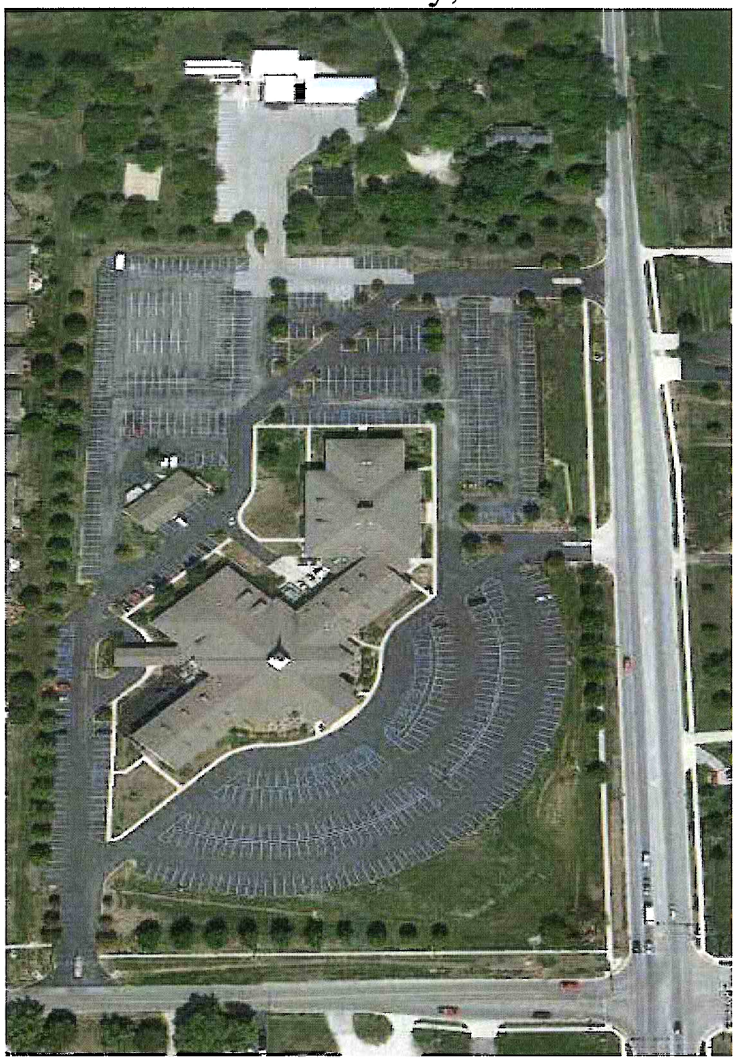
BANNING ENGINEERING

"Your Project is Our Priority"

Hydrologic and Hydraulic Analysis for Plainfield Christian Church Phase 1 Parking Addition in The Town of Plainfield Hendricks County, Indiana



JOSEPH L. [illegible]
REGISTERED
No. PE10403401
STATE OF INDIANA
PROFESSIONAL ENGINEER

4-16-13

Prepared for:
Plainfield Christian Church

April 2013

Banning Engineering, P C. • 853 Columbia Road, Suite 101 • Plainfield, IN 46168
Phone: (317) 707-3700 • Fax: (317) 707-3800 • E-mail: banning@BanningEngineering.com

Hydrologic and Hydraulic Analysis for PCC Phase 1 Parking Addition

Study Area:

Plainfield Christian Church has retained Banning Engineering to design the first phase of a multi-phase project which ultimately will include a children ministry addition to the current church structure. Phase 1 will consist of a parking lot addition in the open area northwest of the church campus. The site is located on the northwest corner of Township Line and Dan Jones in Plainfield, Section 23, T15N, R1E, Guilford Township in Hendricks County, Indiana. The street address is 800 Dan Jones Road .

Existing Conditions:

The existing drainage basin is 1.65 acres consisting of mostly grass areas with sparse trees gently sloping east to an existing catch basin in the Dan Jones right-of-way. The predominant soil types are Brookston and Crosby, poorly drained gently sloping soils on uplands. The site is not within a floodplain.

Proposed Conditions:

The proposed parking lot will increase the drainage basin to 2.15 acres of which will mostly be impervious surface. The drainage design will utilize underground storage chambers to retain the 100 year run-off and release at the 10 year rate. The Rational Method was used to calculate the required storage. The storage chambers utilized are StormTech SC-740 with a storage volume of 75 cft per unit. Based on the calculated storage volume, 114 SC-740 units will be required. Supporting calculations can be found in the attached Appendix. A summary of the release rates are as follows:

Pre-developed 10 year release rate = 2.55 cfs
Post developed 100 year release rate = 2.55 cfs (storage required, see calculations)

Stormwater Quality:

The water quality design for the project consists of holding the water quality volume within the underground chamber system and allowing the volume to filter through the granular fill to a sub-drain finger system at the bottom of the chamber system. This is accomplished by a concrete weir in the outlet structure for the system. The weir will also contain a 4" diameter orifice to allow the system to completely drain in 2.3 hours. An orifice size any smaller would be susceptible to possible debris blockage. To offset the possibility of blockage at the outlet, a Snout will be installed in the first up-stream structure coming into the detention system. An Operation & Maintenance manual for the complete system is included with this report.

References:

