SOUTHFORD PARK

Drainage Report

Prepared for:

Southford Park, LLC

SLR #141.20970.00002.0060

December 22, 2022
**(Revised January 24, 2023;
February 22, 2023; March 15, 2023; August 29, 2023)**

Drainage Report

Southford Park
764 Southford Road (Route 188)
Middlebury, Connecticut
December 22, 2022
Revised January 24, 2023; February 22, 2023; March 15, 2023; August 29, 2023
SLR #141.20970.00002.0060

This Drainage Report has been prepared in support of the proposed development at 764 Southford Road (Route 188) in the town of Middlebury, Connecticut. The development proposes to construct two new warehouse and distribution buildings with access off Southford Road. New parking areas and loading docks associated with the buildings will be constructed, as well as all associated site infrastructure.

Figure 1 – #7-04/009 and #7-04/007 Parcels

Table 1 – Stormwater Data

Parcel Size Total	111.9 acres
Existing Impervious Area (Property)	5.77 acres
Proposed Impervious Area (Property)	33.68 acres
Soil Types (Hydrologic Soil Group)	"A," "B," "C," and "D"
Existing Land Use	Woods, meadow, open space, row crops, gravel, bituminous driveway and parking, sidewalks, and building
Proposed Land Use	Woods, meadow, open space, row crops, gravel, bituminous driveway and parking, sidewalks, and building
Design Storm for Stormwater Management (Town of Middlebury)	No increases in peak rates of runoff for the 2-, 10-, 25-, 50-, and 100-year storms, Connecticut Department of Energy & Environmental Protection (CTDEEP) Groundwater Recharge Volume (GRV), Water Quality Volume (WQV) and Water Quality Flow (WQF), Pollutant Reduction
Water Quality Measures	2-foot sump catch basins, bioretention basins, hydrodynamic separators, sediment chamber (existing)
Design Storm for Storm Drainage (Town of Middlebury)	25-year storm
Federal Emergency Management Agency Special Flood Hazard Areas	Area of Minimal Flood Hazard (Zone X)
Connecticut Department of Energy & Environmental Protection Aquifer Protection Areas	Not Applicable

STORMWATER MANAGEMENT APPROACH

The stormwater management system for this site has been designed utilizing Best Management Practices (BMPs) to provide water quality management while attenuating the proposed peak-flow rates from the development. The design goal is to provide water quality treatment in accordance with the CTDEEP requirements for the groundwater recharge volume (GRV), water quality volume (WQV) and water quality flow (WQF), prevent increases in the predevelopment runoff rates from the site, and to remove pollutants from the site from entering the receiving watercourse and/or waterbody to the maximum extent practicable. Existing drainage patterns will be maintained to the maximum extent practicable, and a new stormwater treatment train proposes catch basins with 2-foot sumps, hydrodynamic separators, and bioretention basins.

The computer program titled *Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2019* by Autodesk, Inc., Version 2018.3, was used for designing the proposed storm drainage collection system. Storm drainage computations performed include pipe capacity, gutter spreads, and hydraulic grade line calculations. The contributing watershed to each individual catch basin inlet was delineated to determine the drainage area and land coverage. These values were used to determine the stormwater runoff to each inlet using the Rational Method. The rainfall intensities for the site were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 10, Precipitation Frequency Data Server (PFDS). The proposed storm drainage system is designed to provide adequate capacity to convey the 10-year storm event.

The level spreader discharge systems are designed to release stormwater from the stormwater basins and will also help improve water quality. The design calls for a level stone berm as an overflow outlet, which will be set against a precast concrete curb. The stone level spreaders were designed to gradually release stormwater in a quiescent manner as sheet flow rather than a concentrated point discharge that results from typical storm pipe outlets or flared end sections.

WATER QUALITY MANAGEMENT

Stormwater runoff from the proposed development will be collected by a subsurface pipe and catch basin drainage system. The proposed drainage system will include catch basins with 2-foot sumps to trap sediment and debris.

Hydrodynamic separators, such as *Cascade* and *CDS*® devices manufactured by Contech Engineered Solutions, will be installed in the proposed storm drainage systems prior to discharging stormwater to the stormwater management basins. These units will further remove suspended solids before discharging downgradient, which will in turn remove other pollutants that tend to attach to the suspended solids and effectively remove other debris and floatables that may be present in stormwater runoff. The hydrodynamic separators have been designed to meet criteria recommended by the CTDEEP *2004 Stormwater Quality Manual*. The devices were designed based on the determined WQF, which is the peak-flow rate associated with the Water Quality Volume (WQV) and sized based on the manufacturer's specifications.

Each of the proposed bioretention stormwater management basins will provide retention volume along its bottom, thus creating a water quality feature within it. This serves several purposes, including stormwater renovation and first-flush retention. The vegetation that will be growing within the basins will provide pollutant removal by filtering stormwater runoff and absorbing excess nutrients that may be present in the stormwater. The CTDEEP *2004 Stormwater Quality Manual* (Chapter 7) recommends methods for sizing stormwater treatment measures with WQV computations. The WQV addresses the initial stormwater runoff, also commonly referred to as the "first-flush" runoff. The WQV provides adequate volume to store the runoff associated with the first 1 inch of rainfall, which tends to contain the highest concentration of potential pollutants. Supporting calculations for the WQV as well as the GRV have been included in the Appendix of this report.

In addition, the Schuler (Simple) Method for estimating pollutant export from urban development sites has been performed to determine the pollutant removal effectiveness of the proposed stormwater treatment train. CTDEEP only requires an 80% removal rate of total suspended solids (TSS) on an annual basis, and does not have a specific removal rate standard for other pollutants such as Total Nitrogen (TN), Total Phosphorous (TP), Zinc, or Total Petroleum Hydrocarbons. The Town of Middlebury also has no such pollutant removal rate requirements. The results demonstrate that the proposed systems will achieve a greater removal rate for TSS than the 80% required by CTDEEP. Though not required by the State or the Town, the removal rates of the other pollutants will provide an overall net benefit to the site. Supporting calculations have been included in the Appendix of this report.

Pollutant Removal Efficiency (%)							
Pollutant	**WS 11**	**WS 31***	**WS 32**	**WS 41**	**WS 43**	**WS 42 + WS 43 (After BMPs)****	**WS 51**
Total Suspended Solids	97.7	93.6	97.5	99.5	77.3	97.7	97.7
Total Nitrogen	65.0	30.0	65.0	75.5	-	65.0	65.0
Total Phosphorous	65.0	50.0	65.0	82.5	-	65.0	65.0
Zinc	85.0	89.5	85.0	96.0	21.0	85.0	85.0
Copper	79.0	89.5	79.0	93.7	-	79.0	79.0
Petroleum Hydrocarbons	88.9	92.2	87.0	96.6	69.0	88.9	88.9

*WS 31 drains to EXDET 310, which is an existing stormwater basin currently outfitted with a sediment chamber for pretreatment. Sediment chambers do not provide as much treatment for TN and TP as hydrodynamic separators, hence the lower removal efficiencies for these pollutants compared to the other watersheds.

**WS 43 drains to Underground 430, whose outflow enters DET 420. In DET 420, the stormwater treated for TN, TP, and Copper as well as TSS, Zinc, and Hydrocarbons

HYDROLOGIC ANALYSIS

A hydrologic analysis was conducted to analyze the predevelopment and postdevelopment peak-flow rates from the site. Five analysis points that receive runoff from the site were selected. Analysis Point A represents the large wetland located west of the site that drains towards Eight Mile Brook. Analysis Point B represents the drainage system located at the intersection of Christian Road and Judd Hill Road, which discharges north of the site. Analysis Point C represents the large wetland system located on the northeastern portion of the property which ultimately discharges via a culvert under Christian Road and drains east towards Avalon Farm Pond. Analysis Point D represents the large wetland system located on the southeastern portion of the property which discharges via a culvert under Southford Road. Analysis Point E represents the wetland located south of the site. The total watershed area delineated is approximately 113 acres under both existing and proposed conditions.

The method of predicting the surface water runoff rates utilized in this analysis was a computer program titled *Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2019* by Autodesk, Inc., Version 2020. The *Hydrographs* program is a computer model that utilizes the methodologies set forth in the *Technical Release No. 55* (TR-55) manual and *Technical Release No. 20* (TR-20) computer model, originally developed by the United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS). The *Hydrographs* computer modeling program is primarily used for conducting hydrology studies such as this one.

The *Hydrographs* computer program forecasts the rate of surface water runoff based upon several factors. The input data includes information on land use, hydrologic soil type, vegetation, contributing watershed area, time of concentration, rainfall data, storage volumes, and the hydraulic capacity of structures. The computer model predicts the amount of runoff as a function of time, with the ability to include the attenuation effect due to dams, lakes, large wetlands, floodplains, and stormwater management basins. The input data for rainfalls with statistical recurrence frequencies of 2, 10, 25, 50, and 100 years was obtained from the NOAA Atlas 14, Volume 10 database. The corresponding rainfall totals are listed below.

Storm Frequency	Rainfall (inches)
2-year	3.59
10-year	5.66
25-year	6.95
50-year	7.90
100-year	8.94

Land use for the site under existing and proposed conditions was determined from field survey and aerial photogrammetry. Land use types used in the analysis included woods, meadow, grassed or open space, row crops, gravel, building, and impervious (paved) cover. Soil types in the watershed were determined from the CTDEEP Geographic Information System (GIS) database of the USDA-NRCS soil survey for New Haven County, Connecticut. For the analysis, the site was determined to contain hydrologic soil types “A,” "B," "C," and "D" as classified by USDA-NRCS. A composite runoff Curve Number (CN) for each subwatershed was calculated based on the different land use and soil types. The time of concentration (Tc) was estimated for each subwatershed using the TR-55 methodology and was computed by summing all travel times through the watershed as sheet flow, shallow concentrated flow, and channel flow.

The existing conditions were modeled with the *Hydrographs* program to determine the peak-flow rates for the various storm events at each analysis point. A revised model was developed incorporating the proposed site conditions and the stormwater management basins. The flows obtained with the revised model were then compared to the results of the existing conditions model.

The following peak rates of runoff were obtained from the *Hydrographs* hydrology results:

Analysis Point A – West Wetland to Eight Mile Brook					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	15.8	39.1	55.1	67.3	80.9
Proposed Conditions	9.5	23.3	32.4	39.3	46.9

Detention Basin 110*					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Proposed Conditions	664.6	665.1	665.4	665.6	665.9

*Top of Berm Elevation = 668.0

Analysis Point B – Drainage in Judd Hill Road					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	2.0	4.9	7.0	8.5	10.2
Proposed Conditions	2.0	4.9	7.0	8.5	10.2

Analysis Point C – Eastern Wetland to Avalon Farm Pond					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	36.3	83.1	114.0	137.6	163.9
Proposed Conditions	33.8	79.0	111.7	137.0	162.4

Detention Basin 310**					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	649.4	650.1	650.4	650.7	651.0
Proposed Conditions	649.2	649.9	650.3	650.5	650.7

**Top of Berm Elevation = 652.0

Detention Basin 320***					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Proposed Conditions	669.0	669.8	670.2	670.4	670.7

***Top of Berm Elevation = 672.0

Analysis Point D – Southeastern Wetland					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	21.8	51.1	71.0	85.7	102.3
Proposed Conditions	21.3	46.8	64.2	76.7	96.8

Detention Basin 410****					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	674.3	675.1	675.5	675.8	676.0
Proposed Conditions	674.5	675.1	675.4	675.6	675.9

****Top of Berm Elevation = 677.0

Detention Basin 420*****					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Proposed Conditions	669.3	670.8	671.7	671.9	672.3

*****Top of Berm Elevation = 674.0

Underground Detention System 430******					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Proposed Conditions	670.6	672.1	672.9	673.5	674.2

******Top of Chamber Elevation = 674.4

Analysis Point E – Southern Wetland					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	8.4	20.1	28.2	34.4	41.2
Proposed Conditions	8.2	20.0	28.0	33.9	40.9

Detention Basin 510*******					
	Water Surface Elevation (feet)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Proposed Conditions	635.2	636.1	636.5	636.8	637.0

*******Top of Berm Elevation = 638.0

Adjacent to the southwest property boundary a sub-analysis point was added for a potential vernal pool that is located downgradient of the proposed development and off site. From a hydrologic perspective, it is important to mimic the existing conditions input flows that contribute to this potential vernal pools hydrologic regime. As such, the design team developed a stormwater management plan that maintains/matches the existing input flows to the potential vernal pool such that it is neither starved of water nor is it flooded with too much stormwater discharge. The following peak rates of runoff were obtained from the *Hydrographs* hydrology results:

Sub-Analysis Point – Potential Vernal Pool -Off Site					
	Peak Runoff Rate (cubic feet per second)				
Storm Frequency (years)	**2**	**10**	**25**	**50**	**100**
Existing Conditions	2.5	6.3	8.9	10.8	13.0
Proposed Conditions	2.1	5.3	7.3	8.7	10.2

CONCLUSION

The results of the hydrologic analysis demonstrate that there will be no increases in peak-flow rates from the proposed development. This was achieved for the storm events modeled through a planned stormwater management system with detention provided in the existing and proposed stormwater basins.

The proposed development will also introduce a new stormwater treatment train consisting of several water quality measures such as catch basins with 2-foot sumps, hydrodynamic separators, and bioretention basins. Through these measures, it is demonstrated that the stormwater management systems sill provide pollutant removal at each discharge location. Removal of TSS is greater than 80% (CTDEEP) and removal of TN, TP, Zinc, Copper, and Petroleum Hydrocarbons will also occur, thus creating an overall benefit compared to the existing site.

All supporting documentation and stormwater-related computations are attached to this report along with the *Hydraflow Hydrographs* model results for stormwater management and *Hydraflow Storm Sewers* model results for the proposed storm drainage system. Illustrative watershed maps for both existing and proposed conditions are also attached to this report.

Attachments

Appendix A – United States Geological Survey Location Map
Appendix B – Federal Emergency Management Agency Flood Insurance Rate Map
Appendix C – Natural Resources Conservation Service Hydrologic Soil Group Map
Appendix D – Storm Drainage Computations
Appendix E – Water Quality Computations
Appendix F – Hydrologic Analysis – Input Computations
Appendix G – Hydrologic Analysis – Computer Model Results
Appendix H – Watershed Maps

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APPENDIX A

UNITED STATES GEOLOGICAL SURVEY LOCATION MAP

Drainage Report

Southford Park

764 Southford Road (Route 188)

Middlebury, Connecticut 06762

December 22, 2022

(Revised January 24, 2023;
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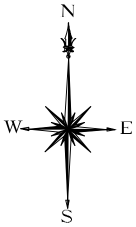

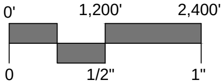

USGS QUADRANGLE MAP, QUAD NO. 63

SOUTHFORD PARK

764 SOUTHFORD ROAD (ROUTE 188)
MIDDLEBURY, CONNECTICUT

PROJECT PHASE:

REV: ---

SLR
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
SLRCONSULTING.COM

DATE	DECEMBER 22, 2022
SCALE	1"=2,400'
PROJ. NO.	20970.00002

DESIGNED	DRAWN	CHECKED
---	MCB	---

DRAWING NAME:
LOC

APPENDIX B

FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP

Drainage Report

Southford Park

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Middlebury, Connecticut 06762

December 22, 2022
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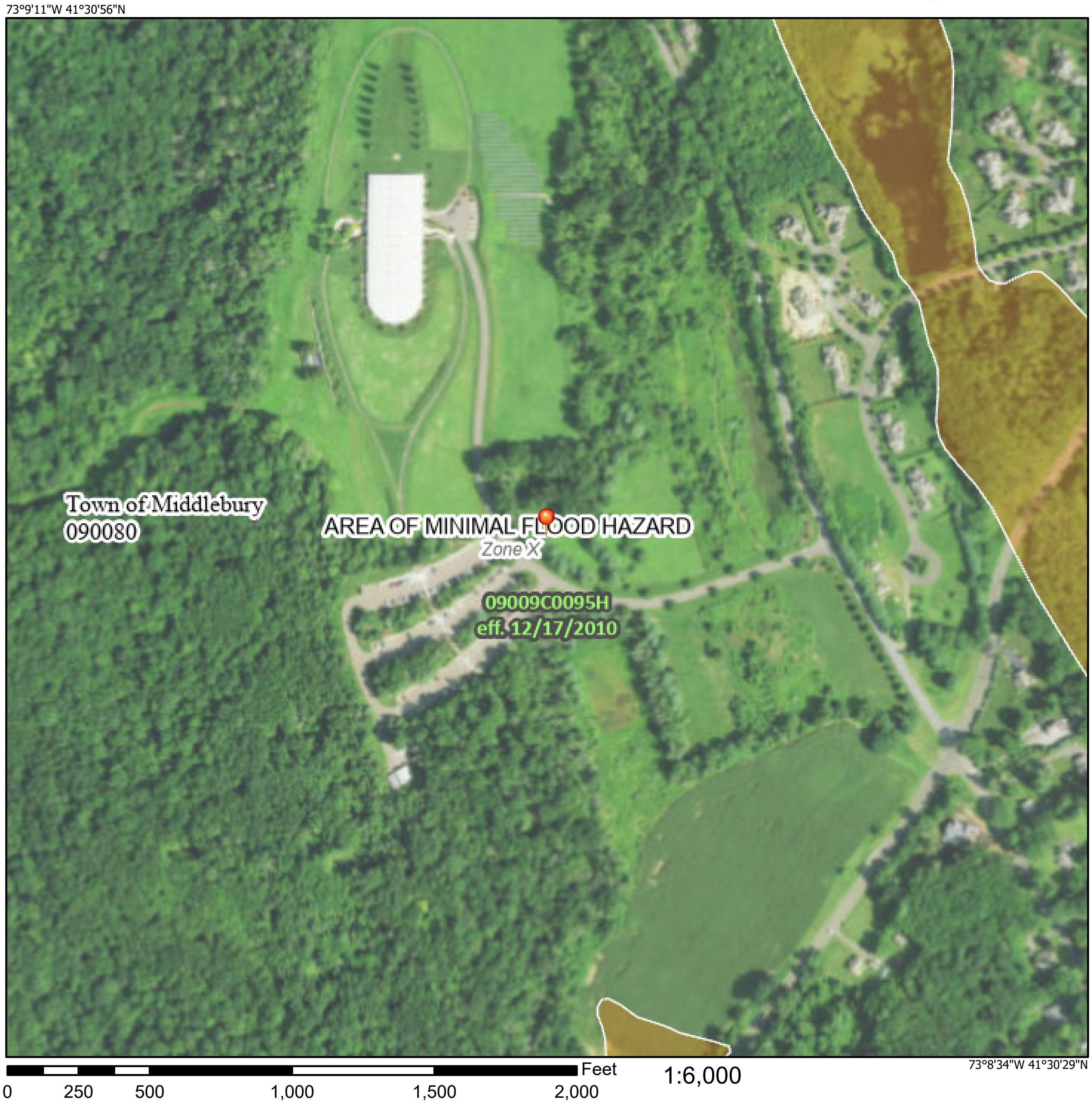
National Flood Hazard Layer FIRMette

FEMA



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/4/2022 at 2:43 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX C

NATURAL RESOURCES CONSERVATION SERVICE HYDROLOGIC SOIL GROUP MAP

Drainage Report

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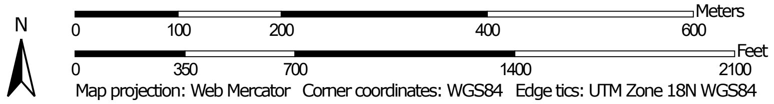
Map Scale: 1:7,340 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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 1:12,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: State of Connecticut
Survey Area Data: Version 22, Sep 12, 2022

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

Date(s) aerial images were photographed: Jun 8, 2020—Jun 12, 2020

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Ridgebury fine sandy loam, 0 to 3 percent slopes	D	2.0	0.7%
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	45.9	16.1%
13	Walpole sandy loam, 0 to 3 percent slopes	B/D	1.2	0.4%
17	Timakwa and Natchaug soils, 0 to 2 percent slopes	B/D	2.3	0.8%
18	Catden and Freetown soils, 0 to 2 percent slopes	B/D	4.6	1.6%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	B	2.1	0.7%
38C	Hinckley loamy sand, 3 to 15 percent slopes	A	1.4	0.5%
45A	Woodbridge fine sandy loam, 0 to 3 percent slopes	C/D	7.5	2.6%
45B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	47.1	16.5%
47C	Woodbridge fine sandy loam, 3 to 15 percent slopes, extremely stony	C/D	47.2	16.6%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	B	3.6	1.3%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	13.1	4.6%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	B	0.6	0.2%
84B	Paxton and Montauk fine sandy loams, 3 to 8 percent slopes	C	38.7	13.6%
84C	Paxton and Montauk fine sandy loams, 8 to 15 percent slopes	C	32.6	11.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
86C	Paxton and Montauk fine sandy loams, 3 to 15 percent slopes, extremely stony	C	15.4	5.4%
86D	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	C	15.4	5.4%
306	Udorthents-Urban land complex	B	1.1	0.4%
W	Water		2.8	1.0%
Totals for Area of Interest			**284.7**	**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

APPENDIX D

STORM DRAINAGE COMPUTATIONS

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Southford Park

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Middlebury, Connecticut 06762

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Rational Method Individual Basin Calculations

Project: Southford Park

By: MCB

Date: Rev. 8/25/23

Location: Middlebury, CT

Checked:

Date:

Basin Name	Impervious Area C=0.9 (sf)	Grassed Area C=0.3 (sf)	Wooded Area C=0.2 (sf)	Total Area (sf)	Total Area (ac)	Weighted C	Tc (min)
System 110							
CCB 101	24739	4663	0	29402	0.67	0.80	5.0
CCB 102	19682	11362	0	31044	0.71	0.68	9.9
System 310							
EXCB A	1754	4666	0	6420	0.15	0.46	5.0
EXCB B	15	258	0	273	0.01	0.33	5.0
EXCB C	4949	1091	0	6040	0.14	0.79	5.0
EXCB D	2228	0	0	2228	0.05	0.90	5.0
EXCB E	3216	0	0	3216	0.07	0.90	5.0
EXCB F	860	0	0	860	0.02	0.90	5.0
CCB 74	2775	87	0	2862	0.07	0.88	5.0
CCB 76	3240	798	0	4038	0.09	0.78	5.0
CCB 77	5060	39288	0	44348	1.02	0.37	5.0
CCB 78	11414	2893	0	14307	0.33	0.78	5.0
CCB 79	14467	71342	0	85809	1.97	0.40	5.0
CCB 80	2519	1092	0	3611	0.08	0.72	5.0
CCB 81	8114	23960	0	32074	0.74	0.45	5.0
CCB 82	4733	11093	0	15826	0.36	0.48	5.0
System 510							
CCB 8	7795	16028	311	24134	0.55	0.49	5.0
CCB 9	4965	9710	209	14884	0.34	0.50	5.0
CCB 11	7850	12886	0	20736	0.48	0.53	5.0
CCB 12	5910	1426	0	7336	0.17	0.78	5.0
CCB 13	7581	1549	0	9130	0.21	0.80	5.0
CCB 14	15981	1606	0	17587	0.40	0.85	5.0
CCB 14A	3987	426	0	4413	0.10	0.84	5.0
CCB 15	7442	13870	0	21312	0.49	0.51	5.0
CCB 16	8301	23668	0	31969	0.73	0.46	5.0

System 430							
CCB 27	3120	0	0	3120	0.07	0.90	5.0
CCB 28	4208	14412	0	18620	0.43	0.44	5.0
CCB 30	9972	0	0	9972	0.23	0.90	5.0
CCB 31	20216	1622	0	21838	0.50	0.86	5.0
CCB 31A	11289	0	0	11289	0.26	0.90	5.0
CCB 32	34813	2361	0	37174	0.85	0.86	5.0
CCB 85	21813	1866	0	23679	0.54	0.85	5.0
CCB 86	22708	0	0	22708	0.52	0.90	5.0
CCB 86A	4090	0	0	4090	0.09	0.90	5.0
CCB 87	36831	0	0	36831	0.85	0.90	5.0
CCB 40	11754	4191	0	15945	0.37	0.74	5.0
CCB 41	10183	3963	0	12387	0.28	0.84	5.0
CCB 42	11288	2611	0	13899	0.32	0.79	5.0
CCB 43	10215	1717	0	11932	0.27	0.81	5.0
CCB 44	4144	10436	0	14580	0.33	0.47	5.0
CCB 45	3340	0	0	3340	0.08	0.90	5.0

System 420							
CCB 21	6432	9790	0	16222	0.37	0.54	5.0
CCB 22	5746	3724	0	9470	0.22	0.66	5.0
CCB 23	4232	0	0	4232	0.10	0.90	5.0
CCB 24	6555	2444	0	8999	0.21	0.74	5.0
CCB 25	5575	0	0	5575	0.13	0.90	5.0
CCB 26	10254	18891	0	29145	0.67	0.51	5.0
CCB 38	16056	956	0	17012	0.39	0.87	5.0
CCB 39	12250	276	0	12526	0.29	0.89	5.0
CCB 48	17772	0	0	17772	0.41	0.90	5.0
CCB 49	8197	4336	0	12533	0.29	0.69	5.0
CCB 50	12018	4074	0	16092	0.37	0.75	5.0
CCB 51	10391	3472	0	13863	0.32	0.75	5.0
CCB 52	9287	1457	0	10744	0.25	0.82	5.0
CCB 53	9289	1599	0	10888	0.25	0.81	5.0
CCB 54	10640	1877	0	12517	0.29	0.81	5.0
CCB 55	11448	2683	0	14131	0.32	0.79	5.0
CCB 56	5043	1518	0	6561	0.15	0.76	5.0
CCB 57	5431	1243	0	6674	0.15	0.79	5.0
CCB 62	10216	2782	0	12998	0.30	0.77	5.0
CCB 63	10107	45010	0	55117	1.27	0.41	5.0
System 400							
CCB 59	5818	874	0	6692	0.15	0.82	5.0
CCB 60	5683	2738	0	8421	0.19	0.70	5.0
CCB 61	18429	34738	0	55746	1.28	0.48	5.0
System 500							
CCB 2	1709	1504	0	3213	0.07	0.62	5.0
CCB 3	1693	3743	3478	8914	0.20	0.37	5.0

Offsite WS 10							
CLCB 92	0	56107	0	56107	1.29	0.30	10.0
AD 93	0	9688	0	9688	0.22	0.30	5.0
AD 95	0	987	0	987	0.02	0.30	5.0
AD 96	0	3923	0	3923	0.09	0.30	5.0

Rational Method Roof Drain System Calculations

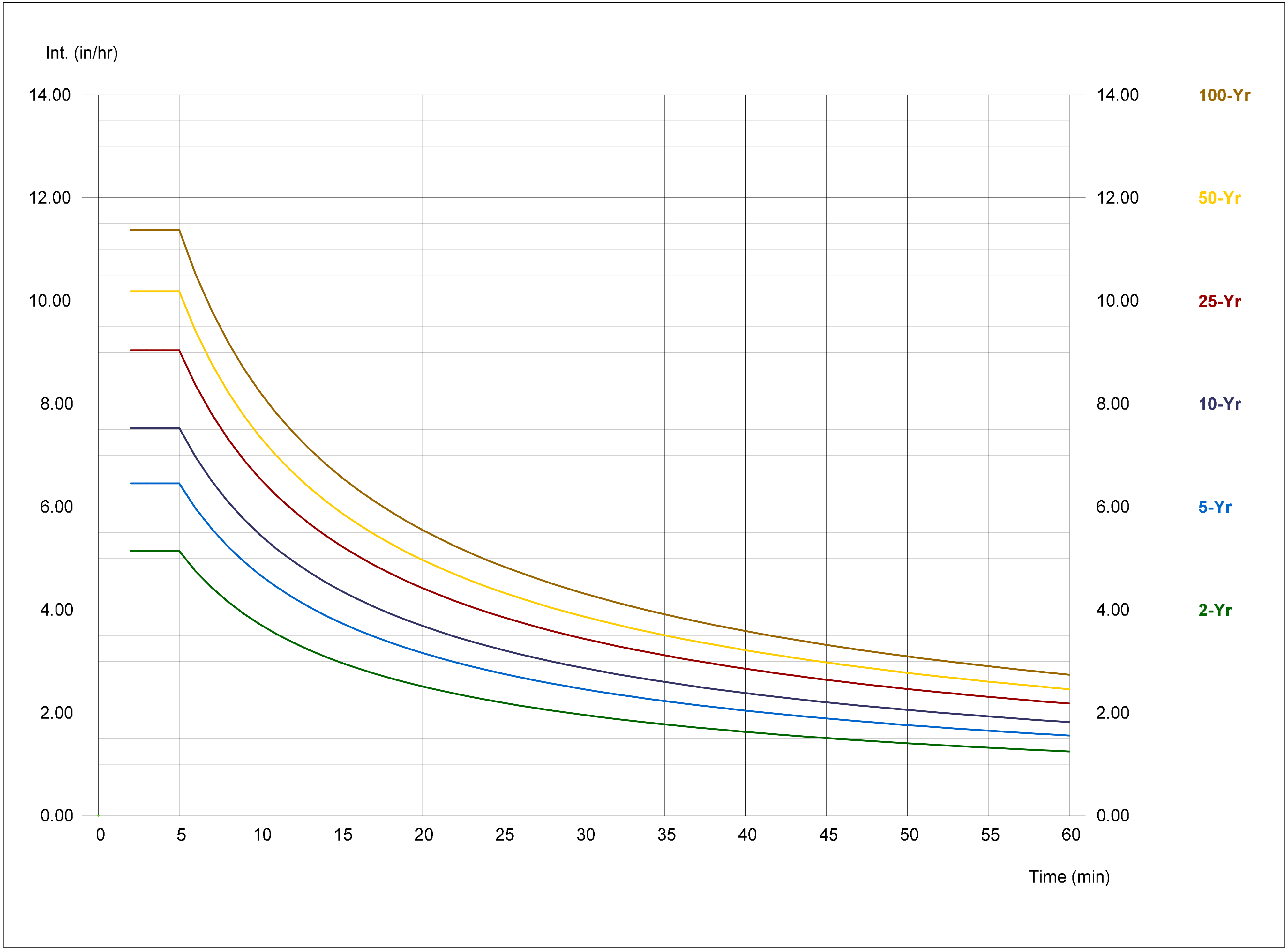
Project: Southford Park
Location: Middlebury, CT
By: MCB
Checked:
Date: Rev. 8/25/23
Date:

Total Roof Runoff to Proposed Storm Drainage System (In Hydraflow Model)

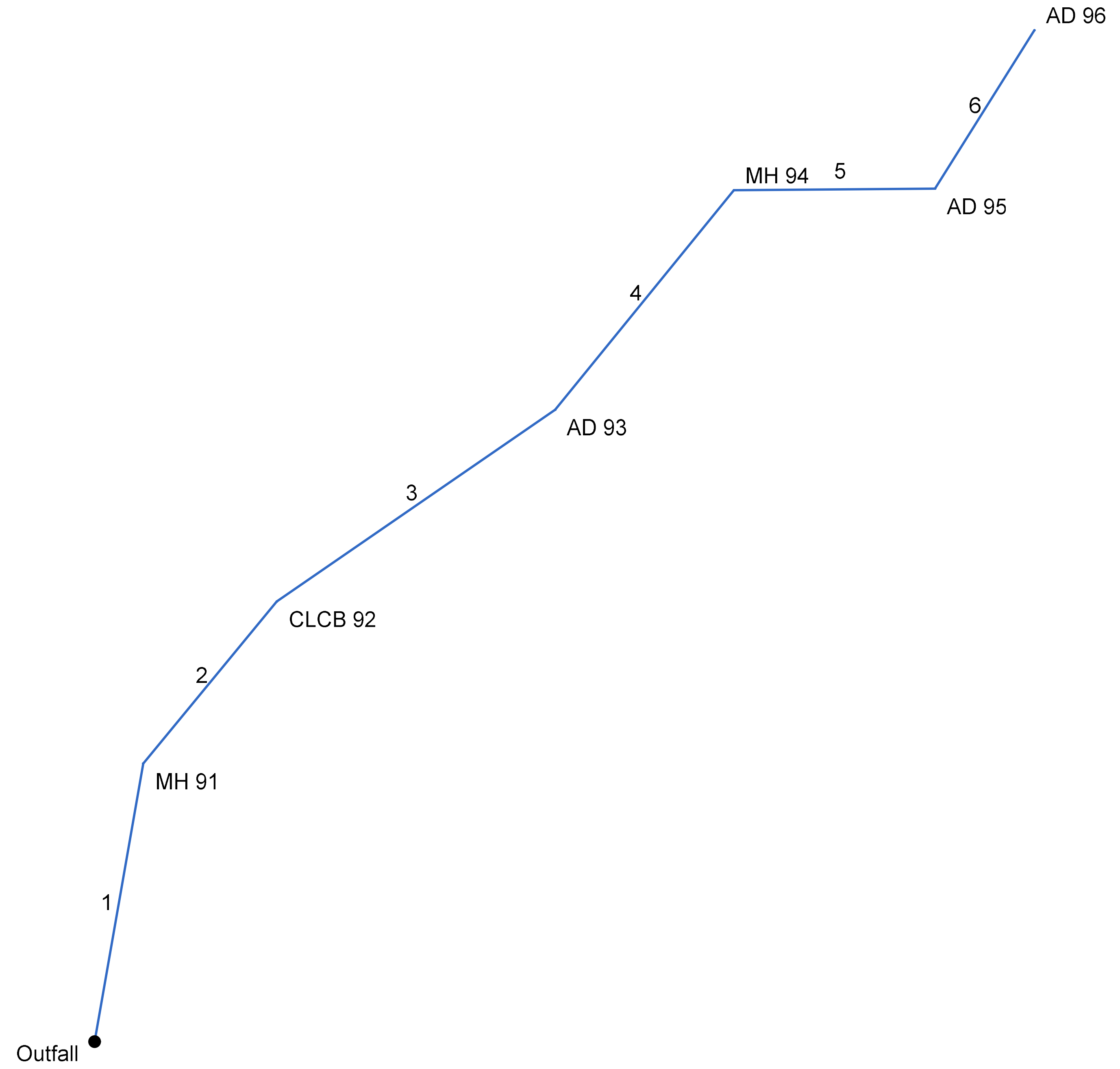
	BLDG TO DET 410	BLDG TO DET 420	BLDG TO DET 320				
C	0.90	0.90	0.90				
I	9.06	9.06	9.06				
A	3.50	2.99	8.89				
Q	28.54	24.38	72.49				

