,275 s.f.		0.45	4624
	Impervious		6,675 s.f.		0.85	5674
		Imp. Percentage:	0.39			
	C. Subtotal					10298
	D. Weighted C					0.61

BASIN	711						
	A. Total Area:	16,650 s.f.	0.38 acres				
	B. Breakdown			C	CA		
	Pervious		6,165 s.f.		0.45	2774	
	Impervious		10,485 s.f.		0.85	8912	
		Imp. Percentage:	0.63				
	C. Subtotal					11687	
	D. Weighted C					0.70	

BASIN	713						
	A. Total Area:	14,050 s.f.	0.32 acres				
	B. Breakdown			C	CA		
	Pervious		6,400 s.f.		0.45	2880	
	Impervious		7,650 s.f.		0.85	6503	
		Imp. Percentage:	0.54				
	C. Subtotal					9383	
	D. Weighted C					0.67	

BASIN	714						
	A. Total Area:	13,050 s.f.	0.30 acres				
	B. Breakdown			C	CA		
	Pervious		6,200 s.f.		0.45	2790	
	Impervious		6,850 s.f.		0.85	5823	
		Imp. Percentage:	0.52				
	C. Subtotal					8613	
	D. Weighted C					0.66	

BASIN	715						
	A. Total Area:	1,330 s.f.	0.03 acres				
	B. Breakdown			C	CA		
	Pervious		1,330 s.f.		0.45	599	
	Impervious		s.f.		0.85	0	
		Imp. Percentage:	0.00				
	C. Subtotal					599	
	D. Weighted C					0.45	

BASIN	EX2						
	A. Total Area:	70,250 s.f.	1.61 acres				
	B. Breakdown			C	CA		
	Pervious		24,900 s.f.		0.45	11205	
	Impervious		45,350 s.f.		0.85	38548	
		Imp. Percentage:	0.65				
	C. Subtotal					49753	
	D. Weighted C					0.71	

BASIN EX3

A. Total Area:	11,420 s.f.	0.26 acres		
B. Breakdown			C	CA
Pervious		1,930 s.f.		0.45 869
Impervious		9,490 s.f.		0.85 8067
	Imp. Percentage:	0.83		
C. Subtotal				8935
D. Weighted C				0.78

BASIN MP715

A. Total Area:	17,518 s.f.	0.40 acres		
B. Breakdown			C	CA
Pervious		6,987 s.f.		0.45 3144
Impervious		10,531 s.f.		0.85 8951
	Imp. Percentage:	0.60		
C. Subtotal				12096
D. Weighted C				0.69

BASIN MP718

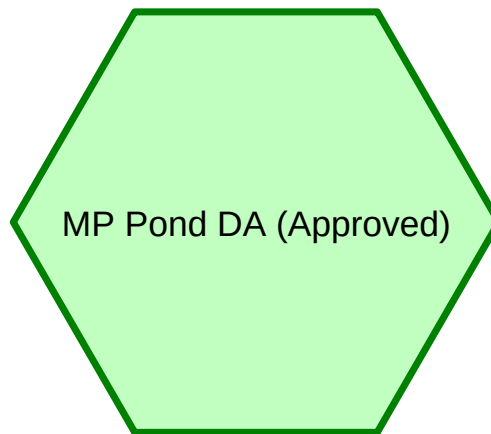
A. Total Area:	6,278 s.f.	0.14 acres		
B. Breakdown			C	CA
Pervious		5,565 s.f.		0.45 2504
Impervious		713 s.f.		0.85 606
	Imp. Percentage:	0.11		
C. Subtotal				3110
D. Weighted C				0.50

Appendix C

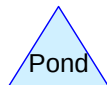
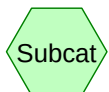
*Water Quantity & Quality Calculations—Master
Plan & Constraint Calculations*



WILLIAMS CREEK
CONSULTING



Master Plan Pond Drainage Area (Approved)



Routing Diagram for Final Drainage Design_01-10-2017
Prepared by {enter your company name here}, Printed 1/19/2017
HydroCAD® 10.00-15 s/n 04552 © 2015 HydroCAD Software Solutions LLC

Summary for Subcatchment MP Pond DA (Approved): Master Plan Pond Drainage Area (Approved)

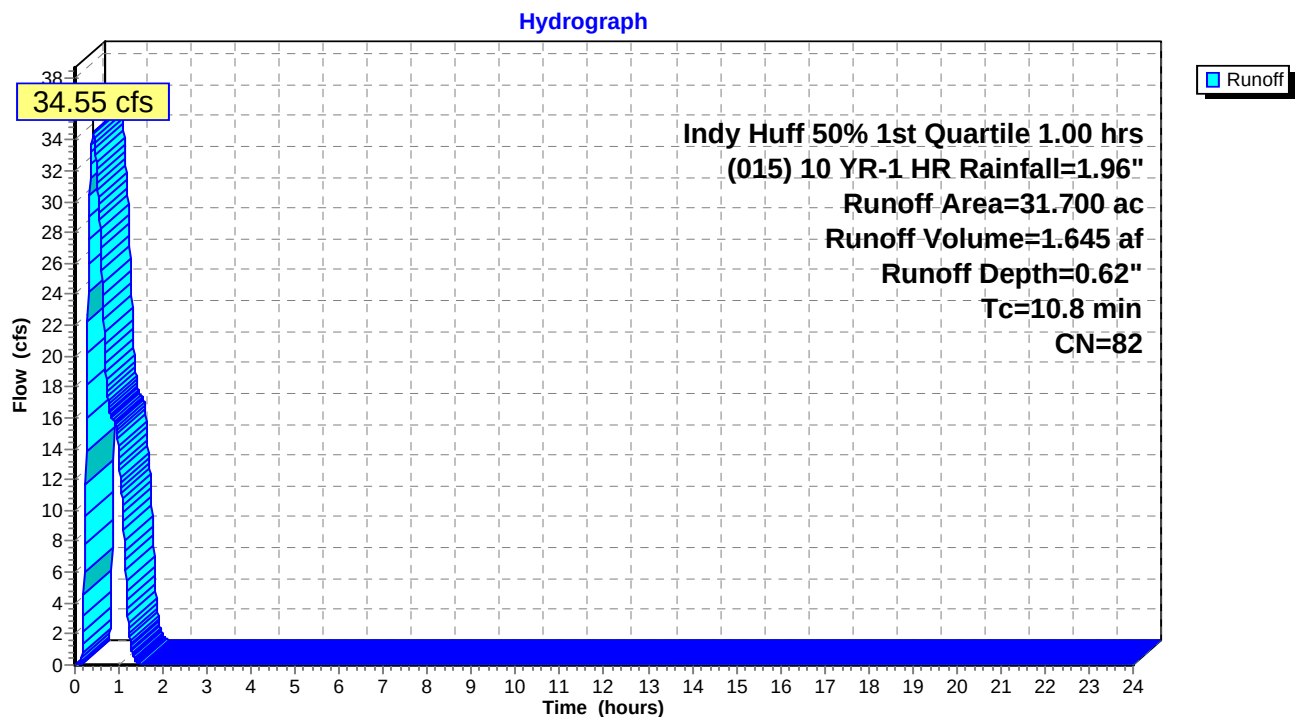
Runoff = 34.55 cfs @ 0.42 hrs, Volume= 1.645 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 1.00 hrs (015) 10 YR-1 HR Rainfall=1.96"

Area (ac)	CN	Description
* 31.700	82	From Spreadsheet
31.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8					Direct Entry, From Spreadsheet

Subcatchment MP Pond DA (Approved): Master Plan Pond Drainage Area (Approved)



Summary for Subcatchment MP Pond DA (Approved): Master Plan Pond Drainage Area (Approved)

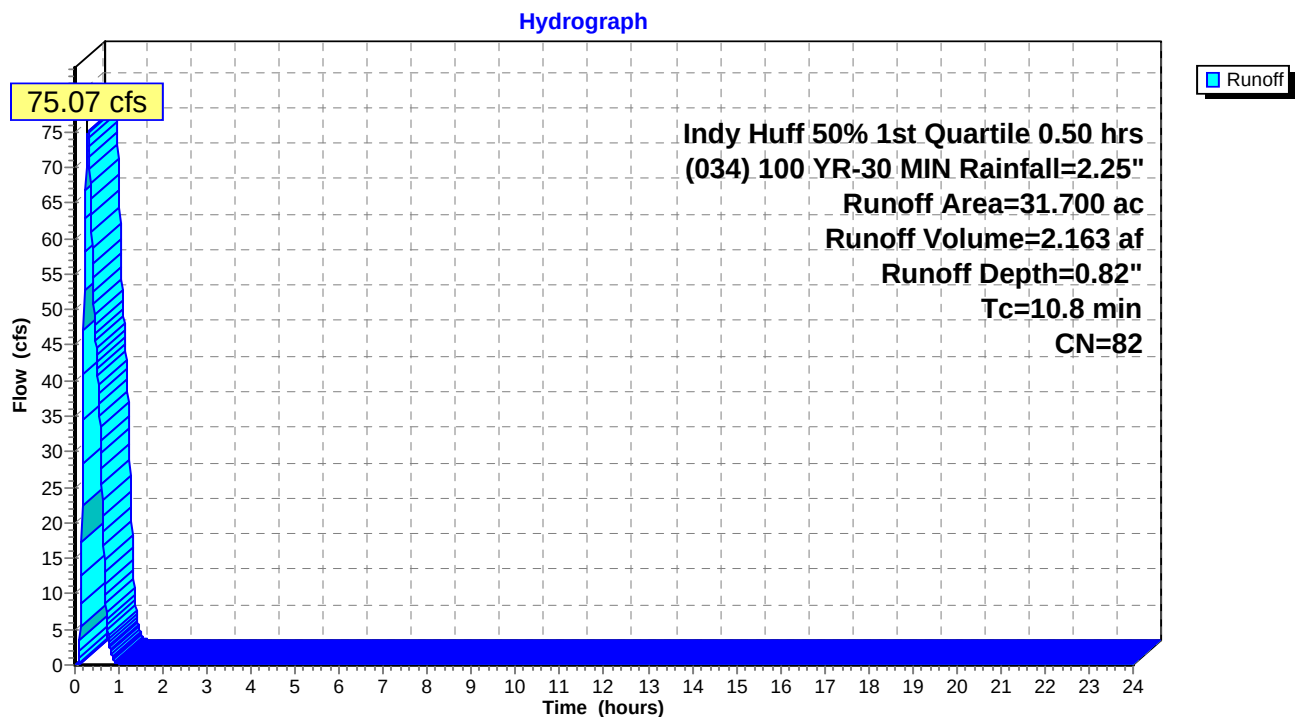
Runoff = 75.07 cfs @ 0.29 hrs, Volume= 2.163 af, Depth= 0.82"