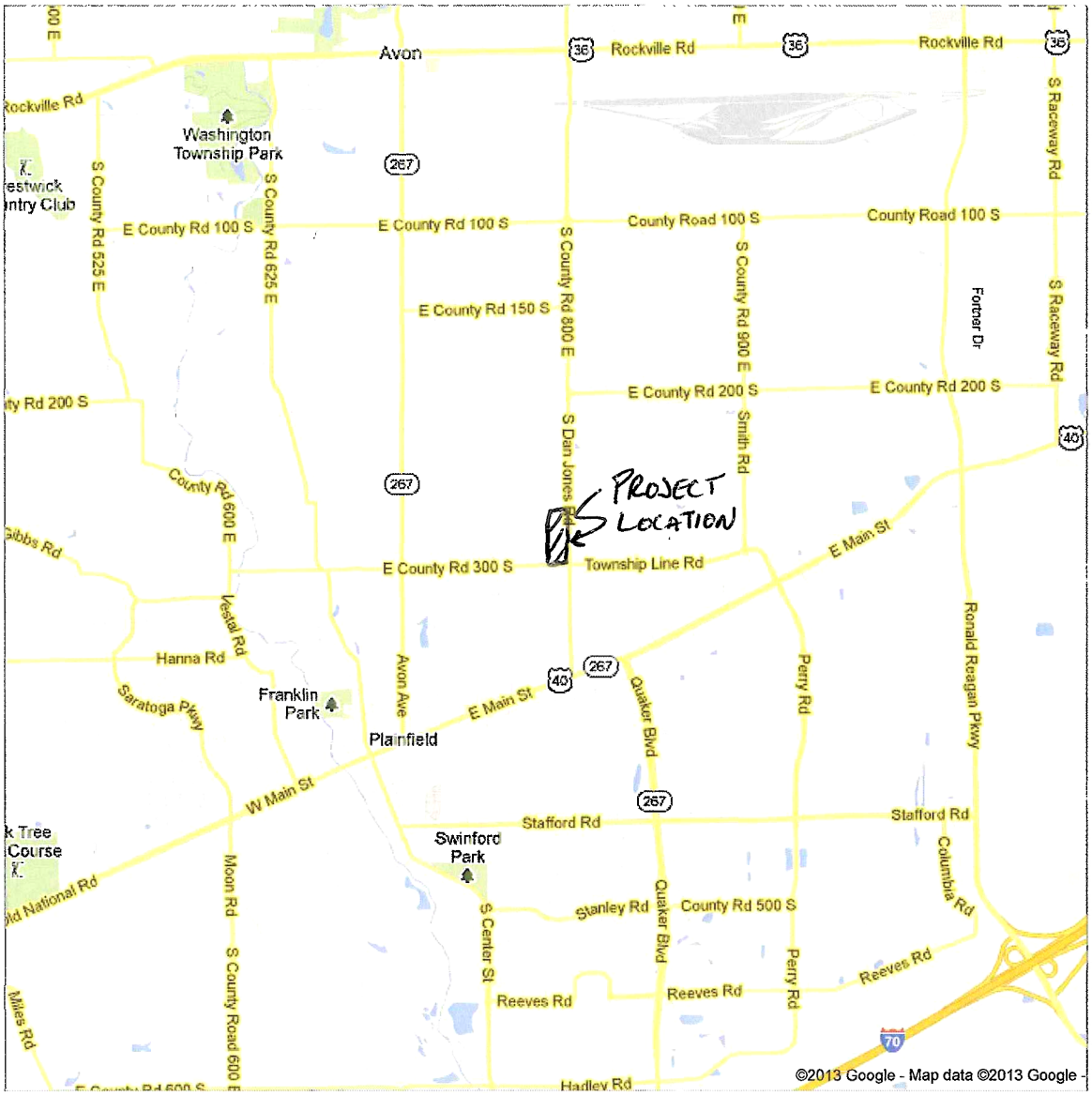
1) Hendricks County Soils Map
2) Town of Plainfield Stormwater Management Ordinance
3) Hendricks County, Indiana Stormwater Technical Standards Manual
4) USGS Mapping
5) Technical Report 55, Small Watershed Hydrology, NRCS

Appendices

1. Location Map
2. Soils Mapping
3. Floodplain Mapping
4. Existing Basin Map
5. Proposed Basin Map
6. Rational Method Calculations
7. Storm Sewer Calculations
8. Water Quality Calculations
9. Operation & Maintenance Manual

Location Maps

Google



Soils Mapping

Map Scale: 1:1,160 if printed on A size (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:1,160 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

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

Soil Survey Area: Hendricks County, Indiana
Survey Area Data: Version 16, Sep 25, 2012

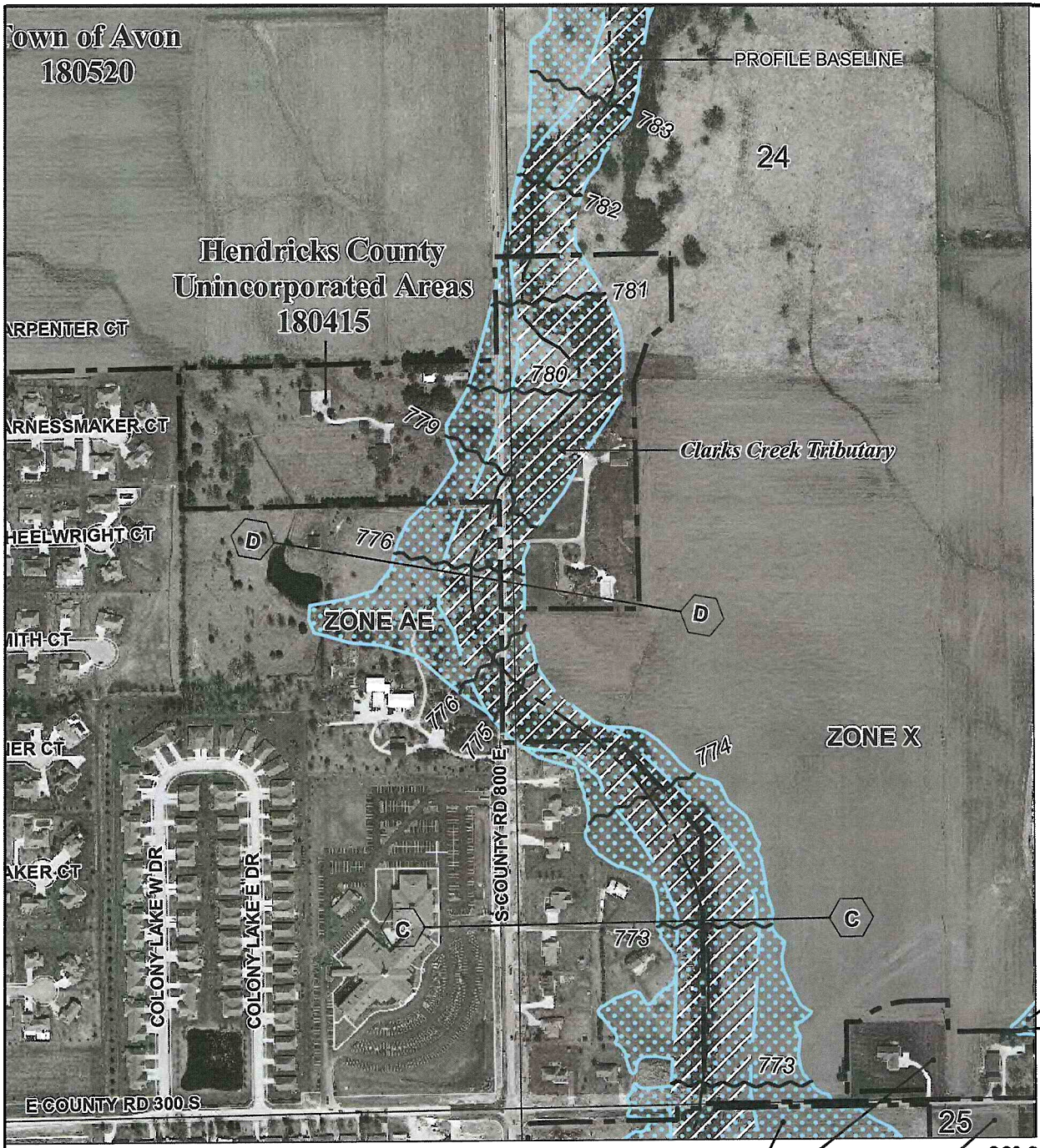
Date(s) aerial images were photographed: 7/14/2003

