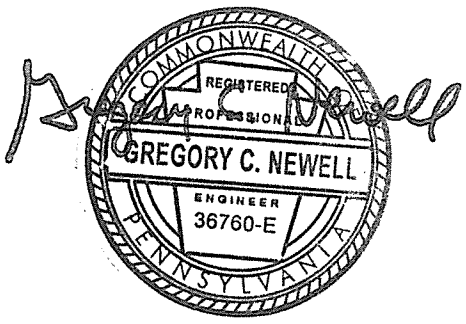
STORMWATER MANAGEMENT REPORT AND SITE DRAINAGE CALCULATIONS

VILLANOVA UNIVERSITY
WEST LANCASTER AVENUE PARKING
LANCASTER AVENUE HOUSING
PERFORMING ARTS CENTER AND PARKING GARAGE

VILLANOVA UNIVERSITY
RADNOR TOWNSHIP
DELAWARE COUNTY, PENNSYLVANIA



Issued: March 6, 2015
Nave Newell No.: 2011-005.00

STORMWATER MANAGEMENT REPORT AND SITE DRAINAGE CALCULATIONS
SUMMARY OF CONTENTS

VILLANOVA
DELAWARE COUNTY, RADNOR, PA

I.

STORMWATER MANAGEMENT NARRATIVE

INTRODUCTION

Villanova University proposes to re-develop the southern portion of the Campus, as part of the CICD development to provide for additional On-Campus Housing, off street parking, a parking garage, and a performing arts center to be located along the southerly side of Lancaster Avenue (US Route 30) on the University Campus located in Radnor Township, Delaware County, Pennsylvania. The plan calls for the re-development of four areas of the campus as follows:

1. *"West Lancaster Avenue Parking"* – Development of south side of Lancaster Avenue (Route 30) west of "Church Walk" to provide for 234 parking spaces interspersed among existing buildings.
2. *"Lancaster Avenue Housing"* – Mixed Use Re-Development of the Main Parking Lot on the southerly side of Lancaster Avenue (US Route 30) east of "Church Walk" and west of Ithan Avenue to provide on-campus housing comprising 1138 beds along with Retail Use. In addition, at grade parking for 62 vehicles is proposed.
3. *"Pike Field Parking Garage"* - Re-Development of the existing at-grade parking lot on the easterly side of Ithan Avenue just north of the SEPTA Route 100 Line to provide for a 5-level parking garage that will accommodate 1289 parking spaces.
4. *"Performing Arts Center"* – Re-Development of the existing at-grade parking lot on the south side of Lancaster Avenue (Route 30) and east side of Ithan Avenue to provide a Performing Arts Center.

There will also be a comprehensive Storm Water Management System that will be constructed as part of the proposed improvements.

EXISTING CONDITIONS

The Re-Development areas as noted above are currently configured as described below:

"Pike Field" – The area under consideration currently consists of two uses. The westerly half is occupied by a parking area that takes access from Ithan Avenue with a small exit drive to Lancaster Avenue. The eastern half of this parcel is a softball field. This area is bounded on the west by Ithan Avenue, on the north by Lancaster Avenue, on the south by SEPTA's Route 100 Line, and on the east by adjacent residential properties. The western half of the parking area drains to the southwest corner at the SEPTA Rail Bridge and Ithan Avenue. The remaining portion of the parking area and ball field drains to the southeast corner of the site to an existing storm water management facility previously constructed as part of the Pike Softball Field Press Box Project. This parcel is tributary to the Valley Run and ultimately is in the Darby Creek Watershed, PA Chapter 93 designation "CWF, MF" - Coldwater Fish, Migratory Fish. Small portions of this parcel along Ithan Avenue and Lancaster Avenue are mapped with Me – "Made Land, Schist and Gneiss Materials" and they are designated Hydrologic Group 'C'. The remaining portion and vast majority of this parcel is mapped GnB2 Glenville Silt Loam, 3 to 8 percent slopes and are Hydrologic Soil Group "C".

"Main Lot"- Located on the southwesterly corner of Lancaster Avenue (Route 30) and Ithan Avenue, this area of nearly 8 acres is almost entirely paved with at-grade parking. The entire parking lot currently drains overland to a drainage swale adjacent to the SEPTA Route 100 Line that discharges to the storm drainage system in Ithan Avenue. The site is located in the Darby Creek watershed (PA Chapter 93 Designation is "CWF, MF" – Coldwater Fish, Migratory Fish). Soils for this area of the campus are mapped as "Me" – Made Land Schist and Gneiss Materials and the hydrologic soils group is "C".

"West Lancaster Avenue"- Located on the southerly side of Lancaster Avenue (Route 30) and westerly side of "Church Walk" this area of nearly 8 acres is comprised of existing University buildings and associated parking. The entire site currently drains to the Lancaster Avenue (Route 30) storm drainage system. The site is located in the Darby Creek watershed (PA Chapter 93 Designation is "CWF, MF" – Coldwater Fish, Migratory Fish). Soils for this area of the campus are mapped as "Me" – Made Land Schist and Gneiss Materials and the hydrologic soils group is "C".

STORM WATER MANAGEMENT CRITERIA

Storm water Management Design shall meet the following criteria:

Peak Rate Control – The Villanova University Re-Development Parcels are subject to the provisions of the Darby – Cobbs Creek Watershed criteria and Radnor Township Storm Water Management Ordinance (Chapter 245 of the Township's Municipal Code). The sites in question are located in the Release Rate District designated B-2 and are subject to the following release rate criteria:

Predevelopment	Reduce to	Post-Development
2 year		1 year
5 year		2 year
10 year		5 year
25 year		5 year
50 year		10 year
100 year		100 year

The Calculation performed to estimate the peak rates of runoff are based Soil Cover Complex Method utilizing HydroCAD Version 10.00 Software.

The following values were utilized for the 24 hour rainfall depths in accordance with Table F-1 from Ordinance Appendix 'F':

Year	24 Hour Rainfall Depth (in)
1	2.64
2	3.36

5	4.32
10	5.28
25	6.24
50	7.20
100	8.40

The ground cover condition for a Re-Development Site for the Pre-Development Condition shall be based on actual land cover conditions.

The analysis pertaining to that portion of the development draining to the existing stormwater detention facility that in-turn discharges to the southeasterly corner of the Pike Softball field was performed utilizing the parameters set forth in the "*Stormwater Management Report" for the "Villanova University Softball Field Press Box*" prepared by *Associated Engineering Consultants, Inc. dated November 13, 2006 and last revised January 8, 2007*. The design for this area is based on the following 24 hour rainfall depths:

Year	24 Hour Rainfall Depth (in)
1	2.6
2	3.3
5	4.2
10	5.0
25	5.7
50	6.4
100	7.3

This area was configured such that the proposed discharge to and from the existing detention system will be maintained / reduced, thereby not affecting the existing functionality of the system.

Storm Drainage Conveyance System – Storm Drains were designed to accommodate the 100 year storm such that there would be no surcharging of storm inlets (this done to insure all storm water is directed to the intended storm water management facility). The storm drainage system was also designed such that the pipes had adequate capacity to convey the 25 year storm. Storm drain design calculations are based on the Rational Method and are based on the PennDOT Region 5 IDF Curves per Figure 'F-4' of Ordinance Appendix 'F'. Storm drains were designed utilizing StormCAD V8i as produced by Bentley Systems.

Groundwater Recharge / Storm water Volume Control – The portion of the project site that includes all tributary areas to all storm water BMP's – which are comprised of rain gardens, sub-surface storm water detention systems / infiltration beds, and cisterns are configured such that

they will provide treatment whether in the form of infiltration or capture and re-use of the total volume of runoff from a minimum 1.0 inch depth event over all tributary impervious surfaces. Portions of the development area have minimal infiltration capacity, thus the intent of the design is to store the stormwater runoff volume from between a 1.0 inch to 1.5 inch runoff from impervious surfaces for the overall project to the greatest extent feasible for either infiltration or re-use.

POST-CONSTRUCTION STORMWATER MANAGEMENT

There are three Points of Interest (POI 1 through 3) considered in this design.

WEST LANCASTER AVENUE RE-DEVELOPMENT (POI 1)
POI No. 1 is located on the southerly side of Lancaster Avenue (Route 30) and northwestern corner of the site area for the West Lancaster Avenue portion of the project. This area involves the construction of at-grade parking that will comprise 234 parking spaces. The entire drainage shed will discharge to proposed underground storm water detention systems / sub-surface infiltration beds and a rain garden that will discharge to the Lancaster Avenue storm drainage system. This portion of the project is designed to meet the requirements of the Darby-Cobbs Creek Act 167 criteria for Release Rate District B-2 while also treating the volume of runoff from 1.37 inches of runoff depth from all impervious surfaces.

LANCASTER AVENUE HOUSING / WESTERLY PORTION OF PARKING GARAGE / PERFORMING ARTS CENTER (POI 2)
POI No. 2 is located at the southwesterly corner of the proposed parking garage site and southeasterly corner of the Lancaster Avenue Housing site and represents the point where drainage from the re-development area enters the Ithan Avenue storm drainage system near the SEPTA Route 100 crossing of Ithan Avenue. There are currently approxmately 8 acres from the main lot and approximately 2 acres from the existing parking lot on the east side of Ithan Avenue tributary to POI 2. The westerly portion of the existing parking area on the easterly side of Ithan Avenue drains to POI No. 2. A proposed sub-surface detention system and sub-surface infiltration bed is proposed to manage the westerly portion of the parking garage while a second stormwater detention system / cistern is proposed to manage the runoff from the Performing Arts Center. Both systems will discharge to the Ithan Avenue storm drainage system. The majority of the Lancaster Avenue Housing Development on the Main Lot will drain to the existing swale just north of the SEPTA Route 100 line and discharge to the Ithan Avenue storm drainage system as the existing Main Lot parking area does today. The majority of the Lancaster Avenue Housing site will discharge to a series of rain gardens, sub-surface stormwater detention systems / sub-surface infiltration beds, and cisterns. This portion of the project is designed to meet the requirements of the Darby-Cobbs Creek Act 167 criteria for Release Rate District B-2 while also treating the volume of runoff from 1.34 inches of runoff depth from all impervious surfaces.

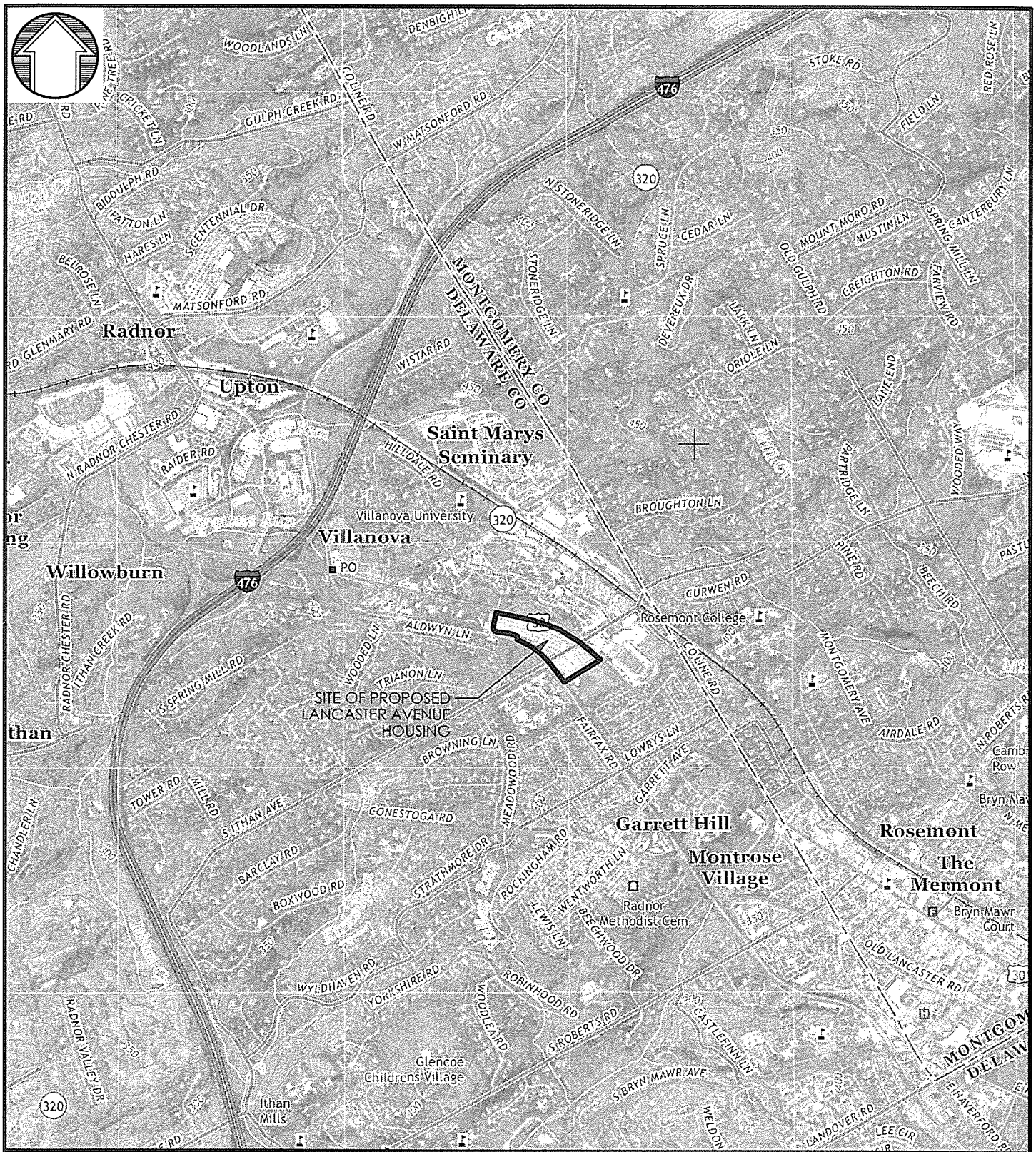
PIKE SOFTBALL FIELD AND ADJACENT PIKE PARKING LOT (POI 3)
POI No. 3 is located at the southeasterly corner of Pike Softball Field. There are currently about 13 acres of area directly tributary to POI 3 in the Pre-Development Condition from the eastern portion of the at-grade parking area comprising the western half of the Pike Field area, the softball field / athletic field area as well as about 5 acres of area from Lancaster Avenue and the northern portion of the Villanova Campus. In the proposed condition, the easterly portion of the proposed parking garage as well as a portion of the driveway between the garage and Performing Arts Center (comprising just over 3 acres) and a small portion of roof area from the Performing Arts Center will discharge to the existing underground detention system / sub-surface infiltration bed as documented in the report entitled "*Villanova Softball Field Press Box Storm water Management Report*" as prepared by *Associated Engineering Consultants, Inc. dated*

November 13, 2006 and last revised January 8, 2007. Under the proposed plan and based on the parameters in the above referenced report, the existing underground system will remain in place and discharges to this system will be reduced from the current condition that exists today.

A proposed underground stormwater detention system / sub-surface infiltration bed is proposed at the northeastern corner of the Pike Field Area. This system is sized to accommodate the drainage from Lancaster Avenue (Route 30), a portion of the northern campus area of Villanova University, and a small portion of the Performing Arts Center site (comprising about 5.6 acres). This portion of the project is designed to meet the requirements of the Darby-Cobbs Creek Act 167 criteria for Release Rate District B-2 while also treating the volume of runoff from 1.04 inches of runoff depth from all impervious surfaces. Note that in this case, the required peak rate reductions for the Darby Cobbs Creek watershed criteria have been applied to both off-site (Lancaster Avenue and northern Villanova campus areas) and on-site areas (Performing Arts Center site) that are tributary to this system.

K:\11Proj\11005\Proj_Data\Support_Data\SWM\Report\COMPOSITE STORMWATER MANAGEMENT NARRATIVE.docx

II.



Nave Newell
Where Ideas Get Down to Earth

900 West Valley Road • Suite 1100
Wayne, PA 19087-1830
p: 610.265.8323 f: 610.265.4299
www.navenewell.com

DRAWING NAME: USGS MAP - "NORRISTOWN" QUADRANGLE

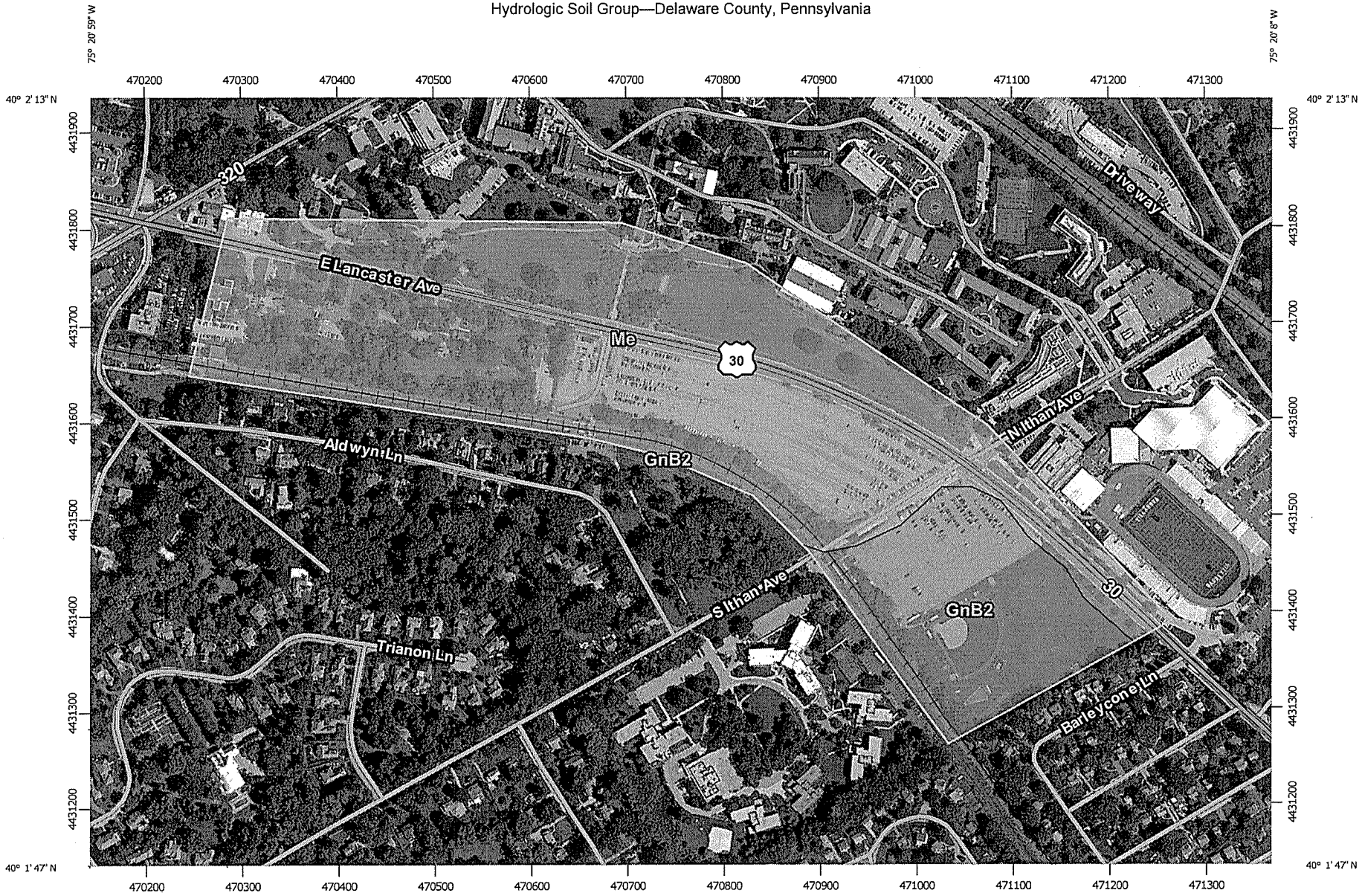
PROJECT NAME: VILLANOVA UNIVERSITY
CICD DEVELOPMENT

SCALE:	DRAWN BY:	PROJECT NUMBER:	SHEET
1" = 2000'	MMB	2011-005	1 of 1
CHK'D BY:	APPROV. BY:	DATE:	
DAT	GCN	11/26/14	

K:\11Proj\11005\CAD\Plan_Set\1005usgs.dgn
12/4/2014 17:49:05
2000.0000 ft / in.
USER: mbruce

III.

Hydrologic Soil Group—Delaware County, Pennsylvania



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: Delaware County, Pennsylvania
Survey Area Data: Version 8, Sep 30, 2014

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

Date(s) aerial images were photographed: Jul 25, 2014—Aug 11, 2014

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Delaware County, Pennsylvania (PA045)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GnB2	Glenville silt loam, 3 to 8 percent slopes, moderately eroded	C/D	11.4	21.1%
Me	Made land, schist and gneiss materials	C	42.7	78.9%
Totals for Area of Interest			**54.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

IV.

TABLE F-1

DESIGN STORM RAINFALL AMOUNT (INCHES)

The design storm rainfall amount chosen for design should be obtained from the PennDOT region in which the site is located according to Figure F-2.

	Region 5						
	Precipitation Depth (in)						
Duration	1 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
5 min	0.33	0.38	0.45	0.50	0.56	0.63	0.68
15 min	0.64	0.75	0.90	1.00	1.15	1.35	1.50
1 hr	1.10	1.35	1.61	1.85	2.15	2.60	2.98
2 hrs	1.34	1.66	2.00	2.34	2.70	3.26	3.76
3 hrs	1.50	1.86	2.28	2.67	3.09	3.69	4.29
6 hrs	1.86	2.28	2.82	3.36	3.90	4.62	5.40
12 hrs	2.28	2.76	3.48	4.20	4.92	5.76	6.72
24 hrs	2.64	3.36	4.32	5.28	6.24	7.20	8.40

Source: "Field Manual of Pennsylvania Department of Transportation," Storm Intensity-Duration-Frequency Charts, PDT- IDF, May 1986.

TABLE F-2

RUNOFF CURVE NUMBERS

LAND USE DESCRIPTION	Hydrologic Condition	HYDROLOGIC SOIL GROUP A	B	C	D
Open Space					
Grass cover < 50%	Poor	68	79	86	89
Grass cover 50% to 75%	Fair	49	69	79	84
Grass cover > 75%	Good	39	61	74	80
Meadow		30	58	71	78
Agricultural					
Pasture, grassland, or range – Continuous forage for grazing	Poor	68	79	86	89
Pasture, grassland, or range – Continuous forage for grazing	Fair	49	69	79	84
Pasture, grassland, or range – Continuous forage for grazing	Good	39	61	74	80
Brush—brush-weed-grass mixture with brush the major element	Poor	48	67	77	83
Brush—brush-weed-grass mixture with brush the major element	Fair	35	56	70	77
Brush—brush-weed-grass mixture with brush the major element	Good	30	48	65	73
Fallow Bare soil	-------	77	86	91	94
Crop residue cover (CR)	Poor	76	85	90	93
	Good	74	83	88	90
Woods – grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77

F-7

Commercial	(85% impervious)	89	92	94	95
Industrial	(72% impervious)	81	88	91	93
Institutional	(50% impervious)	71	82	88	90

Residential districts by average lot size:

	% Impervious				
1/8 acre or less * (townhouses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Farmstead		59	74	82	86
Smooth surfaces (concrete, asphalt, gravel, or bare compacted soil)		98	98	98	98
Water		98	98	98	98
Mining/newly graded areas (pervious areas only)		77	86	91	94

* Includes multi-family housing unless justified lower density can be provided.

Note: Existing site conditions of bare earth or fallow ground shall be considered as meadow when choosing a CN value.

Source: NRCS (SCS) TR-55

F-8

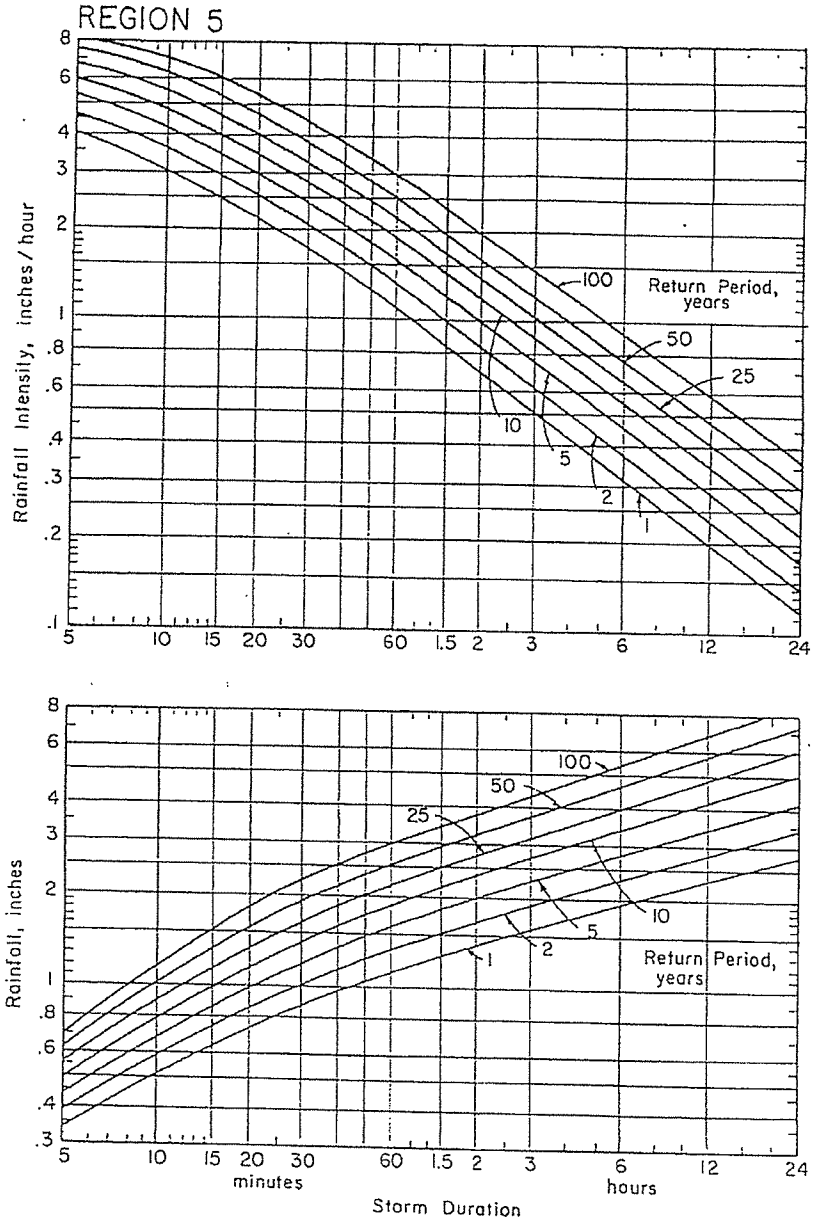
TABLE F-3

RATIONAL RUNOFF COEFFICIENTS

	HYDROLOGIC SOIL GROUP			
LAND USE DESCRIPTION	A	B	C	D
Cultivated land : without conservation treatment	.49	.67	.81	.88
: with conservation treatment	.27	.43	.61	.67
Pasture or range land: poor condition	.38	.63	.78	.84
: good condition	---*	.25	.51	.65
Meadow: good condition	---*	---*	.44	.61
Woods: thin stand, poor cover, no mulch	---*	.34	.59	.70
: good cover	---*	---*	.45	.59
Open spaces, lawns, parks, golf courses, cemeteries				
Good condition: grass cover on 75% or more of the area	---*	.25	.51	.65
Fair condition: grass cover on 50% to 75% of the area	---*	.45	.63	.74
Commercial and business areas (85% impervious)	.84	.90	.93	.96
Industrial districts (72% impervious)	.67	.81	.88	.92
Residential:				
Average lot size Average % impervious				
1/8 acre or less 65	.59	.76	.86	.90
1/4 acre 38	.25	.49	.67	.78
1/3 acre 30	---*	.49	.67	.78
1/2 acre 25	---*	.45	.65	.76
1 acre 20	---*	.41	.63	.74
Paved parking lots, roofs, driveways, etc.	.99	.99	.99	.99
Streets and roads:				
Paved with curbs and storm sewers	.99	.99	.99	.99
Gravel	.57	.76	.84	.88
Dirt	.49	.69	.80	.84

FIGURE F-4

PENNDOT REGION 5 STORM INTENSITY-DURATION-FREQUENCY CURVE



Source: "Field Manual of Pennsylvania Department of Transportation," Storm Intensity-Duration-Frequency Charts, PDT- IDF, May 1986.

F-6

TABLE F-4

MANNING'S ROUGHNESS COEFFICIENTS

Roughness Coefficients (Manning's "n") for Overland Flow

Surface Description	n
Dense growth	0.4 to 0.5
Pasture	0.3 to 0.4
Lawns	0.2 to 0.3
Bluegrass sod	0.2 to 0.5
Short grass prairie	0.1 to 0.2
Sparse vegetation	0.05 to 0.13
Bare clay-loam soil (eroded)	0.01 to 0.03
Concrete/asphalt:	
very shallow depths (less than 1/4 inch)	0.10 to 0.15
small depths (1/4 inch to several inches)	0.05 to 0.10

Roughness Coefficients (Manning's "n") for Channel Flow

Reach Description	n
Natural stream, clean, straight, no rifts or pools	0.03
Natural stream, clean, winding, some pools or shoals	0.04
Natural stream, winding, pools, shoals, stony with some weeds	0.05
Natural stream, sluggish deep pools and weeds	0.07
Natural stream or swale, very weedy or with timber underbrush	0.10
Concrete pipe, culvert, or channel	0.012
Corrugated metal pipe	0.012-0.027[1]
High density polyethylene (HDPE) pipe	
Corrugated	0.021-0.029[2]
Smooth lined	0.012-0.020[2]

[1] Depending upon type, coating, and diameter

[2] Values recommended by the American Concrete Pipe Association, check manufacturer's recommended value./

Source: U.S. Army Corps of Engineers, HEC-1 Users Manual

V.

Villanova University – West Lancaster Avenue Development

Volume Summary

Rain Garden No. 1 (RG-101)

Impervious Surface Area	=	*10300*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*679*	*CF*
Storage Volume	=	***1472***	***CF***
Equivalent Runoff Depth Treated	=	*2.10*	*in.*

Rain Garden No. 2 (RG-102)

Impervious Surface Area	=	*9117*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*601*	*CF*
Storage Volume	=	***1846***	***CF***
Equivalent Runoff Depth Treated	=	*3.07*	*in.*

Infiltration System No. 101

Impervious Surface Area	=	*22892*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*1509*	*CF*
Storage Volume	=	***7279***	***CF***
Equivalent Runoff Depth Treated	=	*4.82*	*in.*

Infiltration System No. 102

Impervious Surface Area	=	*59905*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*3948*	*CF*
Storage Volume	=	***9582***	***CF***
Equivalent Runoff Depth Treated	=	*2.43*	*in.*

Infiltration System No. 103

Impervious Surface Area	=	*61638*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*4062*	*CF*
Storage Volume	=	***10295***	***CF***
Equivalent Runoff Depth Treated	=	*2.53*	*in.*

K:\11Proj\11005\Proj_Data\Support_Data\SWM\Calculations\WLA\SWM Volume Summary.docx

Volume Calculations for Section 245-22 and 245-23 of the Radnor Township Storm Water Management Ordinance

West Lancaster Avenue Parking – Build-out Condition POI-1

1. *Calculation of Net Two Year Runoff Volume* – Calculated utilizing Worksheet 4 from the PaDEP's BMP Manual = 25,045 CF; This is for Build-out condition.

2. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.0 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 177,389 SF (Includes WLA and Portion of PennDOT)
   I = 1.0 inches
   Rev = *14,782 CF*

3. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.5 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 177,389 SF (Includes WLA and Portion of PennDOT)
   I = 1.5 inches
   Rev = **22,174 CF** (Greater of Rev and WQV)

4. *Water Quality Volume per Section 245-23 :*
   WQv = [(P)(Rv)(A)]/12
   P = 1.0 Inch
   Rv = 0.05+0.009(I) where I = % Impervious Coverage
   A = Project Area = 392,714 SF or 9.015 Acres
   Impervious Surface Area = 177,389 SF
   Total Impervious Coverage = 177,389 SF or 45.17%
   Rv = 0.05+0.009(45.17) = 0.45653
   WQv = [(1.0)(0.45653)(9.015)]/12 = 0.34297 Acre Feet or 14,940 CF

   Water Quality/Infiltration Volume Provided: **30,474 CF** > 22,174 CF **OK**

   Equivalent Runoff Depth treated: 30,474/22,174 = 1.37 inches

West Lancaster Avenue **Volume - One Inch**

RG-101

Top of Grate = 406.50
Ground El. = 404.00

1 inch Runoff Volume to RG-1				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*29422*	*SF*					
CN=	*61*	*A=*	*19122*	*6.39*	*1.00*	*0.01*	*20*
CN=	*98*	*A=*	*10300*	*0.20*	*1.00*	*0.79*	*679*
TOTAL RUNOFF VOLUME =							***699***

Retention Volume

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
402.0	*1603*				***545***	***0.01251***	***2' soil 17% voids***
		1.0	*1854*	***1854***			
403.0	*2104*				***2399***	***0.05506***	
		1.0	*2388*	***2388***			
404.0	*2672*				***4787***	***0.10988***	
		1.0	*3002*	***3002***			
405.0	*3331*				***7788***	***0.17879***	
Volumetric Storage	***1472***	***CF***	***at El. 404.50***	***6" surface plus 2' soil***			
Volume Credit	***699***	***CF***					

RG-102 ***(Old LAH RG 7)***

Top of Grate = 438.50
Ground El. = 436.00

1 inch Runoff Volume to RG-6				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*16408*	*SF*					
CN=	*61*	*A=*	*7291*	*6.39*	*1.00*	*0.01*	*8*
CN=	*98*	*A=*	*9117*	*0.20*	*1.00*	*0.79*	*601*
TOTAL RUNOFF VOLUME =							***609***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
436.0	*2150*				***731***	***0.01678***	***2' soil 17% voids***
		1.0	*2230*	***2230***			
437.0	*2310*				***2961***	***0.06798***	
		1.0	*2593*	***2593***			
438.0	*2875*				***5554***	***0.12749***	
Volumetric Storage	***1846***	***CF***	***at El. 436.50***	***6" surface plus 2' soil***			
Volume Credit	***609***	***CF***					

Infiltration System No. 1

1 inch Runoff Volume to Inf 1				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*32731 SF*						
CN=	*61*	*A=*	*9839*	*6.39*	*1.00*	*0.01*	*10*
CN=	*98*	*A=*	*22892*	*0.20*	*1.00*	*0.79*	*1509*
TOTAL RUNOFF VOLUME =							***1519***

Cum Vol (CF)	*Cum Vol (Ac Ft)*
8626	***0.19803***

Volumetric Storage	***7279***	***CF***	***Volume below Outlet***
Volume Credit	***1,519***	***CF***	(stone only)

Infiltration System No. 2

1 inch Runoff Volume to Inf 2				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*97817 SF*						
CN=	*61*	*A=*	*37912*	*6.39*	*1.00*	*0.01*	*40*
CN=	*98*	*A=*	*59905*	*0.20*	*1.00*	*0.79*	*3948*
TOTAL RUNOFF VOLUME =							***3988***

Cum Vol (CF)	*Cum Vol (Ac Ft)*
11361	***0.26082***

Volumetric Storage	***9582***	***CF***	***Volume below Outlet***
Volume Credit	***3,988***	***CF***	(stone only)

Infiltration System No. 3

1 inch Runoff Volume to Infn 3				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*84071 SF*						
CN=	*61*	*A=*	*22433*	*6.39*	*1.00*	*0.01*	*24*
CN=	*98*	*A=*	*61638*	*0.20*	*1.00*	*0.79*	*4062*
TOTAL RUNOFF VOLUME =							***4086***

Cum Vol (CF)	*Cum Vol (Ac Ft)*
22836	***0.52424***

Volumetric Storage	***10295***	***CF***	***Volume below Outlet***
Volume Credit	***4,086***	***CF***	(stone only)

DEWATERING CALCULATIONS - WLA Rain Garden 101

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 101	2,761	0.250	2,564	44.58	1.86	1,381	4,142

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 101	3,125	0.250	4,039	62.04	2.58	1,563	4,688

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 101	3,492	0.250	5,644	77.58	3.23	1,746	5,238

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 101	3,917	0.250	7,618	93.35	3.89	1,959	5,876
vol. in soil media	641						

DEWATERING CALCULATIONS - WLA Rain Garden 102

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 102	3,112	0.250	2,808	43.31	1.80	1,556	4,668

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 102	3,154	0.250	4,003	60.92	2.54	1,577	4,731

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 102	3,352	0.250	5,232	74.92	3.12	1,676	5,028

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
RG 102	3,513	0.250	5,968	81.54	3.40	1,757	5,270
vol. in soil media	860						

DEWATERING CALCULATIONS - WLA Infiltration System 101

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 101	6,735	0.500	9,005	32.09	1.34	6,735	20,205

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 101	6,735	0.500	11,278	40.19	1.67	6,735	20,205

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 101	6,735	0.500	12,915	46.02	1.92	6,735	20,205

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 101	6,735	0.500	15,990	56.98	2.37	6,735	20,205

DEWATERING CALCULATIONS - WLA Infiltration System 102

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 102	8,898	0.250	2,808	15.15	0.63	4,449	13,347

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 102	8,898	0.250	4,003	21.59	0.90	4,449	13,347

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 102	8,898	0.250	5,232	28.22	1.18	4,449	13,347

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 102	8,898	0.250	21,031	113.45	4.73	4,449	13,347

DEWATERING CALCULATIONS - WLA Infiltration System 103

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 103	9,570	0.500	2,834	7.11	0.30	9,570	28,710

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 103	9,570	0.500	5,696	14.28	0.60	9,570	28,710

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 103	9,570	0.500	7,286	18.27	0.76	9,570	28,710

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 103	9,570	0.500	13,285	33.32	1.39	9,570	28,710

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Villanova University - West Lancaster Ave.
Drainage Area: POI 1
2-Year Rainfall: 3.36 **inches**

Total Site Area: 9.015 **acres**
Protected Site Area: 0.000 **acres**
Managed Area: 9.015 **acres**

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	296257	6.801	71	4.08	0.82	0.98	24091
Meadow	D		0.000	78	2.82	0.56	1.39	0
Meadow (20% from Imperv.)	B		0.000	58	7.24	1.45	0.40	0
Meadow (20% from Imperv.)	C	21917	0.503	58	7.24	1.45	0.40	729
Meadow (20% from Imperv.)	D		0.000	78	2.82	0.56	1.39	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	74540	1.711	98	0.20	0.04	3.13	19423
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		392714	9.015					44244

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C		0.000	71	4.08	0.82	0.98	0
Meadow	D		0.000	78	2.82	0.56	1.39	0
Lawn	B		0.000	61	6.39	1.28	0.51	0
Lawn	C	225878	5.185	74	3.51	0.70	1.14	21539
Lawn	D		0.000	80	2.50	0.50	1.53	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	183244	4.207	98	0.20	0.04	3.13	47749
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		409122	9.392					69288

2-Year Volume Increase (ft^3)	25045 ft^3

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

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S) = (P-I_a)^2 / ((P-I_a) + S)$
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

Villanova University – CICD Development

Volume Summary POI 2A

Rain Garden No. 201 (RG-201)			
Impervious Surface Area	=	*9246*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*771*	*CF*
Storage Volume	=	***664***	***CF***
Equivalent Runoff Depth Treated	=	*0.86*	*in.**
Rain Garden No.202 (RG-202)			
Impervious Surface Area	=	*3307*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*276*	*CF*
Storage Volume	=	***285***	***CF***
Equivalent Runoff Depth Treated	=	*1.03*	*in.*
Rain Garden No. 203 (RG-203)			
Impervious Surface Area	=	*8867*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*739*	*CF*
Storage Volume	=	***856***	***CF***
Equivalent Runoff Depth Treated	=	*1.16*	*in.*
Rain Garden No. 204 (RG-204)			
Impervious Surface Area	=	*5064*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*422*	*CF*
Storage Volume	=	***487***	***CF***
Equivalent Runoff Depth Treated	=	*1.15*	*in.*
Rain Garden No. 205 (RG-205)			
Impervious Surface Area	=	*7319*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*610*	*CF*
Storage Volume	=	***696***	***CF***
Equivalent Runoff Depth Treated	=	*1.14*	*in.*

Rain Garden No. 206 (RG-206)

Impervious Surface Area	=	*6627*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*552*	*CF*
Storage Volume	=	***558***	***CF***
Equivalent Runoff Depth Treated	=	*1.01*	*in.*

Rain Garden No. 207 (RG-207) (No RG-202 in POI-1)

Rain Garden No. 208 (RG-208)

Impervious Surface Area	=	*7184*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*599*	*CF*
Storage Volume	=	***950***	***CF***
Equivalent Runoff Depth Treated	=	*1.59*	*in.*

Rain Garden No. 209 (RG-209)

Impervious Surface Area	=	*4385*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*365*	*CF*
Storage Volume	=	***813***	***CF***
Equivalent Runoff Depth Treated	=	*2.22*	*in.*

Rain Garden No. 210 (RG-210)

Impervious Surface Area	=	*9216*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*768*	*CF*
Storage Volume	=	***858***	***CF***
Equivalent Runoff Depth Treated	=	*1.12*	*in.*

Cistern No. 201

Impervious Surface Area	=	*57927*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*4827*	*CF*
Storage Volume	=	***10336***	***CF***
Equivalent Runoff Depth Treated	=	*2.14*	*in.*

Cistern No. 202

Impervious Surface Area	=	*9297*	*SF*

Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*775*	*CF*
Storage Volume	=	***1203***	***CF***
Equivalent Runoff Depth Treated	=	*1.55*	*in.*
Infiltration System No. 201			
Impervious Surface Area	=	*38236*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*3186*	*CF*
Storage Volume	=	***3643***	***CF***
Equivalent Runoff Depth Treated	=	*1.14*	*in.*
Infiltration System No. 202			
Impervious Surface Area	=	*16014*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*1335*	*CF*
Storage Volume	=	***3293***	***CF***
Equivalent Runoff Depth Treated	=	*2.46*	*in.*
Infiltration System No. 203			
Impervious Surface Area	=	*10568*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*881*	*CF*
Storage Volume	=	***986***	***CF***
Equivalent Runoff Depth Treated	=	*1.12*	*in.*

**RG-1 outfall is contributing to Infiltration System No. 1 which accommodates the remaining 0.14" of run-off*

TOTAL Impervious Area to BMP's = 194,286 SF
Bypass BMP's (no volume credit) = 15,832 SF
Ithan Avenue = 11,289 SF (no volume credit)
Total impervious = 218,418 SF

K:\11Proj\11005\Proj_Data\Support_Data\SWM\Report\LAH\SWM Volume Summary-REVISED -COMMENTS.docx

Volume Calculations for Section 245-22 and 245-23 of the Radnor Township Storm Water Management Ordinance

POI No. 2A – Main Lot – Lancaster Avenue Housing (LAH)

1. *Calculation of Net Two Year Runoff Volume* – Calculated utilizing Worksheet 4 from the PaDEP's BMP Manual = -4982 CF (decreased impervious area results in a volume credit).

2. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.0 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 210,118 SF (From Worksheet 4 less Ithan Avenue)
   I = 1.0 inches
   Rev = *17,510 CF*

3. *Water Quality Volume per Section 245-23 :*
   WQv = [(P)(Rv)(A)]/12
   P = 1.0 Inch
   Rv = 0.05+0.009(I) where I = % Impervious Coverage
   A = Project Area = 389,042 SF or 9.41 Acres
   Impervious Surface Area = 210,118 SF or 54.0% Impervious Coverage
   Rv = 0.05+0.009(54.0) = 0.5486
   WQv = [(1.0)(0.5486)(8.9312)]/12= 0.408 Ac-Feet or ***17,785 CF*** (Greater of Rev and WQV)

4. *Water Quality Volume Treated*

Rain Gardens 201 to 206 and 208 to 210	*6,167 CF*
Infiltration Systems 201 through 203	*7,922 CF*
Cisterns 201 and 202	*11,539 CF*
Total Volume Treated	*25,628 CF > 17,785 CF*

Equivalent Runoff Depth treated: 25,628/17,785 = 1.44 inches

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Villanova University - Lancaster Ave. Housing
Drainage Area: POI 2A
2-Year Rainfall: 3.36 **inches**

Total Site Area: 9.412 **acres**
Protected Site Area: 0.000 **acres**
Managed Area: 9.412 **acres**

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	87966	2.019	71	4.08	0.82	0.98	7153
Meadow	D		0.000	78	2.82	0.56	1.39	0
Meadow (20% from Imperv.)	C	61408	1.410	71	4.08	0.82	0.98	4994
Meadow (20% from Ithan.)	C	2996	0.069	71	4.08	0.82	0.98	244
Meadow (20% from Imperv.)	D		0.000	78	2.82	0.56	1.39	0
Impervious	C	245634	5.639	98	0.20	0.04	3.13	64007
Impervious (Ithan Road)	C	11983	0.275	98	0.20	0.04	3.13	3122
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		409987	9.412					79520

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C		0.000	71	4.08	0.82	0.98	0
Meadow	D		0.000	78	2.82	0.56	1.39	0
Lawn	B		0.000	61	6.39	1.28	0.51	0
Lawn	C	176635	4.055	74	3.51	0.70	1.14	16844
Lawn	D		0.000	80	2.50	0.50	1.53	0
Impervious	C	210118	4.824	98	0.20	0.04	3.13	54752
Impervious (Ithan Road)	C	11289	0.259	98	0.20	0.04	3.13	2942
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		398042	9.138					74537

2-Year Volume Increase (ft^3)	-4982 ft^3

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

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S) = (P-I_a)^2 / ((P-I_a) + S)$
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

LANCASTER AVENUE HOUSING - POI-2A					
Volume Calculations for 1" of run-off					
Rain Gardens	Impervious Area	Convert to	Volume	Volume provided (below outlet)	Equivalent run-off depth
No.	(sf)	(cf)	(cf)	(cf)	(in)
201	9246	0.083	771	664	0.86
202	3307	0.083	276	285	1.03
203	8867	0.083	739	856	1.16
204	5064	0.083	422	487	1.15
205	7319	0.083	610	696	1.14
206	6627	0.083	552	558	1.01
~~207~~	~~2619~~	~~0.083~~	~~218~~	~~760~~	~~3.48~~
208	7184	0.083	599	950	1.59
209	4385	0.083	365	813	2.22
210	6216	0.083	518	858	1.66
TOTAL	58215			6167	
Infiltration Systems	Impervious Area	Convert to	Volume	Volume provided (below outlet)	Equivalent run-off depth
No.	(sf)	(cf)	(cf)	(cf)	(in)
201	38236	0.083	3186	3643	1.14
202	16014	0.083	1335	3293	2.47
203	10568	0.083	881	986	1.12
TOTAL	64818			7922	
Cisterns	Impervious Area	Convert to	Volume	Volume provided (below outlet)	Equivalent run-off depth
No.	(sf)	(cf)	(cf)	(cf)	(in)
201	57927	0.083	4827	10336	2.14
202	9297	0.083	775	1203	1.55
TOTAL	67224			11539	
WQ TOTAL	190257			25628	

Infiltration System-201			
Inlet	A total SF	Lawn - B SF	Impervious SF
I-201	8096	1731	6365
I-202	3597	404	3193
I-203	980	0	980
I-204	8646	1349	7297
I-205	2972	203	2769
I-206	2556	200	2356
I-207	1521	0	1521
I-208	19603	5848	13755
RG-201	14913	5667	9246
RG-202	15554	12247	3307
RG-203	15197	6330	8867
~~RG-207~~	0	0	0
RG-208	18063	10879	7184
	111698	44858	66840
FROM RG		35123	28604
FROM INLETS		9735	38236

Cistern-201			
Inlet	A total SF	Lawn - B SF	Impervious SF
RD-201	4117	0	4117
RD-202	7288	0	7288
RD-203A	5809	0	5809
RD-203B	9368	0	9368
RD-204	5925	0	5925
RD-205	7177	0	7177
RD-206	4275	0	4275
RD-207	4115	0	4115
RD-208	5765	0	5765
RD-209	2044	0	2044
RD-210	2044	0	2044
	57927	0	57927

Infiltration System-202			
Inlet	A total SF	Lawn - B SF	Impervious SF
I-209	15282	2923	12359
I-213	3851	196	3655
RG-204	13979	8915	5064
RG-205	24212	16893	7319
	57324	28927	28397

RG-201	14913	5667	9246
RG-202	15554	12247	3307
RG-203	15197	6330	8867
RG-204	13979	8915	5064
RG-205	24212	16893	7319
RG-206	12712	6085	6627
~~RG-207~~	0	0	0
RG-208	18063	10879	7184
RG-209	9942	5557	4385
RG-210	19789	13573	6216
INF-201			38236
INF-202			16014
INF-203			10568
Cistern 201			57927
Cistern 202			9297
TOTAL WATER QUALITY			**190257**

Cistern-202			
Inlet	A total SF	Lawn - B SF	Impervious SF
RD-211	4269	0	4269
RD-212	5028	0	5028
	9297	0	9297

TOTAL IMPERVIOUS TO SWM BMP'S		194286
TOTAL BYPASS IMPERVIOUS		27121
		221407
TOTAL LAWN TO WQ BMP'S		103765
TOTAL BYPASS LAWN		72870
		176635
TOTAL	**398042**	

Infiltration System-203			
Inlet	A total SF	Lawn - B SF	Impervious SF
I-210	7784	729	7055
I-211	1700	674	1026
I-212	221	0	221
I-220	2266	0	2266
	11971	1403	10568

RG-206			
Inlet	A total SF	Lawn - B SF	Impervious SF
RG-206	12712	6085	6627

Detention-201			
Inlet	A total SF	Lawn - B SF	Impervious SF
I-214*	3200	200	3000
YD-201*	3422	2393	1029
YD-202*	769	769	0
RG-209	9942	5557	4385
RG-210	19789	13573	6216
	37122	22492	14630

**Detention flows to Infiltration-202*

Uncontrolled			
Inlet	A total SF	Lawn - B SF	Impervious SF
I-215	4918	0	4918
I-216	2600	0	2600
I-217	1036	0	1036
I-218	5040	0	5040
TD-201	10840	2921	7919
	24434	2921	21513
Overland	18493	12885	5608
Uncap	57064	57064	0
	99991	72870	27121

Lancaster Avenue Housing *POI-2A*

RG-201

Top of Grate = 436.50
Ground El. = 435.50

1 inch Runoff Volume to RG-1				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*14913*	*SF*					
CN=	*61*	*A=*	*5667.00*	*6.39*	*1.00*	*0.01*	*6*
CN=	*98*	*A=*	*9246.00*	*0.20*	*1.00*	*0.79*	*609*
TOTAL RUNOFF VOLUME =							***615***

Retention Volume

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
435.5	*403*				***137***	***0.00315***	***2' soil 17% voids***
		0.5	*451.00*	***226***			
436.0	*499*				***363***	***0.00832***	
		1.0	*602.00*	***602***			
437.0	*705*				***965***	***0.02214***	
Volumetric Storage	***664***	***CF***	***at El. 436.50***	***12" surface plus 2' soil***			
Volume Credit	***615***	***CF***					

RG-202

Top of Grate =435.25
Ground El. = 434.50

1 inch Runoff Volume to RG-2				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*15554*	*SF*					
CN=	*61*	*A=*	*12247.00*	*6.39*	*1.00*	*0.01*	*13*
CN=	*98*	*A=*	*3307.00*	*0.20*	*1.00*	*0.79*	*218*
TOTAL RUNOFF VOLUME =							***231***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
434.5	*339*				***115***	***0.00265***	***2' soil 17% voids***
		0.5	*427.50*	***214***			
435.0	*516*				***329***	***0.00755***	
		1.0	*720.50*	***721***			
436.0	*925*				***1050***	***0.02409***	
Volumetric Storage	***509***	***CF***	***at El. 435.25***	***9" surface plus 2' soil***			
Volume Credit	***231***	***CF***					

RG-203

Top of Grate = 431.25
Ground El. = 430.50

1 inch Runoff Volume to RG-4				*S*	*P*	*Q*	*Runoff Volune (CF)*	***CF***
DA =	*15197*	*SF*						
CN=	*61*	*A=*	*6330.00*	*6.39*	*1.00*	*0.01*	*7*	
CN=	*98*	*A=*	*8867.00*	*0.20*	*1.00*	*0.79*	*584*	
TOTAL RUNOFF VOLUME =							***591***	

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
430.5	*526*				***179***	***0.00411***	***2' soil 17% voids***
		0.5	*579.00*	***290***			

431.0	632					**468**	**0.01075**	
		1.0	755.00	**755**				
432.0	878					**1223**	**0.02808**	
Volumetric Storage	**657**	**CF**	**at El. 431.25**	**9" surface plus 2' soil**				
Volume Credit	**591**	**CF**						

RG-204

Top of Grate = 428.75
Ground El. = 428.00

1 inch Runoff Volume to RG-5				*S*	*P*	*Q*	*Runoff Volune (CF)*	**CF**
DA =	*13979 SF*							
CN=	*61*	*A=*	*8915.00*	*6.39*	*1.00*	*0.01*	*9*	
CN=	*98*	*A=*	*5064.00*	*0.20*	*1.00*	*0.79*	*334*	
TOTAL RUNOFF VOLUME =							***343***	

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
428.00	*438*				**149**	**0.00342**	**2' soil 17% voids**
		1.00	*583.00*	**583**			
429.00	*728*				**732**	**0.01680**	
		0.50	*811.00*	**406**			
429.50	*894*				**1137**	**0.02611**	
Volumetric Storage	**586**	**CF**	**at El. 428.75**	**9" surface plus 2' soil**			
Volume Credit	**343**	**CF**					

RG-205

Top of Grate = 429.00
Ground El. = 428.00

1 inch Runoff Volume to RG-6				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*24212 SF*						
CN=	*61*	*A=*	*16893.00*	*6.39*	*1.00*	*0.01*	*18*
CN=	*98*	*A=*	*7319.00*	*0.20*	*1.00*	*0.79*	*482*
TOTAL RUNOFF VOLUME =							***500***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
428.0	*637*				**217**	**0.00497**	**2' soil 17% voids**
		1.0	*813.50*	**814**			
429.0	*990*				**1030**	**0.02365**	
		0.5	*1088.50*	**544**			
429.5	*1187*				**1574**	**0.03614**	
Volumetric Storage	**1030**	**CF**	**at El. 429.00**	**12" surface plus 2' soil**			
Volume Credit	**500**	**CF**					

RG-206

Top of Grate = 432.25
Ground El. = 431.50

1 inch Runoff Volume to RG-6				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*12712 SF*						
CN=	*61 A=*	*6085.00*		*6.39*	*1.00*	*0.01*	*6*
CN=	*98 A=*	*6627.00*		*0.20*	*1.00*	*0.79*	*437*
TOTAL RUNOFF VOLUME =							***443***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
431.5	*371*				***126***	***0.00290***	***2' soil 17% voids***
		0.5	*444.00*	***222***			
432.0	*517*				***348***	***0.00799***	
		1.0	*685.50*	***686***			
433.0	*854*				***1034***	***0.02373***	
Volumetric Storage	***520***	***CF***	***at El. 429.00***	***12" surface plus 2' soil***			
Volume Credit	***443***	***CF***					

RG-207

Top of Grate = 438.75
Ground El. = 438.00

1 inch Runoff Volume to RG-6				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*0 SF*						
CN=	*61 A=*	*0.00*		*6.39*	*1.00*	*0.01*	*0*
CN=	*98 A=*	*0.00*		*0.20*	*1.00*	*0.79*	*0*
TOTAL RUNOFF VOLUME =							***0***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
438.0	*0*				***0***	***0.00000***	***2' soil 17% voids***
		1.0	*0.00*	***0***			
439.0	*0*				***0***	***0.00000***	
Volumetric Storage	***0***	***CF***	***at El. 0***	***9" surface plus 2' soil***			
Volume Credit	***0***	***CF***					

RG-208

Top of Grate = 435.00
Ground El. = 434.50

1 inch Runoff Volume to RG-6				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*18063 SF*						
CN=	*61 A=*	*10879.00*		*6.39*	*1.00*	*0.01*	*12*
CN=	*98 A=*	*7184.00*		*0.20*	*1.00*	*0.79*	*473*
TOTAL RUNOFF VOLUME =							***485***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
434.5	*1258*				***321***	***0.00736***	***1.5' soil 17% voids***
		0.5	*1258.00*	***629***			
435.0	*1258*				***950***	***0.02180***	
		0.5	*1258.00*	***629***			
435.5	*1258*				***1579***	***0.03624***	
		0.5	*1258.00*	***629***			
436.0	*1258*				***2208***	***0.05068***	

Volumetric Storage	***950***	***CF***	***at El. 435.00***	***6" surface plus 1.5' soil media***	
Volume Credit	***485***	***CF***			

RG-209

Top of Grate = 433.50
Ground El. = 433.00

1 inch Runoff Volume to RG-6			*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*9942 SF*					
CN=	*61 A=*	*5557.00*	*6.39*	*1.00*	*0.01*	*6*
CN=	*98 A=*	*4385.00*	*0.20*	*1.00*	*0.79*	*289*
TOTAL RUNOFF VOLUME =						***295***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
433.0	*1077*				***275***	***0.00630***	***1.5' soil 17% voids***
		1.0	*1077.00*	***1077***			
434.0	*1077*				***1352***	***0.03103***	
		0.5	*1077.00*	***539***			
434.5	*1077*				***1890***	***0.04339***	
Volumetric Storage	***813***	***CF***	***at El. 433.50***	***6" surface plus 1.5' soil media***			
Volume Credit	***295***	***CF***					

RG-210

Top of Grate = 434.00
Ground El. = 433.00

1 inch Runoff Volume to RG-6			*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*19789 SF*					
CN=	*61 A=*	*13573.00*	*6.39*	*1.00*	*0.01*	*14*
CN=	*98 A=*	*6216.00*	*0.20*	*1.00*	*0.79*	*410*
TOTAL RUNOFF VOLUME =						***424***

El.	*Area SF*	*Depth*	*Avg Area SF*	*Inc Vol CF*	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*	
433.0	*1136*				***290***	***0.00665***	***1.5' soil 17% voids***
		1.0	*1136.00*	***1136***			
434.0	*1136*				***1426***	***0.03273***	
		0.5	*1136.00*	***568***			
434.5	*1136*				***1994***	***0.04577***	
Volumetric Storage	***858***	***CF***	***at El. 434.00***	***12" surface plus 1.5' soil media***			
Volume Credit	***424***	***CF***					

Cistern No. 201

Top of Outflow Weir = 427.04

1 inch Runoff Volume to Cistern 1				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*57927 SF*						
CN=	*61 A=*	*0.00*		*6.39*	*1.00*	*0.01*	*0*
CN=	*98 A=*	*57927.00*		*0.20*	*1.00*	*0.79*	*3818*
TOTAL RUNOFF VOLUME =							***3818***

El.	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*
427.04	***10336***	***0.23728***

Volumetric Storage	***10336***	***CF***	***at El. 427.04***	***at low flow weir***
Volume Credit	***3,818***	***CF***		

Cistern No. 202

Top of Outflow Weir = 416.29

1 inch Runoff Volume to Cistern 2				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*9297 SF*						
CN=	*61 A=*	*0.00*		*6.39*	*1.00*	*0.01*	*0*
CN=	*98 A=*	*9297.00*		*0.20*	*1.00*	*0.79*	*613*
TOTAL RUNOFF VOLUME =							***613***

El.	*Cum Vol (CF)*	*Cum Vol (Ac Ft)*
416.29	***1203***	***0.02762***

Volumetric Storage	***1203***	***CF***	***at El. 416.29***	***at low flow weir***
Volume Credit	***613***	***CF***		

Infiltration System No. 201

1 inch Runoff Volume to Inf 1				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*38236 SF*						
CN=	*61 A=*	*0.00*		*6.39*	*1.00*	*0.01*	*0*
CN=	*98 A=*	*38236.00*		*0.20*	*1.00*	*0.79*	*2520*
TOTAL RUNOFF VOLUME =							***2520***

	Cum Vol (CF)	*Cum Vol (Ac Ft)*
	6361	***0.14603***

Volumetric Storage	***3643***	***CF***	***Volume below Outlet***
Volume Credit	***2,520***	***CF***	

Infiltration System No. 202

1 inch Runoff Volume to Inf 2				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*19133 SF*						
CN=	*61 A=*	*3119.00*		*6.39*	*1.00*	*0.01*	*3*
CN=	*98 A=*	*16014.00*		*0.20*	*1.00*	*0.79*	*1055*
TOTAL RUNOFF VOLUME =							***1059***

	Cum Vol (CF)	*Cum Vol (Ac Ft)*
	4446	***0.10207***

Volumetric Storage	***3293***	***CF***	***Volume below Outlet***
Volume Credit	***1,059***	***CF***	

Infiltration System No. 203

1 inch Runoff Volume to Infn 3				*S*	*P*	*Q*	*Runoff Volune (CF)*
DA =	*11971*	*SF*					
CN=	*61*	*A=*	*1403.00*	*6.39*	*1.00*	*0.01*	*1*
CN=	*98*	*A=*	*10568.00*	*0.20*	*1.00*	*0.79*	*697*
TOTAL RUNOFF VOLUME =							***698***

Cum Vol (CF)	*Cum Vol (Ac Ft)*
954	***0.02190***

Volumetric Storage	***739***	***CF***	***Volume below Outlet***
Volume Credit	***698***	***CF***	

Total Impervious Area	***190,257***	**SF**

Stage-Area-Storage for Pond 3P: INFILTRATION-203

Elevation (feet)	Storage (cubic-feet)
415.00	0
415.05	24
415.10	49
415.15	73
415.20	98
415.25	122
415.30	147
415.35	171
415.40	195
415.45	220
415.50	244
415.55	269
415.60	293
415.65	318
415.70	342
415.75	366
415.80	391
415.85	415
415.90	440
415.95	464
416.00	489
416.05	539
416.10	589
416.15	639
416.20	689
416.25	739
416.30	789
416.35	838
416.40	888
416.45	937
416.50	986
416.55	1,034
416.60	1,083
416.65	1,131
416.70	1,179
416.75	1,227
416.80	1,275
416.85	1,322
416.90	1,369
416.95	1,416
417.00	1,462
417.05	1,509
417.10	1,555
417.15	1,600
417.20	1,645
417.25	1,690
417.30	1,734
417.35	1,779
417.40	1,822
417.45	1,865
417.50	1,908
417.55	1,951
417.60	1,992
417.65	2,034
417.70	2,075
417.75	2,115
417.80	2,154
417.85	2,193
417.90	2,231
417.95	2,269
418.00	2,305
418.05	2,341
418.10	2,376
418.15	2,410
418.20	2,442
418.25	2,473
418.30	2,501
418.35	2,529
418.40	2,555
418.45	2,581
418.50	2,606
418.55	2,630
418.60	2,654
418.65	2,679
418.70	2,703
418.75	2,728
418.80	2,752
418.85	2,777
418.90	2,801
418.95	2,825
419.00	2,850
419.05	2,874
419.10	2,899
419.15	2,923
419.20	2,948
419.25	2,972
419.30	2,996
419.35	3,021
419.40	3,045
419.45	3,070
419.50	**3,094**

VOL. BELOW OUTLET 986 CF

Stage-Area-Storage for Pond IP: INFILTRATION-201

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
422.30	0	424.90	10,670
422.35	128	424.95	10,892
422.40	256	425.00	11,111
422.45	384	425.05	11,326
422.50	512	425.10	11,537
422.55	640	425.15	11,745
422.60	768	425.20	11,950
422.65	896	425.25	12,150
422.70	1,024	425.30	12,346
422.75	1,152	425.35	12,538
422.80	1,280	425.40	12,724
422.85	1,408	425.45	12,903
422.90	1,536	425.50	13,075
422.95	1,664	425.55	13,237
423.00	1,792	425.60	13,390
423.05	1,920	425.65	13,534
423.10	2,048	425.70	13,673
423.15	2,176	425.75	13,807
423.20	2,304	425.80	13,938
423.25	2,432	425.85	14,066
423.30	2,560	425.90	14,194
423.35	2,831	425.95	14,322
423.40	3,102	426.00	14,450
423.45	3,373	426.05	14,578
423.50	3,643	426.10	14,706
423.55	3,913	426.15	14,834
423.60	4,181	426.20	14,962
423.65	4,449	426.25	15,090
423.70	4,715	426.30	15,218
423.75	4,981	426.35	15,346
423.80	5,245	426.40	15,474
423.85	5,509	426.45	15,602
423.90	5,771	426.50	15,730
423.95	6,031	426.55	15,858
424.00	6,291	426.60	15,986
424.05	6,549	426.65	16,114
424.10	6,806	426.70	16,242
424.15	7,061	426.75	16,369
424.20	7,315	426.80	**16,497**
424.25	7,567		
424.30	7,818		
424.35	8,067		
424.40	8,314		
424.45	8,559		
424.50	8,802		
424.55	9,044		
424.60	9,283		
424.65	9,520		
424.70	9,755		
424.75	9,987		
424.80	10,217		
424.85	10,445		

VOL. BELOW OUTLET 3,643 cf

Stage-Area-Storage for Pond 2P: INFILTRATION-202

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
418.00	0	420.60	8,225
418.05	110	420.65	8,435
418.10	220	420.70	8,643
418.15	329	420.75	8,850
418.20	439	420.80	9,055
418.25	549	420.85	9,258
418.30	659	420.90	9,460
418.35	768	420.95	9,659
418.40	878	421.00	9,856
418.45	988	421.05	10,051
418.50	1,098	421.10	10,244
418.55	1,208	421.15	10,435
418.60	1,317	421.20	10,622
418.65	1,427	421.25	10,806
418.70	1,537	421.30	10,987
418.75	1,647	421.35	11,166
418.80	1,756	421.40	11,341
418.85	1,866	421.45	11,513
418.90	1,976	421.50	11,681
418.95	2,086	421.55	11,845
419.00	2,196	421.60	12,005
419.05	2,305	421.65	12,159
419.10	2,415	421.70	12,306
419.15	2,525	421.75	12,445
419.20	2,635	421.80	12,576
419.25	2,744	421.85	12,700
419.30	2,854	421.90	12,819
419.35	2,964	421.95	12,934
419.40	3,074	422.00	13,046
419.45	3,184	422.05	13,155
419.50	3,293	422.10	13,265
419.55	3,526	422.15	13,375
419.60	3,758	422.20	13,485
419.65	3,991	422.25	13,595
419.70	4,222	422.30	13,704
419.75	4,453	422.35	13,814
419.80	4,683	422.40	13,924
419.85	4,912	422.45	14,034
419.90	5,141	422.50	14,143
419.95	5,368	422.55	14,253
420.00	5,595	422.60	14,363
420.05	5,820	422.65	14,473
420.10	6,045	422.70	14,583
420.15	6,268	422.75	14,692
420.20	6,491	422.80	14,802
420.25	6,712	422.85	14,912
420.30	6,932	422.90	15,022
420.35	7,151	422.95	15,131
420.40	7,368	423.00	**15,241**
420.45	7,585		
420.50	7,799		
420.55	8,013		

Vol. BELOW OUTLET 3293 cf.