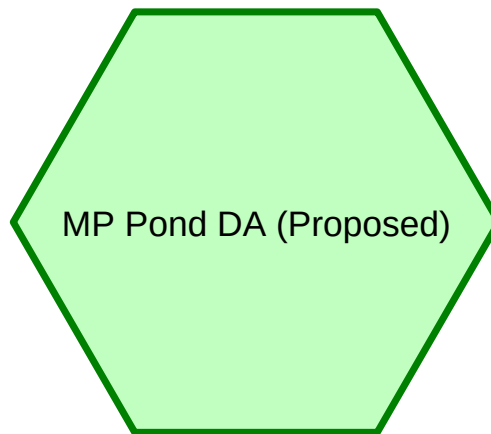
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 0.50 hrs (034) 100 YR-30 MIN Rainfall=2.25"

Area (ac)	CN	Description
* 31.700	82	From Spreadsheet
31.700		100.00% Pervious Area

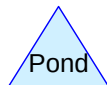
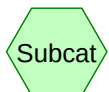
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8					Direct Entry, From Spreadsheet

Subcatchment MP Pond DA (Approved): Master Plan Pond Drainage Area (Approved)





Master Plan Pond Drainage Area (Proposed)



Summary for Subcatchment MP Pond DA (Proposed): Master Plan Pond Drainage Area (Proposed)

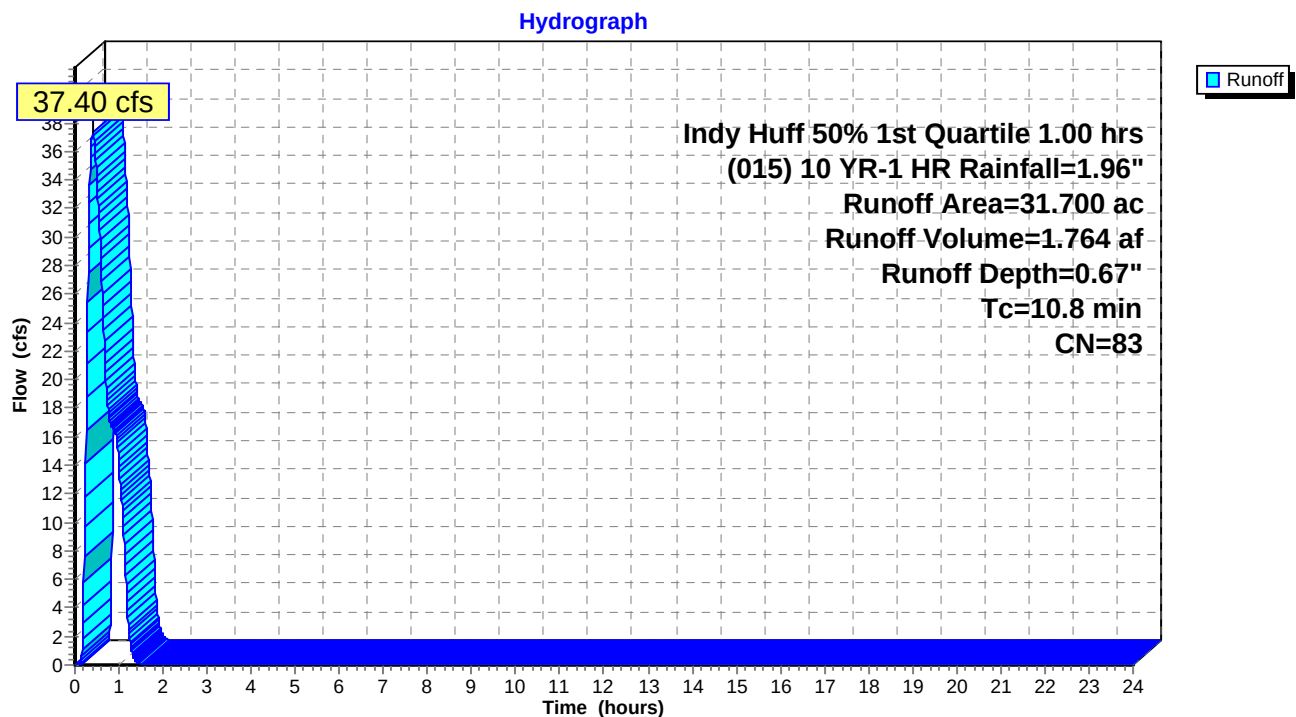
Runoff = 37.40 cfs @ 0.41 hrs, Volume= 1.764 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 1.00 hrs (015) 10 YR-1 HR Rainfall=1.96"

Area (ac)	CN	Description
* 31.700	83	From Spreadsheet
31.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8					Direct Entry, From Spreadsheet

Subcatchment MP Pond DA (Proposed): Master Plan Pond Drainage Area (Proposed)



Summary for Subcatchment MP Pond DA (Proposed): Master Plan Pond Drainage Area (Proposed)

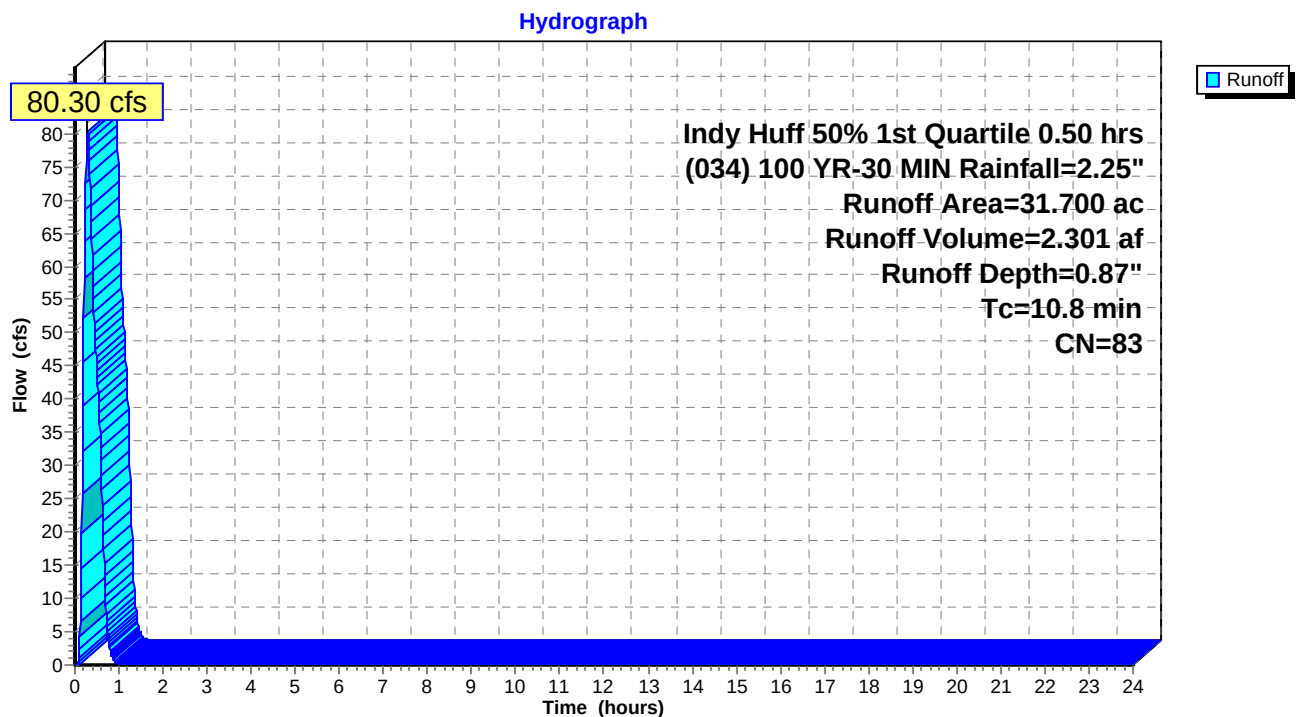
Runoff = 80.30 cfs @ 0.29 hrs, Volume= 2.301 af, Depth= 0.87"

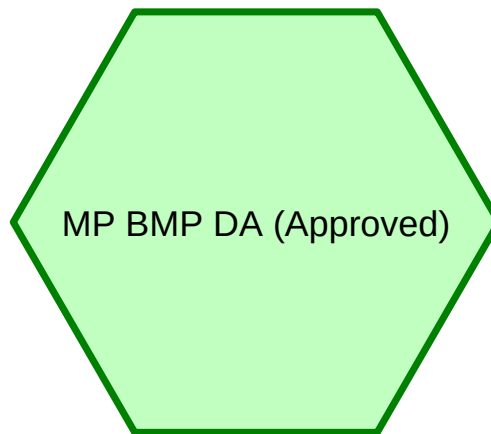
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 0.50 hrs (034) 100 YR-30 MIN Rainfall=2.25"

Area (ac)	CN	Description
* 31.700	83	From Spreadsheet
31.700		100.00% Pervious Area

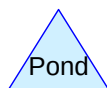
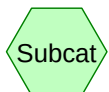
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8					Direct Entry, From Spreadsheet

Subcatchment MP Pond DA (Proposed): Master Plan Pond Drainage Area (Proposed)





Master Plan BMP Drainage Area (Approved)