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

Hendricks County, Indiana (IN063)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Bs	Brookston silty clay loam	1.5	27.6%
CrA	Crosby silt loam, 0 to 3 percent slopes	3.0	55.2%
Gn	Genesee silt loam	0.3	6.0%
MmB2	Miami silt loam, 2 to 6 percent slopes, eroded	0.5	9.5%
MsD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	0.1	1.8%
Totals for Area of Interest		**5.4**	**100.0%**

Floodplain Mapping



MAP SCALE 1" = 500'

250 0 500 1000 FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0257D

FIRM

FLOOD INSURANCE RATE MAP

HENDRICKS COUNTY, INDIANA AND INCORPORATED AREAS

PANEL 257 OF 375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AVON, TOWN OF	180520	0257	D
HENDRICKS COUNTY	180415	0257	D
PLAINFIELD, TOWN OF	180089	0257	D

Notice to User The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

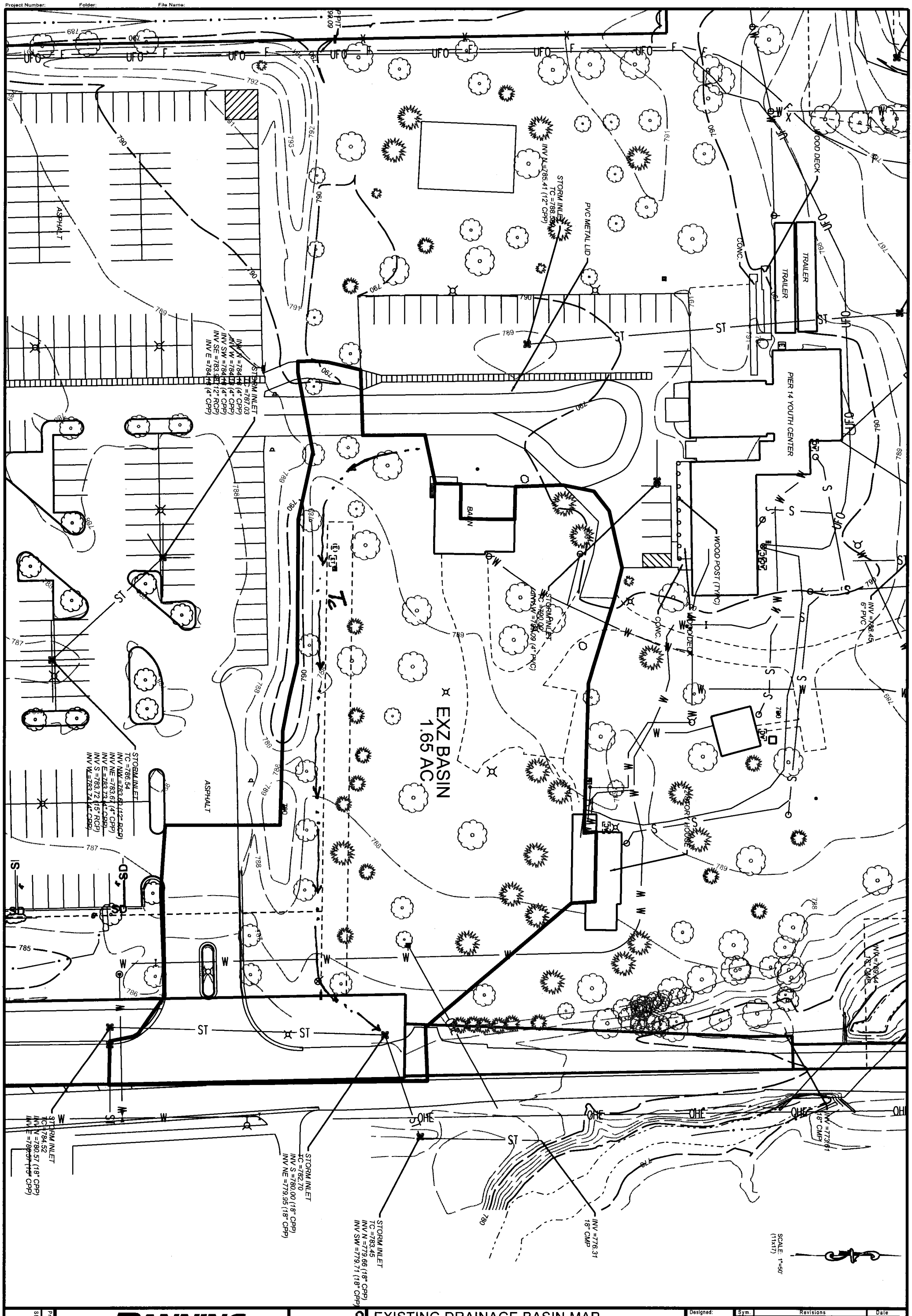
MAP NUMBER
18063C0257D

EFFECTIVE DATE
SEPTEMBER 25, 2009

Federal Emergency Management Agency

Existing Basin Map

04\03\2013
SCALE: 50.0000 ' / in.
Project Number: Folder: File Name:



1 of 1

Sheet No:

Project No: 06048C

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PLAINFIELD, IN 46168
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E-MAIL: Banning@BanningEngineering.com
WEB: www.BanningEngineering.com