Storm Sewer IDF Curves

IDF file: Middlebury.IDF



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Offsite Wetland WS 10.stm	Number of lines: 6	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	62.000	-80.101	MH	0.00	0.00	0.00	0.0	703.00	0.81	703.50	12	Cir	0.013	0.55	706.70	FES 90-MH 91
2	1	46.000	29.464	Grate	0.00	1.29	0.30	10.0	703.50	0.87	703.90	12	Cir	0.013	0.50	707.00	MH 91-CLCB92
3	2	74.000	15.937	DrGrt	0.00	0.22	0.30	5.0	703.90	1.49	705.00	12	Cir	0.013	0.50	709.00	CLCB 92-AD93
4	3	62.000	-16.224	MH	0.00	0.00	0.00	0.0	705.00	0.81	705.50	12	Cir	0.013	0.81	714.50	AD 93-MH 94
5	4	44.000	50.426	DrGrt	0.00	0.02	0.30	5.0	711.30	1.14	711.80	8	Cir	0.011	1.30	715.00	MH 94-AD 95
6	5	41.000	-57.447	DrGrt	0.00	0.09	0.30	5.0	711.80	2.44	712.80	8	Cir	0.011	1.00	716.00	AD 95-AD 96

Project File: Offsite Wetland WS 10.stm

Number of lines: 6

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	62.000	0.00	1.62	0.00	0.00	0.49	0.0	11.0	6.2	3.02	3.20	4.55	12	0.81	703.00	703.50	703.83	704.25	704.10	706.70	FES 90-MH 91
2	1	46.000	1.29	1.62	0.30	0.39	0.49	10.0	10.8	6.3	3.05	3.32	4.27	12	0.87	703.50	703.90	704.45	704.69	706.70	707.00	MH 91-CLCB92
3	2	74.000	0.22	0.33	0.30	0.07	0.10	5.0	9.7	6.7	0.66	0.00	2.02	12	1.49	703.90	705.00	704.93	705.38	707.00	709.00	CLCB 92-AD93
4	3	62.000	0.00	0.11	0.00	0.00	0.03	0.0	6.9	7.9	0.26	0.00	1.64	12	0.81	705.00	705.50	705.38	705.72	709.00	714.50	AD 93-MH 94
5	4	44.000	0.02	0.11	0.30	0.01	0.03	5.0	6.0	8.4	0.28	0.00	2.90	8	1.14	711.30	711.80	711.50	712.05	714.50	715.00	MH 94-AD 95
6	5	41.000	0.09	0.09	0.30	0.03	0.03	5.0	5.0	9.0	0.24	0.00	2.18	8	2.44	711.80	712.80	712.05	713.03	715.00	716.00	AD 95-AD 96

Project File: Offsite Wetland WS 10.stm

Number of lines: 6

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
1	12	3.02	703.00	703.83	0.83	0.63	4.34	0.29	704.12	0.704	62.000	703.50	704.25	0.75**	0.63	4.76	0.35	704.61	0.857	0.781	0.484	0.55	0.19
2	12	3.05	703.50	704.45	0.95	0.77	3.96	0.24	704.69	0.635	46.000	703.90	704.69	0.79	0.67	4.57	0.33	705.02	0.783	0.709	0.326	0.50	0.16
3	12	0.66	703.90	704.93	0.00	0.00	1.04	0.00	704.93	0.000	74.000	705.00	705.38	0.00**	0.00	3.01	0.00	705.38	0.000	0.000	0.000	0.50	n/a
4	12	0.26	705.00	705.38	0.00	0.00	1.05	0.00	705.38	0.000	62.000	705.50	705.72	0.00**	0.00	2.23	0.00	705.72	0.000	0.000	0.000	0.81	n/a
5	8	0.28	711.30	711.50	0.00	0.00	3.36	0.00	711.50	0.000	44.000	711.80	712.05	0.00**	0.00	2.44	0.00	712.05	0.000	0.000	0.000	1.30	n/a
6	8	0.24	711.80	712.05	0.00	0.00	2.05	0.00	712.05	0.000	41.000	712.80	713.03	0.00**	0.00	2.32	0.00	713.03	0.000	0.000	0.000	1.00	n/a

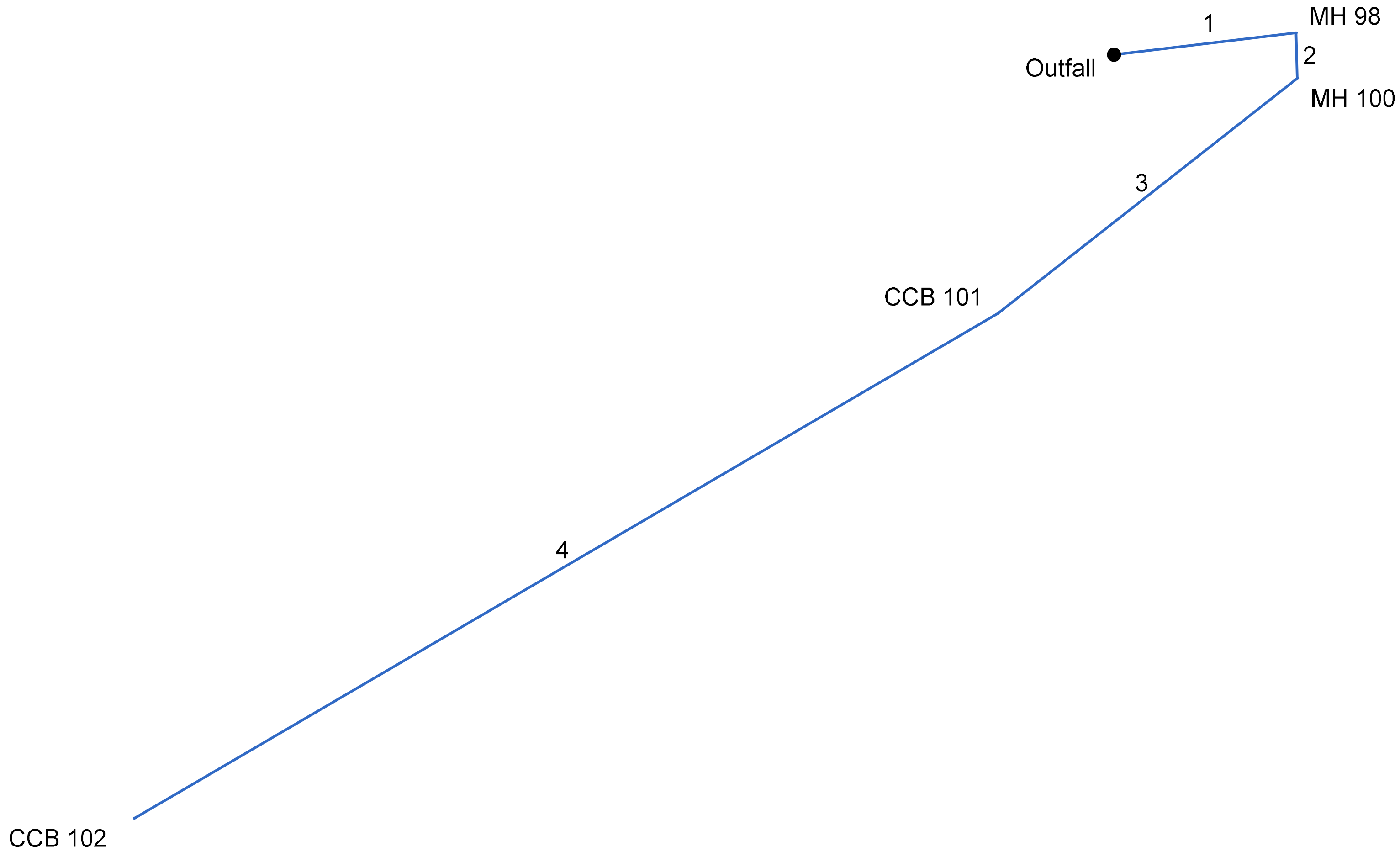
Project File: Offsite Wetland WS 10.stm

Number of lines: 6

Run Date: 8/28/2023

Notes: ; ** Critical depth. ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 110.stm	Number of lines: 4	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	36.000	-6.833	MH	0.00	0.00	0.00	0.0	660.00	7.78	662.80	18	Cir	0.013	1.00	670.20	FES 97 - MH 98
2	1	9.000	95.065	MH	0.00	0.00	0.00	0.0	663.10	10.00	664.00	18	Cir	0.013	0.83	671.00	MH 98 - MH 100
3	2	75.000	53.381	Comb	0.00	0.67	0.80	5.0	664.00	0.93	664.70	18	Cir	0.013	0.50	671.00	MH 100 - CCB 101
4	3	197.000	7.888	Comb	0.00	0.71	0.68	9.9	665.00	1.27	667.50	15	Cir	0.013	1.00	671.00	CCB 101 - CCB 102

Project File: System 110.stm

Number of lines: 4

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	36.000	0.00	1.38	0.00	0.00	1.02	0.0	11.2	6.2	6.27	29.29	3.55	18	7.78	660.00	662.80	665.40	665.53	0.96	670.20	FES 97 - MH 98
2	1	9.000	0.00	1.38	0.00	0.00	1.02	0.0	11.2	6.2	6.28	33.21	3.56	18	10.00	663.10	664.00	665.72	665.76	670.20	671.00	MH 98 - MH 100
3	2	75.000	0.67	1.38	0.80	0.54	1.02	5.0	10.8	6.3	6.39	10.15	3.62	18	0.93	664.00	664.70	665.92	666.19	671.00	671.00	MH 100 - CCB 10
4	3	197.000	0.71	0.71	0.68	0.48	0.48	9.9	9.9	6.6	3.18	7.27	3.48	15	1.27	665.00	667.50	666.29	668.22	671.00	671.00	CCB 101 - CCB 1

Project File: System 110.stm

Number of lines: 4

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

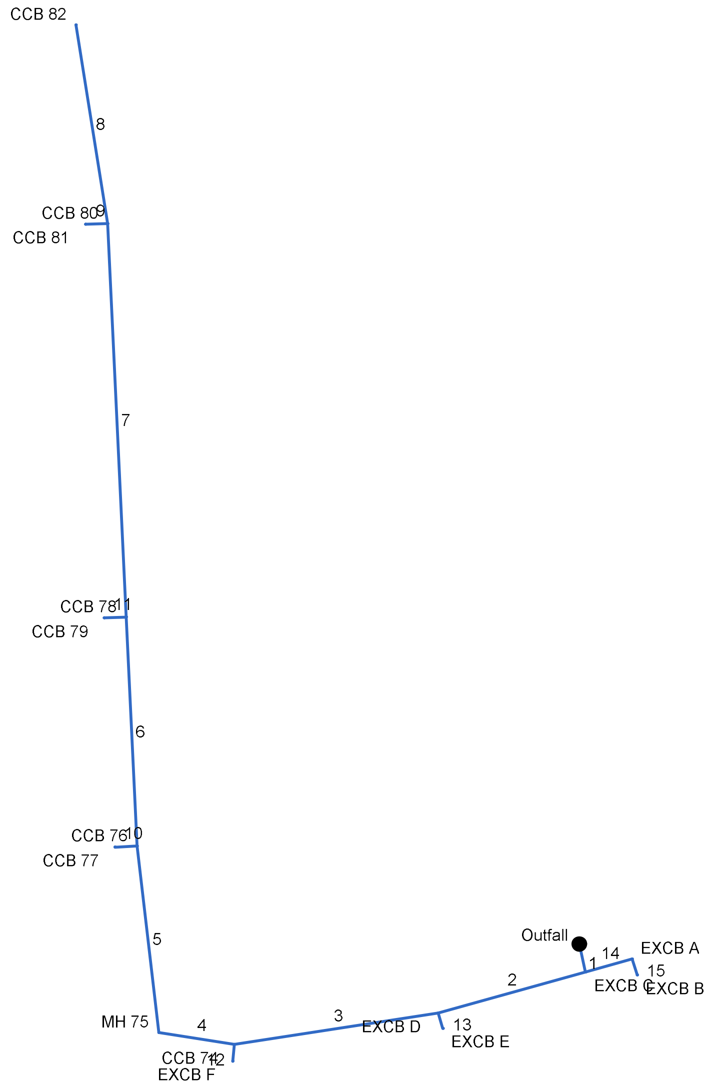
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	6.27	660.00	665.40	1.50	1.77	3.55	0.20	665.60	0.357	36.000	662.80	665.53	1.50	1.77	3.55	0.20	665.72	0.357	0.357	0.128	1.00	0.20
2	18	6.28	663.10	665.72	1.50	1.77	3.56	0.20	665.92	0.358	9.000	664.00	665.76	1.50	1.77	3.56	0.20	665.95	0.358	0.358	0.032	0.83	0.16
3	18	6.39	664.00	665.92	1.50	1.77	3.62	0.20	666.12	0.370	75.000	664.70	666.19	1.49	1.76	3.62	0.20	666.39	0.342	0.356	0.267	0.50	0.10
4	15	3.18	665.00	666.29	1.25	0.73	2.59	0.10	666.39	0.242	197.000	667.50	668.22 j	0.72**	0.73	4.36	0.30	668.51	0.617	0.429	n/a	1.00	0.30

Project File: System 110.stm	Number of lines: 4	Run Date: 8/28/2023

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 310.stm	Number of lines: 15	Date: 8/28/2023

Storm Sewers v2023.00

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	34.000	77.811	Comb	0.00	0.14	0.79	5.0	651.00	1.47	651.50	18	Cir	0.013	1.50	657.79	FES - EXCB C
2	1	180.000	86.652	Comb	0.00	0.05	0.90	5.0	651.60	2.50	656.10	18	Cir	0.013	1.50	663.00	EXCB C - EXCB D
3	2	243.000	6.706	Comb	0.00	0.07	0.88	5.0	656.10	2.43	662.00	18	Cir	0.013	1.46	679.10	EXCB D - CCB 74
4	3	90.000	17.823	MH	0.00	0.00	0.00	0.0	662.00	2.22	664.00	18	Cir	0.013	0.97	678.00	CCB 74-MH 75
5	4	222.000	74.411	Comb	0.00	0.09	0.78	5.0	664.00	3.38	671.50	18	Cir	0.013	1.50	685.10	MH 75-CCB 76
6	5	271.000	3.894	Comb	0.00	0.33	0.78	5.0	671.50	2.40	678.00	18	Cir	0.013	1.50	681.90	CCB 76-CCB 78
7	6	466.000	0.000	Comb	0.00	0.08	0.72	5.0	678.50	3.11	693.00	12	Cir	0.013	1.50	697.10	CCB 78-CCB 80
8	7	238.000	-6.287	Comb	0.00	0.36	0.48	5.0	693.30	3.87	702.50	12	Cir	0.013	1.00	706.00	CCB 80-CCB 82
9	7	26.000	-88.911	Comb	0.00	0.74	0.45	5.0	693.50	1.15	693.80	12	Cir	0.013	1.00	697.10	CCB 80-CCB 81
10	5	26.000	-86.254	Comb	0.00	1.02	0.37	5.0	681.50	1.54	681.90	12	Cir	0.013	1.00	685.10	CCB 76-CCB 77
11	6	26.000	-89.289	Comb	0.00	1.97	0.40	5.0	678.50	0.77	678.70	15	Cir	0.013	1.00	681.90	CCB 78-CCB 79
12	3	20.000	-75.947	Comb	0.00	0.02	0.90	5.0	674.60	1.00	674.80	18	Cir	0.013	1.00	679.10	CCB 74 - EXCB F
13	2	19.000	-90.708	Comb	0.00	0.07	0.90	5.0	658.40	1.05	658.60	12	Cir	0.013	1.00	663.00	EXCB D - EXCB E
14	1	57.000	-93.575	Comb	0.00	0.15	0.46	5.0	651.60	0.53	651.90	12	Cir	0.013	1.50	655.20	EXCB C - EXCB A
15	14	20.000	87.806	Comb	0.00	0.01	0.33	5.0	652.00	1.00	652.20	12	Cir	0.013	1.00	655.20	EXCB A - EXCB B

Project File: System 310.stm

Number of lines: 15

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	34.000	0.14	5.10	0.79	0.11	2.43	5.0	15.0	5.2	12.74	12.73	7.55	18	1.47	651.00	651.50	652.39	652.84	652.50	657.79	FES - EXCB C
2	1	180.000	0.05	4.80	0.90	0.05	2.24	5.0	9.2	6.8	15.36	16.60	9.36	18	2.50	651.60	656.10	652.84	657.51	657.79	663.00	EXCB C - EXCB
3	2	243.000	0.07	4.68	0.88	0.06	2.14	5.0	8.7	7.0	15.02	16.36	8.72	18	2.43	656.10	662.00	657.51	663.41	663.00	679.10	EXCB D - CCB 74
4	3	90.000	0.00	4.59	0.00	0.00	2.06	0.0	8.5	7.1	14.61	15.65	8.51	18	2.22	662.00	664.00	663.41	665.40	679.10	678.00	CCB 74-MH 75
5	4	222.000	0.09	4.59	0.78	0.07	2.06	5.0	8.1	7.3	14.99	19.30	8.73	18	3.38	664.00	671.50	665.40	672.90	678.00	685.10	MH 75-CCB 76
6	5	271.000	0.33	3.48	0.78	0.26	1.61	5.0	7.4	7.6	12.21	16.26	7.25	18	2.40	671.50	678.00	672.90	679.32	685.10	681.90	CCB 76-CCB 78
7	6	466.000	0.08	1.18	0.72	0.06	0.56	5.0	6.2	8.3	4.66	6.28	6.52	12	3.11	678.50	693.00	679.32	693.90	681.90	697.10	CCB 78-CCB 80
8	7	238.000	0.36	0.36	0.48	0.17	0.17	5.0	5.0	9.0	1.56	7.00	3.45	12	3.87	693.30	702.50	693.90	703.03	697.10	706.00	CCB 80-CCB 82
9	7	26.000	0.74	0.74	0.45	0.33	0.33	5.0	5.0	9.0	3.01	3.83	5.10	12	1.15	693.50	693.80	694.17	694.54	697.10	697.10	CCB 80-CCB 81
10	5	26.000	1.02	1.02	0.37	0.38	0.38	5.0	5.0	9.0	3.41	4.42	5.67	12	1.54	681.50	681.90	682.16	682.69	685.10	685.10	CCB 76-CCB 77
11	6	26.000	1.97	1.97	0.40	0.79	0.79	5.0	5.0	9.0	7.12	5.66	5.81	15	0.77	678.50	678.70	679.75	680.07	681.90	681.90	CCB 78-CCB 79
12	3	20.000	0.02	0.02	0.90	0.02	0.02	5.0	5.0	9.0	0.16	10.50	1.99	18	1.00	674.60	674.80	674.73	674.95	679.10	679.10	CCB 74 - EXCB F
13	2	19.000	0.07	0.07	0.90	0.06	0.06	5.0	5.0	9.0	0.57	3.65	3.04	12	1.05	658.40	658.60	658.67	658.91	663.00	663.00	EXCB D - EXCB
14	1	57.000	0.15	0.16	0.46	0.07	0.07	5.0	13.8	5.5	0.40	2.58	0.51	12	0.53	651.60	651.90	652.84	652.85	657.79	655.20	EXCB C - EXCB
15	14	20.000	0.01	0.01	0.33	0.00	0.00	5.0	5.0	9.0	0.03	3.56	0.64	12	1.00	652.00	652.20	652.85	652.27	655.20	655.20	EXCB A - EXCB B

Project File: System 310.stm

Number of lines: 15

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

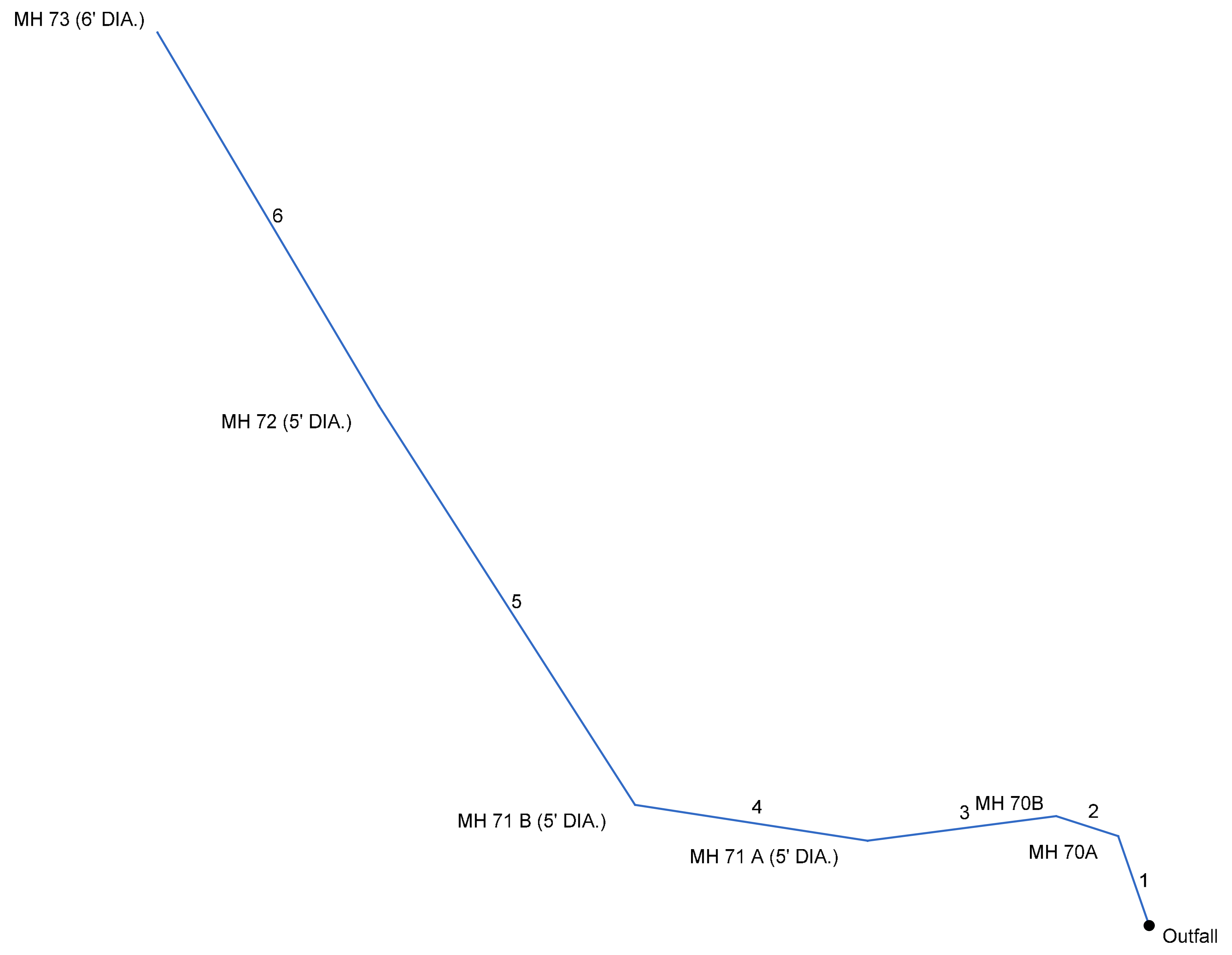
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	12.74	651.00	652.39	1.39	1.67	7.45	0.91	653.30	2.075	34.000	651.50	652.84	1.34**	1.67	7.64	0.91	653.75	2.393	2.234	n/a	1.50	n/a
2	18	15.36	651.60	652.84	1.24	1.56	9.82	1.23	654.07	2.135	180.000	656.10	657.51	1.41**	1.73	8.90	1.23	658.74	2.135	2.135	n/a	1.50	1.85
3	18	15.02	656.10	657.51	1.41	1.72	8.71	1.19	658.70	2.055	243.000	662.00	663.41 j	1.41**	1.72	8.73	1.19	664.59	2.054	2.055	n/a	1.46	n/a
4	18	14.61	662.00	663.41	1.41	1.71	8.49	1.13	664.54	1.950	90.000	664.00	665.40 j	1.40**	1.71	8.53	1.13	666.53	1.949	1.949	n/a	0.97	1.10
5	18	14.99	664.00	665.40	1.40	1.71	8.75	1.18	666.58	2.062	222.000	671.50	672.90	1.40**	1.72	8.72	1.18	674.09	2.061	2.062	n/a	1.50	n/a
6	18	12.21	671.50	672.90	1.40	1.65	7.10	0.85	673.76	1.372	271.000	678.00	679.32 j	1.32**	1.65	7.41	0.85	680.18	1.371	1.371	n/a	1.50	n/a
7	12	4.66	678.50	679.32	0.82	0.69	6.75	0.61	679.93	1.716	466.000	693.00	693.90	0.90**	0.74	6.28	0.61	694.51	1.515	1.615	n/a	1.50	0.92
8	12	1.56	693.30	693.90	0.60	0.42	3.20	0.21	694.11	0.000	238.000	702.50	703.03 j	0.53**	0.42	3.70	0.21	703.24	0.000	0.000	n/a	1.00	0.21
9	12	3.01	693.50	694.17	0.67*	0.56	5.39	0.36	694.53	0.000	26.000	693.80	694.54	0.74**	0.63	4.81	0.36	694.90	0.000	0.000	n/a	1.00	n/a
10	12	3.41	681.50	682.16	0.66*	0.55	6.21	0.41	682.57	0.000	26.000	681.90	682.69	0.79**	0.66	5.13	0.41	683.10	0.000	0.000	n/a	1.00	0.41
11	15	7.12	678.50	679.75	1.25*	1.23	5.81	0.52	680.27	1.218	26.000	678.70	680.07	1.25	1.23	5.81	0.52	680.59	1.217	1.217	0.317	1.00	0.52
12	18	0.16	674.60	674.73	0.13*	0.07	2.17	0.05	674.78	0.000	20.000	674.80	674.95	0.15**	0.09	1.80	0.05	675.00	0.000	0.000	n/a	1.00	n/a
13	12	0.57	658.40	658.67	0.27*	0.17	3.38	0.11	658.78	0.026	19.000	658.60	658.91	0.31**	0.21	2.71	0.11	659.03	0.026	0.026	n/a	1.00	n/a
14	12	0.40	651.60	652.84	1.00	0.79	0.51	0.00	652.85	0.012	57.000	651.90	652.85	0.95	0.77	0.52	0.00	652.85	0.011	0.012	0.007	1.50	0.01
15	12	0.03	652.00	652.85	0.85	0.02	0.04	0.02	652.88	0.000	20.000	652.20	652.27	0.07**	0.02	1.23	0.02	652.29	0.000	0.000	n/a	1.00	0.02

Project File: System 310.stm	Number of lines: 15	Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: System 320.stm	Number of lines: 6	Date: 3/15/2023

Storm Sewers v2018.30

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	19.000	-109.075	MH	0.00	0.00	0.00	0.0	663.50	2.11	663.90	36	Cir	0.013	0.83	672.00	FES 70 - MH 70A
2	1	13.000	-53.118	MH	0.00	0.00	0.00	0.0	665.50	6.92	666.40	30	Cir	0.013	0.48	674.80	MH 70A - MH 70B
3	2	38.000	-25.294	MH	0.00	0.00	0.00	0.0	668.00	5.26	670.00	30	Cir	0.013	0.33	681.00	MH 70B - MH 71A
4	3	47.000	16.339	MH	0.00	0.00	0.00	0.0	670.00	9.57	674.50	30	Cir	0.013	0.79	684.00	MH 71A - MH 71B
5	4	95.000	48.562	MH	0.00	0.00	0.00	0.0	679.50	10.00	689.00	30	Cir	0.013	0.15	698.00	MH 71B - MH 72
6	5	87.000	1.997	MH	72.49	0.00	0.00	0.0	693.50	9.77	702.00	30	Cir	0.013	1.00	712.50	MH 72 - MH 73

Project File: System 320.stm

Number of lines: 6

Date: 3/15/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.000	0.00	0.00	0.00	0.00	0.00	0.0	0.3	0.0	72.49	96.77	10.26	36	2.11	663.50	663.90	668.20	668.43	669.71	672.00	FES 70 - MH 70A
2	1	13.000	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	72.49	107.9	14.77	30	6.92	665.50	666.40	669.78	670.19	672.00	674.80	MH 70A - MH 70B
3	2	38.000	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	72.49	94.09	14.77	30	5.26	668.00	670.00	671.82	673.01	674.80	681.00	MH 70B - MH 71A
4	3	47.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	72.49	126.9	14.81	30	9.57	670.00	674.50	674.12	676.95	681.00	684.00	MH 71A - MH 71B
5	4	95.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	72.49	129.7	21.00	30	10.00	679.50	689.00	680.84	691.45	684.00	698.00	MH 71B - MH 72
6	5	87.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	72.49	128.2	20.88	30	9.77	693.50	702.00	694.85	704.45	698.00	712.50	MH 72 - MH 73

Project File: System 320.stm

Number of lines: 6

Run Date: 3/15/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewers v2018.30

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	36	72.49	663.50	668.20	3.00	7.07	10.26	1.64	669.84	1.182	19.000	663.90	668.43	3.00	7.07	10.26	1.64	670.06	1.181	1.182	0.225	0.83	1.36
2	30	72.49	665.50	669.78	2.50	4.91	14.77	3.39	673.17	3.126	13.000	666.40	670.19	2.50	4.91	14.77	3.39	673.58	3.124	3.125	0.406	0.48	1.63
3	30	72.49	668.00	671.82	2.50	4.91	14.77	3.39	675.21	3.126	38.000	670.00	673.01	2.50	4.91	14.77	3.39	676.40	3.124	3.125	1.187	0.33	1.12
4	30	72.49	670.00	674.12	2.50	4.88	14.77	3.39	677.52	3.126	47.000	674.50	676.95	2.45**	4.88	14.84	3.43	680.37	2.793	2.959	n/a	0.79	2.71
5	30	72.49	679.50	680.84	1.34*	2.67	27.15	3.43	684.26	0.000	95.000	689.00	691.45	2.45**	4.88	14.84	3.43	694.87	0.000	0.000	n/a	0.15	0.51
6	30	72.49	693.50	694.85	1.35*	2.69	26.91	3.43	698.27	0.000	87.000	702.00	704.45	2.45**	4.88	14.84	3.43	707.87	0.000	0.000	n/a	1.00	3.43