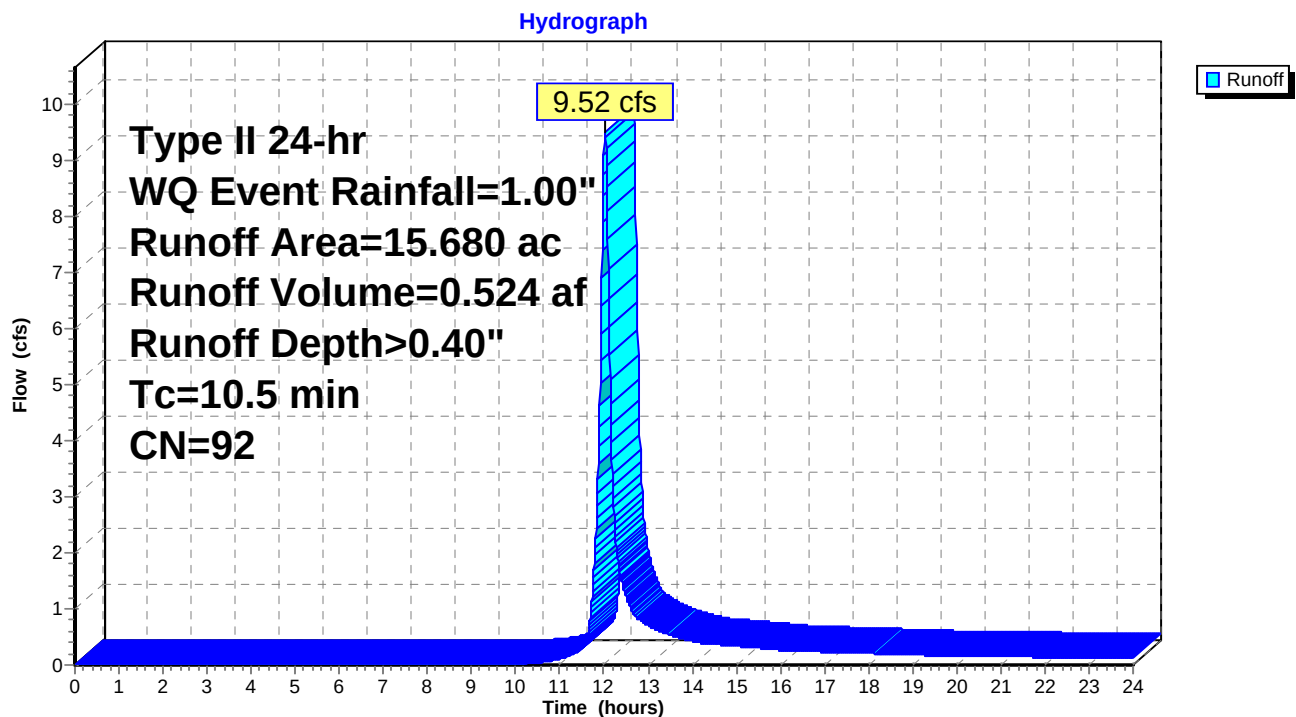
Summary for Subcatchment MP BMP DA (Approved): Master Plan BMP Drainage Area (Approved)

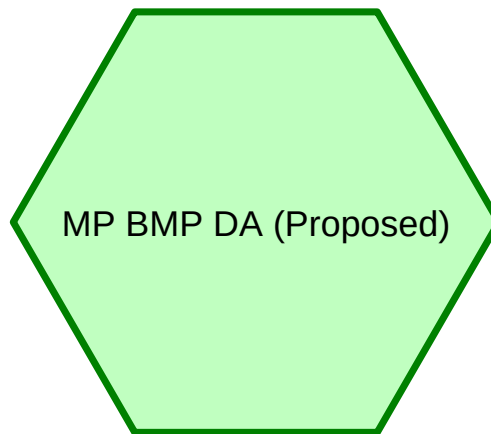
Runoff = 9.52 cfs @ 12.03 hrs, Volume= 0.524 af, Depth> 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.00"

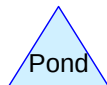
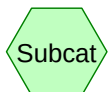
Area (ac)	CN	Description
* 15.680	92	From Spreadsheet
15.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5					Direct Entry, From Spreadsheet

Subcatchment MP BMP DA (Approved): Master Plan BMP Drainage Area (Approved)



Master Plan BMP Drainage Area (Proposed)



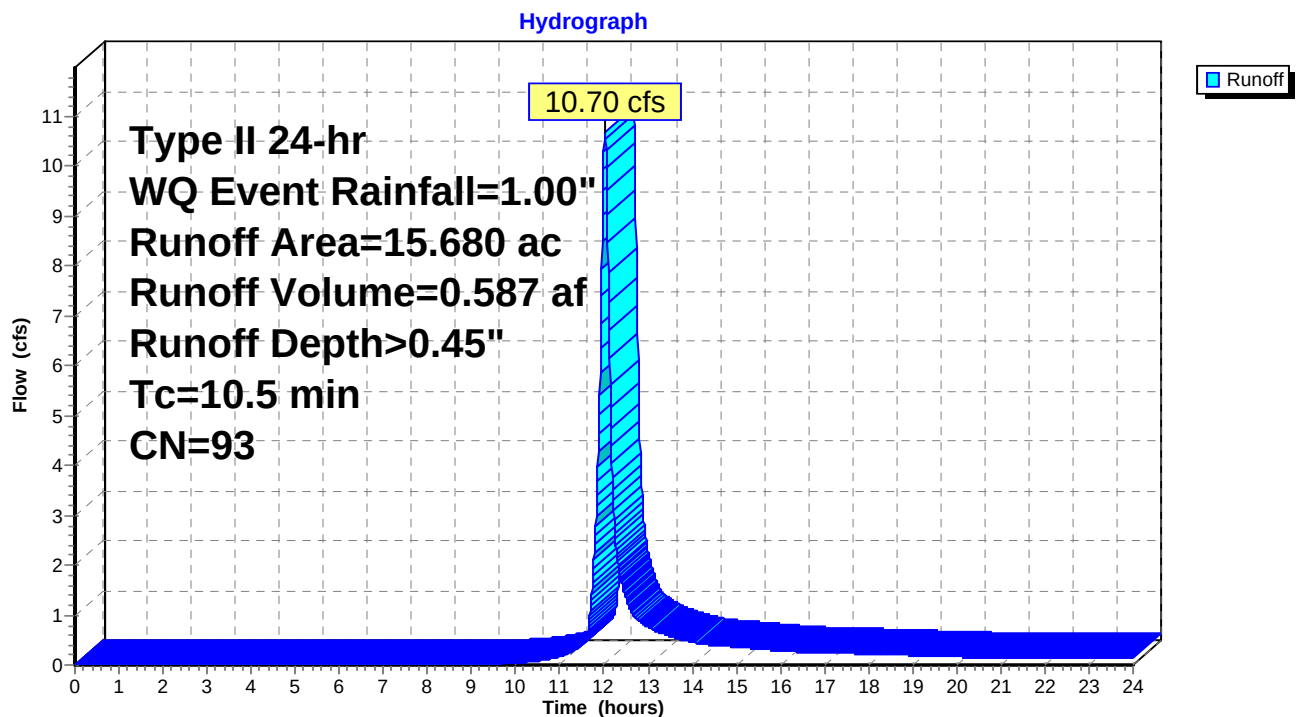
Summary for Subcatchment MP BMP DA (Proposed): Master Plan BMP Drainage Area (Proposed)

Runoff = 10.70 cfs @ 12.03 hrs, Volume= 0.587 af, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.00"

Area (ac)	CN	Description
* 15.680	93	From Spreadsheet
15.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5					Direct Entry, From Spreadsheet

Subcatchment MP BMP DA (Proposed): Master Plan BMP Drainage Area (Proposed)

Scenario: Base

Pipe Report

1046

Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Description	Average Velocity (ft/s)
701-702	702	701	N/A	N/A	N/A	9.43	3.96	37.63	185.00	0.002216	42 inch	0.013	47.36	710.41	710.00	717.50	714.00	3.59	0.50	712.69	711.91		5.46
702-704	704	702	N/A	N/A	N/A	9.43	3.96	37.68	18.00	0.002778	42 inch	0.013	53.02	710.46	710.41	717.50	717.50	3.54	3.59	712.77	712.73		5.98
704-705	705	704	1.49	0.37	0.54	9.43	4.01	38.09	143.00	0.002168	42 inch	0.013	46.84	710.87	710.56	719.50	717.50	5.13	3.44	713.33	713.06		5.43
705-706	706	705	1.05	0.62	0.66	6.62	4.10	27.34	293.00	0.002184	42 inch	0.013	47.02	711.61	710.97	723.50	719.50	8.39	5.03	713.69	713.38		5.07
705-718	718	705	0.61	0.70	0.42	2.27	4.20	9.62	97.00	0.002474	24 inch	0.013	11.25	712.61	712.37	719.47	719.50	4.86	5.13	713.97	713.58		4.02
706-707	707	706	N/A	N/A	N/A	1.97	4.13	8.22	104.00	0.004135	24 inch	0.013	14.55	713.54	713.11	721.60	723.50	6.06	8.39	714.62	714.13		4.77
706-717	717	706	5.44	0.73	3.99	3.99	4.48	18.02	115.00	0.002174	36 inch	0.013	31.10	714.05	713.80	721.00	723.50	3.95	6.70	715.65	715.16		4.56
707-708	708	707	N/A	N/A	N/A	1.46	4.20	6.18	159.00	0.003019	24 inch	0.013	12.43	714.12	713.64	721.31	721.60	5.19	5.96	715.12	714.64		3.95
707-716	716	707	0.73	0.70	0.51	0.51	6.99	3.61	46.00	0.010000	15 inch	0.013	6.46	716.06	715.60	719.76	721.60	2.45	4.75	716.83	716.27		5.41
708-709	709	708	0.24	0.77	0.18	1.46	4.22	6.20	40.00	0.003000	24 inch	0.013	12.39	714.34	714.22	721.02	721.31	4.68	5.09	715.35	715.24		3.95
709-710	710	709	0.39	0.73	0.29	1.08	4.26	4.62	89.00	0.003034	21 inch	0.013	8.73	714.86	714.59	721.22	721.02	4.61	4.68	715.76	715.47		3.68
709-714	714	709	0.22	0.61	0.14	0.20	6.77	1.35	18.00	0.004444	12 inch	0.013	2.38	716.50	716.42	721.00	721.02	3.50	3.60	717.04	716.91		3.12
710-711	711	710	0.77	0.76	0.59	0.79	4.32	3.44	127.00	0.002992	18 inch	0.013	5.75	715.49	715.11	722.10	721.22	5.11	4.61	716.33	715.87		3.40
711-712	712	711	0.31	0.65	0.20	0.20	6.99	1.42	18.00	0.010000	12 inch	0.013	3.56	716.17	715.99	721.50	722.10	4.33	5.11	716.68	716.43		4.28
714-715	715	714	0.07	0.90	0.06	0.06	6.99	0.44	99.00	0.004040	12 inch	0.013	2.26	717.00	716.60	722.20	721.00	4.20	3.40	717.30	717.12		2.24
718-719	719	718	0.55	0.53	0.29	1.36	4.26	5.85	130.00	0.002538	21 inch	0.013	7.98	713.19	712.86	717.00	719.47	2.06	4.86	714.36	714.13		3.63
718-727	727	718	0.62	0.70	0.43	0.48	5.95	2.90	50.00	0.015000	12 inch	0.013	4.36	715.40	714.65	719.50	719.47	3.10	3.82	716.13	715.25		5.94
719-720	720	719	N/A	N/A	N/A	1.07	4.28	4.62	47.00	0.001915	21 inch	0.013	6.93	713.38	713.29	719.00	717.00	3.87	1.96	714.51	714.45		3.09
720-721	721	720	0.37	0.67	0.25	1.07	4.33	4.67	119.00	0.003613	18 inch	0.013	6.31	714.06	713.63	720.00	719.00	4.44	3.87	715.02	714.58		3.91
721-734	734	721	N/A	N/A	N/A	0.82	4.35	3.60	35.00	0.006571	15 inch	0.013	5.24	714.54	714.31	719.80	720.00	4.01	4.44	715.31	715.11		4.60
722-723	723	722	0.15	0.69	0.10	0.65	4.38	2.87	45.00	0.007778	15 inch	0.013	5.70	715.81	715.46	721.00	720.80	3.94	4.09	716.49	716.31		4.65
723-724	724	723	0.08	0.53	0.04	0.55	4.41	2.42	71.00	0.007042	15 inch	0.013	5.42	716.41	715.91	721.00	721.00	3.34	3.84	717.03	716.57		4.29
724-725	725	724	0.10	0.90	0.09	0.50	4.42	2.24	41.00	0.006098	12 inch	0.013	2.78	717.01	716.76	723.65	721.00	5.64	3.24	717.69	717.40		3.94
725-726	726	725	0.75	0.55	0.41	0.41	4.47	1.86	85.00	0.003529	12 inch	0.013	2.12	717.41	717.11	720.00	723.65	1.59	5.54	718.13	717.79		3.04
727-728	728	727	0.15	0.34	0.05	0.05	6.14	0.32	76.00	0.003947	12 inch	0.013	2.24	715.80	715.50	719.00	719.50	2.20	3.00	716.28	716.28		2.01
734-722	722	734	0.24	0.72	0.17	0.82	4.36	3.61	58.00	0.012414	15 inch	0.013	7.20	715.36	714.64	720.80	719.80	4.19	3.91	716.13	715.27		5.87