NOT FOR CONSTRUCTION

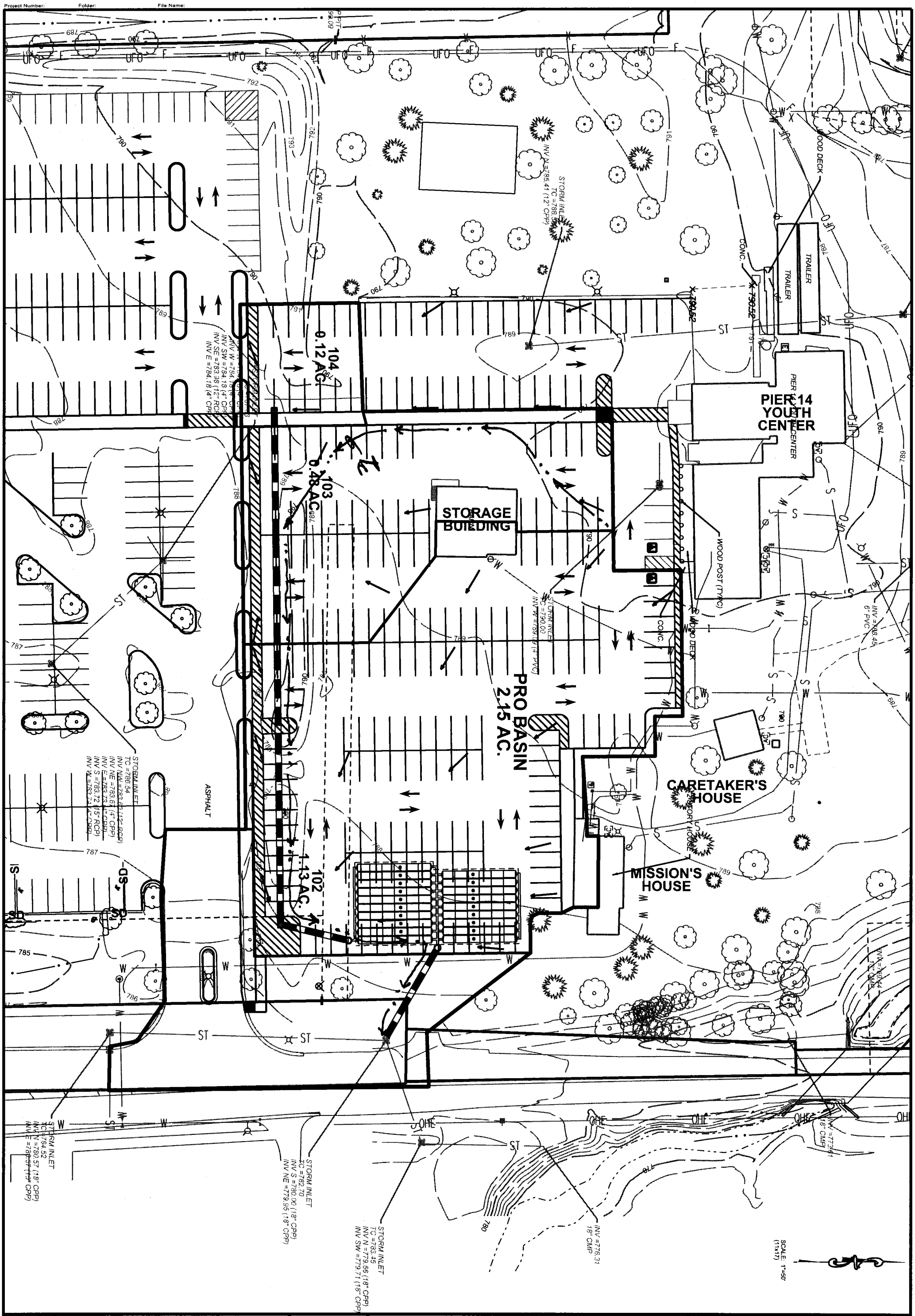
EXISTING DRAINAGE BASIN MAP
PHASE 1 PARKING EXPANSION
PLAINFIELD CHRISTIAN CHURCH
PLAINFIELD, IN

Designed:	RRL
Drawn:	RRL
Checked:	
Scale:	1"=50'
Date:	4-2-13

Sym.	Revisions	Date

Proposed Basin Map

04\03\2013
SCALE: 50.0000 ' / in.
Project Number: Folder: File Name:



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NOT FOR CONSTRUCTION

PROPOSED DRAINAGE BASIN MAP
PHASE 1 PARKING EXPANSION
PLAINFIELD CHRISTIAN CHURCH
PLAINFIELD, IN

Designed: RRL
Drawn: RRL
Checked:
Scale: 1"=50'
Date: 4-2-13

Sym.	Revisions	Date

Project No: 06048C
Sheet No: 1 of 1

Rational Method Calculations

Pre-Developed Condition
Weighted "C" = [0.85(0.04ac)+0.82(0.4ac)+0.16(1.21ac)]/1.65ac = 0.34
I_{10} = (Tc of 15 min.) = 4.55in/hr
A = 1.65ac

Q_{10} = CIA
= 0.34(4.55in/hr)(1.65ac)
= 2.55 cfs

Post-Developed Condition
Weighted "C" = [0.85(0.06ac)+0.82(1.85ac)+0.16(0.24ac)]/2.15ac = 0.75
I_{100} = (Tc of 10 min.) = 7.77in/hr
A = 2.15ac

Q_{100} = CIA
= 0.75(7.77in/hr)(2.15ac)
= 12.53 cfs

For required storage volume, refer to Detention Storage Calculations spreadsheet next page

Detention volume required = 8542 cft
Use StormTech chambers SC-740, 75 cft of storage per unit
8542 cft/75 cft = 113.89, **Use 114 units**

Computation Sheet for Detention Storage Calculations Using the Rational Method
(Ref. HERPICC, Figure 6.2.2)

Project PCC Phase1 Parking
Indy DDF Table
Designer RRL

Design Return Period, years 100

Release Rate Return, years 10 predev.

Watershed Area, acres= 1.65 existing 2.15 proposed

Time-of-Concentration, minutes= 15 existing 10 proposed

Undeveloped Conditions:

Rainfall Intensity, in/hr= 4.55 [iu]
Runoff Coefficient, = 0.34 [Cu]
Peak Discharges, cfs= 2.55 [O=CuiuAu]

Developed Conditions:

Runoff Coefficient, = 0.75

Storm Duration hrs		Rainfall Intensity in/hr	CA	Inflow cfs	Outflow cfs	Storage Rate cfs		Required Storage acre-ft	cu-ft	
0.08		9.69	1.61	15.63	**2.55**	13.08		0.09	3797	
0.17		7.77	1.61	12.53	2.55	9.98		0.14	6158	
0.25		6.53	1.61	10.53	2.55	7.98		0.17	7242	
0.5		4.50	1.61	7.26	2.55	4.71		0.20	**8542**	**
1		2.88	1.61	4.64	2.55	2.09		0.17	7601	
2		1.75	1.61	2.82	2.55	0.27		0.05	1974	
3		1.29	1.61	2.08	2.55	-0.47		-0.12	-5117	
6		0.75	1.61	1.21	2.55	-1.34		-0.67	-29199	
12		0.43	1.61	0.69	2.55	-1.86		-1.86	-80875	
24		0.25	1.61	0.40	2.55	-2.15		-4.29	-187036	

Storm Sewer Calculations

STORM SEWER DESIGN CALCULATIONS
-PIPE DESIGN-

PROJECT:	PCC	STORM:	10 Year
JOB #:	06048C	COMPUTED BY:	RRI
DATE:	4/1/13	SHEET NO.:	