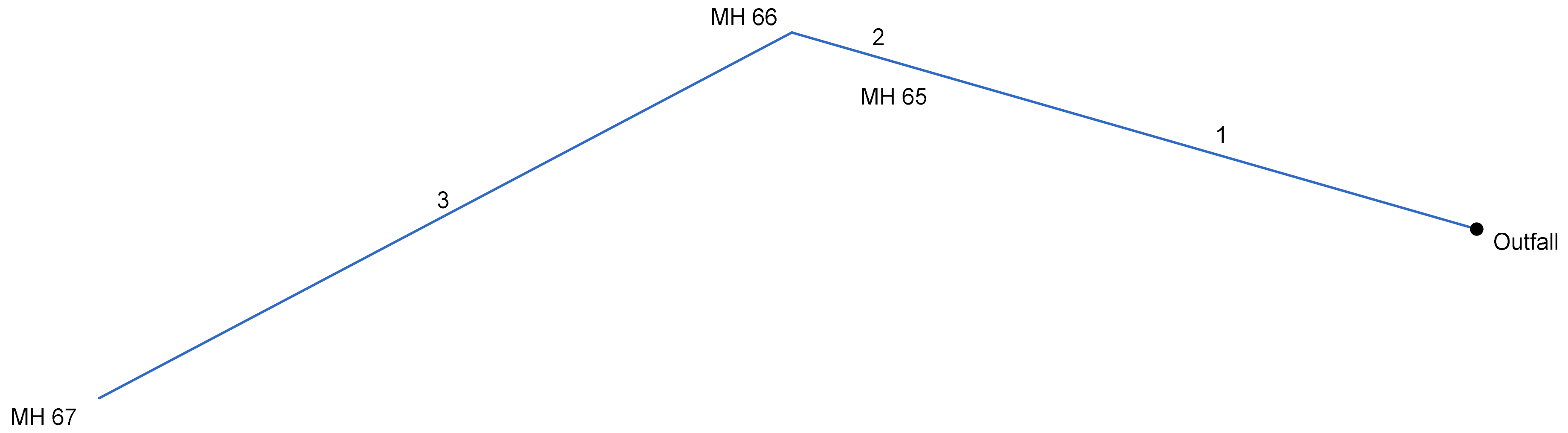
Project File: System 320.stm

Number of lines: 6

Run Date: 3/15/2023

Notes: * depth assumed; ** Critical depth. ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 410.stm	Number of lines: 3	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	77.000	-163.909	MH	0.00	0.00	0.00	0.0	682.00	1.43	683.10	24	Cir	0.013	0.15	687.80	FES 64-MH 65A
2	1	23.000	0.000	MH	0.00	0.00	0.00	0.0	683.10	8.26	685.00	24	Cir	0.013	0.74	689.00	MH 65A-MH 66A
3	2	110.000	-44.000	MH	28.54	0.00	0.00	0.0	685.00	11.82	698.00	18	Cir	0.013	1.00	711.00	MH 66A-MH 67

Project File: System 410.stm

Number of lines: 3

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	77.000	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	28.54	27.03	9.59	24	1.43	682.00	683.10	683.76	684.94	677.15	687.80	FES 64-MH 65A
2	1	23.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	28.54	65.01	9.45	24	8.26	683.10	685.00	684.94	686.84	687.80	689.00	MH 65A-MH 66A
3	2	110.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	28.54	36.10	16.16	18	11.82	685.00	698.00	686.84	699.49	689.00	711.00	MH 66A-MH 67

Project File: System 410.stm

Number of lines: 3

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	28.54	682.00	683.76	1.76	2.93	9.73	1.39	685.15	0.000	77.000	683.10	684.94	1.84**	3.02	9.45	1.39	686.33	0.000	0.000	n/a	0.15	0.21
2	24	28.54	683.10	684.94	1.84*	3.02	9.45	1.39	686.33	0.000	23.000	685.00	686.84	1.84**	3.02	9.45	1.39	688.23	0.000	0.000	n/a	0.74	1.03
3	18	28.54	685.00	686.84	1.50	1.77	16.15	4.06	690.89	7.390	110.000	698.00	699.49 j	1.49**	1.77	16.16	4.06	703.55	6.948	7.169	n/a	1.00	4.06

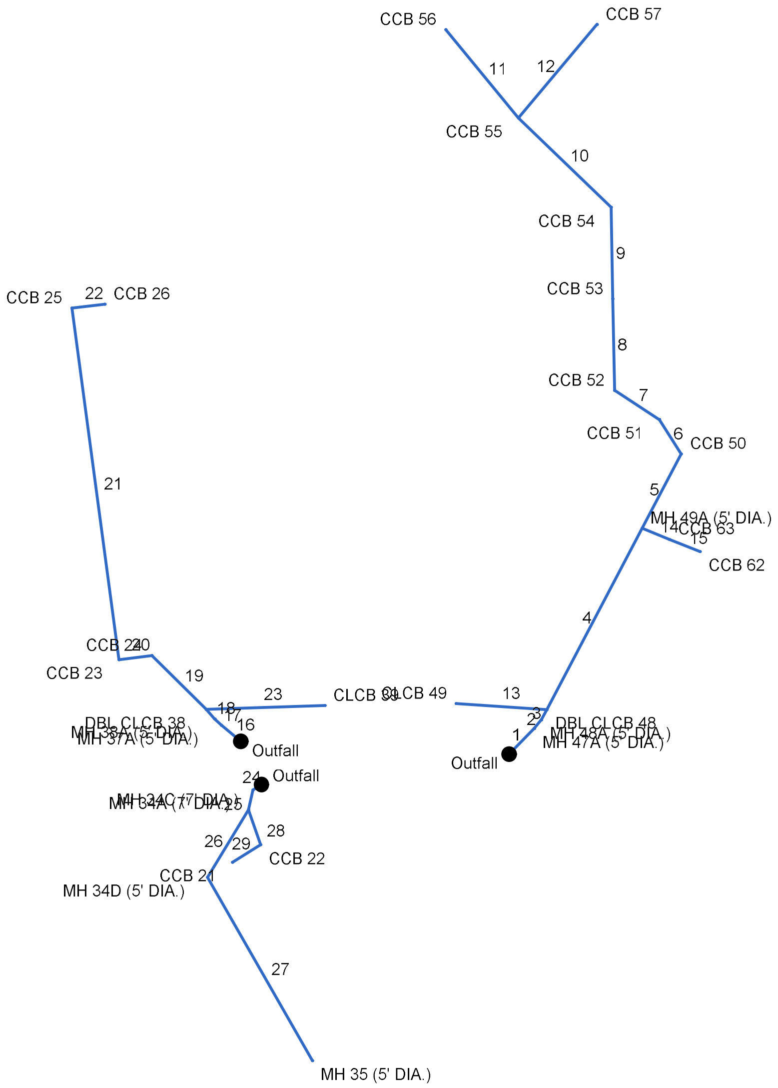
Project File: System 410.stm

Number of lines: 3

Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 420.stm

Number of lines: 29

Date: 8/28/2023

Storm Sewers v2023.00

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	28.000	-45.585	MH	0.00	0.00	0.00	0.0	663.50	3.21	664.40	36	Cir	0.013	0.15	674.20	FES 46 - MH 47A
2	1	9.000	-5.665	MH	0.00	0.00	0.00	0.0	665.00	7.78	665.70	36	Cir	0.013	0.23	675.80	MH 47A - MH 48A
3	2	9.000	-11.078	Grate	0.00	0.41	0.90	5.0	665.70	3.33	666.00	36	Cir	0.013	1.50	675.00	MH 48A - CLCB 48
4	3	161.000	0.008	MH	0.00	0.00	0.00	0.0	666.00	1.24	668.00	30	Cir	0.013	1.00	678.30	CLCB 48 - MH 49A
5	4	66.000	-0.025	Comb	0.00	0.37	0.75	5.0	669.00	4.85	672.20	24	Cir	0.013	1.34	676.00	MH 49A - CCB 50
6	5	32.000	-60.153	Comb	0.00	0.32	0.75	5.0	672.70	5.62	674.50	18	Cir	0.013	0.70	678.20	CCB 50 - CCB 51
7	6	42.000	-24.322	Comb	0.00	0.25	0.82	5.0	674.70	5.48	677.00	15	Cir	0.013	1.28	682.90	CCB 51 - CCB 52
8	7	72.000	55.786	Comb	0.00	0.25	0.81	5.0	679.50	3.47	682.00	15	Cir	0.013	0.50	686.90	CCB 52 - CCB 53
9	8	72.000	0.018	Comb	0.00	0.29	0.81	5.0	683.50	2.08	685.00	15	Cir	0.013	1.12	691.50	CCB 53 - CCB 54
10	9	101.000	-44.962	Comb	0.00	0.32	0.79	5.0	688.30	2.18	690.50	12	Cir	0.013	1.50	696.00	CCB 54 - CCB 55
11	10	90.000	6.712	Comb	0.00	0.15	0.76	5.0	692.80	3.56	696.00	12	Cir	0.013	1.00	702.00	CCB 55 - CCB 56
12	10	96.000	85.776	Comb	0.00	0.15	0.79	5.0	692.80	3.33	696.00	12	Cir	0.013	1.00	702.00	CCB 55 - CCB 57
13	3	71.000	-113.759	Grate	0.00	0.29	0.69	5.0	670.50	2.82	672.50	12	Cir	0.013	1.00	675.50	CLCB 48 - CLCB 49
14	4	23.000	84.664	Comb	0.00	1.27	0.41	5.0	668.80	1.74	669.20	24	Cir	0.013	0.50	673.00	MH 49A - CCB 63
15	14	26.000	-0.491	Comb	0.00	0.30	0.77	5.0	669.20	1.15	669.50	15	Cir	0.013	1.00	673.00	CCB 63 - CCB 62
16	End	20.000	-140.327	MH	0.00	0.00	0.00	0.0	668.00	2.50	668.50	18	Cir	0.013	0.15	675.00	FES 36 - MH 37A
17	16	7.000	4.340	MH	0.00	0.00	0.00	0.0	669.00	8.57	669.60	18	Cir	0.013	0.15	676.10	MH 37A - MH 38A
18	17	10.000	4.476	Grate	0.00	0.39	0.87	5.0	669.50	3.00	669.80	18	Cir	0.013	1.50	675.00	MH 38A - CLCB 38
19	18	60.000	-3.699	Comb	0.00	0.21	0.74	5.0	669.80	2.00	671.00	15	Cir	0.013	1.23	676.20	CLCB 38 - CCB 24
20	19	26.000	-51.901	Comb	0.00	0.10	0.90	5.0	671.00	3.85	672.00	15	Cir	0.013	1.50	676.20	CCB 24 - CCB 23
21	20	279.000	89.531	Comb	0.14	0.13	0.90	5.0	672.00	3.23	681.00	15	Cir	0.013	1.50	685.50	CCB 23 - CCB 25
22	21	26.000	90.925	Comb	0.69	0.67	0.51	5.0	681.50	3.08	682.30	12	Cir	0.013	1.00	685.50	CCB 25 - CCB 26
23	18	93.000	129.603	Grate	0.00	0.29	0.89	5.0	672.30	1.29	673.50	12	Cir	0.013	1.00	675.50	CLCB 38 - CLCB 39

Project File: System 420.stm

Number of lines: 29

Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	End	8.000	147.539	MH	0.00	0.00	0.00	0.0	665.00	2.50	665.20	30	Cir	0.013	0.75	670.00	FES 34 - MH 34A
25	24	16.000	-45.240	MH	0.00	0.00	0.00	0.0	665.50	9.38	667.00	30	Cir	0.013	0.58	674.20	MH 34A - MH 34C
26	25	62.000	18.876	MH	0.00	0.00	0.00	0.0	667.00	2.90	668.80	30	Cir	0.013	0.90	673.00	MH 34C - MH 34D
27	26	166.000	-60.851	MH	24.38	0.00	0.00	0.0	668.80	1.81	671.80	30	Cir	0.013	1.00	676.20	MH 34D - MH 35
28	25	29.000	-31.355	Comb	0.00	0.22	0.66	5.0	667.00	3.45	668.00	12	Cir	0.013	1.47	671.60	MH 34C - CCB 22
29	28	26.000	76.904	Comb	0.00	0.37	0.54	5.0	668.00	1.54	668.40	12	Cir	0.013	1.00	671.60	CCB 22 - CCB 21

Project File: System 420.stm	Number of lines: 29	Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	28.000	0.00	4.37	0.00	0.00	2.97	0.0	7.0	7.8	23.12	119.6	3.27	36	3.21	663.50	664.40	671.80	671.83	666.25	674.20	FES 46 - MH 47A
2	1	9.000	0.00	4.37	0.00	0.00	2.97	0.0	7.0	7.8	23.19	186.0	3.28	36	7.78	665.00	665.70	671.86	671.87	674.20	675.80	MH 47A - MH 48A
3	2	9.000	0.41	4.37	0.90	0.37	2.97	5.0	6.9	7.8	23.26	121.8	3.29	36	3.33	665.70	666.00	671.91	671.92	675.80	675.00	MH 48A - CLCB 4
4	3	161.000	0.00	3.67	0.00	0.00	2.40	0.0	6.3	8.2	19.69	45.71	4.01	30	1.24	666.00	668.00	672.17	672.54	675.00	678.30	CLCB 48 - MH 49
5	4	66.000	0.37	2.10	0.75	0.28	1.65	5.0	6.0	8.3	13.72	49.80	5.27	24	4.85	669.00	672.20	672.79	673.53	678.30	676.00	MH 49A - CCB 50
6	5	32.000	0.32	1.73	0.75	0.24	1.37	5.0	6.0	8.4	11.45	24.91	9.23	18	5.62	672.70	674.50	673.53	675.79	676.00	678.20	CCB 50 - CCB 51
7	6	42.000	0.25	1.41	0.82	0.21	1.13	5.0	5.9	8.4	9.50	15.11	8.16	15	5.48	674.70	677.00	675.79	678.17	678.20	682.90	CCB 51 - CCB 52
8	7	72.000	0.25	1.16	0.81	0.20	0.92	5.0	5.8	8.5	7.86	12.03	8.64	15	3.47	679.50	682.00	680.24	683.11	682.90	686.90	CCB 52 - CCB 53
9	8	72.000	0.29	0.91	0.81	0.23	0.72	5.0	5.6	8.6	6.21	9.32	7.00	15	2.08	683.50	685.00	684.25	686.01	686.90	691.50	CCB 53 - CCB 54
10	9	101.000	0.32	0.62	0.79	0.25	0.49	5.0	5.3	8.8	4.27	5.26	6.67	12	2.18	688.30	690.50	688.98	691.37	691.50	696.00	CCB 54 - CCB 55
11	10	90.000	0.15	0.15	0.76	0.11	0.11	5.0	5.0	9.0	1.03	6.72	4.71	12	3.56	692.80	696.00	693.07	696.43	696.00	702.00	CCB 55 - CCB 56
12	10	96.000	0.15	0.15	0.79	0.12	0.12	5.0	5.0	9.0	1.07	6.50	4.69	12	3.33	692.80	696.00	693.07	696.44	696.00	702.00	CCB 55 - CCB 57
13	3	71.000	0.29	0.29	0.69	0.20	0.20	5.0	5.0	9.0	1.81	5.98	3.10	12	2.82	670.50	672.50	672.17	673.07	675.00	675.50	CLCB 48 - CLCB
14	4	23.000	1.27	1.57	0.41	0.52	0.75	5.0	5.3	8.9	6.66	29.83	2.12	24	1.74	668.80	669.20	672.79	672.81	678.30	673.00	MH 49A - CCB 63
15	14	26.000	0.30	0.30	0.77	0.23	0.23	5.0	5.0	9.0	2.09	6.94	1.70	15	1.15	669.20	669.50	672.85	672.88	673.00	673.00	CCB 63 - CCB 62
16	End	20.000	0.00	1.79	0.00	0.00	1.30	0.0	6.4	8.1	11.42	16.60	6.46	18	2.50	668.00	668.50	671.80	672.04	669.63	675.00	FES 36 - MH 37A
17	16	7.000	0.00	1.79	0.00	0.00	1.30	0.0	6.4	8.1	11.43	30.74	6.47	18	8.57	669.00	669.60	672.13	672.22	675.00	676.10	MH 37A - MH 38A
18	17	10.000	0.39	1.79	0.87	0.34	1.30	5.0	6.3	8.2	11.45	18.19	6.48	18	3.00	669.50	669.80	672.31	672.43	676.10	675.00	MH 38A - CLCB 3
19	18	60.000	0.21	1.11	0.74	0.16	0.70	5.0	6.2	8.3	6.65	9.13	5.42	15	2.00	669.80	671.00	673.41	674.05	675.00	676.20	CLCB 38 - CCB 2
20	19	26.000	0.10	0.90	0.90	0.09	0.55	5.0	6.1	8.3	5.40	12.66	4.40	15	3.85	671.00	672.00	674.61	674.79	676.20	676.20	CCB 24 - CCB 23
21	20	279.000	0.13	0.80	0.90	0.12	0.46	5.0	5.1	9.0	4.96	11.60	4.63	15	3.23	672.00	681.00	675.25	681.90	676.20	685.50	CCB 23 - CCB 25
22	21	26.000	0.67	0.67	0.51	0.34	0.34	5.0	5.0	9.0	3.78	6.25	6.89	12	3.08	681.50	682.30	682.06	683.13	685.50	685.50	CCB 25 - CCB 26

Project File: System 420.stm | Number of lines: 29 | Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
23	18	93.000	0.29	0.29	0.89	0.26	0.26	5.0	5.0	9.0	2.33	4.05	3.63	12	1.29	672.30	673.50	673.41	674.15	675.00	675.50	CLCB 38 - CLCB
24	End	8.000	0.00	0.59	0.00	0.00	0.35	0.0	5.4	8.8	27.41	64.85	5.58	30	2.50	665.00	665.20	671.80	671.84	667.15	670.00	FES 34 - MH 34A
25	24	16.000	0.00	0.59	0.00	0.00	0.35	0.0	5.3	8.8	27.42	125.6	5.59	30	9.38	665.50	667.00	672.20	672.27	670.00	674.20	MH 34A - MH 34C
26	25	62.000	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	24.38	69.88	4.97	30	2.90	667.00	668.80	672.55	672.77	674.20	673.00	MH 34C - MH 34D
27	26	166.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	24.38	55.13	5.87	30	1.81	668.80	671.80	673.12	673.52	673.00	676.20	MH 34D - MH 35
28	25	29.000	0.22	0.59	0.66	0.15	0.35	5.0	5.2	8.9	3.07	6.61	3.91	12	3.45	667.00	668.00	672.55	672.77	674.20	671.60	MH 34C - CCB 22
29	28	26.000	0.37	0.37	0.54	0.20	0.20	5.0	5.0	9.0	1.81	4.42	2.30	12	1.54	668.00	668.40	673.12	673.19	671.60	671.60	CCB 22 - CCB 21

Project File: System 420.stm

Number of lines: 29

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	36	23.12	663.50	671.80	3.00	7.07	3.27	0.17	671.97	0.120	28.000	664.40	671.83	3.00	7.07	3.27	0.17	672.00	0.120	0.120	0.034	0.15	0.02
2	36	23.19	665.00	671.86	3.00	7.07	3.28	0.17	672.03	0.121	9.000	665.70	671.87	3.00	7.07	3.28	0.17	672.04	0.121	0.121	0.011	0.23	0.04
3	36	23.26	665.70	671.91	3.00	7.07	3.29	0.17	672.08	0.122	9.000	666.00	671.92	3.00	7.07	3.29	0.17	672.09	0.122	0.122	0.011	1.50	0.25
4	30	19.69	666.00	672.17	2.50	4.91	4.01	0.25	672.42	0.231	161.000	668.00	672.54	2.50	4.91	4.01	0.25	672.79	0.230	0.231	0.371	1.00	0.25
5	24	13.72	669.00	672.79	2.00	2.22	4.37	0.30	673.09	0.368	66.000	672.20	673.53 j	1.33**	2.22	6.17	0.59	674.12	0.600	0.484	n/a	1.34	0.79
6	18	11.45	672.70	673.53	0.83	1.01	11.37	0.78	674.31	0.000	32.000	674.50	675.79	1.29**	1.62	7.08	0.78	676.57	0.000	0.000	n/a	0.70	n/a
7	15	9.50	674.70	675.79	1.09	1.14	8.37	0.98	676.77	0.000	42.000	677.00	678.17	1.17**	1.19	7.96	0.98	679.15	0.000	0.000	n/a	1.28	1.26
8	15	7.86	679.50	680.24	0.74*	0.75	10.45	0.73	680.96	0.000	72.000	682.00	683.11	1.11**	1.15	6.83	0.73	683.83	0.000	0.000	n/a	0.50	0.36
9	15	6.21	683.50	684.25	0.75*	0.76	8.13	0.54	684.78	0.000	72.000	685.00	686.01	1.01**	1.06	5.87	0.54	686.54	0.000	0.000	n/a	1.12	0.60
10	12	4.27	688.30	688.98	0.68*	0.57	7.45	0.54	689.52	0.000	101.000	690.50	691.37	0.87**	0.72	5.89	0.54	691.91	0.000	0.000	n/a	1.50	0.81
11	12	1.03	692.80	693.07	0.27*	0.17	6.18	0.16	693.23	0.000	90.000	696.00	696.43	0.43**	0.32	3.23	0.16	696.59	0.000	0.000	n/a	1.00	0.16
12	12	1.07	692.80	693.07	0.27*	0.18	6.11	0.17	693.24	0.000	96.000	696.00	696.44	0.44**	0.33	3.27	0.17	696.60	0.000	0.000	n/a	1.00	0.17
13	12	1.81	670.50	672.17	1.00	0.46	2.30	0.08	672.25	0.258	71.000	672.50	673.07 j	0.57**	0.46	3.89	0.24	673.31	0.663	0.461	n/a	1.00	n/a
14	24	6.66	668.80	672.79	2.00	3.14	2.12	0.07	672.86	0.087	23.000	669.20	672.81	2.00	3.14	2.12	0.07	672.88	0.087	0.087	0.020	0.50	0.03
15	15	2.09	669.20	672.85	1.25	1.23	1.70	0.05	672.89	0.105	26.000	669.50	672.88	1.25	1.23	1.70	0.05	672.92	0.105	0.105	0.027	1.00	0.05
16	18	11.42	668.00	671.80	1.50	1.77	6.46	0.65	672.45	1.183	20.000	668.50	672.04	1.50	1.77	6.46	0.65	672.69	1.182	1.182	0.236	0.15	0.10
17	18	11.43	669.00	672.13	1.50	1.77	6.47	0.65	672.78	1.185	7.000	669.60	672.22	1.50	1.77	6.47	0.65	672.87	1.185	1.185	0.083	0.15	0.10
18	18	11.45	669.50	672.31	1.50	1.77	6.48	0.65	672.97	1.189	10.000	669.80	672.43	1.50	1.77	6.48	0.65	673.09	1.189	1.189	0.119	1.50	0.98
19	15	6.65	669.80	673.41	1.25	1.23	5.42	0.46	673.87	1.062	60.000	671.00	674.05	1.25	1.23	5.42	0.46	674.51	1.061	1.061	0.637	1.23	0.56
20	15	5.40	671.00	674.61	1.25	1.23	4.40	0.30	674.91	0.699	26.000	672.00	674.79	1.25	1.23	4.40	0.30	675.09	0.699	0.699	0.182	1.50	0.45
21	15	4.96	672.00	675.25	1.25	0.95	4.04	0.25	675.50	0.589	279.000	681.00	681.90 j	0.90**	0.95	5.23	0.42	682.33	0.777	0.683	n/a	1.50	n/a
22	12	3.78	681.50	682.06	0.56*	0.45	8.33	0.46	682.52	0.000	26.000	682.30	683.13	0.83**	0.69	5.44	0.46	683.59	0.000	0.000	n/a	1.00	n/a

Project File: System 420.stm | Number of lines: 29 | Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

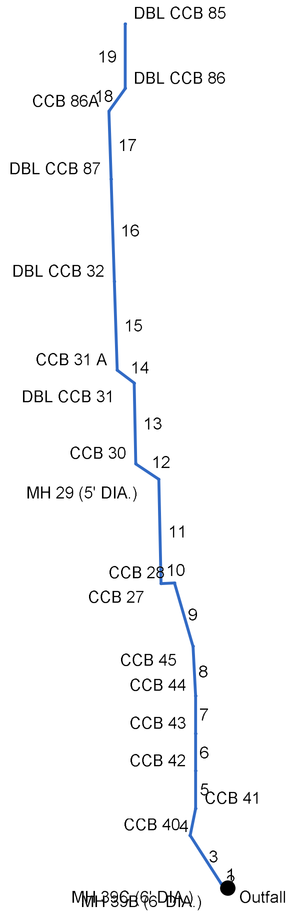
Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream								Len (ft)	Upstream								Check		JL coeff (K)	Minor loss (ft)
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
23	12	2.33	672.30	673.41	1.00	0.54	2.97	0.14	673.55	0.429	93.000	673.50	674.15 j	0.65**	0.54	4.29	0.29	674.44	0.740	0.585	n/a	1.00	n/a
24	30	27.41	665.00	671.80	2.50	4.91	5.59	0.48	672.29	0.447	8.000	665.20	671.84	2.50	4.91	5.58	0.48	672.32	0.447	0.447	0.036	0.75	0.36
25	30	27.42	665.50	672.20	2.50	4.91	5.59	0.49	672.68	0.447	16.000	667.00	672.27	2.50	4.91	5.59	0.49	672.76	0.447	0.447	0.072	0.58	0.28
26	30	24.38	667.00	672.55	2.50	4.91	4.97	0.38	672.94	0.354	62.000	668.80	672.77	2.50	4.91	4.97	0.38	673.16	0.353	0.353	0.219	0.90	0.35
27	30	24.38	668.80	673.12	2.50	4.91	4.97	0.38	673.50	0.354	166.000	671.80	673.52	1.72	3.60	6.76	0.71	674.23	0.527	0.440	0.731	1.00	0.71
28	12	3.07	667.00	672.55	1.00	0.79	3.91	0.24	672.79	0.744	29.000	668.00	672.77	1.00	0.79	3.91	0.24	673.01	0.744	0.744	0.216	1.47	0.35
29	12	1.81	668.00	673.12	1.00	0.79	2.30	0.08	673.20	0.257	26.000	668.40	673.19	1.00	0.79	2.30	0.08	673.27	0.257	0.257	0.067	1.00	0.08

Project File: System 420.stm	Number of lines: 29	Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 430.stm	Number of lines: 19	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	6.000	-179.684	MH	0.00	0.00	0.00	0.0	668.40	3.33	668.60	24	Cir	0.013	0.81	679.00	UG 430 - MH 39B
2	1	11.000	50.985	MH	0.00	0.00	0.00	0.0	668.60	7.27	669.40	24	Cir	0.013	0.15	679.30	MH 39B - MH 39C
3	2	110.000	6.002	Comb	0.00	0.37	0.74	5.0	669.40	6.00	676.00	24	Cir	0.012	1.12	681.70	MH 39C - CCB 40
4	3	53.000	44.642	Comb	0.00	0.28	0.84	5.0	676.00	4.72	678.50	24	Cir	0.013	0.50	684.00	CCB 40 - CCB 41
5	4	72.000	-12.124	Comb	0.00	0.32	0.79	5.0	678.50	2.08	680.00	24	Cir	0.012	0.50	686.50	CCB 41 - CCB 42
6	5	72.000	0.172	Comb	0.00	0.27	0.81	5.0	680.00	2.78	682.00	24	Cir	0.012	0.50	689.00	CCB 42 - CCB 43
7	6	72.000	0.001	Comb	0.00	0.33	0.47	5.0	682.00	2.08	683.50	24	Cir	0.012	0.50	692.00	CCB 43 - CCB 44
8	7	95.000	-2.957	Comb	0.00	0.08	0.90	5.0	683.50	2.11	685.50	24	Cir	0.012	0.50	697.70	CCB 44 - CCB 45
9	8	127.000	-13.178	Comb	0.00	0.43	0.44	5.0	685.50	1.57	687.50	24	Cir	0.012	1.46	703.70	CCB 45 - CCB 28
10	9	26.000	-75.649	Comb	0.00	0.07	0.90	5.0	687.50	1.92	688.00	24	Cir	0.012	1.50	701.40	CCB 28 - CCB 27
11	10	200.000	90.492	MH	0.00	0.00	0.00	0.0	688.00	1.50	691.00	24	Cir	0.012	0.84	708.70	CCB 27 - MH 29
12	11	53.000	-54.085	Comb	0.00	0.23	0.90	5.0	691.00	1.89	692.00	24	Cir	0.012	1.26	707.20	MH 29 - CCB 30
13	12	155.000	54.096	Comb	0.00	0.50	0.86	5.0	692.00	1.94	695.00	24	Cir	0.012	1.22	707.00	CCB 30 - CCB 31
14	13	41.000	-50.835	Comb	0.00	0.26	0.90	5.0	695.00	2.44	696.00	24	Cir	0.012	1.21	706.90	CCB 31 - CCB 31A
15	14	170.000	50.261	Comb	0.00	0.85	0.86	5.0	696.00	1.18	698.00	24	Cir	0.012	0.50	706.30	CCB 31A - CCB 32
16	15	197.000	0.032	Comb	0.00	0.85	0.90	5.0	698.00	0.76	699.50	24	Cir	0.012	0.50	706.30	CCB 32 - CCB 87
17	16	130.000	-0.023	Comb	0.00	0.09	0.90	5.0	700.00	0.77	701.00	24	Cir	0.012	0.98	707.00	CCB 87 - CCB 86A
18	17	54.000	37.244	Comb	0.00	0.52	0.90	5.0	701.00	1.30	701.70	18	Cir	0.012	0.95	707.00	CCB 86A - CCB 86
19	18	124.000	-35.275	Comb	0.00	0.54	0.85	5.0	702.00	1.37	703.70	15	Cir	0.012	1.00	707.20	CCB 86 - CCB 85

Project File: System 430.stm | Number of lines: 19 | Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	6.000	0.00	5.99	0.00	0.00	4.83	0.0	8.9	7.0	33.63	41.29	10.70	24	3.33	668.40	668.60	672.87	673.00	679.00	679.00	UG 430 - MH 39B
2	1	11.000	0.00	5.99	0.00	0.00	4.83	0.0	8.9	7.0	33.66	61.00	10.72	24	7.27	668.60	669.40	674.45	674.69	679.00	679.30	MH 39B - MH 39C
3	2	110.000	0.37	5.99	0.74	0.27	4.83	5.0	8.7	7.0	33.99	60.02	10.91	24	6.00	669.40	676.00	674.96	677.91	679.30	681.70	MH 39C - CCB 40
4	3	53.000	0.28	5.62	0.84	0.24	4.56	5.0	8.6	7.1	32.22	49.12	10.45	24	4.72	676.00	678.50	677.91	680.39	681.70	684.00	CCB 40 - CCB 41
5	4	72.000	0.32	5.34	0.79	0.25	4.33	5.0	8.5	7.1	30.78	35.37	10.04	24	2.08	678.50	680.00	680.39	681.87	684.00	686.50	CCB 41 - CCB 42
6	5	72.000	0.27	5.02	0.81	0.22	4.07	5.0	8.4	7.2	29.19	40.84	9.59	24	2.78	680.00	682.00	681.87	683.85	686.50	689.00	CCB 42 - CCB 43
7	6	72.000	0.33	4.75	0.47	0.16	3.85	5.0	8.2	7.2	27.84	35.37	9.22	24	2.08	682.00	683.50	683.85	685.32	689.00	692.00	CCB 43 - CCB 44
8	7	95.000	0.08	4.42	0.90	0.07	3.70	5.0	8.1	7.3	27.01	35.55	9.01	24	2.11	683.50	685.50	685.32	687.31	692.00	697.70	CCB 44 - CCB 45
9	8	127.000	0.43	4.34	0.44	0.19	3.63	5.0	7.8	7.4	26.87	30.75	9.00	24	1.57	685.50	687.50	687.31	689.30	697.70	703.70	CCB 45 - CCB 28
10	9	26.000	0.07	3.91	0.90	0.06	3.44	5.0	7.8	7.4	25.55	33.98	8.62	24	1.92	687.50	688.00	689.30	689.77	703.70	701.40	CCB 28 - CCB 27
11	10	200.000	0.00	3.84	0.00	0.00	3.38	0.0	7.4	7.6	25.69	30.01	8.71	24	1.50	688.00	691.00	689.77	692.78	701.40	708.70	CCB 27 - MH 29
12	11	53.000	0.23	3.84	0.90	0.21	3.38	5.0	7.3	7.7	25.86	33.66	8.76	24	1.89	691.00	692.00	692.78	693.78	708.70	707.20	MH 29 - CCB 30
13	12	155.000	0.50	3.61	0.86	0.43	3.17	5.0	7.0	7.8	24.77	34.09	8.43	24	1.94	692.00	695.00	693.78	696.75	707.20	707.00	CCB 30 - CCB 31
14	13	41.000	0.26	3.11	0.90	0.23	2.74	5.0	6.9	7.9	21.54	38.27	7.55	24	2.44	695.00	696.00	696.75	697.66	707.00	706.90	CCB 31 - CCB 31
15	14	170.000	0.85	2.85	0.86	0.73	2.50	5.0	6.5	8.1	20.22	26.58	7.35	24	1.18	696.00	698.00	697.66	699.61	706.90	706.30	CCB 31A - CCB 3
16	15	197.000	0.85	2.00	0.90	0.77	1.77	5.0	5.9	8.4	14.90	21.38	5.94	24	0.76	698.00	699.50	699.61	700.89	706.30	706.30	CCB 32 - CCB 87
17	16	130.000	0.09	1.15	0.90	0.08	1.01	5.0	5.6	8.6	8.71	21.49	5.82	24	0.77	700.00	701.00	700.89	702.05	706.30	707.00	CCB 87 - CCB 86
18	17	54.000	0.52	1.06	0.90	0.47	0.93	5.0	5.4	8.7	8.10	12.95	5.97	18	1.30	701.00	701.70	702.05	702.80	707.00	707.00	CCB 86A - CCB 8
19	18	124.000	0.54	0.54	0.85	0.46	0.46	5.0	5.0	9.0	4.15	8.19	4.91	15	1.37	702.00	703.70	702.80	704.52	707.00	707.20	CCB 86 - CCB 85