Scenario: Base

Pipe Report

1004p

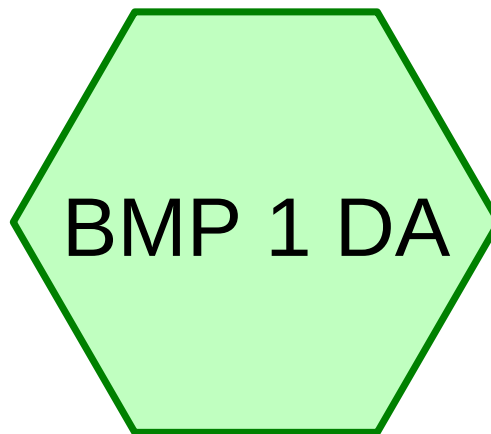
Label	Upstream Node	Downstream Node	Upstream Inlet Area (acres)	Upstream Inlet Rational Coefficient	Upstream Inlet CA (acres)	Upstream Calculated System CA (acres)	System Intensity (in/hr)	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Mannings n	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Upstream Cover (ft)	Downstream Cover (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Description	Average Velocity (ft/s)
701-702	702	701	N/A	N/A	N/A	9.43	5.74	54.61	185.00	0.002216	42 inch	0.013	47.36	710.41	710.00	717.50	714.00	3.59	0.50	713.31	712.31		5.68
702-704	704	702	N/A	N/A	N/A	9.43	5.75	54.67	18.00	0.002778	42 inch	0.013	53.02	710.46	710.41	717.50	717.50	3.54	3.59	713.43	713.38		6.27
704-706	706	704	1.49	0.37	0.54	9.43	5.81	55.20	143.00	0.002168	42 inch	0.013	46.84	710.87	710.56	719.50	717.50	5.13	3.44	714.24	713.85		5.74
705-706	706	705	1.05	0.62	0.66	6.62	5.93	39.53	293.00	0.002184	42 inch	0.013	47.02	711.61	710.97	723.50	719.50	8.39	5.03	714.67	714.31		5.48
705-718	718	705	0.61	0.70	0.42	2.27	6.01	13.75	97.00	0.002474	24 inch	0.013	11.25	712.61	712.37	719.47	719.50	4.86	5.13	714.97	714.61		4.38
706-707	707	706	N/A	N/A	N/A	1.97	5.97	11.87	104.00	0.004135	24 inch	0.013	14.55	713.54	713.11	721.60	723.50	6.06	8.39	715.11	714.89		5.16
706-717	717	706	5.44	0.73	3.99	3.99	6.44	25.88	115.00	0.002174	36 inch	0.013	31.10	714.05	713.80	721.00	723.50	3.95	6.70	716.02	715.44		4.92
707-708	708	707	N/A	N/A	N/A	1.46	6.06	8.91	159.00	0.003019	24 inch	0.013	12.43	714.12	713.64	721.31	721.60	5.19	5.96	715.43	715.14		4.30
707-716	716	707	0.73	0.70	0.51	0.51	9.69	5.01	46.00	0.010000	15 inch	0.013	6.46	716.06	715.60	719.76	721.60	2.45	4.75	716.97	716.43		5.81
708-709	709	708	0.24	0.77	0.18	1.46	6.08	8.94	40.00	0.003000	24 inch	0.013	12.39	714.34	714.22	721.02	721.31	4.68	5.09	715.70	715.62		4.29
709-710	710	709	0.39	0.73	0.29	1.08	6.13	6.65	89.00	0.003034	21 inch	0.013	8.73	714.86	714.59	721.22	721.02	4.61	4.68	716.06	715.86		3.99
709-714	714	709	0.22	0.61	0.14	0.20	9.43	1.88	18.00	0.004444	12 inch	0.013	2.38	716.50	716.42	721.00	721.02	3.50	3.60	717.16	717.00		3.35
710-711	711	710	0.77	0.76	0.59	0.79	6.21	4.95	127.00	0.002992	18 inch	0.013	5.75	715.49	715.11	722.10	721.22	5.11	4.61	716.57	716.20		3.66
711-712	712	711	0.31	0.65	0.20	0.20	9.69	1.97	18.00	0.010000	12 inch	0.013	3.56	716.17	715.99	721.50	722.10	4.33	5.11	716.77	716.71		4.65
714-715	715	714	0.07	0.90	0.06	0.06	9.69	0.62	99.00	0.004040	12 inch	0.013	2.26	717.00	716.60	722.20	721.00	4.20	3.40	717.36	717.27		2.45
718-719	719	718	0.55	0.53	0.29	1.36	6.09	8.37	130.00	0.002538	21 inch	0.013	7.98	713.19	712.86	717.00	719.47	2.06	4.86	715.58	715.22		3.48
718-727	727	718	0.62	0.70	0.43	0.48	8.39	4.09	50.00	0.015000	12 inch	0.013	4.36	715.40	714.65	719.50	719.47	3.10	3.82	716.26	715.42		6.31
719-720	720	719	N/A	N/A	N/A	1.07	6.13	6.60	47.00	0.001915	21 inch	0.013	6.93	713.38	713.29	719.00	717.00	3.87	1.96	715.81	715.73		2.75
720-721	721	720	0.37	0.67	0.25	1.07	6.20	6.68	119.00	0.003613	18 inch	0.013	6.31	714.06	713.63	720.00	719.00	4.44	3.87	716.41	715.93		3.78
721-734	734	721	N/A	N/A	N/A	0.82	6.22	5.15	35.00	0.006571	15 inch	0.013	5.24	714.54	714.31	719.80	720.00	4.01	4.44	716.80	716.58		4.20
722-723	723	722	0.15	0.69	0.10	0.65	6.28	4.11	45.00	0.007778	15 inch	0.013	5.70	715.81	715.46	721.00	720.80	3.94	4.09	717.74	717.56		3.35
723-724	724	723	0.08	0.53	0.04	0.55	6.34	3.48	71.00	0.007042	15 inch	0.013	5.42	716.41	715.91	721.00	721.00	3.34	3.84	718.06	717.85		2.84
724-725	725	724	0.10	0.90	0.09	0.50	6.36	3.23	41.00	0.006098	12 inch	0.013	2.78	717.01	716.76	723.65	721.00	5.64	3.24	718.49	718.15		4.11
725-726	726	725	0.75	0.55	0.41	0.41	6.41	2.67	85.00	0.003529	12 inch	0.013	2.12	717.41	717.11	720.00	723.65	1.59	5.54	719.18	718.70		3.40
727-728	728	727	0.15	0.34	0.05	0.05	8.61	0.44	76.00	0.003947	12 inch	0.013	2.24	715.80	715.50	719.00	719.50	2.20	3.00	716.50	716.49		2.22
734-722	722	734	0.24	0.72	0.17	0.82	6.25	5.18	58.00	0.012414	15 inch	0.013	7.20	715.36	714.64	720.80	719.80	4.19	3.91	717.25	716.87		4.22

Appendix D

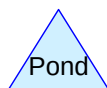
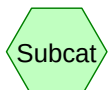
*Water Quantity & Quality Calculations—
Proposed System Performance Calculations*



WILLIAMS CREEK
CONSULTING



BMP 1 Drainage Area



Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

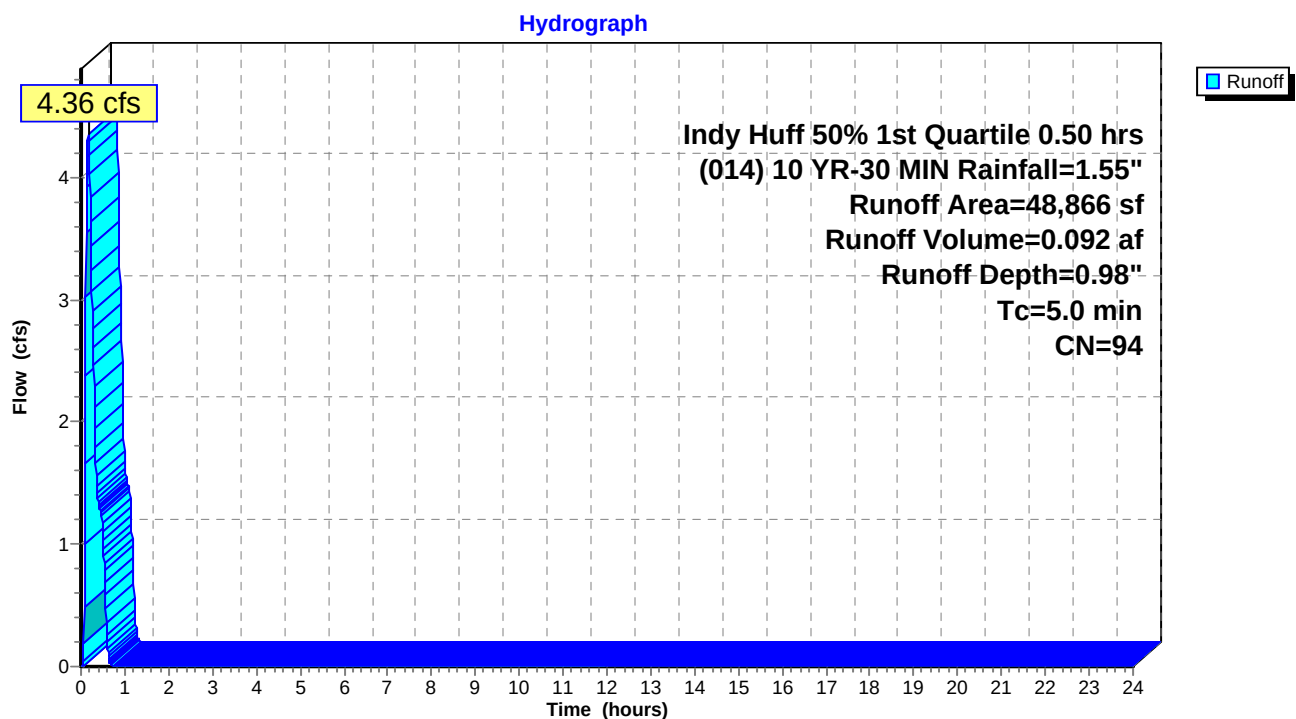
Runoff = 4.36 cfs @ 0.16 hrs, Volume= 0.092 af, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 0.50 hrs (014) 10 YR-30 MIN Rainfall=1.55"