Pipe Type HDPE Smooth Wall
n-value Used: 0.011

STRUCTURE		DESIGN				CAP.		RIM ELEV.		INVERT ELEV.		COVER
FROM	TO	Q (cfs)	L (ft)	DIA. (in)	SLOPE %	Q (cfs)	VEL. (ft/s)	UP	DOWN	UP	DOWN	(ft)
104	103	0.60	74	12	0.55	3.13	3.98	788.35	787.85	784.72	784.31	2.46
103	102	2.97	230	12	0.55	3.13	3.98	787.85	786.00	784.31	783.04	2.37
102	101	8.21	41	15	1.20	8.38	6.83	786.00	786.65	782.79	782.30	1.79
100	EX1	2.55	61	12	0.37	2.57	3.27	787.04	782.70	780.23	780.00	5.64

STORM SEWER DESIGN CALCULATIONS
-COMPOSITE C-VALUES-

PROJECT:	PCC	STORM:	10 Year
JOB #:	06048C	COMPUTED BY:	RRI
DATE:	4/1/13	SHEET NO.:	

BASINS						COMPOSITE BASINS				
BASIN #	c	Area (ft^2)	Area (acres)	c*A		BASIN #	c	Area (acres)	c*A	
104	0.82	5227	0.12	0.10		104	0.82	0.12	0.1	
103	0.82	20909	0.48	0.39		103	0.82	0.48	0.39	
102	0.82	49223	1.13	0.93		102	0.82	1.13	0.93	
							0	0	0	
							0	0	0	
100	0.34	71874	1.65	0.56		100	0.34	1.65	0.56	
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STORM SEWER DESIGN CALCULATIONS
-PIPE DESIGN-

PROJECT:	PCC	STORM:	10 Year
JOB #:	06048C	COMPUTED BY:	RRI
DATE:	4/1/13	SHEET NO.:	

Pipe Type HDPE Smooth Wall
n-value Used: 0.011

STRUCTURE FROM	TO	DESIGN Q (cfs)	L (ft)	DIA. (in)	SLOPE %	CAP. Q (cfs)	VEL. (ft/s)	RIM ELEV. UP	RIM ELEV. DOWN	INVERT ELEV. UP	INVERT ELEV. DOWN	COVER (ft)
104	103	0.60	74	12	0.55	3.13	3.98	788.35	787.85	784.72	784.31	2.46
103	102	2.97	230	12	0.55	3.13	3.98	787.85	786.00	784.31	783.04	2.37
102	101	8.21	41	15	1.20	8.38	6.83	786.00	786.65	782.79	782.30	1.79
100	EX1	2.55	61	12	0.37	2.57	3.27	787.04	782.70	780.23	780.00	5.64

OUTLET RELEASE ≈ 2.55 CFS (PRE-DEV RATE)

Water Quality Calculations

Water Quality Volume (WQv) - Calculation Spreadsheet

Project Name:	PCC Phase 1 Parking Addition	Designed By:	RRL
Project Number:	06048C	Date:	4/3/2013
Designation:	Detention System		

WQv = wate quality volume (in acre feet)
P = 1 inch of rainfall
Rv = 0.05 + 0.009(I) where "I" is percent impervious cover
A = area in acres

$$WQv = \frac{(P)\,(Rv)\,(A)}{12}$$

Required WQv(cf)	WQv(af)	P	Rv	I	A
6642	0.1525	1	0.851	89	2.15

Bottom of detention stone base	**781.6**
Number of storage units	**114**
Incremental storage volume/unit	**see attached chart**
Storage/unit @ 29" of depth	**58 cft**
58 cft * 114 units =	**6612 cft (within tolerance)**
781.6 + 29" =	**784.0 (set weir at this elevation)**

Design oriface to drain down system
Use 4" min. diameter (to avoid clogging)
Q=CA*sqrt(2gh)
Q=(0.6)(0.086)*sqrt[2(32.2)(3.77')
Q=0.8 cfs

Convert to time to determine draw down
6612cft/1 * 1 sec/0.8cft * 1 min/60 sec * 1 hr/60 min = 2.3 hr
Therefore, system will be empty in 2.3 hours

8.0 Incremental Storage Volumes

Table 5 and **Table 6** provide incremental storage volumes for SC-310 and SC-740 chamber systems. This information may be used to calculate a detention/retention system's stage storage volume.

Product Specifications: 1.1, 2.2, 2.3, 2.4 and 2.6

TABLE 5 – SC-310 Incremental Storage Volumes Per Chamber
Assumes 40% Stone Porosity. Calculations are Based Upon a 6-inch Stone Base Under the Chambers.

Depth of Water in System (in)	Cumulative Chamber Storage (ft^3)	Total System Cumulative Storage (ft^3)
28	↑ 14.70	31.00
27	↑ 14.70	30.21
26	Stone 14.70	29.42
25	Cover 14.70	28.63
24	↓ 14.70	27.84
23	↓ 14.70	27.05
22	14.70	26.26
21	14.64	25.43
20	14.49	24.54
19	14.22	23.58
18	13.68	22.47
17	12.99	21.25
16	12.17	19.97
15	11.25	18.62
14	10.23	17.22
13	9.15	15.78
12	7.99	14.29
11	6.78	12.77
10	5.51	11.22
9	4.19	9.64
8	2.83	8.03
7	1.43	6.40
6	↑ 0	4.74
5	↑ 0	3.95
4	Stone 0	3.16
3	Foundation 0	2.37
2	↓ 0	1.58
1	↓ 0	0.79

Note: Add 0.79 cu. ft. of storage for each additional inch of stone foundation.