Project File: System 430.stm | Number of lines: 19 | Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	33.63	668.40	672.87	2.00	3.14	10.71	1.78	674.65	2.211	6.000	668.60	673.00	2.00	3.14	10.70	1.78	674.78	2.210	2.211	0.133	0.81	1.44
2	24	33.66	668.60	674.45	2.00	3.14	10.72	1.79	676.23	2.216	11.000	669.40	674.69	2.00	3.14	10.71	1.78	676.48	2.215	2.215	0.244	0.15	0.27
3	24	33.99	669.40	674.96	2.00	3.09	10.82	1.82	676.78	1.925	110.000	676.00	677.91 j	1.91**	3.09	10.99	1.88	679.79	1.671	1.798	n/a	1.12	n/a
4	24	32.22	676.00	677.91	1.91	3.08	10.42	1.71	679.62	0.000	53.000	678.50	680.39 j	1.89**	3.08	10.48	1.71	682.10	0.000	0.000	n/a	0.50	0.85
5	24	30.78	678.50	680.39	1.89	3.06	10.01	1.57	681.97	0.000	72.000	680.00	681.87 j	1.87**	3.06	10.06	1.57	683.45	0.000	0.000	n/a	0.50	0.79
6	24	29.19	680.00	681.87	1.87	3.03	9.55	1.44	683.31	0.000	72.000	682.00	683.85 j	1.85**	3.03	9.62	1.44	685.29	0.000	0.000	n/a	0.50	0.72
7	24	27.84	682.00	683.85	1.85	3.01	9.18	1.33	685.18	0.000	72.000	683.50	685.32 j	1.82**	3.01	9.26	1.33	686.66	0.000	0.000	n/a	0.50	0.67
8	24	27.01	683.50	685.32	1.82	2.99	8.98	1.27	686.60	0.000	95.000	685.50	687.31 j	1.81**	2.99	9.04	1.27	688.58	0.000	0.000	n/a	0.50	n/a
9	24	26.87	685.50	687.31	1.81	2.98	9.00	1.26	688.57	0.000	127.000	687.50	689.30 j	1.80**	2.98	9.01	1.26	690.57	0.000	0.000	n/a	1.46	1.84
10	24	25.55	687.50	689.30	1.80	2.95	8.56	1.17	690.47	0.000	26.000	688.00	689.77 j	1.77**	2.95	8.67	1.17	690.94	0.000	0.000	n/a	1.50	n/a
11	24	25.69	688.00	689.77	1.77	2.95	8.72	1.18	690.95	0.000	200.000	691.00	692.78	1.78**	2.95	8.71	1.18	693.96	0.000	0.000	n/a	0.84	n/a
12	24	25.86	691.00	692.78	1.78	2.95	8.76	1.19	693.97	0.000	53.000	692.00	693.78	1.78**	2.96	8.75	1.19	694.97	0.000	0.000	n/a	1.26	1.50
13	24	24.77	692.00	693.78	1.78	2.92	8.38	1.12	694.90	0.000	155.000	695.00	696.75 j	1.75**	2.92	8.48	1.12	697.87	0.000	0.000	n/a	1.22	n/a
14	24	21.54	695.00	696.75	1.75	2.79	7.37	0.93	697.68	0.000	41.000	696.00	697.66 j	1.66**	2.79	7.73	0.93	698.59	0.000	0.000	n/a	1.21	1.12
15	24	20.22	696.00	697.66	1.66	2.71	7.26	0.86	698.52	0.000	170.000	698.00	699.61 j	1.61**	2.71	7.45	0.86	700.48	0.000	0.000	n/a	0.50	0.43
16	24	14.90	698.00	699.61	1.61	2.33	5.49	0.64	700.25	0.000	197.000	699.50	700.89 j	1.39**	2.33	6.39	0.64	701.53	0.000	0.000	n/a	0.50	n/a
17	24	8.71	700.00	700.89	0.89	1.35	6.45	0.42	701.31	0.000	130.000	701.00	702.05	1.05**	1.67	5.20	0.42	702.47	0.000	0.000	n/a	0.98	n/a
18	18	8.10	701.00	702.05	1.05	1.32	6.12	0.53	702.58	0.000	54.000	701.70	702.80	1.10**	1.39	5.83	0.53	703.33	0.000	0.000	n/a	0.95	0.50
19	15	4.15	702.00	702.80	0.80	0.83	4.99	0.36	703.17	0.000	124.000	703.70	704.52	0.82**	0.86	4.84	0.36	704.89	0.000	0.000	n/a	1.00	0.36

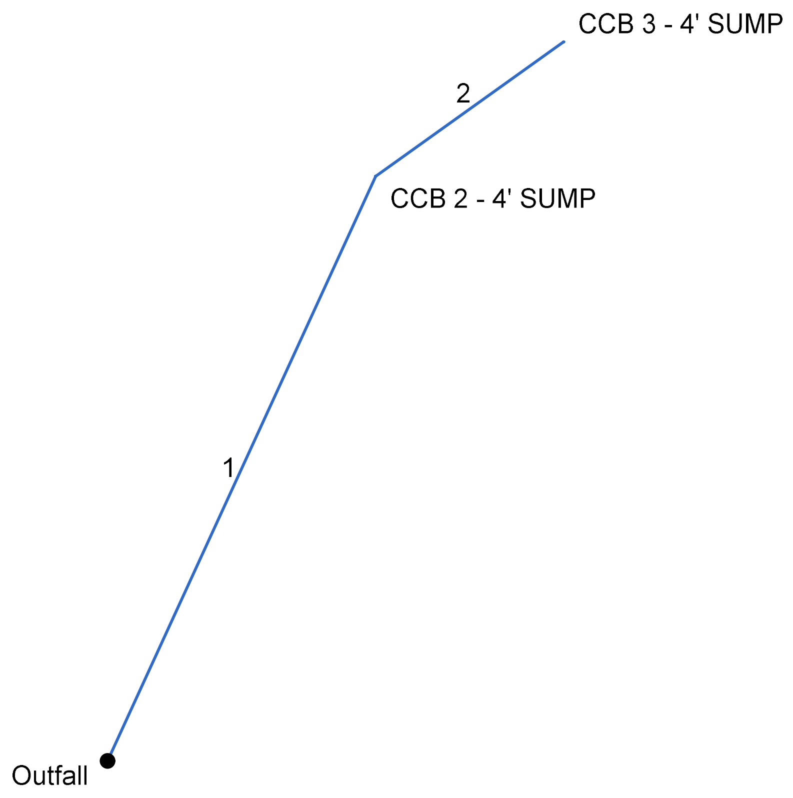
Project File: System 430.stm

Number of lines: 19

Run Date: 8/28/2023

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 500.stm	Number of lines: 2	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	81.000	-65.492	Comb	3.04	0.07	0.62	5.0	631.10	0.74	631.70	15	Cir	0.013	0.83	634.40	FES 1-CCB 2
2	1	29.000	29.774	Comb	0.71	0.20	0.37	5.0	631.70	1.03	632.00	12	Cir	0.013	1.00	634.40	CCB 2-CCB 3

Project File: System 500.stm	Number of lines: 2	Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	81.000	0.07	0.27	0.62	0.04	0.12	5.0	5.3	8.8	4.79	5.56	5.10	15	0.74	631.10	631.70	631.99	632.60	631.10	634.40	FES 1-CCB 2
2	1	29.000	0.20	0.20	0.37	0.07	0.07	5.0	5.0	9.0	1.38	3.62	1.76	12	1.03	631.70	632.00	632.93	632.97	634.40	634.40	CCB 2-CCB 3

Project File: System 500.stm

Number of lines: 2

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	15	4.79	631.10	631.99	0.89	0.93	5.12	0.41	632.40	0.751	81.000	631.70	632.60	0.90	0.94	5.08	0.40	633.00	0.734	0.742	0.601	0.83	0.33
2	12	1.38	631.70	632.93	1.00	0.79	1.76	0.05	632.98	0.150	29.000	632.00	632.97	0.97	0.78	1.77	0.05	633.02	0.132	0.141	0.041	1.00	0.05

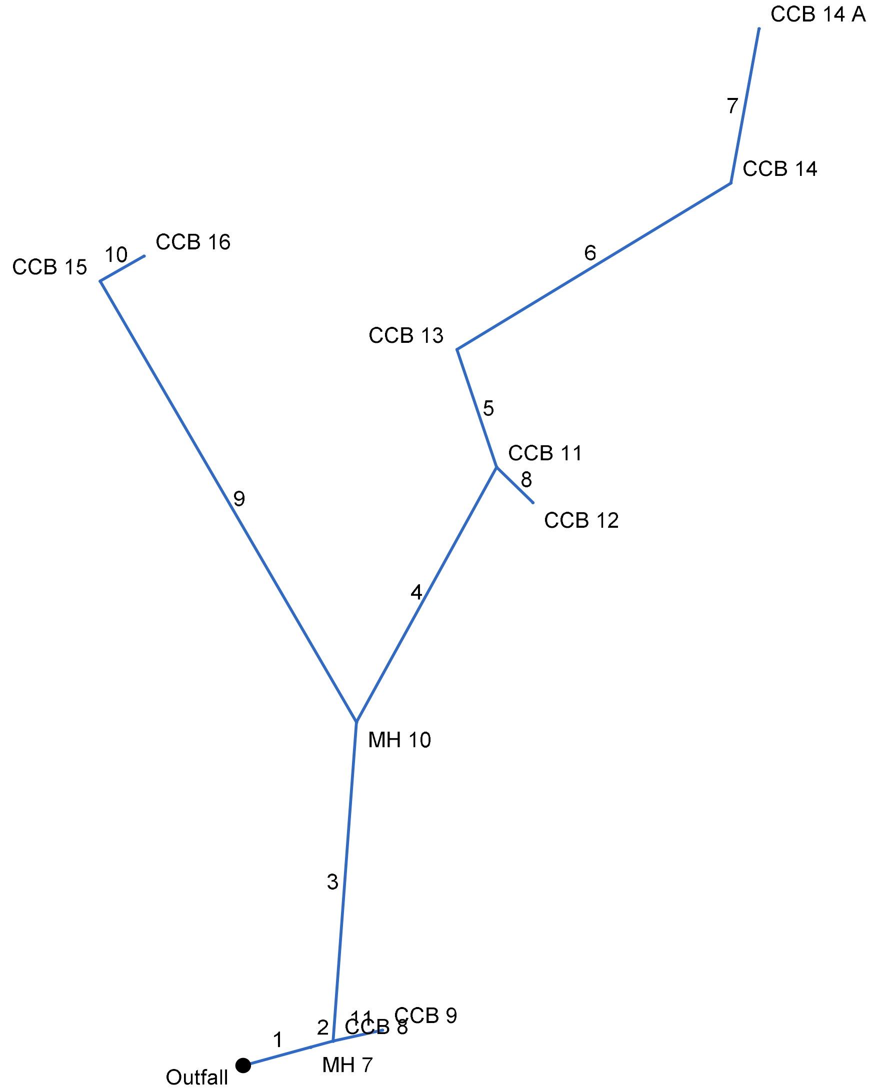
Project File: System 500.stm

Number of lines: 2

Run Date: 8/28/2023

; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 510.stm

Number of lines: 11

Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	36.000	-15.246	MH	0.00	0.00	0.00	0.0	633.00	3.33	634.20	18	Cir	0.012	0.15	644.00	FES 6-MH 7
2	1	12.000	0.114	Comb	0.00	0.88	0.49	5.0	634.20	2.50	634.50	18	Cir	0.012	1.43	640.00	MH 7-CCB 8
3	2	165.000	-70.679	MH	0.00	0.00	0.00	0.0	636.40	7.58	648.90	15	Cir	0.012	0.62	653.00	CCB 8-MH 10
4	3	150.000	24.502	Comb	0.00	0.48	0.52	5.0	649.20	7.53	660.50	12	Cir	0.012	1.50	664.40	MH 10-CCB 11
5	4	64.000	-47.262	Comb	0.00	0.52	0.85	5.0	660.50	8.59	666.00	12	Cir	0.012	1.47	673.60	CCB 11-CCB 13
6	5	165.000	77.185	Comb	0.00	0.40	0.85	5.0	666.00	2.42	670.00	12	Cir	0.012	1.18	673.50	CCB 13-CCB 14
7	6	81.000	-48.320	Comb	0.00	0.10	0.84	5.0	670.00	4.32	673.50	12	Cir	0.012	1.00	676.70	CCB 14-CCB 14A
8	4	26.000	105.799	Comb	0.00	0.18	0.77	5.0	660.50	2.69	661.20	12	Cir	0.012	1.00	664.40	CCB 11-CCB 12
9	3	263.000	-34.284	Comb	0.00	0.23	0.63	5.0	649.20	4.30	660.50	12	Cir	0.012	1.50	664.00	MH 10-CCB 15
10	9	26.000	90.189	Comb	0.00	0.38	0.54	5.0	660.50	1.15	660.80	12	Cir	0.012	1.00	664.00	CCB 15-CCB 16
11	2	26.000	2.370	Comb	0.00	0.33	0.49	5.0	636.40	1.54	636.80	12	Cir	0.012	1.00	640.00	CCB 8-CCB 9

Project File: System 510.stm

Number of lines: 11

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	36.000	0.00	3.50	0.00	0.00	2.20	0.0	6.8	7.9	17.38	20.77	9.83	18	3.33	633.00	634.20	635.77	636.61	634.63	644.00	FES 6-MH 7
2	1	12.000	0.88	3.50	0.49	0.43	2.20	5.0	6.8	7.9	17.40	17.99	9.85	18	2.50	634.20	634.50	636.84	637.12	644.00	640.00	MH 7-CCB 8
3	2	165.000	0.00	2.29	0.00	0.00	1.60	0.0	6.5	8.1	12.93	19.25	10.57	15	7.58	636.40	648.90	639.27	650.12	640.00	653.00	CCB 8-MH 10
4	3	150.000	0.48	1.68	0.52	0.25	1.25	5.0	6.3	8.2	10.25	10.59	13.28	12	7.53	649.20	660.50	650.12	661.49	653.00	664.40	MH 10-CCB 11
5	4	64.000	0.52	1.02	0.85	0.44	0.87	5.0	6.2	8.2	7.13	11.31	9.11	12	8.59	660.50	666.00	661.49	666.98	664.40	673.60	CCB 11-CCB 13
6	5	165.000	0.40	0.50	0.85	0.34	0.42	5.0	5.7	8.6	3.64	6.01	4.99	12	2.42	666.00	670.00	666.98	670.81	673.60	673.50	CCB 13-CCB 14
7	6	81.000	0.10	0.10	0.84	0.08	0.08	5.0	5.0	9.0	0.76	8.02	2.03	12	4.32	670.00	673.50	670.81	673.86	673.50	676.70	CCB 14-CCB 14A
8	4	26.000	0.18	0.18	0.77	0.14	0.14	5.0	5.0	9.0	1.25	6.33	2.52	12	2.69	660.50	661.20	661.49	661.67	664.40	664.40	CCB 11-CCB 12
9	3	263.000	0.23	0.61	0.63	0.14	0.35	5.0	5.1	8.9	3.13	8.00	4.52	12	4.30	649.20	660.50	650.12	661.26	653.00	664.00	MH 10-CCB 15
10	9	26.000	0.38	0.38	0.54	0.21	0.21	5.0	5.0	9.0	1.86	4.14	3.42	12	1.15	660.50	660.80	661.26	661.38	664.00	664.00	CCB 15-CCB 16
11	2	26.000	0.33	0.33	0.49	0.16	0.16	5.0	5.0	9.0	1.46	4.79	1.86	12	1.54	636.40	636.80	639.27	639.31	640.00	640.00	CCB 8-CCB 9

Project File: System 510.stm

Number of lines: 11

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

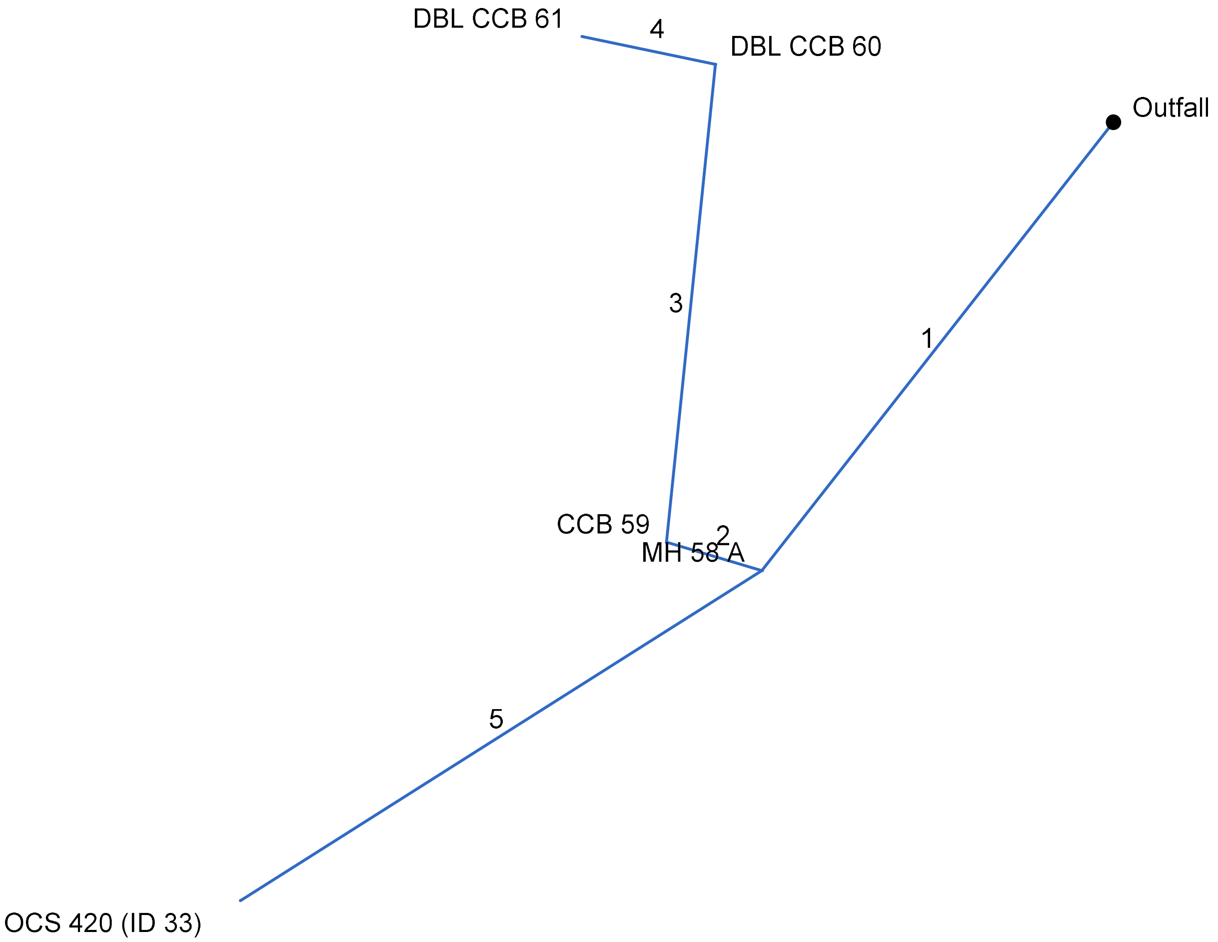
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	17.38	633.00	635.77	1.50	1.77	9.83	1.50	637.27	2.334	36.000	634.20	636.61	1.50	1.77	9.83	1.50	638.11	2.333	2.333	0.840	0.15	0.23
2	18	17.40	634.20	636.84	1.50	1.77	9.85	1.51	638.34	2.340	12.000	634.50	637.12	1.50	1.77	9.85	1.51	638.62	2.339	2.340	0.281	1.43	2.16
3	15	12.93	636.40	639.27	1.25	1.22	10.54	1.73	641.00	3.420	165.000	648.90	650.12 j	1.22**	1.22	10.59	1.74	651.87	3.060	3.240	n/a	0.62	n/a
4	12	10.25	649.20	650.12	0.92	0.76	13.51	2.65	652.77	0.000	150.000	660.50	661.49	0.99**	0.78	13.05	2.65	664.14	0.000	0.000	n/a	1.50	3.97
5	12	7.13	660.50	661.49	0.99	0.78	9.09	1.30	662.79	0.000	64.000	666.00	666.98 j	0.98**	0.78	9.14	1.30	668.27	0.000	0.000	n/a	1.47	1.91
6	12	3.64	666.00	666.98	0.98	0.68	4.66	0.44	667.42	0.000	165.000	670.00	670.81 j	0.81**	0.68	5.32	0.44	671.25	0.000	0.000	n/a	1.18	n/a
7	12	0.76	670.00	670.81	0.81	0.26	1.11	0.13	670.95	0.000	81.000	673.50	673.86 j	0.36**	0.26	2.94	0.13	674.00	0.000	0.000	n/a	1.00	n/a
8	12	1.25	660.50	661.49	0.99	0.36	1.60	0.18	661.68	0.000	26.000	661.20	661.67 j	0.47**	0.36	3.43	0.18	661.86	0.000	0.000	n/a	1.00	0.18
9	12	3.13	649.20	650.12	0.92	0.64	4.13	0.37	650.50	0.000	263.000	660.50	661.26 j	0.76**	0.64	4.91	0.37	661.63	0.000	0.000	n/a	1.50	n/a
10	12	1.86	660.50	661.26	0.76	0.47	2.91	0.24	661.50	0.000	26.000	660.80	661.38 j	0.58**	0.47	3.93	0.24	661.62	0.000	0.000	n/a	1.00	0.24
11	12	1.46	636.40	639.27	1.00	0.79	1.86	0.05	639.33	0.144	26.000	636.80	639.31	1.00	0.79	1.86	0.05	639.36	0.144	0.144	0.037	1.00	0.05

Project File: System 510.stm	Number of lines: 11	Run Date: 8/28/2023

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 400 - Outlet 420 - 25YR.stm	Number of lines: 5	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	109.000	128.065	MH	0.00	0.00	0.00	0.0	648.50	5.96	655.00	18	Cir	0.013	0.94	663.80	*FES 58-MH58 A
2	1	19.000	68.550	Comb	0.00	0.15	0.82	5.0	659.50	5.26	660.50	15	Cir	0.013	1.48	668.70	MH 58A-CCB 59
3	2	92.000	79.212	Comb	0.00	0.19	0.70	5.0	660.50	2.17	662.50	15	Cir	0.013	1.49	667.40	CCB 59-DBL CCB 60
4	3	26.000	-84.046	Comb	0.00	1.28	0.48	5.0	662.80	4.23	663.90	12	Cir	0.013	1.00	667.40	DBL CCB 60-DBL CCB
5	1	118.000	19.535	None	10.66	0.00	0.00	0.0	655.00	5.93	662.00	15	Cir	0.013	1.00	672.50	*MH 58A-OCS 420

Project File: System 400 - Outlet 420 - 25YR.stm

Number of lines: 5

Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	109.000	0.00	1.62	0.00	0.00	0.87	0.0	5.3	8.8	18.32	25.64	10.41	18	5.96	648.50	655.00	650.25	656.45	650.13	663.80	*FES 58-MH58 A
2	1	19.000	0.15	1.62	0.82	0.12	0.87	5.0	5.3	8.8	7.68	14.81	9.45	15	5.26	659.50	660.50	660.14	661.60	663.80	668.70	MH 58A-CCB 59
3	2	92.000	0.19	1.47	0.70	0.13	0.75	5.0	5.1	9.0	6.73	9.52	6.02	15	2.17	660.50	662.50	661.60	663.54	668.70	667.40	CCB 59-DBL CCB
4	3	26.000	1.28	1.28	0.48	0.61	0.61	5.0	5.0	9.0	5.55	7.33	8.07	12	4.23	662.80	663.90	663.54	664.84	667.40	667.40	DBL CCB 60-DBL
5	1	118.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	10.66	15.73	8.75	15	5.93	655.00	662.00	656.45	663.20	663.80	672.50	*MH 58A-OCS 42

Project File: System 400 - Outlet 420 - 25YR.stm

Number of lines: 5

Run Date: 8/28/2023

NOTES:Intensity = 43.09 / (Inlet time + 3.80) ^ 0.72; Return period =Yrs. 25 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	18.32	648.50	650.25	1.50	1.75	10.37	1.67	651.92	3.044	109.000	655.00	656.45 j	1.45**	1.75	10.46	1.70	658.15	2.676	2.860	n/a	0.94	1.60
2	15	7.68	659.50	660.14	0.64*	0.63	12.17	0.70	660.84	0.000	19.000	660.50	661.60	1.10**	1.14	6.72	0.70	662.30	0.000	0.000	n/a	1.48	n/a
3	15	6.73	660.50	661.60	1.10	1.09	5.89	0.59	662.19	0.000	92.000	662.50	663.54 j	1.04**	1.09	6.16	0.59	664.13	0.000	0.000	n/a	1.49	0.88
4	12	5.55	662.80	663.54	0.74	0.62	8.89	0.82	664.36	0.000	26.000	663.90	664.84	0.94**	0.77	7.25	0.82	665.66	0.000	0.000	n/a	1.00	n/a
5	15	10.66	655.00	656.45	1.25	1.21	8.69	1.17	657.63	2.726	118.000	662.00	663.20 j	1.20**	1.21	8.81	1.21	664.41	2.370	2.548	n/a	1.00	n/a

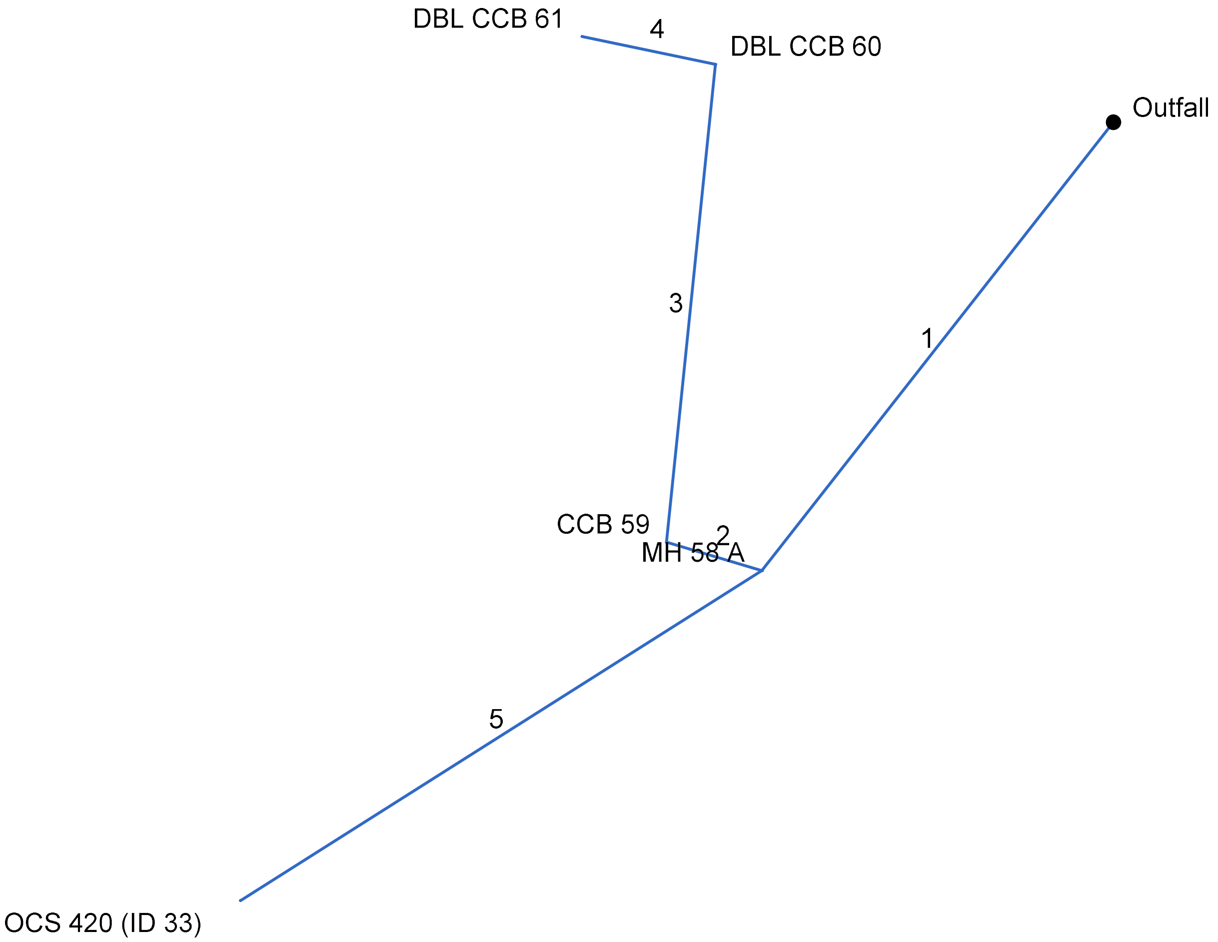
Project File: System 400 - Outlet 420 - 25YR.stm

Number of lines: 5

Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: System 400 - Outlet 420 - 100YR.stm	Number of lines: 5	Date: 8/28/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	109.000	128.065	MH	0.00	0.00	0.00	0.0	648.50	5.96	655.00	18	Cir	0.013	0.94	663.80	*FES 58-MH58 A
2	1	19.000	68.550	Comb	0.00	0.15	0.82	5.0	659.50	5.26	660.50	15	Cir	0.013	1.48	668.70	MH 58A-CCB 59
3	2	92.000	79.212	Comb	0.00	0.19	0.70	5.0	660.50	2.17	662.50	15	Cir	0.013	1.49	667.40	CCB 59-DBL CCB 60
4	3	26.000	-84.046	Comb	0.00	1.28	0.48	5.0	662.80	4.23	663.90	12	Cir	0.013	1.00	667.40	DBL CCB 60-DBL CCB
5	1	118.000	19.535	None	15.62	0.00	0.00	0.0	655.00	5.93	662.00	15	Cir	0.013	1.00	672.50	*MH 58A-OCS 420

Project File: System 400 - Outlet 420 - 100YR.stm	Number of lines: 5	Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	109.000	0.00	1.62	0.00	0.00	0.87	0.0	5.3	11.1	25.29	25.64	14.32	18	5.96	648.50	655.00	650.27	656.50	650.13	663.80	*FES 58-MH58 A
2	1	19.000	0.15	1.62	0.82	0.12	0.87	5.0	5.3	11.1	9.70	14.81	10.48	15	5.26	659.50	660.50	660.24	661.68	663.80	668.70	MH 58A-CCB 59
3	2	92.000	0.19	1.47	0.70	0.13	0.75	5.0	5.0	11.3	8.47	9.52	7.15	15	2.17	660.50	662.50	661.68	663.64	668.70	667.40	CCB 59-DBL CCB
4	3	26.000	1.28	1.28	0.48	0.61	0.61	5.0	5.0	11.4	6.99	7.33	9.47	12	4.23	662.80	663.90	663.64	664.87	667.40	667.40	DBL CCB 60-DBL
5	1	118.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	15.62	15.73	12.73	15	5.93	655.00	662.00	659.49	666.40	663.80	672.50	*MH 58A-OCS 42

Project File: System 400 - Outlet 420 - 100YR.stm

Number of lines: 5

Run Date: 8/28/2023

NOTES:Intensity = 53.44 / (Inlet time + 3.70) ^ 0.72; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	25.29	648.50	650.27	1.50	1.77	14.32	3.19	653.46	5.804	109.000	655.00	656.50	1.50	1.77	14.31	3.19	659.68	5.618	5.711	6.225	0.94	2.99
2	15	9.70	659.50	660.24	0.74*	0.75	12.87	1.02	661.26	0.000	19.000	660.50	661.68	1.18**	1.20	8.10	1.02	662.70	0.000	0.000	n/a	1.48	1.51
3	15	8.47	660.50	661.68	1.18	1.17	7.07	0.81	662.49	0.000	92.000	662.50	663.64 j	1.14**	1.17	7.24	0.81	664.45	0.000	0.000	n/a	1.49	1.21
4	12	6.99	662.80	663.64	0.84	0.70	9.98	1.25	664.88	0.000	26.000	663.90	664.87	0.97**	0.78	8.96	1.25	666.12	0.000	0.000	n/a	1.00	n/a
5	15	15.62	655.00	659.49	1.25	1.23	12.73	2.52	662.01	5.854	118.000	662.00	666.40	1.25	1.23	12.73	2.52	668.92	5.851	5.853	6.906	1.00	2.52