Reprint Rev F

Events for Link 13L: POI 2A - POST

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
1-yr	3.89	3.89	**0.00**
2-yr	6.69	6.69	0.00
5-yr	10.53	10.53	0.00
10-yr	15.17	15.17	0.00
25-yr	23.27	23.27	0.00
50-yr	35.13	35.13	0.00
100-yr	**48.60**	**48.60**	0.00

DEWATERING CALCULATIONS - LAH Infiltration System 201

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 201	6,399	0.250	7,024	52.69	2.20	3,200	9,599

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 201	6,399	0.250	8,573	64.31	2.68	3,200	9,599

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 201	6,399	0.250	10,959	82.21	3.43	3,200	9,599

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 201	6,399	0.250	12,686	95.16	3.96	3,200	9,599

DEWATERING CALCULATIONS - LAH Infiltration System202

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 202	5,489	0.250	5,884	51.45	2.14	2,745	8,234

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 202	5,489	0.250	7,432	64.99	2.71	2,745	8,234

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 202	5,489	0.250	10,221	89.38	3.72	2,745	8,234

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 202	5,489	0.250	11,842	103.56	4.31	2,745	8,234

DEWATERING CALCULATIONS - LAH Infiltration System 203

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 203	1,140	0.250	1,021	42.99	1.79	570	1,710

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 203	1,140	0.250	1,433	60.34	2.51	570	1,710

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 203	1,140	0.250	1,645	69.26	2.89	570	1,710

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
INF 203	1,140	0.250	2,131	89.73	3.74	570	1,710

Villanova University – Garage / Performing Arts Center

Volume Summary POI 2B

Parking Garage Detention System

Impervious Surface Area	=	*34484*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*2874*	*CF*
Storage Volume	=	***4365***	**CF**
Equivalent Runoff Depth Treated	=	*1.51*	*in.*

Performing Arts Center Detention System / Cistern

Impervious Surface Area	=	*26572*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*2214*	*CF*
Storage Volume	=	***3340***	**CF**
Equivalent Runoff Depth Treated	=	*1.51*	*in.*

Volume Calculations for Section 245-22 and 245-23 of the Radnor Township Storm Water Management Ordinance

Pike Parking Garage and PAC – Build-out Condition – POI 2B – Includes Off-Site - Includes Impervious Surfaces from Ithan Avenue

1. *Calculation of Net Two Year Runoff Volume* – Calculated utilizing Worksheet 4 from the PaDEP's BMP Manual = -171 CF

2. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.0 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 84,071 SF
   I = 1.0 inches
   Rev = **7,006 CF** (Greater of Rev and WQV)

3. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.5 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 84,071 SF
   I = 1.5 inches
   Rev = **10,509 CF** (Greater of Rev and WQV)

4. *Water Quality Volume per Section 245-23 :*
   WQv = [(P)(Rv)(A)]/12
   P = 1.0 Inch
   Rv = 0.05+0.009(I) where I = % Impervious Coverage
   A = Project Area = 100,624 SF or 2.31 Acres
   Impervious Surface Area = 84,071 SF
   Total Impervious Coverage = 84,071 or 83.5%
   Rv = 0.05+0.009(83.5) = 0.8019
   WQv = [(1.0)(0.8019)(2.31)]/12 = 0.1544 Acre Feet or **6725 CF**

5. *Water Quality Volume Treated*

Proposed Detention System – Performing Arts Center	*3340 CF*
Proposed Detention System – Garage	*4365 CF*
Total Volume treated	*7705 CF*
With Scenario 8, we are treating = 7705/7006 =	*1.10 inch*

Volume Calculations / Pike Garage and PAC / Build-out Condition / POI 2B

1. *Proposed Garage Basin – POI -2B*

Total Area to Garage POI 2B Basin	*0.79 Acres*
Total Imp Area to POI 2B Basin	*0.79 Acres or 34,484 SF*
1.0 inch Depth Runoff from Impervious Surface	*2,874 CF*
Vol. of Infiltration Bed (172' x 20' x 24" Deep) 40% Voids	*2752 CF*
Total Volume to El. 411.50	*1613 CF*
Total Volume of Storage to Low Flow Orifice	*4365 CF*
Treating:	*1.51 inch storm*
Impervious Loading Ratio	*10 : 1*

2. *Proposed PAC w/ Green Roof - Basin – POI -2B*

Total Area to Garage POI 2B Basin	*0.76 Acres*
Total Imp Area to POI 3A Basin	*0.61 Acres or 26,572 SF*
1.0 inch Depth Runoff from Impervious Surface	*2,214 CF*
Total Volume stored to El. 429.12 – Capture & Re-Use	*3340 CF*
Treating:	*1.51 inch storm*
Impervious Loading Ratio	*NA*

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Villanova University - West Lancaster Ave.
Drainage Area: POI 2B
2-Year Rainfall: 3.36 **inches**

Total Site Area: 3.360 **acres**
Protected Site Area: 0.000 **acres**
Managed Area: 3.360 **acres**

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	11761	0.270	71	4.08	0.82	0.98	956
Meadow	D		0.000	78	2.82	0.56	1.39	0
Meadow (20% from Imperv.)	B		0.000	58	7.24	1.45	0.40	0
Meadow (20% from Imperv.)	C	17772	0.408	71	4.08	0.82	0.98	1445
Meadow (20% from Imperv.)	D		0.000	78	2.82	0.56	1.39	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	81544	1.872	98	0.20	0.04	3.13	21248
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		111077	2.550					23650

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	436	0.010	71	4.08	0.82	0.98	35
Meadow	D		0.000	78	2.82	0.56	1.39	0
Lawn	B		0.000	61	6.39	1.28	0.51	0
Lawn	C	16117	0.370	74	3.51	0.70	1.14	1537
Lawn	D		0.000	80	2.50	0.50	1.53	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	84071	1.930	98	0.20	0.04	3.13	21907
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		100624	2.310					23479

2-Year Volume Increase (ft^3)	-171 ft^3

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

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S) = (P-I_a)^2 / ((P-I_a) + S)$
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

DEWATERING CALCULATIONS - Garage Detention System Basin 2B-1

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-1	34,482	0.250	8,973	12.49	0.52	17,241	51,723

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-1	34,482	0.250	11,717	16.31	0.68	17,241	51,723

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-1	34,482	0.250	14,462	20.13	0.84	17,241	51,723

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-1	34,482	0.250	23,392	32.56	1.36	17,241	51,723

Villanova University – Garage / Performing Arts Center

Volume Summary POI 3

Existing Pike Field Underground Detention Basin (POI-3)

Impervious Surface Area	=	*69,199*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*5766*	*CF*
Storage Volume	=	***5905***	***CF***
Equivalent Runoff Depth Treated	=	*1.02*	*in.*

K:\11Proj\11005\Proj_Data\Support_Data\SWM\Report\Garage\SWM Volume Summary.docx

Villanova University – Garage / Performing Arts Center

Volume Summary POI 3A

Underground Detention Basin (POI-3A)

Impervious Surface Area	=	*159767*	*SF*
Runoff Volume - Impervious Surface Area (1.0 inch runoff)	=	*13314*	*CF*
Storage Volume	=	***14642***	***CF***
Equivalent Runoff Depth Treated	=	*1.10*	*in.*

Volume Calculations for Section 245-22 and 245-23 of the Radnor Township Storm Water Management Ordinance

Pike Parking Garage and PAC – Build-out Condition – POI 3 – Includes Off-Site Impervious Surfaces from Route 30 and Northern Villanova Campus

1. *Calculation of Net Two Year Runoff Volume* – Calculated utilizing Worksheet 4 from the PaDEP's BMP Manual = 4159 CF (decreased impervious area results in a volume credit). This is for Build-out condition

2. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.0 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 229,126 SF (Includes PAC / Garage and Route 30 Widening)
   I = 1.0 inches
   Rev = **19,094 CF** (Greater of Rev and WQV)

3. *Calculation of the Retention (Infiltration) Volume based on a Runoff Depth of 1.5 inch for all Impervious Surfaces:*
   Rev = I x Impervious Area (S.F.) / 12 inches = Volume (CF)
   Impervious Area = 229,126 SF (Includes PAC / Garage and Route 30 Widening)
   I = 1.5 inches
   Rev = **28,641 CF** (Greater of Rev and WQV)

4. *Water Quality Volume per Section 245-23 :*
   WQv = [(P)(Rv)(A)]/12
   P = 1.0 Inch
   Rv = 0.05+0.009(I) where I = % Impervious Coverage
   A = Project Area = 608,969 SF or 13.98
   Impervious Surface Area = 229,126 SF
   Total Impervious Coverage = 608,969 or 37.6%
   Rv = 0.05+0.009(37.6) = 0.3886
   WQv = [(1.0)(0.3886)(13.98)]/12 = 0.4528 Acre Feet or 19,722 CF

5. *Water Quality Volume Treated*

Proposed Detention System – East Side of Pike Field	*14642 CF*
Existing Detention System	*5905 CF*
Total Volume treated	*20547 CF*
With Scenario 8, we are treating = 20547/19722 =	*1.04 inch*

Volume Calculations / Pike Garage and PAC / Build-out Condition / POI 3 / 3A

1. *POI – 3A – Build-out Condition*

Total Area to POI 3A Basin	*5.34 Acres*
Total Imp Area to POI 3A Basin	*3.67 Acres or 159,767 SF*
1.0 inch Depth Runoff from Impervious Surface	*13,314 CF*
Vol. of Infiltration Bed (193' x 74' x 18" Deep) 40% Voids	*8569 CF*
Elevate Low Flow Orifice 6" to 411.00	*6073 CF*
Total Volume of Storage to Low Flow Orifice	*14,642 CF*
Treating:	*1.10 inch storm*
Impervious Loading Ratio	*11.2 : 1*

2. *Existing Basin – POI -3*

Total Area to POI 3 Basin	*3.36 Acres*
Total Imp Area to POI 3A Basin	*1.59 Acres or 69,199 SF*
1.0 inch Depth Runoff from Impervious Surface	*5,766 CF*
Vol. of Infiltration Bed (134' x 73' x 12" Deep) 40% Voids	*3913 CF*
Total Volume to El. 411.65	*1992 CF*
Total Volume of Storage to Low Flow Orifice	*5905 CF*
Treating:	*1.02 inch storm*
Impervious Loading Ratio	*7.07 : 1*

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Villanova University - West Lancaster Ave.
Drainage Area: POI 3
2-Year Rainfall: 3.36 **inches**

Total Site Area: 3.360 **acres**
Protected Site Area: 0.000 **acres**
Managed Area: 3.360 **acres**

Existing Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	366775	8.420	71	4.08	0.82	0.98	29826
Meadow	D		0.000	78	2.82	0.56	1.39	0
Meadow (20% from Imperv.)	B		0.000	58	7.24	1.45	0.40	0
Meadow (20% from Imperv.)	C	16466	0.378	71	4.08	0.82	0.98	1339
Meadow (20% from Imperv.)	D		0.000	78	2.82	0.56	1.39	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	200899	4.612	98	0.20	0.04	3.13	52350
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		584140	13.410					83514

Developed Conditions:

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	I_a (0.2 x S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	B		0.000	55	8.18	1.64	0.30	0
Woodland	C		0.000	70	4.29	0.86	0.92	0
Woodland	D		0.000	77	2.99	0.60	1.33	0
Meadow	B		0.000	58	7.24	1.45	0.40	0
Meadow	C	300868	6.907	71	4.08	0.82	0.98	24466
Meadow	D		0.000	78	2.82	0.56	1.39	0
Lawn	B		0.000	61	6.39	1.28	0.51	0
Lawn	C	36721	0.843	74	3.51	0.70	1.14	3502
Lawn	D		0.000	80	2.50	0.50	1.53	0
Impervious	B		0.000	98	0.20	0.04	3.13	0
Impervious	C	229126	5.260	98	0.20	0.04	3.13	59705
Impervious	D		0.000	98	0.20	0.04	3.13	0
TOTAL:		566715	13.010					87673

2-Year Volume Increase (ft^3)	4159 ft^3

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

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S) = (P-I_a)^2 / ((P-I_a) + S)$
   P = 2-Year Rainfall (in)
   S = (1000 / CN) - 10
2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land use area (sq. ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

DEWATERING CALCULATIONS - POI 3A Basin

2-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	2-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-2	159,865	0.250	44,910	13.48	0.56	79,933	239,798

5-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	5-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-2	159,865	0.250	62,509	18.77	0.78	79,933	239,798

10-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	10-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-2	159,865	0.250	80,368	24.13	1.01	79,933	239,798

100-Year

BMP	Area (SF)	Design Infil Rate (in/hr)	100-Year Volume (CF)	Dewater Time (hr)	Dewater Time (days)	24-Hour Dewater Capacity (CF)	72-Hour Dewater Capacity (CF)
Basin 2B-2	159,865	0.250	139,566	41.91	1.75	79,933	239,798

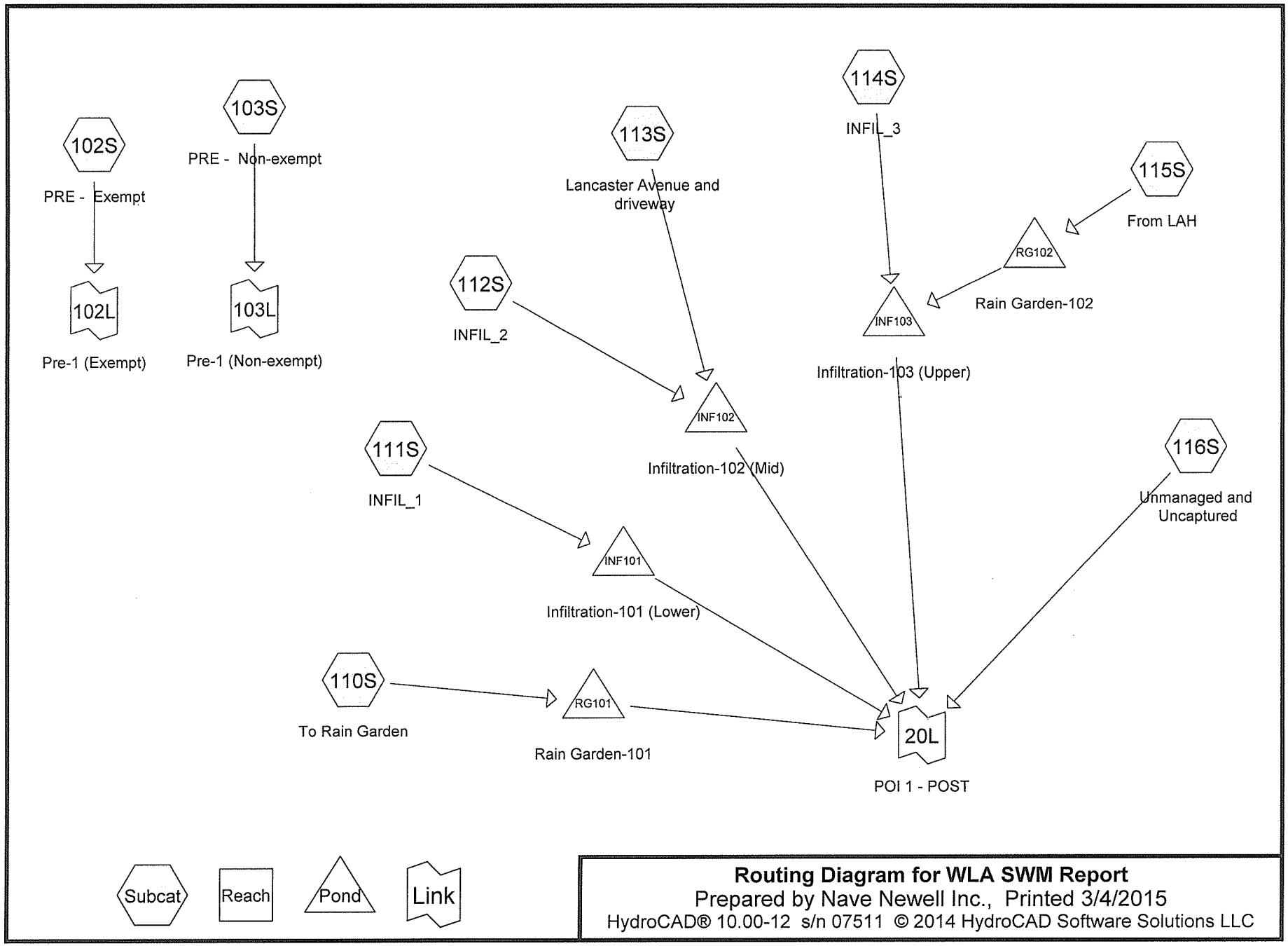
VI.

POI 1 SUMMARY OF FLOWS
Pre-Development/Post Development - w/Exempted Areas

STORM EVENT	Pre-Development Flow (CFS) A	Allowable Flow (CFS) B	Pre-Development Exempt Flow (CFS) C	Allowable Flow (non-exempt plus exempt) (CFS) B+C=D	Post Development Flow (CFS)	% Reduction Allowable (CFS) Reduction D	% Reduction Pre-Dev (CFS) Reduction A+C
1	5.17	5.17	6.27	11.44	3.57	-68.79	-68.79
2	8.59	5.17	9.05	14.22	5.76	-59.49	-67.35
5	13.60	8.59	12.86	21.45	10.22	-52.35	-61.38
10	18.92	13.60	16.69	30.29	18.14	-40.11	-49.06
25	24.39	18.92	20.52	39.44	28.16	-28.60	-37.30
50	29.97	18.92	24.35	43.27	40.95	-5.36	-24.61
100	37.02	37.02	29.11	66.13	57.04	-13.75	-13.75

Nave Newell
Where Ideas Get Down to Earth
900 West Valley Road Suite 1100
Wayne, PA 19087

PROJECT: Villanova
JOB NO. 2011-005.00 BY: LRL
DATE: 3/2/2015 CHK'D: DAT


102S
PRE - Exempt
103S
PRE - Non-exempt
113S
Lancaster Avenue and driveway
114S
INFIL_3
115S
From LAH
RG102
Rain Garden-102
112S
INFIL_2
INF103
Infiltration-103 (Upper)
102L
Pre-1 (Exempt)
103L
Pre-1 (Non-exempt)
INF102
Infiltration-102 (Mid)
111S
INFIL_1
116S
Unmanaged and Uncaptured
INF101
Infiltration-101 (Lower)
110S
To Rain Garden
RG101
Rain Garden-101
20L
POI 1 - POST
Subcat
Reach
Pond
Link
Routing Diagram for WLA SWM Report
Prepared by Nave Newell Inc., Printed 3/4/2015
HydroCAD® 10.00-12 s/n 07511 © 2014 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>1.35"
Flow Length=717' Tc=10.7 min CN=86 Runoff=6.27 cfs 15,086 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>0.82"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=5.88 cfs 17,811 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>1.16"
Tc=10.0 min CN=83 Runoff=1.94 cfs 4,563 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>1.82"
Tc=10.0 min CN=92 Runoff=5.28 cfs 12,745 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>1.82"
Tc=10.0 min CN=92 Runoff=2.67 cfs 6,449 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>1.36"
Tc=6.0 min CN=86 Runoff=3.08 cfs 6,249 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>1.73"
Tc=10.0 min CN=91 Runoff=1.97 cfs 4,730 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>1.43"
Tc=6.0 min CN=87 Runoff=0.96 cfs 1,951 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>0.73"
Tc=20.0 min CN=75 Runoff=2.25 cfs 7,943 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=415.89' Storage=6,307 cf Inflow=5.28 cfs 12,745 cf
Discarded=0.08 cfs 5,690 cf Primary=0.36 cfs 6,795 cf Outflow=0.44 cfs 12,485 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=419.57' Storage=6,033 cf Inflow=5.60 cfs 12,698 cf
Discarded=0.05 cfs 4,456 cf Primary=0.66 cfs 7,791 cf Outflow=0.71 cfs 12,247 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=430.50' Storage=1,914 cf Inflow=1.97 cfs 4,730 cf
Discarded=0.20 cfs 6,632 cf Primary=0.00 cfs 0 cf Outflow=0.20 cfs 6,632 cf

Pond RG101:Rain Garden-101 Peak Elev=402.53' Storage=1,576 cf Inflow=1.94 cfs 4,563 cf
Discarded=0.02 cfs 690 cf Primary=0.39 cfs 3,798 cf Outflow=0.41 cfs 4,488 cf

Pond RG102:Rain Garden-102 Peak Elev=436.89' Storage=1,951 cf Inflow=0.96 cfs 1,951 cf
Outflow=0.00 cfs 0 cf

Link 20L:POI 1 - POST Inflow=3.57 cfs 26,327 cf
Primary=3.57 cfs 26,327 cf

Link 102L:Pre-1 (Exempt) Inflow=6.27 cfs 15,086 cf
Primary=6.27 cfs 15,086 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=5.88 cfs 17,811 cf
Primary=5.88 cfs 17,811 cf

Total Runoff Area = 801,836 sf Runoff Volume = 77,528 cf Average Runoff Depth = 1.16"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>1.97"
Flow Length=717' Tc=10.7 min CN=86 Runoff=9.05 cfs 21,932 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>1.32"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=9.72 cfs 28,517 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>1.74"
Tc=10.0 min CN=83 Runoff=2.91 cfs 6,837 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>2.50"
Tc=10.0 min CN=92 Runoff=7.13 cfs 17,498 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>2.50"
Tc=10.0 min CN=92 Runoff=3.61 cfs 8,854 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>1.97"
Tc=6.0 min CN=86 Runoff=4.42 cfs 9,084 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>2.40"
Tc=10.0 min CN=91 Runoff=2.69 cfs 6,556 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>2.05"
Tc=6.0 min CN=87 Runoff=1.36 cfs 2,809 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>1.20"
Tc=20.0 min CN=75 Runoff=3.88 cfs 13,040 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=416.42' Storage=9,005 cf Inflow=7.13 cfs 17,498 cf
Discarded=0.08 cfs 6,018 cf Primary=0.47 cfs 10,870 cf Outflow=0.55 cfs 16,887 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=419.95' Storage=8,791 cf Inflow=7.82 cfs 17,938 cf
Discarded=0.05 cfs 4,456 cf Primary=1.00 cfs 12,805 cf Outflow=1.06 cfs 17,261 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=430.61' Storage=2,806 cf Inflow=2.69 cfs 6,556 cf
Discarded=0.20 cfs 8,352 cf Primary=0.02 cfs 101 cf Outflow=0.22 cfs 8,453 cf

Pond RG101:Rain Garden-101 Peak Elev=403.03' Storage=2,564 cf Inflow=2.91 cfs 6,837 cf
Discarded=0.02 cfs 790 cf Primary=0.49 cfs 5,946 cf Outflow=0.51 cfs 6,736 cf

Pond RG102:Rain Garden-102 Peak Elev=437.28' Storage=2,808 cf Inflow=1.36 cfs 2,809 cf
Outflow=0.00 cfs 0 cf

Link 20L:POI 1 - POST Inflow=5.76 cfs 42,762 cf
Primary=5.76 cfs 42,762 cf

Link 102L:Pre-1 (Exempt) Inflow=9.05 cfs 21,932 cf
Primary=9.05 cfs 21,932 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=9.72 cfs 28,517 cf
Primary=9.72 cfs 28,517 cf

Total Runoff Area = 801,836 sf Runoff Volume = 115,127 cf Average Runoff Depth = 1.72"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>2.83"
Flow Length=717' Tc=10.7 min CN=86 Runoff=12.86 cfs 31,521 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>2.06"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=15.34 cfs 44,392 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>2.56"
Tc=10.0 min CN=83 Runoff=4.26 cfs 10,077 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>3.42"
Tc=10.0 min CN=92 Runoff=9.58 cfs 23,963 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>3.42"
Tc=10.0 min CN=92 Runoff=4.85 cfs 12,125 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>2.83"
Tc=6.0 min CN=86 Runoff=6.25 cfs 13,055 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>3.32"
Tc=10.0 min CN=91 Runoff=3.65 cfs 9,049 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>2.93"
Tc=6.0 min CN=87 Runoff=1.90 cfs 4,003 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>1.90"
Tc=20.0 min CN=75 Runoff=6.32 cfs 20,709 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=416.91' Storage=11,278 cf Inflow=9.58 cfs 23,963 cf
Discarded=0.08 cfs 6,380 cf Primary=2.24 cfs 16,651 cf Outflow=2.32 cfs 23,031 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=420.53' Storage=12,674 cf Inflow=10.81 cfs 25,180 cf
Discarded=0.05 cfs 4,458 cf Primary=1.38 cfs 19,789 cf Outflow=1.43 cfs 24,247 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=430.77' Storage=4,070 cf Inflow=3.65 cfs 9,049 cf
Discarded=0.20 cfs 10,385 cf Primary=0.04 cfs 555 cf Outflow=0.24 cfs 10,940 cf

Pond RG101:Rain Garden-101 Peak Elev=403.67' Storage=4,039 cf Inflow=4.26 cfs 10,077 cf
Discarded=0.03 cfs 926 cf Primary=0.59 cfs 9,021 cf Outflow=0.62 cfs 9,947 cf

Pond RG102:Rain Garden-102 Peak Elev=437.80' Storage=4,003 cf Inflow=1.90 cfs 4,003 cf
Outflow=0.00 cfs 0 cf

Link 20L:POI 1 - POST Inflow=10.22 cfs 66,725 cf
Primary=10.22 cfs 66,725 cf

Link 102L:Pre-1 (Exempt) Inflow=12.86 cfs 31,521 cf
Primary=12.86 cfs 31,521 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=15.34 cfs 44,392 cf
Primary=15.34 cfs 44,392 cf

Total Runoff Area = 801,836 sf Runoff Volume = 168,894 cf Average Runoff Depth = 2.53"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>3.72"
Flow Length=717' Tc=10.7 min CN=86 Runoff=16.69 cfs 41,426 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>2.85"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=21.29 cfs 61,466 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>3.42"
Tc=10.0 min CN=83 Runoff=5.63 cfs 13,464 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>4.35"
Tc=10.0 min CN=92 Runoff=12.02 cfs 30,507 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>4.35"
Tc=10.0 min CN=92 Runoff=6.08 cfs 15,436 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>3.72"
Tc=6.0 min CN=86 Runoff=8.09 cfs 17,156 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>4.25"
Tc=10.0 min CN=91 Runoff=4.61 cfs 11,581 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>3.83"
Tc=6.0 min CN=87 Runoff=2.45 cfs 5,233 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>2.66"
Tc=20.0 min CN=75 Runoff=8.93 cfs 29,046 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=417.35' Storage=12,915 cf Inflow=12.02 cfs 30,507 cf
Discarded=0.08 cfs 6,655 cf Primary=5.69 cfs 22,630 cf Outflow=5.77 cfs 29,285 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=421.05' Storage=15,696 cf Inflow=13.80 cfs 32,593 cf
Discarded=0.05 cfs 4,459 cf Primary=2.95 cfs 26,980 cf Outflow=3.00 cfs 31,438 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=430.94' Storage=5,440 cf Inflow=4.61 cfs 11,581 cf
Discarded=0.20 cfs 12,277 cf Primary=0.06 cfs 1,178 cf Outflow=0.26 cfs 13,455 cf

Pond RG101:Rain Garden-101 Peak Elev=404.27' Storage=5,644 cf Inflow=5.63 cfs 13,464 cf
Discarded=0.03 cfs 1,067 cf Primary=0.68 cfs 12,242 cf Outflow=0.71 cfs 13,309 cf

Pond RG102:Rain Garden-102 Peak Elev=438.32' Storage=5,232 cf Inflow=2.45 cfs 5,233 cf
Outflow=0.00 cfs 0 cf

Link 20L:POI 1 - POST Inflow=18.14 cfs 92,076 cf
Primary=18.14 cfs 92,076 cf

Link 102L:Pre-1 (Exempt) Inflow=16.69 cfs 41,426 cf
Primary=16.69 cfs 41,426 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=21.29 cfs 61,466 cf
Primary=21.29 cfs 61,466 cf

Total Runoff Area = 801,836 sf Runoff Volume = 225,315 cf Average Runoff Depth = 3.37"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>4.63"
Flow Length=717' Tc=10.7 min CN=86 Runoff=20.52 cfs 51,525 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>3.67"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=27.42 cfs 79,341 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>4.31"
Tc=10.0 min CN=83 Runoff=7.02 cfs 16,946 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>5.30"
Tc=10.0 min CN=92 Runoff=14.44 cfs 37,099 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>5.30"
Tc=10.0 min CN=92 Runoff=7.30 cfs 18,772 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>4.63"
Tc=6.0 min CN=86 Runoff=9.93 cfs 21,338 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>5.18"
Tc=10.0 min CN=91 Runoff=5.55 cfs 14,135 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>4.74"
Tc=6.0 min CN=87 Runoff=2.99 cfs 6,483 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>3.47"
Tc=20.0 min CN=75 Runoff=11.66 cfs 37,834 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=417.80' Storage=14,143 cf Inflow=14.44 cfs 37,099 cf
Discarded=0.08 cfs 6,753 cf Primary=9.16 cfs 28,791 cf Outflow=9.24 cfs 35,544 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=421.54' Storage=17,791 cf Inflow=16.78 cfs 40,110 cf
Discarded=0.05 cfs 4,459 cf Primary=6.45 cfs 34,300 cf Outflow=6.50 cfs 38,759 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=431.12' Storage=6,890 cf Inflow=5.55 cfs 14,886 cf
Discarded=0.20 cfs 12,902 cf Primary=0.08 cfs 2,065 cf Outflow=0.28 cfs 14,967 cf

Pond RG101:Rain Garden-101 Peak Elev=404.63' Storage=6,713 cf Inflow=7.02 cfs 16,946 cf
Discarded=0.04 cfs 1,175 cf Primary=1.99 cfs 15,592 cf Outflow=2.02 cfs 16,767 cf

Pond RG102:Rain Garden-102 Peak Elev=438.52' Storage=5,748 cf Inflow=2.99 cfs 6,483 cf
Outflow=0.04 cfs 752 cf

Link 20L:POI 1 - POST Inflow=28.16 cfs 118,582 cf
Primary=28.16 cfs 118,582 cf

Link 102L:Pre-1 (Exempt) Inflow=20.52 cfs 51,525 cf
Primary=20.52 cfs 51,525 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=27.42 cfs 79,341 cf
Primary=27.42 cfs 79,341 cf

Total Runoff Area = 801,836 sf Runoff Volume = 283,472 cf Average Runoff Depth = 4.24"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>5.55"
Flow Length=717' Tc=10.7 min CN=86 Runoff=24.35 cfs 61,753 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>4.53"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=33.65 cfs 97,775 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>5.21"
Tc=10.0 min CN=83 Runoff=8.40 cfs 20,491 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>6.24"
Tc=10.0 min CN=92 Runoff=16.84 cfs 43,721 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>6.24"
Tc=10.0 min CN=92 Runoff=8.52 cfs 22,122 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>5.55"
Tc=6.0 min CN=86 Runoff=11.76 cfs 25,573 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>6.12"
Tc=10.0 min CN=91 Runoff=6.49 cfs 16,703 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>5.67"
Tc=6.0 min CN=87 Runoff=3.54 cfs 7,747 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>4.30"
Tc=20.0 min CN=75 Runoff=14.44 cfs 46,941 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=418.20' Storage=15,224 cf Inflow=16.84 cfs 43,721 cf
Discarded=0.08 cfs 6,754 cf Primary=12.45 cfs 35,020 cf Outflow=12.53 cfs 41,774 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=422.00' Storage=19,455 cf Inflow=19.75 cfs 47,695 cf
Discarded=0.05 cfs 4,460 cf Primary=10.01 cfs 41,702 cf Outflow=10.06 cfs 46,162 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=431.33' Storage=8,538 cf Inflow=6.49 cfs 18,713 cf
Discarded=0.20 cfs 13,316 cf Primary=0.09 cfs 3,299 cf Outflow=0.29 cfs 16,615 cf

Pond RG101:Rain Garden-101 Peak Elev=404.78' Storage=7,185 cf Inflow=8.40 cfs 20,491 cf
Discarded=0.04 cfs 1,248 cf Primary=4.67 cfs 19,042 cf Outflow=4.71 cfs 20,290 cf

Pond RG102:Rain Garden-102 Peak Elev=438.55' Storage=5,808 cf Inflow=3.54 cfs 7,747 cf
Outflow=0.11 cfs 2,009 cf

Link 20L:POI 1 - POST Inflow=40.95 cfs 146,004 cf
Primary=40.95 cfs 146,004 cf

Link 102L:Pre-1 (Exempt) Inflow=24.35 cfs 61,753 cf
Primary=24.35 cfs 61,753 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=33.65 cfs 97,775 cf
Primary=33.65 cfs 97,775 cf

Total Runoff Area = 801,836 sf Runoff Volume = 342,827 cf Average Runoff Depth = 5.13"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 102S:PRE - Exempt Runoff Area=133,619 sf 47.98% Impervious Runoff Depth>6.71"
Flow Length=717' Tc=10.7 min CN=86 Runoff=29.11 cfs 74,662 cf

Subcatchment 103S:PRE - Non-exempt Runoff Area=259,095 sf 11.23% Impervious Runoff Depth>5.62"
Flow Length=1,060' Tc=16.1 min CN=77 Runoff=41.51 cfs 121,377 cf

Subcatchment 110S:To Rain Garden Runoff Area=47,236 sf 39.09% Impervious Runoff Depth>6.35"
Tc=10.0 min CN=83 Runoff=10.13 cfs 24,983 cf

Subcatchment 111S:INFIL_1 Runoff Area=84,071 sf 73.32% Impervious Runoff Depth>7.43"
Tc=10.0 min CN=92 Runoff=19.84 cfs 52,025 cf

Subcatchment 112S:INFIL_2 Runoff Area=42,539 sf 75.61% Impervious Runoff Depth>7.43"
Tc=10.0 min CN=92 Runoff=10.04 cfs 26,324 cf

Subcatchment 113S:Lancaster Avenue Runoff Area=55,278 sf 50.19% Impervious Runoff Depth>6.71"
Tc=6.0 min CN=86 Runoff=14.04 cfs 30,918 cf

Subcatchment 114S:INFIL_3 Runoff Area=32,731 sf 69.94% Impervious Runoff Depth>7.31"
Tc=10.0 min CN=91 Runoff=7.66 cfs 19,927 cf

Subcatchment 115S:From LAH Runoff Area=16,408 sf 55.56% Impervious Runoff Depth>6.83"
Tc=6.0 min CN=87 Runoff=4.21 cfs 9,341 cf

Subcatchment 116S:Unmanaged and Runoff Area=130,859 sf 4.10% Impervious Runoff Depth>5.38"
Tc=20.0 min CN=75 Runoff=17.97 cfs 58,649 cf

Pond INF101:Infiltration-101 (Lower) Peak Elev=418.49' Storage=15,990 cf Inflow=19.84 cfs 52,025 cf
Discarded=0.08 cfs 6,756 cf Primary=17.08 cfs 42,793 cf Outflow=17.16 cfs 49,549 cf

Pond INF102:Infiltration-102 (Mid) Peak Elev=422.45' Storage=21,031 cf Inflow=23.45 cfs 57,242 cf
Discarded=0.05 cfs 4,461 cf Primary=15.55 cfs 51,034 cf Outflow=15.60 cfs 55,494 cf

Pond INF103:Infiltration-103 (Upper) Peak Elev=431.77' Storage=11,838 cf Inflow=7.66 cfs 23,526 cf
Discarded=0.20 cfs 13,808 cf Primary=0.11 cfs 4,451 cf Outflow=0.31 cfs 18,259 cf

Pond RG101:Rain Garden-101 Peak Elev=404.92' Storage=7,618 cf Inflow=10.13 cfs 24,983 cf
Discarded=0.04 cfs 1,329 cf Primary=7.79 cfs 23,426 cf Outflow=7.83 cfs 24,755 cf

Pond RG102:Rain Garden-102 Peak Elev=438.61' Storage=5,968 cf Inflow=4.21 cfs 9,341 cf
Outflow=0.36 cfs 3,598 cf

Link 20L:POI 1 - POST Inflow=57.04 cfs 180,353 cf
Primary=57.04 cfs 180,353 cf

Link 102L:Pre-1 (Exempt) Inflow=29.11 cfs 74,662 cf
Primary=29.11 cfs 74,662 cf

Link 103L: Pre-1 (Non-exempt)

Inflow=41.51 cfs 121,377 cf
Primary=41.51 cfs 121,377 cf

Total Runoff Area = 801,836 sf Runoff Volume = 418,207 cf Average Runoff Depth = 6.26"
66.25% Pervious = 531,244 sf 33.75% Impervious = 270,592 sf

POI 2a SUMMARY OF FLOWS
Pre-Development/Post Development

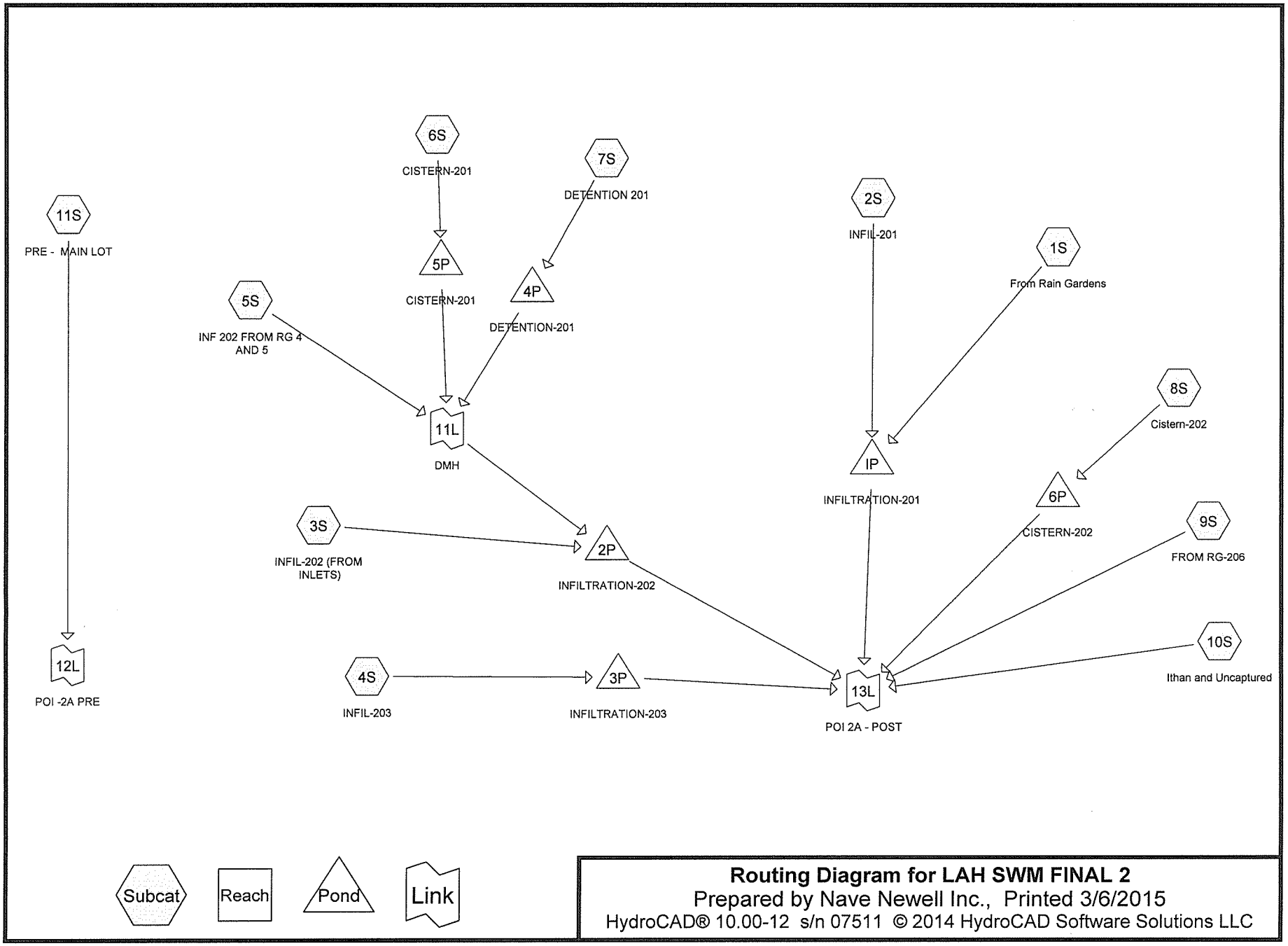
STORM	Pre-Development Flow (CFS)	Allowable Flow (CFS)	Post Development Flow (CFS)
1	22.70		2.54
2	31.67	22.70	4.96
5	43.69	31.67	8.38
10	55.70	43.69	12.96
25	67.65	43.69	22.71
50	79.53	55.70	33.82
100	94.31	94.31	45.95

Percent Reduction Pre-Dev %	Percent Reduction of Allowable %
-88.81	
-84.34	-78.15
-80.82	-73.54
-76.73	-70.34
-66.43	-48.02
-57.48	-39.28
-51.28	-51.28

No Detention Credit taken for Cisterns

Nave Newell
Where Ideas Get Down to Earth
900 West Valley Road Suite 1100
Wayne, Pa 19087

PROJECT:
Villanova
JOB NO. 2011-005.00 BY: LRL
DATE: 3/5/2015 CHK'D: DAT



Routing Diagram for LAH SWM FINAL 2
Prepared by Nave Newell Inc., Printed 3/6/2015
HydroCAD® 10.00-12 s/n 07511 © 2014 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>0.87"
Flow Length=470' Tc=38.4 min CN=78 Runoff=0.88 cfs 4,612 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>1.65"
Tc=15.0 min CN=90 Runoff=2.35 cfs 6,598 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>1.82"
Tc=10.0 min CN=92 Runoff=1.20 cfs 2,900 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>2.00"
Tc=10.0 min CN=94 Runoff=0.81 cfs 1,994 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>0.64"
Flow Length=490' Tc=14.9 min CN=73 Runoff=0.66 cfs 2,041 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>2.41"
Tc=10.0 min CN=98 Runoff=4.35 cfs 11,613 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>0.77"
Flow Length=780' Tc=23.7 min CN=76 Runoff=0.62 cfs 2,395 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>2.41"
Tc=10.0 min CN=98 Runoff=0.70 cfs 1,864 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>0.98"
Tc=10.0 min CN=80 Runoff=0.44 cfs 1,042 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>0.49"
Tc=5.0 min CN=69 Runoff=1.87 cfs 4,045 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>1.57"
Tc=10.0 min CN=89 Runoff=22.70 cfs 53,775 cf

Pond 2P: INFILTRATION-202 Peak Elev=420.11' Storage=6,105 cf Inflow=1.79 cfs 7,818 cf
Outflow=0.21 cfs 5,926 cf

Pond 3P: INFILTRATION-203 Peak Elev=416.87' Storage=1,341 cf Inflow=0.81 cfs 1,994 cf
Outflow=0.46 cfs 1,476 cf

Pond 4P: DETENTION-201 Peak Elev=425.52' Storage=621 cf Inflow=0.62 cfs 2,395 cf
Outflow=0.25 cfs 2,877 cf

Pond 5P: CISTERN-201 Peak Elev=427.87' Storage=11,612 cf Inflow=4.35 cfs 11,613 cf
Outflow=0.00 cfs 0 cf

Pond 6P: CISTERN-202 Peak Elev=416.51' Storage=1,652 cf Inflow=0.70 cfs 1,864 cf
Outflow=0.01 cfs 213 cf

Pond IP: INFILTRATION-201 Peak Elev=424.28' Storage=7,705 cf Inflow=2.71 cfs 11,211 cf
Outflow=0.50 cfs 9,268 cf

Link 11L: DMH Inflow=0.75 cfs 4,918 cf
Primary=0.75 cfs 4,918 cf

Link 12L: POI -2A PRE Inflow=22.70 cfs 53,775 cf
Primary=22.70 cfs 53,775 cf

Link 13L: POI 2A - POST Inflow=2.54 cfs 21,969 cf
Primary=2.54 cfs 21,969 cf

Total Runoff Area = 808,029 sf Runoff Volume = 92,880 cf Average Runoff Depth = 1.38"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>1.38"
Flow Length=470' Tc=38.4 min CN=78 Runoff=1.45 cfs 7,304 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>2.31"
Tc=15.0 min CN=90 Runoff=3.25 cfs 9,232 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>2.50"
Tc=10.0 min CN=92 Runoff=1.62 cfs 3,982 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>2.69"
Tc=10.0 min CN=94 Runoff=1.07 cfs 2,687 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>1.08"
Flow Length=490' Tc=14.9 min CN=73 Runoff=1.19 cfs 3,441 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>3.12"
Tc=10.0 min CN=98 Runoff=5.57 cfs 15,068 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>1.26"
Flow Length=780' Tc=23.7 min CN=76 Runoff=1.05 cfs 3,883 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>3.12"
Tc=10.0 min CN=98 Runoff=0.89 cfs 2,418 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>1.52"
Tc=10.0 min CN=80 Runoff=0.69 cfs 1,612 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>0.87"
Tc=5.0 min CN=69 Runoff=3.61 cfs 7,247 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>2.22"
Tc=10.0 min CN=89 Runoff=31.67 cfs 75,951 cf

Pond 2P: INFILTRATION-202 Peak Elev=420.57' Storage=8,079 cf Inflow=2.81 cfs 14,681 cf
Outflow=0.37 cfs 11,378 cf

Pond 3P: INFILTRATION-203 Peak Elev=417.05' Storage=1,509 cf Inflow=1.07 cfs 2,687 cf
Outflow=0.66 cfs 2,163 cf

Pond 4P: DETENTION-201 Peak Elev=425.77' Storage=1,211 cf Inflow=1.05 cfs 3,883 cf
Outflow=0.33 cfs 4,346 cf

Pond 5P: CISTERN-201 Peak Elev=428.14' Storage=12,219 cf Inflow=5.57 cfs 15,068 cf
Outflow=0.15 cfs 2,912 cf

Pond 6P: CISTERN-202 Peak Elev=416.54' Storage=1,663 cf Inflow=0.89 cfs 2,418 cf
Outflow=0.09 cfs 767 cf

Pond IP: INFILTRATION-201 Peak Elev=424.66' Storage=9,584 cf Inflow=3.90 cfs 16,536 cf
Outflow=1.25 cfs 14,435 cf

Link 11L: DMH Inflow=1.38 cfs 10,698 cf
Primary=1.38 cfs 10,698 cf

Link 12L: POI -2A PRE Inflow=31.67 cfs 75,951 cf
Primary=31.67 cfs 75,951 cf

Link 13L: POI 2A - POST Inflow=4.96 cfs 37,601 cf
Primary=4.96 cfs 37,601 cf

Total Runoff Area = 808,029 sf Runoff Volume = 132,824 cf Average Runoff Depth = 1.97"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>2.12"
Flow Length=470' Tc=38.4 min CN=78 Runoff=2.29 cfs 11,268 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>3.21"
Tc=15.0 min CN=90 Runoff=4.45 cfs 12,846 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>3.42"
Tc=10.0 min CN=92 Runoff=2.18 cfs 5,453 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>3.63"
Tc=10.0 min CN=94 Runoff=1.42 cfs 3,623 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>1.75"
Flow Length=490' Tc=14.9 min CN=73 Runoff=1.99 cfs 5,579 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>4.08"
Tc=10.0 min CN=98 Runoff=7.20 cfs 19,682 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>1.97"
Flow Length=780' Tc=23.7 min CN=76 Runoff=1.69 cfs 6,105 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>4.08"
Tc=10.0 min CN=98 Runoff=1.15 cfs 3,159 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>2.30"
Tc=10.0 min CN=80 Runoff=1.04 cfs 2,440 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>1.48"
Tc=5.0 min CN=69 Runoff=6.29 cfs 12,306 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>3.12"
Tc=10.0 min CN=89 Runoff=43.69 cfs 106,523 cf

Pond 2P: INFILTRATION-202 Peak Elev=420.94' Storage=9,628 cf Inflow=4.22 cfs 25,093 cf
Outflow=1.76 cfs 21,005 cf

Pond 3P: INFILTRATION-203 Peak Elev=417.28' Storage=1,717 cf Inflow=1.42 cfs 3,623 cf
Outflow=0.84 cfs 3,093 cf

Pond 4P: DETENTION-201 Peak Elev=426.18' Storage=2,181 cf Inflow=1.69 cfs 6,105 cf
Outflow=0.42 cfs 6,543 cf

Pond 5P: CISTERN-201 Peak Elev=428.30' Storage=12,564 cf Inflow=7.20 cfs 19,682 cf
Outflow=1.50 cfs 7,517 cf

Pond 6P: CISTERN-202 Peak Elev=416.70' Storage=1,712 cf Inflow=1.15 cfs 3,159 cf
Outflow=0.88 cfs 1,507 cf

Pond IP: INFILTRATION-201 Peak Elev=425.01' Storage=11,133 cf Inflow=5.56 cfs 24,114 cf
Outflow=2.79 cfs 21,827 cf

Link 11L: DMH Inflow=2.91 cfs 19,640 cf
Primary=2.91 cfs 19,640 cf

Link 12L: POI -2A PRE Inflow=43.69 cfs 106,523 cf
Primary=43.69 cfs 106,523 cf

Link 13L: POI 2A - POST Inflow=8.38 cfs 62,178 cf
Primary=8.38 cfs 62,178 cf

Total Runoff Area = 808,029 sf Runoff Volume = 188,984 cf Average Runoff Depth = 2.81"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>2.92"
Flow Length=470' Tc=38.4 min CN=78 Runoff=3.17 cfs 15,513 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>4.13"
Tc=15.0 min CN=90 Runoff=5.66 cfs 16,526 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>4.35"
Tc=10.0 min CN=92 Runoff=2.73 cfs 6,943 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>4.58"
Tc=10.0 min CN=94 Runoff=1.76 cfs 4,565 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>2.49"
Flow Length=490' Tc=14.9 min CN=73 Runoff=2.85 cfs 7,930 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>5.03"
Tc=10.0 min CN=98 Runoff=8.82 cfs 24,301 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>2.75"
Flow Length=780' Tc=23.7 min CN=76 Runoff=2.37 cfs 8,508 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>5.03"
Tc=10.0 min CN=98 Runoff=1.41 cfs 3,900 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>3.13"
Tc=10.0 min CN=80 Runoff=1.40 cfs 3,317 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>2.16"
Tc=5.0 min CN=69 Runoff=9.25 cfs 17,999 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>4.03"
Tc=10.0 min CN=89 Runoff=55.70 cfs 137,761 cf

Pond 2P: INFILTRATION-202 Peak Elev=421.38' Storage=11,282 cf Inflow=11.10 cfs 35,925 cf
Outflow=6.30 cfs 31,182 cf

Pond 3P: INFILTRATION-203 Peak Elev=417.52' Storage=1,921 cf Inflow=1.76 cfs 4,565 cf
Outflow=0.98 cfs 4,031 cf

Pond 4P: DETENTION-201 Peak Elev=426.67' Storage=3,272 cf Inflow=2.37 cfs 8,508 cf
Outflow=0.52 cfs 8,927 cf

Pond 5P: CISTERN-201 Peak Elev=428.60' Storage=13,217 cf Inflow=8.82 cfs 24,301 cf
Outflow=6.00 cfs 12,126 cf

Pond 6P: CISTERN-202 Peak Elev=416.77' Storage=1,735 cf Inflow=1.41 cfs 3,900 cf
Outflow=1.40 cfs 2,247 cf

Pond IP: INFILTRATION-201 Peak Elev=425.30' Storage=12,343 cf Inflow=7.24 cfs 32,039 cf
Outflow=4.41 cfs 29,576 cf

Link 11L: DMH Inflow=9.13 cfs 28,983 cf
Primary=9.13 cfs 28,983 cf

Link 12L: POI -2A PRE Inflow=55.70 cfs 137,761 cf
Primary=55.70 cfs 137,761 cf

Link 13L: POI 2A - POST Inflow=12.96 cfs 88,353 cf
Primary=12.96 cfs 88,353 cf

Total Runoff Area = 808,029 sf Runoff Volume = 247,261 cf Average Runoff Depth = 3.67"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>3.76"
Flow Length=470' Tc=38.4 min CN=78 Runoff=4.09 cfs 19,942 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>5.06"
Tc=15.0 min CN=90 Runoff=6.85 cfs 20,246 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>5.30"
Tc=10.0 min CN=92 Runoff=3.29 cfs 8,443 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>5.52"
Tc=10.0 min CN=94 Runoff=2.10 cfs 5,511 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>3.28"
Flow Length=490' Tc=14.9 min CN=73 Runoff=3.76 cfs 10,425 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>5.99"
Tc=10.0 min CN=98 Runoff=10.43 cfs 28,922 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>3.57"
Flow Length=780' Tc=23.7 min CN=76 Runoff=3.08 cfs 11,032 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>5.99"
Tc=10.0 min CN=98 Runoff=1.67 cfs 4,642 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>3.99"
Tc=10.0 min CN=80 Runoff=1.77 cfs 4,226 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>2.90"
Tc=5.0 min CN=69 Runoff=12.38 cfs 24,142 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>4.96"
Tc=10.0 min CN=89 Runoff=67.65 cfs 169,399 cf

Pond 2P: INFILTRATION-202 Peak Elev=421.74' Storage=12,407 cf Inflow=16.51 cfs 47,038 cf
Outflow=12.95 cfs 41,771 cf

Pond 3P: INFILTRATION-203 Peak Elev=417.77' Storage=2,134 cf Inflow=2.10 cfs 5,511 cf
Outflow=1.12 cfs 4,973 cf

Pond 4P: DETENTION-201 Peak Elev=427.25' Storage=4,441 cf Inflow=3.08 cfs 11,032 cf
Outflow=0.61 cfs 11,431 cf

Pond 5P: CISTERN-201 Peak Elev=428.77' Storage=13,594 cf Inflow=10.43 cfs 28,922 cf
Outflow=9.47 cfs 16,738 cf

Pond 6P: CISTERN-202 Peak Elev=416.81' Storage=1,745 cf Inflow=1.67 cfs 4,642 cf
Outflow=1.66 cfs 2,989 cf

Pond IP: INFILTRATION-201 Peak Elev=425.64' Storage=13,519 cf Inflow=8.95 cfs 40,188 cf
Outflow=5.93 cfs 37,548 cf

Link 11L: DMH Inflow=13.51 cfs 38,595 cf
Primary=13.51 cfs 38,595 cf

Link 12L: POI -2A PRE Inflow=67.65 cfs 169,399 cf
Primary=67.65 cfs 169,399 cf

Link 13L: POI 2A - POST Inflow=22.71 cfs 115,649 cf
Primary=22.71 cfs 115,649 cf

Total Runoff Area = 808,029 sf Runoff Volume = 306,929 cf Average Runoff Depth = 4.56"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>4.61"
Flow Length=470' Tc=38.4 min CN=78 Runoff=5.02 cfs 24,500 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>6.00"
Tc=15.0 min CN=90 Runoff=8.04 cfs 23,992 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>6.24"
Tc=10.0 min CN=92 Runoff=3.83 cfs 9,950 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>6.48"
Tc=10.0 min CN=94 Runoff=2.44 cfs 6,459 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>4.09"
Flow Length=490' Tc=14.9 min CN=73 Runoff=4.69 cfs 13,025 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>6.95"
Tc=10.0 min CN=98 Runoff=12.05 cfs 33,544 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>4.41"
Flow Length=780' Tc=23.7 min CN=76 Runoff=3.80 cfs 13,642 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>6.95"
Tc=10.0 min CN=98 Runoff=1.93 cfs 5,384 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>4.87"
Tc=10.0 min CN=80 Runoff=2.14 cfs 5,157 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>3.67"
Tc=5.0 min CN=69 Runoff=15.63 cfs 30,613 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>5.89"
Tc=10.0 min CN=89 Runoff=79.53 cfs 201,296 cf

Pond 2P: INFILTRATION-202 Peak Elev=421.97' Storage=12,984 cf Inflow=20.15 cfs 58,351 cf
Outflow=18.35 cfs 52,756 cf

Pond 3P: INFILTRATION-203 Peak Elev=418.06' Storage=2,352 cf Inflow=2.44 cfs 6,459 cf
Outflow=1.26 cfs 5,918 cf

Pond 4P: DETENTION-201 Peak Elev=428.03' Storage=5,632 cf Inflow=3.80 cfs 13,642 cf
Outflow=0.78 cfs 14,024 cf

Pond 5P: CISTERN-201 Peak Elev=428.87' Storage=13,799 cf Inflow=12.05 cfs 33,544 cf
Outflow=11.60 cfs 21,352 cf

Pond 6P: CISTERN-202 Peak Elev=416.84' Storage=1,755 cf Inflow=1.93 cfs 5,384 cf
Outflow=1.92 cfs 3,730 cf

Pond IP: INFILTRATION-201 Peak Elev=426.07' Storage=14,628 cf Inflow=10.66 cfs 48,492 cf
Outflow=7.64 cfs 45,661 cf

Link 11L: DMH Inflow=16.49 cfs 48,401 cf
Primary=16.49 cfs 48,401 cf

Link 12L: POI -2A PRE Inflow=79.53 cfs 201,296 cf
Primary=79.53 cfs 201,296 cf

Link 13L: POI 2A - POST Inflow=33.82 cfs 143,835 cf
Primary=33.82 cfs 143,835 cf

Total Runoff Area = 808,029 sf Runoff Volume = 367,563 cf Average Runoff Depth = 5.46"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S:From Rain Gardens Runoff Area=63,727 sf 44.89% Impervious Runoff Depth>5.71"
Flow Length=470' Tc=38.4 min CN=78 Runoff=6.19 cfs 30,326 cf

Subcatchment 2S:INFIL-201 Runoff Area=47,971 sf 79.71% Impervious Runoff Depth>7.18"
Tc=15.0 min CN=90 Runoff=9.52 cfs 28,698 cf

Subcatchment 3S:INFIL-202 (FROM Runoff Area=19,133 sf 83.70% Impervious Runoff Depth>7.43"
Tc=10.0 min CN=92 Runoff=4.51 cfs 11,840 cf

Subcatchment 4S:INFIL-203 Runoff Area=11,971 sf 88.28% Impervious Runoff Depth>7.67"
Tc=10.0 min CN=94 Runoff=2.86 cfs 7,647 cf

Subcatchment 5S:INF 202 FROM RG 4 Runoff Area=38,191 sf 32.42% Impervious Runoff Depth>5.15"
Flow Length=490' Tc=14.9 min CN=73 Runoff=5.87 cfs 16,382 cf

Subcatchment 6S:CISTERN-201 Runoff Area=57,927 sf 100.00% Impervious Runoff Depth>8.15"
Tc=10.0 min CN=98 Runoff=14.07 cfs 39,323 cf

Subcatchment 7S:DETENTION201 Runoff Area=37,122 sf 39.41% Impervious Runoff Depth>5.49"
Flow Length=780' Tc=23.7 min CN=76 Runoff=4.71 cfs 16,990 cf

Subcatchment 8S:Cistern-202 Runoff Area=9,297 sf 100.00% Impervious Runoff Depth>8.15"
Tc=10.0 min CN=98 Runoff=2.26 cfs 6,311 cf

Subcatchment 9S:FROM RG-206 Runoff Area=12,712 sf 52.13% Impervious Runoff Depth>5.99"
Tc=10.0 min CN=80 Runoff=2.61 cfs 6,343 cf