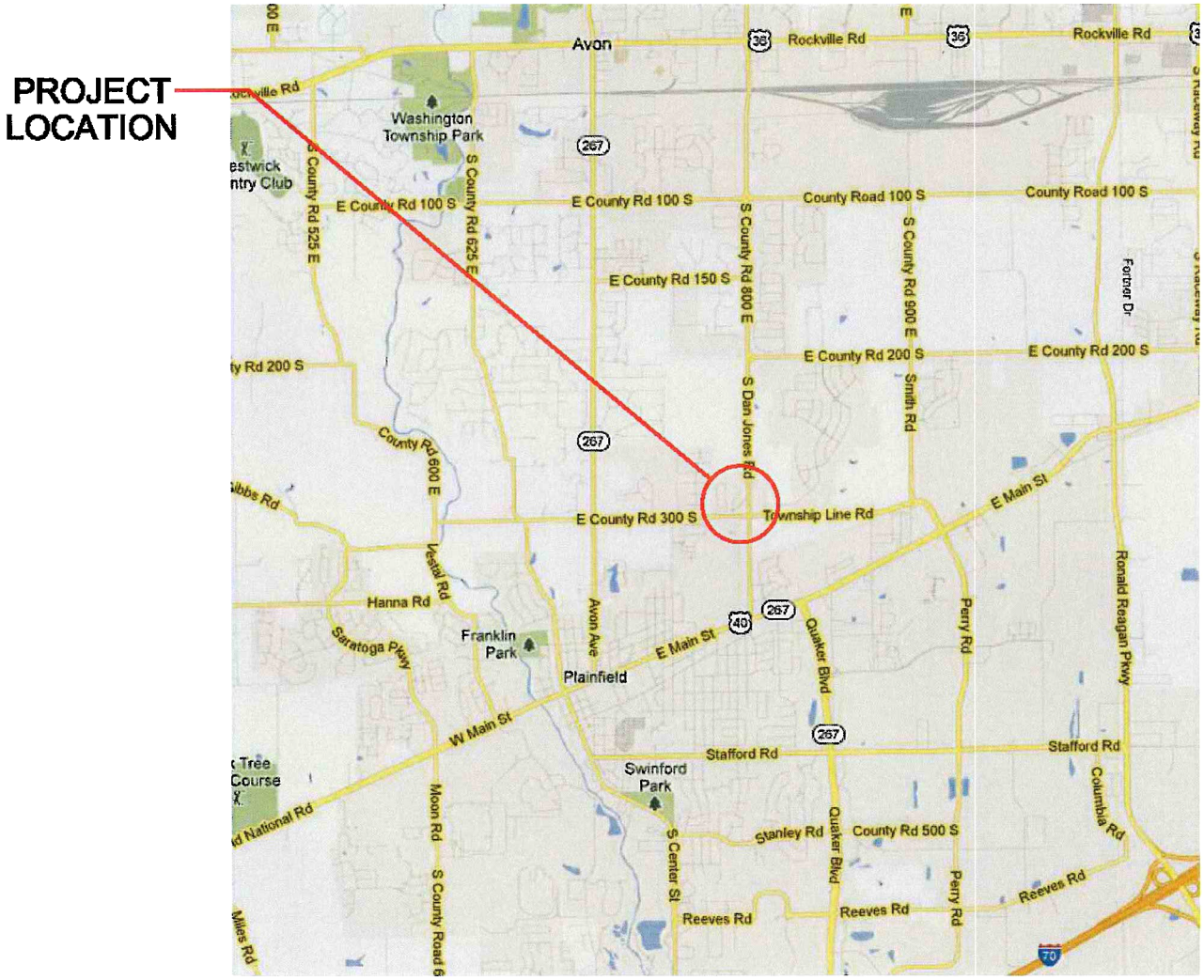
TABLE 6 – SC-740 Incremental Storage Volumes Per Chamber
Assumes 40% Stone Porosity. Calculations are Based Upon a 6-inch Stone Base Under the Chambers.

Depth of Water in System (in)	Cumulative Chamber Storage (ft^3)	Total System Cumulative Storage (ft^3)
42	↑ 45.90	74.90
41	↑ 45.90	73.77
40	Stone 45.90	72.64
39	Cover 45.90	71.52
38	↓ 45.90	70.39
37	↓ 45.90	69.26
36	45.90	68.14
35	45.85	66.98
34	45.69	65.75
33	45.41	64.46
32	44.81	62.97
31	44.01	61.36
30	43.06	59.66
29	41.98	57.89
28	40.80	56.05
27	39.54	54.17
26	38.18	52.23
25	36.74	50.23
24	35.22	48.19
23	33.64	46.11
22	31.99	44.00
21	30.29	41.85
20	28.54	39.67
19	26.74	37.47
18	24.89	35.23
17	23.00	32.96
16	21.06	30.68
15	19.09	28.36
14	17.08	26.03
13	15.04	23.68
12	12.97	21.31
11	10.87	18.92
10	8.74	16.51
9	6.58	14.09
8	4.41	11.66
7	2.21	9.21
6	↑ 0	6.76
5	↑ 0	5.63
4	Stone 0	4.51
3	Foundation 0	3.38
2	↓ 0	2.25
1	↓ 0	1.13

Note: Add 1.13 cu. ft. of storage for each additional inch of stone foundation.

Operation & Maintenance Manual

BMP Operations and Maintenance Manual for Plainfield Christian Church – Phase 1



LOCATION MAP
NO SCALE

Table of Contents

1. Administrative Information:

BMP Owner Information

Name:	**Plainfield Christian Church**
Primary Contact:	**Tom Richardson**
Street Address:	**800 N. Dan Jones Road**
City/State/Zip Code:	**Plainfield, IN 46168**
Business Phone Number:	**317-839-2384**

Cost Responsibility

As a condition of the Plainfield, Indiana Stormwater Management Ordinance (#33-2006), it must be stated that any cost incurred during the maintenance of any of the following described Best Management Practices, BMPs, shall be incurred by the owner listed above. If at the time of this submittal no owner is listed, one shall be provided once construction of the BMP is completed. In the event that ownership changes, responsibility for maintaining the BMPs shall change accordingly. It is the responsibility of the preceding owner to pass the information contained within this document to the new owner.

Right-of-Entry

As a condition of the Plainfield, Indiana Stormwater Management Ordinance (#33-2006), it must be stated that the owner declared above shall allow entry by Town of Plainfield personnel to inspect the BMPs described within this manual. Town personnel shall be granted access when, and only when they are inspecting the BMPs.