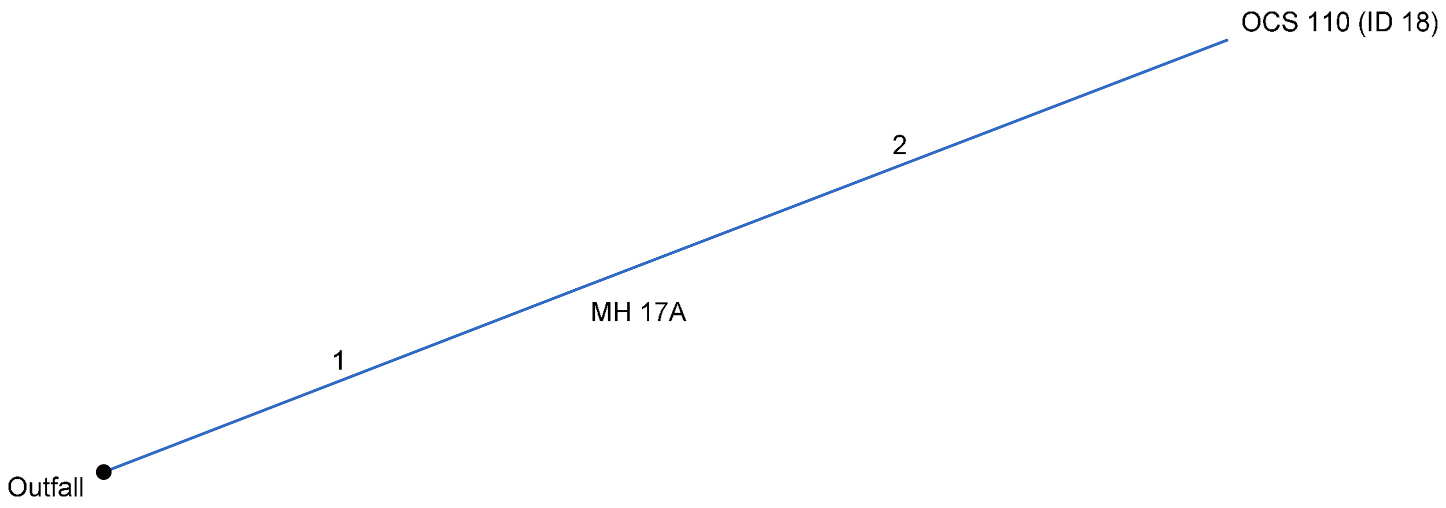
Project File: System 400 - Outlet 420 - 100YR.stm

Number of lines: 5

Run Date: 8/28/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Outlet 110.stm	Number of lines: 2	Date: 3/15/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	82.000	-21.169	MH	0.00	0.00	0.00	0.0	639.00	7.32	645.00	15	Cir	0.013	0.15	656.00	FES 17-MH 17A
2	1	113.000	0.189	None	2.61	0.00	0.00	0.0	651.50	7.52	660.00	15	Cir	0.013	1.00	667.17	MH 17A-OCS 110

Project File: Outlet 110.stm

Number of lines: 2

Date: 3/15/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	82.000	0.00	0.00	0.00	0.00	0.00	0.0	0.3	0.0	2.61	17.47	3.10	15	7.32	639.00	645.00	640.25	645.65	641.50	656.00	FES 17-MH 17A
2	1	113.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.61	17.71	7.20	15	7.52	651.50	660.00	651.82	660.65	656.00	667.17	MH 17A-OCS 110

Project File: Outlet 110.stm

Number of lines: 2

Run Date: 3/15/2023

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	15	2.61	639.00	640.25	1.25	0.64	2.13	0.07	640.32	0.163	82.000	645.00	645.65 j	0.65**	0.64	4.07	0.26	645.90	0.582	0.373	n/a	0.15	n/a
2	15	2.61	651.50	651.82	0.32*	0.25	10.32	0.26	652.08	0.000	113.000	660.00	660.65	0.65**	0.64	4.07	0.26	660.90	0.000	0.000	n/a	1.00	n/a

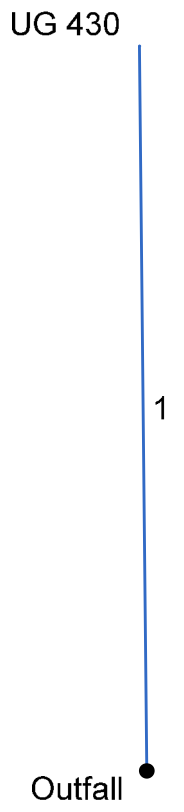
Project File: Outlet 110.stm

Number of lines: 2

Run Date: 3/15/2023

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: New.stm	Number of lines: 1	Date: 3/15/2023

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	56.000	-90.532	None	10.63	0.00	0.00	0.0	666.00	4.29	668.40	24	Cir	0.013	1.00	679.00	FES 39A - UG 430

Project File: New.stm

Number of lines: 1

Date: 3/15/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	56.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	10.63	46.82	3.38	24	4.29	666.00	668.40	672.70	672.82	668.00	679.00	FES 39A - UG 43

Project File: New.stm

Number of lines: 1

Run Date: 3/15/2023

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

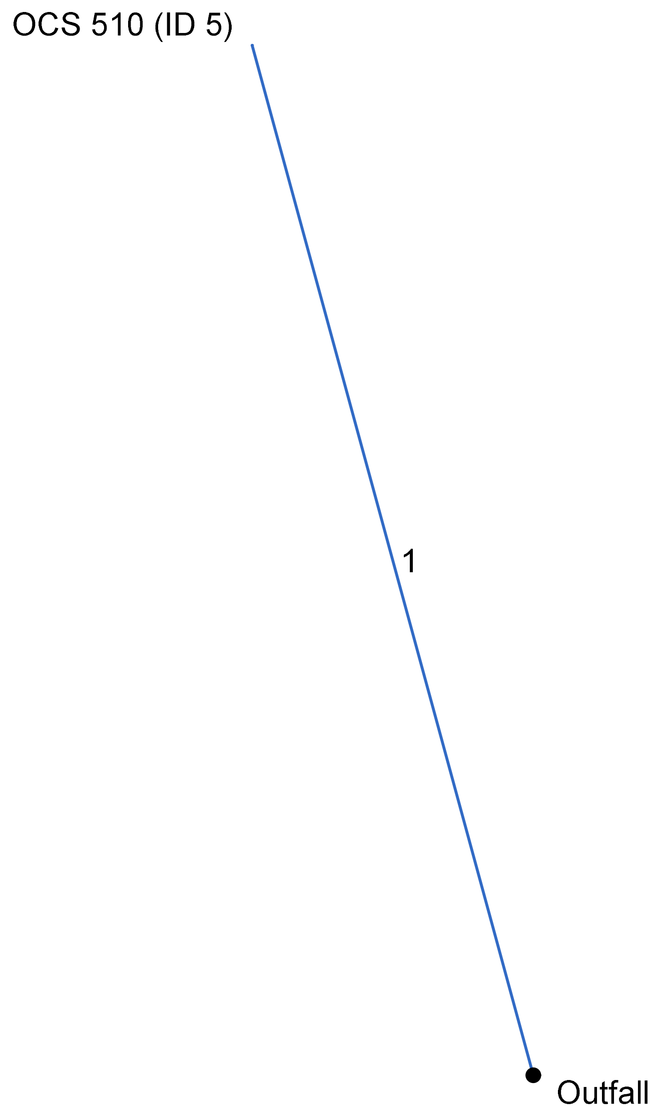
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	10.63	666.00	672.70	2.00	3.14	3.38	0.18	672.88	0.221	56.000	668.40	672.82	2.00	3.14	3.38	0.18	673.00	0.221	0.221	0.124	1.00	0.18

Project File: New.stm	Number of lines: 1	Run Date: 3/15/2023

; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Outlet 510.stm	Number of lines: 1	Date: 8/28/2023

Storm Sewers v2023.00

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	64.000	-105.074	None	11.40	0.00	0.00	0.0	630.80	1.09	631.50	18	Cir	0.013	1.00	636.00	FES 4-OCS 510

Project File: Outlet 510.stm	Number of lines: 1	Date: 8/28/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	64.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	11.40	11.42	6.45	18	1.09	630.80	631.50	632.50	633.20	-3.68	636.00	FES 4-OCS 510

Project File: Outlet 510.stm

Number of lines: 1

Run Date: 8/28/2023

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	18	11.40	630.80	632.50	1.50	1.77	6.45	0.65	633.15	1.090	64.000	631.50	633.20	1.50	1.77	6.45	0.65	633.84	1.090	1.090	0.698	1.00	0.65

Project File: Outlet 510.stm

Number of lines: 1

Run Date: 8/28/2023

; c = cir e = ellip b = box

Outlet Protection Calculations

Project:	Southford Park	By:	MCB	Date:	8/29/2023
Location:	Middlebury, CT	Checked:		Date:	
Outlet I.D.	**FES 1**				

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:

FES 1

Design Criteria (25-yr Storm Event):

Q (cfs) = 4.79		R_p (ft)=	1.25
D (in) =	15	S_p (ft) =	1.25
V (fps) = 5.1		Tw (ft)=	1.25

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.060	Modified	5 inches

Preformed Scour Hole Dimensions:

$F = 0.5(R_p)$	=	0.625 ft
$C = 3.0(S_p)+6.0(F)$	=	8ft
$B = 2.0(S_p)+6.0(F)$	=	6ft
d (Depth of Stone)	=	12 inches

Outlet Protection Calculations

Project: Southford Park By: MCB Date: 8/29/2023
Location: Middlebury, CT Checked: Date:
Outlet I.D. **FES 6**

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:
FES 6

Design Criteria (25-yr Storm Event):

Q (cfs) =	17.38	R_p (ft)=	1.5
D (in) =	18	S_p (ft) =	1.5
V (fps) =	9.83	Tw (ft)=	3.27

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.100	Modified	5 inches

Preformed Scour Hole Dimensions:

$F = 0.5(R_p)$ = 0.75 ft
$C = 3.0(S_p)+6.0(F)$ = 9ft
$B = 2.0(S_p)+6.0(F)$ = 8ft
d (Depth of Stone) = 12 inches

Outlet Protection Calculations

Project:	Southford Park	By:	MCB	Date:	8/29/2023
Location:	Middlebury, CT	Checked:		Date:	
Outlet I.D.	**FES 34**				

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:

FES 34

Design Criteria (25-yr Storm Event):

Q (cfs) =	27.41	R_p (ft)=	2.5
D (in) =	30	S_p (ft) =	2.5
V (fps) =	5.58	Tw (ft)=	6.8

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.045	Modified	5 inches

Preformed Scour Hole Dimensions:

F = 0.5(R_p) = 1.25 ft
C = 3.0(S_p)+6.0(F) = 15ft
B = 2.0(S_p)+6.0(F) = 13ft
d (Depth of Stone) = 12 inches

Outlet Protection Calculations

Project: Southford Park By: MCB Date: 08/29/23
Location: Middlebury, CT Checked: Date:
Outlet I.D. **FES 36**

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:
FES 36

Design Criteria (25-yr Storm Event):
Q (cfs) = 11.42 R_p (ft)= 1.5
D (in) = 18 S_p (ft) = 1.5
V (fps) = 6.46 Tw (ft)= 3.8

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11-13.1** use Type 'B' ---> TW≥ 0.5 Rp

Rip Rap Stone Size:

Velocity	Rip Rap Specification	D_{50} Stone Size
0-8 fps	Modified	5 inches

Preformed Scour Hole Dimensions:
F(ft)=0.5(R_p) = n/a
C(ft)=3.0(S_p)+6.0(F) = n/a
B(ft)=2.0(S_p)+6.0(F) = n/a

Rip Rap Splash Pad Dimensions:
L_a = 19 ft
W1 = 3.0(S_p) min. = 5 ft
W2 = 3.0(Sp)+0.4(La) min. = 12 ft
d (Depth of Stone) = 12 inches

Outlet Protection Calculations

Project: Southford Park By: MCB Date: 03/15/23
Location: Middlebury, CT Checked: Date:
Outlet I.D. **FES 39A**

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:
FES 39A

Design Criteria (100-yr Storm Event):

Q (cfs) =	10.63	R_p (ft)=	2
D (in) =	24	S_p (ft) =	2
V (fps) =	3.38	Tw (ft)=	6.7

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11-13.1** use Type 'B' ---> TW≥ 0.5 Rp

Rip Rap Stone Size:

Velocity	Rip Rap Specification	D_{50} Stone Size
0-8 fps	Modified	5 inches

Preformed Scour Hole Dimensions:
$F(ft)=0.5(R_p)$ = n/a
$C(ft)=3.0(S_p)+6.0(F)$ = n/a
$B(ft)=2.0(S_p)+6.0(F)$ = n/a

Rip Rap Splash Pad Dimensions:

L_a	=	16	ft
W1 = 3.0(S_p) min.	=	6	ft
W2 = 3.0(Sp)+0.4(La) min.	=	12	ft
d (Depth of Stone)	=	12	inches

Outlet Protection Calculations

Project:	Southford Park	By:	MCB	Date:	03/15/23
Location:	Middlebury, CT	Checked:		Date:	
Outlet I.D.	**FES 46**				

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:

FES 46

Design Criteria (25-yr Storm Event):

Q (cfs) =	23.12	R_p (ft)=	3
D (in) =	36	S_p (ft) =	3
V (fps) =	3.27	Tw (ft)=	8.3

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11-13.1** use Type 'B' ---> TW≥ 0.5 Rp

Rip Rap Stone Size:

Velocity	Rip Rap Specification	D_{50} Stone Size
0-8 fps	Modified	5 inches

Preformed Scour Hole Dimensions:

F(ft)=0.5(R_p)	=	n/a
C(ft)=3.0(S_p)+6.0(F)	=	n/a
B(ft)=2.0(S_p)+6.0(F)	=	n/a

Rip Rap Splash Pad Dimensions:

L_a	=	21	ft
W1 = 3.0(S_p) min.	=	9	ft
W2 = 3.0(Sp)+0.4(La) min.	=	17	ft
d (Depth of Stone)	=	12	inches

Outlet Protection Calculations

Project: Southford Park
Location: Middlebury, CT
Outlet I.D. **FES 58**

By: MCB
Checked:

Date: 8/29/2023
Date:

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:

FES 58

Design Criteria (100-yr Storm Event):

Q (cfs) =	25.29	R_p (ft)=	1.5
D (in) =	18	S_p (ft) =	1.5
V (fps) =	14.32	Tw (ft)=	1.5

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.358	Modified	5 inches

Preformed Scour Hole Dimensions:

$F = 0.5(R_p)$	=	0.75 ft
$C = 3.0(S_p)+6.0(F)$	=	9ft
$B = 2.0(S_p)+6.0(F)$	=	8ft
d (Depth of Stone)	=	12 inches

Outlet Protection Calculations

Project: Southford Park By: MCB Date: 3/15/2023
Location: Middlebury, CT Checked: Date:
Outlet I.D. **FES 70**

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:
FES 70

Design Criteria (25-yr Storm Event):

Q (cfs) =	72.49	R_p (ft)=	3
D (in) =	36	S_p (ft) =	3
V (fps) =	10.26	Tw (ft)=	4.71

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.184	Modified	5 inches

Preformed Scour Hole Dimensions:

F = 0.5(R_p) = 1.5 ft
C = 3.0(S_p)+6.0(F) = 18ft
B = 2.0(S_p)+6.0(F) = 15ft
d (Depth of Stone) = 12 inches

Outlet Protection Calculations

Project:	Southford Park	By:	MCB	Date:	8/29/2023
Location:	Middlebury, CT	Checked:		Date:	
Outlet I.D.	**FES 97**				

*Based on Connecticut DOT Drainage Manual, Section 11.13

Description:

FES 97

Design Criteria (25-yr Storm Event):

Q (cfs) = 6.27		R_p (ft)=	1.5
D (in) =	18	S_p (ft) =	1.5
V (fps) = 3.55		Tw (ft)=	5.4

Q= Flow rate at discharge point in cubic feet per second (cfs)
D= Outlet pipe diameter (in)
V= Flow velocity at discharge point (ft/s)
R_p= Maximum inside pipe rise (ft)
S_p= inside diametere for circular sections of maximum inside pipe span for non-circular sections (ft)
T_w= Tailwater depth (ft)

Based on **Table 11.13.1,** A *Preformed Scour Hole* is used *One Half Pipe Rise Depression (Type I)*

Rip Rap Stone Size:

D_{50} Computed (ft)	Rip Rap Specification	D_{50} Stone Size Required
0.016	Modified	5 inches

Preformed Scour Hole Dimensions:

F = 0.5(R_p) = 0.75 ft
C = 3.0(S_p)+6.0(F) = 9ft
B = 2.0(S_p)+6.0(F) = 8ft
d (Depth of Stone) = 12 inches

Level Spreader Design

Level Spreader 100 - Vegetated Level Spreader

Broad Crest Elevation (ft)	704.00	
Length (ft)	**75**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	5.71	(Veg. Lvl. Spreader)

Elevation (Feet)	Weir Discharge (cfs)	Area (sf)	Velocity (fps)
704.00	0.00	0.00	0.00
704.05	2.68	3.75	0.72
704.08	5.71	6.20	0.92
704.10	7.59	7.50	1.01
704.15	13.94	11.25	1.24
704.20	21.47	15.00	1.43
704.25	30.00	18.75	1.60
704.30	39.44	22.50	1.75
704.35	49.70	26.25	1.89
704.40	60.72	30.00	2.02
704.45	72.45	33.75	2.15
704.50	84.85	37.50	2.26

Q=CiA
Q=(0.3*11.4 in/hr * 1.66 acres)
Q=5.71 cfs

Level Spreader Design

Level Spreader 110

Broad Crest Elevation (ft)	660.00	
Length (ft)	**70**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	36.30	(DET 110 Discharge)

Elevation (Feet)	Weir Discharge (cfs)	Area (sf)	Velocity (fps)
660.00	0.00	0.00	0.00
660.05	2.50	3.50	0.72
660.10	7.08	7.00	1.01
660.15	13.01	10.50	1.24
660.20	20.04	14.00	1.43
660.25	28.00	17.50	1.60
660.297	36.30	20.81	1.74
660.30	36.81	21.00	1.75
660.35	46.38	24.50	1.89
660.40	56.67	28.00	2.02
660.45	67.62	31.50	2.15
660.50	79.20	35.00	2.26

Level Spreader Design

Level Spreader 320

Broad Crest Elevation (ft)	664.00	
Length (ft)	**60**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	30.36	(DET 320 Discharge)

Elevation (Feet)	Weir Discharge (cfs)	Area (sf)	Velocity (fps)
664.00	0.00	0.00	0.00
664.05	2.15	3.00	0.72
664.10	6.07	6.00	1.01
664.15	11.15	9.00	1.24
664.20	17.17	12.00	1.43
664.25	24.00	15.00	1.60
664.29	30.36	17.54	1.73
664.30	31.55	18.00	1.75
664.35	39.76	21.00	1.89
664.40	48.57	24.00	2.02
664.45	57.96	27.00	2.15
664.50	67.88	30.00	2.26

Level Spreader Design

Level Spreader 510

Broad Crest Elevation (ft)	632.00	
Length (ft)	**36**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	11.40	(DET 510 Discharge)

Elevation (Feet)	Weir Discharge (cfs)	Area (sf)	Velocity (fps)
632.00	0.00	0.00	0.00
632.05	1.29	1.80	0.72
632.10	3.64	3.60	1.01
632.15	6.69	5.40	1.24
632.20	10.30	7.20	1.43
632.21	11.40	7.70	1.48
632.25	14.40	9.00	1.60
632.30	18.93	10.80	1.75
632.35	23.85	12.60	1.89
632.40	29.14	14.40	2.02
632.45	34.78	16.20	2.15
632.50	40.73	18.00	2.26

Level Spreader Design

Level Spreader 500 - Vegetated Level Spreader

Broad Crest Elevation (ft)	630.00	
Length (ft)	**15**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	5.05	(Veg. Lvl. Spreader)

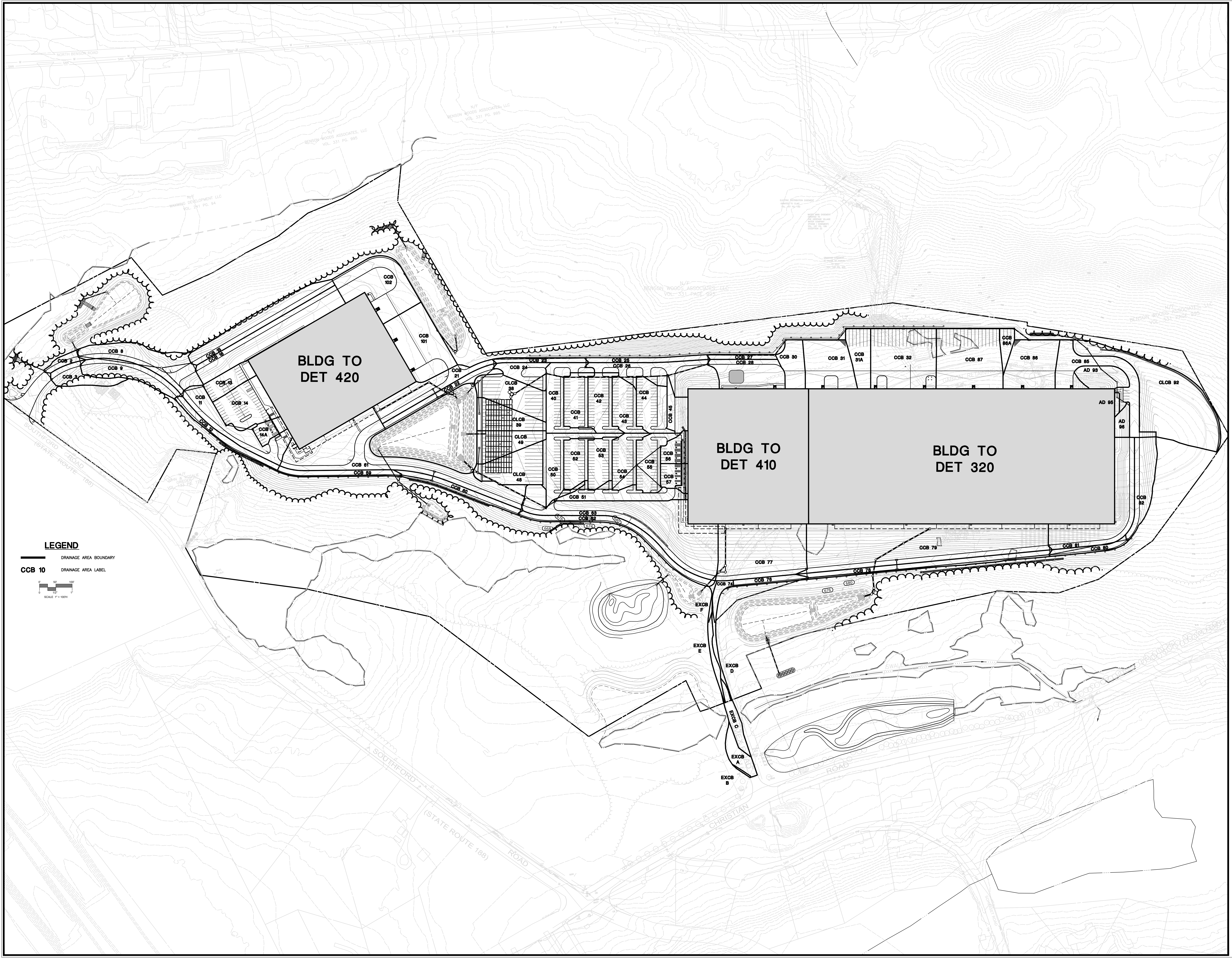
Elevation (Feet)	**Weir Discharge (cfs)**	**Area (sf)**	**Velocity (fps)**
630.00	0.00	0.00	0.00
630.05	0.54	0.75	0.72
630.10	1.52	1.50	1.01
630.15	2.79	2.25	1.24
630.20	4.29	3.00	1.43
630.22	5.05	3.34	1.51
630.25	6.00	3.75	1.60
630.30	7.89	4.50	1.75
630.35	9.94	5.25	1.89
630.40	12.14	6.00	2.02
630.45	14.49	6.75	2.15
630.50	16.97	7.50	2.26

Level Spreader Design

Level Spreader - Temp. Sediment Trap

Broad Crest Elevation (ft)	696.00	
Length (ft)	**36**	
Discharge Coefficient	3.2	
Elevation Increment	0.05	
Q-100 year (cfs)	18.00	(Temp. Sed. Trap Disch

Elevation (Feet)	**Weir Discharge (cfs)**	**Area (sf)**	**Velocity (fps)**
696.00	0.00	0.00	0.00
696.05	1.29	1.80	0.72
696.10	3.64	3.60	1.01
696.15	6.69	5.40	1.24
696.20	10.30	7.20	1.43
696.25	14.40	9.00	1.60
696.29	18.00	10.44	1.72
696.30	18.93	10.80	1.75
696.35	23.85	12.60	1.89
696.40	29.14	14.40	2.02
696.45	34.78	16.20	2.15
696.50	40.73	18.00	2.26



SLR
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
SLRCONSULTING.COM

DESCRIPTION	DATE	BY
TOWN COMMENTS	01/24/2023	MCB
STORM DRAINAGE DESIGN CHANGES	03/15/2023	MCB
P&Z SUBMISSION	08/24/2023	MCB

DRAINAGE AREA MAP - STORM DRAINAGE SYSTEM

SOUTHFORD PARK

764 SOUTHFORD ROAD (ROUTE 188)
MIDDLEBURY, CONNECTICUT

MCB	MCB	RJM
DESIGNED	DRAWN	CHECKED

SCALE 1"=100'

DATE DECEMBER 22, 2022

PROJECT NO. 20970.00002

SHEET NO. 1 OF 1

SHEET NAME CB

APPENDIX E

WATER QUALITY COMPUTATIONS

Drainage Report

Southford Park

764 Southford Road (Route 188)

Middlebury, Connecticut 06762

December 22, 2022

(Revised January 24, 2023;
February 22, 2023; March 15, 2023; August 29, 2023)

STORMWATER QUALITY CALCULATIONS

Water Quality Volume (WQV)

Basin ID	Total Area (ac.)	Impervious Area (ac.)	Percent Impervious	Volumetric Runoff Coeff., R	WQV (ac-ft)	Total Volume Required (ac-ft)	Total Volume Provided[1.] (ac-ft)
DET 110	2.41	1.25	52%	0.52	0.104	0.104	***0.510***
DET 320	10.48	8.90	85%	0.81	0.711	0.711	***0.822***
FES 58	1.56	0.66	42%	0.43	0.056	0.056	***0.098***
DET 420	18.86	13.63	72%	0.70	1.101	1.101	***1.227***
DET 510	4.48	1.91	43%	0.43	0.162	0.162	***0.224***

[1.] - Volume provided below low-flow orifice or overflow

$$\textbf{WQV =} \quad \frac{(1.0\text{ inches}) \times A \times R}{12}$$

Where:

WQV = Water Quality Volume in acre-feet

A = Contributing Area in acres

R = 0.05 + 0.009 (I)

I = Site Imperviousness as percent

Groundwater Recharge Volume (GRV)

GRV = F x I

Where: GRV = Groundwater Recharge in cubic feet
F = target depth factor per Hydrologic Soil Group in feet
I = net increase in impervious area (redevelopment projects)

<u>**Analysis Point A**</u>: (Contains HSG C & D)

Surface	**Existing**	**Proposed**	**Difference**
Impv. (HSG C)	54,405	265,710	211,305
Impv. (HSG D)	0	0	0
Total	*54,405*	*265,710*	*211,305*

GRV = 0.008 x 211,305 = 1,761
0.00 x 0 = 0 +
$\boxed{1,761}$ CF

<u>**Analysis Point C**</u>: (Contains HSG B, C, & D)

Surface	**Existing**	**Proposed**	**Difference**
Impv. (HSG B)	0	0	0
Impv. (HSG C)	114,983	448,602	333,619
Impv. (HSG D)	2,514	2,514	0
Total	*117,497*	*451,116*	*333,619*

GRV = 0.02 x 0 = 0
0.008 x 333,619 = 2,780
0.00 x 0 = 0 +
$\boxed{2,780}$ CF

<u>**Analysis Point D**</u>: (Contains HSG A, B, C & D)

Surface	**Existing**	**Proposed**	**Difference**
Impv. (HSG A)	0	0	0
Impv. (HSG B)	0	0	0
Impv. (HSG C)	102,055	558,929	456,874
Impv. (HSG D)	5,478	14,592	9,114
Total	*107,533*	*573,521*	*465,988*

GRV = 0.03 x 0 = 0
0.02 x 0 = 0
0.008 x 456,874 = 3,807
0.00 x 9,114 = 0 +
$\boxed{3,807}$ CF

<u>**Analysis Point E**</u>: (Contains HSG C & D)

Surface	**Existing**	**Proposed**	**Difference**
Impv. (HSG C)	17,255	96,179	78,924
Impv. (HSG D)	1,966	0	-1,966
Total	*19,221*	*96,179*	*76,958*

GRV = 0.008 x 76,958 = 641
0.00 x -1,966 = 0 +
$\boxed{641}$ CF

Total GRV Required = ***8,990*** CF

Total GRV Provided **=** ***66,669*** CF ***OK***

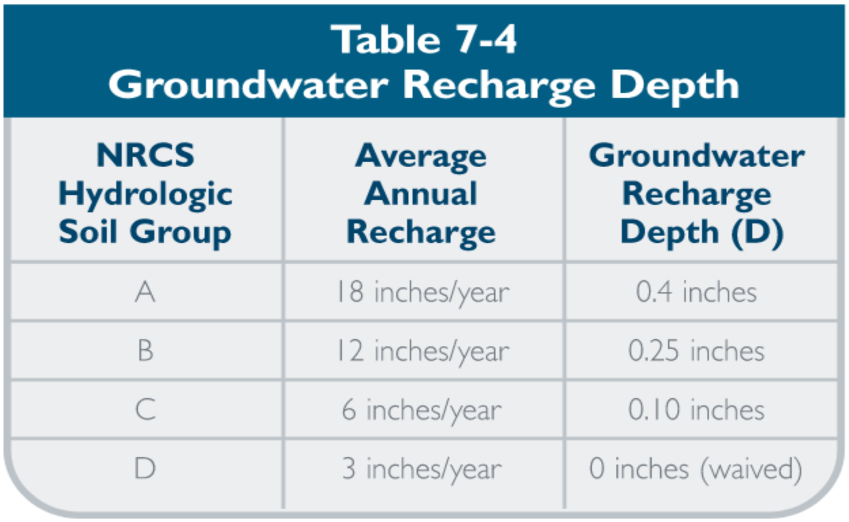


Table 7-4
Groundwater Recharge Depth

NRCS Hydrologic Soil Group	Average Annual Recharge	Groundwater Recharge Depth (D)
A	18 inches/year	0.4 inches
B	12 inches/year	0.25 inches
C	6 inches/year	0.10 inches
D	3 inches/year	0 inches (waived)

Table 7-4 from CTDEEP Stormwater Quality Manual, 2004

STORMWATER QUALITY CALCULATIONS
Water Quality Volume (WQV)

DET 110

Sediment Forebay

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
660.0	978	0.0	0.000	**0.000**
661.0	1,529	1,253.5	0.029	**0.029**
662.0	2,155	1,842.0	0.042	**0.071**
663.0	2,855	2,505.0	0.058	**0.129**

DET 320

Sediment Forebay

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
663.0	2,053	0.0	0.000	**0.000**
664.0	2,923	2,488.0	0.057	**0.057**
665.0	6,823	4,873.0	0.112	**0.169**
666.0	5,141	5,982.0	0.137	**0.306**

Main Basin

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
665.5	15,590	0.0	0.000	**0.000**
666.0	16,416	8,001.5	0.184	**0.184**
667.0	24,484	20,450.0	0.469	**0.653**

FES 58

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
647.0	727	0.0	0.000	**0.000**
648.0	1,172	949.5	0.022	**0.022**
649.0	1,649	1,410.5	0.032	**0.054**
650.0	2,184	1,916.5	0.044	**0.098**

DET 420

Sediment Forebay

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
662.5	2,660	0.0	0.000	**0.000**
663.0	3,261	1,480.3	0.034	**0.034**
664.0	4,560	3,910.5	0.090	**0.124**
665.0	5,926	5,243.0	0.120	**0.244**
666.0	7,340	6,633.0	0.152	**0.396**

STORMWATER QUALITY CALCULATIONS
Water Quality Volume (WQV)

Main Basin

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
665.0	13,264	0.0	0.000	**0.000**
666.0	15,349	14,306.5	0.328	**0.328**
667.0	28,435	21,892.0	0.503	**0.831**

DET 510

Sediment Forebay

Elevation (ft)	Surface Area (ft2)	Volume (ft3)	Volume (ac-ft)	Cumulative Volume (ac-ft)
632.0	766	0.0	0.000	**0.000**
633.0	1,221	993.5	0.023	**0.023**
634.0	1,736	1,478.5	0.034	**0.057**
635.0	2,352	2,044.0	0.047	**0.104**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 7

Contributing Basins			Imperv. Area (acres)	Total Area (acres)
Total			1.91	3.51

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.158 acre-feet

Where:

I = % of Impervious Cover = 54%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.540

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 3.51 acres = 0.0055 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.540

CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] = 95

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.105 Ia/P = 0.105

(TR-55)

From Exhibit 4-III, q_u = 650 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 1.92 cfs **Cascade CS-5**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 20								
Contributing Basins			Imperv. Area (acres)	Total Area (acres)				
Total			5.12	6.64				
Table 4.1: WQV = (P)(R_v)(A)/12 =				0.412	acre-feet			
Where:								
I = % of Impervious Cover =				77%				
R_v = volumetric runoff coeff. 0.05 + 0.009(I) =				0.744				
P = design precipitation (1.0" for water quality storm) =					1	inch		
A = site area (acres) =				6.64	acres =	0.0104	miles^2	
Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)								
			Q =	0.744				
CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] =					97			
Where:								
Q = runoff depth (in watershed inches)								
			t_c =	0.1	hours			
Type III Rainfall Distribution:								
From Table 4-1, Ia =		0.062		Ia/P =	0.062			
(TR-55)								
From Exhibit 4-III, q_u =		700	csm/in.					
(TR-55)								
WQF = (qu)(A)(Q) =		5.40	cfs		**Cascade CS-8**			

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 34B

Contributing Basins			Imperv. Area (acres)	Total Area (acres)
Total			4.41	4.72

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.350 acre-feet

Where:

I = % of Impervious Cover = 93%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.891

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 4.72 acres = 0.0074 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.891

CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] = 99

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.041 Ia/P = 0.041

(TR-55)

From Exhibit 4-III, q_u = 700 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 4.60 cfs **Cascade CS-8**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 37

Contributing Basins	Imperv. Area (acres)	Total Area (acres)
Total	1.54	2.37

Table 4.1: WQV = $(P)(R_v)(A)/12$ = 0.125 acre-feet

Where:

I = % of Impervious Cover = 65%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.635

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 2.37 acres = 0.0037 $miles^2$

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.635

CN = $1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)^{0.5}]$ = 96

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.041 Ia/P = 0.041

(TR-55)

From Exhibit 4-III, q_u = 700 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 1.65 cfs **Cascade CS-4**

SLR Consulting

COMPUTATION SHEET - WATER QUALITY FLOW (WQF)

Project **20970.00002**
Made By: MCB
Date: 3/14/2023
Chkd by:
Date:

Subject: **Southford Park**

MH 47

Contributing Basins			Imperv. Area (acres)	Total Area (acres)
Total			2.84	4.36

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.231 acre-feet

Where:

I = % of Impervious Cover = 65%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.636

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 4.36 acres = 0.0068 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.636

CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] = 96

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.041 Ia/P = 0.041

(TR-55)

From Exhibit 4-III, q_u = 700 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 3.04 cfs **Cascade CS-6**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

CCB 59

Contributing Basins	Imperv. Area (acres)	Total Area (acres)
Total	0.66	1.56

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.056 acre-feet

Where:

I = % of Impervious Cover = 42%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.431

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 1.56 acres = 0.0024 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.431

$CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)^{0.5}] =$ 93

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.151 Ia/P = 0.151

(TR-55)

From Exhibit 4-III, q_u = 625 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 0.66 cfs **Cascade CS-4**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 66

Contributing Basins	Imperv. Area (acres)	Total Area (acres)
Total	3.50	3.50

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.277 acre-feet

Where:

I = % of Impervious Cover = 100%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.950

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 3.5 acres = 0.0055 $miles^2$

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.950

CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] = 100

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.041 Ia/P = 0.041

(TR-55)

From Exhibit 4-III, q_u = 700 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 3.64 cfs **Cascade CS-6**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 71

Contributing Basins			Imperv. Area (acres)	Total Area (acres)
Total			8.89	8.89

Table 4.1: WQV = (P)(R_v)(A)/12 = 0.704 acre-feet

Where:

I = % of Impervious Cover = 100%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.950

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 8.89 acres = 0.0139 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.950

CN = 1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)$^{0.5}$] = 100

Where:

Q = runoff depth (in watershed inches)

t_c = 0.1 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.041 Ia/P = 0.041

(TR-55)

From Exhibit 4-III, q_u = 700 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 9.24 cfs **Cascade CS-10**

	SLR Consulting	Project	**20970.00002**
	COMPUTATION SHEET - WATER QUALITY FLOW (WQF)	Made By:	MCB
Subject:	**Southford Park**	Date:	3/14/2023
		Chkd by:	
		Date:	

MH 99

Contributing Basins	Imperv. Area (acres)	Total Area (acres)
Total	1.25	1.65

Table 4.1: WQV = $(P)(R_v)(A)/12$ = 0.101 acre-feet

Where:

I = % of Impervious Cover = 76%

R_v = volumetric runoff coeff. 0.05 + 0.009(I) = 0.732

P = design precipitation (1.0" for water quality storm) = 1 inch

A = site area (acres) = 1.65 acres = 0.0026 miles^2

Q = runoff depth (in watershed inches) = [WQV(acrefeet)]*[12(inches/foot)]/drainage area (acres)

Q = 0.732

CN = $1000 / [10+ 5P + 10Q -10(Q^2 + 1.25QP)^{0.5}]$ = 97

Where:

Q = runoff depth (in watershed inches)

t_c = 0.17 hours

Type III Rainfall Distribution:

From Table 4-1, Ia = 0.062 Ia/P = 0.062

(TR-55)

From Exhibit 4-III, q_u = 650 csm/in.

(TR-55)

WQF = (qu)(A)(Q) = 1.23 cfs **Cascade CS-4**

MH 7

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

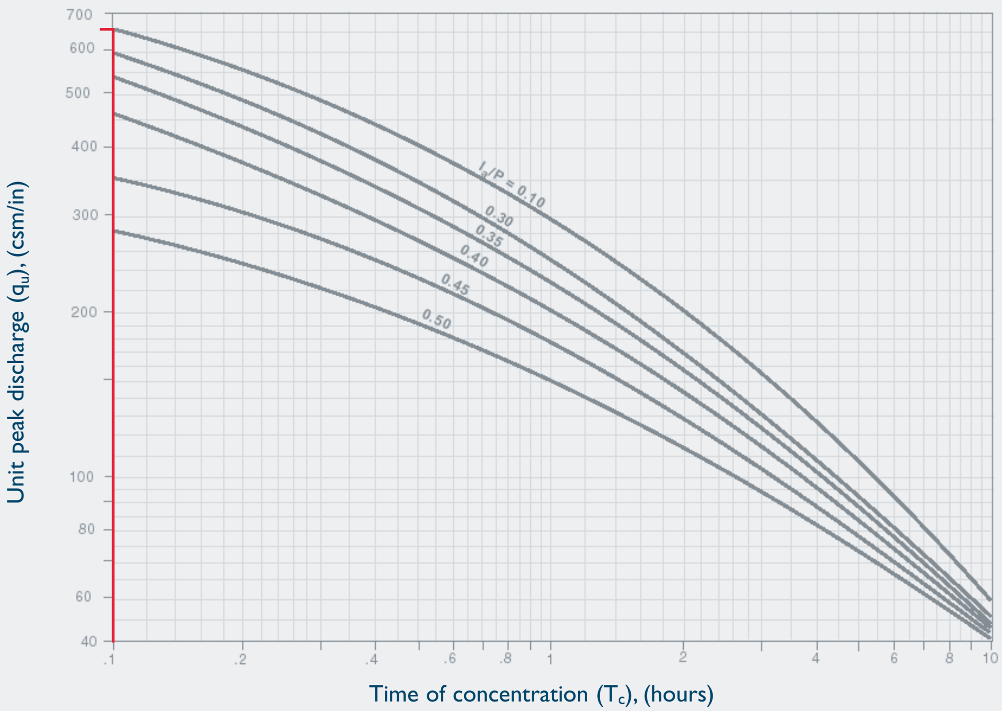
   - *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	55	1.636	70	0.857	85	0.353
41	2.878	56	1.571	71	0.817	86	0.326
42	2.762	57	1.509	72	0.778	87	0.299
43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   - *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



MH 20

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

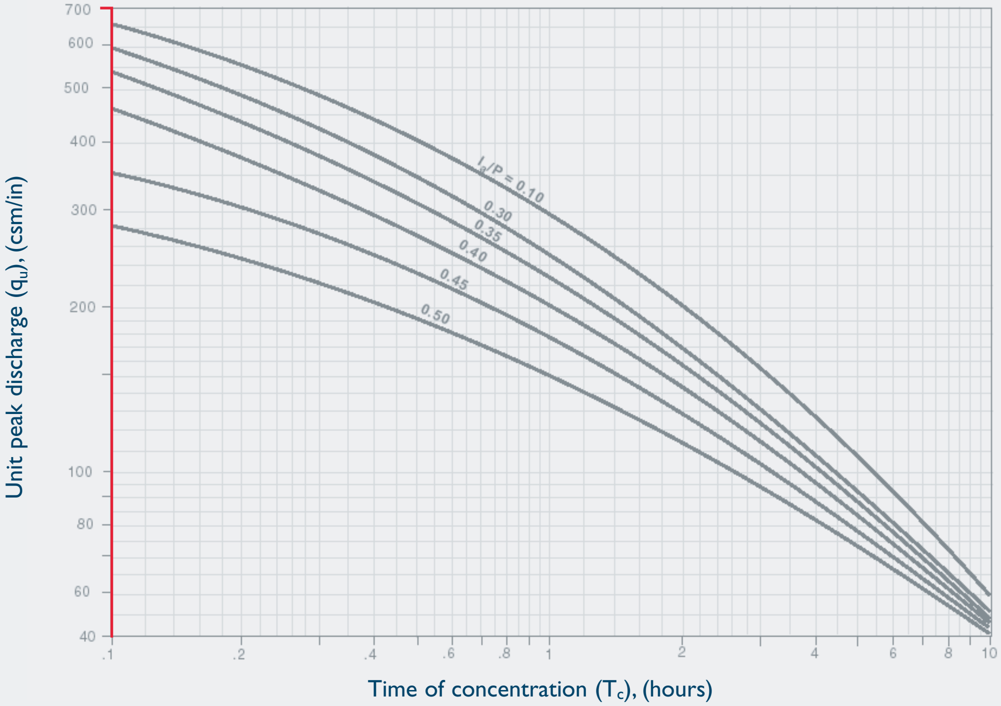
   ❍ *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	55	1.636	70	0.857	85	0.353
41	2.878	56	1.571	71	0.817	86	0.326
42	2.762	57	1.509	72	0.778	87	0.299
43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   ❍ *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



MH 34B, MH 66, MH 71

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

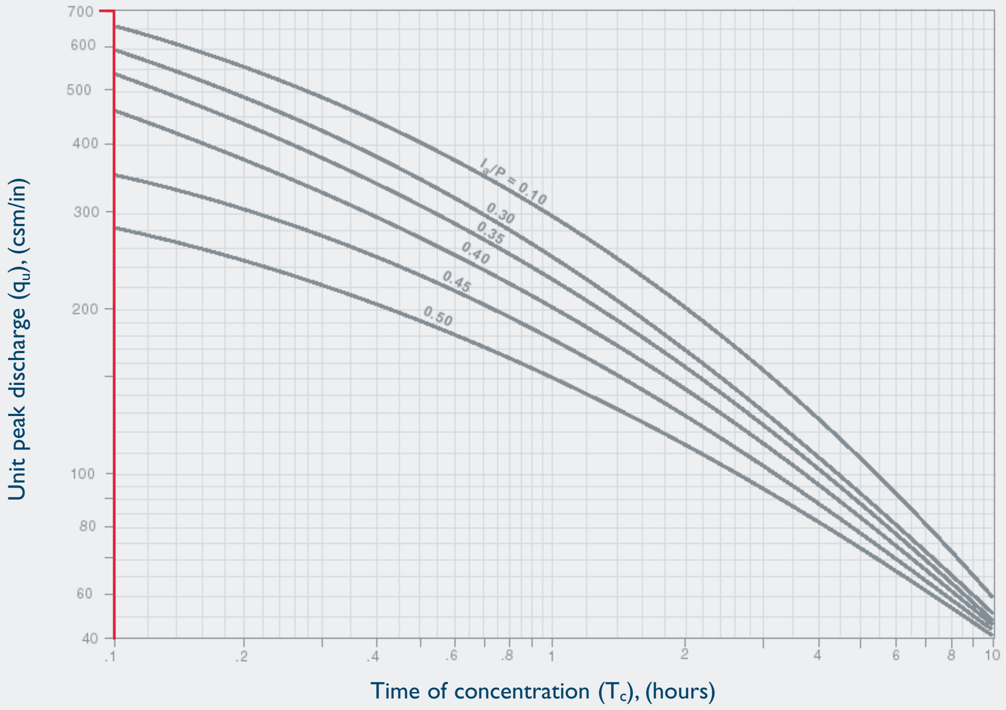
   ❍ *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	55	1.636	70	0.857	85	0.353
41	2.878	56	1.571	71	0.817	86	0.326
42	2.762	57	1.509	72	0.778	87	0.299
43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   ❍ *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



MH 37 & MH 47

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

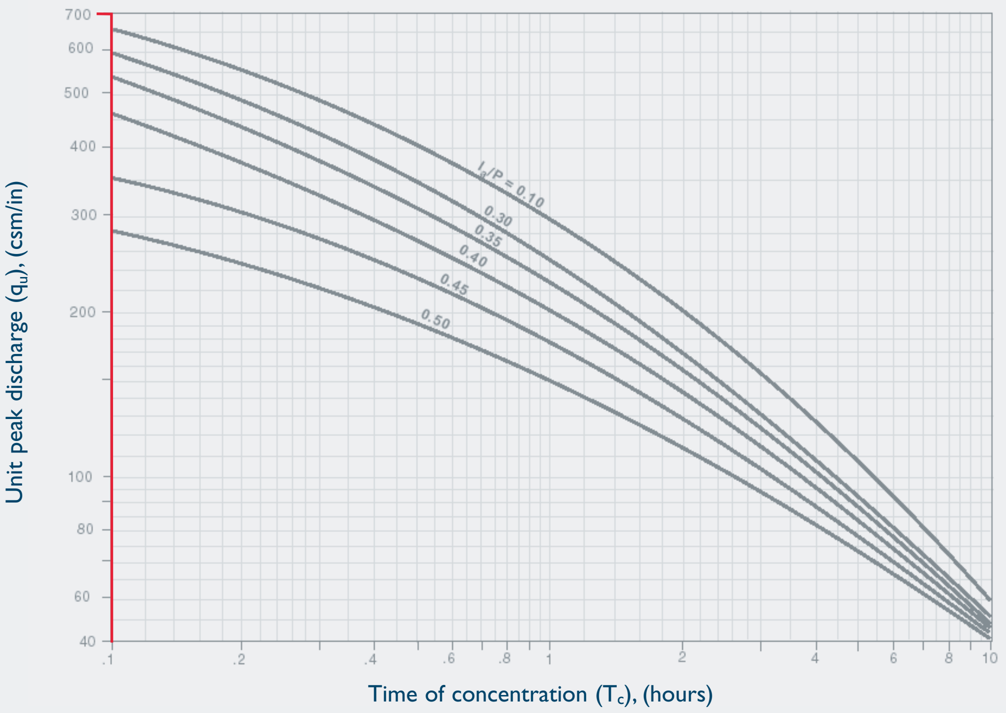
   ❍ *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
40	3.000	55	1.636	70	0.857	85	0.353
41	2.878	56	1.571	71	0.817	86	0.326
42	2.762	57	1.509	72	0.778	87	0.299
43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   ❍ *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



CCB 59

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

   - ❍ *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

Table 4-1 I_a values for runoff curve numbers

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44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
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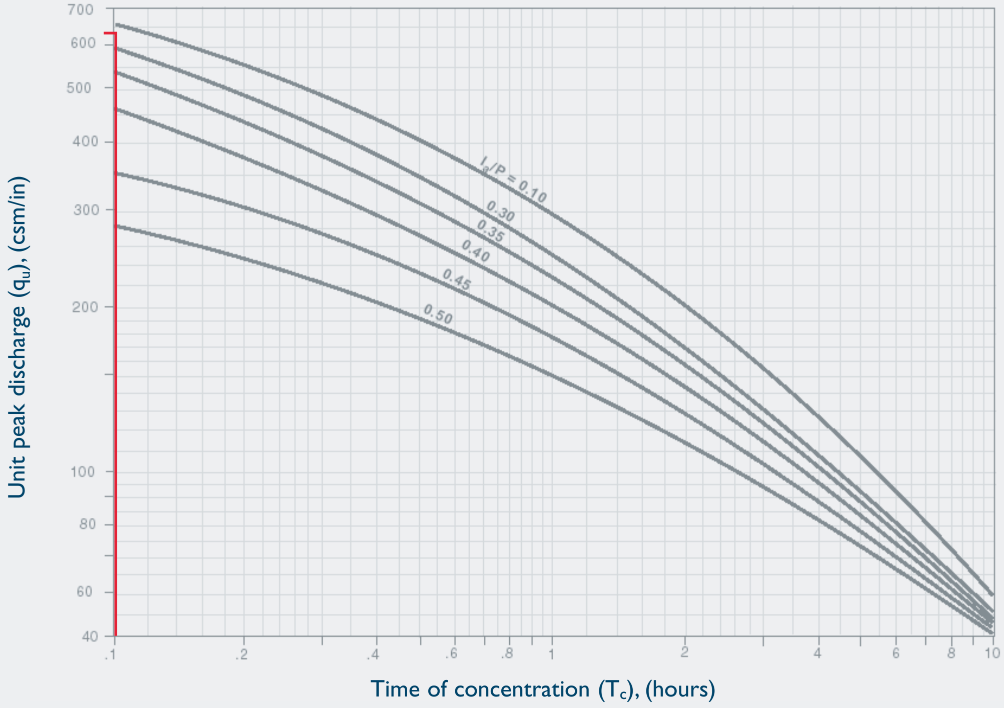
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   - ❍ *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



MH 99

2. Compute the time of concentration (t_c) based on the methods described in Chapter 3 of TR-55. A minimum value of 0.167 hours (10 minutes) should be used. For sheet flow, the flow path should not be longer than 300 feet.

3. Using the computed CN, t_c, and drainage area (A) in acres, compute the peak discharge for the water quality storm (i.e., the water quality flow [WQF]), based on the procedures described in Chapter 4 of TR-55.

   - *Read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55 (reproduced below); compute I_a/P*

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43	2.651	58	1.448	73	0.740	88	0.273
44	2.545	59	1.390	74	0.703	89	0.247
45	2.444	60	1.333	75	0.667	90	0.222
46	2.348	61	1.279	76	0.632	91	0.198
47	2.255	62	1.226	77	0.597	92	0.174
48	2.167	63	1.175	78	0.564	93	0.151
49	2.082	64	1.125	79	0.532	94	0.128
50	2.000	65	1.077	80	0.500	95	0.105
51	1.922	66	1.030	81	0.469	96	0.083
52	1.846	67	0.985	82	0.439	97	0.062
53	1.774	68	0.941	83	0.410	98	0.041
54	1.704	69	0.899	84	0.381		

   - *Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 (reproduced below) for appropriate t_c*

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution

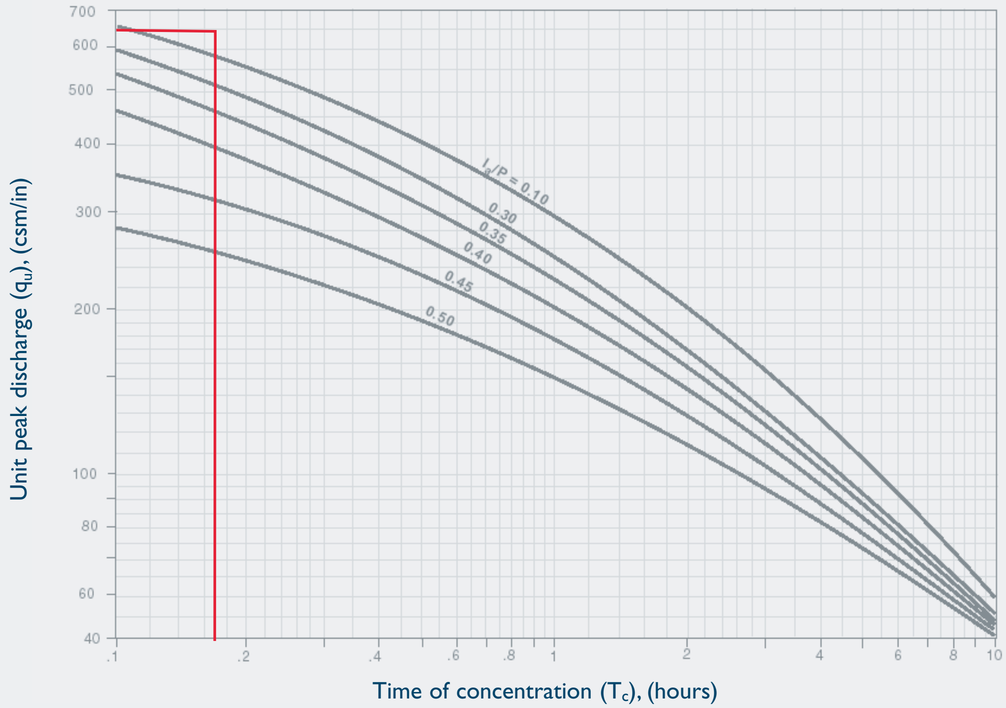

TABLE 1 – CTDOT LIST OF QUALIFIED HYDRODYNAMIC SEPARATOR MANUFACTURERS

HYDRODYNAMIC SEPARATOR NAME	COMPANY INFORMATION
Barracuda	BaySaver Technologies, LLC 1030 Deer Hollow Drive Mt. Airy, MD 21771 (800)-229-7283 https://baysaver.com/
Cascade	Contech Engineered Solutions 9025 Centre Point Dr. West Chester, OH 45069 (800)-338-1122 https://www.conteches.com/
CDS	
Concentrator	AquaShield Inc. 2733 Kanasita Drive Suite 111 Chattanooga, TN 37343 (423)-870-8888 https://www.aquashieldinc.com/
Xcelerator	
Downstream Defender	Hydro International 94 Hutchins Drive Portland, ME 04102 (207)-756-6200 https://hydro-int.com/en
First Defense	
DVS	Oldcastle Infrastructure 7000 Central Prkwy, Suite 800 Atlanta, GA 30328 (888)-965-3227 https://oldcastleinfrastructure.com/
HydroStorm	Hydroworks, LLC 257 Cox St. Roselle, NJ 07203 (848)-235-5950 https://hydroworks.com/
SciClone	BioClean Envr. Services 5796 Armada Dr. Suite 250 Carlsbad, CA 92008 (855)-566-3938 https://biocleanenvironmental.com/

TABLE 2 - PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS

Max WQF (cfs)	**Product Model**									
	Barracuda	***Cascade***	***CDS***	***Concentrator***	***Downstream Defender***	***DVS***	***First Defense***	***HydroStorm***	***SciClone***	***Xcelerator***
0.1	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.2	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.3	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.4	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-3(3.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-4(4)	XC-2(2.5)
0.5	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-3(3.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-4(4)	XC-2(2.5)
0.6	Barracuda S3(3)	CS-3(3)	CDS-4(4)	AS-3(3.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-4(4)	XC-3(3.5)
0.7	Barracuda S3(3)	CS-3(3)	CDS-4(4)	AS-3(3.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-4(4)	XC-3(3.5)
0.8	Barracuda S4(4)	CS-3(3)	CDS-4(4)	AS-4(4.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-5(5)	XC-3(3.5)
0.9	Barracuda S4(4)	CS-3(3)	CDS-4(4)	AS-4(4.5)	4ft(4)	DVS-48(4)	4ft(4)	HS5(5)	SC-5(5)	XC-3(3.5)
1.0	Barracuda S4(4)	CS-3(3)	CDS-5(5)	AS-4(4.5)	4ft(4)	DVS-48(4)	4ft(4)	HS5(5)	SC-5(5)	XC-3(3.5)
1.1	Barracuda S4(4)	CS-4(4)	CDS-5(5)	AS-4(4.5)	4ft(4)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-3(3.5)
1.2	Barracuda S4(4)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-4(4.5)
1.3	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-4(4.5)
1.4	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS6(6)	SC-6(6)	XC-4(4.5)
1.5	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-6(6)	6ft(6)	DVS-60(5)	4ft(4)	HS6(6)	SC-6(6)	XC-4(4.5)
1.6	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)
1.7	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)
1.8	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)

TABLE 2 - PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS (continued)

Max WQF (cfs)	**Product Model**									
	Barracuda	***Cascade***	***CDS***	***Concentrator***	***Downstream Defender***	***DVS***	***First Defense***	***HydroStorm***	***SciClone***	***Xcelerator***
1.9	Barracuda S5(5)	CS-5(5)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-5(5.5)
2.0	Barracuda S6(6)	CS-5(5)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS7(7)	SC-7(7)	XC-5(5.5)
2.1	Barracuda S6(6)	CS-5(5)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS7(7)	SC-7(7)	XC-5(5.5)
2.2	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	6ft(6)	DVS-72(6)	5ft(5)	HS7(7)	SC-8(8)	XC-5(5.5)
2.3	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	6ft(6)	DVS-84(7)	5ft(5)	HS7(7)	SC-8(8)	XC-5(5.5)
2.4	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	6ft(6)	DVS-84(7)	6ft(6)	HS7(7)	SC-8(8)	XC-5(5.5)
2.5	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	6ft(6)	DVS-84(7)	6ft(6)	HS7(7)	SC-8(8)	XC-5(5.5)
2.6	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	8ft(8)	DVS-84(7)	6ft(6)	HS7(7)	SC-8(8)	XC-5(5.5)
2.7	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	8ft(8)	DVS-84(7)	6ft(6)	HS8(8)	SC-8(8)	XC-5(5.5)
2.8	Barracuda S6(6)	CS-5(5)	CDS-7(7)	AS-7(7)	8ft(8)	DVS-84(7)	6ft(6)	HS8(8)	SC-8(8)	XC-6(6.5)
2.9	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-84(7)	6ft(6)	HS8(8)	SC-9(9)	XC-6(6.5)
3.0	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-84(7)	6ft(6)	HS8(8)	SC-9(9)	XC-6(6.5)
3.1	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	6ft(6)	HS8(8)	SC-9(9)	XC-6(6.5)
3.2	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	6ft(6)	HS8(8)	SC-9(9)	XC-6(6.5)
3.3	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	6ft(6)	HS8(8)	SC-9(9)	XC-6(6.5)
3.4	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	7ft(7)	HS8(8)	SC-9(9)	XC-6(6.5)
3.5	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	7ft(7)	HS8(8)	SC-9(9)	XC-6(6.5)
3.6	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	7ft(7)	HS9(9)	SC-10(10)	XC-6(6.5)

TABLE 2 - PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS (continued)

Max WQF (cfs)	**Product Model**									
	Barracuda	***Cascade***	***CDS***	***Concentrator***	***Downstream Defender***	***DVS***	***First Defense***	***HydroStorm***	***SciClone***	***Xcelerator***
3.7	Barracuda S8(8)	CS-6(6)	CDS-8(8)	AS-8(8)	8ft(8)	DVS-96(8)	7ft(7)	HS9(9)	SC-10(10)	XC-6(6.5)
3.8	Barracuda S8(8)	CS-6(6)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-96(8)	7ft(7)	HS9(9)	SC-10(10)	XC-6(6.5)
3.9	Barracuda S8(8)	CS-6(6)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-96(8)	7ft(7)	HS9(9)	SC-10(10)	XC-7(7.5)
4.0	Barracuda S8(8)	CS-6(6)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-96(8)	7ft(7)	HS9(9)	SC-10(10)	XC-7(7.5)
4.1	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-120(10)	7ft(7)	HS9(9)	SC-10(10)	XC-7(7.5)
4.2	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-120(10)	7ft(7)	HS9(9)	SC-10(10)	XC-7(7.5)
4.3	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-120(10)	7ft(7)	HS9(9)	SC-10(10)	XC-7(7.5)
4.4	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	8ft(8)	DVS-120(10)	7ft(7)	HS9(9)	SC-11(11)	XC-7(7.5)
4.5	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	10ft(10)	DVS-120(10)	7ft(7)	HS10(10)	SC-11(11)	XC-7(7.5)
4.6	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	10ft(10)	DVS-120(10)	7ft(7)	HS10(10)	SC-11(11)	XC-7(7.5)
4.7	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-9(9)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-7(7.5)
4.8	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-7(7.5)
4.9	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-7(7.5)
5.0	Barracuda S8(8)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-7(7.5)
5.1	Barracuda S10(10)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-7(7.5)
5.2	Barracuda S10(10)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-11(11)	XC-8(8.5)
5.3	Barracuda S10(10)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-12(12)	XC-8(8.5)
5.4	Barracuda S10(10)	CS-8(8)	CDS-10(10)	AS-10(10)	10ft(10)	DVS-120(10)	8ft(8)	HS10(10)	SC-12(12)	XC-8(8.5)

TABLE 2 - PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS (continued)

Max WQF (cfs)	Product Model									
	Barracuda	*Cascade*	*CDS*	*Concentrator*	*Downstream Defender*	*DVS*	*First Defense*	*HydroStorm*	*SciClone*	*Xcelerator*
9.1		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.2		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.3		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.4		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.5		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.6		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.7		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.8		CS-10(10)		AS-13(13)	12ft(12)					XC-10(10.5)
9.9		CS-10(10)			12ft(12)					XC-10(10.5)
10.0		CS-10(10)			12ft(12)					XC-10(10.5)
10.1		CS-10(10)								XC-10(10.5)
10.2		CS-10(10)								XC-11(11.5)
10.3		CS-10(10)								XC-11(11.5)
10.4		CS-10(10)								XC-11(11.5)
10.5		CS-10(10)								XC-11(11.5)
10.6		CS-10(10)								XC-11(11.5)
10.7		CS-10(10)								XC-11(11.5)
10.8		CS-10(10)								XC-11(11.5)

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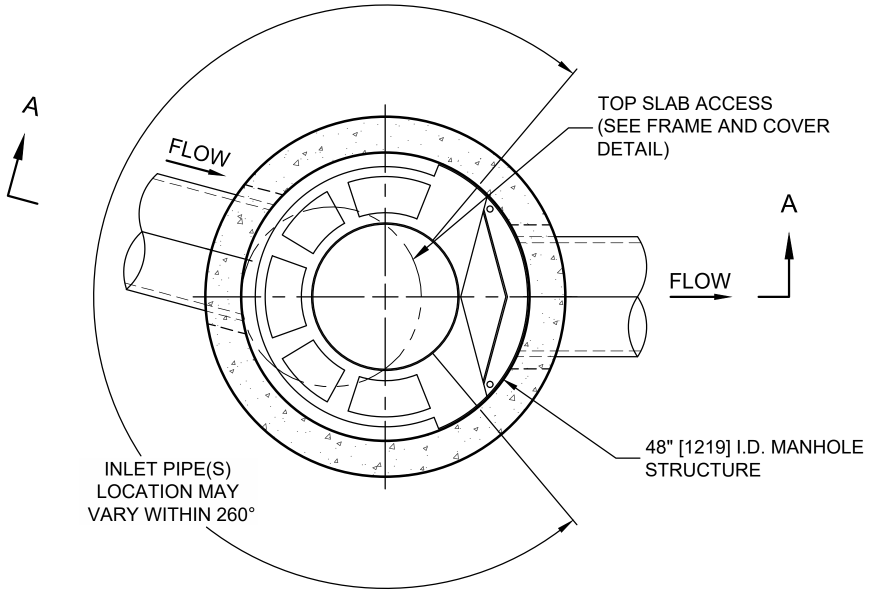
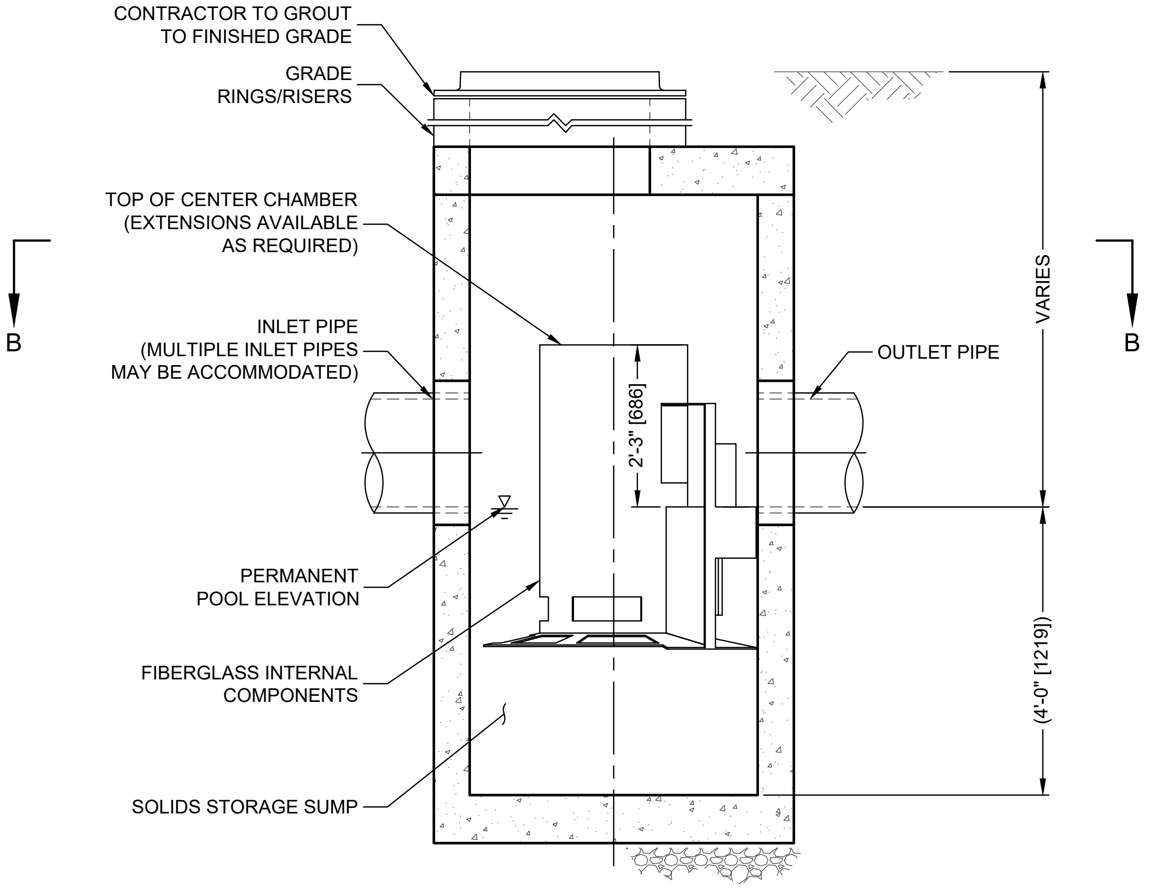