Subcatchment 10S:Ithan and Uncaptured Runoff Area=99,991 sf 27.12% Impervious Runoff Depth>4.69"
Tc=5.0 min CN=69 Runoff=19.79 cfs 39,045 cf

Subcatchment 11S:PRE - MAINLOT Runoff Area=409,987 sf 78.54% Impervious Runoff Depth>7.07"
Tc=10.0 min CN=89 Runoff=94.31 cfs 241,411 cf

Pond 2P: INFILTRATION-202 Peak Elev=422.45' Storage=14,038 cf Inflow=24.07 cfs 72,692 cf
Outflow=21.13 cfs 66,927 cf

Pond 3P: INFILTRATION-203 Peak Elev=418.53' Storage=2,620 cf Inflow=2.86 cfs 7,647 cf
Outflow=1.54 cfs 7,101 cf

Pond 4P: DETENTION-201 Peak Elev=428.27' Storage=5,913 cf Inflow=4.71 cfs 16,990 cf
Outflow=2.66 cfs 17,351 cf

Pond 5P: CISTERN-201 Peak Elev=428.95' Storage=13,986 cf Inflow=14.07 cfs 39,323 cf
Outflow=13.68 cfs 27,120 cf

Pond 6P: CISTERN-202 Peak Elev=416.87' Storage=1,767 cf Inflow=2.26 cfs 6,311 cf
Outflow=2.25 cfs 4,657 cf

Pond IP: INFILTRATION-201 Peak Elev=426.31' Storage=15,246 cf Inflow=12.81 cfs 59,024 cf
Outflow=10.96 cfs 55,906 cf

Link 11L: DMH Inflow=19.74 cfs 60,852 cf
Primary=19.74 cfs 60,852 cf

Link 12L: POI -2A PRE Inflow=94.31 cfs 241,411 cf
Primary=94.31 cfs 241,411 cf

Link 13L: POI 2A - POST Inflow=45.95 cfs 179,980 cf
Primary=45.95 cfs 179,980 cf

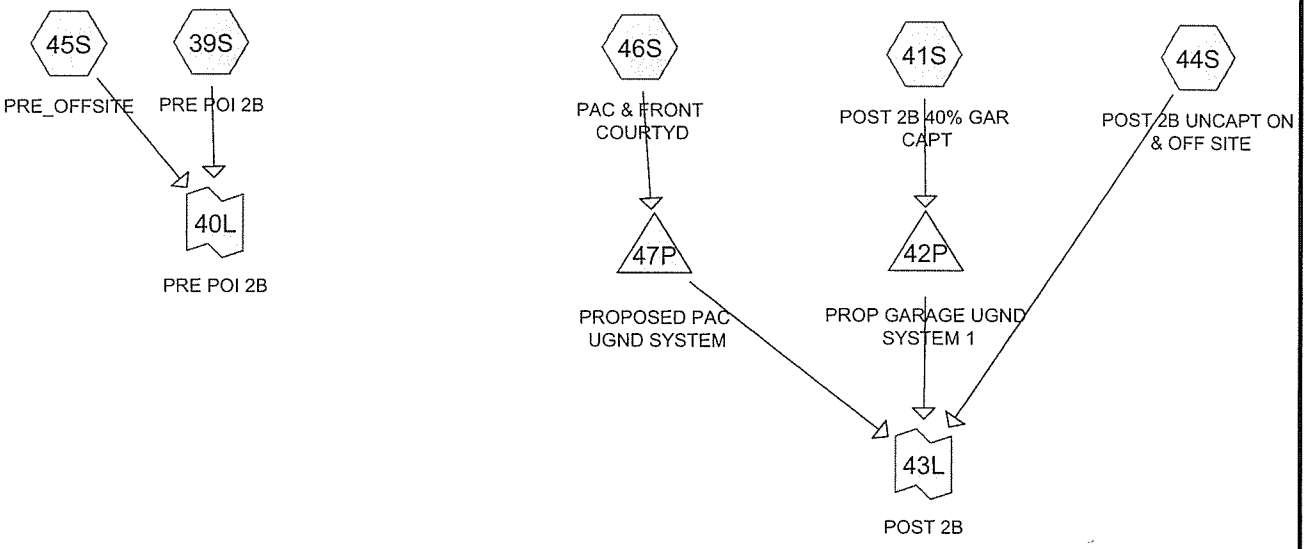
Total Runoff Area = 808,029 sf Runoff Volume = 444,317 cf Average Runoff Depth = 6.60"
32.75% Pervious = 264,601 sf 67.25% Impervious = 543,428 sf

POI 2b SUMMARY OF FLOWS
Pre-Development/Post Development - w/Exempted Areas

STORM EVENT	Pre-Development Flow (CFS) A	Allowable Flow (CFS) B	Pre-Development Exempt Flow (CFS) C	Allowable Flow (non-exempt plus exempt) (CFS) B+C=D	Post Development Flow (CFS)	% Reduction Allowable (CFS) Reduction D	% Reduction Pre-Dev (CFS) Reduction A+C
1	8.11	8.11	0.93	9.04	4.16	-53.98	-53.98
2	10.62	8.11	1.20	9.31	6.02	-35.34	-49.07
5	13.93	10.62	1.55	12.17	9.20	-24.40	-40.57
10	17.22	13.93	1.91	15.84	11.52	-27.27	-39.78
25	20.49	13.93	2.26	16.19	13.57	-16.18	-40.35
50	23.76	17.22	2.62	19.84	15.45	-22.13	-41.43
100	27.82	27.82	3.06	30.88	17.69	-42.71	-42.71

Nave Newell
Where Ideas Get Down to Earth
900 West Valley Road Suite 1100
Wayne, PA 19087

PROJECT: Villanova
JOB NO. 2011-005.00 BY: JLH
DATE: 2/25/2015 CHK'D: DAT



Subcat Reach Pond Link

Routing Diagram for Garage_SWM_POI_2B
Prepared by Microsoft, Printed 3/3/2015
HydroCAD® 10.00-13 s/n 07511 © 2014 HydroCAD Software Solutions LLC

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=2.10"
Flow Length=722' Tc=5.1 min CN=95 Runoff=8.11 cfs 0.402 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=2.41"
Tc=5.0 min CN=98 Runoff=3.00 cfs 0.159 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=1.74"
Tc=5.0 min CN=91 Runoff=2.34 cfs 0.110 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=2.30"
Flow Length=597' Tc=5.0 min CN=97 Runoff=0.93 cfs 0.048 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=2.10"
Tc=5.0 min CN=95 Runoff=2.69 cfs 0.133 af

Pond 42P: PROP GARAGE UGND SYSTEM 1 Peak Elev=418.26' Storage=2,962 cf Inflow=3.00 cfs 0.159 af
Outflow=2.06 cfs 0.121 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=429.35' Storage=3,694 cf Inflow=2.69 cfs 0.133 af
Outflow=0.19 cfs 0.056 af

Link 40L: PRE POI 2B Inflow=9.04 cfs 0.450 af
Primary=9.04 cfs 0.450 af

Link 43L: POST 2B Inflow=4.16 cfs 0.288 af
Primary=4.16 cfs 0.288 af

Total Runoff Area = 4.860 ac Runoff Volume = 0.852 af Average Runoff Depth = 2.10"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=2.80"
Flow Length=722' Tc=5.1 min CN=95 Runoff=10.62 cfs 0.537 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=3.13"
Tc=5.0 min CN=98 Runoff=3.84 cfs 0.206 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=2.41"
Tc=5.0 min CN=91 Runoff=3.19 cfs 0.153 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=3.02"
Flow Length=597' Tc=5.0 min CN=97 Runoff=1.20 cfs 0.063 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=2.80"
Tc=5.0 min CN=95 Runoff=3.52 cfs 0.177 af

Pond 42P: PROP GARAGE UGND SYSTEM 1 Peak Elev=418.46' Storage=3,290 cf Inflow=3.84 cfs 0.206 af
Outflow=2.68 cfs 0.169 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=429.72' Storage=4,291 cf Inflow=3.52 cfs 0.177 af
Outflow=1.12 cfs 0.101 af

Link 40L: PRE POI 2B Inflow=11.82 cfs 0.600 af
Primary=11.82 cfs 0.600 af

Link 43L: POST 2B Inflow=6.02 cfs 0.422 af
Primary=6.02 cfs 0.422 af

Total Runoff Area = 4.860 ac Runoff Volume = 1.136 af Average Runoff Depth = 2.80"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=3.75"
Flow Length=722' Tc=5.1 min CN=95 Runoff=13.93 cfs 0.718 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=4.08"
Tc=5.0 min CN=98 Runoff=4.95 cfs 0.269 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=3.32"
Tc=5.0 min CN=91 Runoff=4.31 cfs 0.211 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=3.97"
Flow Length=597' Tc=5.0 min CN=97 Runoff=1.55 cfs 0.083 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=3.75"
Tc=5.0 min CN=95 Runoff=4.62 cfs 0.237 af

Pond 42P: PROP GARAGE UGND SYSTEM 1 Peak Elev=418.72' Storage=3,729 cf Inflow=4.95 cfs 0.269 af
Outflow=3.30 cfs 0.232 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=430.27' Storage=5,149 cf Inflow=4.62 cfs 0.237 af
Outflow=2.25 cfs 0.160 af

Link 40L: PRE POI 2B Inflow=15.49 cfs 0.801 af
Primary=15.49 cfs 0.801 af

Link 43L: POST 2B Inflow=9.20 cfs 0.603 af
Primary=9.20 cfs 0.603 af

Total Runoff Area = 4.860 ac Runoff Volume = 1.518 af Average Runoff Depth = 3.75"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=4.70"
Flow Length=722' Tc=5.1 min CN=95 Runoff=17.22 cfs 0.900 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=5.04"
Tc=5.0 min CN=98 Runoff=6.07 cfs 0.332 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=4.25"
Tc=5.0 min CN=91 Runoff=5.42 cfs 0.269 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=4.93"
Flow Length=597' Tc=5.0 min CN=97 Runoff=1.91 cfs 0.103 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=4.70"
Tc=5.0 min CN=95 Runoff=5.71 cfs 0.297 af

Pond 42P: PROP GARAGEUGND SYSTEM 1 Peak Elev=419.00' Storage=4,203 cf Inflow=6.07 cfs 0.332 af
Outflow=3.86 cfs 0.295 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=430.78' Storage=5,947 cf Inflow=5.71 cfs 0.297 af
Outflow=2.92 cfs 0.221 af

Link 40L: PRE POI 2B Inflow=19.13 cfs 1.003 af
Primary=19.13 cfs 1.003 af

Link 43L: POST 2B Inflow=11.52 cfs 0.785 af
Primary=11.52 cfs 0.785 af

Total Runoff Area = 4.860 ac Runoff Volume = 1.902 af Average Runoff Depth = 4.70"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=5.65"
Flow Length=722' Tc=5.1 min CN=95 Runoff=20.49 cfs 1.083 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=6.00"
Tc=5.0 min CN=98 Runoff=7.18 cfs 0.395 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=5.19"
Tc=5.0 min CN=91 Runoff=6.53 cfs 0.329 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=5.88"
Flow Length=597' Tc=5.0 min CN=97 Runoff=2.26 cfs 0.123 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=5.65"
Tc=5.0 min CN=95 Runoff=6.79 cfs 0.358 af

Pond 42P: PROP GARAGEUGND SYSTEM 1 Peak Elev=419.30' Storage=4,709 cf Inflow=7.18 cfs 0.395 af
Outflow=4.38 cfs 0.358 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=431.24' Storage=6,684 cf Inflow=6.79 cfs 0.358 af
Outflow=3.43 cfs 0.281 af

Link 40L: PRE POI 2B Inflow=22.76 cfs 1.205 af
Primary=22.76 cfs 1.205 af

Link 43L: POST 2B Inflow=13.57 cfs 0.968 af
Primary=13.57 cfs 0.968 af

Total Runoff Area = 4.860 ac Runoff Volume = 2.287 af Average Runoff Depth = 5.65"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=6.60"
Flow Length=722' Tc=5.1 min CN=95 Runoff=23.76 cfs 1.266 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=6.96"
Tc=5.0 min CN=98 Runoff=8.29 cfs 0.458 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=6.14"
Tc=5.0 min CN=91 Runoff=7.63 cfs 0.389 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=6.84"
Flow Length=597' Tc=5.0 min CN=97 Runoff=2.62 cfs 0.143 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=6.60"
Tc=5.0 min CN=95 Runoff=7.87 cfs 0.418 af

Pond 42P: PROP GARAGE UGND SYSTEM 1 Peak Elev=419.62' Storage=5,243 cf Inflow=8.29 cfs 0.458 af
Outflow=4.87 cfs 0.421 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=431.67' Storage=7,358 cf Inflow=7.87 cfs 0.418 af
Outflow=3.84 cfs 0.341 af

Link 40L: PRE POI 2B Inflow=26.37 cfs 1.408 af
Primary=26.37 cfs 1.408 af

Link 43L: POST 2B Inflow=15.45 cfs 1.151 af
Primary=15.45 cfs 1.151 af

Total Runoff Area = 4.860 ac Runoff Volume = 2.674 af Average Runoff Depth = 6.60"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment39S: PRE POI 2B Runoff Area=2.300 ac 88.70% Impervious Runoff Depth=7.80"
Flow Length=722' Tc=5.1 min CN=95 Runoff=27.82 cfs 1.495 af

Subcatchment41S: POST 2B 40% GAR Runoff Area=0.790 ac 100.00% Impervious Runoff Depth=8.16"
Tc=5.0 min CN=98 Runoff=9.68 cfs 0.537 af

Subcatchment44S: POST 2B UNCAPTON Runoff Area=0.760 ac 69.74% Impervious Runoff Depth=7.32"
Tc=5.0 min CN=91 Runoff=9.00 cfs 0.464 af

Subcatchment45S: PRE_OFFSITE Runoff Area=0.250 ac 96.00% Impervious Runoff Depth=8.04"
Flow Length=597' Tc=5.0 min CN=97 Runoff=3.06 cfs 0.167 af

Subcatchment46S: PAC & FRONT Runoff Area=0.760 ac 80.26% Impervious Runoff Depth=7.80"
Tc=5.0 min CN=95 Runoff=9.22 cfs 0.494 af

Pond 42P: PROP GARAGE UGND SYSTEM 1 Peak Elev=420.03' Storage=5,925 cf Inflow=9.68 cfs 0.537 af
Outflow=5.70 cfs 0.500 af

Pond 47P: PROPOSED PAC UGND SYSTEM Peak Elev=432.19' Storage=8,178 cf Inflow=9.22 cfs 0.494 af
Outflow=4.28 cfs 0.417 af

Link 40L: PRE POI 2B Inflow=30.88 cfs 1.662 af
Primary=30.88 cfs 1.662 af

Link 43L: POST 2B Inflow=17.69 cfs 1.381 af
Primary=17.69 cfs 1.381 af

Total Runoff Area = 4.860 ac Runoff Volume = 3.157 af Average Runoff Depth = 7.80"
13.37% Pervious = 0.650 ac 86.63% Impervious = 4.210 ac

POI 3 SUMMARY OF FLOWS
Pre-Development/Post Development - w/Exempted Areas

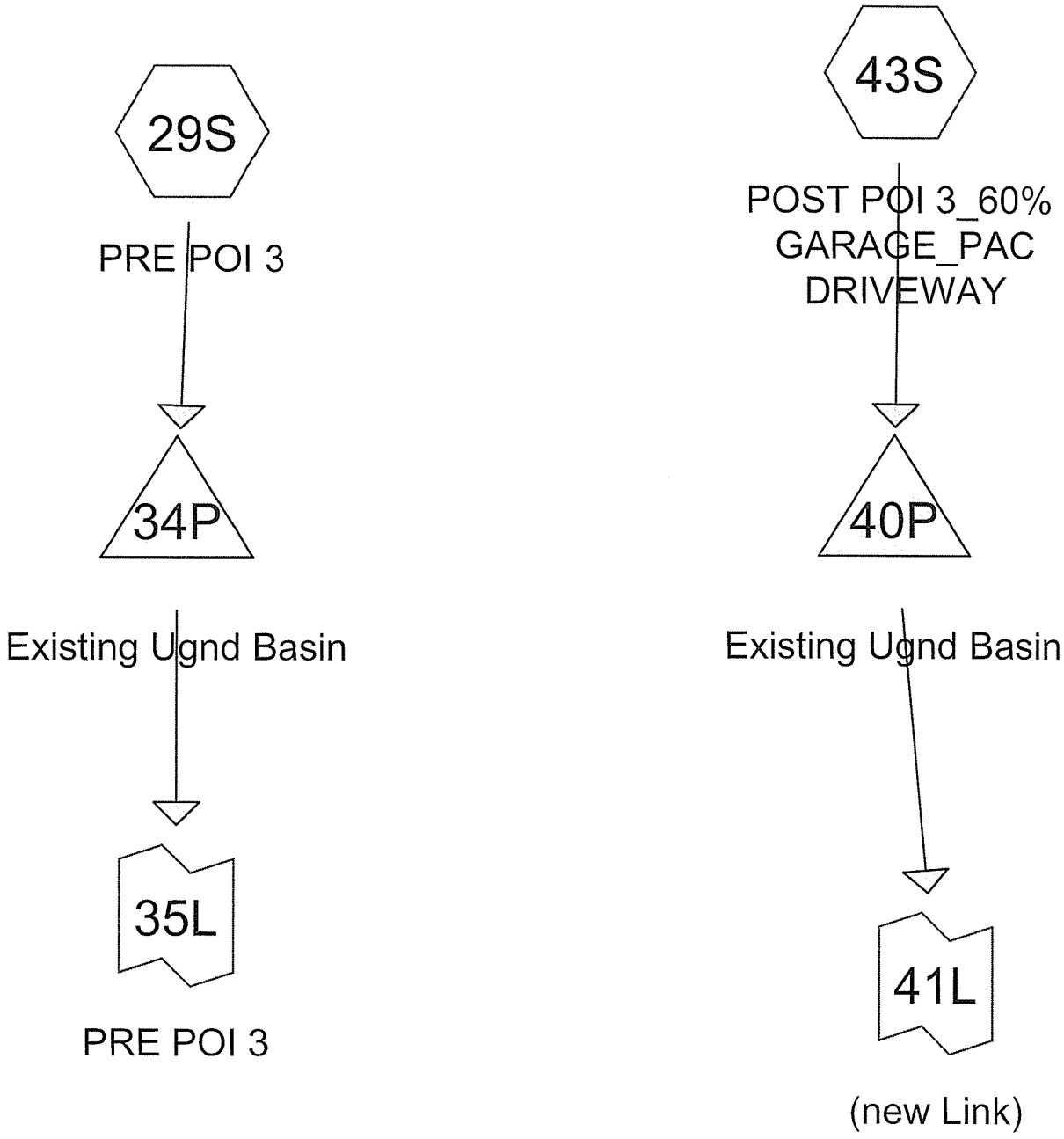
STORM EVENT	Pre-Development Flow (CFS) A	Allowable Flow (CFS) B	Pre-Development Exempt Flow (CFS) C	Allowable Flow (non-exempt plus exempt) (CFS) B+C=D	Post Development Flow (CFS)	% Reduction Allowable (CFS) Reduction D	% Reduction Pre-Dev (CFS) Reduction A+C
1	2.48	2.48	0.00	2.48	2.23	-10.08	-10.08
2	3.81	3.81	0.00	3.81	3.47	-8.92	-8.92
5	6.16	6.16	0.00	6.16	5.73	-6.98	-6.98
10	8.66	8.66	0.00	8.66	8.20	-5.31	-5.31
25	11.13	11.13	0.00	11.13	10.64	-4.40	-4.40
50	14.10	14.10	0.00	14.10	13.49	-4.33	-4.33
100	21.82	21.82	0.00	21.82	20.92	-4.12	-4.12

Nave Newell
Where Ideas Get Down to Earth
900 West Valley Road Suite 1100
Wayne, PA 19087

PROJECT: Villanova

JOB NO. 2011-005.00 BY: JLH

DATE: 2/25/2015 CHK'D: DAT



Subcat Reach Pond Link

Routing Diagram for Garage_SWM_POI_3
Prepared by Microsoft, Printed 3/3/2015
HydroCAD® 10.00-13 s/n 07511 © 2014 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.300	74	>75% Grass cover, Good, HSG C (29S, 43S)
1.770	98	Impervious B Soils (29S)
1.590	98	Paved parking, HSG C (43S)
6.660	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.890	HSG C	29S, 43S
0.000	HSG D	
1.770	Other	29S
6.660		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	3.300	0.000	0.000	3.300	>75% Grass cover, Good	29S, 43S
0.000	0.000	0.000	0.000	1.770	1.770	Impervious B Soils	29S
0.000	0.000	1.590	0.000	0.000	1.590	Paved parking	43S
0.000	**0.000**	**4.890**	**0.000**	**1.770**	**6.660**	**TOTAL AREA**	

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=1.40"
Tc=5.0 min CN=87 Runoff=8.38 cfs 0.384 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=1.26"
Tc=5.0 min CN=85 Runoff=7.74 cfs 0.352 af

Pond 34P: Existing Ugnd Basin Peak Elev=412.32' Storage=5,425 cf Inflow=8.38 cfs 0.384 af
Discarded=0.07 cfs 0.087 af Primary=2.48 cfs 0.297 af Outflow=2.55 cfs 0.384 af

Pond 40P: Existing Ugnd Basin Peak Elev=412.23' Storage=4,908 cf Inflow=7.74 cfs 0.352 af
Discarded=0.07 cfs 0.083 af Primary=2.23 cfs 0.269 af Outflow=2.30 cfs 0.352 af

Link 35L: PRE POI 3 Inflow=2.48 cfs 0.297 af
Primary=2.48 cfs 0.297 af

Link 41L: (new Link) Inflow=2.23 cfs 0.269 af
Primary=2.23 cfs 0.269 af

Total Runoff Area = 6.660 ac Runoff Volume = 0.736 af Average Runoff Depth = 1.33"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=2.00"
Tc=5.0 min CN=87 Runoff=11.88 cfs 0.551 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=1.84"
Tc=5.0 min CN=85 Runoff=11.23 cfs 0.516 af

Pond 34P: Existing Ugnd Basin Peak Elev=412.74' Storage=7,865 cf Inflow=11.88 cfs 0.551 af
Discarded=0.07 cfs 0.094 af Primary=3.81 cfs 0.457 af Outflow=3.88 cfs 0.551 af

Pond 40P: Existing Ugnd Basin Peak Elev=412.65' Storage=7,331 cf Inflow=11.23 cfs 0.516 af
Discarded=0.07 cfs 0.091 af Primary=3.47 cfs 0.426 af Outflow=3.54 cfs 0.516 af

Link 35L: PRE POI 3 Inflow=3.81 cfs 0.457 af
Primary=3.81 cfs 0.457 af

Link 41L: (new Link) Inflow=3.47 cfs 0.426 af
Primary=3.47 cfs 0.426 af

Total Runoff Area = 6.660 ac Runoff Volume = 1.067 af Average Runoff Depth = 1.92"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=2.82"
Tc=5.0 min CN=87 Runoff=16.44 cfs 0.776 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=2.64"
Tc=5.0 min CN=85 Runoff=15.84 cfs 0.738 af

Pond 34P: Existing Ugnd Basin Peak Elev=413.24' Storage=10,854 cf Inflow=16.44 cfs 0.776 af
Discarded=0.07 cfs 0.102 af Primary=6.16 cfs 0.673 af Outflow=6.23 cfs 0.776 af

Pond 40P: Existing Ugnd Basin Peak Elev=413.16' Storage=10,368 cf Inflow=15.84 cfs 0.738 af
Discarded=0.07 cfs 0.098 af Primary=5.73 cfs 0.640 af Outflow=5.80 cfs 0.738 af

Link 35L: PRE POI 3 Inflow=6.16 cfs 0.673 af
Primary=6.16 cfs 0.673 af

Link 41L: (new Link) Inflow=5.73 cfs 0.640 af
Primary=5.73 cfs 0.640 af

Total Runoff Area = 6.660 ac Runoff Volume = 1.514 af Average Runoff Depth = 2.73"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=3.57"
Tc=5.0 min CN=87 Runoff=20.52 cfs 0.981 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=3.37"
Tc=5.0 min CN=85 Runoff=19.98 cfs 0.943 af

Pond 34P: Existing Ugnd Basin Peak Elev=413.68' Storage=13,396 cf Inflow=20.52 cfs 0.981 af
Discarded=0.07 cfs 0.108 af Primary=8.67 cfs 0.873 af Outflow=8.74 cfs 0.981 af

Pond 40P: Existing Ugnd Basin Peak Elev=413.60' Storage=12,964 cf Inflow=19.98 cfs 0.943 af
Discarded=0.07 cfs 0.105 af Primary=8.20 cfs 0.839 af Outflow=8.27 cfs 0.943 af

Link 35L: PRE POI 3 Inflow=8.67 cfs 0.873 af
Primary=8.67 cfs 0.873 af

Link 41L: (new Link) Inflow=8.20 cfs 0.839 af
Primary=8.20 cfs 0.839 af

Total Runoff Area = 6.660 ac Runoff Volume = 1.924 af Average Runoff Depth = 3.47"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=4.23"
Tc=5.0 min CN=87 Runoff=24.08 cfs 1.163 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=4.02"
Tc=5.0 min CN=85 Runoff=23.61 cfs 1.126 af

Pond 34P: Existing Ugnd Basin Peak Elev=414.06' Storage=15,435 cf Inflow=24.08 cfs 1.163 af
Discarded=0.07 cfs 0.112 af Primary=11.13 cfs 1.051 af Outflow=11.20 cfs 1.164 af

Pond 40P: Existing Ugnd Basin Peak Elev=413.99' Storage=15,066 cf Inflow=23.61 cfs 1.126 af
Discarded=0.07 cfs 0.109 af Primary=10.64 cfs 1.017 af Outflow=10.71 cfs 1.126 af

Link 35L: PRE POI 3 Inflow=11.13 cfs 1.051 af
Primary=11.13 cfs 1.051 af

Link 41L: (new Link) Inflow=10.64 cfs 1.017 af
Primary=10.64 cfs 1.017 af

Total Runoff Area = 6.660 ac Runoff Volume = 2.289 af Average Runoff Depth = 4.12"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=4.90"
Tc=5.0 min CN=87 Runoff=27.63 cfs 1.348 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=4.68"
Tc=5.0 min CN=85 Runoff=27.24 cfs 1.311 af

Pond 34P: Existing Ugnd Basin Peak Elev=414.47' Storage=17,294 cf Inflow=27.63 cfs 1.348 af
Discarded=0.07 cfs 0.116 af Primary=14.10 cfs 1.232 af Outflow=14.17 cfs 1.348 af

Pond 40P: Existing Ugnd Basin Peak Elev=414.39' Storage=17,003 cf Inflow=27.24 cfs 1.311 af
Discarded=0.07 cfs 0.113 af Primary=13.49 cfs 1.198 af Outflow=13.56 cfs 1.311 af

Link 35L: PRE POI 3 Inflow=14.10 cfs 1.232 af
Primary=14.10 cfs 1.232 af

Link 41L: (new Link) Inflow=13.49 cfs 1.198 af
Primary=13.49 cfs 1.198 af

Total Runoff Area = 6.660 ac Runoff Volume = 2.658 af Average Runoff Depth = 4.79"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3 Runoff Area=3.300 ac 53.64% Impervious Runoff Depth=5.77"
Tc=5.0 min CN=87 Runoff=32.17 cfs 1.587 af

Subcatchment43S: POST POI 3_60% Runoff Area=3.360 ac 47.32% Impervious Runoff Depth=5.54"
Tc=5.0 min CN=85 Runoff=31.89 cfs 1.551 af

Pond 34P: Existing Ugnd Basin Peak Elev=414.96' Storage=18,743 cf Inflow=32.17 cfs 1.587 af
Discarded=0.07 cfs 0.119 af Primary=21.82 cfs 1.467 af Outflow=21.89 cfs 1.587 af

Pond 40P: Existing Ugnd Basin Peak Elev=414.91' Storage=18,673 cf Inflow=31.89 cfs 1.551 af
Discarded=0.07 cfs 0.116 af Primary=20.92 cfs 1.435 af Outflow=20.99 cfs 1.551 af

Link 35L: PRE POI 3 Inflow=21.82 cfs 1.467 af
Primary=21.82 cfs 1.467 af

Link 41L: (new Link) Inflow=20.92 cfs 1.435 af
Primary=20.92 cfs 1.435 af

Total Runoff Area = 6.660 ac Runoff Volume = 3.138 af Average Runoff Depth = 5.65"
49.55% Pervious = 3.300 ac 50.45% Impervious = 3.360 ac

POI 3A SUMMARY OF FLOWS
Pre-Development/Post Development - w/Exempted Areas

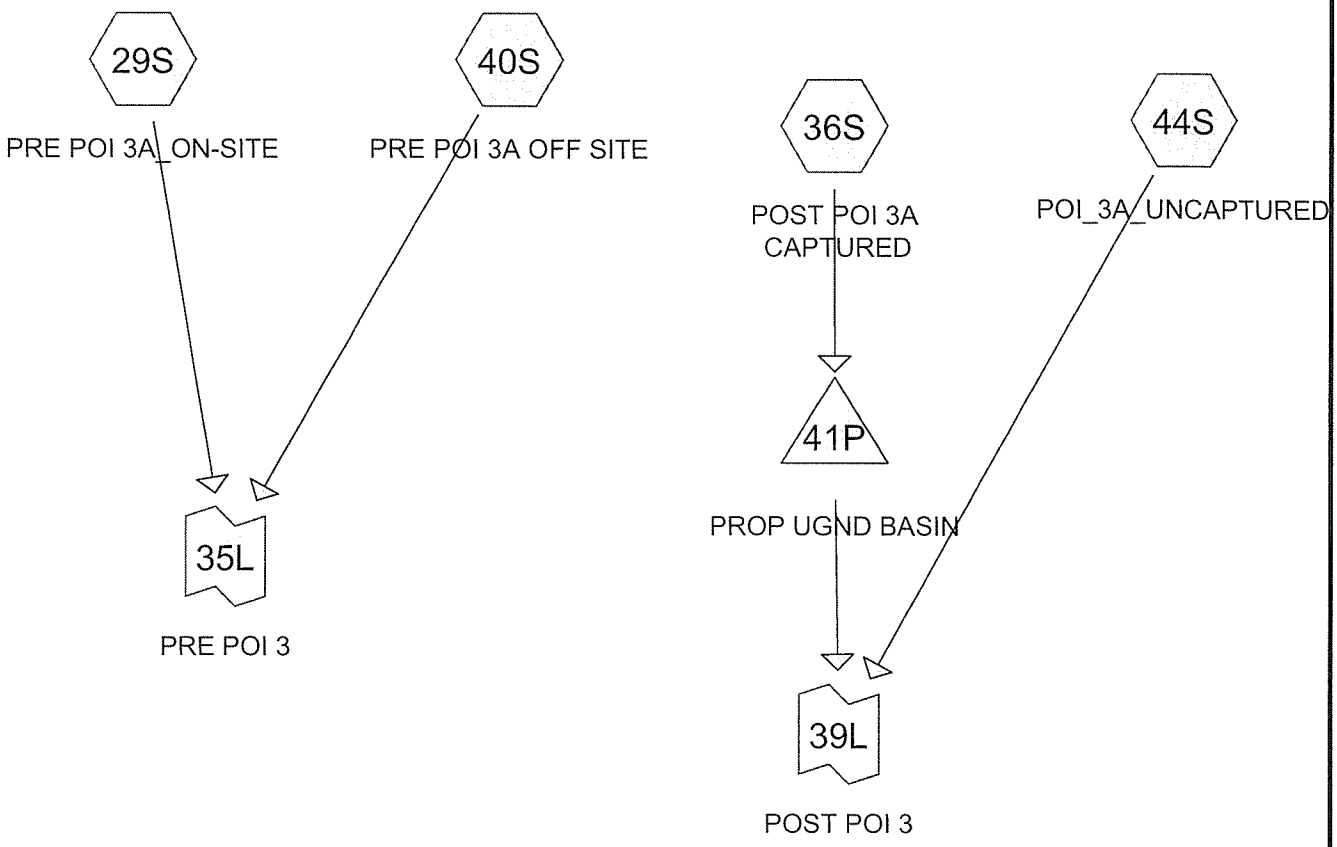
STORM EVENT	Pre-Development Flow (CFS) A	Allowable Flow (CFS) B	Pre-Development Exempt Flow (CFS) C	Allowable Flow (non-exempt plus exempt) (CFS) B+C=D	Post Development Flow (CFS)	% Reduction Allowable (CFS) Reduction D	% Reduction Pre-Dev (CFS) Reduction A+C
1	15.40	15.40	0.00	15.40	5.73	-62.79	-62.79
2	23.40	15.40	0.00	15.40	10.79	-29.94	-53.89
5	34.69	23.40	0.00	23.40	18.33	-21.67	-47.16
10	46.41	34.69	0.00	34.69	25.65	-26.06	-44.73
25	58.35	34.69	0.00	34.69	33.01	-4.84	-43.43
50	70.40	46.41	0.00	46.41	40.51	-12.71	-42.46
100	85.53	85.53	0.00	85.53	50.58	-40.86	-40.86

Nave Newell
Where Ideas Get Down to Earth
900 West Valley Road Suite 1100
Wayne, PA 19087

PROJECT: Villanova

JOB NO. 2011-005.00 BY: JLH

DATE: 2/25/2015 CHK'D: DAT



Subcat Reach Pond Link

Routing Diagram for POI_3A_Apply Off Site Reductions to pre
Prepared by Microsoft, Printed 3/3/2015
HydroCAD® 10.00-13 s/n 07511 © 2014 HydroCAD Software Solutions LLC

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=0.73"
Flow Length=752' Tc=8.6 min CN=75 Runoff=6.24 cfs 0.337 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=1.66"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=11.40 cfs 0.737 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=1.58"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=9.16 cfs 0.605 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=0.69"
Flow Length=752' Tc=8.6 min CN=74 Runoff=5.55 cfs 0.303 af

Pond 41P: PROP UGND BASIN Peak Elev=411.84' Storage=16,091 cf Inflow=11.40 cfs 0.737 af
Outflow=2.20 cfs 0.588 af

Link 35L: PRE POI 3 Inflow=14.66 cfs 0.942 af
Primary=14.66 cfs 0.942 af

Link 39L: POST POI 3 Inflow=5.73 cfs 0.891 af
Primary=5.73 cfs 0.891 af

Total Runoff Area = 20.730 ac Runoff Volume = 1.982 af Average Runoff Depth = 1.15"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=1.20"
Flow Length=752' Tc=8.6 min CN=75 Runoff=10.57 cfs 0.553 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=2.32"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=15.77 cfs 1.031 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=2.23"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=12.83 cfs 0.854 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=1.14"
Flow Length=752' Tc=8.6 min CN=74 Runoff=9.58 cfs 0.503 af

Pond 41P: PROP UGND BASIN Peak Elev=412.36' Storage=22,053 cf Inflow=15.77 cfs 1.031 af
Outflow=3.50 cfs 0.882 af

Link 35L: PRE POI 3 Inflow=22.21 cfs 1.407 af
Primary=22.21 cfs 1.407 af

Link 39L: POST POI 3 Inflow=10.79 cfs 1.385 af
Primary=10.79 cfs 1.385 af

Total Runoff Area = 20.730 ac Runoff Volume = 2.941 af Average Runoff Depth = 1.70"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=1.91"
Flow Length=752' Tc=8.6 min CN=75 Runoff=16.94 cfs 0.877 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=3.22"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=21.62 cfs 1.435 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=3.12"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=17.75 cfs 1.198 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=1.83"
Flow Length=752' Tc=8.6 min CN=74 Runoff=15.58 cfs 0.807 af

Pond 41P: PROP UGND BASIN Peak Elev=413.12' Storage=30,529 cf Inflow=21.62 cfs 1.435 af
Outflow=4.87 cfs 1.285 af

Link 35L: PRE POI 3 Inflow=32.91 cfs 2.075 af
Primary=32.91 cfs 2.075 af

Link 39L: POST POI 3 Inflow=18.33 cfs 2.092 af
Primary=18.33 cfs 2.092 af

Total Runoff Area = 20.730 ac Runoff Volume = 4.317 af Average Runoff Depth = 2.50"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=2.68"
Flow Length=752' Tc=8.6 min CN=75 Runoff=23.73 cfs 1.230 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=4.15"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=27.46 cfs 1.845 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=4.04"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=22.68 cfs 1.549 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=2.59"
Flow Length=752' Tc=8.6 min CN=74 Runoff=22.01 cfs 1.139 af

Pond 41P: PROP UGND BASIN Peak Elev=413.85' Storage=38,036 cf Inflow=27.46 cfs 1.845 af
Outflow=7.01 cfs 1.696 af

Link 35L: PRE POI 3 Inflow=44.01 cfs 2.779 af
Primary=44.01 cfs 2.779 af

Link 39L: POST POI 3 Inflow=25.65 cfs 2.835 af
Primary=25.65 cfs 2.835 af

Total Runoff Area = 20.730 ac Runoff Volume = 5.763 af Average Runoff Depth = 3.34"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=3.49"
Flow Length=752' Tc=8.6 min CN=75 Runoff=30.76 cfs 1.601 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=5.08"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=33.26 cfs 2.261 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=4.97"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=27.59 cfs 1.904 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=3.39"
Flow Length=752' Tc=8.6 min CN=74 Runoff=28.69 cfs 1.491 af

Pond 41P: PROP UGND BASIN Peak Elev=414.63' Storage=45,222 cf Inflow=33.26 cfs 2.261 af
Outflow=8.61 cfs 2.111 af

Link 35L: PRE POI 3 Inflow=55.33 cfs 3.506 af
Primary=55.33 cfs 3.506 af

Link 39L: POST POI 3 Inflow=33.01 cfs 3.601 af
Primary=33.01 cfs 3.601 af

Total Runoff Area = 20.730 ac Runoff Volume = 7.257 af Average Runoff Depth = 4.20"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=4.33"
Flow Length=752' Tc=8.6 min CN=75 Runoff=37.93 cfs 1.986 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=6.02"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=39.03 cfs 2.679 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=5.90"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=32.47 cfs 2.263 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=4.22"
Flow Length=752' Tc=8.6 min CN=74 Runoff=35.51 cfs 1.855 af

Pond 41P: PROP UGND BASIN Peak Elev=415.67' Storage=52,140 cf Inflow=39.03 cfs 2.679 af
Outflow=10.34 cfs 2.529 af

Link 35L: PRE POI 3 Inflow=66.81 cfs 4.249 af
Primary=66.81 cfs 4.249 af

Link 39L: POST POI 3 Inflow=40.51 cfs 4.384 af
Primary=40.51 cfs 4.384 af

Total Runoff Area = 20.730 ac Runoff Volume = 8.783 af Average Runoff Depth = 5.08"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

Time span=0.00-42.00 hrs, dt=0.04 hrs, 1051 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment29S: PRE POI 3A_ON-SITE Runoff Area=5.510 ac 2.18% Impervious Runoff Depth=5.40"
Flow Length=752' Tc=8.6 min CN=75 Runoff=46.99 cfs 2.481 af

Subcatchment36S: POST POI 3A Runoff Area=5.340 ac 68.73% Impervious Runoff Depth=7.20"
Flow Length=1,256' Tc=14.8 min CN=90 Runoff=46.20 cfs 3.204 af

Subcatchment40S: PRE POI 3A OFF SITE Runoff Area=4.600 ac 67.39% Impervious Runoff Depth=7.08"
Flow Length=1,661' Tc=15.6 min CN=89 Runoff=38.54 cfs 2.714 af

Subcatchment44S: POI_3A_UNCAPTURED Runoff Area=5.280 ac 0.00% Impervious Runoff Depth=5.28"
Flow Length=752' Tc=8.6 min CN=74 Runoff=44.17 cfs 2.325 af

Pond 41P: PROP UGND BASIN Peak Elev=416.43' Storage=56,372 cf Inflow=46.20 cfs 3.204 af
Outflow=22.56 cfs 3.054 af

Link 35L: PRE POI 3 Inflow=81.21 cfs 5.195 af
Primary=81.21 cfs 5.195 af

Link 39L: POST POI 3 Inflow=50.58 cfs 5.379 af
Primary=50.58 cfs 5.379 af

Total Runoff Area = 20.730 ac Runoff Volume = 10.724 af Average Runoff Depth = 6.21"
66.76% Pervious = 13.840 ac 33.24% Impervious = 6.890 ac

VII.

West Lancaster Avenue
Drainage Areas

Inlet	A total	Lawn - B	Impervious	C wt	25 yr Q	100 yr Q	A total-acres
	SF	SF	SF		cfs	cfs	
I-101	2901	1035	1866	0.73	***0.32***	**0.40**	0.0666
I-102	7898	4219	3679	0.59	***0.72***	**0.88**	0.1813
I-102A	4970	715	4255	0.88	***0.68***	**0.83**	0.1141
I-102B	19984	10326	9658	0.61	***1.87***	**2.28**	0.4588
I-103	5740	1047	4693	0.86	***0.75***	**0.92**	0.1318
I-104	19200	6514	12686	0.74	***2.18***	**2.67**	0.4408
I-105	3994	1786	2208	0.66	***0.40***	**0.49**	0.0917
I-106	3797	492	3305	0.89	***0.52***	**0.64**	0.0872
I-107	6582	1069	5513	0.87	***0.88***	**1.08**	0.1511
I-108	18382	5469	12913	0.77	***2.18***	**2.66**	0.4221
I-109	5995	3208	2787	0.59	***0.55***	**0.67**	0.1376
I-110	5221	2318	2903	0.66	***0.53***	**0.65**	0.1199
I-111	17575	3839	13736	0.83	***2.24***	**2.74**	0.4035
I-112	4096	1421	2675	0.73	***0.46***	**0.56**	0.0940
I-113	9088	1569	7519	0.86	***1.21***	**1.47**	0.2087
I-114	4508	471	4037	0.91	***0.63***	**0.77**	0.1035
I-115	2524	91	2433	0.96	***0.37***	**0.46**	0.0580
I-116	14180	6408	7772	0.66	***1.43***	**1.75**	0.3256
I-117	2947	1142	1805	0.70	***0.32***	**0.39**	0.0677
I-118	11821	4529	7292	0.71	***1.28***	**1.57**	0.2714
I-119	6562	664	5898	0.92	***0.92***	**1.13**	0.1507
I-120	10383	371	10012	0.96	***1.54***	**1.88**	0.2384
I-121	1506	200	1306	0.89	***0.21***	**0.25**	0.0346
I-122	5240	41	5199	0.98	***0.79***	**0.97**	0.1203
I-123	9043	2866	6177	0.76	***1.05***	**1.28**	0.2076
I-124	15092	6474	8618	0.67	***1.56***	**1.91**	0.3465
I-125	11822	5893	5929	0.62	***1.13***	**1.38**	0.2714
I-126	9135	4071	5064	0.66	***0.93***	**1.13**	0.2097
I-127	12742	9256	3486	0.45	***0.89***	**1.08**	0.2926
RG-101	14384	13512	872	0.29	***0.65***	**0.80**	0.3303
RG-102	16480	7291	9189	0.66	***1.68***	**2.05**	0.3784

Q= (C wt) x I x (A total acres)

$$C\ wt = \frac{[0.99 \times (Impervious)] + [0.25 \times (Lawn - B)]}{A\ total}$$

I 25 = 6.70 in/hr; per PennDOT Road Design Manual, Vol III
I 100 = 8.19 Fig. 2.10.4.2(E), Region 5 I.D.F., 5 min. duration

C = 0.25 Lawn - B
C = 0.99 Impervious

Conduit FlexTable: Combined Pipe/Node Report (25 YR stormcad-WLA_3-01-15.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-112	MH-110	31.0	18.0	18.0	0.016	0.013	0.46	13.34	431.70	431.20	435.60	435.50	431.95	431.98	3.53
MH-110	OS-INF-103	4.0	18.0	18.0	0.025	0.013	0.46	16.61	430.70	430.60	435.50	435.50	431.98	431.98	4.11
OS RG-102	C.O. 104	16.0	12.0	12.0	0.005	0.013	1.68	2.52	436.00	435.92	440.00	440.20	436.59	436.47	3.43
YD-100	C.O. 101	30.0	12.0	12.0	0.006	0.010	0.50	3.59	436.60	436.42	438.60	440.00	436.89	436.74	3.22
C.O. 101	C.O. 102	40.0	12.0	12.0	0.010	0.012	0.59	3.86	436.42	436.02	440.00	440.00	436.74	436.28	3.56
C.O. 102	C.O. 104	90.0	12.0	12.0	0.009	0.012	0.80	3.64	435.82	435.02	440.00	440.20	436.19	435.50	3.72
C.O. 104	I-119	62.0	12.0	12.0	0.012	0.010	2.48	5.06	434.82	434.08	440.20	438.90	435.50	434.58	6.42
C.O. 103	I-119	26.0	12.0	12.0	0.012	0.010	0.02	4.97	436.50	436.20	440.00	438.90	436.55	436.24	1.49
I-119	MH-114	99.0	18.0	18.0	0.010	0.010	3.49	13.72	433.88	432.88	438.90	439.95	434.59	433.61	6.49
I-120	MH-115	13.0	18.0	18.0	0.020	0.010	1.55	19.31	435.00	434.74	439.64	439.70	435.47	435.07	6.55
I-122	MH-115	27.0	18.0	18.0	0.010	0.010	0.80	13.40	435.00	434.74	439.83	439.70	435.33	435.12	4.16
MH-115	I-121	12.0	18.0	18.0	0.012	0.010	2.35	14.75	434.54	434.40	439.70	439.49	435.12	434.86	6.11
I-121	MH-114	23.0	18.0	18.0	0.010	0.010	2.35	13.35	434.20	433.98	439.49	439.95	434.78	434.43	5.69
MH-114	I-118	99.0	18.0	18.0	0.009	0.010	5.84	13.02	432.68	431.78	439.95	438.00	433.61	432.85	7.17
I-118	I-117	59.0	18.0	18.0	0.010	0.013	7.14	10.41	431.58	431.00	438.00	437.17	432.61	432.48	6.35
I-117	MH-113	40.0	18.0	18.0	0.010	0.013	7.46	10.50	431.00	430.60	437.17	436.50	432.32	432.17	6.45
MH-113	OS-INF-103	14.0	18.0	18.0	0.000	0.010	7.46	0.00	430.60	430.60	436.50	436.40	432.03	431.98	4.22
I-111	MH-116	16.0	18.0	18.0	0.026	0.013	2.27	17.02	428.60	428.18	432.40	432.50	429.17	428.58	6.69
EX-I-123	I-124	111.0	18.0	18.0	0.027	0.013	0.60	17.15	432.84	429.88	436.34	434.50	433.13	430.07	4.55
I-124	I-125	115.0	18.0	18.0	0.017	0.013	2.94	13.78	428.68	426.70	434.50	432.00	429.33	427.43	6.20
I-125	I-126	79.0	18.0	18.0	0.023	0.013	4.08	15.86	426.50	424.70	432.00	429.40	427.27	425.54	7.52
I-126	I-127	83.0	18.0	18.0	0.014	0.013	5.01	12.63	424.50	423.30	429.40	427.00	425.36	424.24	6.73
I-127	MH-116	171.0	18.0	18.0	0.011	0.013	5.90	11.07	423.10	421.20	427.00	432.50	424.04	422.79	6.37
MH-116	MH-117	44.0	18.0	18.0	0.036	0.010	8.17	26.04	421.00	419.40	432.50	426.10	422.62	422.46	4.62
MH-117	OS-INF-102	2.0	18.0	18.0	0.050	0.013	8.17	23.49	419.20	419.10	426.10	426.10	422.46	422.45	4.62
I-110	I-109	102.0	18.0	18.0	0.041	0.013	0.49	21.36	425.56	421.34	432.36	426.60	425.82	421.50	4.97
I-109	MH-108	27.0	18.0	18.0	0.039	0.013	1.01	20.61	421.14	420.10	426.60	422.55	421.51	421.54	6.04
MH-108	OS-INF-102	3.0	18.0	18.0	0.033	0.013	1.01	19.18	419.20	419.10	422.55	422.50	421.54	421.54	0.57

Conduit FlexTable: Combined Pipe/Node Report (25 YR stormcad-WLA_3-01-15.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-106	MH-103	71.0	18.0	18.0	0.020	0.013	0.52	14.96	417.54	416.10	422.00	422.55	417.81	417.80	3.97
MH-103	OS-INF-101	4.0	18.0	18.0	0.000	0.013	0.52	0.00	415.90	415.90	422.55	422.50	417.80	417.80	0.30
I-105	MH-102	20.0	18.0	18.0	0.010	0.013	0.41	10.50	416.30	416.10	420.10	422.40	417.80	417.80	0.23
MH-102	OS-INF-101	2.0	18.0	18.0	0.000	0.013	0.41	0.00	415.90	415.90	422.40	422.40	417.80	417.80	0.23
I-103	MH-101	51.0	18.0	18.0	0.010	0.013	0.77	10.61	416.62	416.10	420.62	419.95	417.80	417.80	3.49
MH-101	OS-INF-101	4.0	18.0	18.0	0.000	0.013	0.77	0.00	415.50	415.50	419.95	419.95	417.80	417.80	0.43
I-102	I-102A	52.0	18.0	18.0	0.020	0.010	0.72	19.31	408.68	407.64	412.68	411.20	409.00	407.96	5.23
I-102A	I-102B	103.0	18.0	18.0	0.022	0.010	1.40	20.14	407.44	405.20	411.20	408.00	407.88	405.82	6.55
I-102B	RG-101	44.0	18.0	18.0	0.030	0.010	3.29	23.47	405.00	403.70	408.00	405.00	405.69	404.63	9.37
OS-INF 103	MH-109	37.0	18.0	18.0	0.014	0.013	0.00	12.21	430.00	429.50	435.94	435.46	430.00	429.50	0.00
MH-109	MH-107	277.0	18.0	18.0	0.029	0.013	0.00	17.96	429.30	421.20	435.46	425.20	429.30	421.20	0.00
OF-INF-102	MH-107	17.0	18.0	18.0	0.018	0.013	6.50	13.95	417.50	417.20	425.50	425.20	418.49	418.20	7.76
MH-107	MH-106	36.0	18.0	18.0	0.021	0.013	6.50	15.06	417.00	416.26	425.20	423.86	417.99	416.98	8.20
OS INF-101	MH-106	26.0	18.0	18.0	0.010	0.013	9.24	10.50	413.50	413.24	423.10	423.86	416.16	415.95	5.23
MH-106	MH-105	112.0	18.0	18.0	0.015	0.013	15.74	12.86	413.04	411.36	423.86	419.50	415.34	412.78	8.91
MH-105	I-101	209.0	18.0	18.0	0.018	0.010	15.74	18.41	410.00	406.20	419.50	410.47	411.42	408.23	11.71
I-101	MH-119	48.0	18.0	18.0	0.020	0.013	16.07	14.85	406.00	405.04	410.47	409.75	407.58	406.47	9.09
I-128	I-129	77.0	24.0	24.0	0.036	0.013	0.00	42.83	410.90	408.14	417.23	413.00	410.90	408.14	0.00
I-129	MH-119	63.0	24.0	24.0	0.030	0.013	0.00	39.18	407.14	405.25	413.00	409.75	407.14	405.25	0.00
MH-119	I-130	73.0	24.0	24.0	0.008	0.013	16.07	19.64	402.45	401.90	409.75	406.40	403.90	403.28	6.97
I-130	I-131	94.0	24.0	24.0	0.029	0.013	16.07	38.69	400.20	397.45	406.40	401.96	401.65	399.03	11.74
I-131	EX.I-132	27.0	24.0	24.0	0.029	0.013	16.07	38.45	397.25	396.47	401.96	401.13	398.70	397.50	11.69
RG-OS101	MH-127	129.0	18.0	18.0	0.018	0.013	3.22	14.03	400.00	397.70	402.00	401.00	400.68	398.19	6.45
MH-127	EX.I-132	34.0	18.0	18.0	0.016	0.013	3.22	13.11	397.50	396.97	401.00	401.13	398.18	397.49	6.14
EX.I-132	OF-112	2.0	24.0	24.0	0.040	0.013	6.33	45.24	396.37	396.29	401.13	401.13	397.26	397.03	10.15

Conduit FlexTable: Combined Pipe/Node Report (100 YR stormcad-WLA_3-01-15.stc)

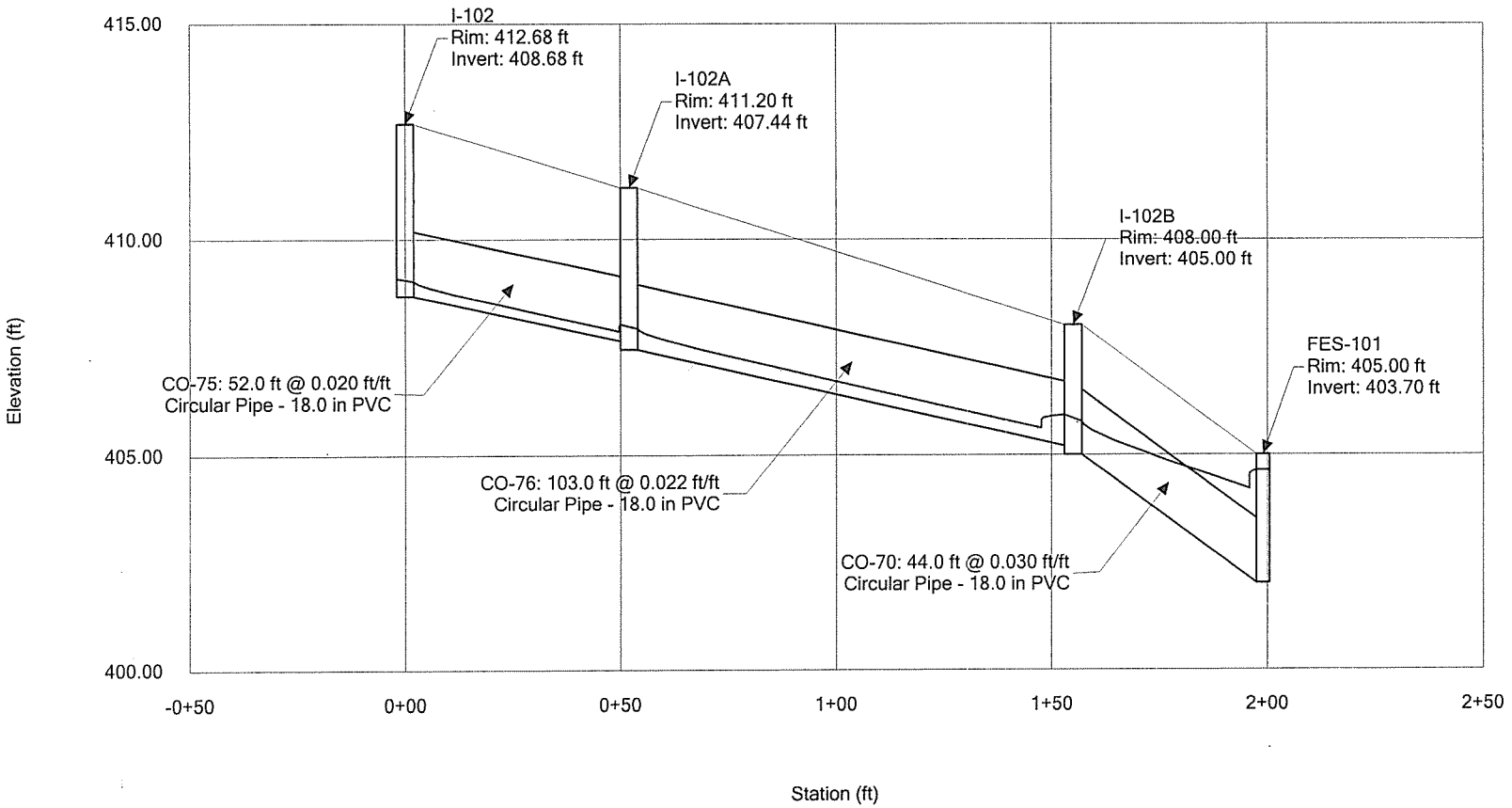
Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-106	MH-103	71.0	18.0	18.0	0.020	0.013	0.64	14.96	417.54	416.10	422.00	422.55	417.84	417.80	4.22
MH-103	OS-INF-101	4.0	18.0	18.0	0.000	0.013	0.64	0.00	415.90	415.90	422.55	422.50	417.80	417.80	0.36
I-105	MH-102	20.0	18.0	18.0	0.010	0.013	0.50	10.50	416.30	416.10	420.10	422.40	417.80	417.80	0.28
MH-102	OS-INF-101	2.0	18.0	18.0	0.000	0.013	0.50	0.00	415.90	415.90	422.40	422.40	417.80	417.80	0.28
I-103	MH-101	51.0	18.0	18.0	0.010	0.013	0.94	10.61	416.62	416.10	420.62	419.95	417.80	417.80	3.70
MH-101	OS-INF-101	4.0	18.0	18.0	0.000	0.013	0.94	0.00	415.50	415.50	419.95	419.95	417.80	417.80	0.53
I-102	I-102A	52.0	18.0	18.0	0.020	0.010	0.88	19.31	408.68	407.64	412.68	411.20	409.03	408.02	5.55
I-102A	I-102B	103.0	18.0	18.0	0.022	0.010	1.71	20.14	407.44	405.20	411.20	408.00	407.93	405.92	6.95
I-102B	RG-101	44.0	18.0	18.0	0.030	0.010	4.02	23.47	405.00	403.70	408.00	405.00	405.77	404.63	9.93
OS-INF 103	MH-109	37.0	18.0	18.0	0.014	0.013	0.00	12.21	430.00	429.50	435.94	435.46	430.00	429.50	0.00
MH-109	MH-107	277.0	18.0	18.0	0.029	0.013	0.00	17.96	429.30	421.20	435.46	425.20	429.30	421.20	0.00
OF-INF-102	MH-107	17.0	18.0	18.0	0.018	0.013	6.50	13.95	417.50	417.20	425.50	425.20	418.49	418.20	7.76
MH-107	MH-106	36.0	18.0	18.0	0.021	0.013	6.50	15.06	417.00	416.26	425.20	423.86	417.99	416.98	8.20
OS INF-101	MH-106	26.0	18.0	18.0	0.010	0.013	9.24	10.50	413.50	413.24	423.10	423.86	416.16	415.95	5.23
MH-106	MH-105	112.0	18.0	18.0	0.015	0.013	15.74	12.86	413.04	411.36	423.86	419.50	415.34	412.78	8.91
MH-105	I-101	209.0	18.0	18.0	0.018	0.010	15.74	18.41	410.00	406.20	419.50	410.47	411.42	408.26	11.71
I-101	MH-119	48.0	18.0	18.0	0.020	0.013	16.14	14.85	406.00	405.04	410.47	409.75	407.61	406.47	9.13
I-128	I-129	77.0	24.0	24.0	0.036	0.013	0.00	42.83	410.90	408.14	417.23	413.00	410.90	408.14	0.00
I-129	MH-119	63.0	24.0	24.0	0.030	0.013	0.00	39.18	407.14	405.25	413.00	409.75	407.14	405.25	0.00
MH-119	I-130	73.0	24.0	24.0	0.008	0.013	16.14	19.64	402.45	401.90	409.75	406.40	403.90	403.28	6.98
I-130	I-131	94.0	24.0	24.0	0.029	0.013	16.14	38.69	400.20	397.45	406.40	401.96	401.65	399.04	11.76
I-131	EX.I-132	27.0	24.0	24.0	0.029	0.013	16.14	38.45	397.25	396.47	401.96	401.13	398.70	397.50	11.70
RG-OS101	MH-127	129.0	18.0	18.0	0.018	0.013	3.22	14.03	400.00	397.70	402.00	401.00	400.68	398.19	6.45
MH-127	EX.I-132	34.0	18.0	18.0	0.016	0.013	3.22	13.11	397.50	396.97	401.00	401.13	398.18	397.49	6.14
EX.I-132	OF-112	2.0	24.0	24.0	0.040	0.013	6.40	45.24	396.37	396.29	401.13	401.13	397.27	397.04	10.18

Conduit FlexTable: Combined Pipe/Node Report (100 YR stormcad-WLA_3-01-15.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-112	MH-110	31.0	18.0	18.0	0.016	0.013	0.57	13.34	431.70	431.20	435.60	435.50	431.98	431.98	3.75
MH-110	OS-INF-103	4.0	18.0	18.0	0.025	0.013	0.57	16.61	430.70	430.60	435.50	435.50	431.98	431.98	4.38
OS RG-102	C.O. 104	16.0	12.0	12.0	0.005	0.013	2.05	2.52	436.00	435.92	440.00	440.20	436.67	436.53	3.58
YD-100	C.O. 101	30.0	12.0	12.0	0.006	0.010	0.50	3.59	436.60	436.42	438.60	440.00	436.89	436.75	3.22
C.O. 101	C.O. 102	40.0	12.0	12.0	0.010	0.012	0.61	3.86	436.42	436.02	440.00	440.00	436.75	436.29	3.59
C.O. 102	C.O. 104	90.0	12.0	12.0	0.009	0.012	0.87	3.64	435.82	435.02	440.00	440.20	436.21	435.55	3.81
C.O. 104	I-119	62.0	12.0	12.0	0.012	0.010	2.93	5.06	434.82	434.08	440.20	438.90	435.55	434.63	6.68
C.O. 103	I-119	26.0	12.0	12.0	0.012	0.010	0.02	4.97	436.50	436.20	440.00	438.90	436.56	436.25	1.57
I-119	MH-114	99.0	18.0	18.0	0.010	0.010	4.16	13.72	433.88	432.88	438.90	439.95	434.66	433.71	6.81
I-120	MH-115	13.0	18.0	18.0	0.020	0.010	1.90	19.31	435.00	434.74	439.64	439.70	435.52	435.11	6.95
I-122	MH-115	27.0	18.0	18.0	0.010	0.010	0.97	13.40	435.00	434.74	439.83	439.70	435.37	435.18	4.42
MH-115	I-121	12.0	18.0	18.0	0.012	0.010	2.87	14.75	434.54	434.40	439.70	439.49	435.18	434.91	6.47
I-121	MH-114	23.0	18.0	18.0	0.010	0.010	2.87	13.35	434.20	433.98	439.49	439.95	434.84	434.49	6.02
MH-114	I-118	99.0	18.0	18.0	0.009	0.010	7.03	13.02	432.68	431.78	439.95	438.00	433.71	433.34	7.51
I-118	I-117	59.0	18.0	18.0	0.010	0.013	8.62	10.41	431.58	431.00	438.00	437.17	433.16	432.76	4.88
I-117	MH-113	40.0	18.0	18.0	0.010	0.013	9.01	10.50	431.00	430.60	437.17	436.50	432.56	432.26	5.10
MH-113	OS-INF-103	14.0	18.0	18.0	0.000	0.010	9.01	0.00	430.60	430.60	436.50	436.40	432.06	431.98	5.10
I-111	MH-116	16.0	18.0	18.0	0.026	0.013	2.77	17.02	428.60	428.18	432.40	432.50	429.23	428.62	7.09
EX-I-123	I-124	111.0	18.0	18.0	0.027	0.013	0.73	17.15	432.84	429.88	436.34	434.50	433.16	430.09	4.83
I-124	I-125	115.0	18.0	18.0	0.017	0.013	3.59	13.78	428.68	426.70	434.50	432.00	429.40	427.53	6.56
I-125	I-126	79.0	18.0	18.0	0.023	0.013	4.98	15.86	426.50	424.70	432.00	429.40	427.36	425.66	7.94
I-126	I-127	83.0	18.0	18.0	0.014	0.013	6.12	12.63	424.50	423.30	429.40	427.00	425.46	424.38	7.10
I-127	MH-116	171.0	18.0	18.0	0.011	0.013	7.21	11.07	423.10	421.20	427.00	432.50	424.14	422.95	6.67
MH-116	MH-117	44.0	18.0	18.0	0.036	0.010	9.98	26.04	421.00	419.40	432.50	426.10	422.70	422.47	5.65
MH-117	OS-INF-102	2.0	18.0	18.0	0.050	0.013	9.98	23.49	419.20	419.10	426.10	426.10	422.47	422.45	5.65
I-110	I-109	102.0	18.0	18.0	0.041	0.013	0.59	21.36	425.56	421.34	432.36	426.60	425.85	421.63	5.28
I-109	MH-108	27.0	18.0	18.0	0.039	0.013	1.23	20.61	421.14	420.10	426.60	422.55	421.56	421.54	6.42
MH-108	OS-INF-102	3.0	18.0	18.0	0.033	0.013	1.23	19.18	419.20	419.10	422.55	422.50	421.54	421.54	0.70