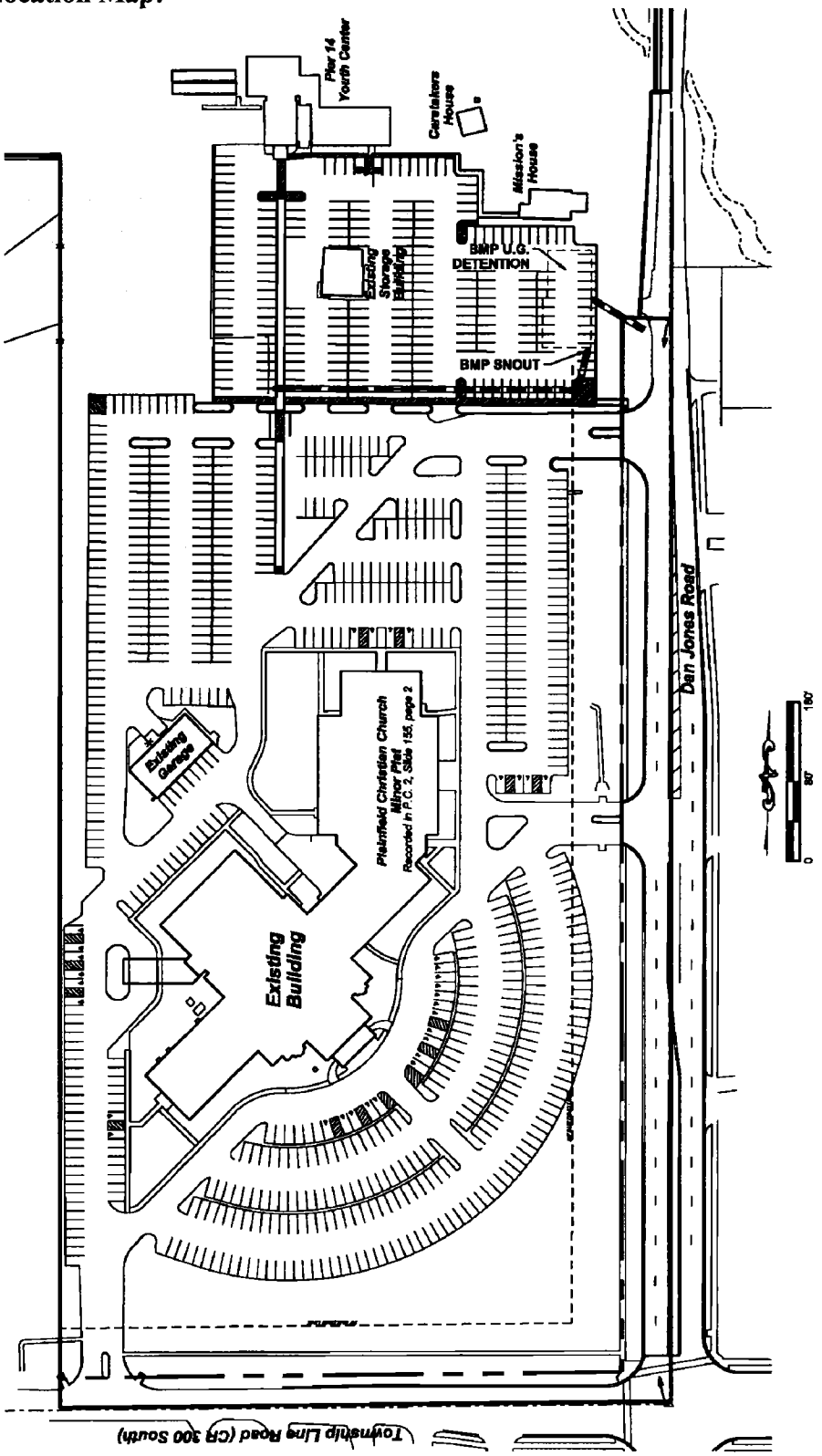
2. BMP Locations:

The project is located at 800 N. Dan Jones Road Plainfield, Indiana.

Driving Directions

From the intersection of U.S. 40 and Dan Jones Road in Plainfield, Indiana travel north along Dan Jones Road approximately 7/8 mile. Underground detention system is on west side of Dan Jones Road in parking lot approximately 50' from edge of pavement of Dan Jones Road. Snout is located in the same area, refer to attached BMP Location Map.

BMP Location Map:



3 Underground Storage Chambers with Filtration:

Description

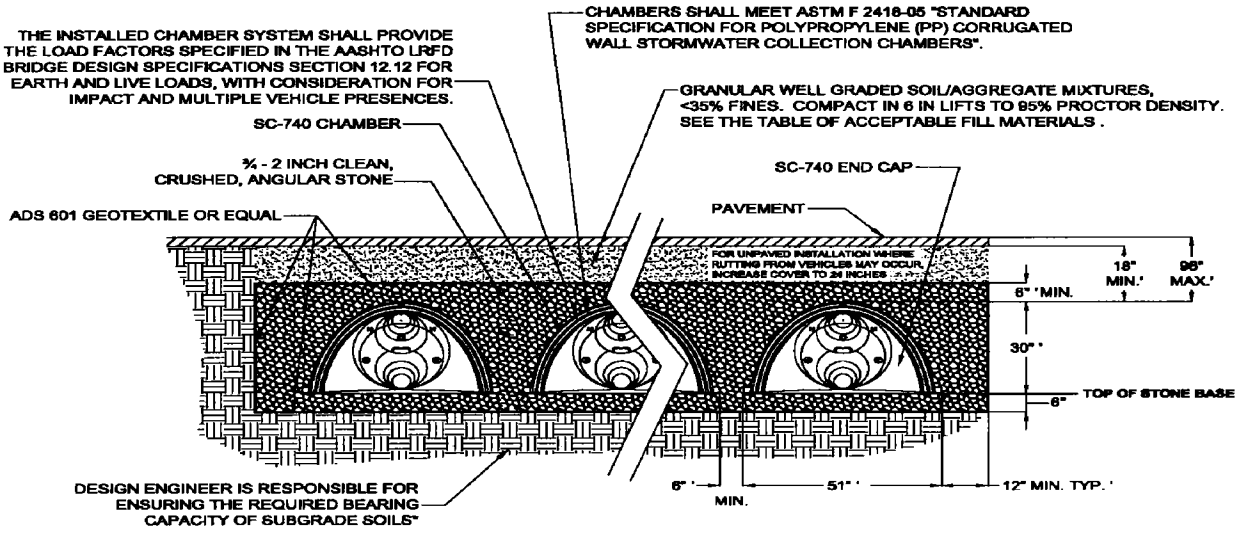
Underground storage chambers control water by means of hydraulic control structures to restrict outlet discharge. The objectives of the system are to remove particulate pollutants and to reduce runoff values associated with the development. The system also includes filtration through granular medium and geotextile perimeter to address the water quality volume. The filtered water quality volume is then collected via sub-surface drain and routed to the outlet.

Maintenance Considerations

Regular maintenance and inspection practices are needed. The table below outlines these practices.

Activity	Schedule
• Visual inspection of system. • Visual inspection of outlet structure	Monthly Maintenance
• Monitor for sediment accumulation in the system. • Examine to ensure that inlet and outlet devices are free of debris and operational.	Annual inspection
• Clean and remove debris from inlet and outlet structures.	As-needed maintenance
• Remove sediment from chambers.	5- to 7-year maintenance

Figure 1:



THIS CROSS SECTION DETAILS THE REQUIREMENTS NECESSARY TO SATISFY THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS USING STORMTECH CHAMBERS

* NOTE: CHAMBER SYSTEM DESIGN MUST BE IN ACCORDANCE WITH STORMTECH DESIGN MANUAL

STORMTECH SC-740 CROSS SECTION (4 / C111)

NO SCALE

Maintenance Schedule

Date Installed:

Month After Installation	1	2	3	4	5	6	7	8	9	10	11	12
Clean and remove debris from inlet and outlet structures	X	X	X	X	X	X	X	X	X	X	X	X
Monitor for sediment accumulation in system												X
Examine to ensure that inlet and outlet devices are free of debris and operational												X