	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

Subcatchment BMP 1 DA: BMP 1 Drainage Area



Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

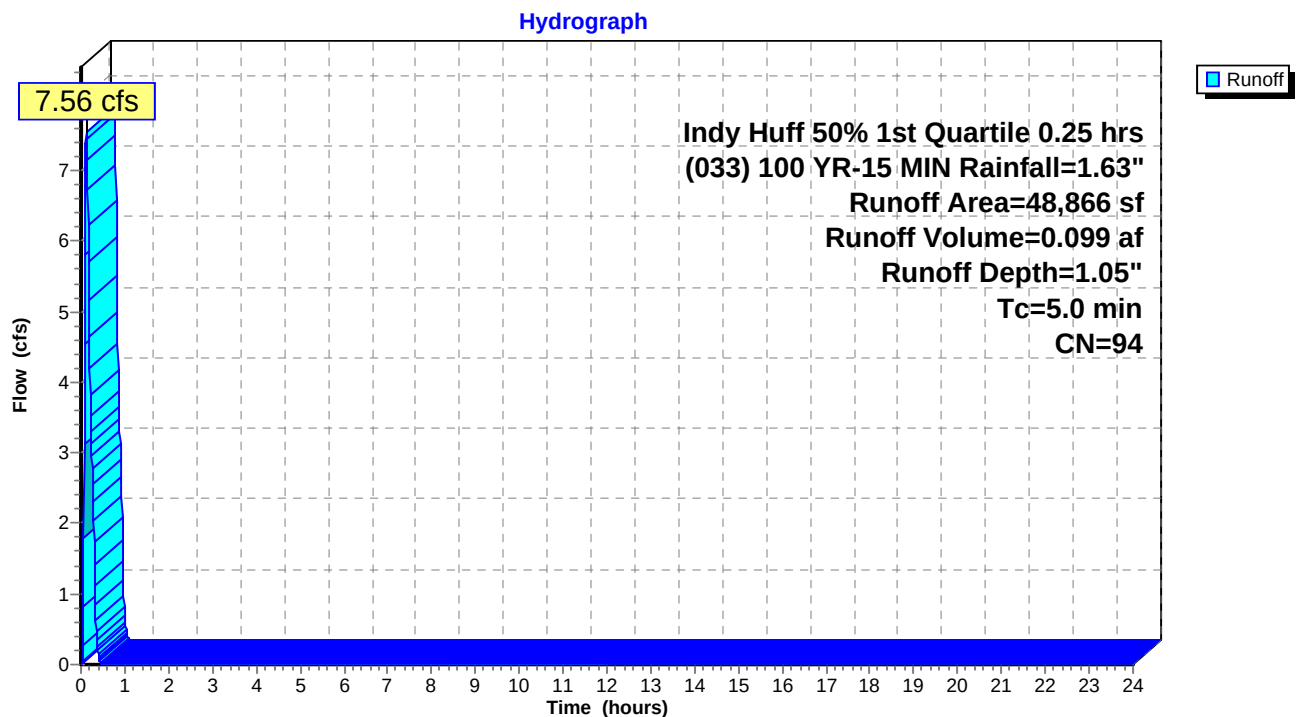
Runoff = 7.56 cfs @ 0.12 hrs, Volume= 0.099 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 0.25 hrs (033) 100 YR-15 MIN Rainfall=1.63"

	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

Subcatchment BMP 1 DA: BMP 1 Drainage Area



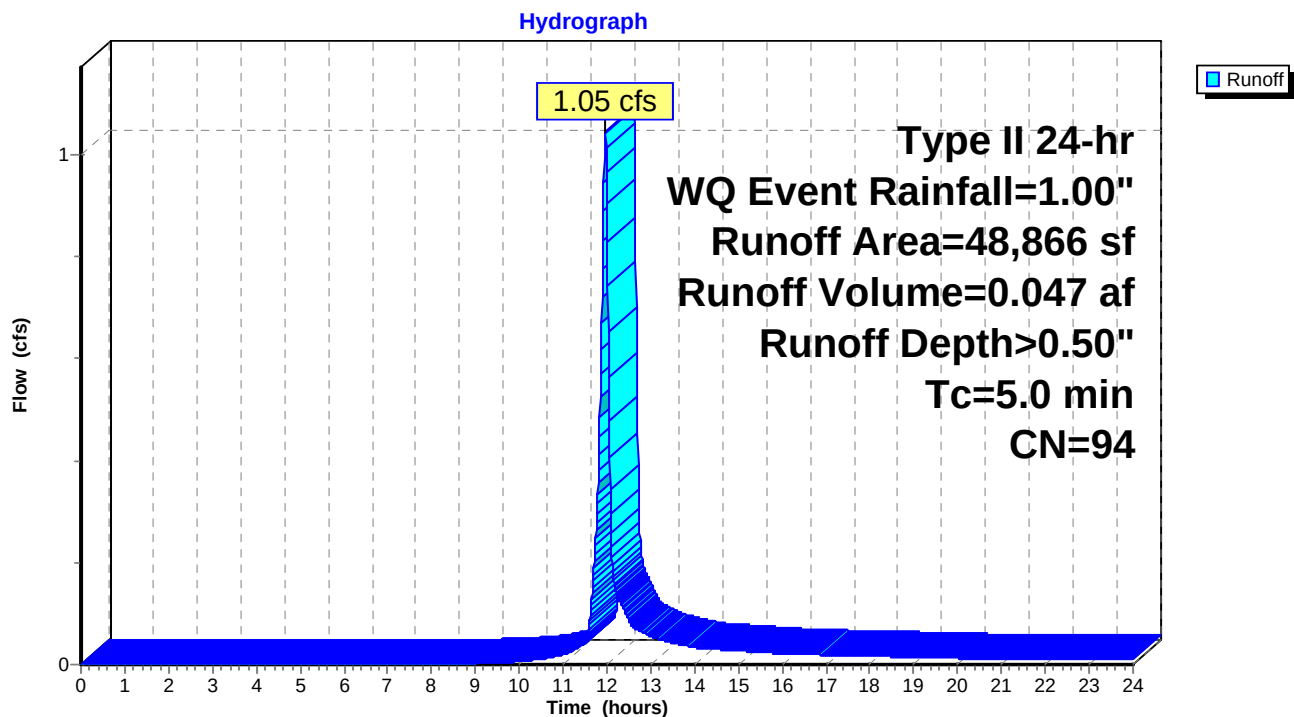
Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

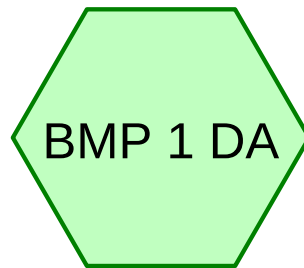
Runoff = 1.05 cfs @ 11.96 hrs, Volume= 0.047 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.00"

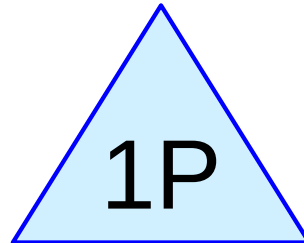
	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

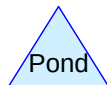
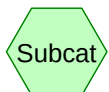
Subcatchment BMP 1 DA: BMP 1 Drainage Area



BMP 1 Drainage Area



BMP 1



Final Drainage Design_01-10-2017

Prepared by {enter your company name here}

Printed 1/19/2017

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Page 2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	712.29	712.05	110.0	0.0022	0.013	36.0	0.0	0.0

Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

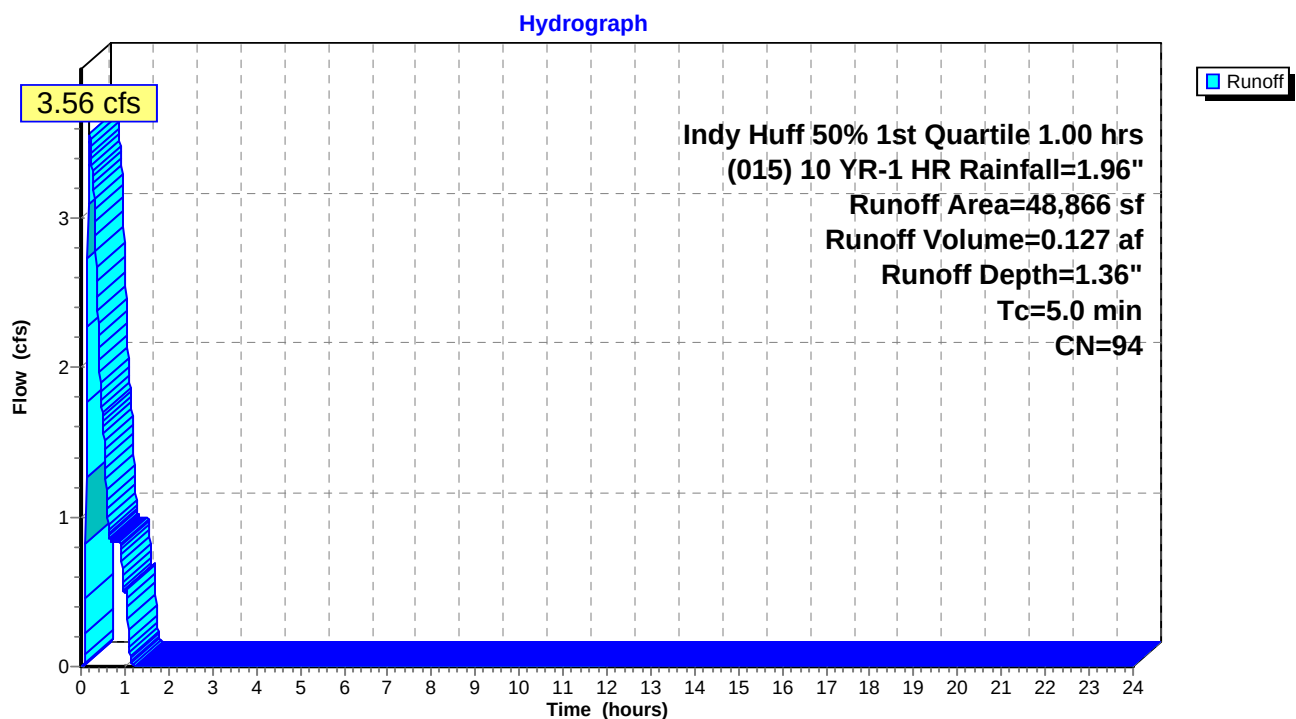
Runoff = 3.56 cfs @ 0.19 hrs, Volume= 0.127 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 1.00 hrs (015) 10 YR-1 HR Rainfall=1.96"