Profile Report

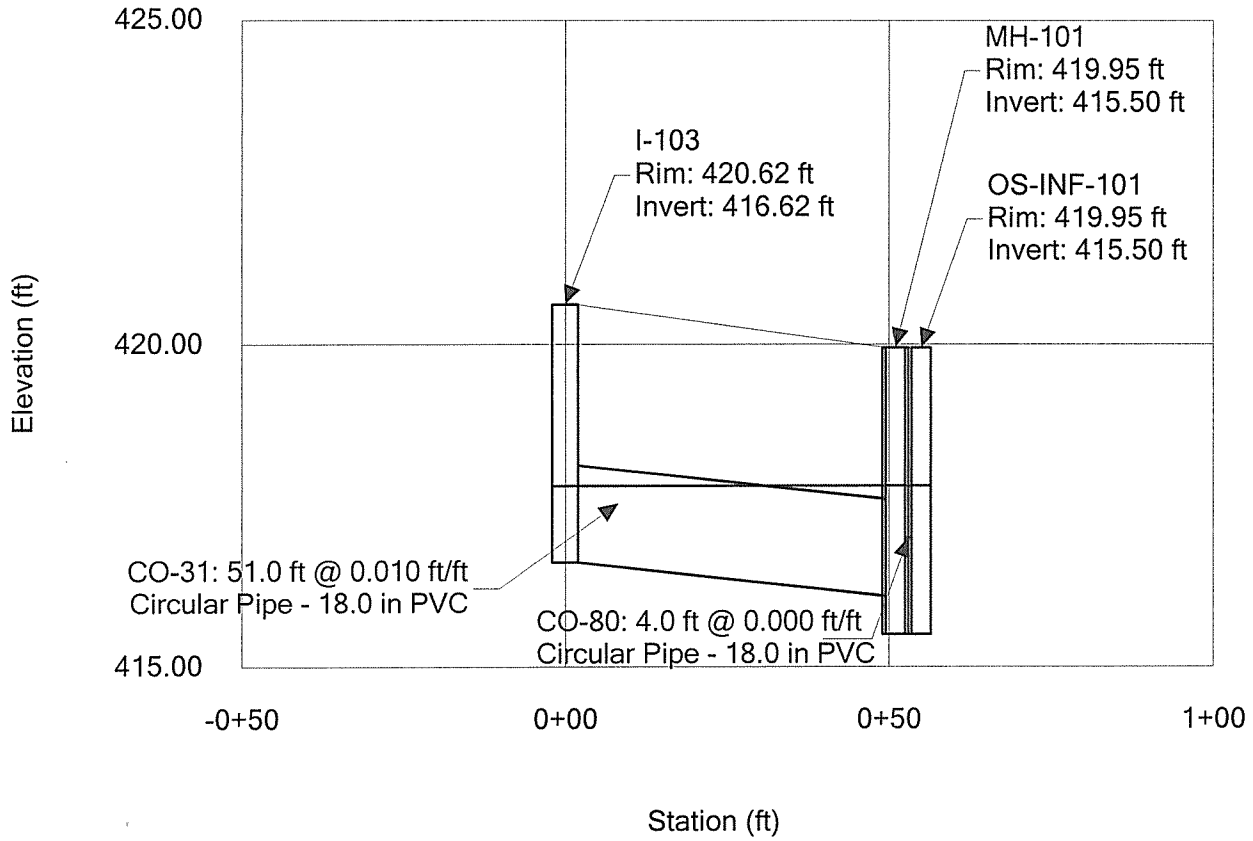
Engineering Profile - I-102 T0 RG-101 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report

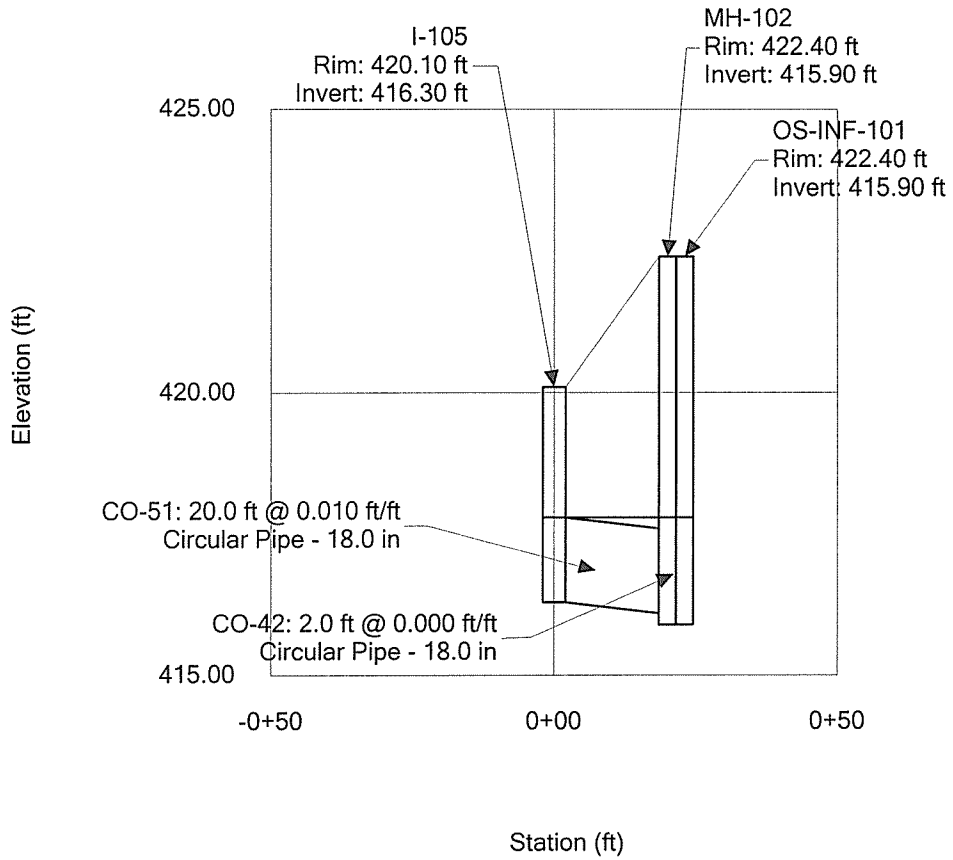
Engineering Profile - I-103 TO OS-INF-101 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report

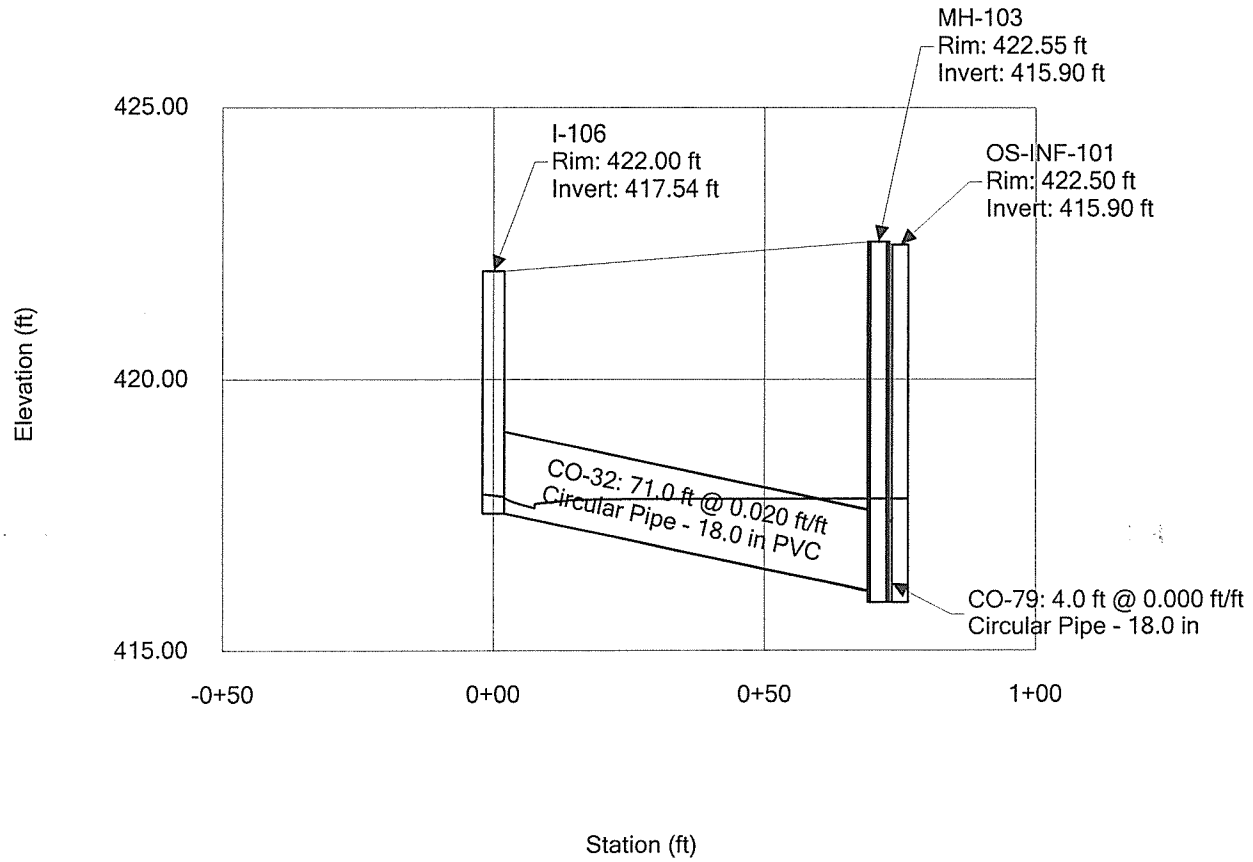
Engineering Profile - I-105 TO OS-INF-101 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

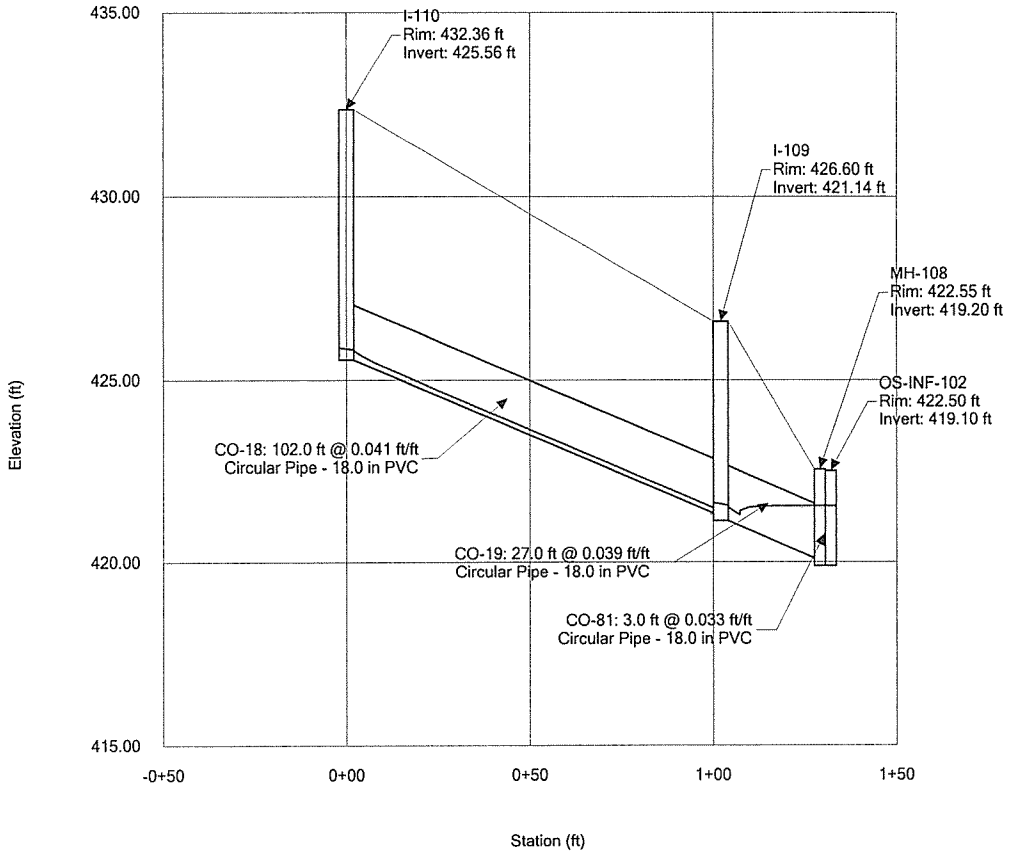
Profile Report

Engineering Profile - I-106 TO OS-INF-101 (100 YR stormcad-WLA_3-01-15.stc)



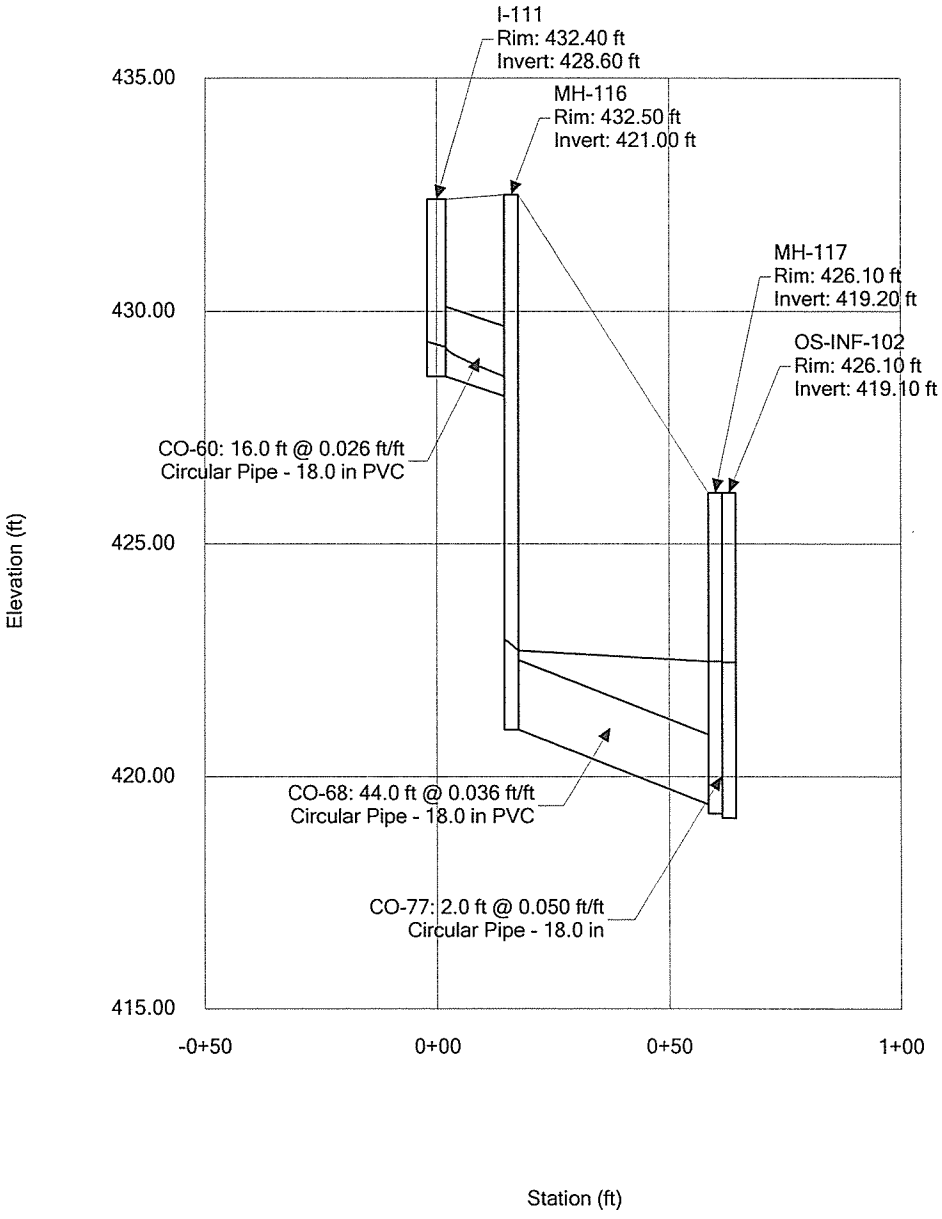
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-110 TO OS INF-102 (100 YR stormcad-WLA_3-01-15.stc)

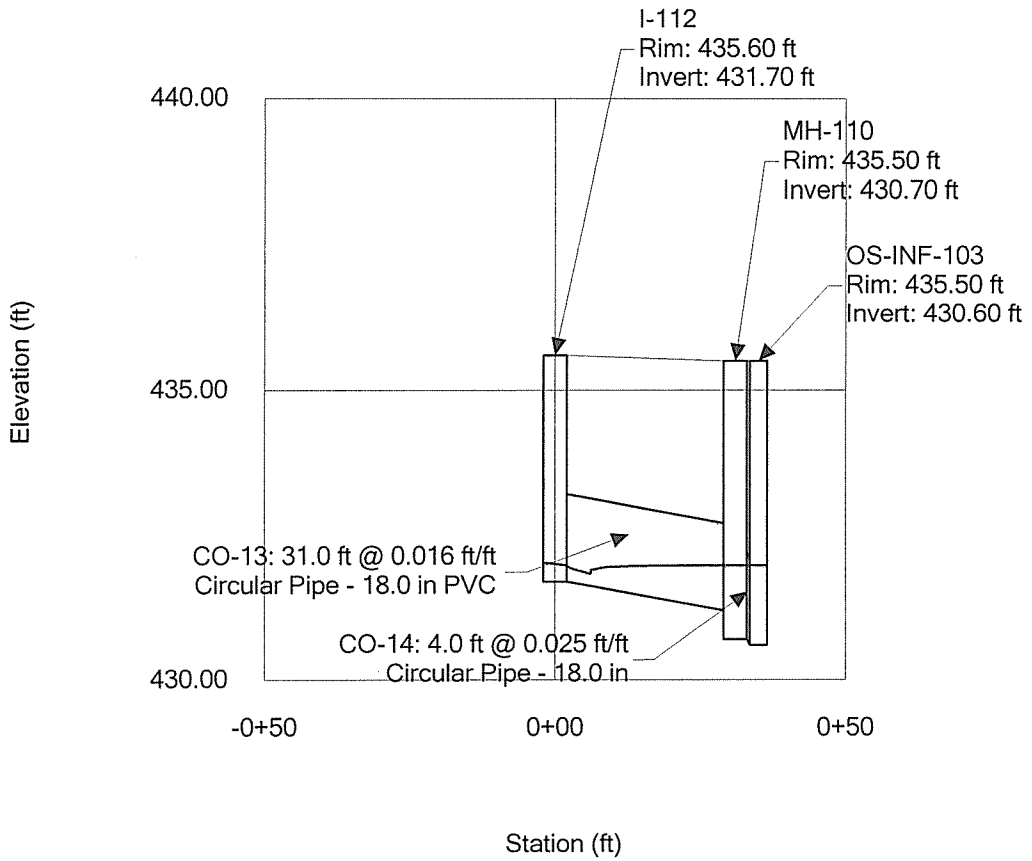


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1
-203-755-1666

Profile Report
Engineering Profile - I-111 TO OS-INF-102 (100 YR stormcad-WLA_3-01-15.stc)

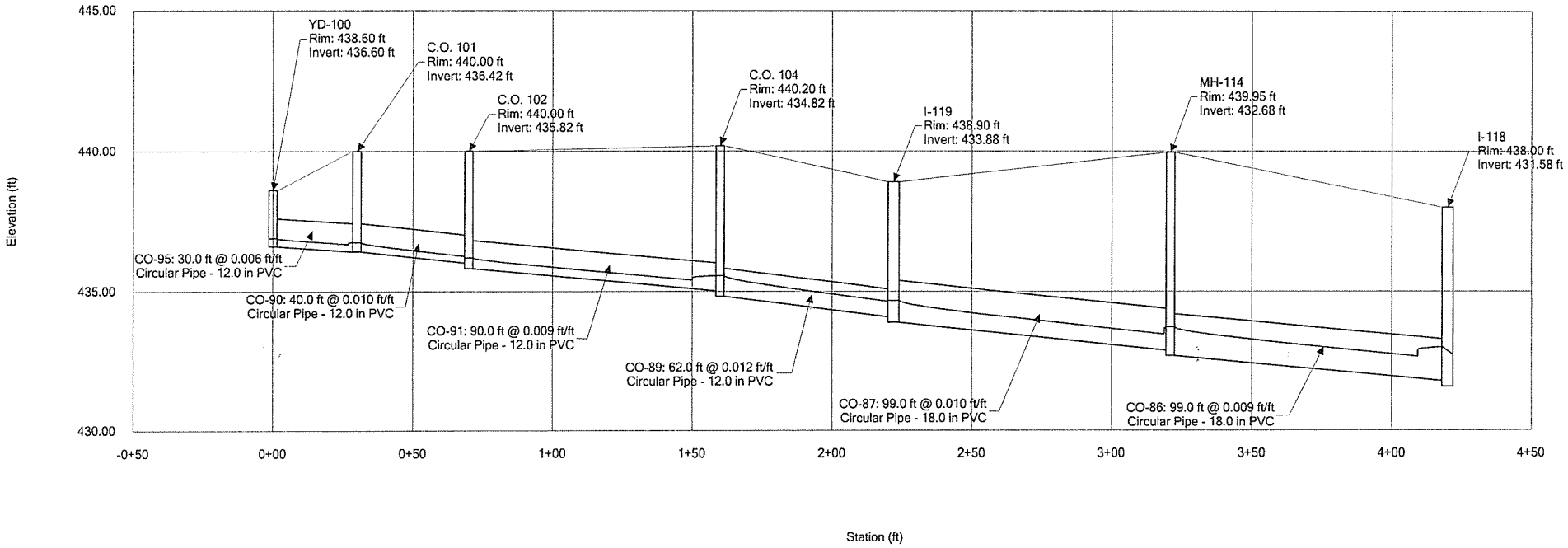


Profile Report
Engineering Profile - I-112 to OS-INF-103 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

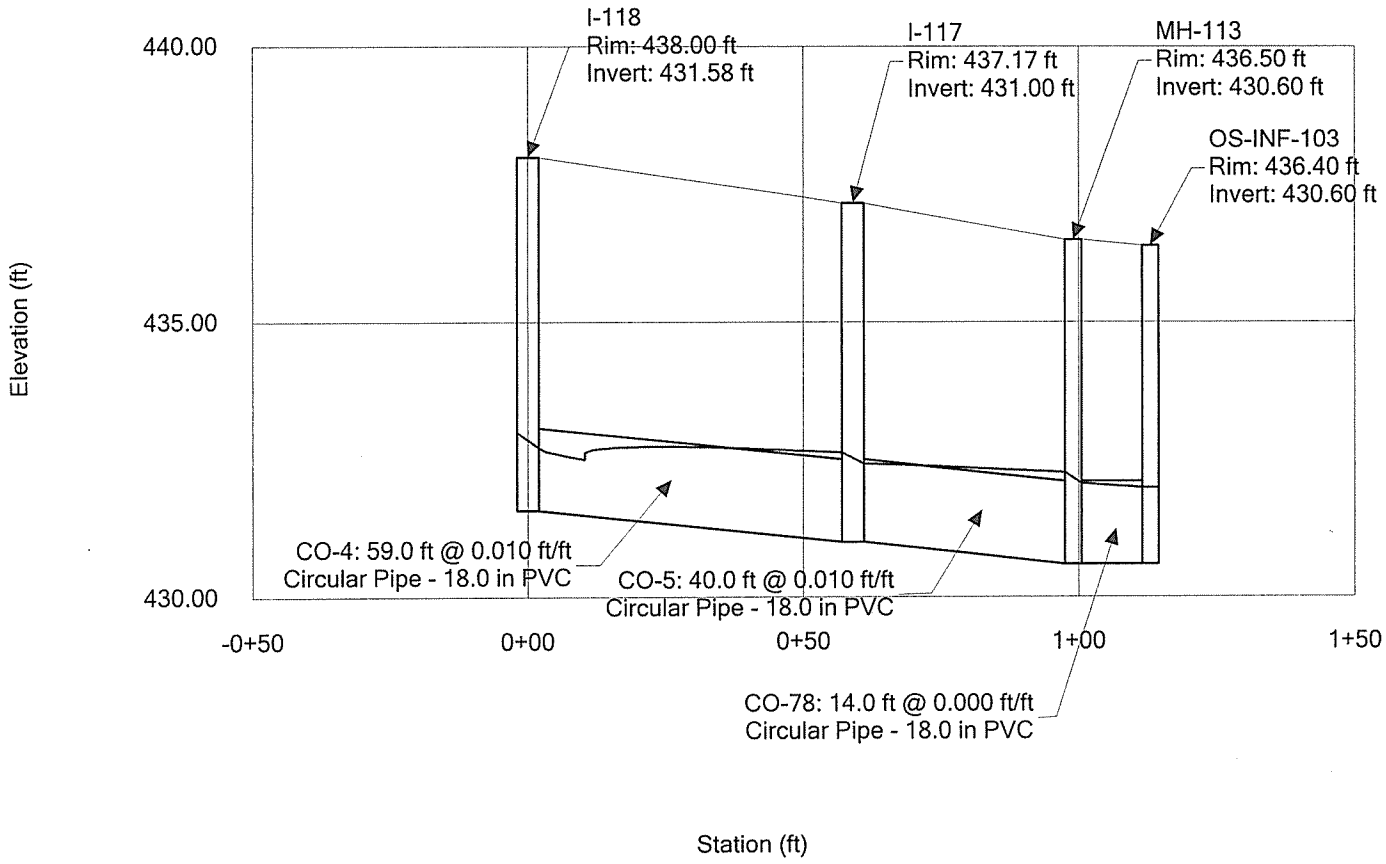
Profile Report
Engineering Profile - YD-100 TO I-118 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-
203-755-1666

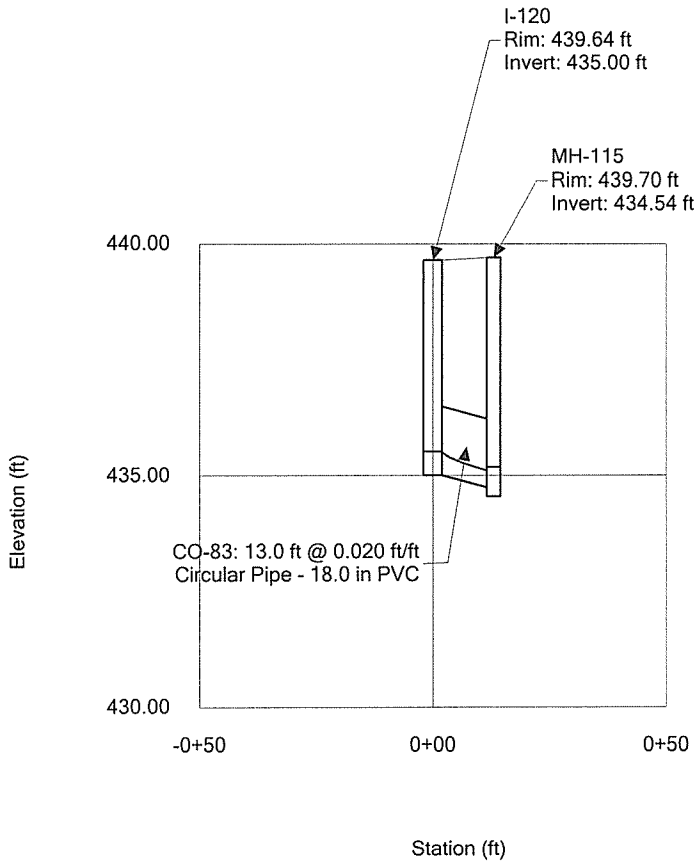
Profile Report

Engineering Profile - I-118 TO OS-INF-103 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

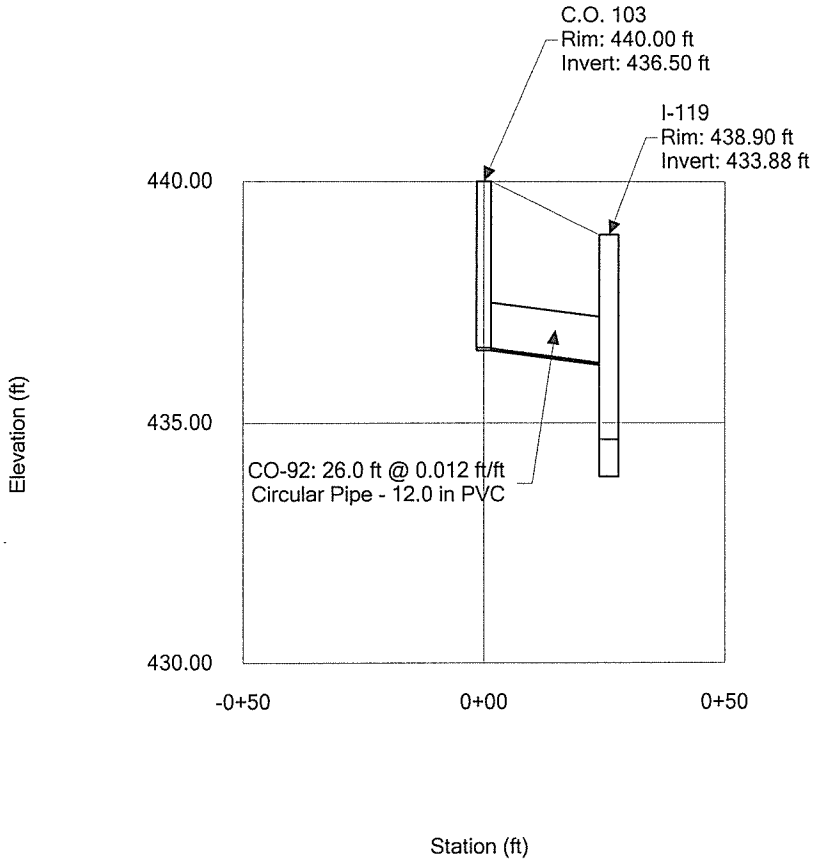
Profile Report
Engineering Profile - I-120 TO MH-115 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

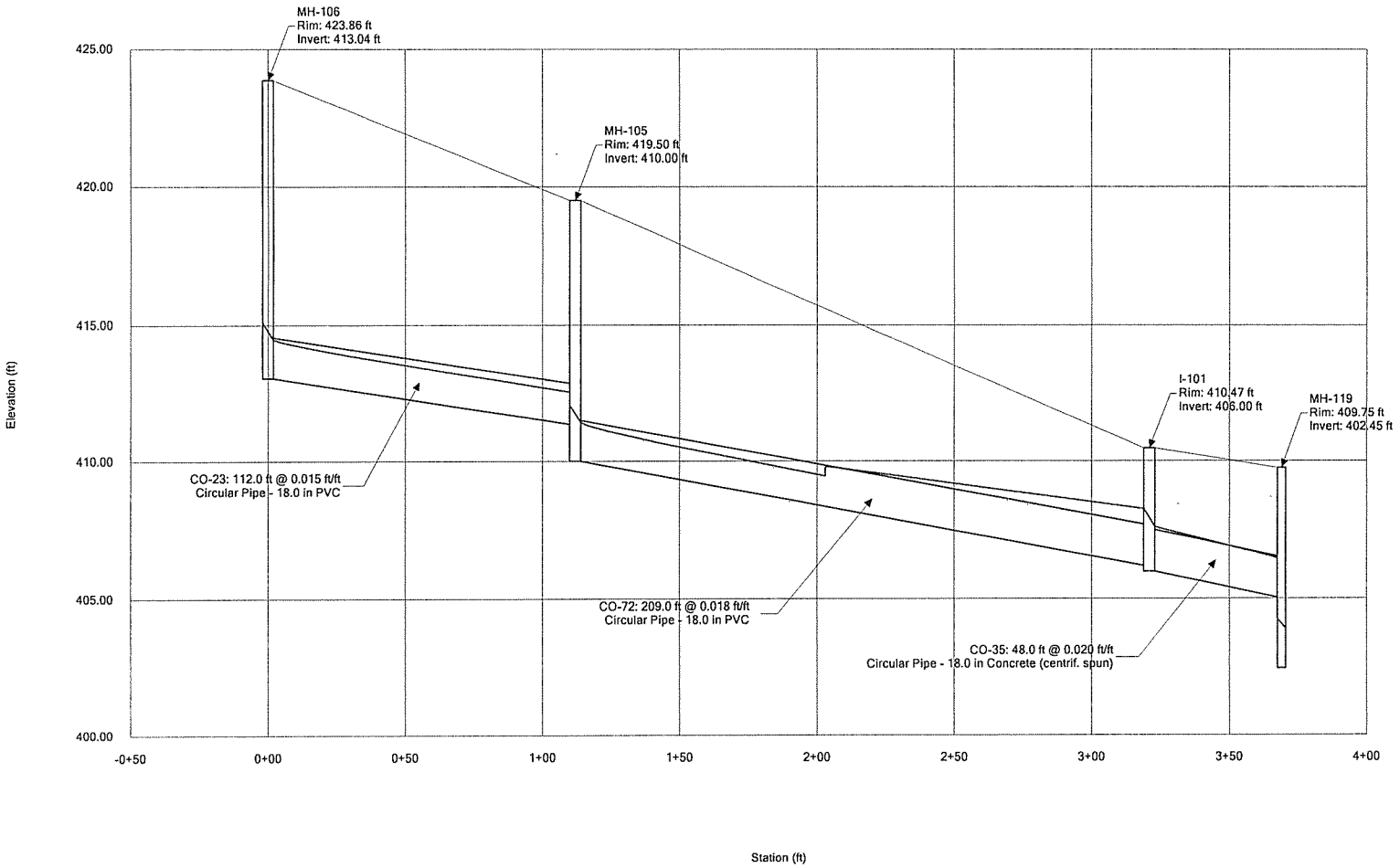
Profile Report

Engineering Profile - C.O.-103 TO I-119 (100 YR stormcad-WLA_3-01-15.stc)



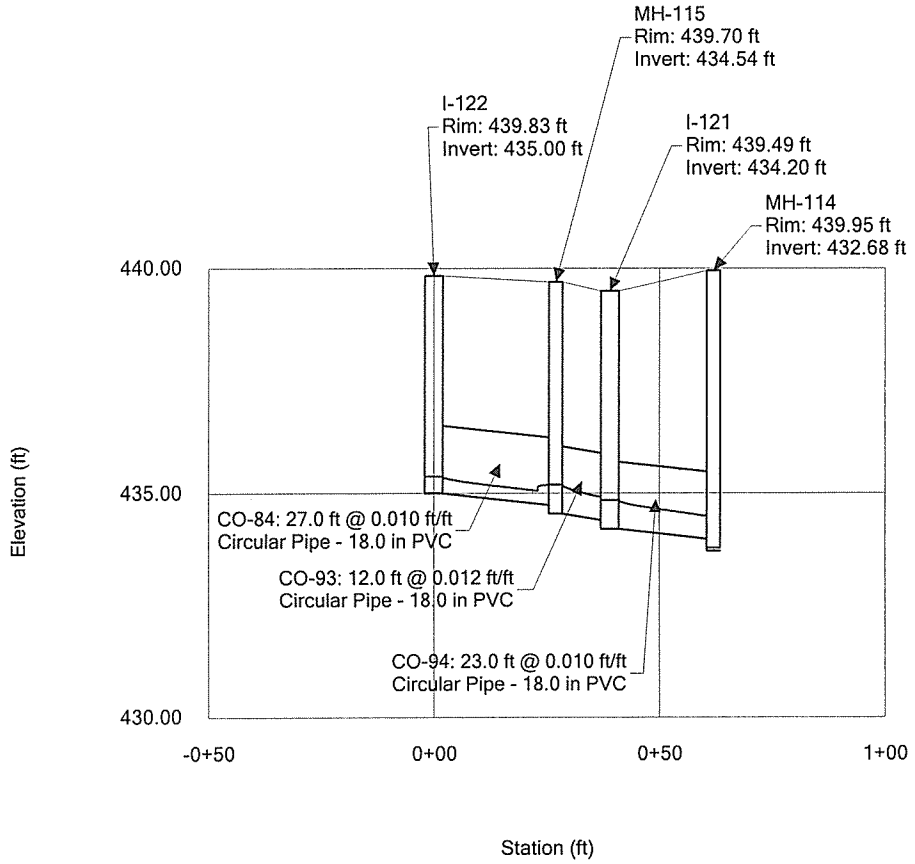
Profile Report

Engineering Profile - MH-106 TO MH-119 (100 YR stormcad-WLA_3-01-15.stc)



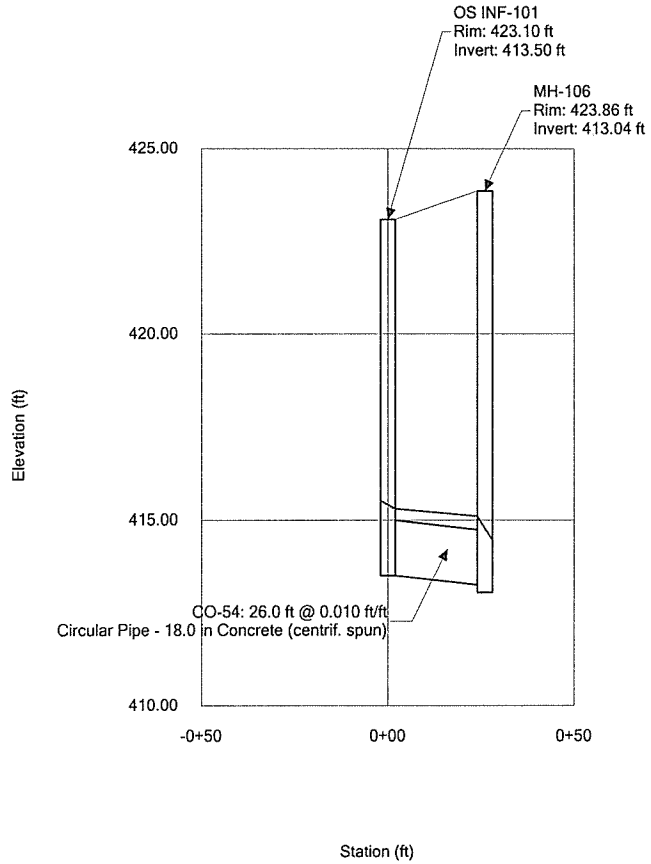
Profile Report

Engineering Profile - I-122 TO MH-114 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

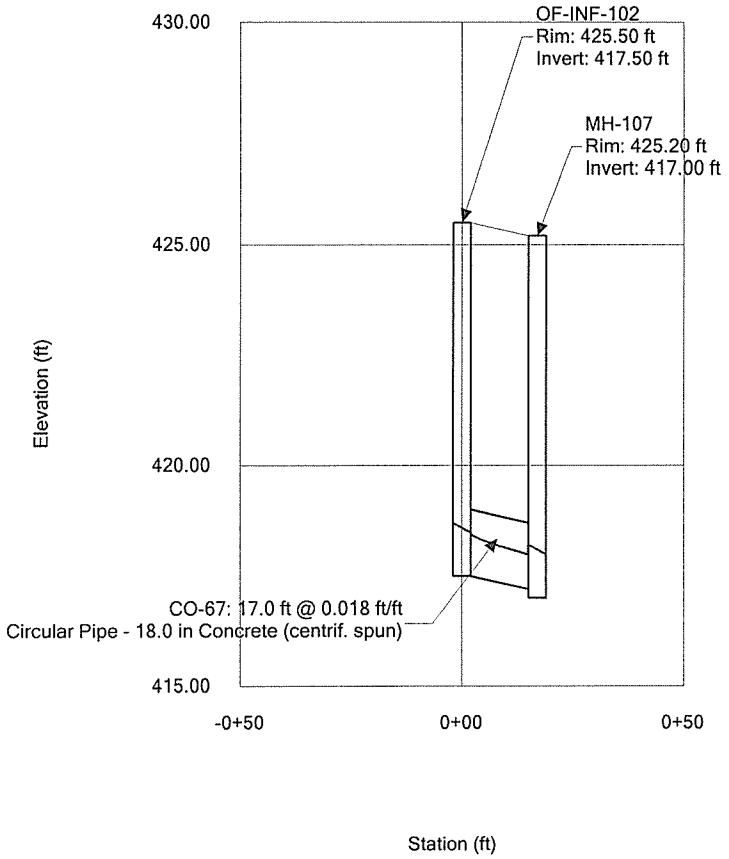
Profile Report
Engineering Profile - OS-INF-101 TO MH-106 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

Profile Report

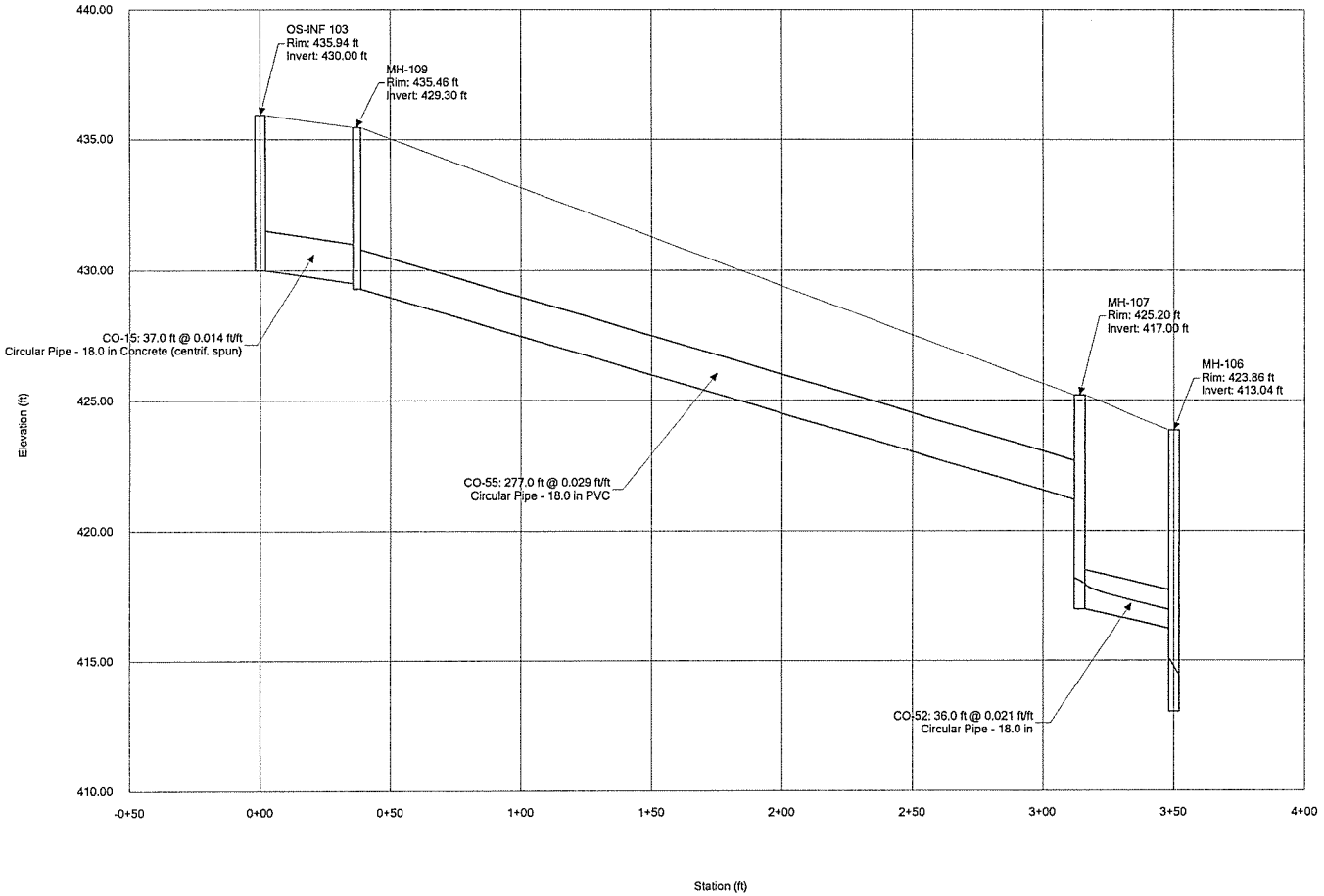
Engineering Profile - OS-INF-102 TO MH-107 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

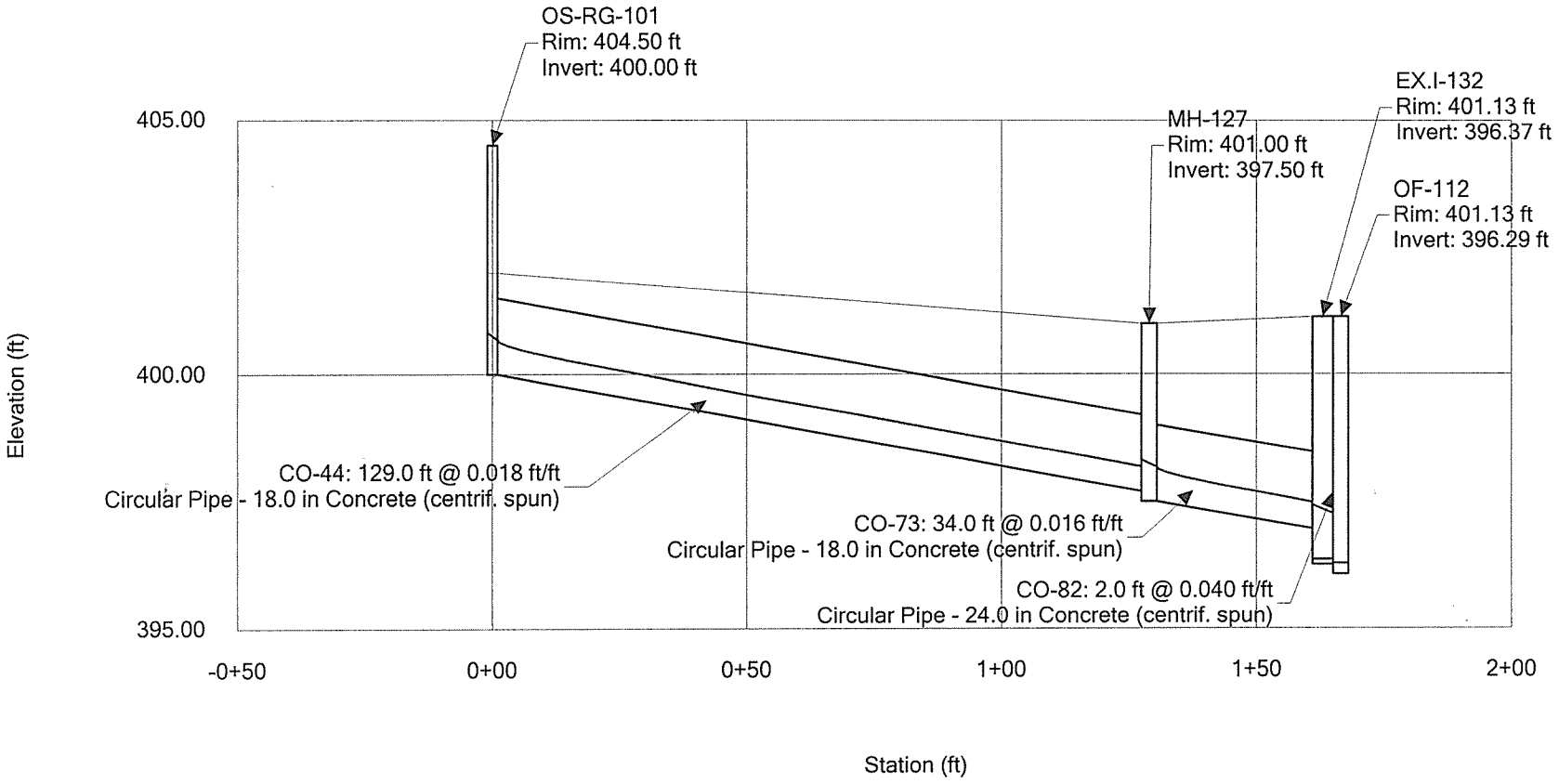
Profile Report

Engineering Profile - OS-INF-103 TO MH-106 (100 YR stormcad-WLA_3-01-15.stc)



Profile Report

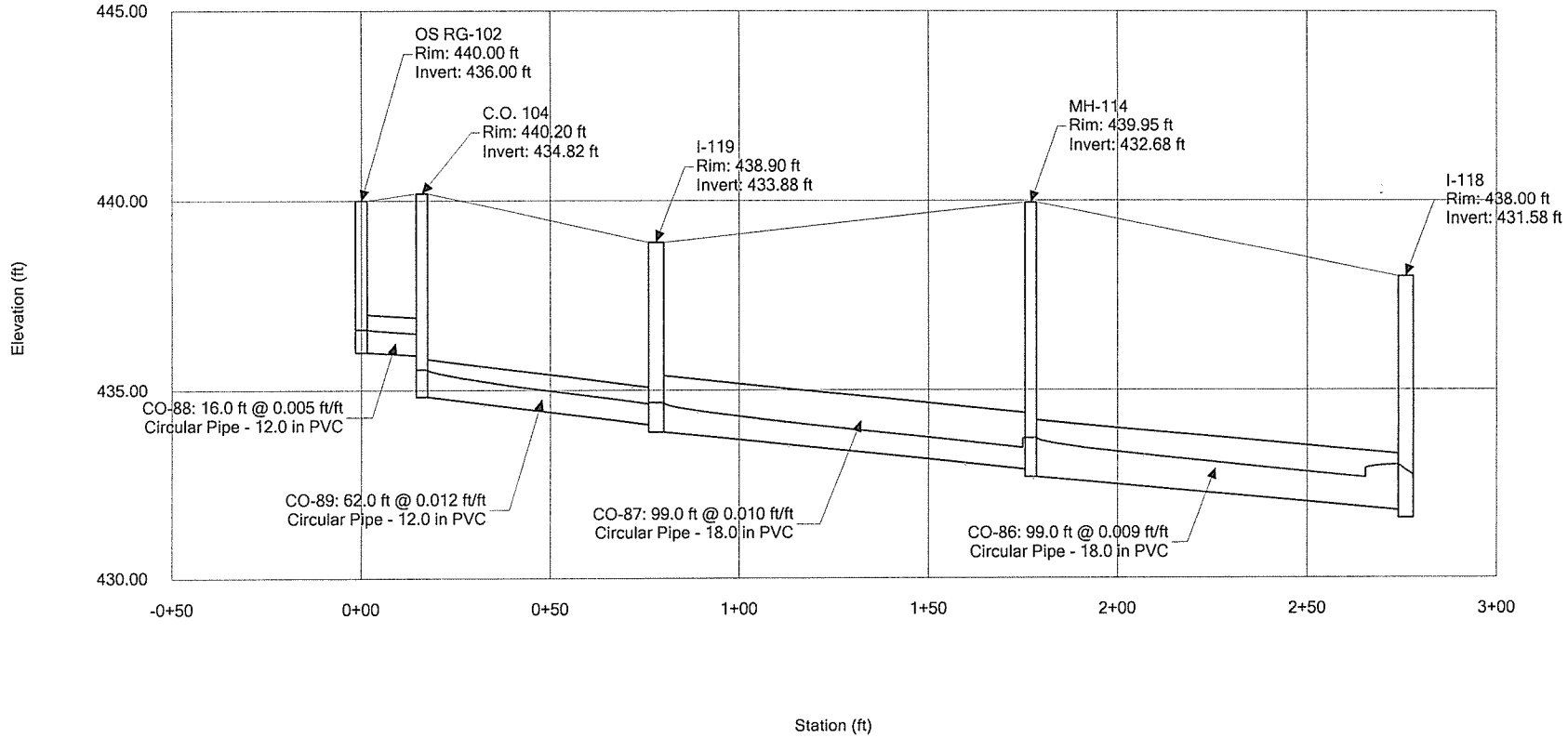
Engineering Profile - OS-RG-101 TO OF-112 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

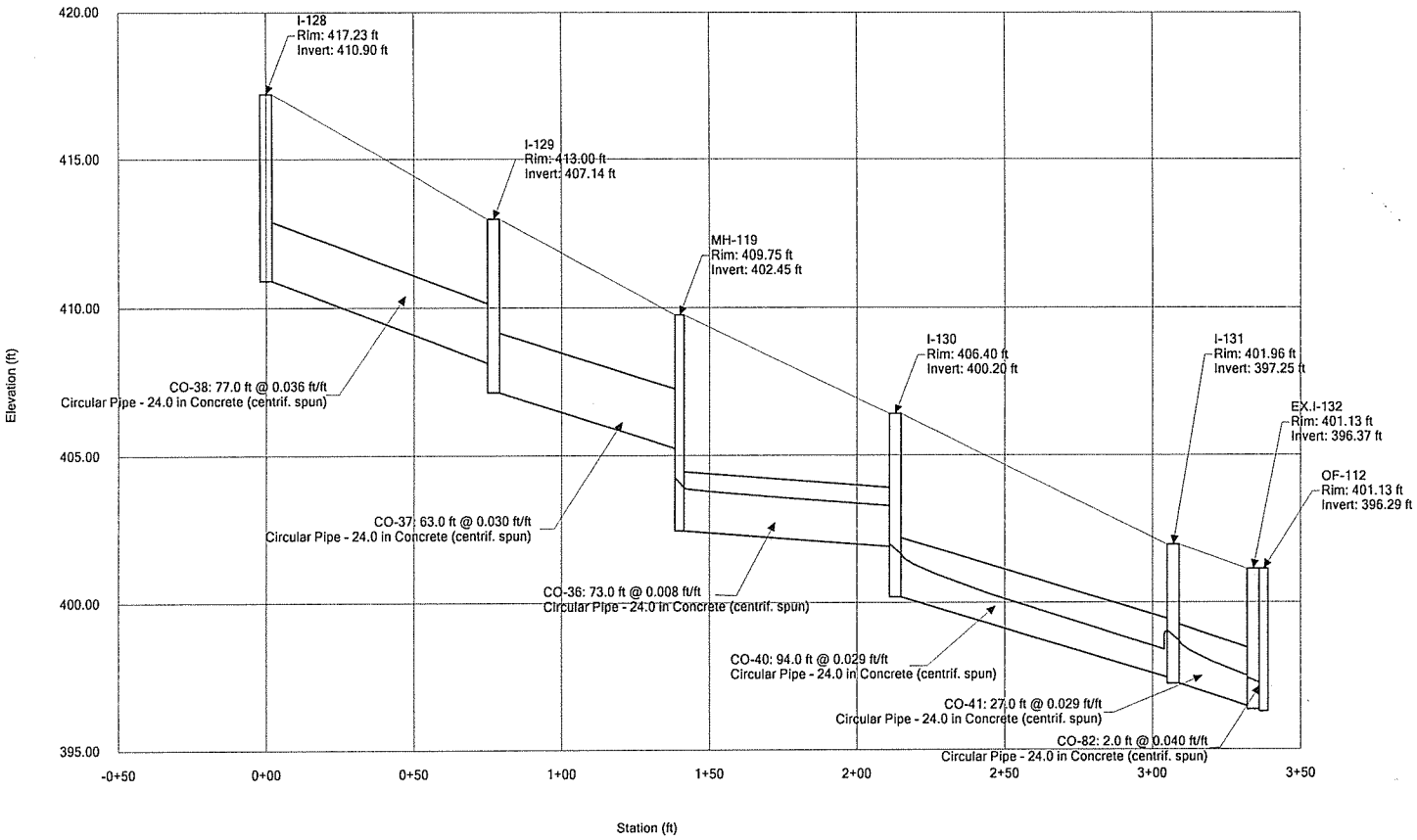
Profile Report

Engineering Profile - OS-RG-102 TO I-118 (100 YR stormcad-WLA_3-01-15.stc)



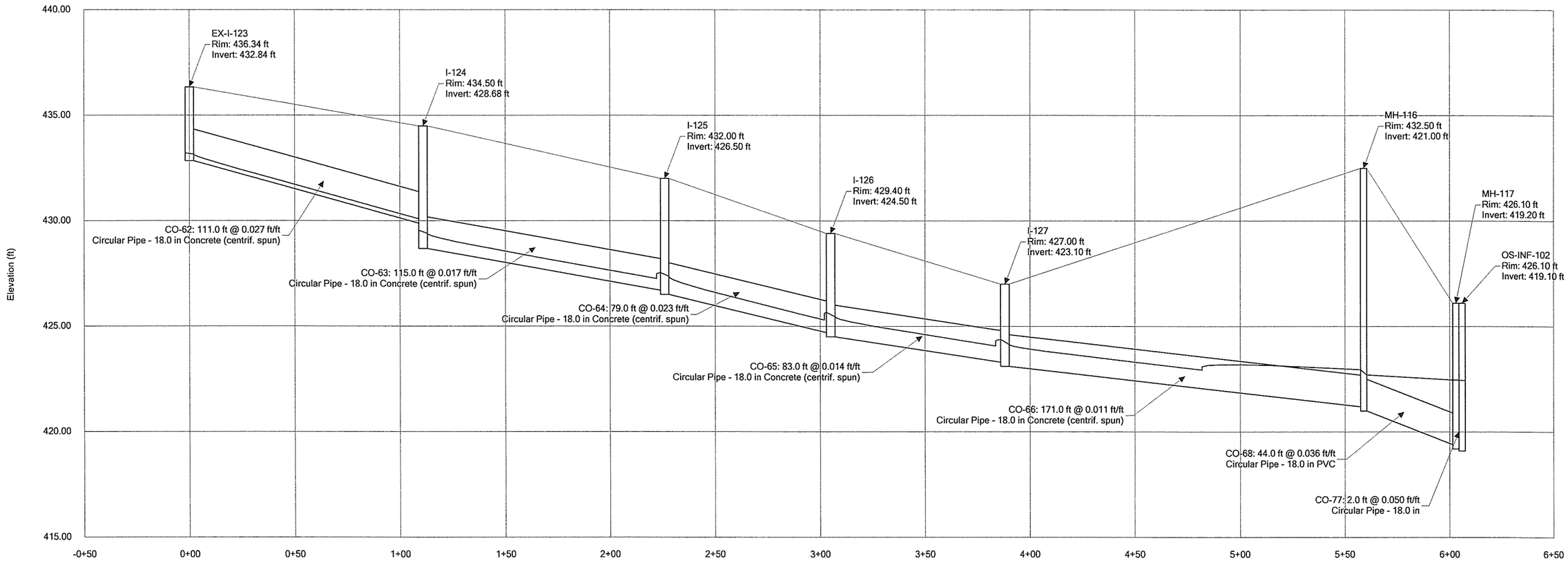
Profile Report

Engineering Profile - I-128 to EX-I-132 (100 YR stormcad-WLA_3-01-15.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

Profile Report
Engineering Profile - EX I-123 TO MH-117 (100 YR stormcad-WLA_3-01-15.stc)



Lancaster Avenue Housing
Drainage Areas

Inlet	A total	Lawn - B	Impervious	C wt	25 yr Q	100 yr Q
	SF	SF	SF		cfs	cfs
I-201	8096	1731	6365	0.83	***1.04***	**1.27**
I-202	3597	404	3193	0.91	***0.50***	**0.61**
I-203	980	0	980	0.99	***0.15***	**0.18**
I-204	8646	1349	7297	0.87	***1.16***	**1.42**
I-205	2972	203	2769	0.94	***0.43***	**0.52**
I-206	2556	200	2356	0.93	***0.37***	**0.45**
I-207	1521	0	1521	0.99	***0.23***	**0.28**
I-208	19603	5848	13755	0.77	***2.32***	**2.84**
I-209	15282	2923	12359	0.85	***1.99***	**2.44**
I-210	7784	729	7055	0.92	***1.10***	**1.35**
I-211	1700	674	1026	0.70	***0.18***	**0.22**
I-212	221	0	221	0.99	***0.03***	**0.04**
I-213	3851	196	3655	0.95	***0.56***	**0.69**
I-214	3200	200	3000	0.94	***0.46***	**0.57**
I-215	4918	0	4918	0.99	***0.75***	**0.92**
I-216	2600	0	2600	0.99	***0.40***	**0.48**
I-217	1036	0	1036	0.99	***0.16***	**0.19**
I-218	5040	0	5040	0.99	***0.77***	**0.94**
I-220	2266	0	2266	0.99	***0.35***	**0.42**
RD-201	4117	0	4117	0.99	***0.63***	**0.77**
RD-202	7288	0	7288	0.99	***1.11***	**1.36**
RD-203A	5809	0	5809	0.99	***0.88***	**1.08**
RD-203B	9368	0	9368	0.99	***1.43***	**1.74**
RD-204	5925	0	5925	0.99	***0.90***	**1.10**
RD-205	7177	0	7177	0.99	***1.09***	**1.34**
RD-206	4275	0	4275	0.99	***0.65***	**0.80**
RD-207	4115	0	4115	0.99	***0.63***	**0.77**
RD-208	5765	0	5765	0.99	***0.88***	**1.07**
RD-209	2044	0	2044	0.99	***0.31***	**0.38**
RD-210	2044	0	2044	0.99	***0.31***	**0.38**
RD-211	4269	0	4269	0.99	***0.65***	**0.79**
RD-212	5028	0	5028	0.99	***0.77***	**0.94**
YD-201	3422	2393	1029	0.47	***0.25***	**0.30**
YD-202	769	769	0	0.25	***0.03***	**0.04**
RG-201	14913	5667	9246	0.71	***1.63***	**1.99**
RG-202	15554	12247	3307	0.41	***0.97***	**1.19**
RG-203	15197	6330	8867	0.68	***1.59***	**1.95**
RG-204	13979	8915	5064	0.52	***1.11***	**1.36**
RG-205	24212	16893	7319	0.47	***1.76***	**2.16**
RG-206	12712	6085	6627	0.64	***1.24***	**1.52**
RG-207	11945	9326	2619	0.41	***0.76***	**0.93**
RG-208	18063	10879	7184	0.54	***1.51***	**1.85**
RG-209	9942	5557	4385	0.58	***0.88***	**1.08**
RG-210	19789	13573	6216	0.48	***1.47***	**1.80**
TD-201	10840	2921	7919	0.79	***1.32***	**1.61**