PLAN VIEW B-B

NOT TO SCALE



ELEVATION A-A

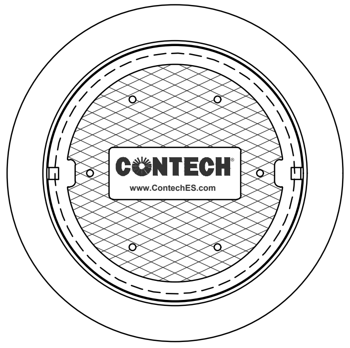
NOT TO SCALE

CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-4 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER

(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
3. CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
4. CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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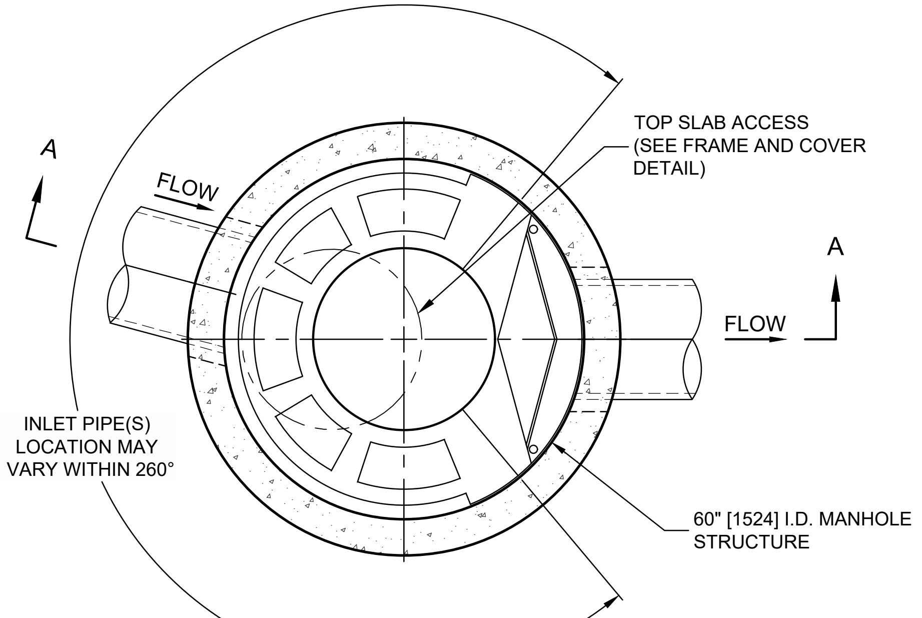
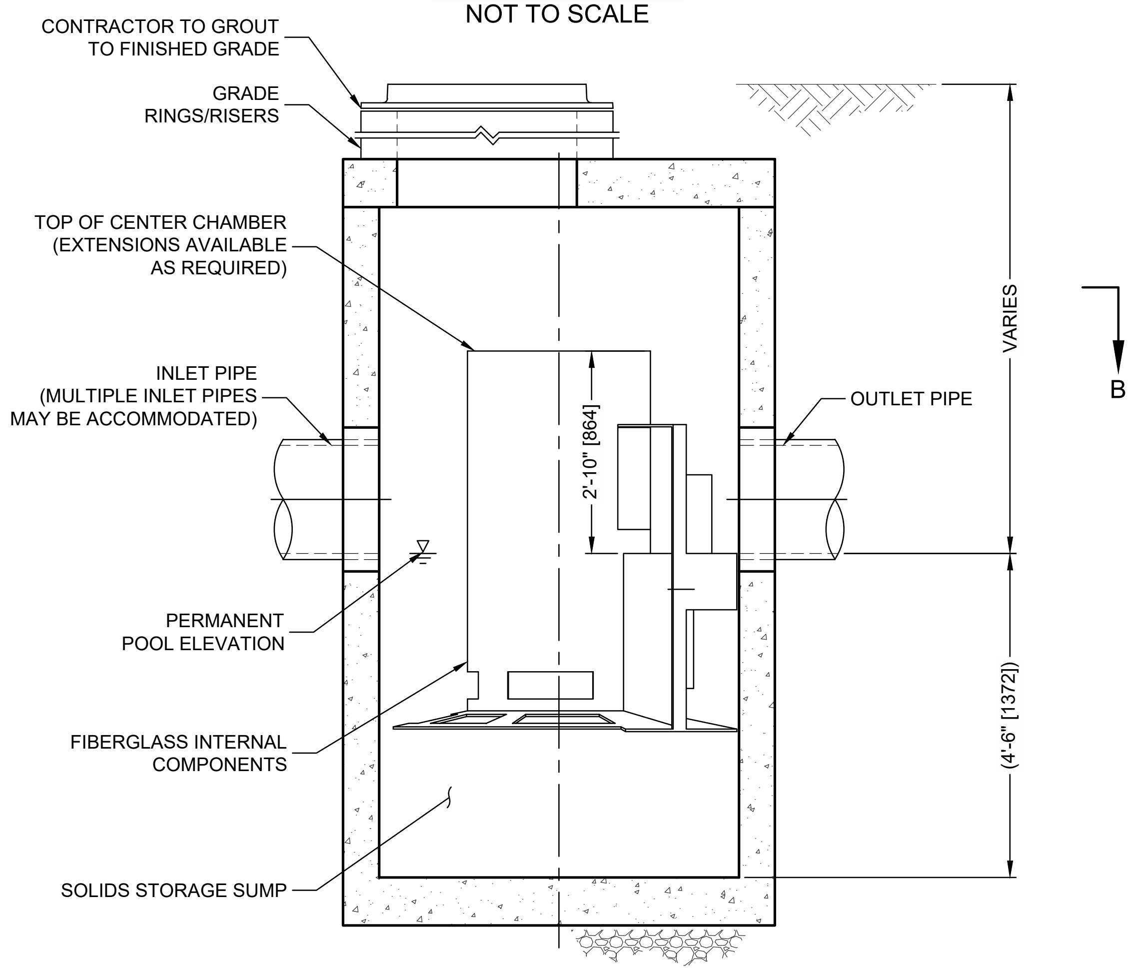
CS-4
CASCADE SEPARATOR
STANDARD DETAIL



PLAN VIEW B-B

NOT TO SCALE



ELEVATION A-A

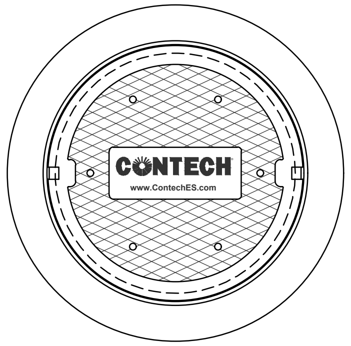
NOT TO SCALE

CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-5 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER

(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES

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5. CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
6. ALTERNATE UNITS ARE SHOWN IN MILLIMETERS [mm].

INSTALLATION NOTES

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D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

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CS-5
CASCADE SEPARATOR
STANDARD DETAIL

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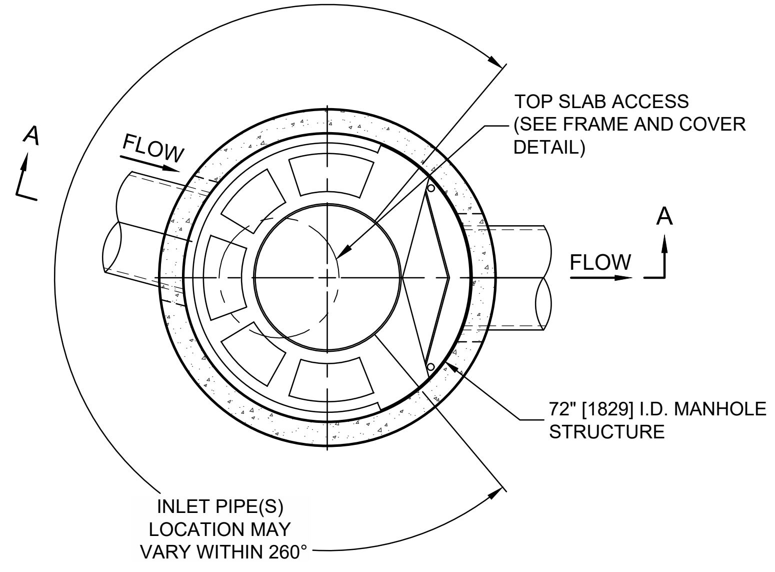
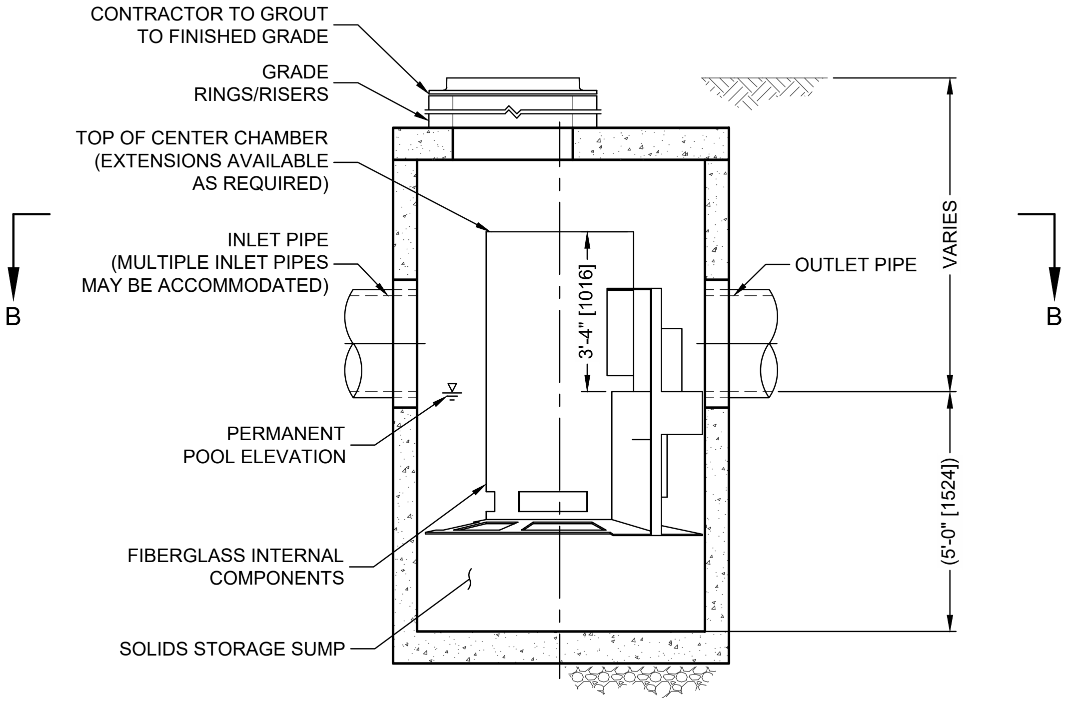


PLAN VIEW B-B
NOT TO SCALE



ELEVATION A-A
NOT TO SCALE

CASCADE
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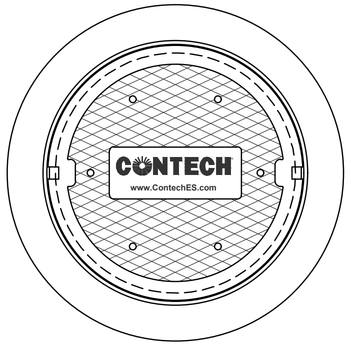
CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-6 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER
(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES
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CS-6
CASCADE SEPARATOR
STANDARD DETAIL

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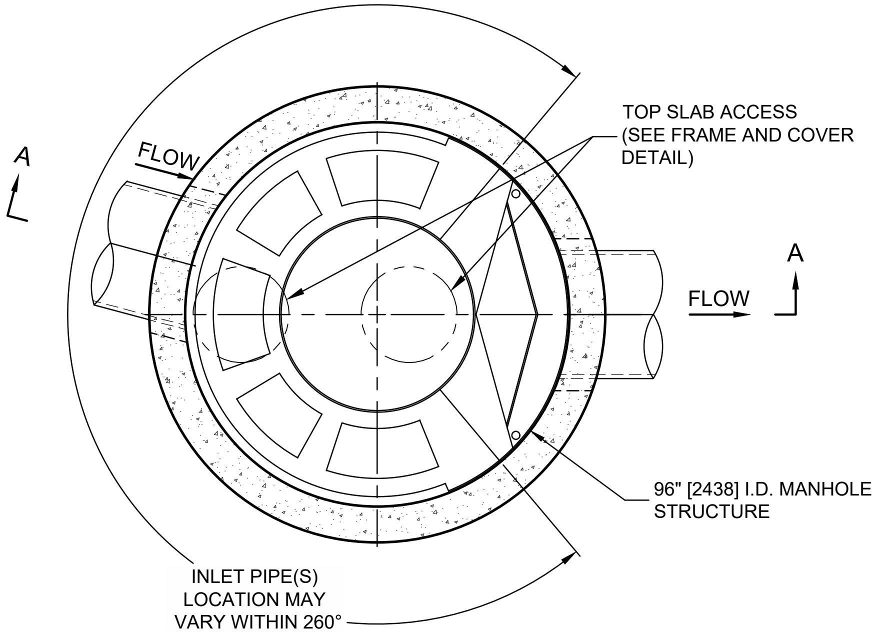
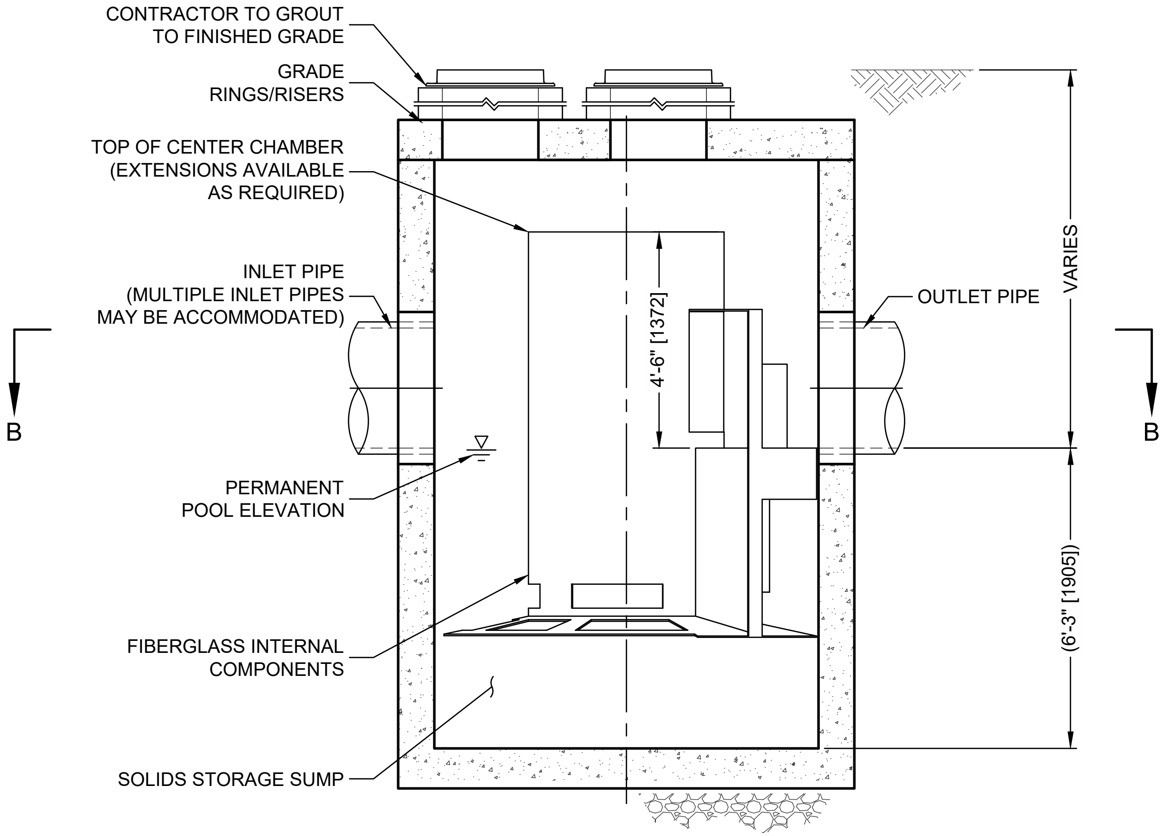


PLAN VIEW B-B

NOT TO SCALE



ELEVATION A-A

NOT TO SCALE

CASCADE
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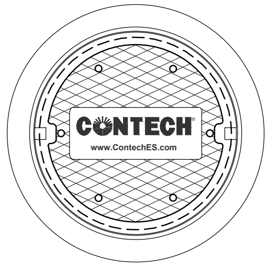
CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-8 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (cfs [L/s])			
PEAK FLOW RATE (cfs [L/s])			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			
PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
NOTES / SPECIAL REQUIREMENTS:			



FRAME AND COVER

(DIAMETER VARIES)
NOT TO SCALE

GENERAL NOTES

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CS-8
CASCADE SEPARATOR
STANDARD DETAIL

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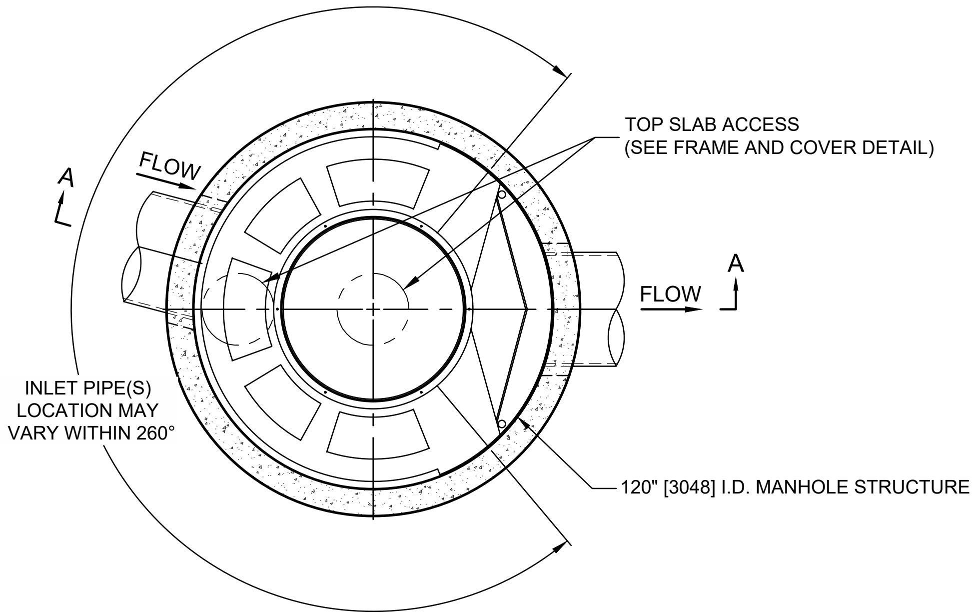
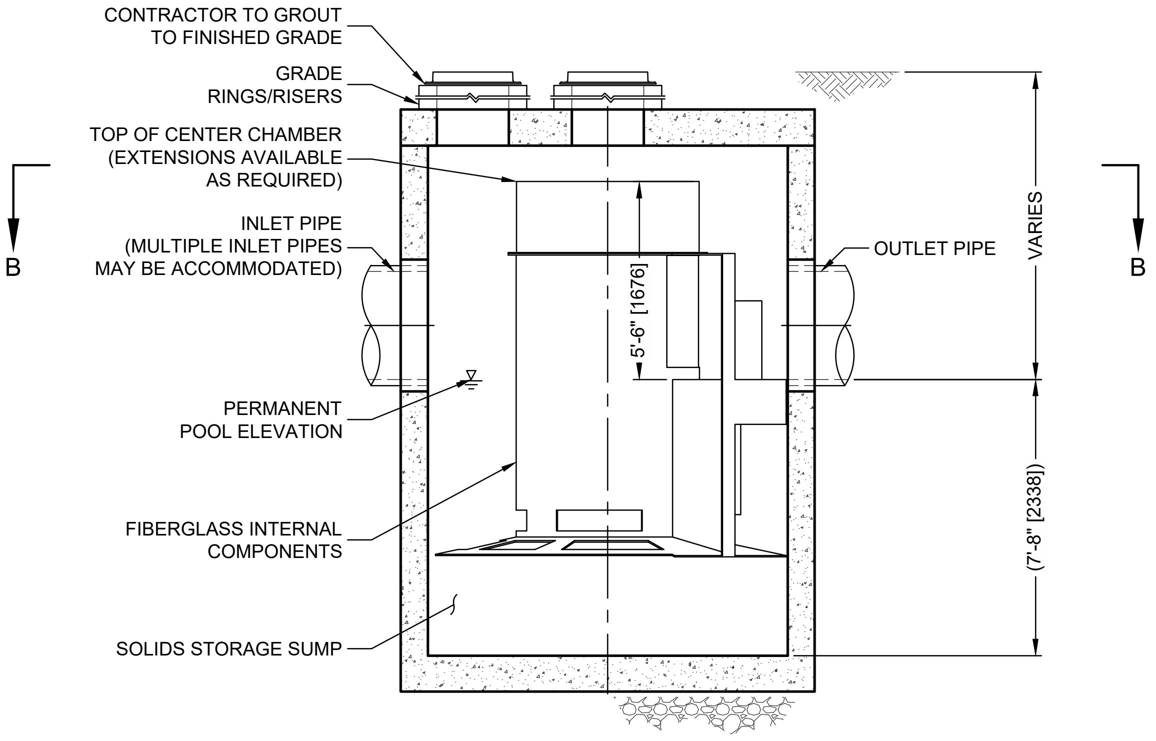


PLAN VIEW B-B

NOT TO SCALE



ELEVATION A-A

NOT TO SCALE

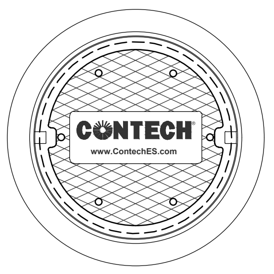
CASCADE
separator™

CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-10 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

INTERNAL COMPONENTS WILL BE FIELD INSTALLED. CONTACT YOUR CONTECH REPRESENTATIVE FOR ADDITIONAL INFORMATION.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES



FRAME AND COVER

(DIAMETER VARIES)
NOT TO SCALE

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (cfs [L/s])	
PEAK FLOW RATE (cfs [L/s])	
RETURN PERIOD OF PEAK FLOW (yrs)	
RIM ELEVATION	

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES / SPECIAL REQUIREMENTS:

GENERAL NOTES

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INSTALLATION NOTES

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CS-10
CASCADE SEPARATOR
STANDARD DETAIL

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CONTECH
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Cascade Separator™ Inspection and Maintenance Guide

CASCADE
separator™

Maintenance

The Cascade Separator™ system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

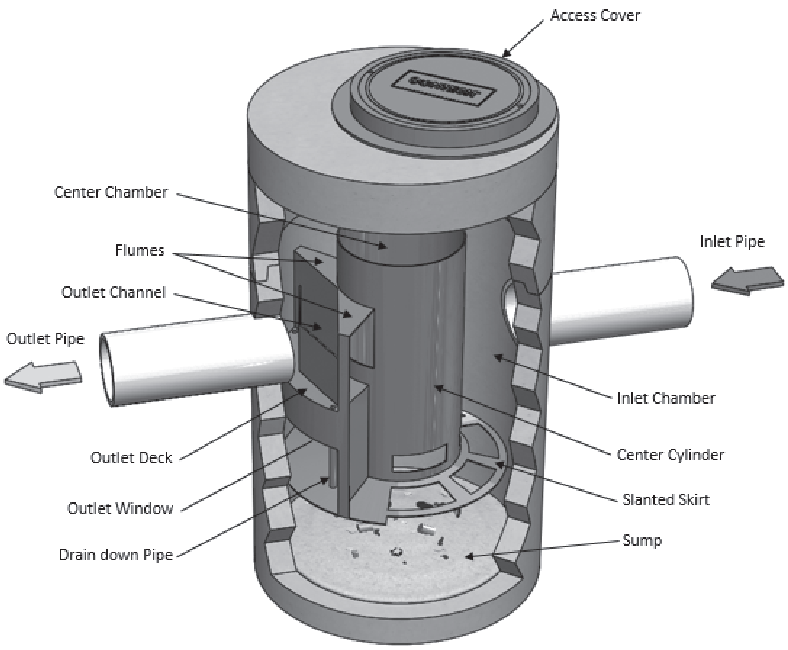
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



Cascade Separator™ Maintenance Indicators and Sediment Storage Capacities

Model Number	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CS-4	4	1.2	1.5	0.5	0.7	0.5
CS-5	5	1.3	1.5	0.5	1.1	0.8
CS-6	6	1.8	1.5	0.5	1.6	1.2
CS-8	8	2.4	1.5	0.5	2.8	2.1
CS-10	10	3.0	1.5	0.5	4.4	3.3
CS-12	12	3.6	1.5	0.5	6.3	4.8

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

Cascade Separator™ Inspection & Maintenance Log

Cascade Model:			Location:		
Date	Depth Below Invert to Top of Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

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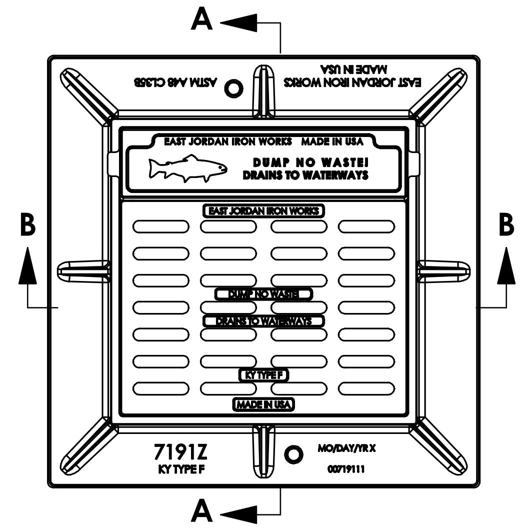
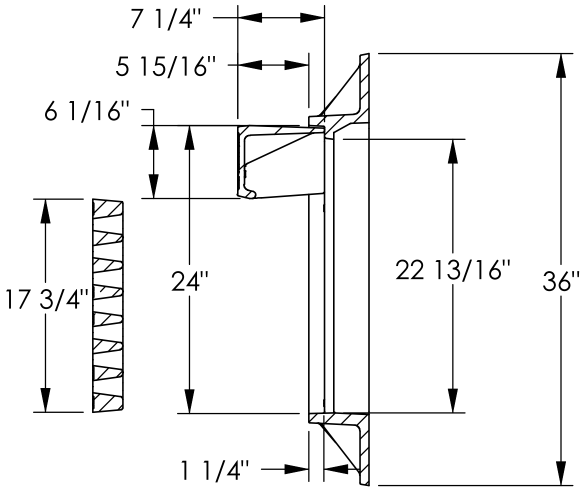
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

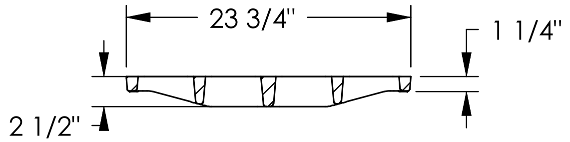
7191Z/7191M/7191T COMBINATION

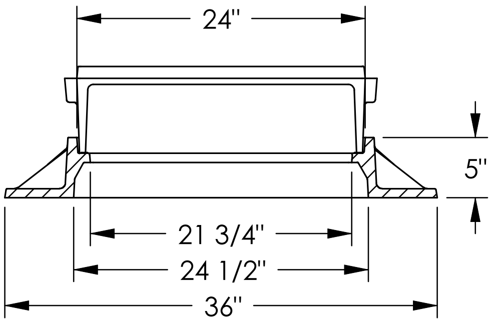
NOTE: COMPONENTS ARE SHIPPED LOOSE. NOT ASSEMBLED





SECTION A-A





SECTION B-B

PRODUCT NUMBER

00719131C01

DESIGN FEATURES

MATERIALS

FRAME-GRAY IRON
ASTM A48 CL35B

GRATE-GRAY IRON
ASTM A48 CL35B

HOOD-GRAY IRON
ASTM A48 CL35B

DESIGN LOAD
HEAVY DUTY

COATING
UNDIPPED

OPEN AREA
123 SQ INCHES

√ DESIGNATES MACHINE SURFACE

REFERENCE INFORMATION

00719111
00719131
00719161

DRAWING DETAILS

ORIGINAL DRAWING: DEF 2/10/2010

REVISED BY:

Corporate
Headquarters
301 Spring Street
PO Box 439
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Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

I. Pollutant Load Calculation:

Pollutant Loading:

L = 0.226 * R * C * A

Where:

L = annual load (lbs or billion colonies)
R = annual runoff (in.)
C = pollutant or bacteria concentration (mg/l or #/100ml)
A = contributing watershed area (acres, see table)

Annual Runoff:

R = P * Pj * Rv

Where:

P = average annual rainfall = 48.7 inches
Pj = fraction of annual rainfall events producing runoff = 0.9
Rv = runoff coefficient (fraction of rainfall converted to runoff)
Rv = 0.05 + 0.009(I)   where I = % site imperviousness (see table)

Pollutant Concentration

Pollutant	*C*	*Units*
Sediment [1]	80.0	mg/l
Total N [1]	2.10	mg/l
Total P [1]	0.23	mg/l
Zinc [1]	0.176	mg/l
Copper [2]	0.047	mg/l
Petroleum Hydrocarbons [3]	3.5	mg/l

Sources:

[1] - The National Stormwater Quality Database, Version 1.1 (Pitt & Maestre, 2005, 2018)

[2] - National NURP Study Average, Controlling urban runoff : a practical manual for planning and designing urban BMPs (Schueler, 1987)

[3] - New Jersey Stormwater Best Management Practices Manual (Feb. 2004)

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

II. Input Parameters:

Analysis Point A

Proposed	
Parameter	**PRWS-11**
P	48.7
Pj	0.90
I	51.9
Rv	0.52
A	2.41

Analysis Point C

Proposed	
Parameter	**PRWS-31**
P	48.7
Pj	0.90
I	17.8
Rv	0.21
A	8.05

Proposed	
Parameter	**PRWS-32**
P	48.7
Pj	0.90
I	84.9
Rv	0.81
A	10.48

Analysis Point D

Proposed	
Parameter	**PRWS-41**
P	48.7
Pj	0.90
I	76.4
Rv	0.74
A	4.58

Proposed	
Parameter	**PRWS-42**
P	48.7
Pj	0.90
I	69.6
Rv	0.68
A	12.22

Proposed	
Parameter	**PRWS-43**
P	48.7
Pj	0.90
I	77.1
Rv	0.74
A	6.64

Analysis Point E

Proposed	
Parameter	**PRWS-51**
P	48.7
Pj	0.90
I	42.6
Rv	0.43
A	4.48

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

III. Initial Pollutant Load Estimation:

Analysis Point A

Pollutant	PRWS-11				Total Pnt A	Units
Sediment	990.5				990.5	lbs
Total N	26.0				26.0	lbs
Total P	2.8				2.8	lbs
Zinc	2.2				2.2	lbs
Copper	0.6				0.6	lbs
Hydrocarbons	43.3				43.3	lbs