	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

Subcatchment BMP 1 DA: BMP 1 Drainage Area



Summary for Pond 1P: BMP 1

Inflow Area = 1.122 ac, 75.83% Impervious, Inflow Depth = 1.36" for (015) 10 YR-1 HR event
 Inflow = 3.56 cfs @ 0.19 hrs, Volume= 0.127 af
 Outflow = 0.89 cfs @ 0.64 hrs, Volume= 0.127 af, Atten= 75%, Lag= 26.8 min
 Primary = 0.89 cfs @ 0.64 hrs, Volume= 0.127 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 722.50' @ 0.64 hrs Surf.Area= 2,676 sf Storage= 3,044 cf
 Flood Elev= 723.25' Surf.Area= 3,560 sf Storage= 5,374 cf

Plug-Flow detention time= 78.6 min calculated for 0.127 af (100% of inflow)
 Center-of-Mass det. time= 78.7 min (104.9 - 26.2)

Volume	Invert	Avail.Storage	Storage Description		
#1	721.00'	278,604 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
721.00	1,500	300.0	0	0	1,500
722.00	2,200	325.0	1,839	1,839	2,782
723.00	3,210	350.0	2,689	4,528	4,167
723.25	3,560	356.0	846	5,374	4,515
800.00	3,560	356.0	273,230	278,604	31,838

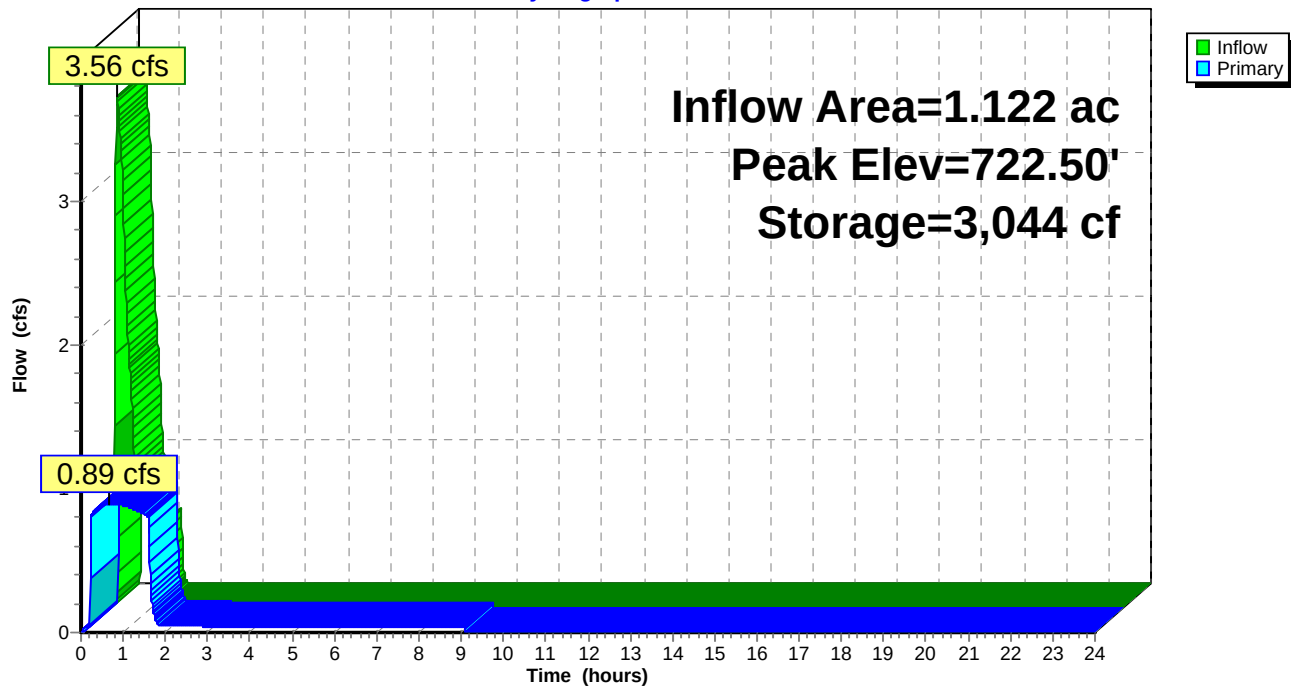
Device	Routing	Invert	Outlet Devices
#1	Primary	712.29'	36.0" Round 702-700 L= 110.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.29' / 712.05' S= 0.0022 ' /' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	717.84'	4.0" Vert. Underdrain Outlet Orifice C= 0.600
#3	Device 2	721.00'	1.000 in/hr Infiltration to Underdrain over Surface area
#4	Device 2	721.60'	24.0" x 24.0" Horiz. Overflow Riser #1 C= 0.600 Limited to weir flow at low heads
#5	Device 1	723.00'	24.0" x 24.0" Horiz. Overflow Riser #2 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.89 cfs @ 0.64 hrs HW=722.50' (Free Discharge)

- 1=702-700 (Passes 0.89 cfs of 100.42 cfs potential flow)
- 2=Underdrain Outlet Orifice (Orifice Controls 0.89 cfs @ 10.20 fps)
- 3=Infiltration to Underdrain (Passes < 0.06 cfs potential flow)
- 4=Overflow Riser #1 (Passes < 18.22 cfs potential flow)
- 5=Overflow Riser #2 (Controls 0.00 cfs)

Pond 1P: BMP 1

Hydrograph



Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

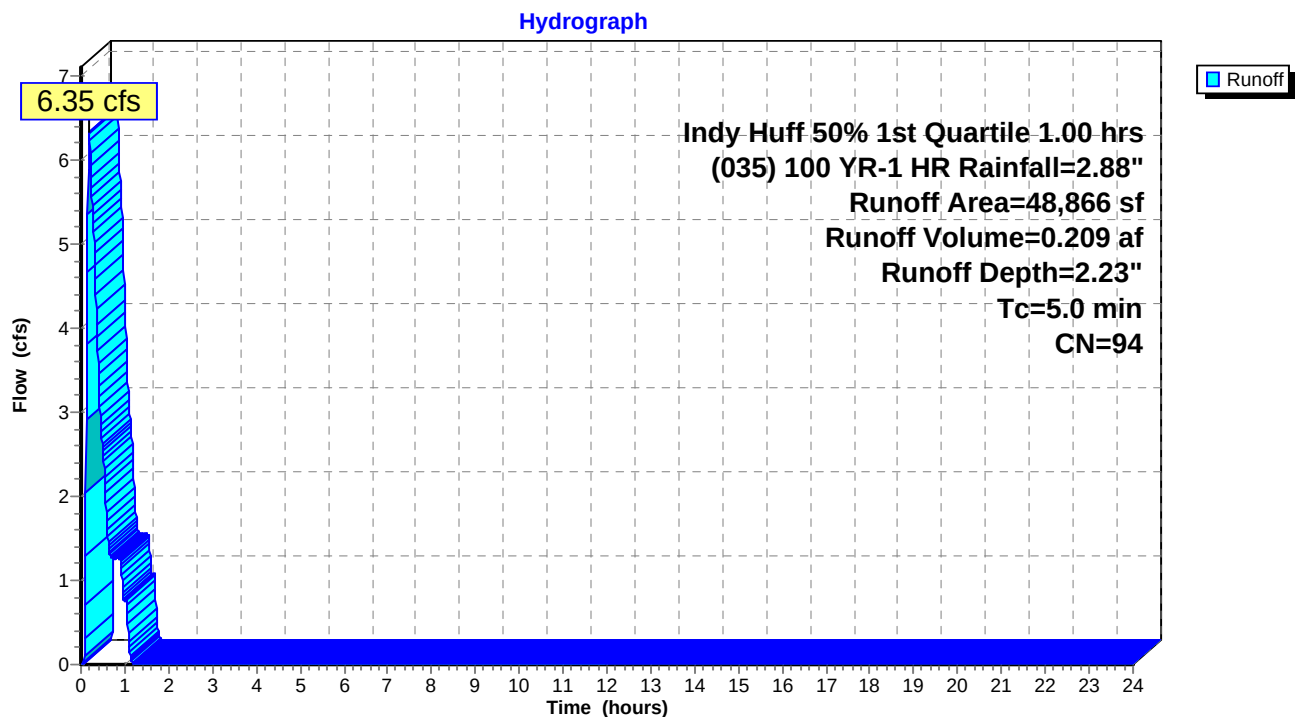
Runoff = 6.35 cfs @ 0.18 hrs, Volume= 0.209 af, Depth= 2.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Indy Huff 50% 1st Quartile 1.00 hrs (035) 100 YR-1 HR Rainfall=2.88"

	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

Subcatchment BMP 1 DA: BMP 1 Drainage Area



Summary for Pond 1P: BMP 1

Inflow Area = 1.122 ac, 75.83% Impervious, Inflow Depth = 2.23" for (035) 100 YR-1 HR event
 Inflow = 6.35 cfs @ 0.18 hrs, Volume= 0.209 af
 Outflow = 2.33 cfs @ 0.53 hrs, Volume= 0.209 af, Atten= 63%, Lag= 20.7 min
 Primary = 2.33 cfs @ 0.53 hrs, Volume= 0.209 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 723.14' @ 0.53 hrs Surf.Area= 3,405 sf Storage= 4,993 cf
 Flood Elev= 723.25' Surf.Area= 3,560 sf Storage= 5,374 cf

Plug-Flow detention time= 71.3 min calculated for 0.209 af (100% of inflow)
 Center-of-Mass det. time= 71.5 min (96.6 - 25.1)

Volume	Invert	Avail.Storage	Storage Description		
#1	721.00'	278,604 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
721.00	1,500	300.0	0	0	1,500
722.00	2,200	325.0	1,839	1,839	2,782
723.00	3,210	350.0	2,689	4,528	4,167
723.25	3,560	356.0	846	5,374	4,515
800.00	3,560	356.0	273,230	278,604	31,838