Q= (C wt) x I x (A total acres)

$$C\ wt = \frac{[0.99 \times (Impervious)] + [0.25 \times (Lawn - B)]}{A\ total}$$

I 25 =	6.70	in/hr; per PennDOT Road Design Manual, Vol III
I 100 =	8.19	Fig. 2.10.4.2(E), Region 5 I.D.F., 5 min. duration
C =	0.25	Lawn - B
C =	0.99	Impervious

Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc) 25 YR

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-214	FES 201	6.0	18.0	18.0	0.005	0.013	0.47	7.43	434.75	434.72	436.50	435.00	435.01	434.97	2.35
RG-210	MH-221	13.0	12.0	12.0	0.005	0.012	1.48	2.83	431.00	430.93	433.50	434.00	431.52	431.44	3.65
RG-209	YD-202	16.0	12.0	12.0	0.005	0.012	0.89	2.73	431.00	430.92	433.50	434.00	431.39	431.31	3.10
YD-201	YD-202	27.0	12.0	12.0	0.005	0.012	0.25	2.78	430.70	430.56	434.00	434.00	430.91	430.76	2.20
YD-202	DB-202	177.0	12.0	12.0	0.005	0.012	1.17	2.74	428.06	427.17	434.00	434.00	428.67	428.54	3.35
DB-202	MH-222	13.0	12.0	12.0	0.005	0.012	1.17	2.83	426.97	426.90	434.00	434.00	428.52	428.51	1.49
RD-203B		94.0	12.0	12.0	0.005	0.012	1.44	2.73	428.55	428.08	430.00	430.00	429.44	429.32	3.52
		24.0	12.0	12.0	0.005	0.012	1.44	2.73	428.08	427.96	430.00	430.00	429.32	429.28	1.83
		91.0	12.0	12.0	0.005	0.012	1.44	2.74	427.96	427.50	430.00	430.00	429.28	429.16	1.83
		24.0	12.0	12.0	0.005	0.012	1.44	2.73	427.50	427.38	430.00	430.00	429.16	429.12	1.83
		74.0	12.0	12.0	0.005	0.012	1.44	2.73	427.38	427.01	430.00	430.00	429.12	429.02	1.83
	Cistern 201B	22.0	12.0	12.0	0.005	0.012	1.44	2.73	427.01	426.90	430.00	430.50	429.02	428.99	1.83
RD-203A		104.0	8.0	8.0	0.005	0.012	0.89	0.93	428.31	427.79	435.00	435.00	430.23	429.75	2.55
		58.0	8.0	8.0	0.005	0.012	0.89	0.93	427.79	427.50	435.00	435.00	429.75	429.48	2.55
RD-207		52.0	12.0	12.0	0.010	0.012	0.63	3.78	433.00	432.50	435.00	435.00	433.33	432.96	3.57
		113.0	12.0	12.0	0.009	0.012	0.63	3.63	432.50	431.50	435.00	435.00	432.96	432.95	3.47
RD-208		13.0	12.0	12.0	0.032	0.012	0.89	6.85	431.20	430.79	435.00	435.00	433.06	433.05	1.13
		24.0	12.0	12.0	0.005	0.012	0.89	2.73	430.79	430.67	435.00	435.00	433.05	433.04	1.13
		156.0	12.0	12.0	0.005	0.012	0.89	2.73	430.67	429.89	435.00	435.00	433.04	432.95	1.13
	RD-205	133.0	12.0	12.0	0.005	0.012	1.52	2.74	429.89	429.22	435.00	435.00	432.95	432.75	1.93
RD-206		51.0	12.0	12.0	0.020	0.012	0.66	5.40	434.00	433.00	436.00	435.00	434.34	433.24	4.67
	RD-205	113.0	12.0	12.0	0.013	0.012	0.66	4.45	433.00	431.50	435.00	435.00	433.34	432.75	4.06
RD-205		237.0	12.0	12.0	0.004	0.012	3.28	2.45	429.22	428.26	435.00	435.00	432.61	430.90	4.18
RD-210		130.0	8.0	8.0	0.029	0.012	0.31	2.22	432.00	428.26	435.00	435.00	432.26	430.90	4.50
		164.0	12.0	12.0	0.005	0.012	3.59	2.63	428.26	427.50	435.00	435.00	430.90	429.48	4.58
		16.0	15.0	15.0	0.005	0.012	4.49	4.95	427.50	427.42	435.00	435.00	429.48	429.41	3.66
		58.0	15.0	15.0	0.005	0.012	4.49	4.95	427.42	427.13	435.00	435.00	429.41	429.17	3.66
	MH-203	45.0	15.0	15.0	0.005	0.012	4.49	5.00	427.13	426.90	435.00	430.50	429.17	428.99	3.66
RD-201	DB 203	176.0	8.0	8.0	0.009	0.012	0.63	1.21	433.00	431.50	435.00	434.00	433.37	431.84	3.50
DB 203	MH-203	64.0	8.0	8.0	0.063	0.012	0.63	3.27	431.50	427.50	434.00	430.50	431.87	428.99	7.24

150

Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
RD-202		102.0	12.0	12.0	0.005	0.012	1.12	2.73	428.00	427.49	430.00	430.00	429.21	429.13	1.42
		21.0	12.0	12.0	0.005	0.012	1.12	2.79	427.49	427.38	430.00	430.00	429.13	429.11	1.42
	MH-203	143.0	12.0	12.0	0.003	0.012	1.12	2.24	427.38	426.90	430.00	430.50	429.11	428.99	1.42
RG-201	I-205	35.0	12.0	12.0	0.006	0.012	1.64	2.92	431.10	430.90	436.50	436.64	431.64	431.44	3.82
I-207	I-206	64.0	18.0	18.0	0.005	0.012	0.23	8.05	433.50	433.18	438.50	437.37	433.68	433.36	2.02
I-206	I-205	43.0	18.0	18.0	0.005	0.012	0.60	8.14	433.00	432.78	437.37	436.64	433.29	433.06	2.70
I-205	I-204	83.0	18.0	18.0	0.005	0.012	2.67	8.09	430.70	430.28	436.64	435.53	431.32	430.98	4.11
I-204	I-203	91.0	18.0	18.0	0.005	0.012	3.85	8.09	430.08	429.62	435.53	435.00	430.83	430.35	4.52
I-203	I-202	48.0	18.0	18.0	0.005	0.012	4.00	8.05	429.42	429.18	435.00	433.78	430.19	429.93	4.55
RG-203	DB-205	38.0	12.0	12.0	0.005	0.012	1.61	2.73	426.80	426.61	431.25	434.25	428.61	428.54	2.05
RG-208	DB-207	100.0	12.0	12.0	0.005	0.012	1.52	2.73	428.58	428.08	435.00	435.34	429.58	429.42	3.57
RG-202	DB-207	17.0	12.0	12.0	0.005	0.012	0.98	2.81	430.80	430.71	435.00	435.34	431.22	431.12	3.26
DB-207	DB-206	76.0	12.0	12.0	0.005	0.012	2.51	2.73	427.88	427.50	435.34	436.00	429.34	429.02	3.19
DB-206	DB-205	95.0	12.0	12.0	0.005	0.012	2.51	2.74	427.30	426.82	436.00	434.25	428.94	428.54	3.19
DB-205	I-202	45.0	12.0	12.0	0.005	0.012	4.11	2.76	426.41	426.18	434.25	433.78	428.33	427.82	5.24
I-202	I-201	77.0	18.0	18.0	0.005	0.012	8.62	8.10	425.98	425.59	433.78	431.70	427.63	427.19	4.88
I-201	INF-201A	36.0	18.0	18.0	0.005	0.012	9.66	8.05	425.40	425.22	431.70	430.80	426.96	426.70	5.47
I-208	INF-201B	6.0	12.0	12.0	0.005	0.012	2.34	2.73	424.73	424.70	428.88	429.30	426.72	426.70	2.98
I-219	MH-215	210.0	24.0	24.0	0.005	0.012	15.00	17.33	426.15	425.10	434.50	431.50	427.59	426.64	6.21
MH-215	MH-220 Outfall to Exist Pipe	76.0	24.0	24.0	0.005	0.012	15.00	17.33	424.90	424.52	431.50	431.50	426.34	425.92	6.21
INF-201 Outlet	INF-201 Outfall	14.0	30.0	30.0	0.093	0.012	12.24	135.40	423.30	422.00	428.40	423.00	424.47	422.68	17.12
DET-201 Outlet	MH-202	47.0	18.0	18.0	0.005	0.012	5.58	8.13	425.00	424.76	430.90	430.10	426.25	426.19	4.96
RG-205	Cistern 201 Outlet	7.0	12.0	12.0	0.006	0.012	1.78	2.92	425.30	425.26	428.75	430.00	426.66	426.64	2.26
Cistern 201 Outlet	MH-202	94.0	24.0	24.0	0.005	0.012	13.94	17.33	424.00	423.53	430.00	430.10	426.49	426.19	4.44
MH-202	MH-201	100.0	24.0	24.0	0.005	0.012	19.52	17.33	423.33	422.83	430.10	430.00	425.89	425.25	6.21

Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
RG-204	MH-201	36.0	12.0	12.0	0.005	0.012	1.12	2.73	425.30	425.12	428.75	430.00	425.75	425.57	3.30
MH-201	MH-218	67.0	24.0	24.0	0.005	0.012	20.64	17.46	422.63	422.29	430.00	429.95	424.92	424.44	6.57
MH-218	MH-219	76.0	24.0	24.0	0.005	0.012	20.64	17.33	422.09	421.71	429.95	429.00	424.11	423.58	6.57
MH-219	MH-223	28.0	24.0	24.0	0.009	0.012	20.64	23.61	421.51	421.25	429.00	428.46	423.14	422.74	8.47
I-213	INF-202C	9.0	12.0	12.0	0.006	0.012	0.57	2.88	420.95	420.90	425.90	426.80	422.16	422.16	0.72
I-209	INF-202A	12.0	12.0	12.0	0.192	0.012	2.01	16.90	421.80	419.50	428.17	428.35	422.40	422.16	14.48
I-212	I-211	30.0	12.0	12.0	0.005	0.012	0.03	2.73	417.20	417.05	420.90	422.30	417.99	417.99	1.19
I-211	I-210	47.0	12.0	12.0	0.005	0.012	0.22	2.76	416.85	416.61	422.30	421.30	417.99	417.99	0.28
I-210	INF-203A	5.0	12.0	12.0	0.020	0.012	1.33	5.46	416.10	416.00	421.30	422.50	417.97	417.96	1.69
RD-212	MH-220	113.0	8.0	8.0	0.027	0.012	0.77	2.13	419.00	416.00	421.10	418.10	419.42	416.50	5.62
I-220	INF-203B	5.0	12.0	12.0	0.020	0.012	0.35	5.46	416.10	416.00	423.75	423.75	417.96	417.96	0.44
RD-211		84.0	8.0	8.0	0.024	0.012	0.66	2.02	433.00	431.00	435.00	433.25	433.38	431.26	5.17
		50.0	8.0	8.0	0.020	0.012	0.66	1.85	431.00	430.00	433.25	432.50	431.38	430.27	4.85
	CIST 202	20.0	12.0	12.0	0.005	0.012	0.66	2.73	416.00	415.90	432.50	418.25	416.50	416.50	2.86
RG-206	I-218	26.0	12.0	12.0	0.005	0.012	1.25	2.73	427.80	427.67	432.50	432.00	428.28	428.14	3.40
I-218	I-217	38.0	18.0	18.0	0.007	0.012	2.03	9.59	427.17	426.90	432.00	430.60	427.71	427.66	4.30
I-217	I-216	98.0	18.0	18.0	0.051	0.012	4.33	25.70	426.70	421.70	430.60	425.40	427.50	422.51	10.81
I-216	I-215	112.0	18.0	18.0	0.057	0.012	4.72	27.20	421.50	415.10	425.40	418.80	422.34	415.99	11.55
I-215	MH-208	47.0	18.0	18.0	0.038	0.012	5.48	22.14	414.90	413.12	418.80	416.00	415.80	415.00	10.39
INF-202 Outlet	INF-203 Outlet	81.0	24.0	24.0	0.041	0.012	21.04	49.46	419.50	416.20	426.60	423.75	421.14	420.42	15.11
INF-203 Outlet	MH-210	23.0	24.0	24.0	0.017	0.012	22.58	32.32	414.90	414.50	423.75	424.00	420.02	419.82	7.19
INF-201 Outfall	MH-210	4.0	18.0	18.0	0.025	0.012	12.00	17.99	418.00	417.90	422.00	424.00	419.87	419.82	6.79
MH-210	MH-208	20.0	18.0	18.0	0.014	0.012	34.58	13.46	413.40	413.12	424.00	416.00	416.85	415.00	19.57

Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc) 100 YR

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
I-214	FES 201	6.0	18.0	18.0	0.005	0.013	0.58	7.43	434.75	434.72	436.50	435.00	435.03	435.00	2.50
RG-210	MH-221	13.0	12.0	12.0	0.005	0.012	1.81	2.83	431.00	430.93	433.50	434.00	431.58	431.50	3.82
RG-209	YD-202	16.0	12.0	12.0	0.005	0.012	1.09	2.73	431.00	430.92	433.50	434.00	431.44	431.36	3.27
YD-201	YD-202	27.0	12.0	12.0	0.005	0.012	0.31	2.78	430.70	430.56	434.00	434.00	430.93	430.78	2.33
YD-202	DB-202	177.0	12.0	12.0	0.005	0.012	1.43	2.74	428.06	427.17	434.00	434.00	428.76	428.55	3.52
DB-202	MH-222	13.0	12.0	12.0	0.005	0.012	1.43	2.83	426.97	426.90	434.00	434.00	428.53	428.51	1.82
RD-203B		94.0	12.0	12.0	0.005	0.012	1.76	2.73	428.55	428.08	430.00	430.00	429.67	429.48	2.24
		24.0	12.0	12.0	0.005	0.012	1.76	2.73	428.08	427.96	430.00	430.00	429.48	429.43	2.24
		91.0	12.0	12.0	0.005	0.012	1.76	2.74	427.96	427.50	430.00	430.00	429.43	429.24	2.24
		24.0	12.0	12.0	0.005	0.012	1.76	2.73	427.50	427.38	430.00	430.00	429.24	429.19	2.24
		74.0	12.0	12.0	0.005	0.012	1.76	2.73	427.38	427.01	430.00	430.00	429.19	429.04	2.24
	Cistern 201B	22.0	12.0	12.0	0.005	0.012	1.76	2.73	427.01	426.90	430.00	430.50	429.04	428.99	2.24
RD-203A		104.0	8.0	8.0	0.005	0.012	1.09	0.93	428.31	427.79	435.00	435.00	430.84	430.12	3.12
		58.0	8.0	8.0	0.005	0.012	1.09	0.93	427.79	427.50	435.00	435.00	430.12	429.72	3.12
RD-207		52.0	12.0	12.0	0.010	0.012	0.77	3.78	433.00	432.50	435.00	435.00	434.98	434.96	0.99
		113.0	12.0	12.0	0.009	0.012	0.77	3.63	432.50	431.50	435.00	435.00	434.96	434.91	0.99
RD-208		13.0	12.0	12.0	0.032	0.012	1.08	6.85	431.20	430.79	435.00	435.00	435.07	435.06	1.38
		24.0	12.0	12.0	0.005	0.012	1.08	2.73	430.79	430.67	435.00	435.00	435.06	435.04	1.38
		156.0	12.0	12.0	0.005	0.012	1.08	2.73	430.67	429.89	435.00	435.00	435.04	434.91	1.38
	RD-205	133.0	12.0	12.0	0.005	0.012	1.86	2.74	429.89	429.22	435.00	435.00	434.91	434.61	2.36
RD-206		51.0	12.0	12.0	0.020	0.012	0.81	5.40	434.00	433.00	436.00	435.00	434.66	434.66	4.94
	RD-205	113.0	12.0	12.0	0.013	0.012	0.81	4.45	433.00	431.50	435.00	435.00	434.66	434.61	1.03
RD-205		237.0	12.0	12.0	0.004	0.012	4.01	2.45	429.22	428.26	435.00	435.00	434.40	431.85	5.11
RD-210		130.0	8.0	8.0	0.029	0.012	0.38	2.22	432.00	428.26	435.00	435.00	432.29	431.85	4.76
		164.0	12.0	12.0	0.005	0.012	4.39	2.63	428.26	427.50	435.00	435.00	431.85	429.72	5.59
		16.0	15.0	15.0	0.005	0.012	5.48	4.95	427.50	427.42	435.00	435.00	429.72	429.62	4.47
		58.0	15.0	15.0	0.005	0.012	5.48	4.95	427.42	427.13	435.00	435.00	429.62	429.27	4.47
	MH-203	45.0	15.0	15.0	0.005	0.012	5.48	5.00	427.13	426.90	435.00	430.50	429.27	428.99	4.47
RD-201	DB 203	176.0	8.0	8.0	0.009	0.012	0.77	1.21	433.00	431.50	435.00	434.00	433.42	431.89	3.67
DB 203	MH-203	64.0	8.0	8.0	0.063	0.012	0.77	3.27	431.50	427.50	434.00	430.50	431.92	428.99	7.67

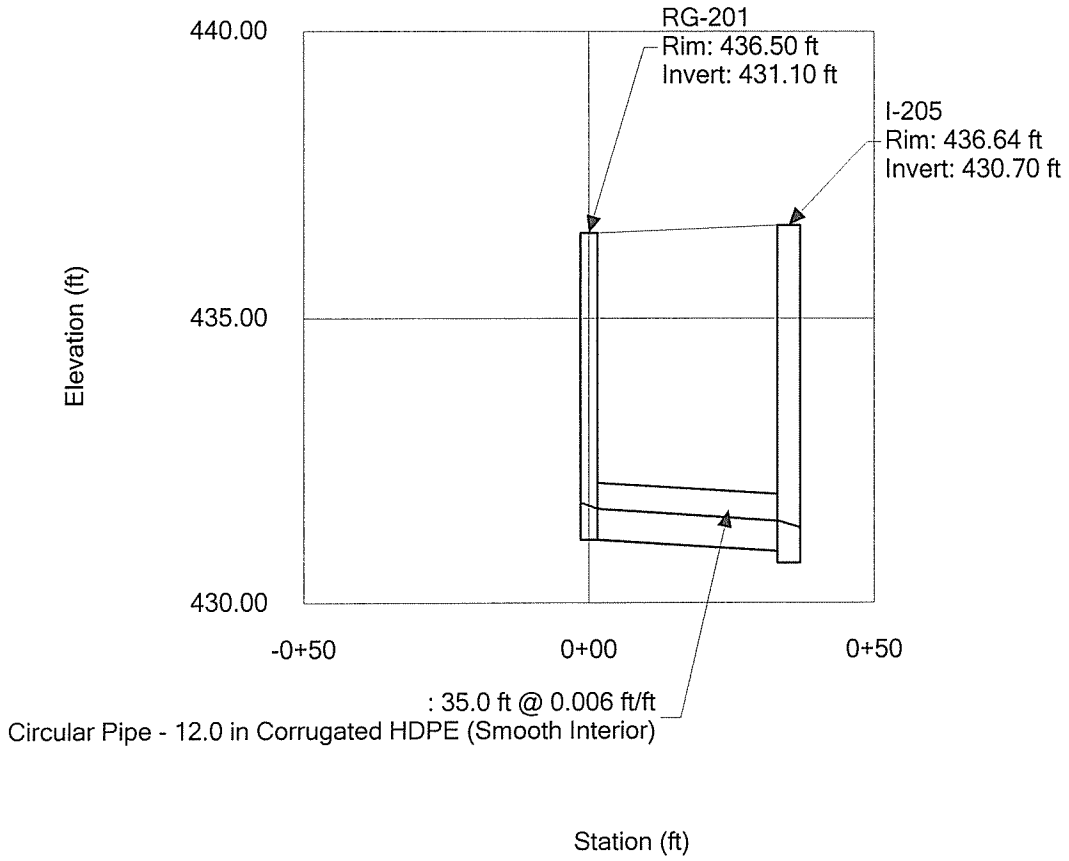
Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc)

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
RD-202		102.0	12.0	12.0	0.005	0.012	1.37	2.73	428.00	427.49	430.00	430.00	429.32	429.20	1.74
		21.0	12.0	12.0	0.005	0.012	1.37	2.79	427.49	427.38	430.00	430.00	429.20	429.17	1.74
	MH-203	143.0	12.0	12.0	0.003	0.012	1.37	2.24	427.38	426.90	430.00	430.50	429.17	428.99	1.74
RG-201	I-205	35.0	12.0	12.0	0.006	0.012	2.00	2.92	431.10	430.90	436.50	436.64	431.71	431.52	4.00
I-207	I-206	64.0	18.0	18.0	0.005	0.012	0.29	8.05	433.50	433.18	438.50	437.37	433.70	433.37	2.14
I-206	I-205	43.0	18.0	18.0	0.005	0.012	0.74	8.14	433.00	432.78	437.37	436.64	433.32	433.08	2.86
I-205	I-204	83.0	18.0	18.0	0.005	0.012	3.27	8.09	430.70	430.28	436.64	435.53	431.39	431.08	4.34
I-204	I-203	91.0	18.0	18.0	0.005	0.012	4.70	8.09	430.08	429.62	435.53	435.00	430.91	430.44	4.75
I-203	I-202	48.0	18.0	18.0	0.005	0.012	4.89	8.05	429.42	429.18	435.00	433.78	430.27	430.02	4.77
RG-203	DB-205	38.0	12.0	12.0	0.005	0.012	1.96	2.73	426.80	426.61	431.25	434.25	429.55	429.45	2.50
RG-208	DB-207	100.0	12.0	12.0	0.005	0.012	1.86	2.73	428.58	428.08	435.00	435.34	431.00	430.77	2.37
RG-202	DB-207	17.0	12.0	12.0	0.005	0.012	1.20	2.81	430.80	430.71	435.00	435.34	431.26	431.17	3.44
DB-207	DB-206	76.0	12.0	12.0	0.005	0.012	3.06	2.73	427.88	427.50	435.34	436.00	430.65	430.17	3.90
DB-206	DB-205	95.0	12.0	12.0	0.005	0.012	3.06	2.74	427.30	426.82	436.00	434.25	430.05	429.45	3.90
DB-205	I-202	45.0	12.0	12.0	0.005	0.012	5.03	2.76	426.41	426.18	434.25	433.78	429.14	428.37	6.40
I-202	I-201	77.0	18.0	18.0	0.005	0.012	10.53	8.10	425.98	425.59	433.78	431.70	428.10	427.44	5.96
I-201	INF-201A	36.0	18.0	18.0	0.005	0.012	11.81	8.05	425.40	425.22	431.70	430.80	427.09	426.70	6.68
I-208	INF-201B	6.0	12.0	12.0	0.005	0.012	2.86	2.73	424.73	424.70	428.88	429.30	426.73	426.70	3.64
I-219	MH-215	210.0	24.0	24.0	0.005	0.012	15.00	17.33	426.15	425.10	434.50	431.50	427.59	426.64	6.21
MH-215	MH-220 Outfall to Exist Pipe	76.0	24.0	24.0	0.005	0.012	15.00	17.33	424.90	424.52	431.50	431.50	426.34	425.92	6.21
INF-201 Outlet	INF-201 Outfall	14.0	30.0	30.0	0.093	0.012	12.24	135.40	423.30	422.00	428.40	423.00	424.47	422.68	17.12
DET-201 Outlet	MH-202	47.0	18.0	18.0	0.005	0.012	5.58	8.13	425.00	424.76	430.90	430.10	426.49	426.38	4.96
RG-205	Cistern 201 Outlet	7.0	12.0	12.0	0.006	0.012	2.17	2.92	425.30	425.26	428.75	430.00	426.89	426.86	2.77
Cistern 201 Outlet	MH-202	94.0	24.0	24.0	0.005	0.012	14.33	17.33	424.00	423.53	430.00	430.10	426.70	426.38	4.56
MH-202	MH-201	100.0	24.0	24.0	0.005	0.012	19.91	17.33	423.33	422.83	430.10	430.00	426.07	425.41	6.34

Conduit FlexTable: Combined Pipe/Node Report (StormCAD - LAH.stc)

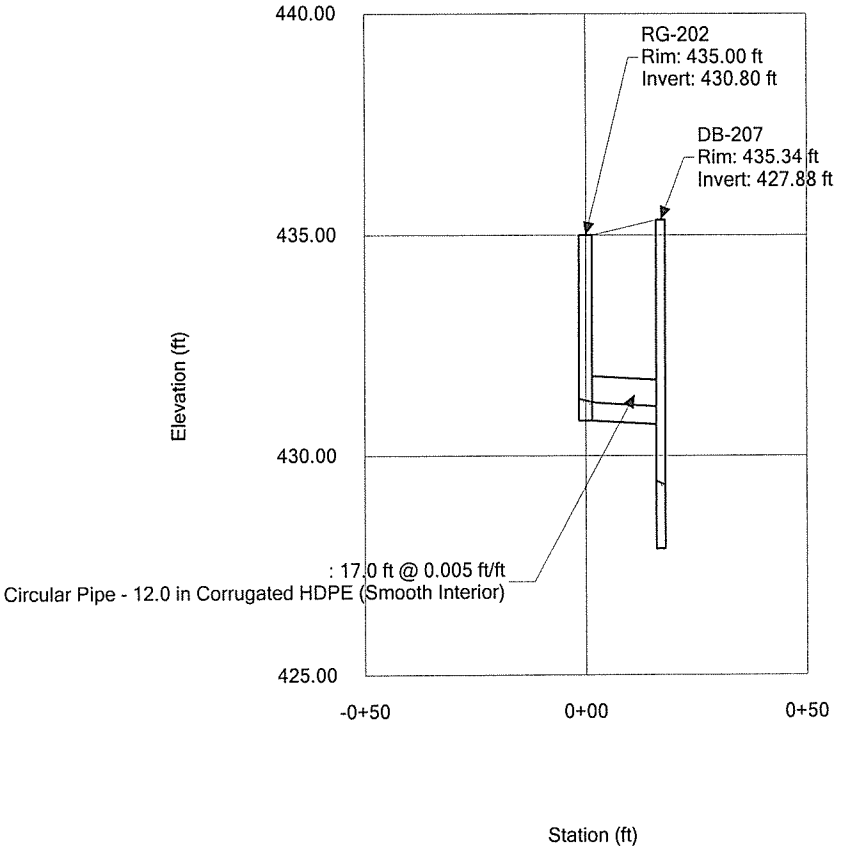
Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Total Flow (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Downstream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
RG-204	MH-201	36.0	12.0	12.0	0.005	0.012	1.37	2.73	425.30	425.12	428.75	430.00	425.80	425.62	3.48
MH-201	MH-218	67.0	24.0	24.0	0.005	0.012	21.29	17.46	422.63	422.29	430.00	429.95	425.05	424.55	6.78
MH-218	MH-219	76.0	24.0	24.0	0.005	0.012	21.29	17.33	422.09	421.71	429.95	429.00	424.19	423.62	6.78
MH-219	MH-223	28.0	24.0	24.0	0.009	0.012	21.29	23.61	421.51	421.25	429.00	428.46	423.16	422.77	8.51
I-213	INF-202C	9.0	12.0	12.0	0.006	0.012	0.70	2.88	420.95	420.90	425.90	426.80	422.16	422.16	0.88
I-209	INF-202A	12.0	12.0	12.0	0.192	0.012	2.46	16.90	421.80	419.50	428.17	428.35	422.47	422.16	15.34
I-212	I-211	30.0	12.0	12.0	0.005	0.012	0.04	2.73	417.20	417.05	420.90	422.30	418.01	418.01	1.27
I-211	I-210	47.0	12.0	12.0	0.005	0.012	0.27	2.76	416.85	416.61	422.30	421.30	418.00	418.00	0.34
I-210	INF-203A	5.0	12.0	12.0	0.020	0.012	1.62	5.46	416.10	416.00	421.30	422.50	417.97	417.96	2.07
RD-212	MH-220	113.0	8.0	8.0	0.027	0.012	0.94	2.13	419.00	416.00	421.10	418.10	419.46	416.50	5.92
I-220	INF-203B	5.0	12.0	12.0	0.020	0.012	0.43	5.46	416.10	416.00	423.75	423.75	417.96	417.96	0.54
RD-211		84.0	8.0	8.0	0.024	0.012	0.80	2.02	433.00	431.00	435.00	433.25	433.42	431.29	5.46
		50.0	8.0	8.0	0.020	0.012	0.80	1.85	431.00	430.00	433.25	432.50	431.42	430.31	5.11
	CIST 202	20.0	12.0	12.0	0.005	0.012	0.80	2.73	416.00	415.90	432.50	418.25	416.50	416.50	3.02
RG-206	I-218	26.0	12.0	12.0	0.005	0.012	1.53	2.73	427.80	427.67	432.50	432.00	428.34	428.20	3.58
I-218	I-217	38.0	18.0	18.0	0.007	0.012	2.48	9.59	427.17	426.90	432.00	430.60	427.77	427.72	4.55
I-217	I-216	98.0	18.0	18.0	0.051	0.012	4.81	25.70	426.70	421.70	430.60	425.40	427.54	422.57	11.15
I-216	I-215	112.0	18.0	18.0	0.057	0.012	5.30	27.20	421.50	415.10	425.40	418.80	422.39	416.07	11.93
I-215	MH-208	47.0	18.0	18.0	0.038	0.012	6.22	22.14	414.90	413.12	418.80	416.00	415.86	415.00	10.76
INF-202 Outlet	INF-203 Outlet	81.0	24.0	24.0	0.041	0.012	21.04	49.46	419.50	416.20	426.60	423.75	421.14	420.42	15.11
INF-203 Outlet	MH-210	23.0	24.0	24.0	0.017	0.012	22.58	32.32	414.90	414.50	423.75	424.00	420.02	419.82	7.19
INF-201 Outfall	MH-210	4.0	18.0	18.0	0.025	0.012	12.00	17.99	418.00	417.90	422.00	424.00	419.87	419.82	6.79
MH-210	MH-208	20.0	18.0	18.0	0.014	0.012	34.58	13.46	413.40	413.12	424.00	416.00	416.85	415.00	19.57

Profile Report
Engineering Profile - RG-201 TO I-205 (StormCAD - LAH.stc)



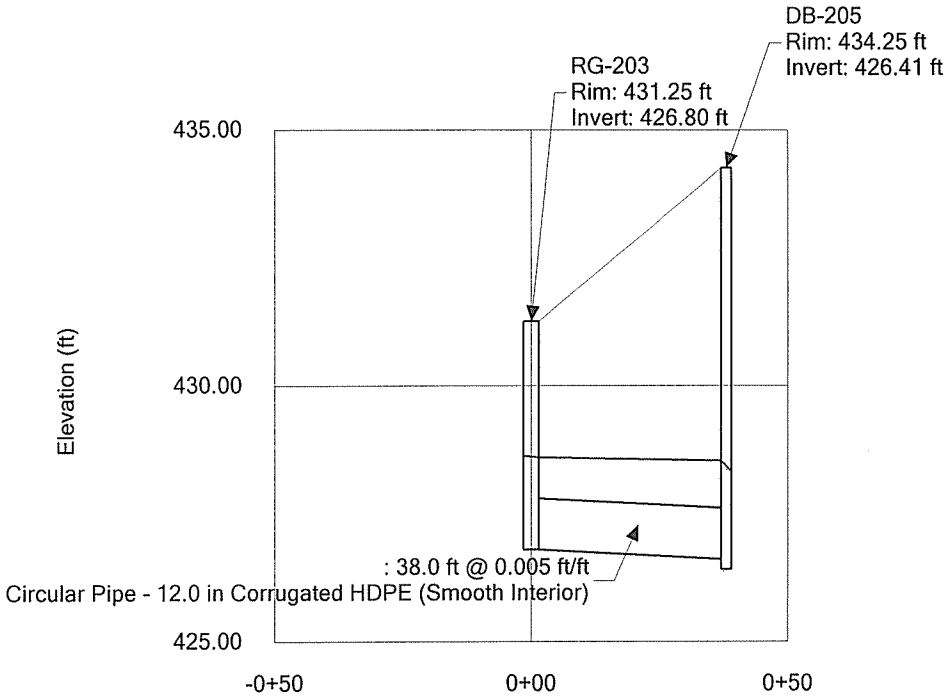
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RG-202 TO DB-207 (StormCAD - LAH.stc)



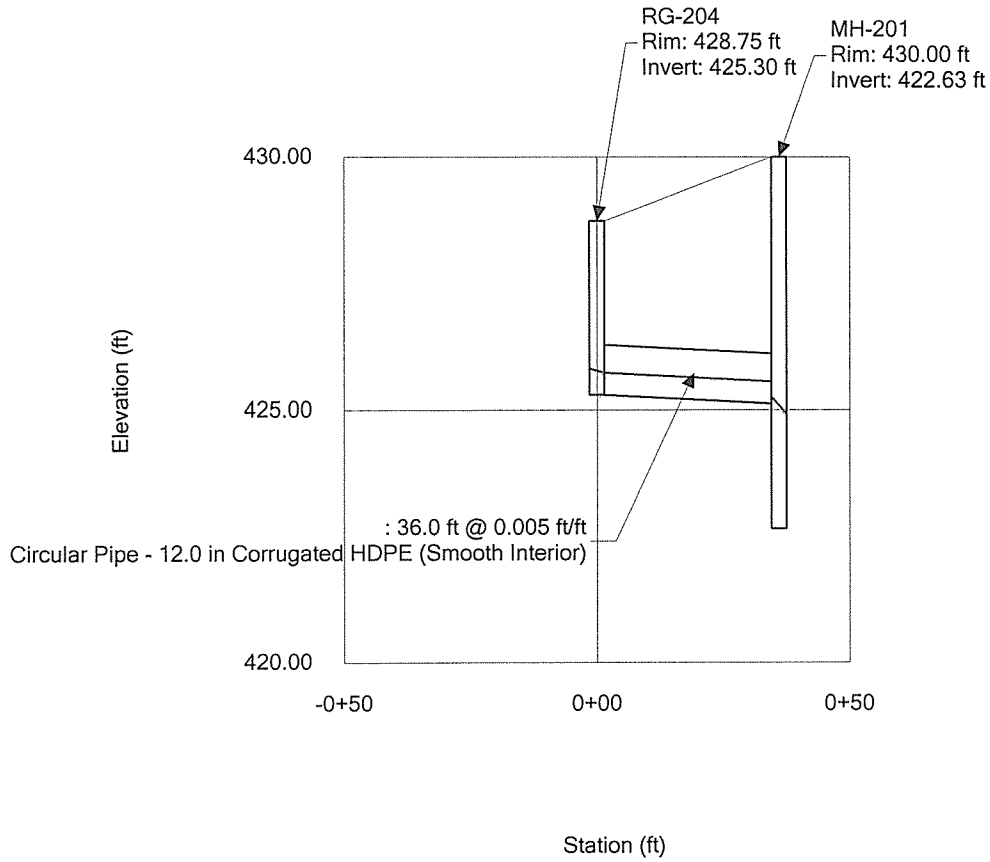
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RG-203 TO DB-205 (StormCAD - LAH.stc)



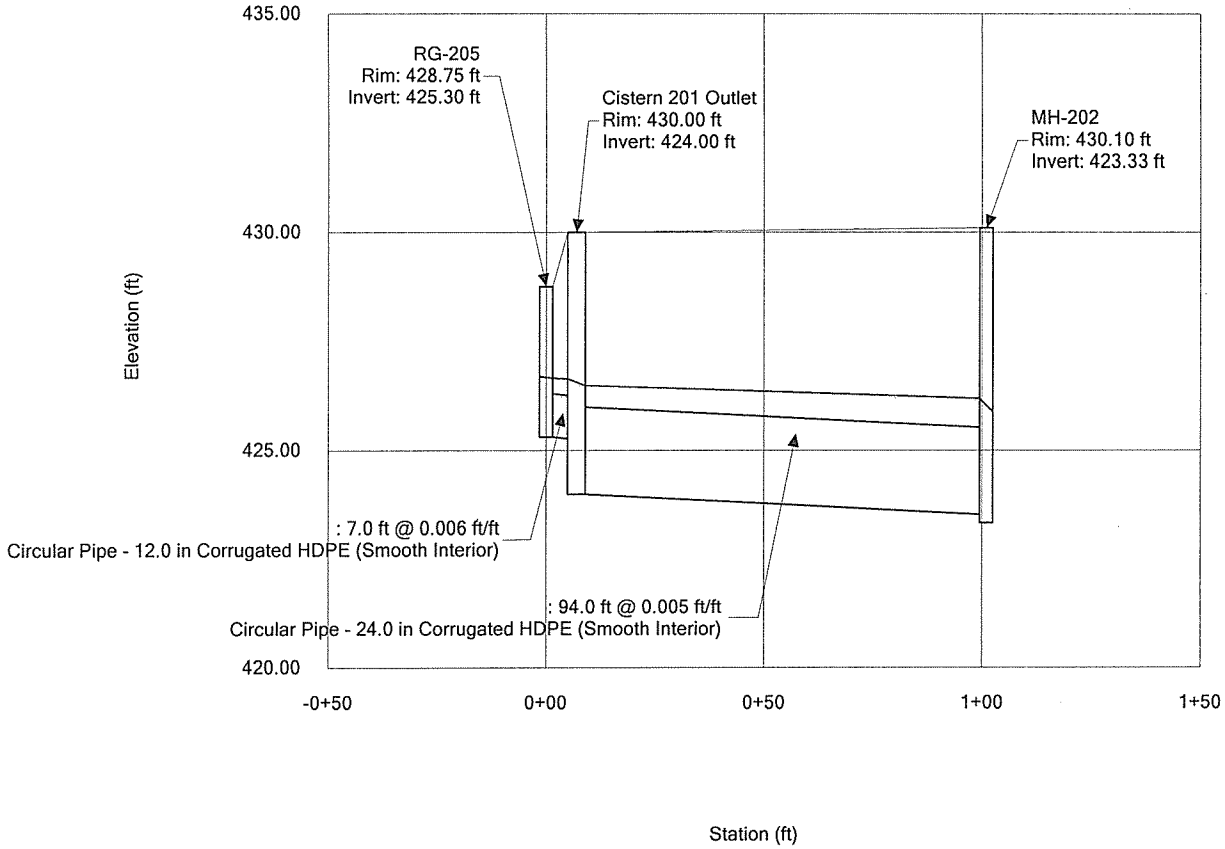
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RG-204 TO MH-201 (StormCAD - LAH.stc)



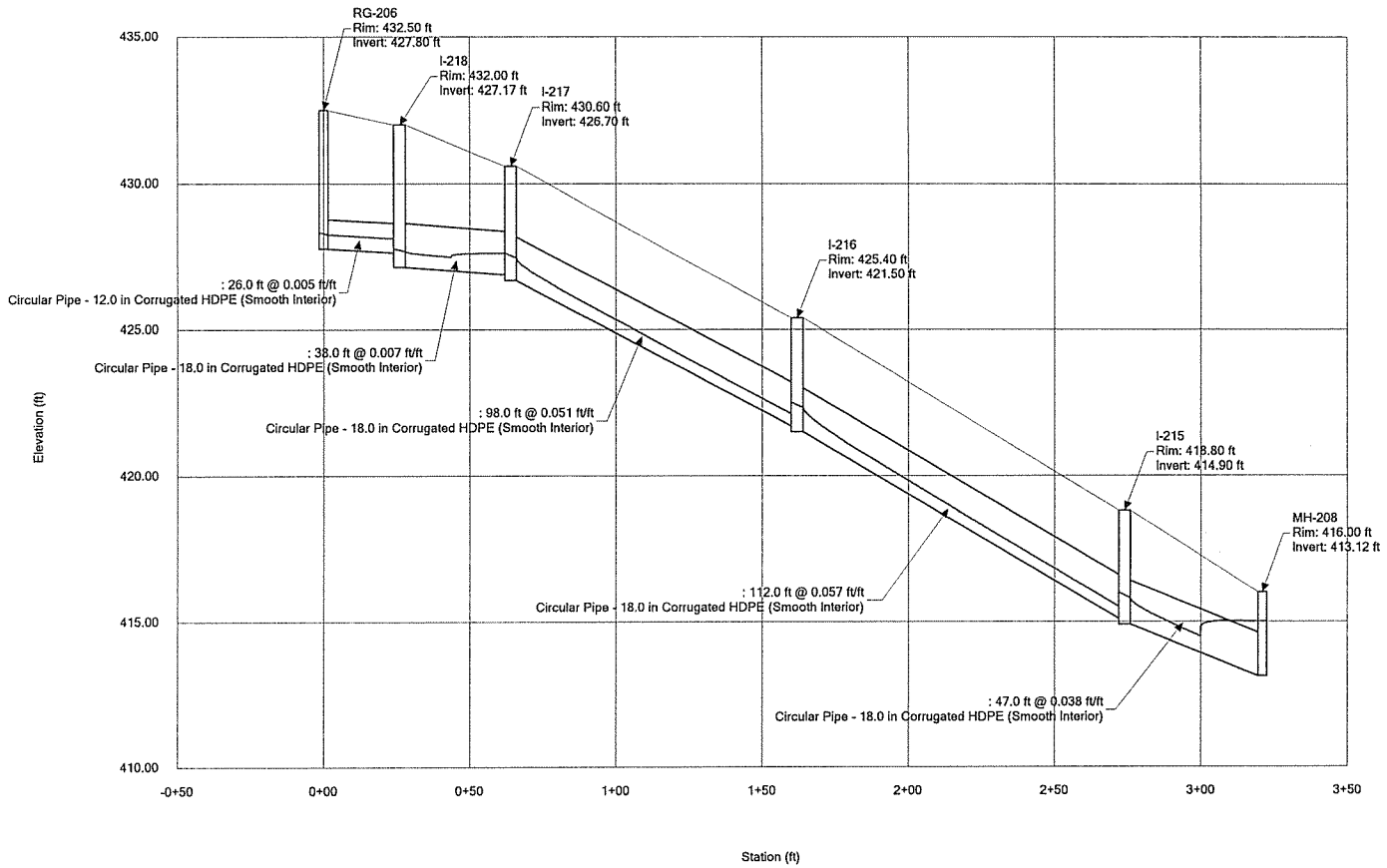
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RG-205 TO MH-202 (StormCAD - LAH.stc)

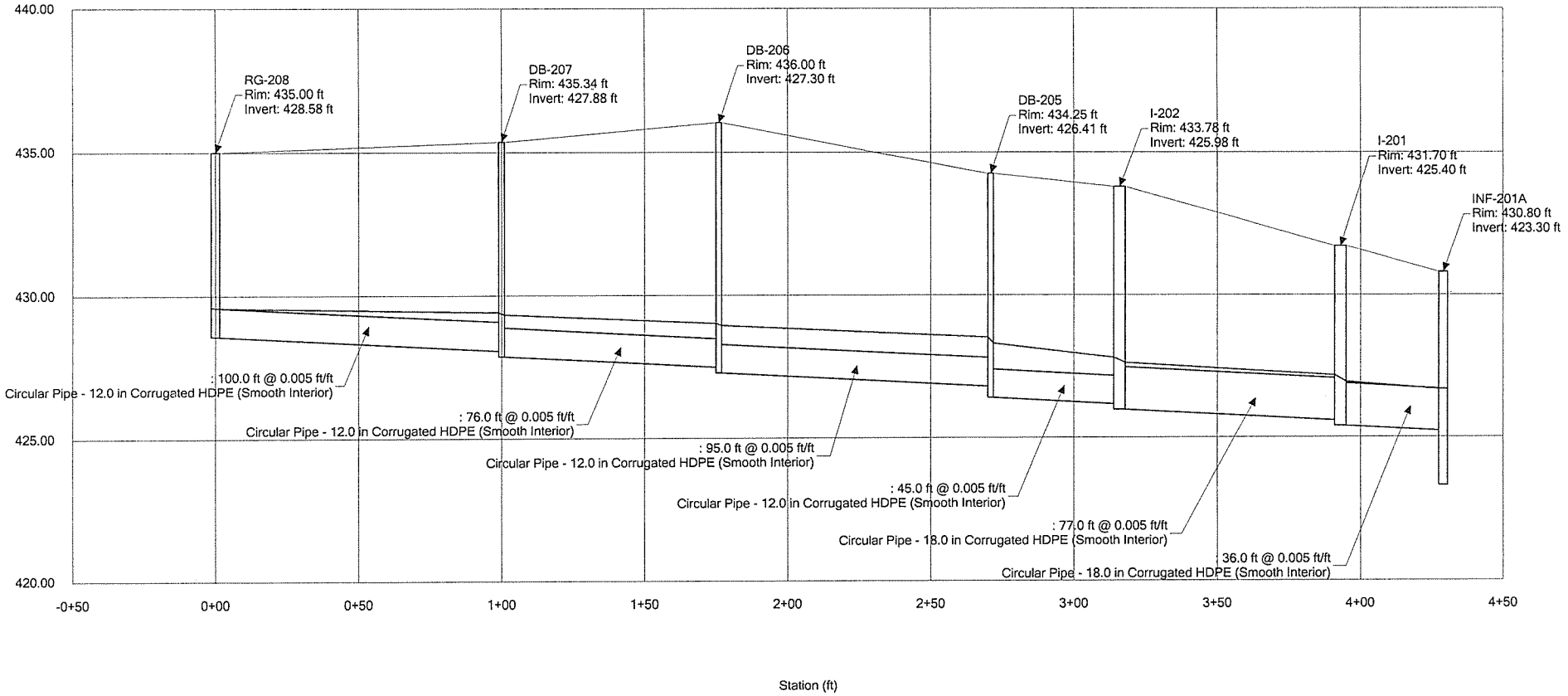


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

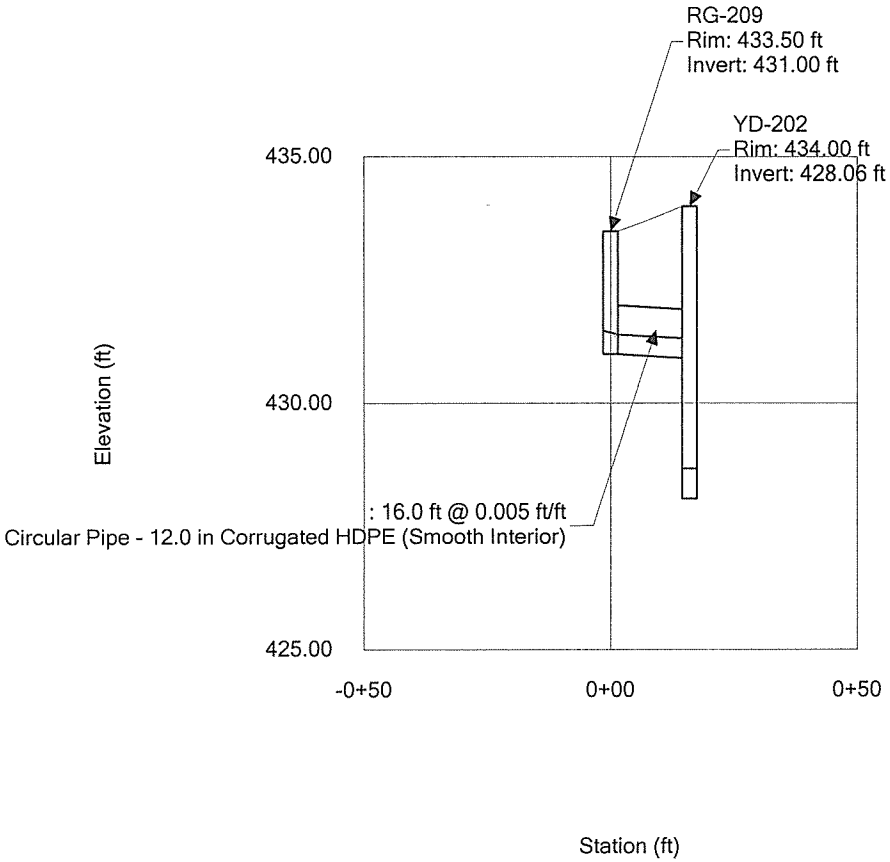
Profile Report
Engineering Profile - RG-206 TO MH-208 (StormCAD - LAH.stc)



Profile Report
Engineering Profile - RG-208 TO INF-201A (StormCAD - LAH.stc)

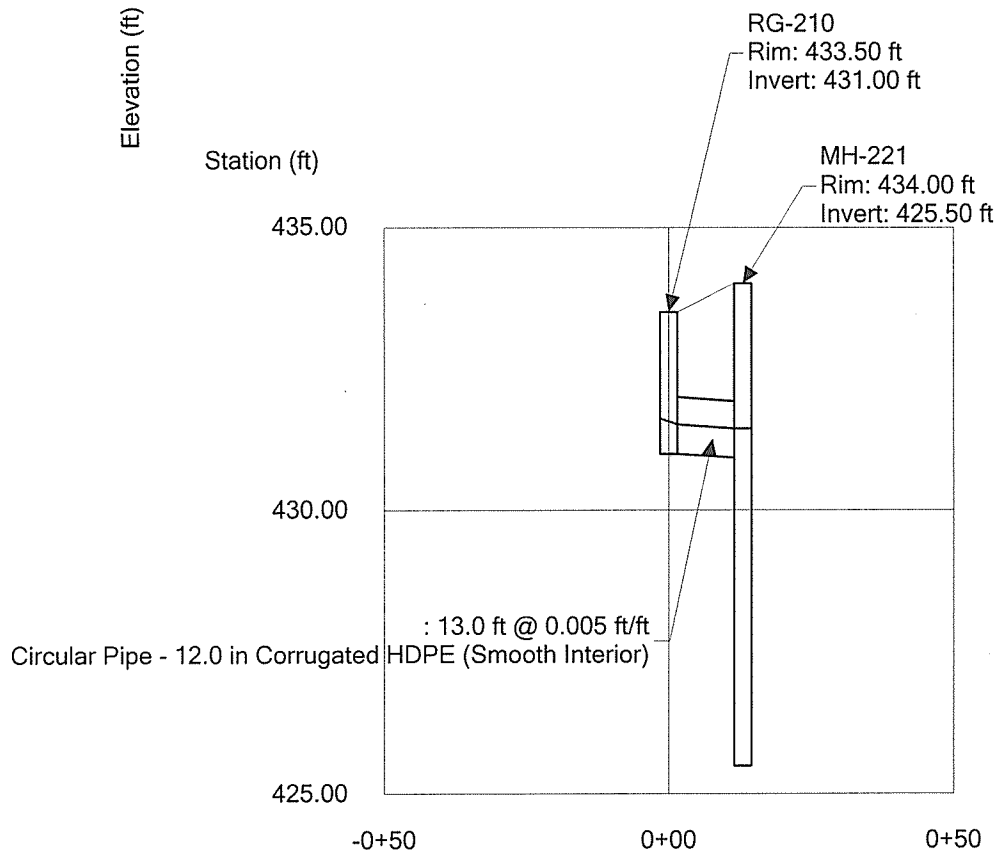


Profile Report
Engineering Profile - RG-209 TO YD-202 (StormCAD - LAH.stc)



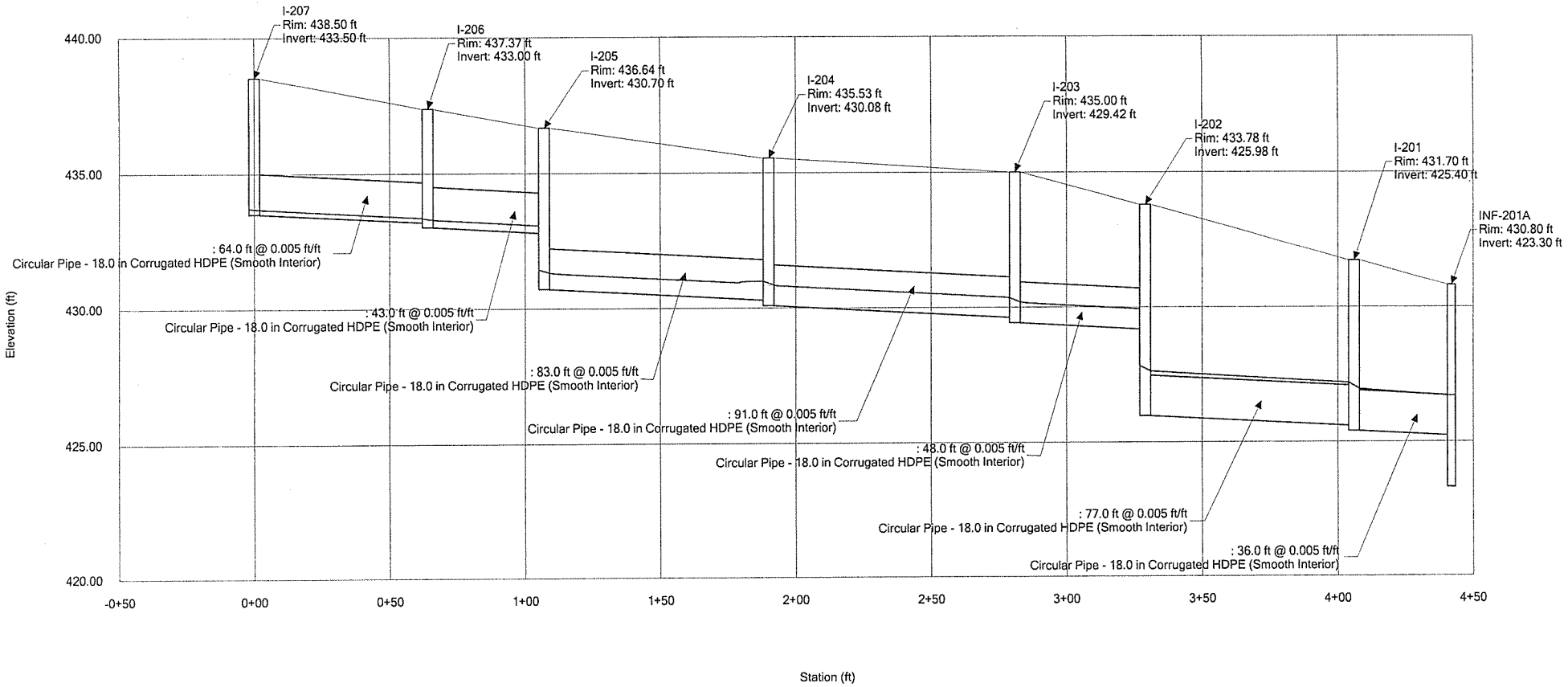
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RG-210 TO MH-221 (StormCAD - LAH.stc)



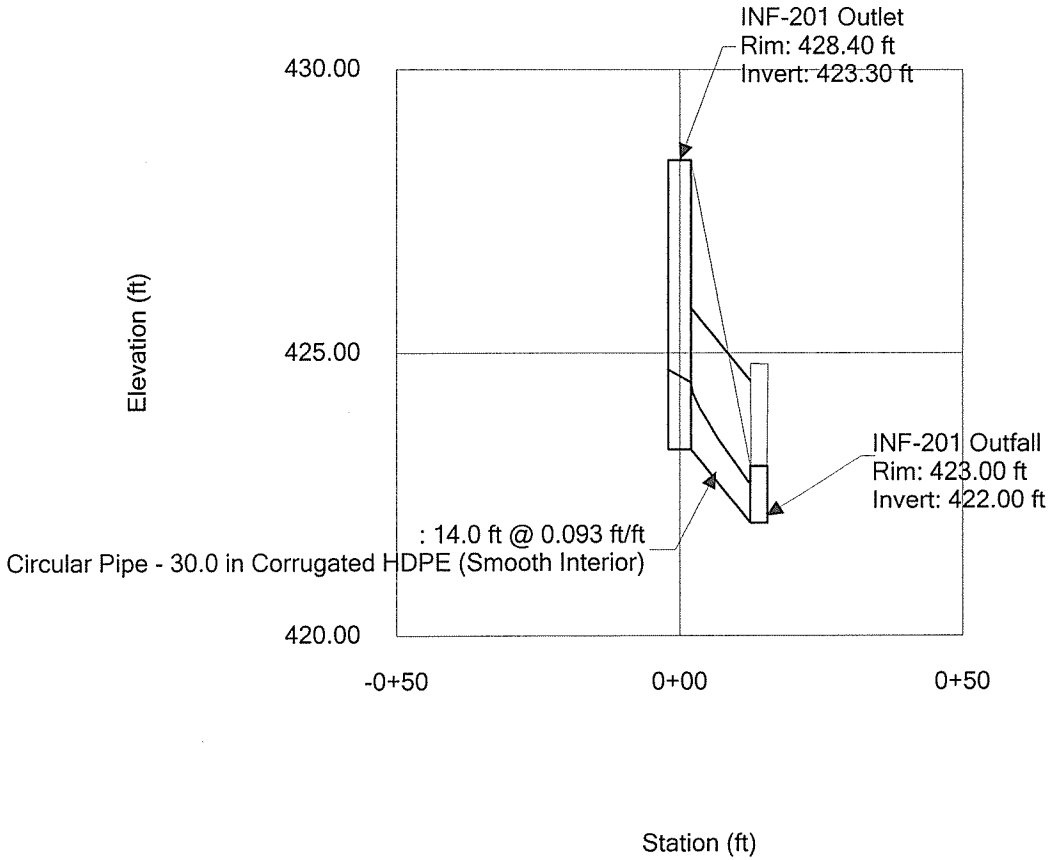
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-207 TO INF-201A (StormCAD - LAH.stc)



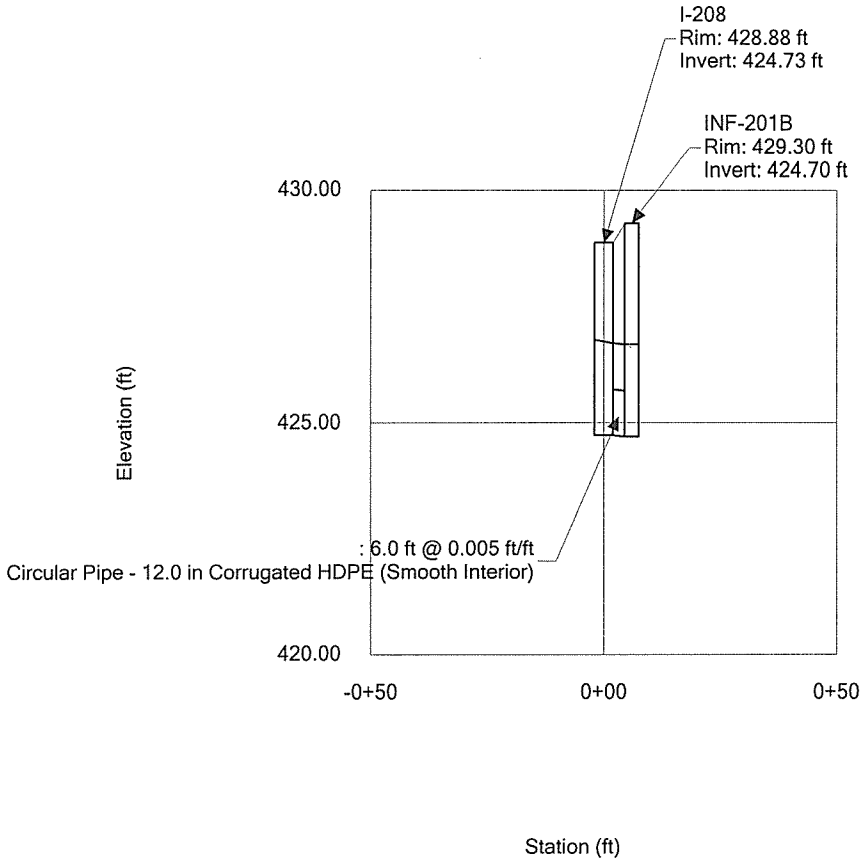
Profile Report

Engineering Profile - INF 201 OUT TO INF 201 OUTFALL (StormCAD - LAH.stc)

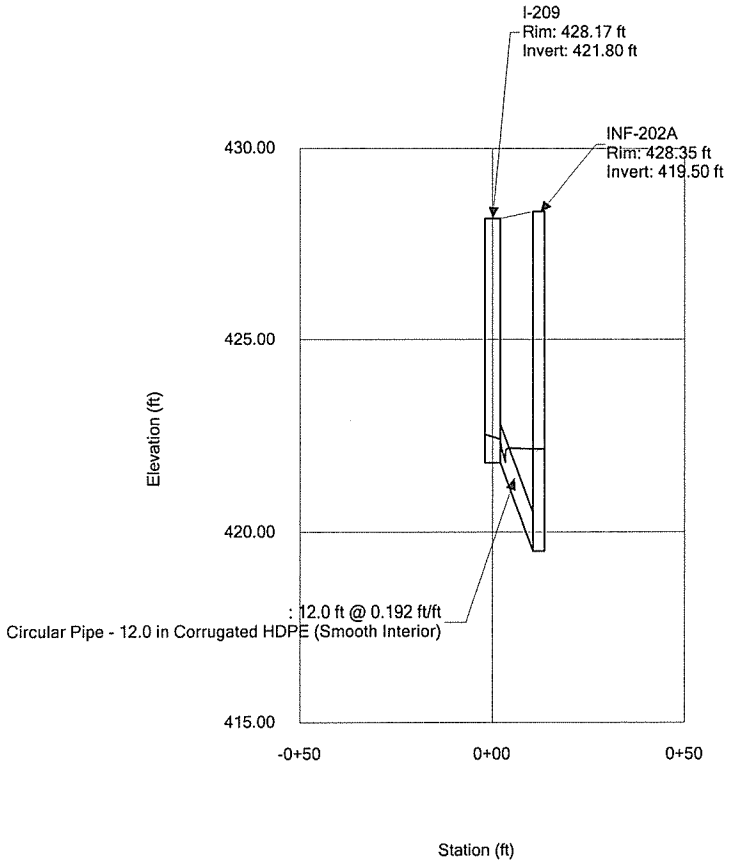


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-208 TO INF-201B (StormCAD - LAH.stc)

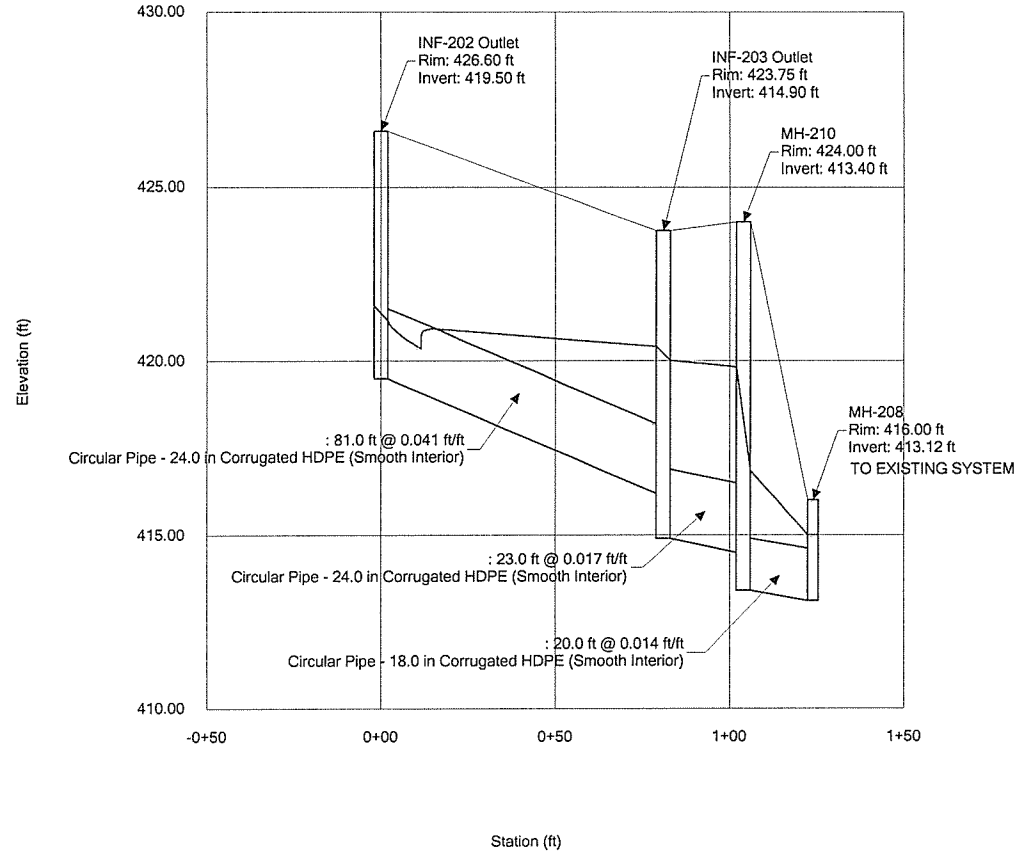


Profile Report
Engineering Profile - I-209 TO INF-202A (StormCAD - LAH.stc)