4 SNOUT ® :

Background:

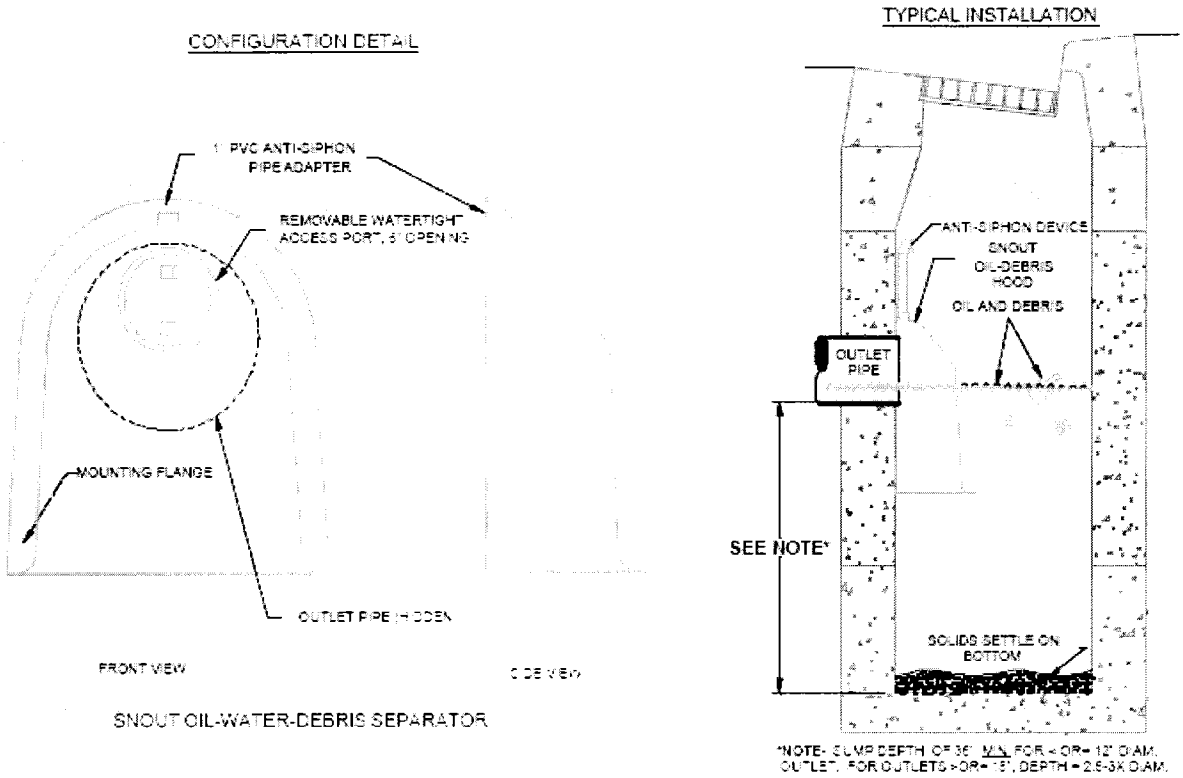
The SNOUT ® system from Best Management Products, Inc. (BMP, Inc.) is based on a vented hood that can reduce floatable trash and debris, free oils, and other solids from stormwater discharges. In its most basic application, a SNOUT ® hood is installed over the outlet pipe of a catch basin or other stormwater quality structure which incorporates a deep sump (see Figure 1). The SNOUT ® forms a baffle in the structure which collects floatables and free oils on the surface of the captured stormwater, while permitting heavier solids to sink to the bottom of the sump. The clarified intermediate layer is forced out of the structure through the open bottom of the SNOUT ® by displacement from incoming flow. The resultant discharge contains considerably less unsightly trash and other gross pollutants, and can also offer modest reductions of free-oils and finer solids.

As with any structural stormwater quality BMP (Best Management Practice), design and maintenance considerations will have a dramatic impact on SNOUT ® system performance over the life of the facility. The most important factor to consider when designing structures which will incorporate a SNOUT ® is the depth of the sump (the sump is defined as the depth from beneath the invert of the outlet pipe to the bottom of the structure) . Simply put, the deeper the sump, the more effective the unit will be both in terms of pollutant removals and reducing frequency of maintenance. More volume in a structure means more quiescence, thus allowing the pollutant constituents a better chance to separate out. Secondly, more volume means fewer cycles between maintenance operations, because the structure has a greater capacity.

Maintenance Recommendations:

1-Monthly monitoring for the first year of a new installation after the site has been stabilized.
2-Measurements should be taken after each rain event of .5 inches or more, or monthly, as determined by local weather conditions.
3-Checking sediment depth and noting the surface pollutants in the structure will be helpful in planning maintenance. The pollutants collected in SNOUT ® equipped structures will consist of floatable debris and oils on the surface of the captured water, and grit and sediment on the bottom of the structure.
4-It is best to schedule maintenance based on the solids collected in the sump. Optimally, the structure should be cleaned when the sump is half full (e.g. when 2 feet of material collects in a 4 foot sump, clean it out).
5-Structures should also be cleaned if a spill or other incident causes a larger than normal accumulation of pollutants in a structure.
6-Maintenance is best done with a vacuum truck.
7-If oil absorbent hydrophobic booms are being used in the structure to enhance hydrocarbon capture and removals, they should be checked on a monthly basis, and serviced or replaced when more than 2/3 of the boom is submerged, indicating a nearly saturated state.
8-All collected wastes must be handled and disposed of according to local environmental requirements.
9-To maintain the SNOUT ® hoods themselves, an annual inspection of the antisiphon vent and access hatch are recommended. A simple flushing of the vent, or gentle rodding with a flexible wire are all that's typically needed to maintain the anti-siphon properties. Opening and closing the access hatch once a year ensures a lifetime of trouble-free service.

Figure 1:



Further maintenance recommendations and site inspection field report sheets are available from BMP, Inc.

SNOUT® is a registered trademark of
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Website: www.bmpinc.com
The SNOUT® is protected by US PATENT # 6126817 and CANADIAN PATENT# 2285146

Maintenance Schedule Snout ®

Date Installed:_____

Month After Installation	1	2	3	4	5	6	7	8	9	10	11	12
Visual Inspection	X	X	X	X	X	X	X	X	X	X	X	X
Sediment Depth Measurement	X	X	X	X	X	X	X	X	X	X	X	X
Inspect Antisiphon Vent and Hatch												X

5. References:

1) Plainfield, Indiana Stormwater Management Ordinance (#33-2006)
2) National Menu of Best Management Practices for Stormwater Phase II, July 2005, United States Environmental Protection Agency
3) Hendricks County Stormwater Management Handbook, February 2005 Edition