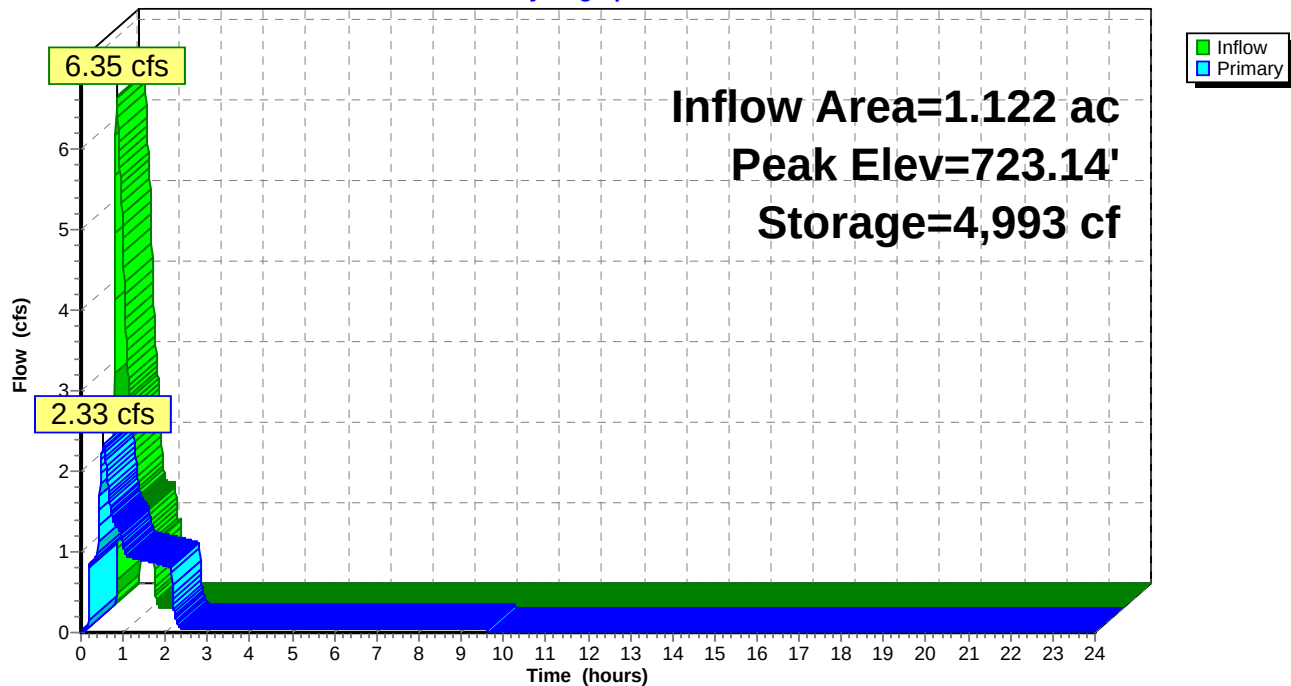
Device	Routing	Invert	Outlet Devices
#1	Primary	712.29'	36.0" Round 702-700 L= 110.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.29' / 712.05' S= 0.0022 ' /' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	717.84'	4.0" Vert. Underdrain Outlet Orifice C= 0.600
#3	Device 2	721.00'	1.000 in/hr Infiltration to Underdrain over Surface area
#4	Device 2	721.60'	24.0" x 24.0" Horiz. Overflow Riser #1 C= 0.600 Limited to weir flow at low heads
#5	Device 1	723.00'	24.0" x 24.0" Horiz. Overflow Riser #2 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.33 cfs @ 0.53 hrs HW=723.14' (Free Discharge)

- 1=702-700 (Passes 2.33 cfs of 104.07 cfs potential flow)
- 2=Underdrain Outlet Orifice (Orifice Controls 0.95 cfs @ 10.91 fps)
- 3=Infiltration to Underdrain (Passes < 0.08 cfs potential flow)
- 4=Overflow Riser #1 (Passes < 23.91 cfs potential flow)
- 5=Overflow Riser #2 (Weir Controls 1.38 cfs @ 1.23 fps)

Pond 1P: BMP 1

Hydrograph



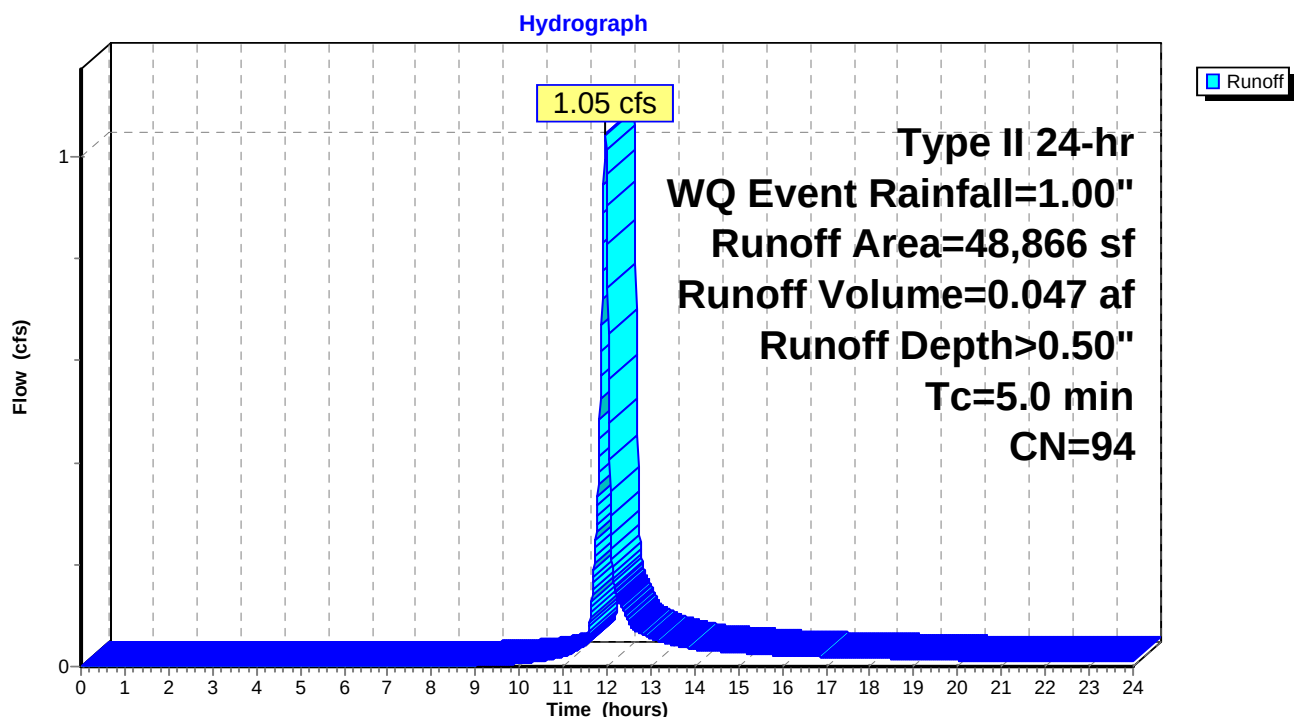
Summary for Subcatchment BMP 1 DA: BMP 1 Drainage Area

Runoff = 1.05 cfs @ 11.96 hrs, Volume= 0.047 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr WQ Event Rainfall=1.00"

	Area (sf)	CN	Description
*	37,056	98	From Spreadsheet
	11,810	80	>75% Grass cover, Good, HSG D
	48,866	94	Weighted Average
	11,810		24.17% Pervious Area
	37,056		75.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, From Spreadsheet

Subcatchment BMP 1 DA: BMP 1 Drainage Area

Summary for Pond 1P: BMP 1

Inflow Area = 1.122 ac, 75.83% Impervious, Inflow Depth > 0.50" for WQ Event event
 Inflow = 1.05 cfs @ 11.96 hrs, Volume= 0.047 af
 Outflow = 0.04 cfs @ 13.44 hrs, Volume= 0.044 af, Atten= 96%, Lag= 88.5 min
 Primary = 0.04 cfs @ 13.44 hrs, Volume= 0.044 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 721.58' @ 13.44 hrs Surf.Area= 1,890 sf Storage= 982 cf

Flood Elev= 723.25' Surf.Area= 3,560 sf Storage= 5,374 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 203.9 min (1,031.8 - 827.9)

Volume	Invert	Avail.Storage	Storage Description		
#1	721.00'	278,604 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
721.00	1,500	300.0	0	0	1,500
722.00	2,200	325.0	1,839	1,839	2,782
723.00	3,210	350.0	2,689	4,528	4,167
723.25	3,560	356.0	846	5,374	4,515
800.00	3,560	356.0	273,230	278,604	31,838

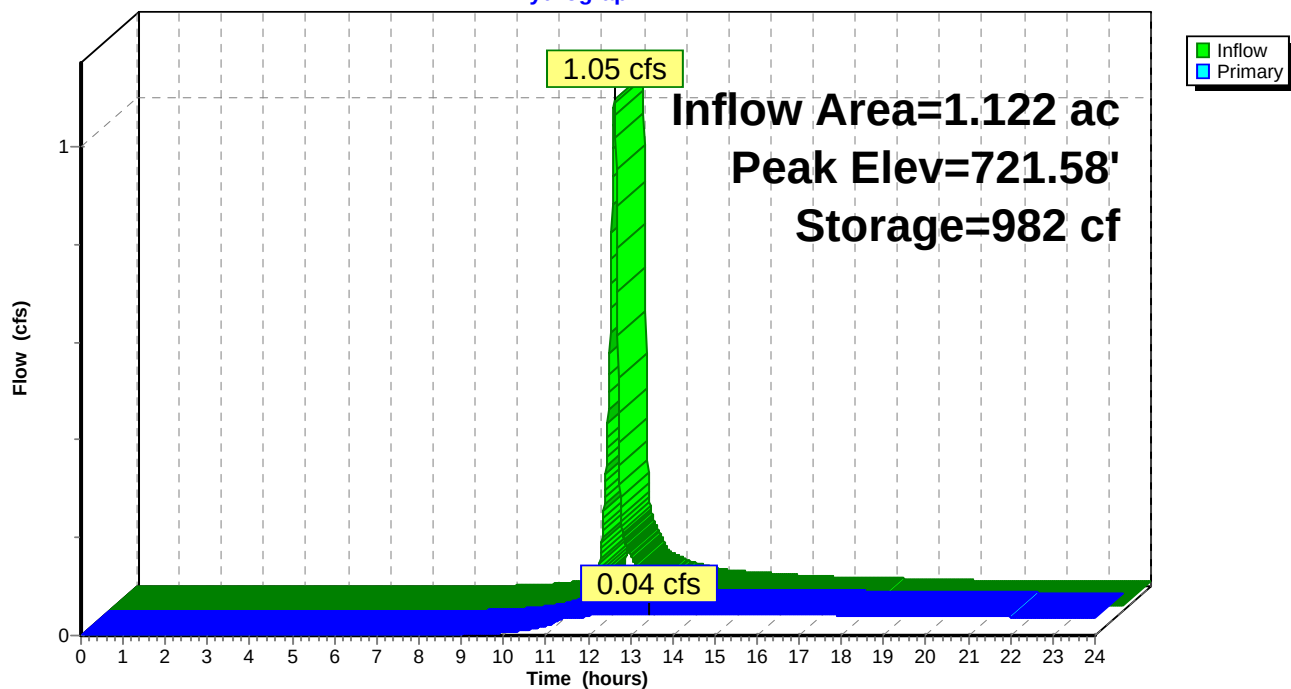
Device	Routing	Invert	Outlet Devices
#1	Primary	712.29'	36.0" Round 702-700 L= 110.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 712.29' / 712.05' S= 0.0022 ' /' Cc= 0.900 n= 0.013, Flow Area= 7.07 sf
#2	Device 1	717.84'	4.0" Vert. Underdrain Outlet Orifice C= 0.600
#3	Device 2	721.00'	1.000 in/hr Infiltration to Underdrain over Surface area
#4	Device 2	721.60'	24.0" x 24.0" Horiz. Overflow Riser #1 C= 0.600 Limited to weir flow at low heads
#5	Device 1	723.00'	24.0" x 24.0" Horiz. Overflow Riser #2 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.04 cfs @ 13.44 hrs HW=721.58' (Free Discharge)