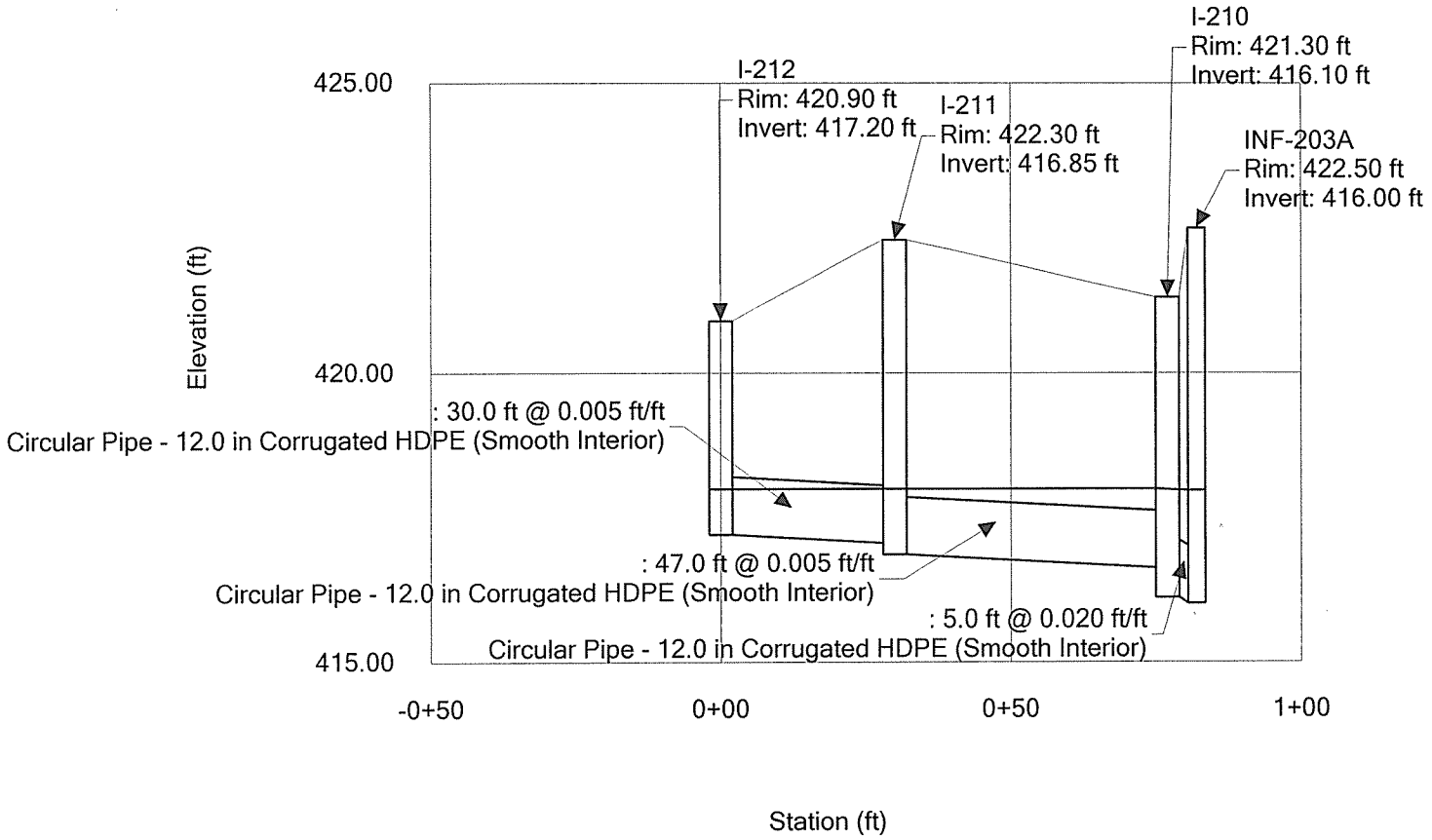
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - INF-202 OUT TO MH-208 (StormCAD - LAH.stc)



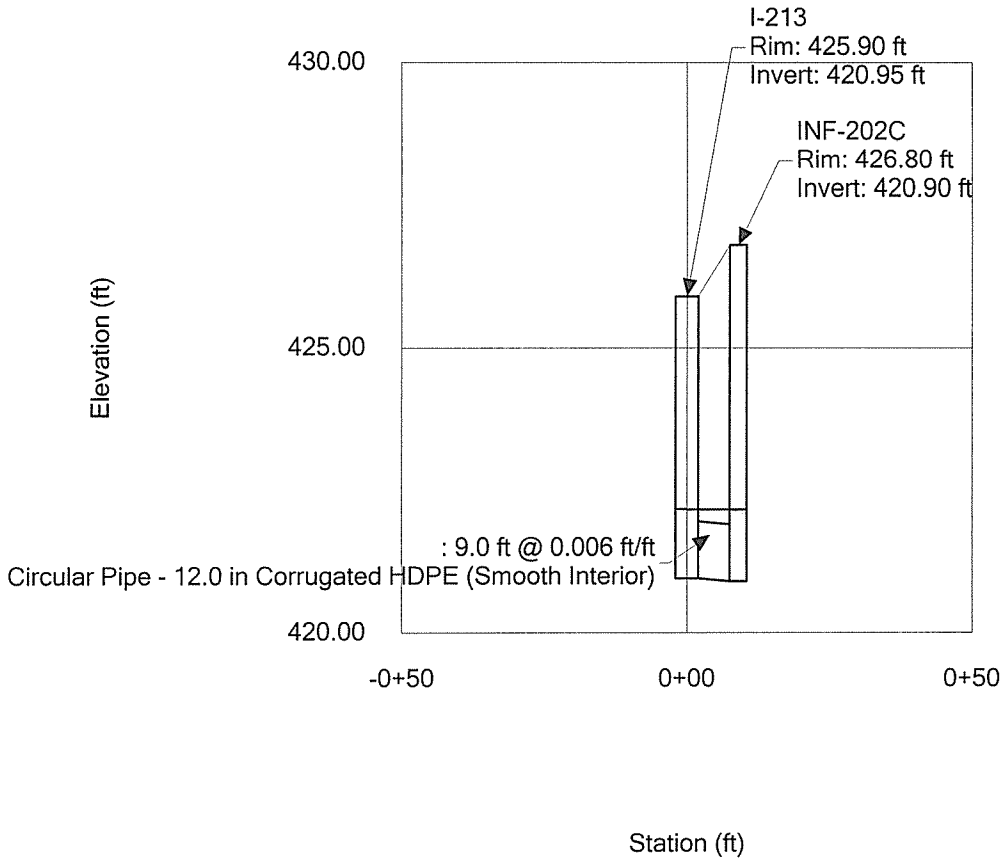
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

Profile Report
Engineering Profile - I-212 TO INF-203 (StormCAD - LAH.stc)



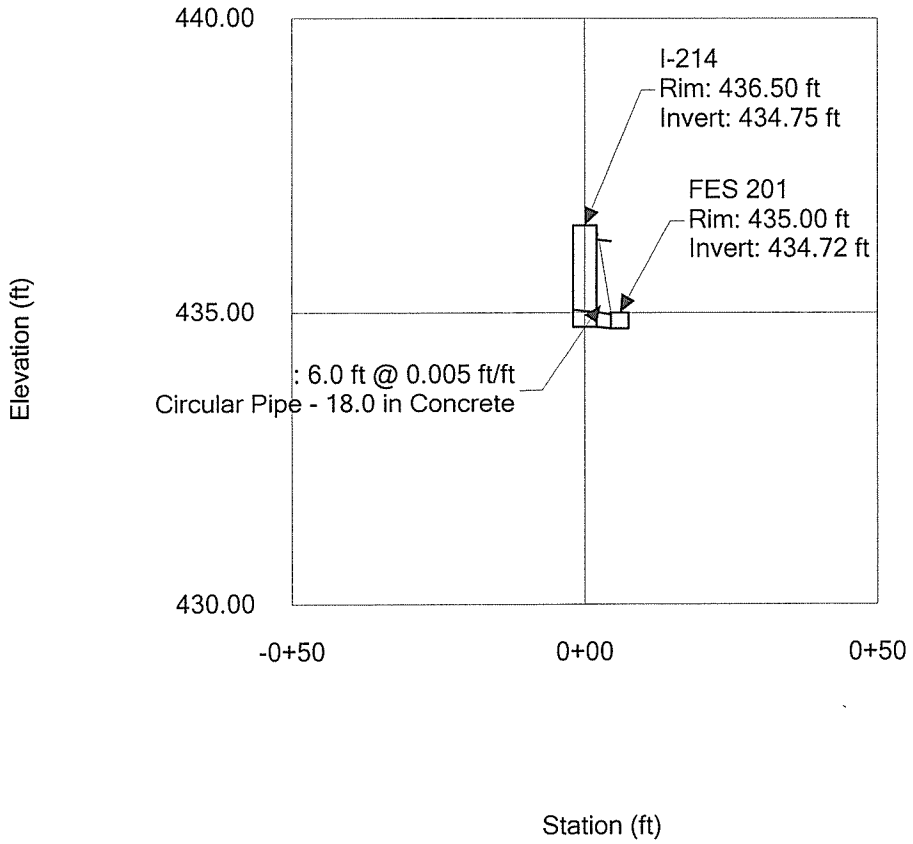
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-213 TO INF-202C (StormCAD - LAH.stc)



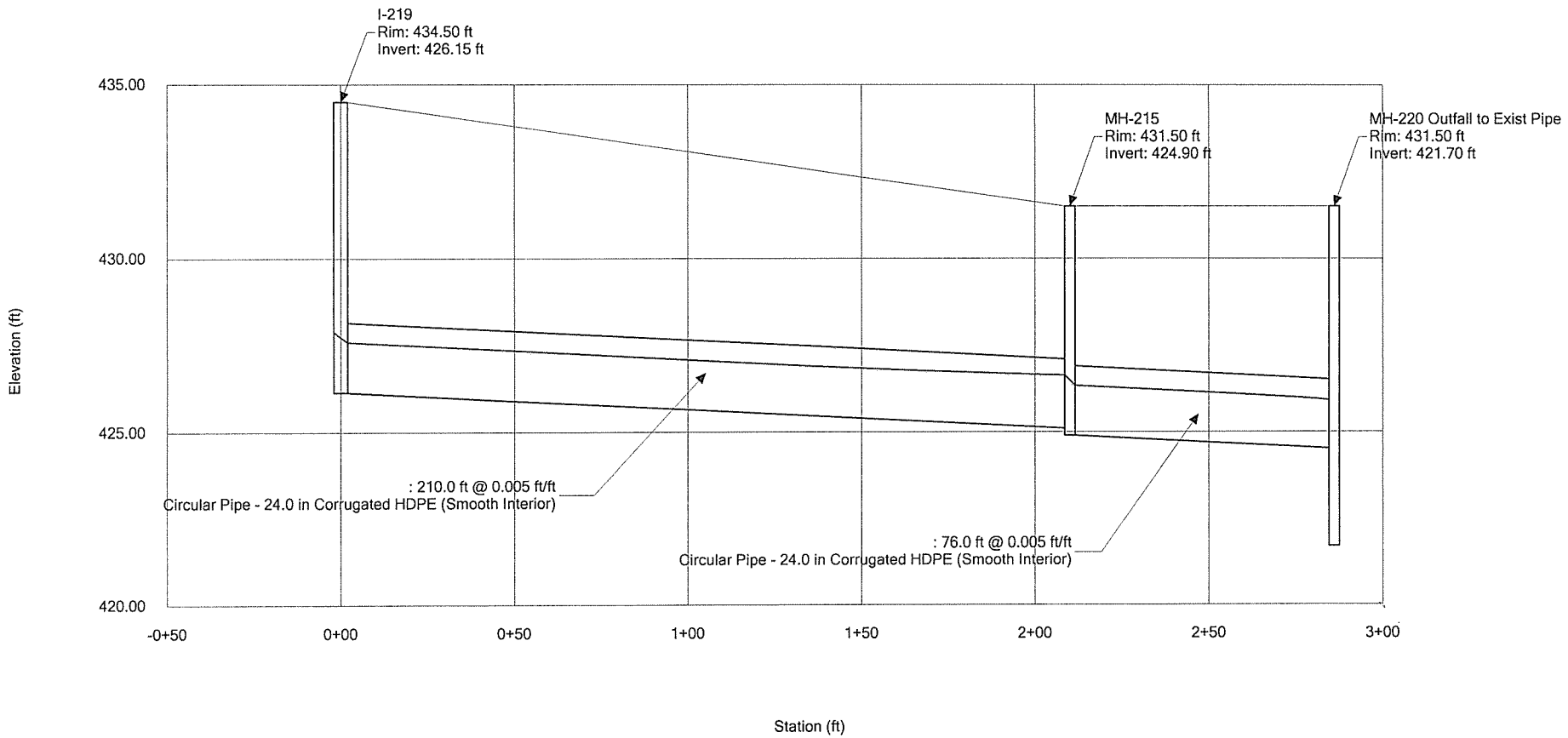
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-214 TO FES-201 (StormCAD - LAH.stc)



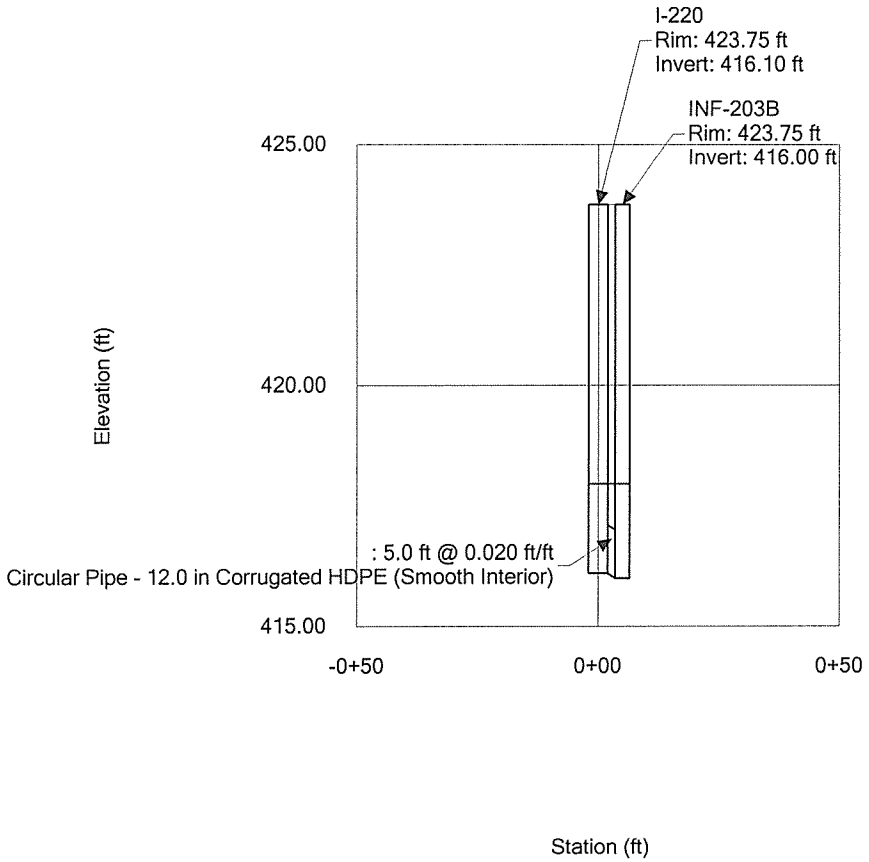
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - I-219 TO EXISTING PIPE (StormCAD - LAH.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

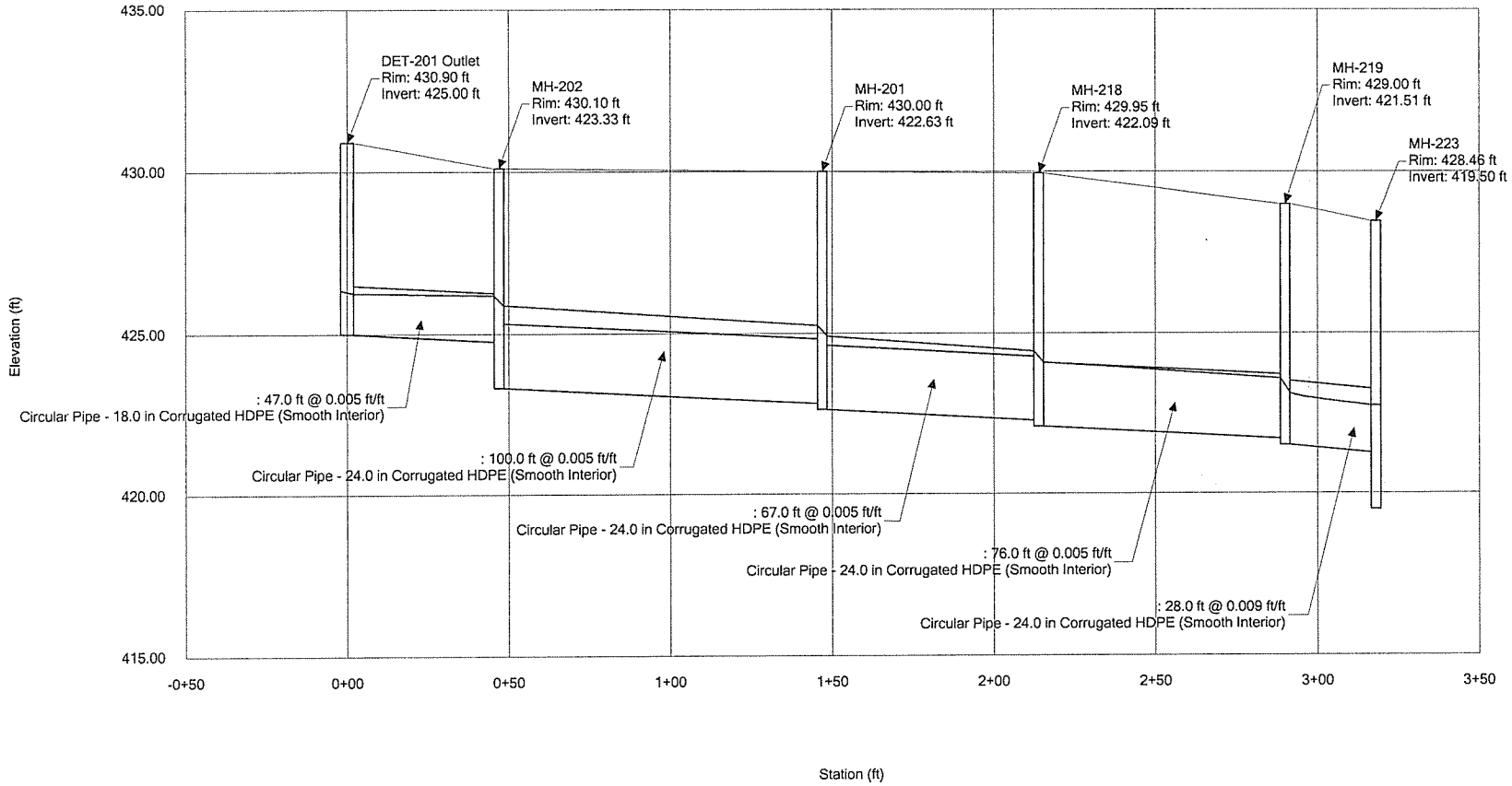
Profile Report
Engineering Profile - I-220 TO INF-203B (StormCAD - LAH.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

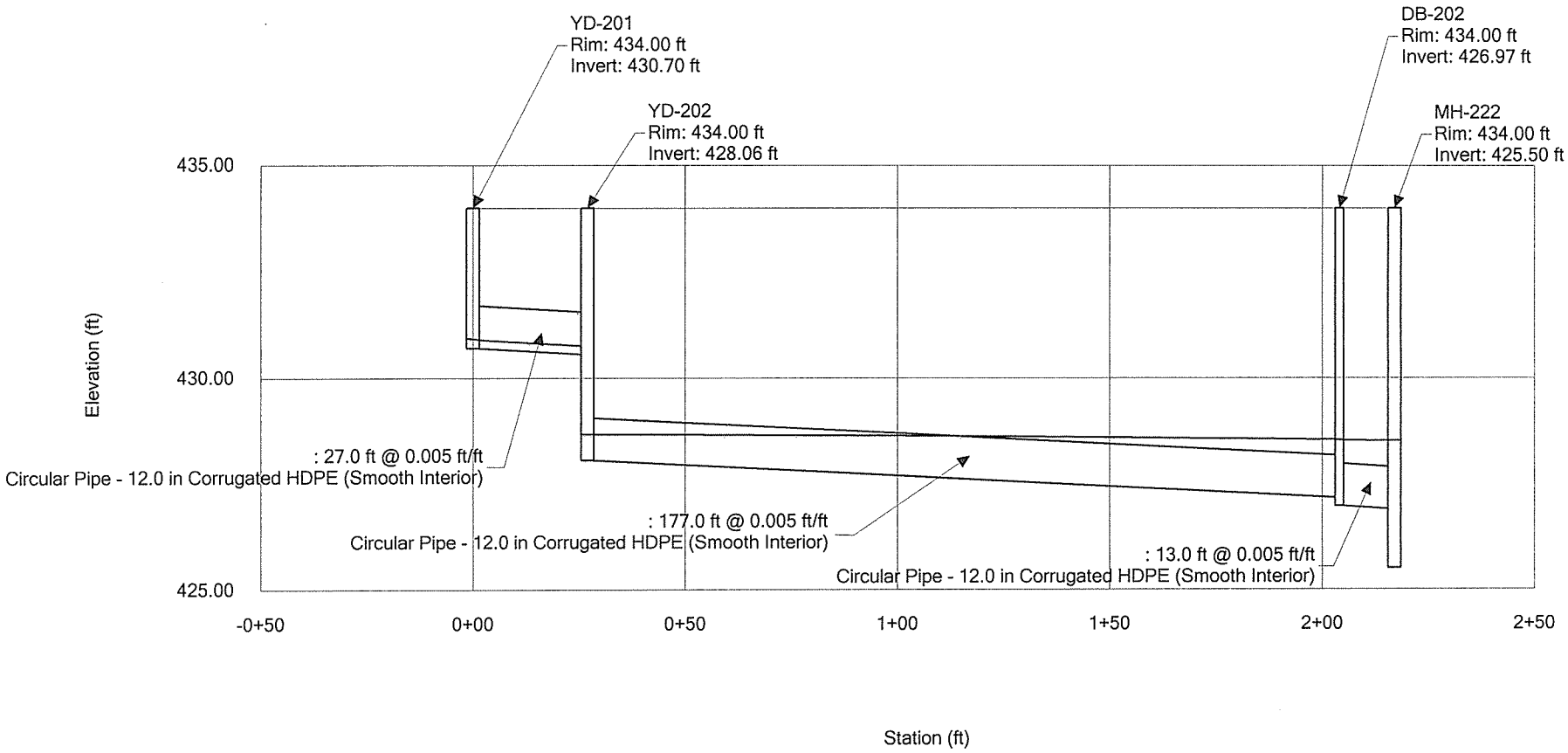
Profile Report

Engineering Profile - DET-201 OUT TO MH-223 (StormCAD - LAH.stc)

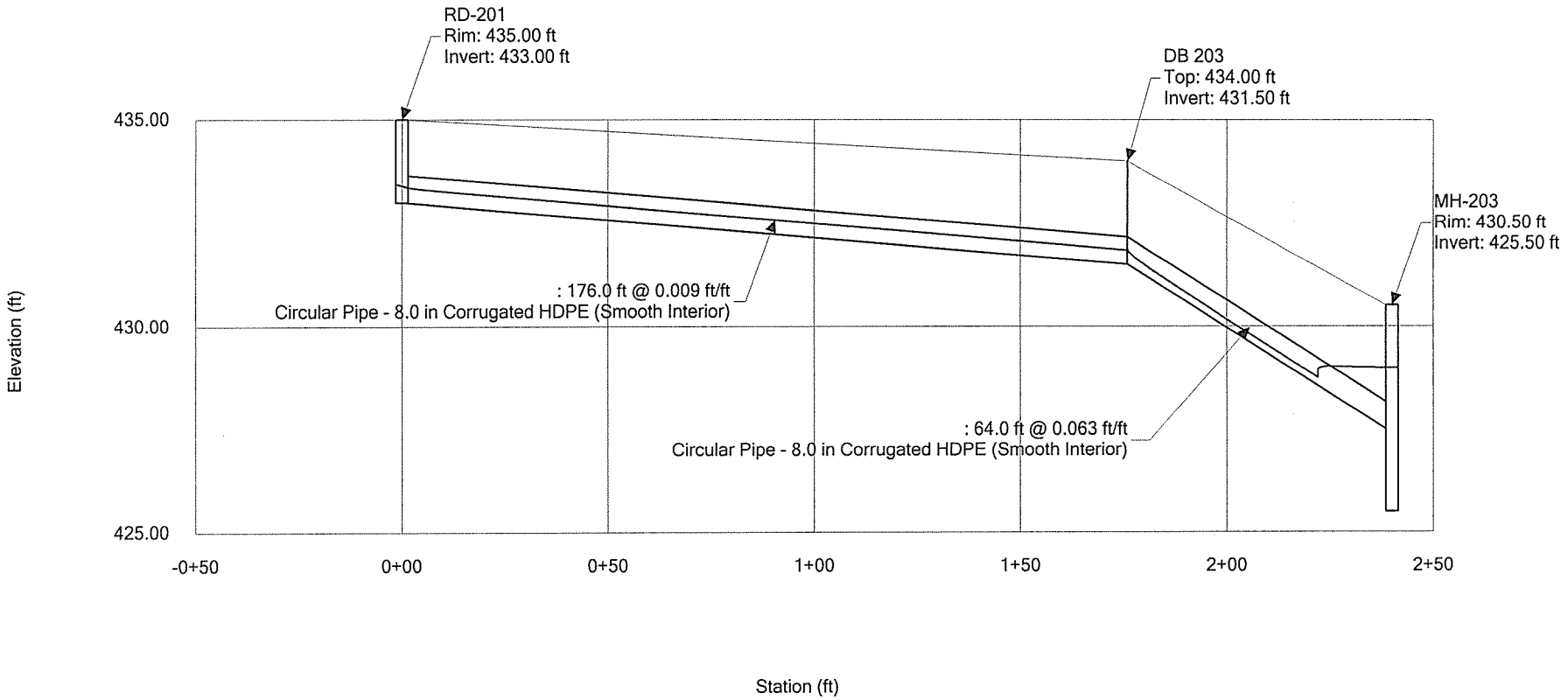


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203
-755-1666

Profile Report
Engineering Profile - YD-201 TO MH-222 (StormCAD - LAH.stc)

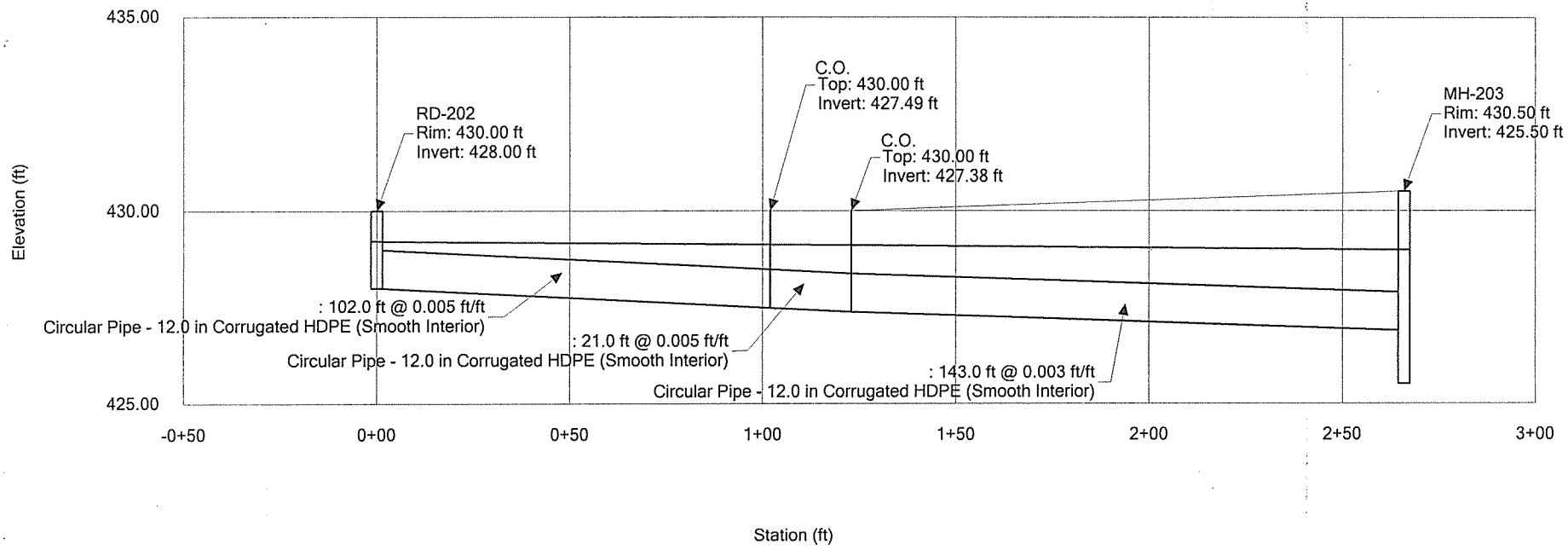


Profile Report
Engineering Profile - RD-201 TO MH-203 (StormCAD - LAH.stc)

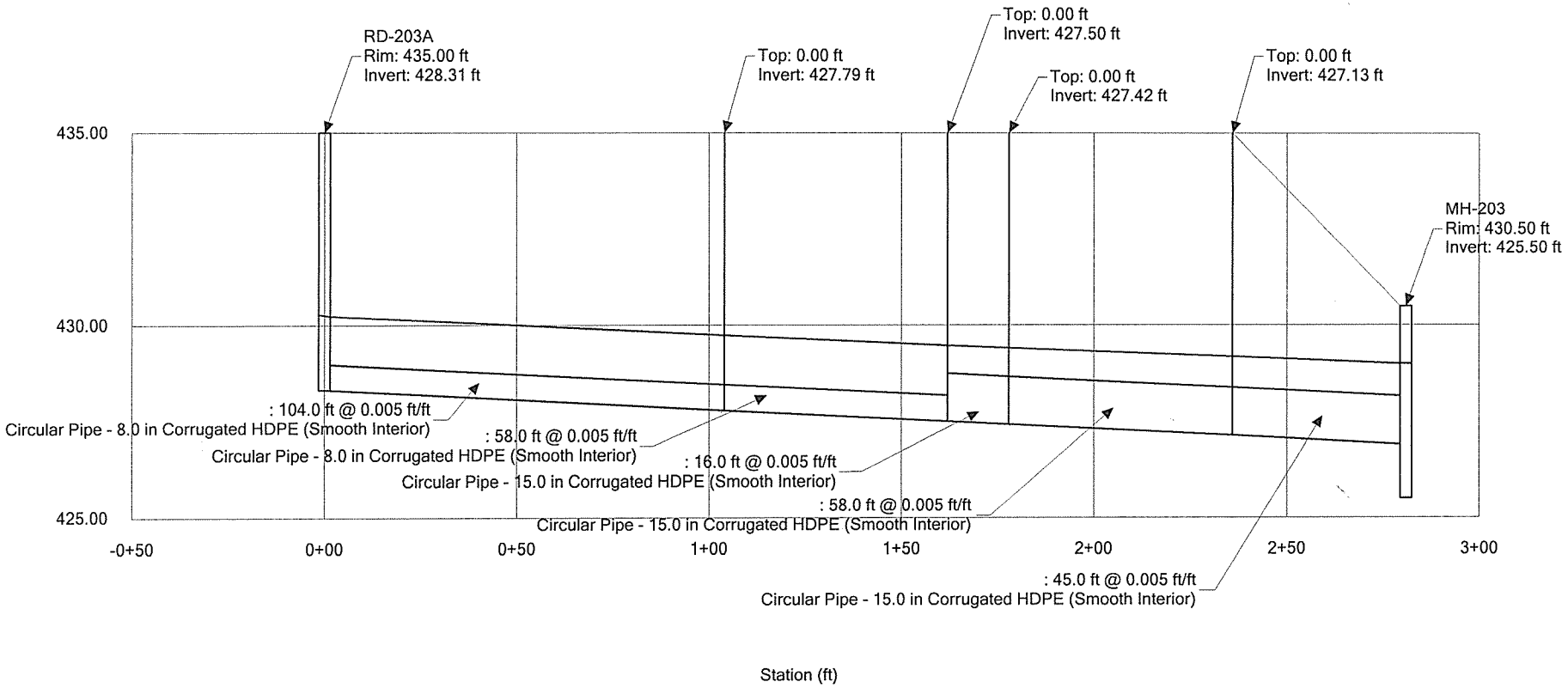


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

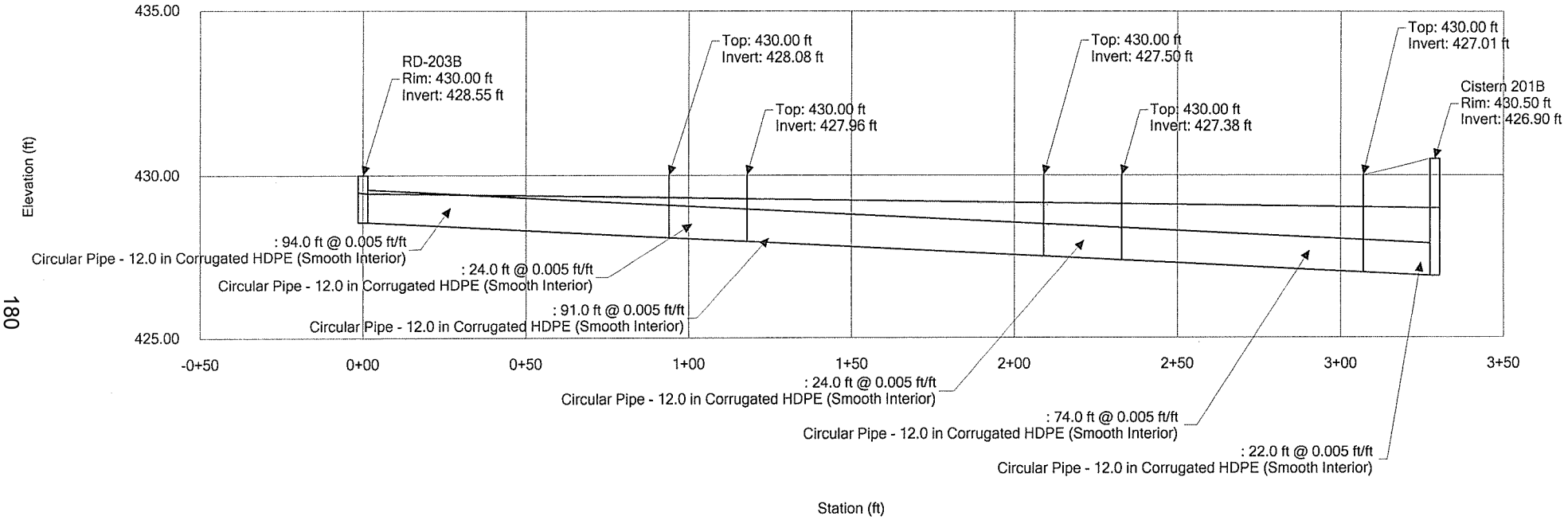
Profile Report
Engineering Profile - RD-202 TO MH-203 (StormCAD - LAH.stc)



Profile Report
Engineering Profile - RD-203A TO MH-203 (StormCAD - LAH.stc)

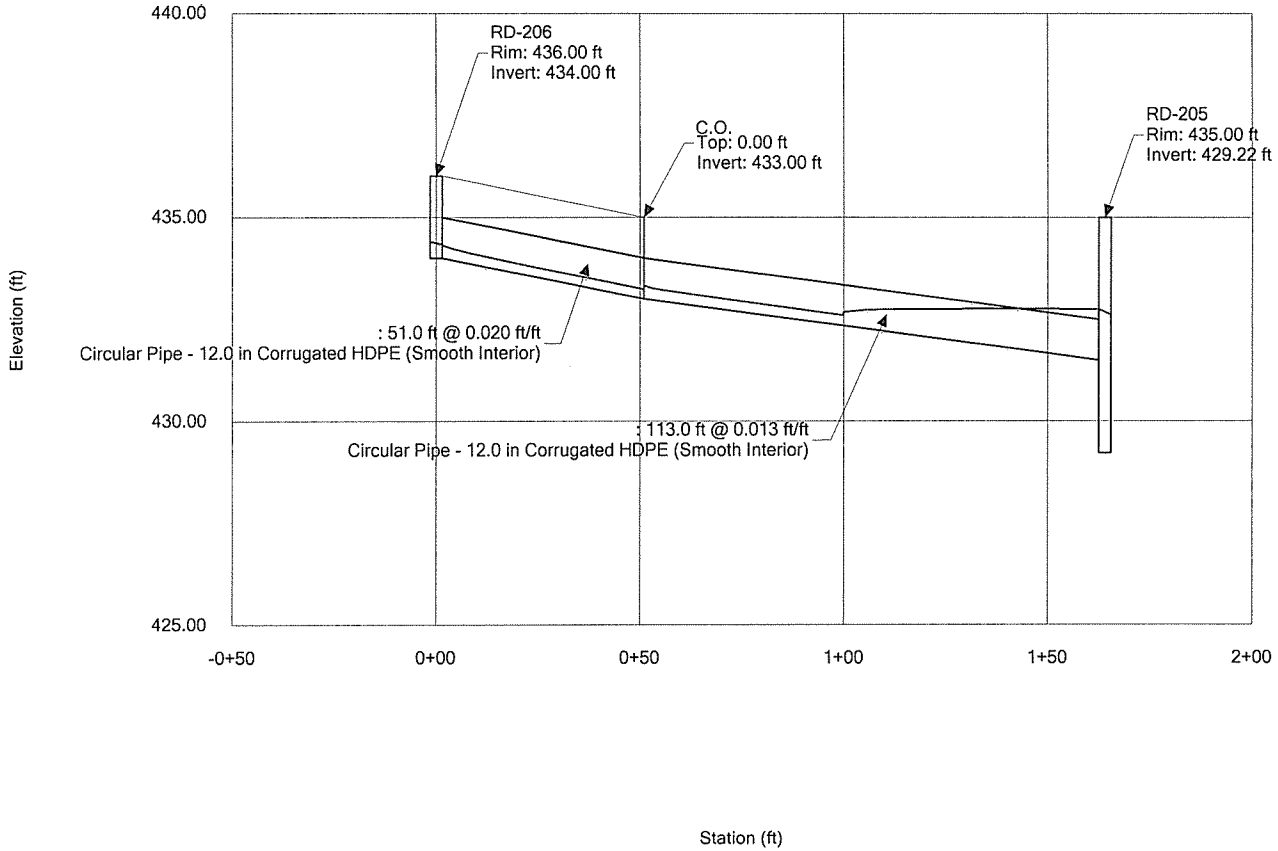


Profile Report
Engineering Profile - RD-203B TO CIST-201B (StormCAD - LAH.stc)



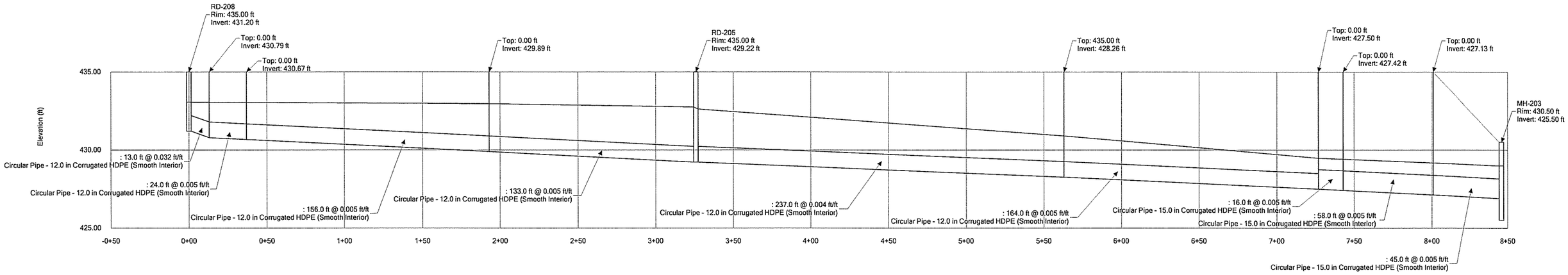
180

Profile Report
Engineering Profile - RD-206 TO RD-205 (StormCAD - LAH.stc)

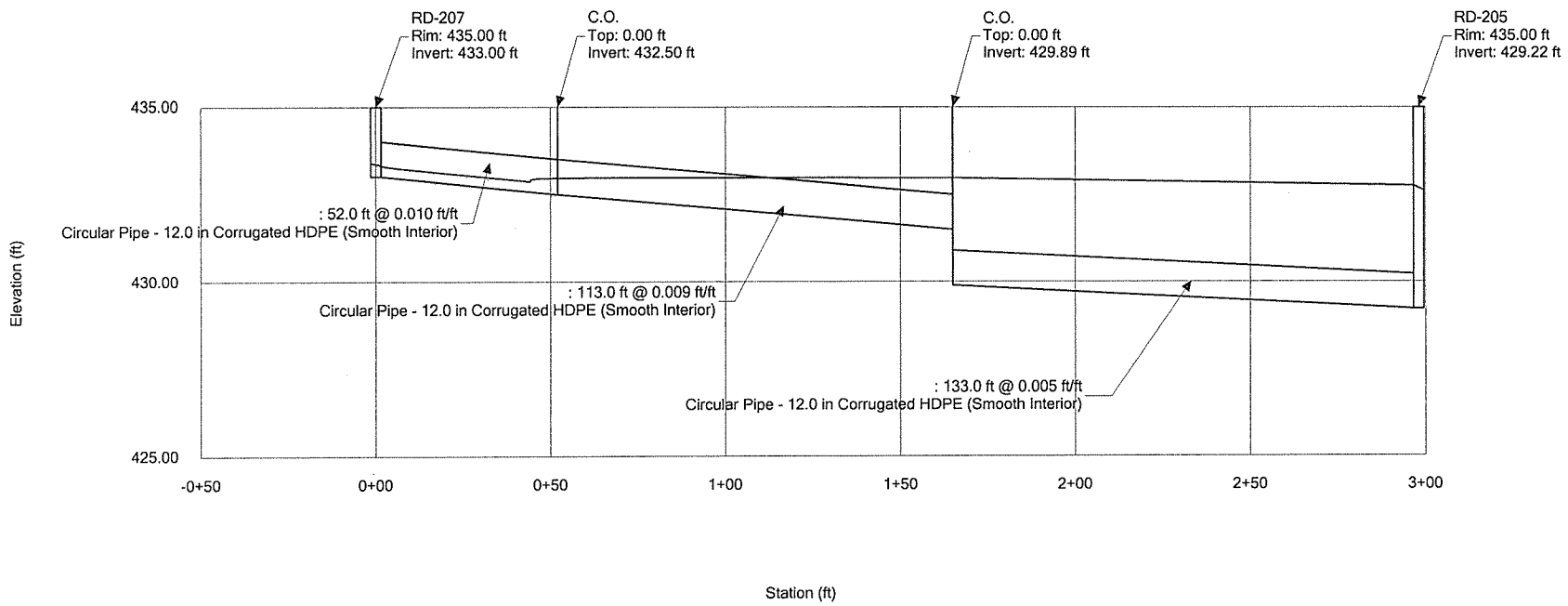


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RD-208 TO MH-203 (StormCAD - LAH.stc)

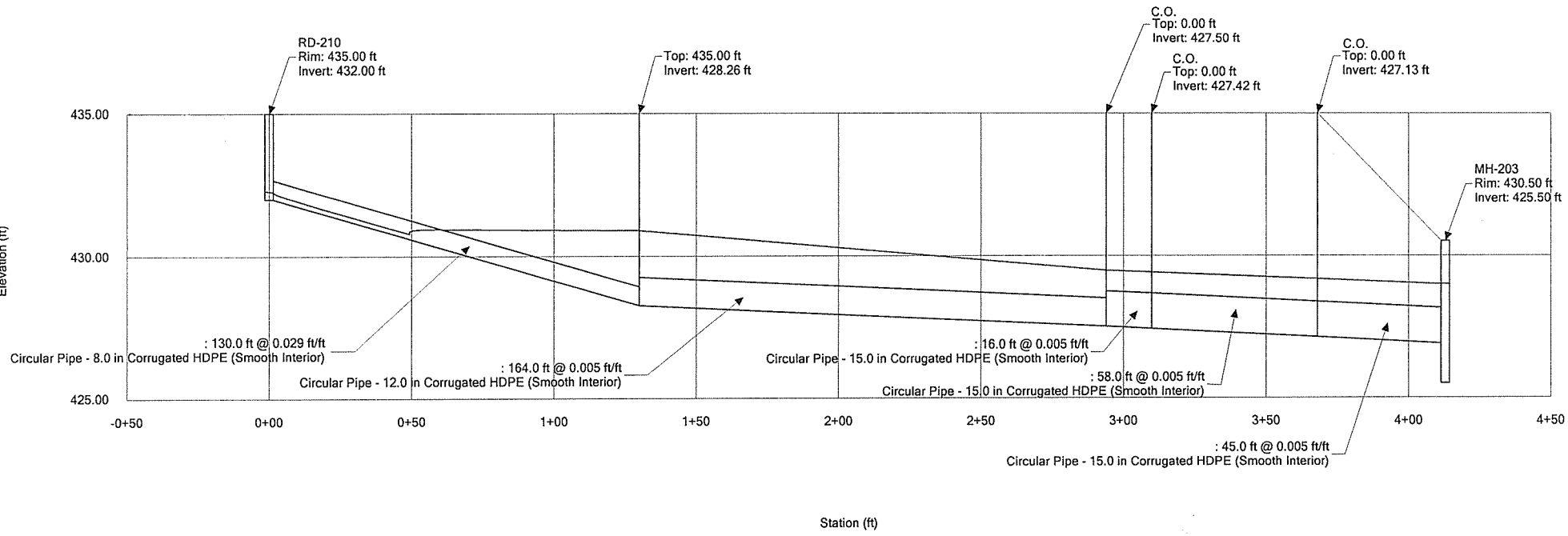


Profile Report
Engineering Profile - RD-207 TO RD-205 (StormCAD - LAH.stc)



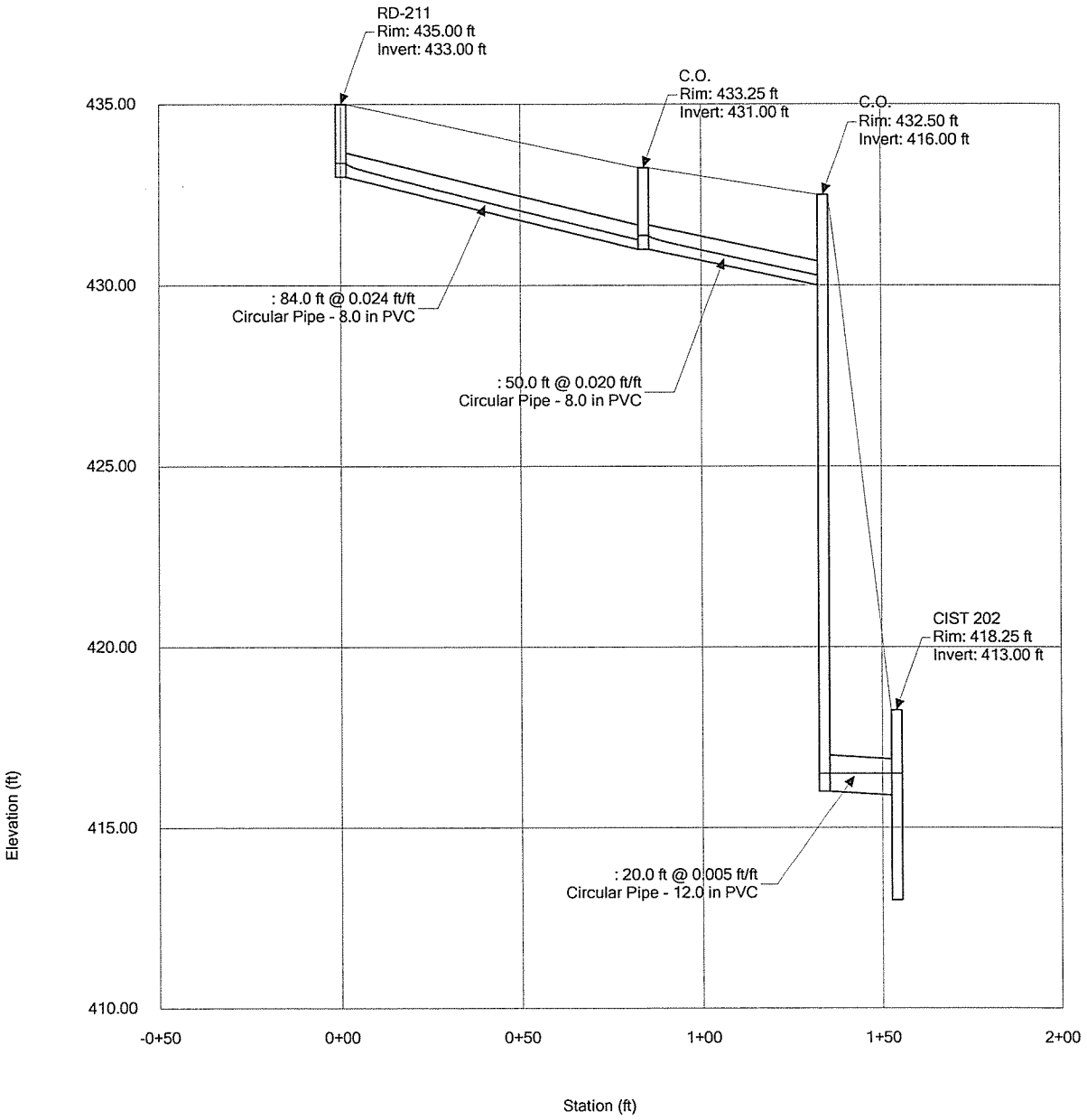
Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA
+1-203-755-1666

Profile Report
Engineering Profile - RD-210 TO MH-203 (StormCAD - LAH.stc)

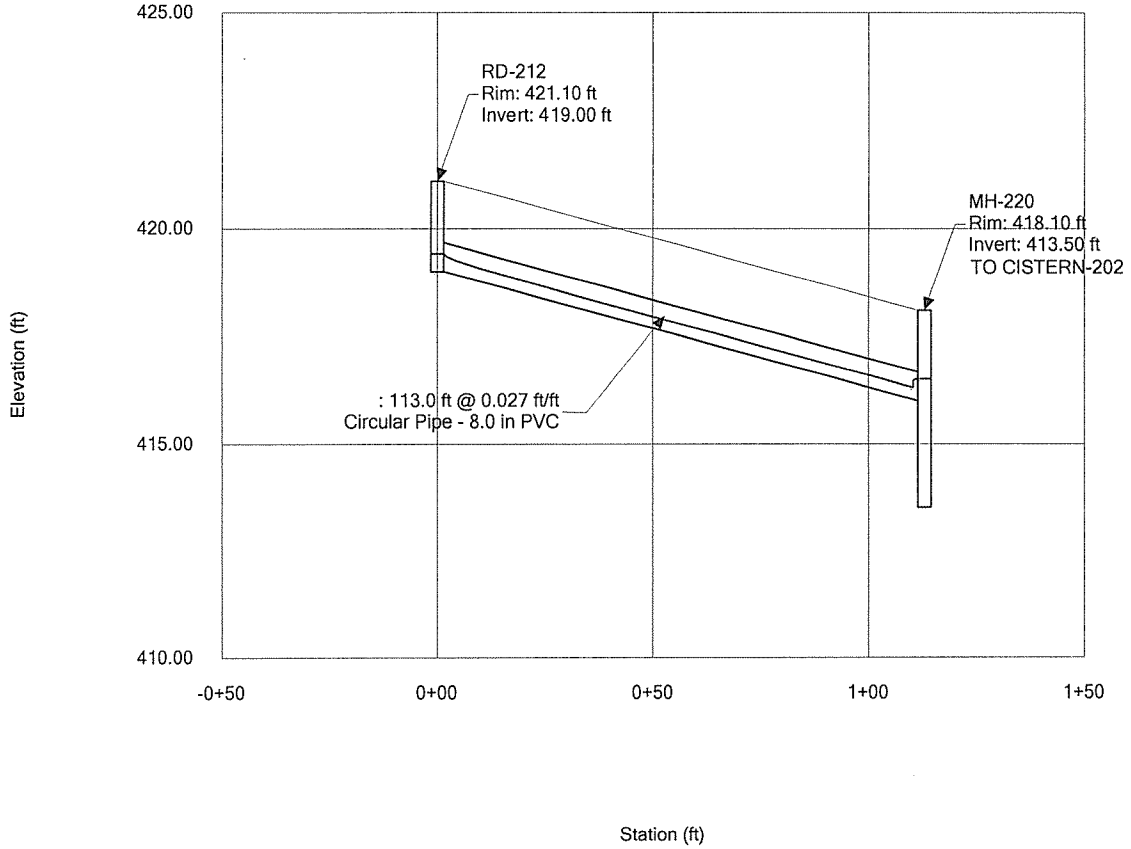


Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

Profile Report
Engineering Profile - RD-211 TO CIST-202 (StormCAD - LAH.stc)

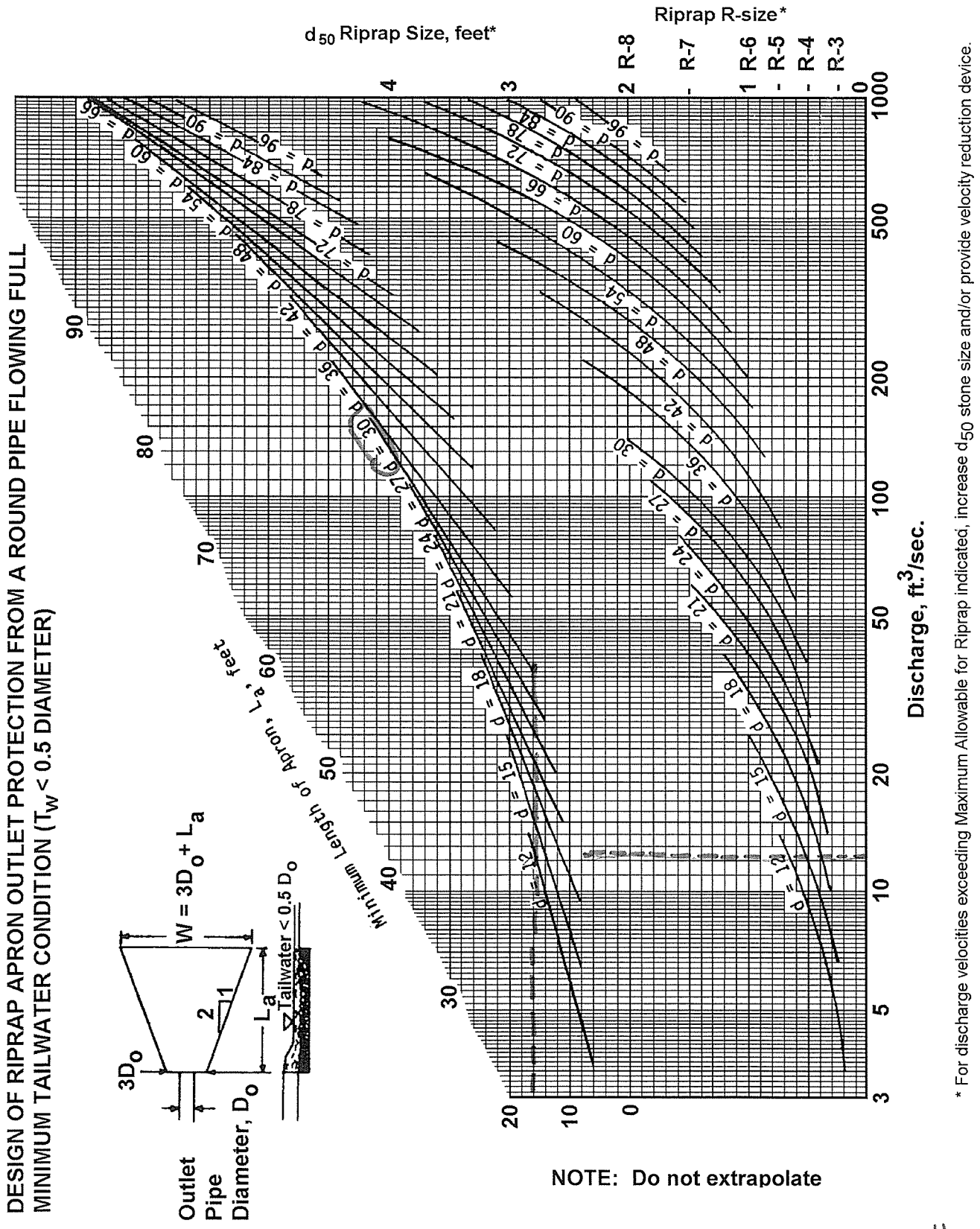


Profile Report
Engineering Profile - RD-212 TO MH-220 (StormCAD - LAH.stc)



OS - INF-101

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



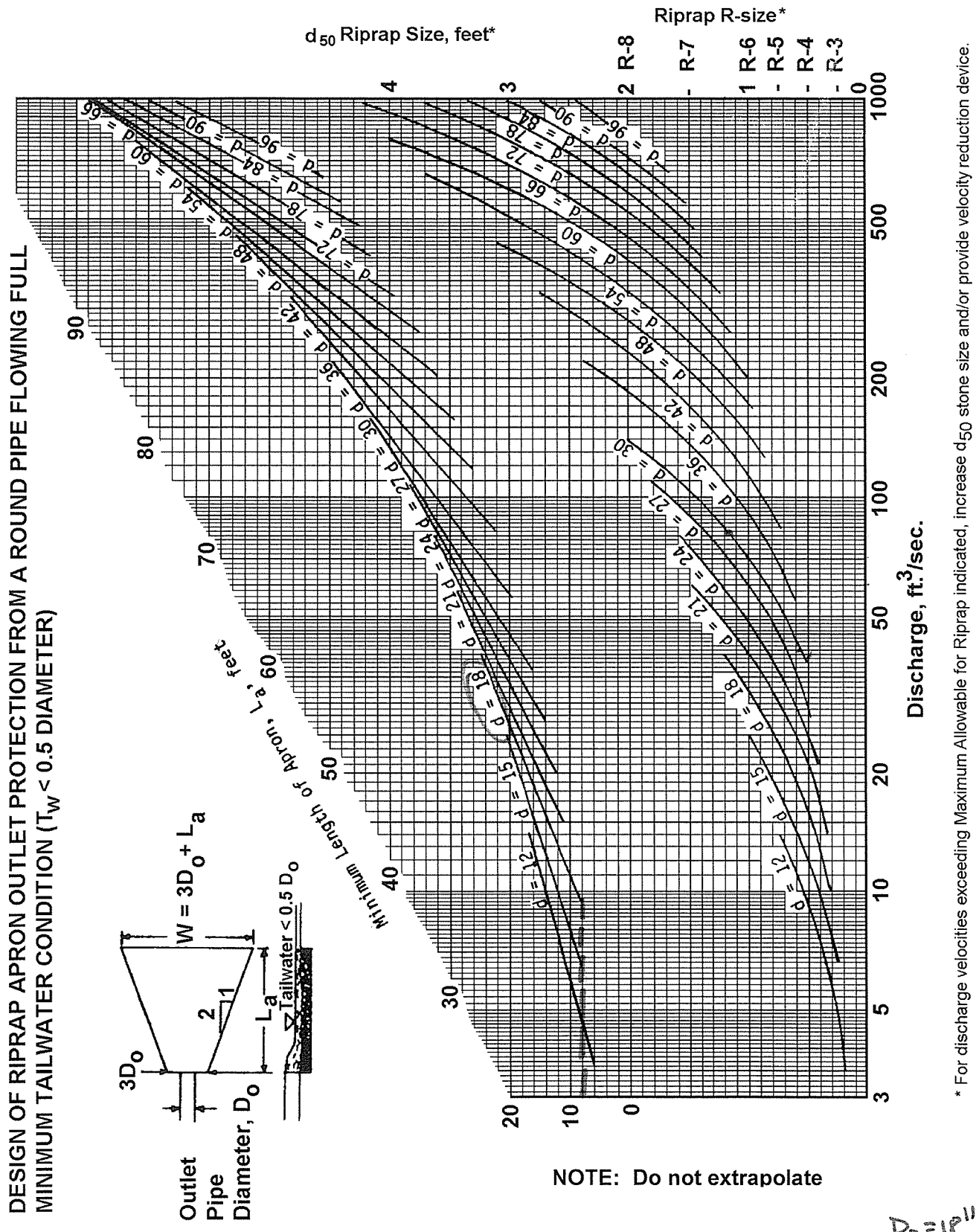
* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

Adapted from USDA - NRCS

Not to be used for Box Culverts

$D_o = 30''$
$V = 17.12$ ft/s
$Q = 12.24$ cfs
$L_a = 16'$
$W = 3(2.5') + 16' = 23.5'$

FIGURE 9.3
Riprap Apron Design, Minimum Tailwater Condition



* For discharge velocities exceeding Maximum Allowable for Riprap indicated, increase d_{50} stone size and/or provide velocity reduction device.

Adapted from USDA - NRCS

Not to be used for Box Culverts

$D_o = 18''$

$V = \frac{Q}{A}$ $Q = 0.57\ cfs$ $A = \frac{\pi(.75)^2}{2} = .8836\ ft^2$

$V = 0.645\ ft/s$

$L_a = 8'$

$W = 3(1.5) + 8 = 12.5'$

Garage/PAC Drainage Areas

Inlet	A total SF	Lawn - B SF	Impervious SF	C wt	25 yr Q cfs	100 yr Q cfs
I-301	1180	0	1180	0.99	***0.18***	***0.22***
I-302	4395	0	4395	0.99	***0.67***	***0.82***
I-302-ROOF	1041	0	1041	0.99	***0.16***	***0.19***
MH-302	550	0	550	0.99	***0.08***	***0.10***
I-303	5432	0	5432	0.99	***0.83***	***1.01***
I-303-ROOF	2780	0	2780	0.99	***0.42***	***0.52***
I-304	2764	380	2384	0.89	***0.38***	***0.46***
I-304-ROOF	4125	0	4125	0.99	***0.63***	***0.77***
I-305	3793	1358	2435	0.73	***0.42***	***0.52***
I-306	15091	5196	9895	0.74	***1.71***	***2.09***
I-307	11904	3888	8016	0.75	***1.37***	***1.67***
I-308	18717	5882	12835	0.76	***2.18***	***2.67***
I-309	19697	7974	11723	0.69	***2.09***	***2.56***
I-310	13137	7405	5732	0.57	***1.16***	***1.41***
I-311	5474	5474	0	0.25	***0.21***	***0.26***
I-311 ROOF	48698	0	48698	0.99	***7.42***	***9.06***
I-312	15464	3773	11691	0.81	***1.93***	***2.35***
I-313	2534	0	2534	0.99	***0.39***	***0.47***
I-314	14214	0	14214	0.99	***2.16***	***2.65***
I-220	8258	1881	6377	0.82	***1.04***	***1.28***
I-221	596	0	596	0.99	***0.09***	***0.11***
I-222	9841	4612	5229	0.64	***0.97***	***1.19***
I-223	2408	419	1989	0.86	***0.32***	***0.39***
I-224	6723	6543	180	0.27	***0.28***	***0.34***
YD-G3	5612	0	5612	0.99	***0.85***	***1.04***
YD-G4	2038	1345	693	0.50	***0.16***	***0.19***
RG-1	14384	13512	872	0.29	***0.65***	***0.80***

Q= (C wt) x I x (A total acres)

$$C\ wt = \frac{[0.99 \times (Impervious)] + [0.25 \times (Lawn - B)]}{A\ total}$$

I 25 =	6.70	in/hr; per PennDOT Road Design Manual, Vol III
I 100 =	8.19	Fig. 2.10.4.2(E), Region 5 I.D.F., 5 min. duration
C =	0.25	Lawn - B
C =	0.99	Impervious

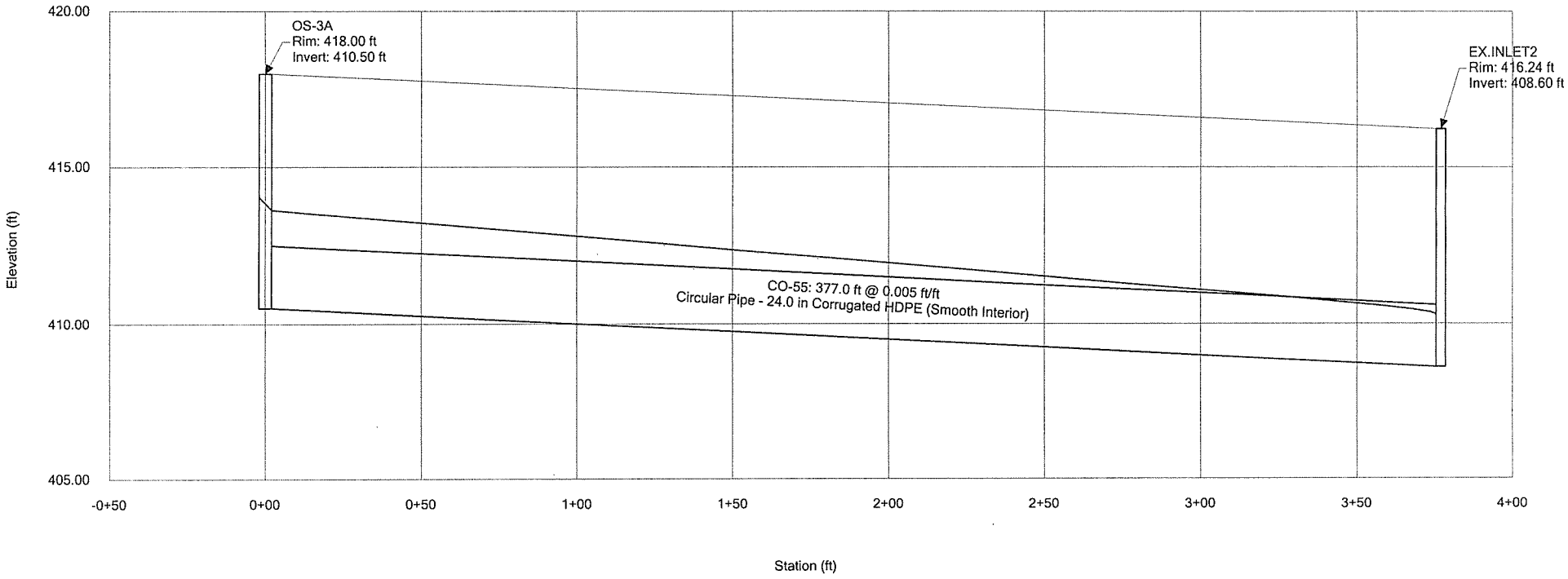
Conduit FlexTable: Combined Pipe/Node Report (Stormcad-GARAGE.stc) 100 YR

Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Flow (Link) (ft^3/s)	Capacity (Full Flow) (ft^3/s)	Invert (Upstream) (ft)	Invert (Down stream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
YD-3-1	YD-3-2	38.0	12.0	12.0	0.012	0.012	0.03	4.20	421.50	421.05	424.70	424.25	421.57	421.11	1.54
YD-3-2	MH-309	37.0	12.0	12.0	0.033	0.012	0.13	7.04	420.85	419.62	424.25	423.50	421.00	419.72	3.49
I-311	MH-309	60.0	18.0	18.0	0.005	0.012	9.34	8.05	418.00	417.70	421.75	423.50	419.54	419.15	5.29
MH-309	MH-310	60.0	18.0	18.0	0.005	0.012	9.48	8.05	417.50	417.20	423.50	425.50	418.91	418.39	5.36
YD-G4	MH-313	13.0	24.0	24.0	0.023	0.012	0.23	37.23	416.10	415.80	420.00	420.00	416.26	416.01	3.28
MH-313	MH-315	102.0	18.0	18.0	0.008	0.013	0.23	9.30	415.80	415.00	420.00	421.50	415.98	415.75	2.21
MH-302	I-302	18.0	18.0	18.0	0.014	0.013	0.11	12.38	427.50	427.25	431.25	431.00	427.62	427.54	2.18
I-302	MH-303	28.0	18.0	18.0	0.005	0.013	1.20	7.43	427.05	426.91	431.00	432.00	427.47	427.47	3.09
I-303	MH-303	77.0	18.0	18.0	0.006	0.013	1.63	8.12	428.75	428.29	432.59	432.00	429.23	428.75	3.59
MH-303	I-301	20.0	18.0	18.0	0.015	0.013	2.83	12.86	426.71	426.41	432.00	431.75	427.35	427.21	5.84
I-301	MH-314	34.0	18.0	18.0	0.005	0.013	3.07	7.43	426.41	426.24	431.75	432.25	427.08	426.91	4.00
MH-314	MH-315	106.0	18.0	18.0	0.014	0.013	3.07	12.50	417.00	415.50	432.25	421.50	417.67	416.01	5.85
MH-315	EX-MH-6	67.0	24.0	24.0	0.023	0.012	3.29	37.27	415.00	413.45	421.50	425.98	415.63	414.97	7.32
EX-MH-6	MH-310	48.0	24.0	24.0	0.006	0.012	3.29	18.72	413.45	413.17	425.98	425.50	414.96	414.96	4.48
MH-310	OF-2	92.0	24.0	24.0	0.003	0.012	12.77	13.03	413.17	412.91	425.50	418.84	414.78	414.53	4.73
YD-G3	I-221	19.0	12.0	12.0	0.005	0.013	1.14	2.58	428.60	428.50	432.64	432.75	429.57	429.55	3.19
OS-2B	I-220	29.0	18.0	18.0	0.010	0.013	4.28	10.68	429.00	428.70	435.00	433.65	429.79	429.81	5.71
I-220	I-221	38.0	18.0	18.0	0.005	0.012	5.67	8.26	428.70	428.50	433.65	432.75	429.62	429.55	5.03
I-221	I-222	210.0	18.0	18.0	0.045	0.012	6.94	24.20	428.30	418.80	432.75	422.50	429.32	419.98	11.82
I-222	I-223	39.0	18.0	18.0	0.052	0.012	8.24	25.90	418.60	416.58	422.50	419.00	419.71	417.22	13.02
I-223	I-224	37.0	18.0	18.0	0.035	0.012	8.67	21.33	415.05	413.75	419.00	417.50	417.09	416.88	4.90
OS-2B-1	I-224	82.0	18.0	18.0	0.034	0.013	5.70	19.24	416.50	413.75	421.75	417.50	417.42	416.88	9.49
I-224	MH-224	20.0	18.0	18.0	0.011	0.012	14.74	11.93	413.55	413.33	417.50	416.00	416.34	416.00	8.34
MH-224	EX. INLET	46.0	18.0	18.0	0.005	0.012	14.74	8.05	413.13	412.90	416.00	415.03	415.77	415.00	8.34
I-304	I-305	80.0	18.0	18.0	0.015	0.013	1.28	12.92	425.80	424.59	429.75	428.30	426.22	424.91	4.66
I-310	I-309	115.0	18.0	18.0	0.010	0.013	1.54	10.27	432.17	431.07	435.88	434.78	432.64	431.83	4.18
I-309	I-308	97.0	18.0	18.0	0.016	0.013	4.34	13.41	430.87	429.29	434.78	433.00	431.67	430.37	6.77
I-308	I-307	52.0	18.0	18.0	0.026	0.013	7.27	16.86	429.09	427.75	433.00	431.50	430.13	429.01	9.18
I-307	I-306	92.0	18.0	18.0	0.025	0.013	9.11	16.61	427.55	425.25	431.50	429.00	428.72	426.83	9.62
I-306	I-305	72.0	18.0	18.0	0.006	0.013	11.41	8.40	425.05	424.59	429.00	428.30	426.83	425.88	6.46
I-305	MH-316	34.0	18.0	18.0	0.109	0.013	13.26	34.70	422.00	418.29	428.30	422.00	423.36	420.25	18.33
MH-316	MH-304	26.0	18.0	18.0	0.005	0.013	13.26	7.43	418.09	417.96	422.00	422.00	419.81	419.32	7.50
MH-304	MH-305	202.0	30.0	30.0	0.005	0.013	13.26	29.00	416.96	415.95	422.00	421.00	418.78	418.64	5.78
I-312	I-313	71.0	18.0	18.0	0.012	0.013	2.58	11.63	423.75	422.88	427.50	426.59	424.59	424.60	5.29
I-313	I-314	133.0	18.0	18.0	0.004	0.013	8.10	6.57	422.68	422.16	426.59	426.60	424.44	423.65	4.58
I-314	MH-305	30.0	24.0	24.0	0.153	0.013	16.00	88.39	421.87	417.29	426.60	421.00	423.31	417.97	21.35
MH-305	MH-306	165.0	30.0	30.0	0.006	0.013	29.25	32.41	415.75	414.72	421.00	420.00	418.36	417.53	5.96
MH-306	MH-307	22.0	30.0	30.0	0.009	0.013	29.25	39.11	411.50	411.30	420.00	419.90	417.25	417.14	5.96
MH-307	OF-4	2.0	24.0	24.0	0.550	0.013	29.25	167.76	411.60	410.50	419.90	416.50	416.46	416.43	9.31
OS-3A	EX.INLET2	377.0	24.0	24.0	0.005	0.012	22.56	17.40	410.50	408.60	418.00	416.24	413.63	410.29	7.18

Conduit FlexTable: Combined Pipe/Node Report (Stormcad-GARAGE.stc) 25 YR

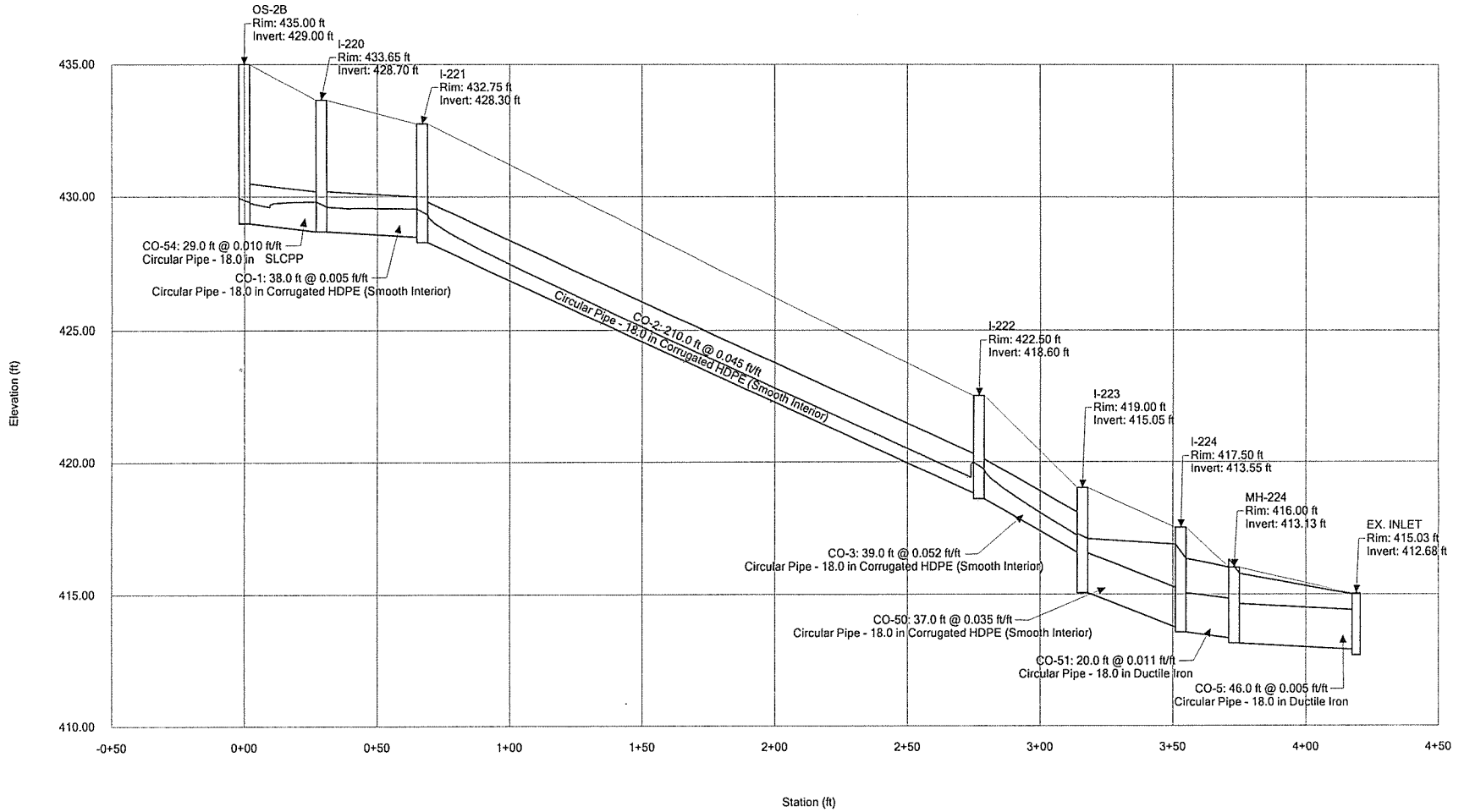
Start Node	Stop Node	Length (Unified) (ft)	Diameter (in)	Rise (Unified) (in)	Slope (ft/ft)	Manning's n	Flow (Link) (ft³/s)	Capacity (Full Flow) (ft³/s)	Invert (Upstream) (ft)	Invert (Down stream) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (Average) (ft/s)
YD-3-1	YD-3-2	38.0	12.0	12.0	0.012	0.012	0.02	4.20	421.50	421.05	424.70	424.25	421.56	421.10	1.41
YD-3-2	MH-309	37.0	12.0	12.0	0.033	0.012	0.10	7.04	420.85	419.62	424.25	423.50	420.98	419.70	3.22
I-311	MH-309	60.0	18.0	18.0	0.005	0.012	9.27	8.05	418.00	417.70	421.75	423.50	419.50	419.13	5.25
MH-309	MH-310	60.0	18.0	18.0	0.005	0.012	9.37	8.05	417.50	417.20	423.50	425.50	418.90	418.38	5.30
YD-G4	MH-313	13.0	24.0	24.0	0.023	0.012	0.17	37.23	416.10	415.80	420.00	420.00	416.24	415.98	3.00
MH-313	MH-315	102.0	18.0	18.0	0.008	0.013	0.17	9.30	415.80	415.00	420.00	421.50	415.95	415.67	2.03
MH-302	I-302	18.0	18.0	18.0	0.014	0.013	0.08	12.38	427.50	427.25	431.25	431.00	427.61	427.48	2.01
I-302	MH-303	28.0	18.0	18.0	0.005	0.013	0.95	7.43	427.05	426.91	431.00	432.00	427.41	427.39	2.89
I-303	MH-303	77.0	18.0	18.0	0.006	0.013	1.35	8.12	428.75	428.29	432.59	432.00	429.19	428.70	3.41
MH-303	I-301	20.0	18.0	18.0	0.015	0.013	2.30	12.86	426.71	426.41	432.00	431.75	427.28	427.12	5.51
I-301	MH-314	34.0	18.0	18.0	0.005	0.013	2.48	7.43	426.41	426.24	431.75	432.25	427.01	426.84	3.78
MH-314	MH-315	106.0	18.0	18.0	0.014	0.013	2.48	12.50	417.00	415.50	432.25	421.50	417.60	415.95	5.51
MH-315	EX-MH-6	67.0	24.0	24.0	0.023	0.012	2.65	37.27	415.00	413.45	421.50	425.98	415.57	414.92	6.87
EX-MH-6	MH-310	48.0	24.0	24.0	0.006	0.012	2.65	18.72	413.45	413.17	425.98	425.50	414.91	414.91	4.22
MH-310	OF-2	92.0	24.0	24.0	0.003	0.012	12.03	13.03	413.17	412.91	425.50	418.84	414.75	414.53	4.71
YD-G3	I-221	19.0	12.0	12.0	0.005	0.013	0.86	2.58	428.60	428.50	432.64	432.75	429.49	429.48	2.96
OS-2B	I-220	29.0	18.0	18.0	0.010	0.013	4.28	10.68	429.00	428.70	435.00	433.65	429.79	429.77	5.71
I-220	I-221	38.0	18.0	18.0	0.005	0.012	5.33	8.26	428.70	428.50	433.65	432.75	429.59	429.48	4.97
I-221	I-222	210.0	18.0	18.0	0.045	0.012	6.28	24.20	428.30	418.80	432.75	422.50	429.27	419.88	11.50
I-222	I-223	39.0	18.0	18.0	0.052	0.012	7.26	25.90	418.60	416.58	422.50	419.00	419.64	417.17	12.58
I-223	I-224	37.0	18.0	18.0	0.035	0.012	7.58	21.33	415.05	413.75	419.00	417.50	416.91	416.74	4.29
OS-2B-1	I-224	82.0	18.0	18.0	0.034	0.013	5.70	19.24	416.50	413.75	421.75	417.50	417.42	416.74	9.49
I-224	MH-224	20.0	18.0	18.0	0.011	0.012	13.56	11.93	413.55	413.33	417.50	416.00	416.28	416.00	7.68
MH-224	EX. INLET	46.0	18.0	18.0	0.005	0.012	13.56	8.05	413.13	412.90	416.00	415.03	415.65	415.00	7.68
I-304	I-305	80.0	18.0	18.0	0.015	0.013	1.15	12.92	425.80	424.59	429.75	428.30	426.20	424.89	4.52
I-310	I-309	115.0	18.0	18.0	0.010	0.013	1.16	10.27	432.17	431.07	435.88	434.78	432.57	431.69	3.85
I-309	I-308	97.0	18.0	18.0	0.016	0.013	3.27	13.41	430.87	429.29	434.78	433.00	431.56	430.18	6.26
I-308	I-307	52.0	18.0	18.0	0.026	0.013	5.47	16.86	429.09	427.75	433.00	431.50	429.99	428.79	8.52
I-307	I-306	92.0	18.0	18.0	0.025	0.013	6.86	16.61	427.55	425.25	431.50	429.00	428.56	426.30	8.95
I-306	I-305	72.0	18.0	18.0	0.006	0.013	8.59	8.40	425.05	424.59	429.00	428.30	426.30	425.73	5.41
I-305	MH-316	34.0	18.0	18.0	0.109	0.013	10.17	34.70	422.00	418.29	428.30	422.00	423.23	419.81	17.04
MH-316	MH-304	26.0	18.0	18.0	0.005	0.013	10.17	7.43	418.09	417.96	422.00	422.00	419.55	419.19	5.76
MH-304	MH-305	202.0	30.0	30.0	0.005	0.013	10.17	29.00	416.96	415.95	422.00	421.00	418.03	417.85	5.39
I-312	I-313	71.0	18.0	18.0	0.012	0.013	1.94	11.63	423.75	422.88	427.50	426.59	424.28	424.26	4.88
I-313	I-314	133.0	18.0	18.0	0.004	0.013	7.33	6.57	422.68	422.16	426.59	426.60	424.13	423.55	4.15
I-314	MH-305	30.0	24.0	24.0	0.153	0.013	14.51	88.39	421.87	417.29	426.60	421.00	423.24	417.93	20.77
MH-305	MH-306	165.0	30.0	30.0	0.006	0.013	24.68	32.41	415.75	414.72	421.00	420.00	417.49	417.21	7.27
MH-306	MH-307	22.0	30.0	30.0	0.009	0.013	24.68	39.11	411.50	411.30	420.00	419.90	417.01	416.93	5.03
MH-307	OF-4	2.0	24.0	24.0	0.550	0.013	24.68	167.76	411.60	410.50	419.90	416.50	416.45	416.43	7.86
OS-3A	EX.INLET2	377.0	24.0	24.0	0.005	0.012	22.56	17.40	410.50	408.60	418.00	416.24	413.63	410.29	7.18

Profile Report
Engineering Profile - OS-3A to EX.INLET2 (Stormcad-GARAGE.stc)



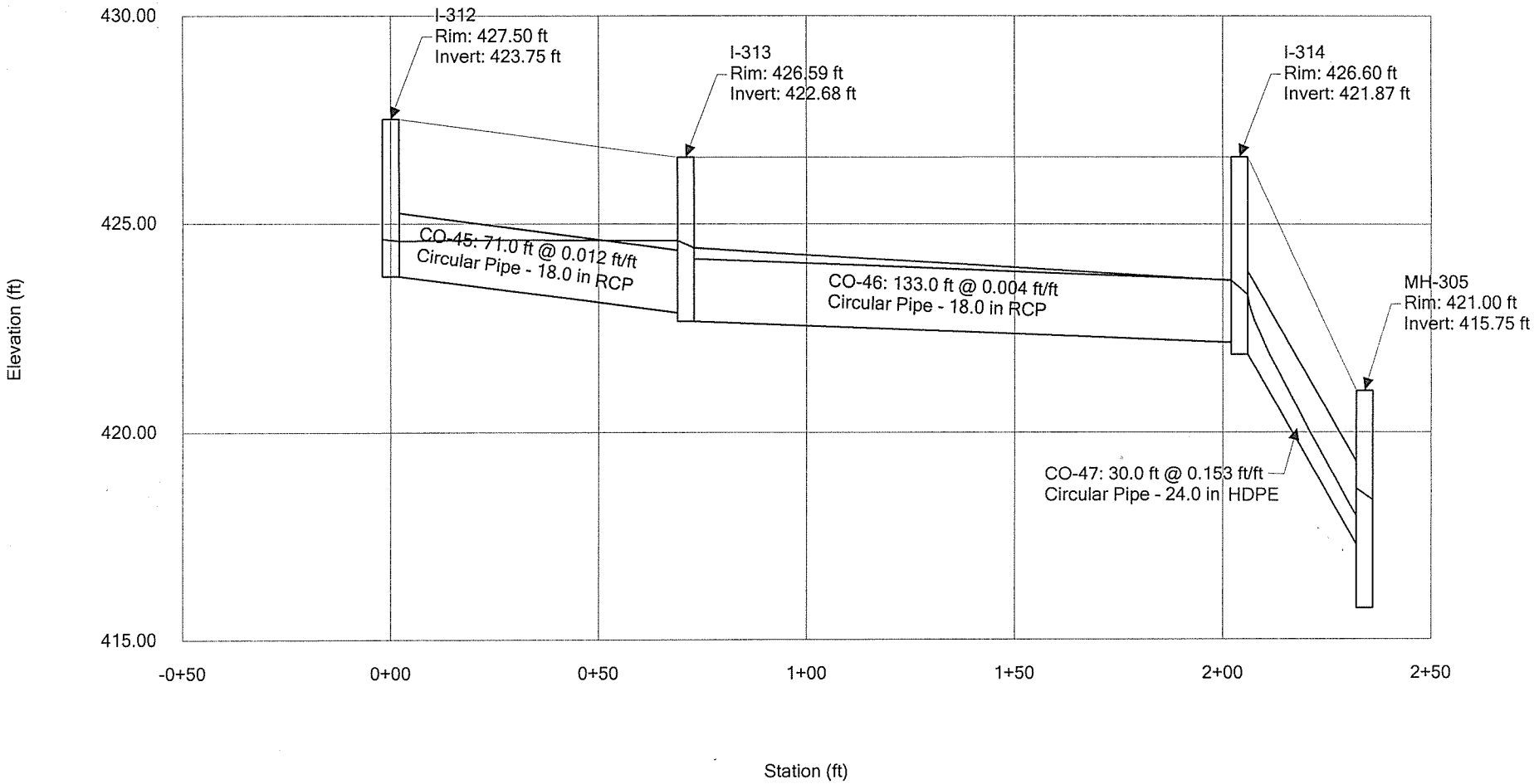
Profile Report

Engineering Profile - OS-2B to EX.INLET (Stormcad-GARAGE.stc)

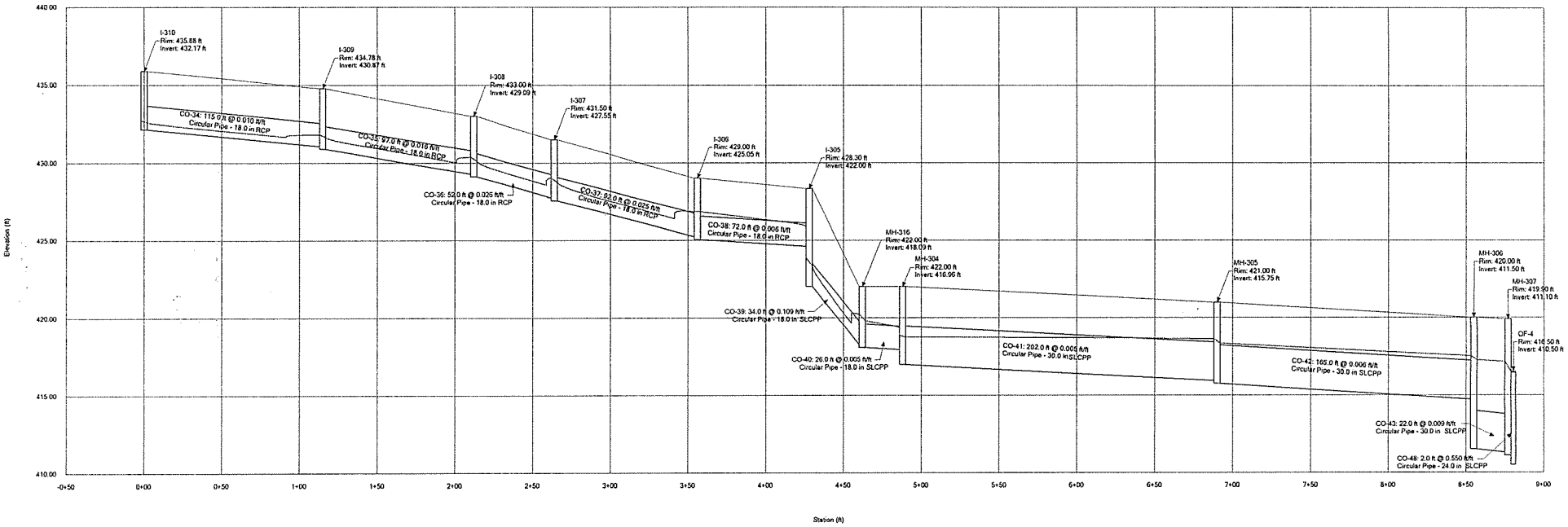


Profile Report

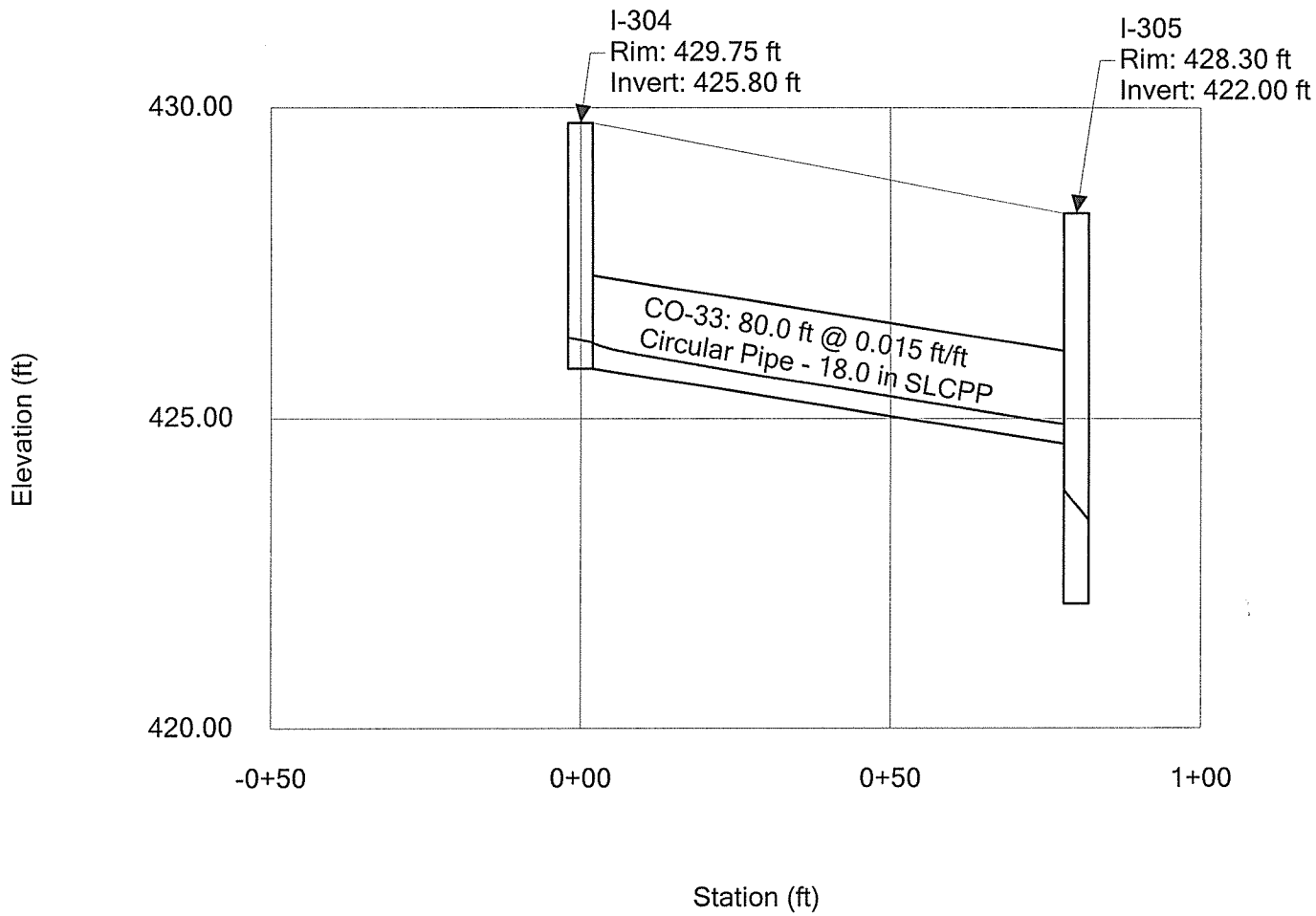
Engineering Profile - I-312 to MH-305 (Stormcad-GARAGE.stc)



Profile Report
Engineering Profile - I-310 to Basin 3A (Stormcad-GARAGE.stc)

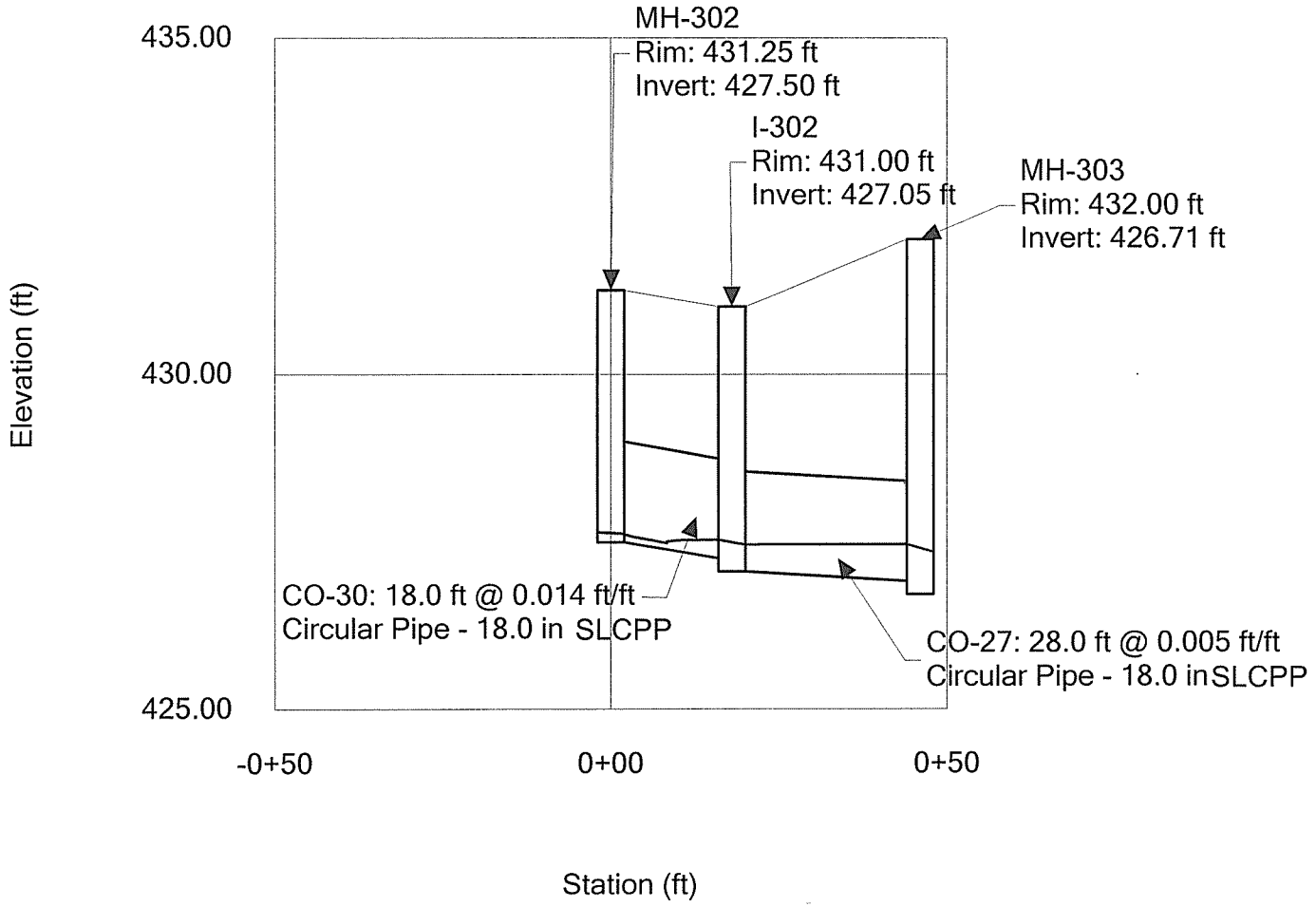


Profile Report
Engineering Profile - I-304 to I-305 (Stormcad-GARAGE.stc)

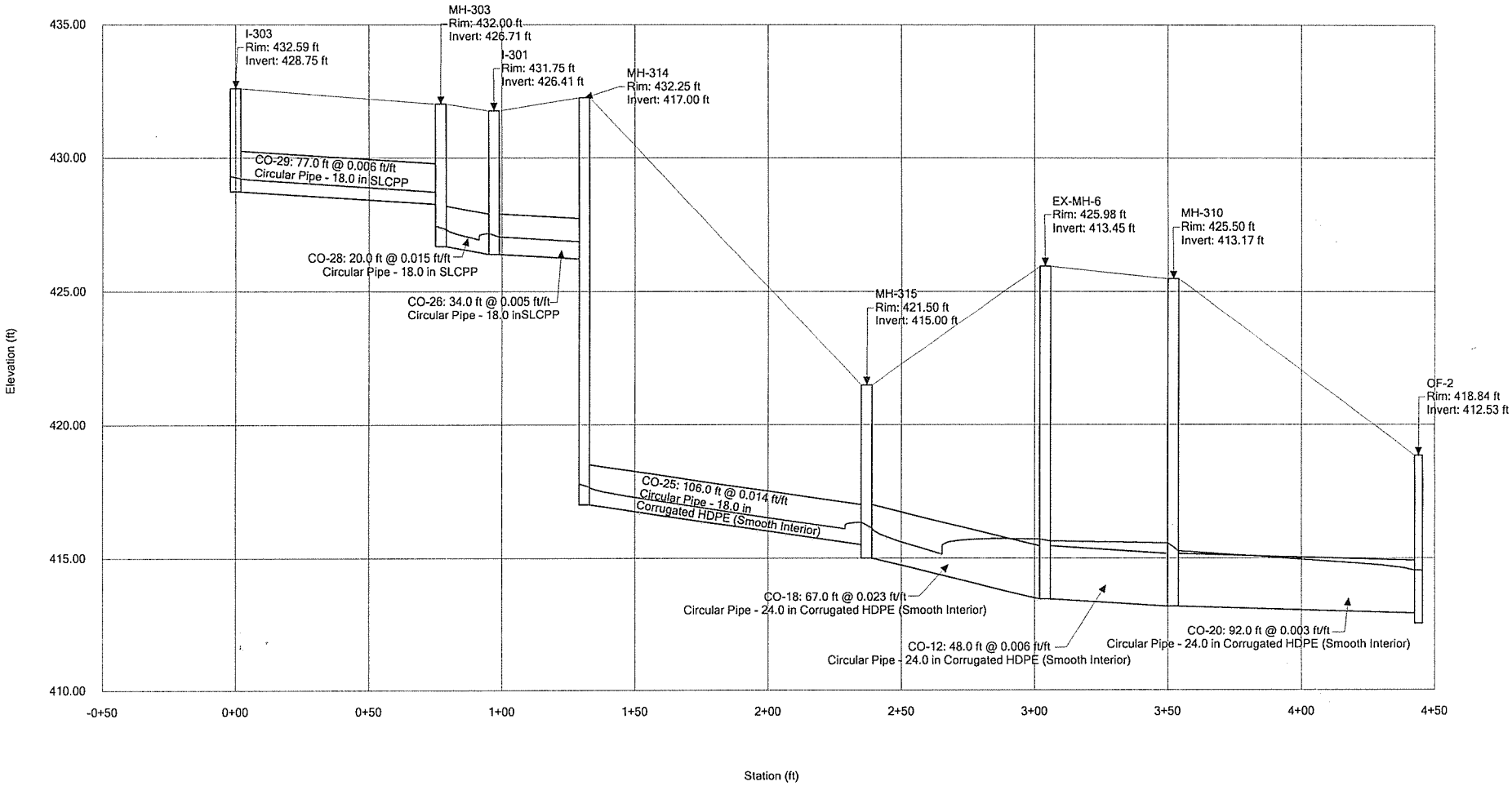


Profile Report

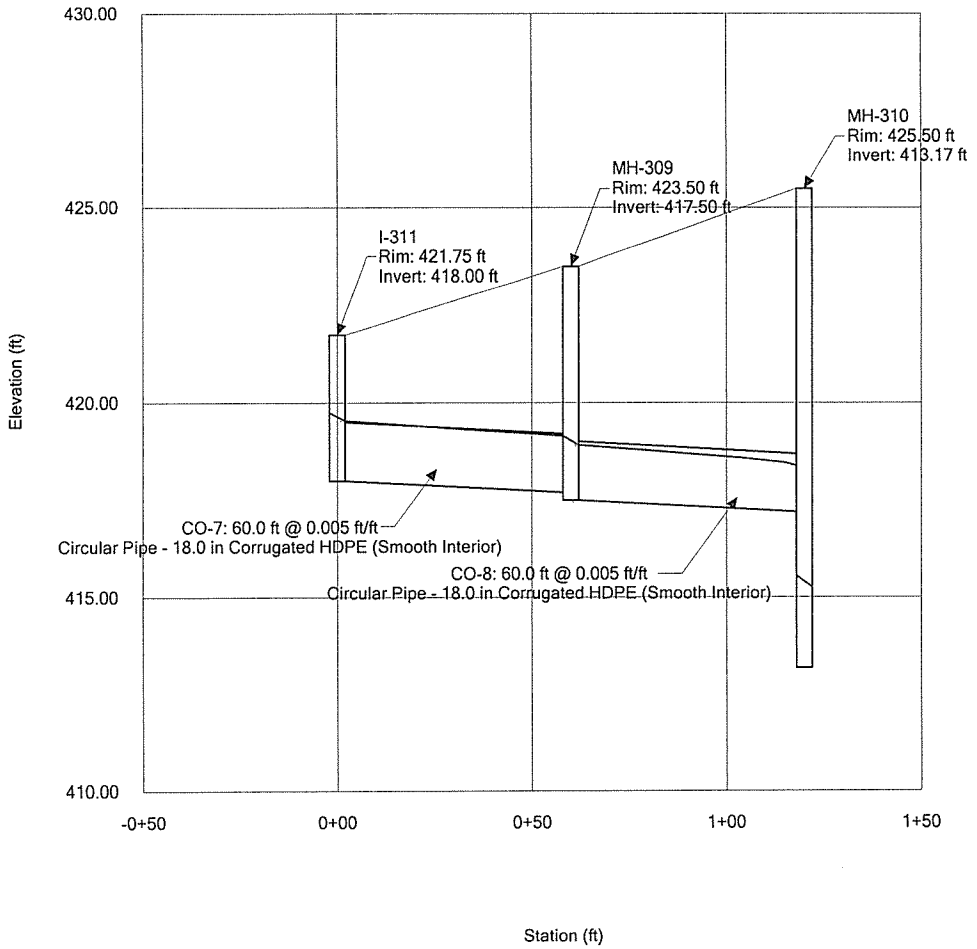
Engineering Profile - MH-302 to MH-303 (Stormcad-GARAGE.stc)



Profile Report
Engineering Profile - I-303 to OF2 (Stormcad-GARAGE.stc)



Profile Report
Engineering Profile - I-311 to MH-310 (Stormcad-GARAGE.stc)



Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203
-755-1666

VIII.

ADVANCED GeoServices
Engineering for the Environment. Planning for People.℠
1055 Andrew Drive, Suite A
West Chester, PA 19380-4293
tel 610.840.9100 fax 610.840.9199
www.advancedgeoservices.com

October 8, 2014 2014-3198-01

Villanova University
Maintenance Building 1st
Project Management
800 Lancaster Avenue
Villanova, PA 19085

Attention: Ms. Marilou Smith, LEED

INFILTRATION TEST REPORT
LAH DEVELOPMENT
VILLANOVA UNIVERSITY

Dear Ms. Smith:

Advanced GeoServices is pleased to present this summary of the infiltration testing performed for the proposed LAH Development at Villanova University. This work was performed in accordance with the infiltration testing scope of work included in our September 18, 2014 Service Agreement with Villanova University.

Infiltration testing was originally planned for a total of 40 locations, as shown on Drawings CU4.01, CU4.02, and CU4.03 developed by Voith & Mactavish Architects LLP and Robert A. M. Stern Architects LLP and included in the Request for Proposal. However, the two locations on the north side of Lancaster Avenue by the proposed future pedestrian bridge (TP-9 and TP-10) and the two locations within Pike Filed (TP-26 and TP-27) were eliminated from the present study. Thus, testing was performed at 36 locations.

Test Borings

To provide an indication of subsurface conditions, an initial boring was drilled at each infiltration test location to a depth of 7 feet to determine if any limiting zones (groundwater and/or rock) were present. No limiting zones were encountered at the test locations. The boring locations are shown on the attached drawings and logs of the borings are included in Appendix A.

Infiltration Testing

Infiltration testing was conducted at 36 locations via the Maryland Method (Maryland Stormwater Manual Appendix D.1) using test borings and 5-inch diameter casing. The test locations are shown on the attached drawings. The Maryland Method is an approved alternative for infiltration testing in the PADEP Manual (Appendix C) and provides the same measurements (infiltration rate in inches per hour). The tests were conducted on September 23, 24 and 26, 2014. The weather at the time of testing was generally partly sunny and warm (in the mid- 70°s F). A description of the test method is provided below.

- A secondary boring was drilled at each of the test locations adjacent to the initial boring used to characterize the subsurface conditions. The secondary boring was extended to the depth of 5 feet.
- A five-inch diameter PVC pipe was installed to the bottom of each borehole and the annular space around the pipe was backfilled with the drilling spoils.
- The pipes were filled with clean water to a depth of 24 inches above the bottom of the borehole (2 gallons of water) and allowed to pre-soak for 24 hours.
- Following the pre-soak, the pipes were refilled to a depth of 24 inches above the bottom of the borehole.
- Using a depth-to-water meter, the water levels in the pipes were monitored for a period of one hour and the data (time and depth) were recorded. This procedure (i.e., refilling to a depth of 24 inches above the bottom of the pipe and monitoring the water level for one hour) was repeated three additional times, for a total of four trials at each test location.

The field data is included in Appendix B and a summary of the results with the calculated infiltration rates are shown on the attached Table. The infiltration rate was calculated as the average of the last readings from the four trials at that location. Note that the listed infiltration rates are the calculated results; no factor of safety was applied.

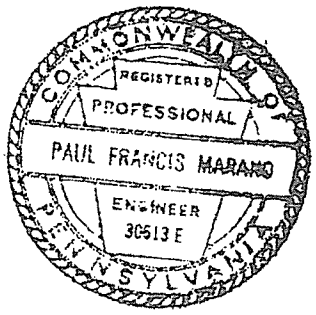
The infiltration rates calculated in this report are estimates based upon the conditions encountered at the test locations and the depths of the testing. The actual average infiltration rate for each stormwater feature will depend upon the soil types and soil densities encountered throughout the bottom of the feature.

We appreciate this opportunity to be of service to you. If you have any questions regarding the contents of this report, please contact us.

Very truly yours,

ADVANCED GEOSERVICES CORP.

Paul F. Marano, P.E.
Project Consultant



PFM:kk

Attachments

cc: A. Tweedie (Nave Newell)

TABLE

VILLANOVA UNIVERSITY LAH DEVELOPMENT
INFILTRATION TESTING RESULTS

Location	Test Depth (feet)	Test Elev. (feet)	Soil Type	Infiltration Rate (in/hr)
TP-1	5	400	silty fine sand	0.36
TP-2	5	402.5	silty coarse to fine sand	0.27
TP-3	5	409.5	silty coarse to fine sand	0.12
TP-4	5	414.25	silty coarse to fine sand	1.14
TP-5	5	418.25	silty coarse to fine sand	0.90
TP-6	5	430.5	silty fine sand	0.12
TP-7	5	431.25	silty fine sand	0.30
TP-8	5	431.5	silty fine sand	0.12
TP-9	5			
TP-10	5			
TP-11	5	433.75	fine sandy silt *	0.18
TP-12	5	432.5	clayey silt *	4.05
TP-13	5	430.5	coarse to fine sand and gravel *	0.27
TP-14	5	428.5	silty fine sand	0.90
TP-15	5	427.5	silty coarse to fine sand and gravel *	11.70
TP-16	5	426	silty coarse to fine sand *	0.03
TP-17	5	424.5	silty coarse to fine sand and gravel *	12.84
TP-18	5	424.25	silty coarse to fine sand and gravel *	1.23
TP-19	5	428.5	coarse to fine sand and gravel *	0.48
TP-20	5	423.5	clayey silt *	12.69
TP-21	5	428.25	coarse to fine sand and gravel *	16.44
TP-22	5	430.25	silty fine sand	0.30
TP-23	5	430.5	silty coarse to fine sand *	0.33
TP-24	5	423.25	clayey silt	3.66
TP-25	5	422.5	silty coarse to fine sand and gravel *	0.75
TP-26	5			
TP-27	5			
TP-28	5	397.5	fine sandy silt with clay	0.33
TP-29	5	401.5	silty fine sand	0.09
TP-30	5	414	silty fine sand	0.60
TP-31	5	417	silty coarse to fine sand	0.72
TP-32	5	422	silty coarse to fine sand	0.87
TP-33	5	424.5	silty fine sand	0.90
TP-34	5	425.5	silty fine sand	1.00
TP-35	5	431.5	clayey silt w/ concrete fragments*	9.06
TP-36	5	431	clayey silt	1.86
TP-37	5	430	sand gravel and cobbles *	1.29
TP-38	5	430	silty fine sand	0.63
TP-39	5	429	silty coarse to fine sand and gravel *	1.32
TP-40	5	429	silty sand and gravel	1.44

* Fill Material

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-1
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:23	0	0	3.27	0.00	0	0	0
10:53	30	30	3.3	0.03	0.03	0.72	0.72
11:23	30	60	3.31	0.01	0.04	0.24	0.48

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:23	0	0	3.04	0.00	0	0	0
11:53	30	30	3.06	0.02	0.02	0.48	0.48
12:23	30	60	3.07	0.01	0.03	0.24	0.36

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:23	0	0	3.01	0.00	0	0	0
12:53	30	30	3.02	0.01	0.01	0.24	0.24
1:23	30	60	3.03	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:23	0	0	3	0.00	0	0	0
1:53	30	30	3.02	0.02	0.02	0.48	0.48
2:23	30	60	3.03	0.01	0.03	0.24	0.36

Test conducted in silty fine sand (elev. 400)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-2
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:22	0	0	2.72	0.00	0	0	0
10:52	30	30	2.73	0.01	0.01	0.24	0.24
11:22	30	60	2.74	0.01	0.02	0.24	0.24

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:22	0	0	2.74	0.00	0	0	0
11:52	30	30	2.75	0.01	0.01	0.24	0.24
12:22	30	60	2.76	0.01	0.02	0.24	0.24

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:22	0	0	2.76	0.00	0	0	0
12:52	30	30	2.78	0.02	0.02	0.48	0.48
1:22	30	60	2.78	0.00	0.02	0.00	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:22	0	0	2.78	0.00	0	0	0
1:52	30	30	2.8	0.02	0.02	0.48	0.48
2:22	30	60	2.81	0.01	0.03	0.24	0.36

Test conducted in silty coarse to fine sand (elev. 402.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-3
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:20	0	0	2.82	0.00	0	0	0
10:50	30	30	2.84	0.02	0.02	0.48	0.48
11:20	30	60	2.84	0.00	0.02	0.00	0.24

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:20	0	0	2.84	0.00	0	0	0
11:50	30	30	2.85	0.01	0.01	0.24	0.24
12:20	30	60	2.85	0.00	0.01	0.00	0.12

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:20	0	0	2.85	0.00	0	0	0
12:50	30	30	2.85	0.00	0.00	0.00	0.00
1:20	30	60	2.85	0.00	0.00	0.00	0.00

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:20	0	0	2.85	0.00	0	0	0
1:50	30	30	2.85	0.00	0.00	0.00	0.00
2:20	30	60	2.86	0.01	0.01	0.24	0.12

Test conducted in silty coarse to fine sand (elev.409.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-4
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:19	0	0	3.05	0.00	0	0	0
10:49	30	30	3.11	0.06	0.06	1.44	1.44
11:19	30	60	3.18	0.07	0.13	1.68	1.56

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:19	0	0	3	0.00	0	0	0
11:49	30	30	3.06	0.06	0.06	1.44	1.44
12:19	30	60	3.11	0.05	0.11	1.20	1.32

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:19	0	0	3.02	0.00	0	0	0
12:49	30	30	3.06	0.04	0.04	0.96	0.96
1:19	30	60	3.09	0.03	0.07	0.72	0.84

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:19	0	0	3.01	0.00	0	0	0
1:49	30	30	3.05	0.04	0.04	0.96	0.96
2:19	30	60	3.08	0.03	0.07	0.72	0.84

Test conducted in silty coarse to fine sand (elev. 414.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-5
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:35	0	0	3.03	0.00	0	0	0
8:05	30	30	3.06	0.03	0.03	0.72	0.72
8:35	30	60	3.1	0.04	0.07	0.96	0.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:35	0	0	3.01	0.00	0	0	0
9:05	30	30	3.05	0.04	0.04	0.96	0.96
9:35	30	60	3.09	0.04	0.08	0.96	0.96

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:35	0	0	2.95	0.00	0	0	0
10:05	30	30	2.98	0.03	0.03	0.72	0.72
10:35	30	60	3.02	0.04	0.07	0.96	0.84

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:35	0	0	3.01	0.00	0	0	0
11:05	30	30	3.05	0.04	0.04	0.96	0.96
11:35	30	60	3.09	0.04	0.08	0.96	0.96

Test conducted in silty coarse to fine sand (elev. 418.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-6
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:30	0	0	2.97	0.00	0	0	0
8:00	30	30	2.97	0.00	0.00	0.00	0.00
8:30	30	60	2.98	0.01	0.01	0.24	0.12

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:30	0	0	2.98	0.00	0	0	0
9:00	30	30	2.98	0.00	0.00	0.00	0.00
9:30	30	60	2.99	0.01	0.01	0.24	0.12

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:30	0	0	2.99	0.00	0	0	0
10:00	30	30	3	0.01	0.01	0.24	0.24
10:30	30	60	3	0.00	0.01	0.00	0.12

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:30	0	0	3	0.00	0	0	0
11:00	30	30	3	0.00	0.00	0.00	0.00
11:30	30	60	3.01	0.01	0.01	0.24	0.12

Test conducted in silty fine sand (elev. 430.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-7
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:31	0	0	2.89	0.00	0	0	0
8:01	30	30	2.91	0.02	0.02	0.48	0.48
8:31	30	60	2.92	0.01	0.03	0.24	0.36

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:31	0	0	2.92	0.00	0	0	0
9:01	30	30	2.94	0.02	0.02	0.48	0.48
9:31	30	60	2.95	0.01	0.03	0.24	0.36

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:31	0	0	2.95	0.00	0	0	0
10:01	30	30	2.96	0.01	0.01	0.24	0.24
10:31	30	60	2.97	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:31	0	0	2.98	0.00	0	0	0
11:01	30	30	2.99	0.01	0.01	0.24	0.24
11:31	30	60	3	0.01	0.02	0.24	0.24

Test conducted in silty fine sand (elev. 431.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-8
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:32	0	0	2.68	0.00	0	0	0
8:02	30	30	2.68	0.00	0.00	0.00	0.00
8:32	30	60	2.68	0.00	0.00	0.00	0.00

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:32	0	0	2.68	0.00	0	0	0
9:02	30	30	2.69	0.01	0.01	0.24	0.24
9:32	30	60	2.69	0.00	0.01	0.00	0.12

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:32	0	0	2.69	0.00	0	0	0
10:02	30	30	2.7	0.01	0.01	0.24	0.24
10:32	30	60	2.71	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:32	0	0	2.71	0.00	0	0	0
11:02	30	30	2.71	0.00	0.00	0.00	0.00
11:32	30	60	2.72	0.01	0.01	0.24	0.12

Test conducted in silty fine sand (elev. 431.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-11
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:29	0	0	3.07	0.00	0	0	0
7:59	30	30	3.07	0.00	0.00	0.00	0.00
8:29	30	60	3.08	0.01	0.01	0.24	0.12

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:29	0	0	2.99	0.00	0	0	0
8:59	30	30	3	0.01	0.01	0.24	0.24
9:29	30	60	3.01	0.01	0.02	0.24	0.24

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:29	0	0	3.01	0.00	0	0	0
9:59	30	30	3.02	0.01	0.01	0.24	0.24
10:29	30	60	3.03	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:29	0	0	3.01	0.00	0	0	0
10:59	30	30	3.01	0.00	0.00	0.00	0.00
11:29	30	60	3.02	0.01	0.01	0.24	0.12

Test conducted in fine sandy silt (Fill) (elev. 433.75)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-12
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:27	0	0	2.91	0.00	0	0	0
7:57	30	30	3.1	0.19	0.19	4.56	4.56
8:27	30	60	3.3	0.20	0.39	4.80	4.68

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:27	0	0	3.01	0.00	0	0	0
8:57	30	30	3.18	0.17	0.17	4.08	4.08
9:27	30	60	3.33	0.15	0.32	3.60	3.84

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:27	0	0	3.03	0.00	0	0	0
9:57	30	30	3.17	0.14	0.14	3.36	3.36
10:27	30	60	3.35	0.18	0.32	4.32	3.84

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:27	0	0	3.03	0.00	0	0	0
10:57	30	30	3.2	0.17	0.17	4.08	4.08
11:27	30	60	3.35	0.15	0.32	3.60	3.84

Test conducted in clayey silt (Fill) (elev. 432.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-13
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:25	0	0	2.33	0.00	0	0	0
7:55	30	30	2.34	0.01	0.01	0.24	0.24
8:25	30	60	2.36	0.02	0.03	0.48	0.36

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:25	0	0	2.36	0.00	0	0	0
8:55	30	30	2.36	0.00	0.00	0.00	0.00
9:25	30	60	2.38	0.02	0.02	0.48	0.24

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:25	0	0	2.38	0.00	0	0	0
9:55	30	30	2.39	0.01	0.01	0.24	0.24
10:25	30	60	2.4	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:25	0	0	2.4	0.00	0	0	0
10:55	30	30	2.41	0.01	0.01	0.24	0.24
11:25	30	60	2.42	0.01	0.02	0.24	0.24

Test conducted in coarse to fine sand and gravel (Fill) (elev. 430.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-14
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:35	0	0	3.07	0.00	0	0	0
1:05	30	30	3.11	0.04	0.04	0.96	0.96
1:35	30	60	3.15	0.04	0.08	0.96	0.96

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:35	0	0	2.99	0.00	0	0	0
2:05	30	30	3.02	0.03	0.03	0.72	0.72
2:35	30	60	3.06	0.04	0.07	0.96	0.84

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:35	0	0	3.03	0.00	0	0	0
3:05	30	30	3.07	0.04	0.04	0.96	0.96
3:35	30	60	3.11	0.04	0.08	0.96	0.96

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
3:35	0	0	2.95	0.00	0	0	0
4:05	30	30	2.97	0.02	0.02	0.48	0.48
4:35	30	60	3.02	0.05	0.07	1.20	0.84

Test conducted in silty fine sand (elev. 428.50)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-15
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:38	0	0	2.8	0.00	0	0	0
1:08	30	30	3.45	0.65	0.65	15.60	15.60
1:38	30	60	3.87	0.42	1.07	10.08	12.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:38	0	0	2.93	0.00	0	0	0
2:08	30	30	3.53	0.60	0.60	14.40	14.40
2:38	30	60	3.89	0.36	0.96	8.64	11.52

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:38	0	0	2.94	0.00	0	0	0
3:08	30	30	3.51	0.57	0.57	13.68	13.68
3:38	30	60	3.91	0.40	0.97	9.60	11.64

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
3:38	0	0	3.04	0.00	0	0	0
4:08	30	30	3.55	0.51	0.51	12.24	12.24
4:38	30	60	3.94	0.39	0.90	9.36	10.80

Test conducted in silty coarse to fine sand and gravel (Fill) (elev. 427.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-16
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:40	0	0	2.57	0.00	0	0	0
1:10	30	30	2.57	0.00	0.00	0.00	0.00
1:40	30	60	2.57	0.00	0.00	0.00	0.00

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:40	0	0	2.57	0.00	0	0	0
2:10	30	30	2.57	0.00	0.00	0.00	0.00
2:40	30	60	2.57	0.00	0.00	0.00	0.00

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:40	0	0	2.57	0.00	0	0	0
3:10	30	30	2.58	0.01	0.01	0.24	0.24
3:40	30	60	2.58	0.00	0.01	0.00	0.12

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
3:40	0	0	2.58	0.00	0	0	0
4:10	30	30	2.58	0.00	0.00	0.00	0.00
4:40	30	60	2.58	0.00	0.00	0.00	0.00

Test conducted in silty coarse to fine sand (Fill) (elev. 426)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-17
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:42	0	0	2.89	0.00	0	0	0
1:12	30	30	3.84	0.95	0.95	22.80	22.80
1:42	30	60	4.1	0.26	1.21	6.24	14.52

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:42	0	0	3.07	0.00	0	0	0
2:12	30	30	3.64	0.57	0.57	13.68	13.68
2:42	30	60	3.93	0.29	0.86	6.96	10.32

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:42	0	0	3.04	0.00	0	0	0
3:12	30	30	3.72	0.68	0.68	16.32	16.32
3:42	30	60	4.09	0.37	1.05	8.88	12.60

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
3:42	0	0	3.02	0.00	0	0	0
4:12	30	30	3.78	0.76	0.76	18.24	18.24
4:42	30	60	4.18	0.40	1.16	9.60	13.92

Test conducted in silty coarse to fine sand and gravel (Fill) (elev. 424.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-18
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:45	0	0	3.03	0.00	0	0	0
1:15	30	30	3.08	0.05	0.05	1.20	1.20
1:45	30	60	3.15	0.07	0.12	1.68	1.44

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:45	0	0	2.89	0.00	0	0	0
2:15	30	30	2.94	0.05	0.05	1.20	1.20
2:45	30	60	3.01	0.07	0.12	1.68	1.44

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:45	0	0	3.01	0.00	0	0	0
3:15	30	30	3.05	0.04	0.04	0.96	0.96
3:45	30	60	3.09	0.04	0.08	0.96	0.96

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
3:45	0	0	3.01	0.00	0	0	0
4:15	30	30	3.06	0.05	0.05	1.20	1.20
4:45	30	60	3.1	0.04	0.09	0.96	1.08

Test conducted in silty coarse to fine sand and gravel (Fill) (elev. 424.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-19
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:22	0	0	3.01	0.00	0	0	0
7:52	30	30	3.03	0.02	0.02	0.48	0.48
8:22	30	60	3.05	0.02	0.04	0.48	0.48

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:22	0	0	3	0.00	0	0	0
8:52	30	30	3.02	0.02	0.02	0.48	0.48
9:22	30	60	3.04	0.02	0.04	0.48	0.48

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:22	0	0	3	0.00	0	0	0
9:52	30	30	3.02	0.02	0.02	0.48	0.48
10:22	30	60	3.04	0.02	0.04	0.48	0.48