- 1=702-700 (Passes 0.04 cfs of 95.00 cfs potential flow)
 2=Underdrain Outlet Orifice (Passes 0.04 cfs of 0.79 cfs potential flow)
 3=Infiltration to Underdrain (Exfiltration Controls 0.04 cfs)
 4=Overflow Riser #1 (Controls 0.00 cfs)
 5=Overflow Riser #2 (Controls 0.00 cfs)

Pond 1P: BMP 1

Hydrograph



Appendix E

Stormsewer Conveyance Calculations



WILLIAMS CREEK
CONSULTING

Project: SNRC Building Indiana Masonic Home
Location: Indiana Masonic Home

Design: DAM

Date: 1/19/2017

Revision:

Yr. Storm: 10

N Value: 0.013 RCP

System: A

Sheet #: 1B

STORM SEWER DESIGN SUMMARY

#REF!

FROM	TO	INVERT	ELEV.	LENGTH	SLOPE	PIPE DIAM.	PROPOSED FLOW	PIPE CAPACITY		COVER	DEPTH	
POINT	POINT	UP	LOW	FT.	PERCENT	INCHES	CFS	CFS	RIM	FEET	FEET	REMARKS
713	714	718.83	718.24	117	0.0050	12	1.50	2.52	722.50	2.50	3.67	RCP
714	715	718.24	717.60	98	0.0065	12	2.84	2.86	723.40	3.99	5.16	RCP
MP711	715	716.05	715.37	136	0.0050	15	3.44	4.55	723.42	5.93	7.37	RCP
715	712	715.37	714.76	61	0.0100	15	6.34	6.43	724.25	7.44	8.88	RCP
EX3	712	714.00	713.90	20	0.0050	18	1.43	7.40	723.99	8.28	9.99	RCP
711	712	718.83	718.67	46	0.0035	12	1.87	2.10	722.50	2.50	3.67	RCP
712	710	713.90	713.73	164	0.0010	30	9.64	13.20	723.80	7.11	9.90	RCP
EX2	710	719.04	718.73	62	0.0050	18	4.47	7.40	723.25	2.50	4.21	RCP
710	709	713.73	713.56	86	0.0020	30	15.03	18.31	722.50	5.98	8.77	RCP
709	708	713.56	713.09	189	0.0025	30	17.24	20.30	724.50	8.15	10.94	RCP
708	706	713.09	712.93	61	0.0026	30	18.39	20.87	726.22	10.34	13.13	RCP
707	706	720.33	719.73	120	0.0050	12	1.61	2.51	724.00	2.50	3.67	RCP
706	705	712.93	712.56	148	0.0025	36	20.76	33.30	723.20	6.93	10.27	RCP
705	704	712.56	712.18	153	0.0025	36	21.65	33.30	721.60	5.70	9.04	RCP
703	704	718.33	717.71	83	0.0075	12	2.69	3.07	722.00	2.50	3.67	RCP
704	700	712.18	711.91	110	0.0025	36	24.34	33.30	723.00	7.49	10.82	RCP
702	701	720.33	719.04	129	0.0100	12	1.61	3.54	724.00	2.50	3.67	RCP
701	700	719.04	718.17	79	0.0110	12	3.60	3.72	722.50	2.29	3.46	RCP
MP715	MP718	717.00	715.80	153	0.0078	12	1.94	3.14	722.15	3.98	5.15	RCP
MP718	700	715.80	714.65	231	0.0050	12	2.37	2.51	719.50	2.53	3.70	RCP
700	MP706	711.91	711.65	86	0.0030	36	30.79	36.48	722.50	7.26	10.59	RCP

File: Storm Sewer Calculations		
Project: Skilled Nursing Rehabilitation Center		
Location: Indiana Masonic Home		
Design: DAM		
Date: 19-Jan-17		
Revision:		
Yr. Storm:	10	
N Value:	0.013	HDPE/RCP
System:	A	
Sheet #:	1A	

File: Storm Sewer Calculations		
Project: Skilled Nursing Rehabilitation Center		
Location: Indiana Masonic Home		
Design: DAM		
Date: 19-Jan-17		
Revision:		
Yr. Storm:	10	
N Value:	0.013	HDPE/RCP
System:	A	
Sheet #:	1A	

File: Storm Sewer Calculations

Project: Skilled Nursing Rehabilitation Center

Location: Indiana Masonic Home

Design: DAM

Date: 19-Jan-17

Revision:

Yr. Storm: 10

N Value: 0.013 HDPE/RCP

System: A

Sheet #: 1A

STORM SEWER DESIGN COMPUTATIONS

File: Storm Sewer Calculations

Project: Skilled Nursing Rehabilitation Center

Location: Indiana Masonic Home

Design: DAM

Date: 19-Jan-17

Revision:

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Design: DAM

Date: 19-Jan-17

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N Value: 0.013 HDPE/RCP

System: A

Sheet #: 1A

STORM SEWER DESIGN COMPUTATIONS

FROM POINT	TO POINT	AREA DRAIN Ac	RUN-OFF COEFF. C	C x A		INLET TIME MIN.	RAIN FALL INCHES	RUNOFF CFS		INVERT UP	ELEV. LOW	LENGTH FT.	SLOPE FT./FT.	PIPE DIAM. INCHES	EVENT VEL. FT./ SEC	MAX VEL. FT./SEC	CAP. CFS	FLOW TIME MIN.	NOTES	
				INCR.	ACCUM.			INCR.	ACCUM.											
713	714	0.32	0.67	0.22	0.22	5.00	6.98	1.50	1.50	718.83	718.24	117	0.0050	12	1.92	3.21	2.52	0.61	RCP	
714	715	0.30	0.66	0.20	0.41	5.61	6.75	1.34	2.84	718.24	717.60	98	0.0065	12	3.62	3.64	2.86	0.45	RCP	
MP711	715	Taken from Previously Approved Master Plan							3.44	3.44	716.05	715.37	136	0.0050	15	2.80	3.71	4.55	0.61	RCP
715	712	0.03	0.45	0.01	0.43	17.40	4.22	0.06	6.34	715.37	714.76	61	0.0100	15	5.16	5.24	6.43	0.19	RCP	
EX3	712	0.26	0.78	0.21	0.21	5.00	6.98	1.43	1.43	714.00	713.90	20	0.0050	18	0.81	4.19	7.40	0.08	RCP	
711	712	0.38	0.70	0.27	0.27	5.00	6.98	1.87	1.87	718.83	718.67	46	0.0035	12	2.39	2.67	2.10	0.29	RCP	
712	710			0.00	1.06	17.59	4.19	0.00	9.64	713.90	713.73	164	0.0010	30	1.96	2.69	13.20	1.02	RCP	
EX2	710	1.61	0.71	1.14	1.14	20.00	3.91	4.47	4.47	719.04	718.73	62	0.0050	18	2.53	4.19	7.40	0.25	RCP	
710	709	0.39	0.61	0.24	2.44	20.25	3.89	0.92	15.03	713.73	713.56	86	0.0020	30	3.06	3.73	18.31	0.38	RCP	
709	708	0.67	0.85	0.57	3.02	20.63	3.85	2.21	17.24	713.56	713.09	189	0.0025	30	3.51	4.14	20.30	0.76	RCP	
708	706	0.38	0.79	0.30	3.32	21.39	3.77	1.15	18.39	713.09	712.93	61	0.0026	30	3.75	4.25	20.87	0.24	RCP	
707	706	0.30	0.76	0.23	0.23	5.00	6.98	1.61	1.61	720.33	719.73	120	0.0050	12	2.05	3.19	2.51	0.63	RCP	
706	705	0.28	0.74	0.20	3.76	21.63	3.75	0.77	20.76	712.93	712.56	148	0.0025	36	2.94	4.71	33.30	0.52	RCP	
705	704	10YR Discharge from BMP1							0.89	21.65	712.56	712.18	153	0.0025	36	3.06	4.71	33.30	0.54	RCP
703	704	0.62	0.62	0.38	0.38	5.00	6.98	2.69	2.69	718.33	717.71	83	0.0075	12	3.42	3.91	3.07	0.35	RCP	
704	700	100YR Discharge from BMP1 Only (Not Added)								24.34	712.18	711.91	110	0.0025	36	3.44	4.71	33.30	0.39	RCP
702	701	0.30	0.76	0.23	0.23	5.00	6.98	1.61	1.61	720.33	719.04	129	0.0100	12	2.05	4.52	3.54	0.48	RCP	
701	700	0.40	0.73	0.29	0.52	5.48	6.80	1.99	3.60	719.04	718.17	79	0.0110	12	4.59	4.74	3.72	0.28	RCP	
MP715	MP718	0.40	0.69	0.28	0.28	5.00	6.98	1.94	1.94	717.00	715.80	153	0.0078	12	2.47	4.00	3.14	0.64	RCP	
MP718	700	0.14	0.50	0.07	0.35	7.81	6.04	0.43	2.37	715.80	714.65	231	0.0050	12	3.02	3.19	2.51	1.21	RCP	
700	MP706	0.22	0.60	0.13	1.00	22.15	3.70	0.47	30.79	711.91	711.65	86	0.0030	36	4.36	5.16	36.48	0.28	RCP	