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:22	0	0	3.01	0.00	0	0	0
10:52	30	30	3.03	0.02	0.02	0.48	0.48
11:22	30	60	3.05	0.02	0.04	0.48	0.48

Test conducted in coarse to fine sand and gravel (Fill) (elev. 428.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-20
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:31	0	0	3.03	0.00	0	0	0
8:01	30	30	3.82	0.79	0.79	18.96	18.96
8:31	30	60	4.34	0.52	1.31	12.48	15.72

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:31	0	0	3.01	0.00	0	0	0
9:01	30	30	3.92	0.91	0.91	21.84	21.84
9:31	30	60	4.32	0.40	1.31	9.60	15.72

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:31	0	0	3.02	0.00	0	0	0
10:01	30	30	3.92	0.90	0.90	21.60	21.60
10:31	30	60	4.38	0.46	1.36	11.04	16.32

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:31	0	0	3.45	0.00	0	0	0
11:01	30	30	4.04	0.59	0.59	14.16	14.16
11:31	30	60	4.3	0.26	0.85	6.24	10.20

Test conducted in clayey silt (Fill) (elev. 423.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-21
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:20	0	0	2.94	0.00	0	0	0
7:50	30	30	3.75	0.81	0.81	19.44	19.44
8:20	30	60	4.29	0.54	1.35	12.96	16.20

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:20	0	0	3.03	0.00	0	0	0
8:50	30	30	4.18	1.15	1.15	27.60	27.60
9:20	30	60	4.51	0.33	1.48	7.92	17.76

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:20	0	0	3.04	0.00	0	0	0
9:50	30	30	4.05	1.01	1.01	24.24	24.24
10:20	30	60	4.38	0.33	1.34	7.92	16.08

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:20	0	0	3.07	0.00	0	0	0
10:50	30	30	4.08	1.01	1.01	24.24	24.24
11:20	30	60	4.38	0.30	1.31	7.20	15.72

Test conducted in coarse to fine sand and gravel (Fill) (elev. 428.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-22
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:18	0	0	3.01	0.00	0	0	0
7:48	30	30	3.02	0.01	0.01	0.24	0.24
8:18	30	60	3.03	0.01	0.02	0.24	0.24

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:18	0	0	3.03	0.00	0	0	0
8:48	30	30	3.04	0.01	0.01	0.24	0.24
9:18	30	60	3.06	0.02	0.03	0.48	0.36

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:18	0	0	3.01	0.00	0	0	0
9:48	30	30	3.02	0.01	0.01	0.24	0.24
10:18	30	60	3.03	0.01	0.02	0.24	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:18	0	0	3	0.00	0	0	0
10:48	30	30	3.02	0.02	0.02	0.48	0.48
11:18	30	60	3.03	0.01	0.03	0.24	0.36

Test conducted in silty fine sand (elev. 430.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-23
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:17	0	0	2.99	0.00	0	0	0
7:47	30	30	3.01	0.02	0.02	0.48	0.48
8:17	30	60	3.02	0.01	0.03	0.24	0.36

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:17	0	0	3.02	0.00	0	0	0
8:47	30	30	3.03	0.01	0.01	0.24	0.24
9:17	30	60	3.04	0.01	0.02	0.24	0.24

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:17	0	0	3.01	0.00	0	0	0
9:47	30	30	3.01	0.00	0.00	0.00	0.00
10:17	30	60	3.03	0.02	0.02	0.48	0.24

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:17	0	0	2.98	0.00	0	0	0
10:47	30	30	3.01	0.03	0.03	0.72	0.72
11:17	30	60	3.02	0.01	0.04	0.24	0.48

Test conducted in silty coarse to fine sand (Fill) (elev. 430.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-24
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:56	0	0	2.76	0.00	0	0	0
12:26	30	30	3.02	0.26	0.26	6.24	6.24
12:56	30	60	3.2	0.18	0.44	4.32	5.28

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:56	0	0	2.97	0.00	0	0	0
1:26	30	30	3.13	0.16	0.16	3.84	3.84
1:56	30	60	3.25	0.12	0.28	2.88	3.36

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:56	0	0	3.03	0.00	0	0	0
2:26	30	30	3.17	0.14	0.14	3.36	3.36
2:56	30	60	3.28	0.11	0.25	2.64	3.00

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:56	0	0	2.91	0.00	0	0	0
3:26	30	30	3.06	0.15	0.15	3.60	3.60
3:56	30	60	3.16	0.10	0.25	2.40	3.00

Test conducted in clayey silt (elev. 423.25)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-25
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:58	0	0	3	0.00	0	0	0
12:28	30	30	3.04	0.04	0.04	0.96	0.96
12:58	30	60	3.07	0.03	0.07	0.72	0.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:58	0	0	2.98	0.00	0	0	0
1:28	30	30	3.01	0.03	0.03	0.72	0.72
1:58	30	60	3.04	0.03	0.06	0.72	0.72

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:58	0	0	2.95	0.00	0	0	0
2:28	30	30	2.98	0.03	0.03	0.72	0.72
2:58	30	60	3.01	0.03	0.06	0.72	0.72

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:58	0	0	3.01	0.00	0	0	0
3:28	30	30	3.04	0.03	0.03	0.72	0.72
3:58	30	60	3.07	0.03	0.06	0.72	0.72

Test conducted in silty coarse to fine sand and gravel (Fill) (elev. 422.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-28
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:06	0	0	3.06	0.00	0	0	0
10:36	30	30	3.08	0.02	0.02	0.48	0.48
11:06	30	60	3.1	0.02	0.04	0.48	0.48

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:06	0	0	3.01	0.00	0	0	0
11:36	30	30	3.02	0.01	0.01	0.24	0.24
12:06	30	60	3.03	0.01	0.02	0.24	0.24

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:06	0	0	3	0.00	0	0	0
12:36	30	30	3.02	0.02	0.02	0.48	0.48
1:06	30	60	3.03	0.01	0.03	0.24	0.36

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:06	0	0	3.01	0.00	0	0	0
1:36	30	30	3.02	0.01	0.01	0.24	0.24
2:06	30	60	3.03	0.01	0.02	0.24	0.24

Test conducted in fine sandy silt with clay (elev. 397.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-29
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:07	0	0	2.64	0.00	0	0	0
10:37	30	30	2.64	0.00	0.00	0.00	0.00
11:07	30	60	2.65	0.01	0.01	0.24	0.12

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:07	0	0	2.65	0.00	0	0	0
11:37	30	30	2.65	0.00	0.00	0.00	0.00
12:07	30	60	2.66	0.01	0.01	0.24	0.12

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:07	0	0	2.66	0.00	0	0	0
12:37	30	30	2.66	0.00	0.00	0.00	0.00
1:07	30	60	2.66	0.00	0.00	0.00	0.00

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:07	0	0	2.66	0.00	0	0	0
1:37	30	30	2.66	0.00	0.00	0.00	0.00
2:07	30	60	2.67	0.01	0.01	0.24	0.12

Test conductedd in silty fine sand (elev. 401.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-30
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:10	0	0	3.05	0.00	0	0	0
10:40	30	30	3.07	0.02	0.02	0.48	0.48
11:10	30	60	3.1	0.03	0.05	0.72	0.60

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:10	0	0	2.97	0.00	0	0	0
11:40	30	30	3	0.03	0.03	0.72	0.72
12:10	30	60	3.03	0.03	0.06	0.72	0.72

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:10	0	0	3	0.00	0	0	0
12:40	30	30	3.03	0.03	0.03	0.72	0.72
1:10	30	60	3.05	0.02	0.05	0.48	0.60

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:10	0	0	2.99	0.00	0	0	0
1:40	30	30	3.01	0.02	0.02	0.48	0.48
2:10	30	60	3.03	0.02	0.04	0.48	0.48

Test conducted in silty fine sand (elev. 414)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-31
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:13	0	0	3.04	0.00	0	0	0
10:43	30	30	3.07	0.03	0.03	0.72	0.72
11:13	30	60	3.1	0.03	0.06	0.72	0.72

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:13	0	0	3.01	0.00	0	0	0
11:43	30	30	3.05	0.04	0.04	0.96	0.96
12:13	30	60	3.07	0.02	0.06	0.48	0.72

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:13	0	0	3.01	0.00	0	0	0
12:43	30	30	3.04	0.03	0.03	0.72	0.72
1:13	30	60	3.07	0.03	0.06	0.72	0.72

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:13	0	0	3	0.00	0	0	0
1:43	30	30	3.03	0.03	0.03	0.72	0.72
2:13	30	60	3.06	0.03	0.06	0.72	0.72

Test conducted in silty coarse to fine sand (elev. 417)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-32
September 23, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:14	0	0	3.03	0.00	0	0	0
10:44	30	30	3.07	0.04	0.04	0.96	0.96
11:14	30	60	3.1	0.03	0.07	0.72	0.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:14	0	0	3.02	0.00	0	0	0
11:44	30	30	3.05	0.03	0.03	0.72	0.72
12:14	30	60	3.07	0.02	0.05	0.48	0.60

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:14	0	0	3	0.00	0	0	0
12:44	30	30	3.04	0.04	0.04	0.96	0.96
1:14	30	60	3.06	0.02	0.06	0.48	0.72

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:14	0	0	3	0.00	0	0	0
1:44	30	30	3.03	0.03	0.03	0.72	0.72
2:14	30	60	3.05	0.02	0.05	0.48	0.60

Test conducted in silty coarse to fine sand (elev. 422)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-33
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:26	0	0	3	0.00	0	0	0
7:56	30	30	3.04	0.04	0.04	0.96	0.96
8:26	30	60	3.08	0.04	0.08	0.96	0.96

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:26	0	0	3.03	0.00	0	0	0
8:56	30	30	3.06	0.03	0.03	0.72	0.72
9:26	30	60	3.1	0.04	0.07	0.96	0.84

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:26	0	0	3	0.00	0	0	0
9:56	30	30	3.03	0.03	0.03	0.72	0.72
10:26	30	60	3.07	0.04	0.07	0.96	0.84

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:26	0	0	3	0.00	0	0	0
10:56	30	30	3.05	0.05	0.05	1.20	1.20
11:26	30	60	3.08	0.03	0.08	0.72	0.96

Test conducted in silty fine sand (elev. 424.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-34
September 24, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:27	0	0	3.03	0.00	0	0	0
7:57	30	30	3.07	0.04	0.04	0.96	0.96
8:27	30	60	3.1	0.03	0.07	0.72	0.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:27	0	0	3.01	0.00	0	0	0
8:57	30	30	3.05	0.04	0.04	0.96	0.96
9:27	30	60	3.08	0.03	0.07	0.72	0.84

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:27	0	0	2.97	0.00	0	0	0
9:57	30	30	3	0.03	0.03	0.72	0.72
10:27	30	60	3.02	0.02	0.05	0.48	0.60

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:27	0	0	3	0.00	0	0	0
10:57	30	30	3.04	0.04	0.04	0.96	0.96
11:27	30	60	3.07	0.03	0.07	0.72	0.84

Test conducted in silty fine sand (elev. 425.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-35
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:08	0	0	2.95	0.00	0	0	0
7:38	30	30	3.59	0.64	0.64	15.36	15.36
8:08	30	60	3.81	0.22	0.86	5.28	10.32

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:08	0	0	3.05	0.00	0	0	0
8:38	30	30	3.53	0.48	0.48	11.52	11.52
9:08	30	60	3.76	0.23	0.71	5.52	8.52

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:08	0	0	3.03	0.00	0	0	0
9:38	30	30	3.51	0.48	0.48	11.52	11.52
10:08	30	60	3.77	0.26	0.74	6.24	8.88

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:08	0	0	3.08	0.00	0	0	0
10:38	30	30	3.54	0.46	0.46	11.04	11.04
11:08	30	60	3.79	0.25	0.71	6.00	8.52

Test conducted in clayey silt w/concrete fragments (Fill) (elev. 431.5)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-36
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:10	0	0	2.74	0.00	0	0	0
7:40	30	30	2.85	0.11	0:11	2.64	2.64
8:10	30	60	2.94	0.09	0.20	2.16	2.40

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:10	0	0	2.94	0.00	0	0	0
8:40	30	30	3.02	0.08	0.08	1.92	1.92
9:10	30	60	3.09	0.07	0.15	1.68	1.80

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:10	0	0	3	0.00	0	0	0
9:40	30	30	3.06	0.06	0.06	1.44	1.44
10:10	30	60	3.13	0.07	0.13	1.68	1.56

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:10	0	0	3.05	0.00	0	0	0
10:40	30	30	3.13	0.08	0.08	1.92	1.92
11:10	30	60	3.19	0.06	0.14	1.44	1.68

Test conducted in clayey silt (elev. 431)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-37
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:11	0	0	3.05	0.00	0	0	0
7:41	30	30	3.1	0.05	0.05	1.20	1.20
8:11	30	60	3.14	0.04	0.09	0.96	1.08

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:11	0	0	2.99	0.00	0	0	0
8:41	30	30	3.05	0.06	0.06	1.44	1.44
9:11	30	60	3.11	0.06	0.12	1.44	1.44

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:11	0	0	3	0.00	0	0	0
9:41	30	30	3.06	0.06	0.06	1.44	1.44
10:11	30	60	3.11	0.05	0.11	1.20	1.32

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:11	0	0	3.01	0.00	0	0	0
10:41	30	30	3.07	0.06	0.06	1.44	1.44
11:11	30	60	3.12	0.05	0.11	1.20	1.32

Test conducted in sand gravel and cobbles (Fill) (elev. 430)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-38
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
7:13	0	0	3.06	0.00	0	0	0
7:43	30	30	3.1	0.04	0.04	0.96	0.96
8:13	30	60	3.13	0.03	0.07	0.72	0.84

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
8:13	0	0	2.99	0.00	0	0	0
8:43	30	30	3.01	0.02	0.02	0.48	0.48
9:13	30	60	3.04	0.03	0.05	0.72	0.60

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
9:13	0	0	2.93	0.00	0	0	0
9:43	30	30	2.96	0.03	0.03	0.72	0.72
10:13	30	60	2.97	0.01	0.04	0.24	0.48

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
10:13	0	0	2.97	0.00	0	0	0
10:43	30	30	3.02	0.05	0.05	1.20	1.20
11:13	30	60	3.02	0.00	0.05	0.00	0.60

Test conducted in silty fine sand (elev. 430)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-39
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:53	0	0	2.95	0.00	0	0	0
12:23	30	30	3.01	0.06	0.06	1.44	1.44
12:53	30	60	3.06	0.05	0.11	1.20	1.32

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:53	0	0	3.02	0.00	0	0	0
1:23	30	30	3.07	0.05	0.05	1.20	1.20
1:53	30	60	3.13	0.06	0.11	1.44	1.32

Trial No. 3

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:53	0	0	2.99	0.00	0	0	0
2:23	30	30	3.04	0.05	0.05	1.20	1.20
2:53	30	60	3.1	0.06	0.11	1.44	1.32

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:53	0	0	2.98	0.00	0	0	0
3:23	30	30	3.04	0.06	0.06	1.44	1.44
3:53	30	60	3.09	0.05	0.11	1.20	1.32

Test conducted in silty coarse to fine sand and gravel (elev. 429)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate

Villanova University LAH Development
INFILTRATION TESTING RESULTS
TP-40
September 26, 2014

Trial No. 1

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
11:54	0	0	2.99	0.00	0	0	0
12:24	30	30	3.07	0.08	0.08	1.92	1.92
12:54	30	60	3.13	0.06	0.14	1.44	1.68

Trial No. 2

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
12:54	0	0	3.02	0.00	0	0	0
1:24	30	30	3.08	0.06	0.06	1.44	1.44
1:54	30	60	3.14	0.06	0.12	1.44	1.44

Trial No. 3

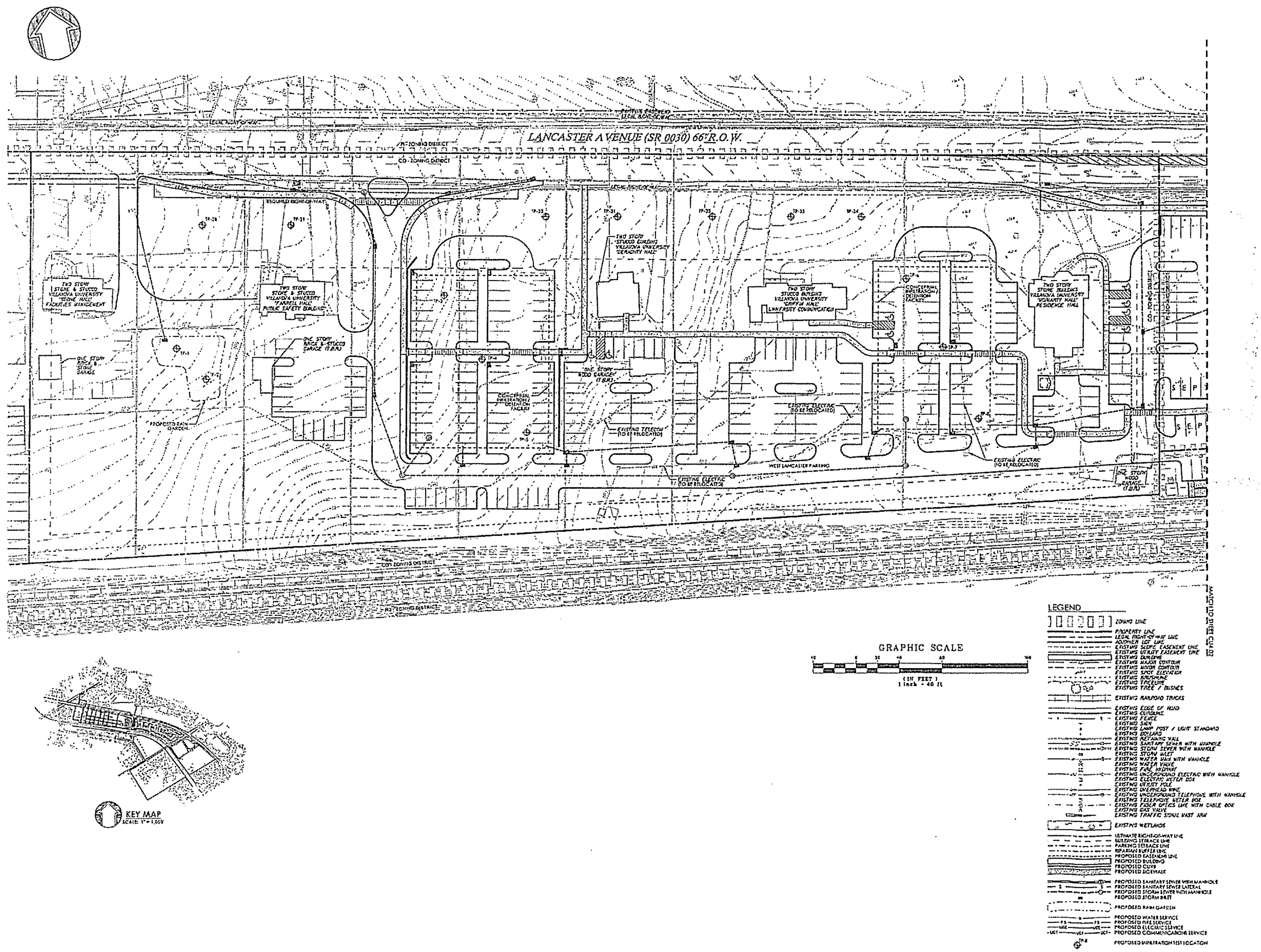
Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
1:54	0	0	3.02	0.00	0	0	0
2:24	30	30	3.08	0.06	0.06	1.44	1.44
2:54	30	60	3.14	0.06	0.12	1.44	1.44

Trial No. 4

Time	ti	T	Depth	hi	H	Ii	I
	(min)	(min)	(ft)	(ft)	(ft)	(in/hr)	(in/hr)
2:54	0	0	2.97	0.00	0	0	0
3:24	30	30	3.02	0.05	0.05	1.20	1.20
3:54	30	60	3.07	0.05	0.10	1.20	1.20

Test conducted in silty sand and gravel (elev. 429)

ti = duration of interval
T = cumulative time
Depth = distance from top of pipe to top of water level in pipe
hi = change in depth during interval
H = cumulative change in depth
Ii = infiltration rate for interval
I = cumulative infiltration rate



Villanova University
CICD Development
Lancaster and Ithan Avenues
Villanova PA 19085

VMA
RAMSA

ARCHITECT-OF-RECORD
Voith & Mactavish Architects LLP
2401 Walnut Street, 6th Floor
Philadelphia, PA 19103
phone 215-545-4544
fax 215-545-3299
www.voithandmactavish.com

DESIGN ARCHITECT
Robert A.M. Stern Architects LLP
460 West 34th Street
New York, New York 10001
phone: 212-967-5100
fax: 212-967-5588
www.ramsa.com

CIVIL ENGINEER
Nave Newell Inc.
900 West Valley Road, Suite 1100
Wayne, PA 19087
phone: 610-265-8323
fax: 610-265-4299
www.navenewell.com

STRUCTURAL ENGINEER
Macintosh Engineering
One East Uwchlan Avenue, Ste. 403
Exton, PA 19341
phone: 484-475-2180
fax: 484-475-2181
www.macintoshang.com

MEP&FP ENGINEER
Bala Consulting Engineers, Inc.
443 South Gulph Road
King of Prussia, PA 19406
phone: 610-649-8000
fax: 610-649-8475

LANDSCAPE ARCHITECT
Sikora Wells Appel
8 Kings Highway West, Suite A
Haddonfield, NJ 08033
phone: 856-433-6380
www.sikora-wa.com

ACOUSTIC CONSULTANT
Acentech Inc.
8 Interplex Drive, Suite 218
Trevose, PA 19053
phone: 215-245-8244
fax: 215-245-1798
www.acentech.com

ELEVATOR CONSULTANT
Zipf Associates Inc.
25 Bala Avenue, Suite 201
Bala Cynwyd, PA 19004
phone: 610-667-1717
fax: 610-667-0216

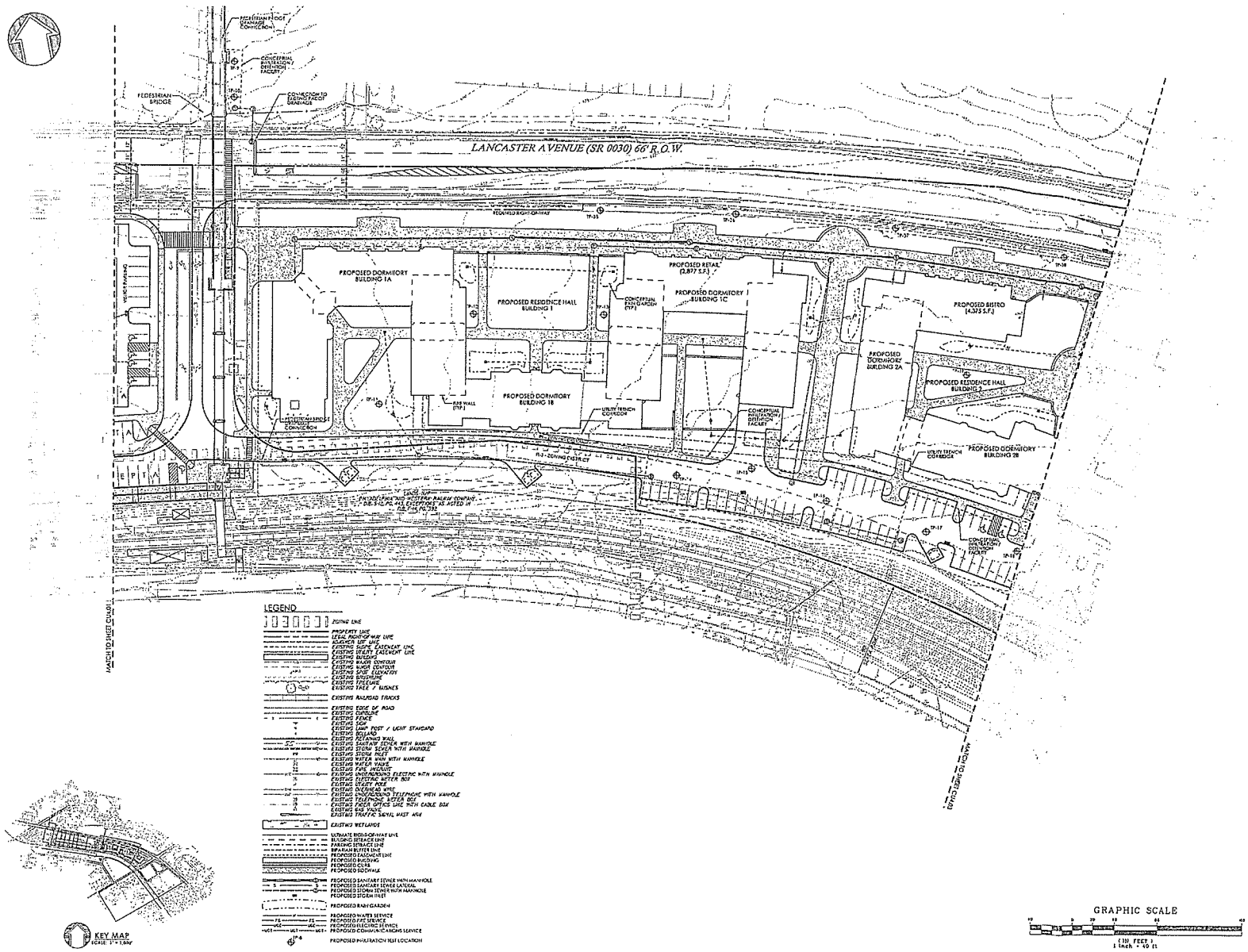
CONDITIONAL USE PLAN
NOT FOR CONSTRUCTION

Revision	August 15, 2014
Date	May 2, 2014
Title	Conceptual Utility Plan
Scale	1" = 40'
Drawn By	HPS / DWN

CU4.01

Contractor to verify all dimensions in field and inform Architect of any discrepancies before starting work.

CU4.01_ConceptualUtilityPlan.dgn 5/20/2014 12:42:55 PM



Villanova University
CICD Development
Lancaster and Ithan Avenues
Villanova PA 19085

VMA
RAMSA

ARCHITECT-OF-RECORD
Wolfe & Mastaitis Architects LLP
2401 Walnut Street, 6th Floor
Philadelphia, PA 19103
phone 215-848-4544
fax 215-848-3293
www.wolfemastaitis.com

DESIGN ARCHITECT
Robert A.M. Stern Architects LLP
460 West 34th Street
New York, New York 10001
phone: 212-967-5100
fax: 212-967-5858
www.ramsa.com

CIVIL ENGINEER
Nave Newell Inc.
969 West Valley Road, Suite 1100
Wayne, PA 19087
phone: 610-265-8323
fax: 610-265-4299
www.navenewell.com

STRUCTURAL ENGINEER
Macintosh Engineering
One East Uwchlan Avenue, Ste. 403
Exton, PA 19341
phone: 484-478-2180
fax: 484-478-2181
www.macintoshengr.com

MEP&FP ENGINEER
Rolf Consulting Engineers, Inc.
443 South Gulph Road
King of Prussia, PA 19406
phone: 610-649-8600
fax: 610-649-8476

LANDSCAPE ARCHITECT
Sikora Wells Appel
8 Kings Highway West, Suite A
Haddonfield, NJ 08033
phone: 856-433-6260
www.swainc.com

ACOUSTIC CONSULTANT
Acentech Inc.
8 Interplex Drive, Suite 218
Trevose, PA 19053
phone: 215-245-4244
fax: 215-245-1796
www.acentech.com

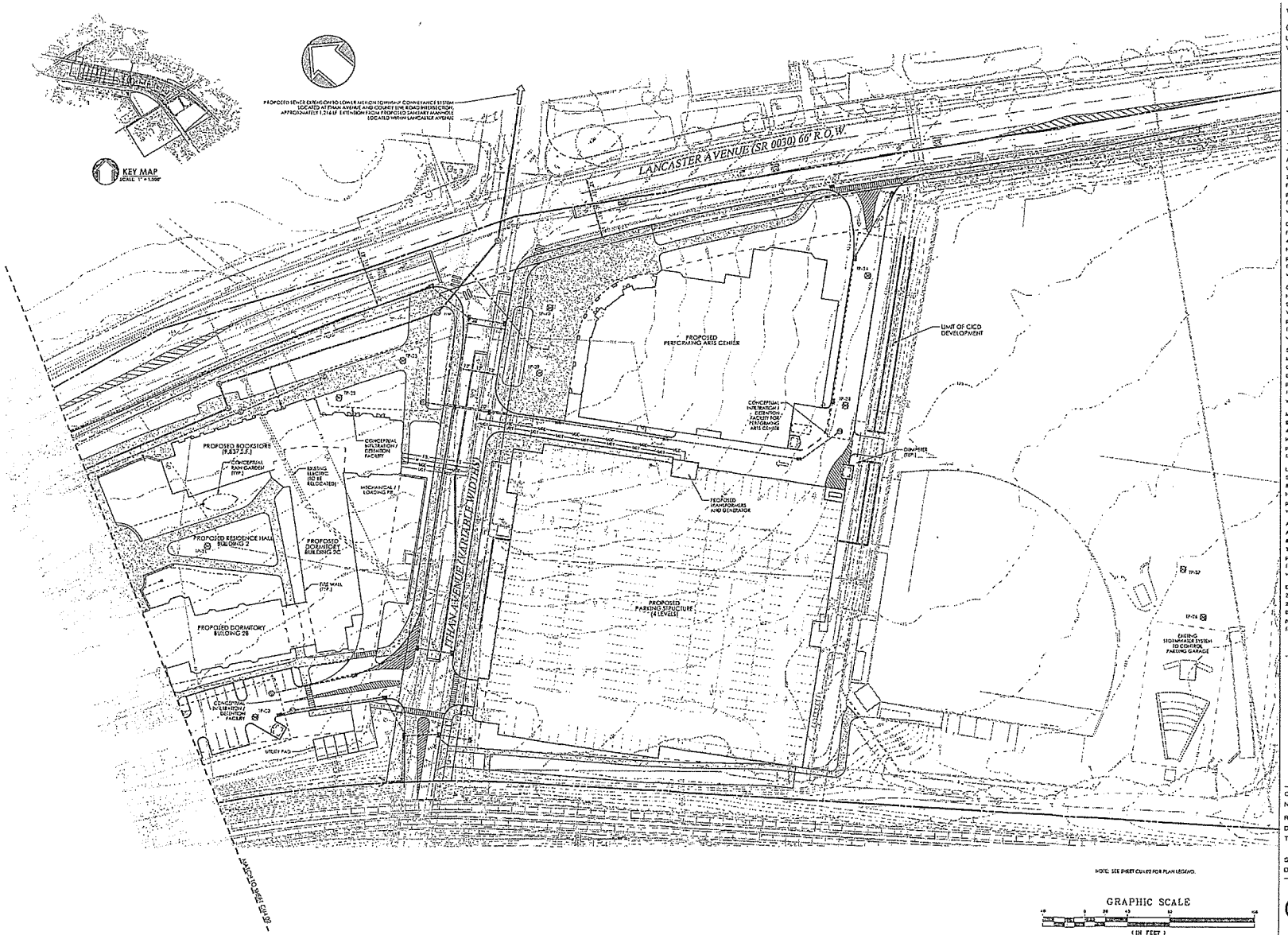
ELEVATOR CONSULTANT
Zipf Associates Inc.
25 Bala Avenue, Suite 201
Bala Cynwyd, PA 19004
phone: 610-667-1717
fax: 610-667-0216

CONDITIONAL USE PLAN
NOT FOR CONSTRUCTION

Revision	August 15, 2014
Date	May 2, 2014
Title	Conceptual Utility Plan
Scale	1" = 40'
Drawn By	HPS / DWN

CU4.02

Contractor to verify all dimensions in field and inform Architect of any discrepancies before starting work.



Villanova University
CICD Development
Lancaster and Phan Avenues
Villanova PA 19085

VMA
RAMSA

ARCHITECT-OF-RECORD
Voith & Maddrella Architects LLP
2401 Walnut Street, 6th Floor
Philadelphia, PA 19103
phone 215-545-4864
fax 215-545-3299
www.voithandmaddrella.com

DESIGN ARCHITECT
Robert A.M. Stern Architects LLP
460 West 34th Street
New York, New York 10001
phone: 212-967-5100
fax: 212-957-5508
www.ramsa.com

CIVIL ENGINEER
Nave Newell Inc.
930 West Valley Road, Suite 1100
Wayne, PA 19087
phone: 610-265-9323
fax: 610-265-4299
www.navenewell.com

STRUCTURAL ENGINEER
Mashtaler Engineering
One East Uwchlan Avenue, Ste. 403
Exton, PA 19341
phone: 484-475-2160
fax: 484-475-2161
www.mashtalerlong.com

MEP/FP ENGINEER
Bala Consulting Engineers, Inc.
443 South Gulph Road
King of Prussia, PA 19406
phone: 610-649-8000
fax: 610-649-8475

LANDSCAPE ARCHITECT
Olin + Wells Appel
8 Kings Highway West, Suite A
Haddonfield, NJ 08033
phone: 856-433-6333
www.olinwells.com

ACOUSTIC CONSULTANT
Acentech Inc.
6 Interplex Drive, Suite 218
Trevose, PA 19053
phone: 215-245-8244
fax: 215-245-1756
www.acentech.com

ELEVATOR CONSULTANT
Zipf Associates Inc.
33 Bala Avenue, Suite 201
Bala Cynwyd, PA 19004
phone: 610-667-1717
fax: 610-667-0218

CONDITIONAL USE PLAN
NOT FOR CONSTRUCTION

Revision	August 15, 2014
Date	May 2, 2014
Title	Conceptual Utility Plan
Scale	1" = 40'
Drawn By	MPB / DWN

CU4.03

Contractor to verify all dimensions in field and inform Architect of any discrepancies before starting work.

CU4.03_ConceptualUtilityPlan.dwg 5/20/2014 11:57:49 PM

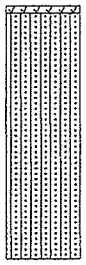
APPENDIX A

LOG OF TEST BORING

TEST BORING TP-1

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 405.0 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

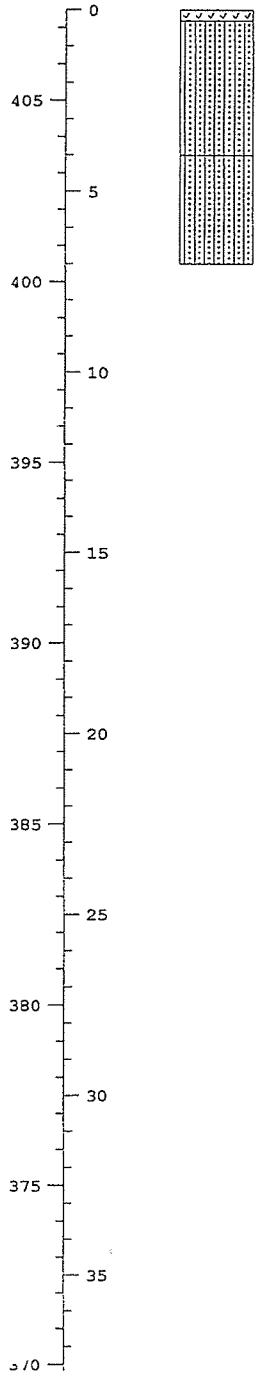
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
405 — 0		Topsoil with root mat. 405 / 0.2			
		Medium dense moist gray-brown silty fine SAND, trace clay. 404.8			
400 — 5		7.0			
		Completion Depth = 7 feet 398 END OF TEST BORING @ 7.0 FT.			
395 — 10					
390 — 15					
385 — 20					
380 — 25					
375 — 30					
370 — 35					

LOG OF TEST BORING

TEST BORING TP-2

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 407.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds



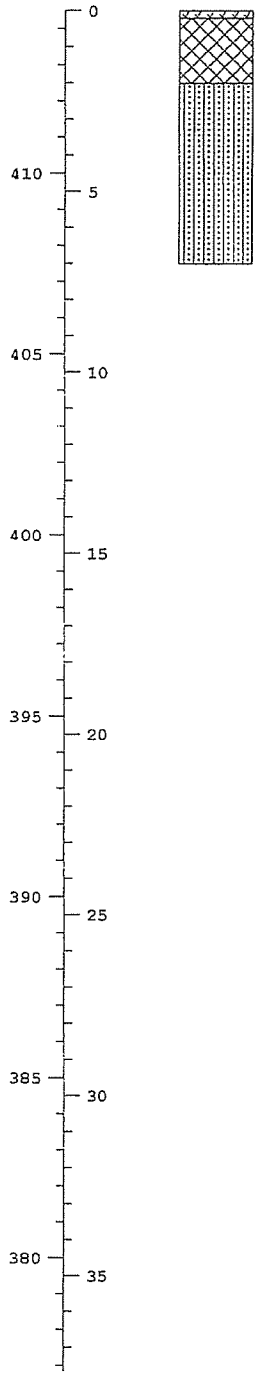
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Topsoil with grass root mat. 407.5 0.3 Medium dense moist orange-brown silty fine SAND. 407.2 4.0			
		Medium dense moist gray-brown silty coarse to fine SAND, trace gravel. 403.5 7.0			
		Completion Depth = 7 feet 400.5 END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-3

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 414.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Topsoil with grass root mat. 414.5 0.2 Medium dense moist brown silty coarse to fine SAND, trace gravel. 414.3 2.0 (FILL) 412.5 Medium dense moist brown silty coarse to fine SAND. 7.0			
		Completion Depth = 7 feet 407.5 END OF TEST BORING @ 7.0 FT.			

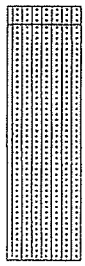
LOG OF TEST BORING

TEST BORING TP-4

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 419.3 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 419.3		Aggregate SAND and GRAVEL.			
0.5 / 418.8		Medium dense moist brown silty fine SAND, trace gravel.			
7.0 / 412.3		Medium dense to dense moist gray-brown silty coarse to fine SAND.			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

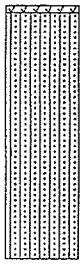


LOG OF TEST BORING

TEST BORING TP-5

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 423.3 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 423.3		Topsoil with grass root mat. 0.2 / 423.1			
		Medium dense to dense moist brown silty coarse to fine SAND. 7.0 / 416.3			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

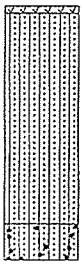
420 — 5
415 — 10
410 — 15
405 — 20
400 — 25
395 — 30
390 — 35

LOG OF TEST BORING

TEST BORING TP-6

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

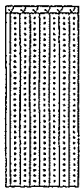
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
435 — 0		Topsoil with root mat. 435.5 0.2 Medium dense moist brown silty fine SAND. 435.3			
430 — 5		6.0 Dense moist brown silty coarse to fine SAND with gravel. 429.5 7.0 428.5			
425 — 10		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
415 — 20					
410 — 25					
405 — 30					
400 — 35					

LOG OF TEST BORING

TEST BORING TP-7

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: None Encountered

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 436.3 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

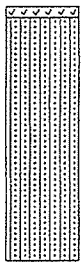
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0		Topsoil root mat.	436.3			
			0.2			
435		Medium dense to dense moist brown silty fine SAND.	436.1			
5			5.0			
430		Completion Depth = 5 feet	431.3			
		END OF TEST BORING @ 5.0 FT.				
10						
425						
15						
420						
20						
415						
25						
410						
30						
405						
35						

LOG OF TEST BORING

TEST BORING TP-8

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 436.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0 / 435		Topsoil with grass root mat.	436.5			
			0.3			
		Medium dense to dense moist brown silty fine SAND.	436.2			
5 / 430			7.0			
		Completion Depth = 7 feet	429.5			
10 / 425		END OF TEST BORING @ 7.0 FT.				
15 / 420						
20 / 415						
25 / 410						
30 / 405						
35						

LOG OF TEST BORING

TEST BORING TP-11

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 438.8 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

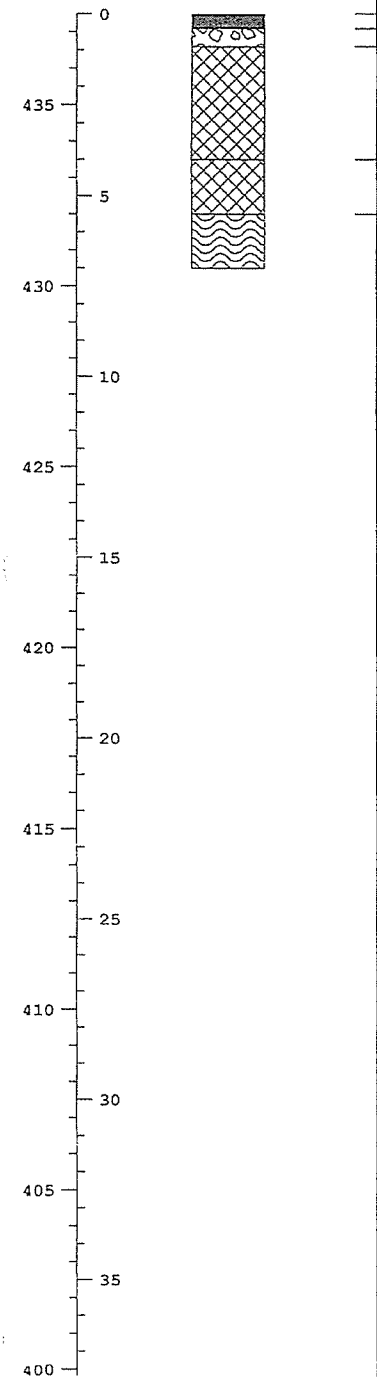
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 438.8		Asphalt. 0.4 / 438.4			
		Aggregate base course. 0.7 / 438.1			
		Medium dense moist brown fine sandy SILT. (FILL) 3.0 / 435.8			
5		Medium dense moist gray-brown fine sandy SILT, trace metal debris. (FILL) 7.0 / 431.8			
10		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
15					
20					
25					
30					
35					

LOG OF TEST BORING

TEST BORING TP-12

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 437.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Asphalt. 437.5 / 0.4			
		Aggregate base course. 437.1 / 0.9			
		Medium dense moist brown silty coarse to fine SAND. 436.6			
		(FILL) 4.0			
		Soft gray clayey SILT with wood, brick, and metal debris. 433.5 / 5.5			
		(FILL) 432 / 7.0			
		Soft dark gray black organic SILT. 430.5			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-13

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

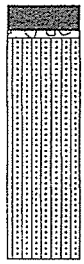
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
435 — 0		Asphalt. 435.5 0.4 Aggregate base course. 435.1 0.8 Medium dense moist gray coarse to fine SAND and GRAVEL, trace cobbles. 434.7 (FILL) 5.0			
430 — 5		Medium dense moist gray micaceous silty coarse to fine SAND. 430.5 (FILL) 7.0 428.5			
425 — 10		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
415 — 15					
410 — 20					
405 — 25					
400 — 30					
	— 35				

LOG OF TEST BORING

TEST BORING TP-14

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 433.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

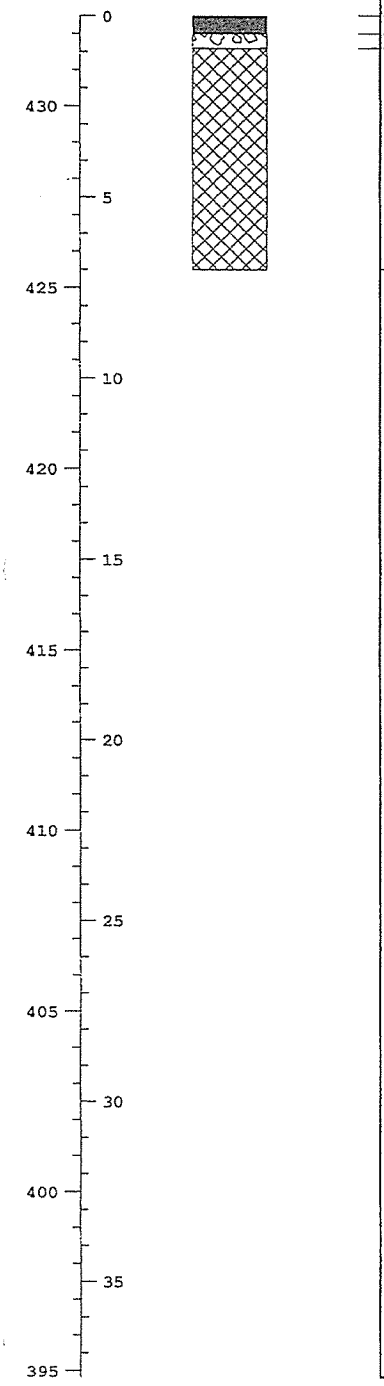
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
433.5 / 0		Asphalt. 0.7			
432.8		Aggregate base course. 0.9			
432.6		Medium dense moist gray-brown micaceous silty fine SAND.			
426.5 / 7.0		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-15

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 432.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds



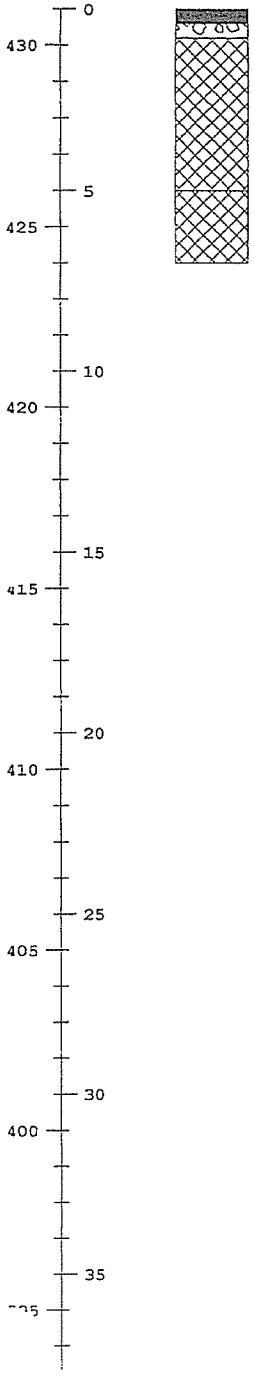
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Asphalt. 432.5 0.5 Aggregate base course. 432 0.9 Loose gray-brown silty coarse to fine SAND and GRAVEL, trace concrete fragments. 431.6 (FILL) 7.0			
		Completion Depth = 7 feet 425.5 END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-16

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 431.0 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds



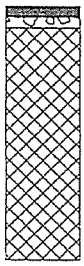
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Asphalt. 431 / 0.4			
		Aggregate base course. 430.6 / 0.8			
		Medium dense moist brown silty coarse to fine SAND, trace gravel. 430.2			
		(FILL)			
		5.0			
		Concrete rubble. 426			
		7.0			
		Completion Depth = 7 feet 424 END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-17

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 429.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0 / 425 / 5 / 420 / 10 / 415 / 15 / 410 / 20 / 405 / 25 / 400 / 30 / 395 / 35		Asphalt.	429.5			
			0.3			
		Aggregate base course.	429.2			
			0.6			
		Loose moist brown silty coarse to fine SAND and GRAVEL, trace glass fragments. (FILL)	428.9			
			7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	422.5			

LOG OF TEST BORING

TEST BORING TP-18

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

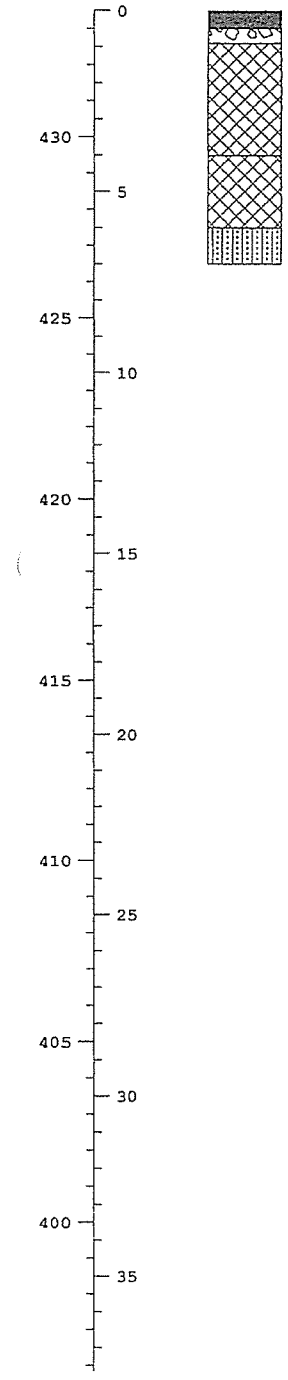
PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 429.3 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0		Asphalt.	429.3			
			0.2			
		Aggregate base course.	429.1			
			0.8			
		Loose, very moist silty coarse to fine SAND and GRAVEL, trace metal debris and batteries. (FILL)	428.5			
425 5			7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	422.3			
420 10						
415 15						
410 20						
405 25						
400 30						
395 35						

LOG OF TEST BORING
TEST BORING TP-19

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 433.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds



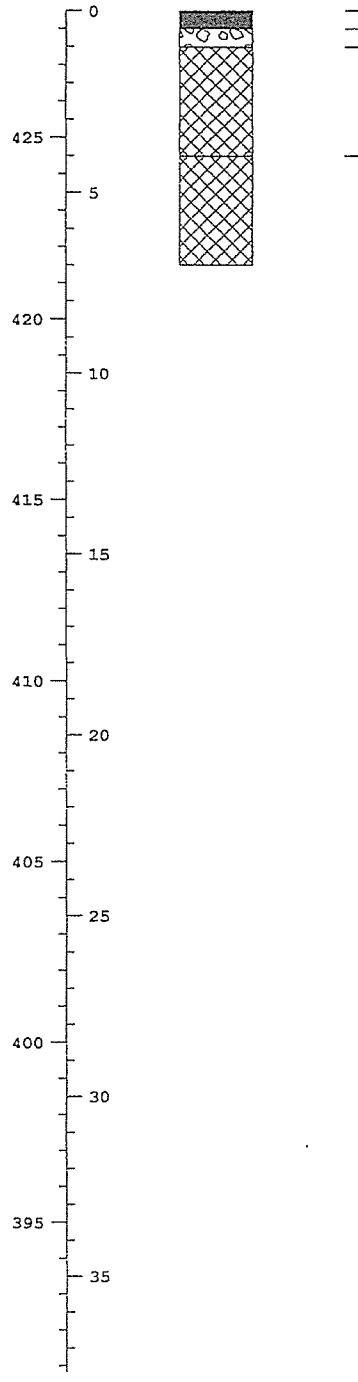
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
		Asphalt.	433.5 0.5			
		Aggregate base course.	433 0.9			
		Loose to medium dense moist brown silty coarse to fine SAND.	432.6			
		(FILL)	4.0			
		Brown coarse to fine SAND and GRAVEL with concrete rubble.	429.5 6.0			
		Medium dense brown silty fine SAND.	427.5 7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	426.5			

LOG OF TEST BORING

TEST BORING TP-20

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 428.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
		Asphalt.	428.5 0.5			
		Aggregate base course.	428 1.0			
		Medium dense moist brown silty SAND. (FILL)	427.5 4.0			
		Soft very moist gray clayey SILT, trace wood debris and ash. (FILL)	424.5 7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	421.5			

LOG OF TEST BORING

TEST BORING TP-21

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 433.3 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 433.3		Asphalt. 0.3 / 433 Aggregate base course. 0.6 / 432.7 Medium dense moist brown coarse to fine SAND and aggregate GRAVEL. (FILL) 5.0 / 428.3 Soft very moist gray clayey SILT. (FILL) 7.0 / 426.3 Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

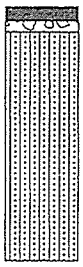
430 — 5 — 425 — 10 — 420 — 15 — 415 — 20 — 410 — 25 — 405 — 30 — 400 — 35

LOG OF TEST BORING

TEST BORING TP-22

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.3 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
435 — 0		Asphalt.	435.3 0.4			
		Aggregate base course.	434.9 0.7			
		Medium dense moist brown silty fine SAND.	434.6			
430 — 5			7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	428.3			
425 — 10						
415 — 20						
410 — 25						
405 — 30						
400 — 35						

LOG OF TEST BORING

TEST BORING TP-23

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
435 — 0		Asphalt.	435.5 0.3			
		Medium dense moist brown silty coarse to fine SAND, trace cobbles. (FILL)	435.2			
430 — 5			7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	428.5			
425 — 10						
420 — 15						
415 — 20						
410 — 25						
405 — 30						
400 — 35						

LOG OF TEST BORING

TEST BORING TP-24

DATE: 9/25/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 428.3 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

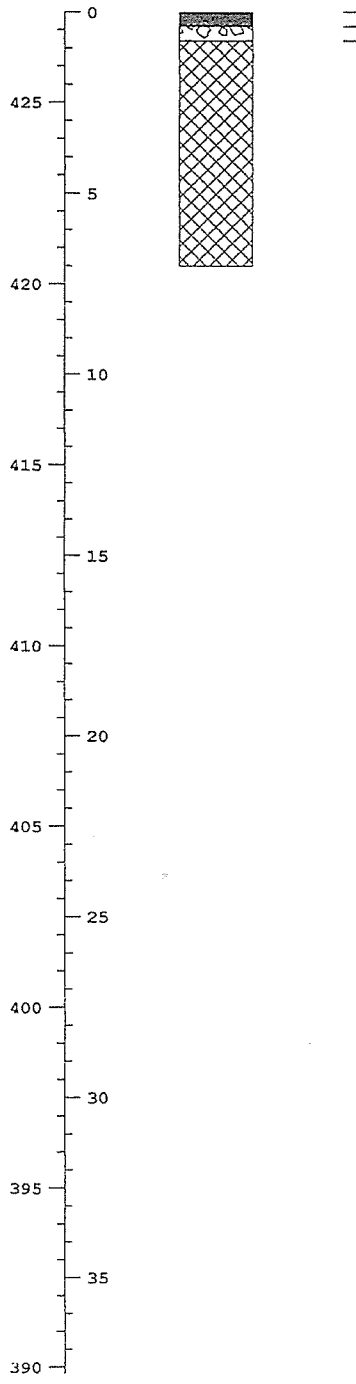
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0 / 425		Asphalt.	428.3 / 0.4			
		Aggregate base course.	427.9 / 0.8			
		Dense moist brown-gray silty SAND and GRAVEL with cobbles. (FILL)	427.5 / 4.5			
5		Stiff moist light brown clayey SILT.	423.8 / 7.0			
420		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	421.3			
10						
415						
15						
410						
20						
405						
25						
400						
30						
395						
35						

LOG OF TEST BORING

TEST BORING TP-25

DATE: 9/25/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 427.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
		Asphalt. 427.5 0.4 Aggregate base course. 427.1 0.8 Dense moist brown silty coarse to fine SAND and GRAVEL, trace cobbles. 426.7 (FILL) 7.0			
		Completion Depth = 7 feet 420.5 END OF TEST BORING @ 7.0 FT.			

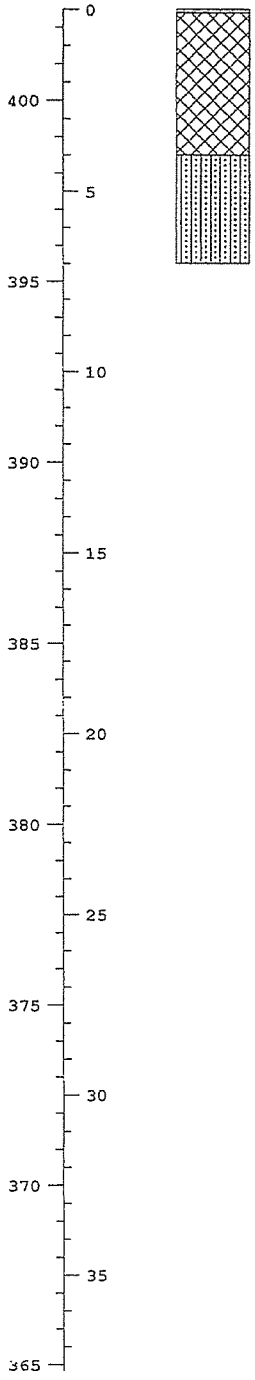
LOG OF TEST BORING

TEST BORING TP-28

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 402.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

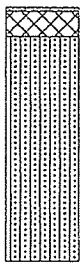
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 402.5		Grass root mat.			
0.1 / 402.4		Medium dense moist light brown silty fine SAND, trace gravel. (FILL)			
4.0 / 398.5		Medium dense moist fine sandy SILT with clay.			
7.0 / 395.5		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			



LOG OF TEST BORING
TEST BORING TP-29

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 406.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

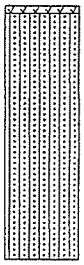
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 406.5		Topsoil with root mat. 0.1			
405		Aggregate GRAVEL and COBBLES. (FILL) 406.4 0.8			
		Medium dense moist brown silty SAND, trace gravel. 405.7			
5 / 400		7.0			
		Completion Depth = 7 feet 399.5 END OF TEST BORING @ 7.0 FT.			
10 / 395					
15 / 390					
20 / 385					
25 / 380					
30 / 375					
35					

LOG OF TEST BORING

TEST BORING TP-30

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 419.0 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

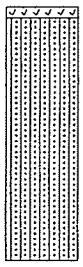
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 419		Grass root mat. 0.2			
		Medium dense moist brown silty fine SAND. 418.8			
5 / 415		7.0			
		Completion Depth = 7 feet 412			
10 / 410		END OF TEST BORING @ 7.0 FT.			
15 / 405					
20 / 400					
25 / 395					
30 / 390					
35 / 385					

LOG OF TEST BORING

TEST BORING TP-31

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 422.0 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

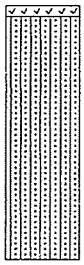
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 422		Topsoil with grass root mat. 0.3			
		Medium dense moist brown silty coarse to fine SAND. 421.7			
5 / 415		7.0			
		Completion Depth = 7 feet 415 END OF TEST BORING @ 7.0 FT.			
10 / 410					
15 / 405					
20 / 400					
25 / 395					
30 / 390					
35					

LOG OF TEST BORING

TEST BORING TP-32

DATE: 9/22/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 427.0 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

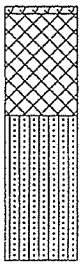
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
0 / 425 / 5 / 420 / 10 / 415 / 15 / 410 / 20 / 405 / 25 / 400 / 30 / 395 / 35		Topsoil with grass root mat. 427 0.3 Medium dense moist brown silty coarse to fine SAND. 426.7 7.0 Completion Depth = 7 feet 420 END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-33

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 429.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

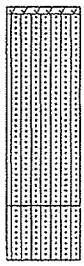
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0 / 425 / 5 / 420 / 10 / 415 / 15 / 410 / 20 / 405 / 25 / 400 / 30 / 395 / 35		Topsoil with grass root mat.	429.5 0.2			
		Medium dense moist brown silty SAND. (FILL)	429.3 3.0			
		Medium dense to dense silty fine SAND.	426.5 7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	422.5			

LOG OF TEST BORING

TEST BORING TP-34

DATE: 9/23/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 430.5 ft.
CHECKED BY: PFM
DRILLER: J. Swope
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
430 — 0		Topsoil with grass root mat. 430.5 0.2 Medium dense moist brown silty fine SAND. 430.3			
425 — 5		5.5 Dense moist brown silty coarse to fine SAND, 425 trace gravel. 7.0			
420 — 10		423.5 Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
415 — 15					
410 — 20					
405 — 25					
400 — 30					
395 — 35					

LOG OF TEST BORING

TEST BORING TP-35

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

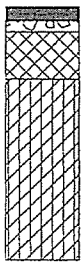
PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 436.5 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
435 / 0		Asphalt. 436.5 0.3 Aggregate base course. 436.2 0.6 Medium dense moist brown silty coarse to fine SAND. 435.9 2.5 (FILL) 434 Soft moist gray to black clayey SILT, trace concrete fragments and metal debris. (FILL) 7.0			
430 / 5		Completion Depth = 7 feet 429.5 END OF TEST BORING @ 7.0 FT.			
425 / 10					
420 / 15					
415 / 20					
410 / 25					
405 / 30					
35					

LOG OF TEST BORING
TEST BORING TP-36

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

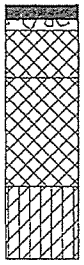
PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 436.0 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
0 / 435		Asphalt.	436 / 0.4			
		Aggregate base course.	435.6 / 0.7			
		Medium dense brown silty SAND and GRAVEL. (FILL)	435.3 / 2.0			
5 / 430		Firm very moist brown gray clayey SILT.	434 / 7.0			
10 / 425		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	429			
15 / 420						
20 / 415						
25 / 410						
30 / 405						
35 / 400						

LOG OF TEST BORING
TEST BORING TP-37

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.0 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

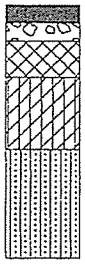
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
435 / 0		Asphalt. 435 0.4 Aggregate base course. 434.6 0.7 Medium dense moist brown silty coarse to fine SAND. 434.3 2.0 (FILL) 433 Dense moist brown SAND, GRAVEL and COBBLES. 5.0 430 (FILL) 7.0 Firm moist gray brown clayey SILT. 428 Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
430 / 5					
425 / 10					
15					
415 / 20					
410 / 25					
405 / 30					
400 / 35					

LOG OF TEST BORING

TEST BORING TP-38

DATE: 9/24/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 435.0 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

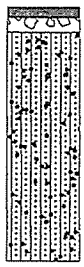
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description		SPT (N)	Moisture (%)	Other Tests
435 — 0		Asphalt.	435 0.5			
		Aggregate base course.	434.5 1.0			
		Medium dense moist gray brown silty SAND. (FILL)	434 2.0			
		Soft to firm very moist gray clayey SILT.	433 4.0			
430 — 5		Medium dense moist brown silty fine SAND.	431 7.0			
		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.	428			
425 — 10						
— 15						
415 — 20						
410 — 25						
405 — 30						
400 — 35						

LOG OF TEST BORING

TEST BORING TP-39

DATE: 9/25/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 434.0 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

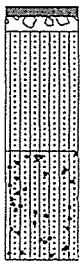
ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
434 / 0		Asphalt. 0.3			
433.7 / 0.3		Aggregate base course. 0.7			
433.3 / 0.7		Medium dense moist brown silty coarse to fine SAND and GRAVEL.			
427 / 7.0		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			

LOG OF TEST BORING

TEST BORING TP-40

DATE: 9/25/14
PROJECT: Villanova University LAH Project
BORING LOCATION: See Drawings
DRILLING METHOD: Hollow Stem Auger
DRILLING COMPANY: Earth Core Services
WATER ENCOUNTERED AT: Dry at Completion

PROJECT NO.: 2014-3198-01
SURFACE ELEVATION: 434.0 ft.
CHECKED BY: PFM
DRILLER: T. Fryberger
INSPECTOR: M. Simonds

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS BLOWS PER 6 INCHES	Soil Description	SPT (N)	Moisture (%)	Other Tests
434 / 0		Asphalt. 0.3			
433.7		Aggregate base course. 0.7			
433.3		Medium dense moist brown silty fine SAND. 4.0			
430 / 5		Medium dense moist brown silty SAND and GRAVEL. 7.0			
427		Completion Depth = 7 feet END OF TEST BORING @ 7.0 FT.			
425 / 10					
420 / 15					
415 / 20					
410 / 25					
405 / 30					
400 / 35					