Analysis Point C

Pollutant	PRWS-31	PRWS-32			Total Pnt C	Units
Sediment	1,344.9	6,780.9			8,125.8	lbs
Total N	35.3	178.0			213.3	lbs
Total P	3.9	19.5			23.4	lbs
Zinc	3.0	14.9			17.9	lbs
Copper	0.8	4.0			4.8	lbs
Hydrocarbons	58.8	296.7			355.5	lbs

Analysis Point D

Pollutant	PRWS-41	PRWS-42	PRWS-43		Total Pnt D	Units
Sediment	2,684.9	6,569.4	3,925.8		13,180.2	lbs
Total N	70.5	172.4	103.1		346.0	lbs
Total P	7.7	18.9	11.3		37.9	lbs
Zinc	5.9	14.5	8.6		29.0	lbs
Copper	1.6	3.9	2.3		7.7	lbs
Hydrocarbons	117.5	287.4	171.8		576.6	lbs

Analysis Point E

Pollutant	PRWS-51				Total Pnt E	Units
Sediment	1,543.2				1,543.2	lbs
Total N	40.5				40.5	lbs
Total P	4.4				4.4	lbs
Zinc	3.4				3.4	lbs
Copper	0.9				0.9	lbs
Hydrocarbons	67.5				67.5	lbs

IV. Pollutant Removal Efficiency by BMP:

<u>Proposed Best Management Practices:</u>
Catch Basins with Sumps
Hydrodynamic Separators (Offline)
Bioretention Basin
Extended Detention Pond
Sediment Chamber

Pollutant	% Pollutant Removal By BMP				
	Catch Basins w/ Sump [2]	*Hydro-Dynamic Separators* [2]	*Bioretention Basin* [3]	*Extended Detention Pond* [1]	*Sediment Chamber* [5]
Sediment	9	75	90	80	65
Total N	-	-	65	30	-
Total P	-	-	65	50	-
Zinc	-	21	81 [4]	70	65
Copper	-	-	79 [4]	70	65
Hydrocarbons	14	64	64 [2]	74 [2]	65

<u>Sources:</u>

[1] - Controlling urban runoff : a practical manual for planning and designing urban BMPs (Schueler, 1987)

[2] - University of New Hampshire Stormwater Center, 2012 Biennial Report

[3] - New Hampshire Stormwater Manual - Volume 1 - December 2008

[4] - Center for Watershed Protection - National Pollutant Removal Performance Database - Version 3 - September 2007

[5] - Stormwater Best Management Practice - Sediment Filters and Sediment Chambers - USEPA - December 2021

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

V. Pollutant Load Removal:

WS 11

Pollutant	Initial Pollutant Load (lbs)	Pollutant Load After BMP (lbs)				Percent Removal Effeciency
		Catch Basins w/ Sumps	Hydrodynamic Separator	Bioretention Basin 110	End Pollutant Load	
Sediment	990.5	901.3	225.3	22.5	22.5	97.7%
Total N	26.0	26.0	26.0	9.1	9.1	65.0%
Total P	2.8	2.8	2.8	1.0	1.0	65.0%
Zinc	2.2	2.2	1.7	0.3	0.3	85.0%
Copper	0.6	0.6	0.6	0.1	0.1	79.0%
Hydroc	43.3	37.3	13.4	4.8	4.8	88.9%

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

> **Analysis Point C**

WS 31

Pollutant	Initial Pollutant Load (lbs)	Proposed Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Catch Basins w/ Sumps	Sediment Chamber	Extended Detention Pond	End Pollutant Load	
Sediment	1344.9	1223.8	428.3	85.7	85.7	93.6%
Total N	35.3	35.3	35.3	24.7	24.7	30.0%
Total P	3.9	3.9	3.9	1.9	1.9	50.0%
Zinc	3.0	3.0	1.0	0.3	0.3	89.5%
Copper	0.8	0.8	0.3	0.1	0.1	89.5%
Hydroc	58.8	50.6	17.7	4.6	4.6	92.2%

WS 32

Pollutant	Initial Pollutant Load (lbs)	Proposed Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Hydrodynamic Separator	Bioretention Basin 320		End Pollutant Load	
Sediment	6780.9	1695.2	169.5		169.5	97.5%
Total N	178.0	178.0	62.3		62.3	65.0%
Total P	19.5	19.5	6.8		6.8	65.0%
Zinc	14.9	11.8	2.2		2.2	85.0%
Copper	4.0	4.0	0.8		0.8	79.0%
Hydroc	296.7	106.8	38.4		38.4	87.0%

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

> **Analysis Point D**

WS 41

Pollutant	Initial Pollutant Load (lbs)	Proposed Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Hydrodynamic Separator	Bioretention Basin 410	Extended Detention 410	End Pollutant Load	
Sediment	2684.9	671.2	67.1	13.4	13.4	99.5%
Total N	70.5	70.5	24.7	17.3	17.3	75.5%
Total P	7.7	7.7	2.7	1.4	1.4	82.5%
Zinc	5.9	4.2	0.8	0.2	0.2	96.0%
Copper	1.6	1.6	0.3	0.1	0.1	93.7%
Hydroc	117.5	42.3	15.2	4.0	4.0	96.6%

WS 43

Pollutant	Initial Pollutant Load (lbs)	Proposed Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Catch Basins w/ Sumps	Hydrodynamic Separator		End Pollutant Load	
Sediment	3925.8	3572.5	893.1		893.1	77.3%
Total N	103.1	103.1	103.1		103.1	0.0%
Total P	11.3	11.3	11.3		11.3	0.0%
Zinc	8.6	8.6	6.8		6.8	21.0%
Copper	2.3	2.3	2.3		2.3	0.0%
Hydroc	171.8	147.7	53.2		53.2	69.0%

WS 42 + WS 43 (After BMP Removals)

Pollutant	Initial Pollutant Load (lbs)	Proposed Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Catch Basins w/ Sumps	Hydrodynamic Separator	Bioretention Basin 420	End Pollutant Load	
Sediment	7462.5	6790.9	1697.7	169.8	169.8	97.7%
Total N	275.5	275.5	275.5	96.4	96.4	65.0%
Total P	30.2	30.2	30.2	10.6	10.6	65.0%
Zinc	21.3	21.3	16.8	3.2	3.2	85.0%
Copper	6.2	6.2	6.2	1.3	1.3	79.0%
Hydroc	340.6	292.9	105.4	38.0	38.0	88.9%

Simple Method (Schueler Method) for Estimating Pollutant Export from Urban Development Sites

> **Analysis Point E**

WS 51

Pollutant	Initial Pollutant Load (lbs)	Pollutant Load After BMP (lbs)				Percent Removal Efficiency
		Catch Basins w/ Sumps	Hydrodynamic Separator	Bioretention Basin 510	End Pollutant Load	
Sediment	1543.2	1404.3	351.1	35.1	35.1	97.7%
Total N	40.5	40.5	40.5	14.2	14.2	65.0%
Total P	4.4	4.4	4.4	1.6	1.6	65.0%
Zinc	3.4	3.4	2.7	0.5	0.5	85.0%
Copper	0.9	0.9	0.9	0.2	0.2	79.0%
Hydroc	67.5	58.1	20.9	7.5	7.5	88.9%

APPENDIX F

HYDROLOGIC ANALYSIS – INPUT COMPUTATIONS

Drainage Report

Southford Park

764 Southford Road (Route 188)

Middlebury, Connecticut 06762

December 22, 2022

(Revised January 24, 2023;
February 22, 2023; March 15, 2023; August 29, 2023)

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ **_Present_**] Developed Watershed: EXWS-10

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			11.83	827.98
C Soil	Meadow	71			6.04	428.81
C Soil	Open Space - Good Condition	74			2.94	217.59
C Soil	Gravel	89			0.08	7.18
D Soil	Woods - Good Condition	77			0.38	29.16
N/A	Paved/Impervious	98			0.34	33.61
N/A	Building	98			0.002	0.24
				Totals =	21.61	1544.57

(0.03377 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1544.57}{21.61}$$

Use CN = 71

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 3/14/23 Checked: Date:
Circle one: [✓ ***Present***] Developed Watershed: EXWS-VP

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			2.92	204.46
D Soil	Woods - Good Condition	77			0.33	25.17
				Totals =	3.25	229.63

(0.00507 sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{229.63}{3.25}$ Use CN = $\boxed{71}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ Present] Developed Watershed: EXWS-20

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Woods - Good Condition	70			0.69	48.28
C Soil	Meadow	71			1.27	90.44
C Soil	Open Space - Good Condition	74			0.09	6.44
N/A	Paved/Impervious	98			0.002	0.20
				Totals =	2.05	145.35

(0.00321 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{145.35}{2.05}$$

Use CN = $\boxed{71}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ ***Present***] Developed Watershed: EXWS-30

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
B Soil	Open Space - Good Condition	61			0.07	4.27
B Soil	Row Crops	78			0.79	61.64
C Soil	Woods - Good Condition	70			15.28	1069.53
C Soil	Meadow	71			9.49	673.61
C Soil	Open Space - Good Condition	74			5.80	429.15
C Soil	Row Crops	85			2.85	242.35
C Soil	Gravel	89			0.05	4.18
D Soil	Woods - Good Condition	77			1.10	84.95
D Soil	Meadow	78			0.01	0.64
D Soil	Open Space - Good Condition	80			0.16	12.50
N/A	Paved/Impervious	98			0.10	9.44
				Totals =	35.69	2592.25

(0.05576 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{2592.25}{35.69}$$

Use CN = $\boxed{73}$

SLR

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ Present] Developed Watershed: EXWS-31

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			1.90	133.06
C Soil	Meadow	71			1.93	136.68
C Soil	Open Space - Good Condition	74			2.59	191.66
C Soil	Gravel	89			0.02	1.86
N/A	Paved/Impervious	98			1.46	143.11
N/A	Building	98			1.07	105.16
					Totals =	8.97	711.52

(0.01402 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{711.52}{8.97}$$

Use CN = 79

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ Present] Developed Watershed: EXWS-40

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
A Soil	Woods - Good Condition	30			0.43	12.98
A Soil	Row Crops	67			0.96	64.10
B Soil	Woods - Good Condition	55			1.80	99.17
B Soil	Open Space - Good Condition	61			0.13	8.07
B Soil	Row Crops	78			2.85	222.16
C Soil	Woods - Good Condition	70			15.39	1077.16
C Soil	Open Space - Good Condition	74			0.83	61.11
C Soil	Row Crops	85			2.61	221.94
C Soil	Gravel	89			0.02	1.53
D Soil	Woods - Good Condition	77			3.93	302.49
N/A	Paved/Impervious	98			0.05	4.75
N/A	Building	98			0.05	5.37
				Totals =	29.05	2080.84
					(0.04539	sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{2080.84}{29.05}$$

Use CN = 72

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ Present] Developed Watershed: EXWS-41

Soil Name and Hydrologic Group (appendix A)	**Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)**	**CN Value [1.]**			**Area** [✓ Acres] Sq. Ft. %	**Product of CN x Area**
		Table 2-2	**Figure 2-3**	**Figure 2-4**		
C Soil	Woods - Good Condition	70			1.32	92.32
C Soil	Meadow	71			0.13	9.24
C Soil	Open Space - Good Condition	74			1.59	117.95
C Soil	Gravel	89			0.20	17.80
N/A	Paved/Impervious	98			2.02	198.20
				Totals =	5.27	435.52
					(0.00823	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{435.52}{5.27}$ Use CN = 83

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 12/22/22 Checked: Date:
Circle one: [✓ Present] Developed Watershed: EXWS-50

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value[1]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Woods - Good Condition	70			7.84	548.65
C Soil	Open Space - Good Condition	74			0.89	65.55
C Soil	Gravel	89			0.26	23.22
D Soil	Woods - Good Condition	77			0.89	68.16
N/A	Paved/Impervious	98			0.06	5.82
N/A	Building	98			0.12	11.86
				Totals =	10.05	723.26

(0.01570 sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{723.26}{10.05}$ Use CN = $\boxed{72}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: ______ Date: ______
Circle one: Present [✓ ***Developed***] Watershed: PRWS-10

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value 1.			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			3.36	235.46
C Soil	Meadow	71			2.22	157.53
C Soil	Open Space - Good Condition	74			2.88	213.23
D Soil	Woods - Good Condition	77			0.32	24.78
D Soil	Open Space - Good Condition	80			0.004	0.36
					Totals = 8.79	631.36

(0.01373 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{631.36}{8.79}$$

Use CN = 72

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: 3/14/23 Checked: Date:
Circle one: [✓ ***Present***] Developed Watershed: PRWS-VP

Soil Name and Hydrologic Group **(appendix A)**	**Cover Description** **(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)**	**CN Value [1.]**			**Area** [✓ **Acres**] Sq. Ft. %	**Product of CN x Area**
		Table 2-2	**Figure 2-3**	**Figure 2-4**		
C Soil	Woods - Good Condition	70			0.70	49.30
C Soil	Open Space - Good Condition	74			0.43	31.57
D Soil	Woods - Good Condition	77			0.33	25.17
				Totals =	1.46	106.04

(0.00228 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{106.04}{1.46}$$

Use CN = 73

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ ***Developed***] Watershed: PRWS-11

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Open Space - Good Condition	74			1.62	119.71
N/A	Paved/Impervious	98			1.17	114.89
				Totals =	2.79	234.60

(0.00436 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{234.60}{2.79}$$

Use CN = 84

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ ***Developed***] Watershed: PRWS-20

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value[1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			0.69	48.28
C Soil	Meadow	71			1.27	90.44
C Soil	Open Space - Good Condition	74			0.09	6.59
				Totals =	2.05	145.31

(0.00321 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{145.31}{2.05}$$

Use CN = 71

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: ________ Date: ________
Circle one: Present [✓ ***Developed***] Watershed: PRWS-30

Soil Name and Hydrologic Group (appendix A)	**Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)**	**CN Value**[1]			**Area**	**Product of CN x Area**
		Table 2-2	**Figure 2-3**	**Figure 2-4**	[✓ Acres] Sq. Ft. %	
B Soil	Open Space - Good Condition	61			0.07	4.27
B Soil	Row Crops	78			0.79	61.64
C Soil	Woods - Good Condition	70			13.30	930.73
C Soil	Meadow	71			4.11	291.76
C Soil	Open Space - Good Condition	74			4.54	336.20
C Soil	Row Crops	85			2.85	242.35
D Soil	Woods - Good Condition	77			1.10	84.95
D Soil	Meadow	78			0.01	0.64
D Soil	Open Space - Good Condition	80			0.16	12.50
N/A	Paved/Impervious	98			0.03	3.08
				Totals =	26.96	1968.11

(0.04212 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1968.11}{26.96}$$

Use CN = $\boxed{73}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ Developed] Watershed: PRWS-31

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			1.88	131.41
C Soil	Open Space - Good Condition	74			4.75	351.21
N/A	Paved/Impervious	98			1.43	140.10
				Totals =	8.05	622.72

(0.01258 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{622.72}{8.05}$$

Use CN = $\boxed{77}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ Developed] Watershed: PRWS-32

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Open Space - Good Condition	74			1.58	117.19
N/A	Building	98			8.90	871.74
				Totals =	10.48	988.93

(0.01637 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{988.93}{10.48}$$

Use CN = $\boxed{94}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: ______ Date: ______
Circle one: Present [✓ ***Developed***] Watershed: PRWS-40

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	**Figure 2-3**	**Figure 2-4**		
A Soil	Woods - Good Condition	30			0.43	12.98
A Soil	Row Crops	67			0.96	64.10
B Soil	Woods - Good Condition	55			1.80	99.17
B Soil	Open Space - Good Condition	61			0.13	8.07
B Soil	Row Crops	78			2.85	222.16
C Soil	Woods - Good Condition	70			5.68	397.91
C Soil	Open Space - Good Condition	74			2.39	176.56
C Soil	Row Crops	85			2.61	221.94
D Soil	Woods - Good Condition	77			2.04	157.40
D Soil	Open Space - Good Condition	80			0.92	73.57
N/A	Paved/Impervious	98			0.70	68.85
N/A	Building	98			0.02	1.55
				Totals =	20.54	1504.27
					(0.03209 sq mi)	

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{1504.27}{20.54}$$

Use CN = 73

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ Developed] Watershed: PRWS-41

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Woods - Good Condition	70			1.02	71.14
C Soil	Open Space - Good Condition	74			0.06	4.45
N/A	Building	98			3.50	343.04
				Totals =	4.58	418.63
					(0.00715	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{418.63}{4.58}$ Use CN = 91

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ ***Developed***] Watershed: PRWS-42

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Open Space - Good Condition	74			3.01	222.58
D Soil	Open Space - Good Condition	80			0.68	54.18
N/A	Building	98			2.99	292.92
N/A	Paved/Impervious	98			4.38	429.69
				Totals =	11.06	999.38
					(0.01728 sq mi)	

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{999.38}{11.06}$$

Use CN = 90

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ ***Developed***] Watershed: PRWS-11

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area [✓ Acres] Sq. Ft. %	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4		
C Soil	Open Space - Good Condition	74			1.51	112.08
N/A	Paved/Impervious	98			5.12	501.96
				Totals =	6.64	614.04
					(0.01037	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{614.04}{6.64}$ Use CN = 93

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: ______ Date: ______
Circle one: Present [✓ Developed] Watershed: PRWS-50

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Woods - Good Condition	70			3.40	237.90
C Soil	Open Space - Good Condition	74			2.28	168.94
C Soil	Gravel	89			0.04	3.71
D Soil	Woods - Good Condition	77			0.66	50.51
D Soil	Open Space - Good Condition	80			0.22	17.45
N/A	Paved/Impervious	98			0.22	21.48
N/A	Building	98			0.03	3.32
				Totals =	6.85	503.31
					(0.01070	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{503.31}{6.85}$ Use CN = $\boxed{73}$

Curve Number Calculations

Project: Southford Park
Location: 764 Southford Road
Middlebury, CT
By: MCB Date: Rev. 3/14/23 Checked: Date:
Circle one: Present [✓ ***Developed***] Watershed: PRWS-51

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.]			Area	Product of CN x Area
		Table 2-2	Figure 2-3	Figure 2-4	[✓ Acres] Sq. Ft. %	
C Soil	Woods - Good Condition	70			0.27	18.61
C Soil	Open Space - Good Condition	74			2.74	202.90
D Soil	Open Space - Good Condition	80			0.06	4.46
N/A	Paved/Impervious	98			1.51	147.73
				Totals =	4.57	373.70

(0.00714 sq mi)

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{373.70}{4.57}$$

Use CN = 82

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-10
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID	**A-B**		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.010		
6. $T_t = \dfrac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.446	=	0.446

Shallow concentrated flow (assume hyd. radius = depth of flow)

	Segment ID	**B-C**						
7. Surface description		WOODS						
8. Manning's roughness coeff., n		0.100						
9. Paved or unpaved		UNPVD						
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40						
11. Flow Length, L	ft.	56.0						
12. Watercourse slope, s	ft./ft.	0.036						
13. Average velocity, $V = \dfrac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.53						
14. $T_t = \dfrac{L}{3600 * V}$	hr.	0.010	+				=	0.010

Channel flow

	Segment ID							
15. Channel Bottom width, b	ft.							
16. Horizontal side slope component, z (z horiz:1 vert)	ft.							
17. Depth of flow, d	ft.							
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$							
19. Wetted perimeter, P_w	ft.							
20. Hydraulic Radius, $R = \dfrac{A}{P_w}$	ft.							
21. Channel slope, s	ft./ft.							
22. Manning's roughness coeff., n								
23. $V = \dfrac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.							
24. Flow length, L	ft.							
25. $T_t = \dfrac{L}{3600 * V}$	hr.		+				=	0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.456

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-20
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.045		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.162	=	0.162

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**		**C-D**				
7. Surface description		GRASS		WOODS				
8. Manning's roughness coeff., n		0.080		0.100				
9. Paved or unpaved		UNPVD		UNPVD				
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.40				
11. Flow Length, L	ft.	478.0		158.0				
12. Watercourse slope, s	ft./ft.	0.086		0.082				
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	2.97		2.32				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.045	+	0.019			=	0.064

Channel flow

Segment ID								
15. Channel Bottom width, b	ft.							
16. Horizontal side slope component, z (z horiz:1 vert)	ft.							
17. Depth of flow, d	ft.							
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$							
19. Wetted perimeter, P_w	ft.							
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.							
21. Channel slope, s	ft./ft.							
22. Manning's roughness coeff., n								
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.							
24. Flow length, L	ft.							
25. $T_t = \frac{L}{3600 * V}$	hr.		+				=	0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.226

SLR

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-30
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.030		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.287	=	0.287

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**		**C-D**		**D-E**		**E-F**		
7. Surface description		WOODS		CROPS		WOODS		GRASS		
8. Manning's roughness coeff., n		0.100		0.058		0.100		0.080		
9. Paved or unpaved		UNPVD		UNPVD		UNPVD		UNPVD		
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.40		0.40		0.40		
11. Flow Length, L	ft.	141.0		480.0		62.0		62.0		
12. Watercourse slope, s	ft./ft.	0.050		0.021		0.016		0.016		
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.81		2.02		1.02		1.28		
14. $T_t = \frac{L}{3600 * V}$	hr.	0.022	+	0.066	+	0.017	+	0.013	=	0.118

Channel flow

Segment ID										
15. Channel Bottom width, b	ft.									
16. Horizontal side slope component, z (z horiz:1 vert)	ft.									
17. Depth of flow, d	ft.									
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$									
19. Wetted perimeter, P_w	ft.									
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.									
21. Channel slope, s	ft./ft.									
22. Manning's roughness coeff., n										
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.									
24. Flow length, L	ft.									
25. $T_t = \frac{L}{3600 * V}$	hr.		+						=	0.000
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)								hr.		0.405

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-31
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.045		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.162	=	0.162

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**		**C-D**				
7. Surface description		GRASS		BIT				
8. Manning's roughness coeff., n		0.080		0.015				
9. Paved or unpaved		UNPVD		PVD				
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.20				
11. Flow Length, L	ft.	234.0		176.0				
12. Watercourse slope, s	ft./ft.	0.111		0.034				
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	3.37		6.26				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.019	+	0.008			=	0.027

Channel flow

Segment ID		**D-E**					
15. Channel Bottom width, b	ft.	18" RCP					
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	--					
17. Depth of flow, d	ft.	FULL					
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$	1.77					
19. Wetted perimeter, P_w	ft.	4.71					
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.38					
21. Channel slope, s	ft./ft.	0.035					
22. Manning's roughness coeff., n		0.013					
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	11.17					
24. Flow length, L	ft.	1055.0					
25. $T_t = \frac{L}{3600 * V}$	hr.	0.026				=	0.026
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)						hr.	0.216

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-40
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.010		
6. $T_t = \dfrac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.446	=	0.446

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**					
7. Surface description		WOODS					
8. Manning's roughness coeff., n		0.100					
9. Paved or unpaved		UNPVD					
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40					
11. Flow Length, L	ft.	1035.0					
12. Watercourse slope, s	ft./ft.	0.043					
13. Average velocity, $V = \dfrac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.68					
14. $T_t = \dfrac{L}{3600 * V}$	hr.	0.171	+			=	0.171

Channel flow

Segment ID							
15. Channel Bottom width, b	ft.						
16. Horizontal side slope component, z (z horiz:1 vert)	ft.						
17. Depth of flow, d	ft.						
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$						
19. Wetted perimeter, P_w	ft.						
20. Hydraulic Radius, $R = \dfrac{A}{P_w}$	ft.						
21. Channel slope, s	ft./ft.						
22. Manning's roughness coeff., n							
23. $V = \dfrac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.						
24. Flow length, L	ft.						
25. $T_t = \dfrac{L}{3600 * V}$	hr.		+			=	0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.617

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ Present] Developed
Watershed: EXWS-41
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID	**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.045		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.162	=	0.162

Shallow concentrated flow (assume hyd. radius = depth of flow)

	Segment ID	**B-C**		**C-D**				
7. Surface description		GRASS		BIT				
8. Manning's roughness coeff., n		0.080		0.015				
9. Paved or unpaved		UNPVD		PVD				
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.20				
11. Flow Length, L	ft.	18.0		246.0				
12. Watercourse slope, s	ft./ft.	0.045		0.037				
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	2.14		6.53				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.002	+	0.010			=	0.013

Channel flow

	Segment ID	**D-E**		**E-F**				
15. Channel Bottom width, b	ft.	12" RCP		15" RCP				
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	--		--				
17. Depth of flow, d	ft.	FULL		FULL				
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$	0.79		1.23				
19. Wetted perimeter, P_w	ft.	3.14		3.93				
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.25		0.31				
21. Channel slope, s	ft./ft.	0.038		0.047				
22. Manning's roughness coeff., n		0.013		0.013				
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	8.90		11.45				
24. Flow length, L	ft.	280.0		221.0				
25. $T_t = \frac{L}{3600 * V}$	hr.	0.009	+	0.005			=	0.014
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)						hr.		0.189

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: [✓ ***Present***] Developed
Watershed: EXWS-50
Circle one: [✓ ***T_c***] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID	**A-B**		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.025		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.309	=	0.309

Shallow concentrated flow (assume hyd. radius = depth of flow)

	Segment ID	**B-C**						
7. Surface description		WOODS						
8. Manning's roughness coeff., n		0.100						
9. Paved or unpaved		UNPVD						
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40						
11. Flow Length, L	ft.	620.0						
12. Watercourse slope, s	ft./ft.	0.079						
13. Average velocity, $V = \frac{1.49}{n}(d^{\frac{2}{3}})(s^{\frac{1}{2}})$	fps.	2.27						
14. $T_t = \frac{L}{3600 * V}$	hr.	0.076	+				=	0.076

Channel flow

	Segment ID							
15. Channel Bottom width, b	ft.							
16. Horizontal side slope component, z (z horiz:1 vert)	ft.							
17. Depth of flow, d	ft.							
18. Cross sectional flow area, A (assume trapazoidal)	ft.^{2}							
19. Wetted perimeter, P_w	ft.							
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.							
21. Channel slope, s	ft./ft.							
22. Manning's roughness coeff., n								
23. $V = \frac{1.49}{n}(R^{\frac{2}{3}})(s^{\frac{1}{2}})$	fps.							
24. Flow length, L	ft.							
25. $T_t = \frac{L}{3600 * V}$	hr.		+				=	0.000
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)							hr.	0.385

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
Location: Middlebury, CT
Circle one: Present [✓ Developed]
Circle one: [✓ T_c] T_t

By: MCB
Checked:
Watershed: PRWS-10
Subwatershed:

Date: 03/15/23
Date:

Sheet flow (applicable to T_c only)

Segment ID		A-B		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.060		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.145	=	0.145

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		B-C		C-D				
7. Surface description		GRASS		WOODS				
8. Manning's roughness coeff., n		0.080		0.100				
9. Paved or unpaved		UNPVD		UNPVD				
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.40				
11. Flow Length, L	ft.	151.0		73.0				
12. Watercourse slope, s	ft./ft.	0.119		0.151				
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	3.49		3.14				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.012	+	0.006			=	0.018

Channel flow

Segment ID		D-E		E-F				
15. Channel Bottom width, b	ft.	3.00		12" RCP				
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	6.00		--				
17. Depth of flow, d	ft.	0.50		FULL				
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$	3.00		0.79				
19. Wetted perimeter, P_w	ft.	9.08		3.14				
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.33		0.25				
21. Channel slope, s	ft./ft.	0.02		0.015				
22. Manning's roughness coeff., n		0.024		0.013				
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	4.20		5.59				
24. Flow length, L	ft.	380.0		118.0				
25. $T_t = \frac{L}{3600 * V}$	hr.	0.025	+	0.006			=	0.031

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.194

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park By: MCB Date: 03/15/23
Location: Middlebury, CT Checked: Date:
Circle one: Present [✓ Developed] Watershed: PRWS-11
Circle one: [✓ T_c] T_t Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID	**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.050		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.156	=	0.156

Shallow concentrated flow (assume hyd. radius = depth of flow)

	Segment ID	**B-C**		**C-D**						
7. Surface description		GRASS		BIT						
8. Manning's roughness coeff., n		0.080		0.015						
9. Paved or unpaved		UNPVD		PVD						
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.20						
11. Flow Length, L	ft.	20.0		77.0						
12. Watercourse slope, s	ft./ft.	0.025		0.013						
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.60		3.87						
14. $T_t = \frac{L}{3600 * V}$	hr.	0.003	+	0.006	+				=	0.009

Channel flow

	Segment ID	**D-E**		**E-F**						
15. Channel Bottom width, b	ft.	15" RCP		18" RCP						
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	--		--						
17. Depth of flow, d	ft.	FULL		FULL						
18. Cross sectional flow area, A (assume trapazoidal)	ft.^{2}	1.23		1.77						
19. Wetted perimeter, P_w	ft.	3.93		4.71						
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.31		0.38						
21. Channel slope, s	ft./ft.	0.013		0.062						
22. Manning's roughness coeff., n		0.013		0.013						
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	6.02		14.86						
24. Flow length, L	ft.	197.0		120.0						
25. $T_t = \frac{L}{3600 * V}$	hr.	0.009	+	0.002					=	0.011
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)							hr.			0.176

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ Developed]
Watershed: PRWS-20
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.045		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.162	=	0.162

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**		**C-D**				
7. Surface description		GRASS		WOODS				
8. Manning's roughness coeff., n		0.080		0.100				
9. Paved or unpaved		UNPVD		UNPVD				
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40		0.40				
11. Flow Length, L	ft.	478.0		158.0				
12. Watercourse slope, s	ft./ft.	0.086		0.082				
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	2.97		2.32				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.045	+	0.019			=	0.064

Channel flow

Segment ID								
15. Channel Bottom width, b	ft.							
16. Horizontal side slope component, z (z horiz:1 vert)	ft.							
17. Depth of flow, d	ft.							
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$							
19. Wetted perimeter, P_w	ft.							
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.							
21. Channel slope, s	ft./ft.							
22. Manning's roughness coeff., n								
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.							
24. Flow length, L	ft.							
25. $T_t = \frac{L}{3600 * V}$	hr.		+				=	0.000
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)	hr.							0.226

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park By: MCB Date: 03/15/23
Location: Middlebury, CT Checked: Date:
Circle one: Present [✓ Developed] Watershed: PRWS-30
Circle one: [✓ T_c] T_t Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		A-B		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.030		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.287	=	0.287

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		B-C	C-D	D-E	E-F	
7. Surface description		WOODS	CROPS	WOODS	GRASS	
8. Manning's roughness coeff., n		0.100	0.058	0.100	0.080	
9. Paved or unpaved		UNPVD	UNPVD	UNPVD	UNPVD	
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40	0.40	0.40	0.40	
11. Flow Length, L	ft.	141.0	480.0	62.0	62.0	
12. Watercourse slope, s	ft./ft.	0.050	0.021	0.016	0.016	
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.81	2.02	1.02	1.28	
14. $T_t = \frac{L}{3600 * V}$	hr.	0.022 +	0.066 +	0.017 +	0.013 =	0.118

Channel flow

Segment ID						
15. Channel Bottom width, b	ft.					
16. Horizontal side slope component, z (z horiz:1 vert)	ft.					
17. Depth of flow, d	ft.					
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$					
19. Wetted perimeter, P_w	ft.					
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.					
21. Channel slope, s	ft./ft.					
22. Manning's roughness coeff., n						
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.					
24. Flow length, L	ft.					
25. $T_t = \frac{L}{3600 * V}$	hr.	+			=	0.000
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)	hr.					0.405

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ Developed]
Watershed: PRWS-31
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	72.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.181		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.072	=	0.072

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**					
7. Surface description		BIT					
8. Manning's roughness coeff., n		0.015					
9. Paved or unpaved		PVD					
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.20					
11. Flow Length, L	ft.	322.0					
12. Watercourse slope, s	ft./ft.	0.040					
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	6.79					
14. $T_t = \frac{L}{3600 * V}$	hr.	0.013	+			=	0.013

Channel flow

Segment ID		**C-D**	**D-E**	**E-F**	**F-G**		
15. Channel Bottom width, b	ft.	12" HDPE	15" HDPE	18" HDPE	18" RCP		
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	--	--	--	--		
17. Depth of flow, d	ft.	FULL	FULL	FULL	FULL		
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$	0.79	1.23	1.77	1.77		
19. Wetted perimeter, P_w	ft.	3.14	3.93	4.71	4.71		
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.25	0.31	0.38	0.38		
21. Channel slope, s	ft./ft.	0.031	0.026	0.028	0.035		
22. Manning's roughness coeff., n		0.012	0.012	0.012	0.013		
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	8.71	9.23	10.82	11.17		
24. Flow length, L	ft.	690.0	271.0	312	472.0		
25. $T_t = \frac{L}{3600 * V}$	hr.	0.022	0.008	0.008	0.012	=	0.050
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)					hr.		0.135

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ Developed]
Watershed: PRWS-40
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID		**A-B**	
1. Surface description (Table 3-1)			WOODS	
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)			0.400	
3. Flow Length, L (< 300ft)		ft.	100.0	
4. Two-year 24-hr rainfall, P_2		in.	3.59	
5. Land slope, s		ft./ft.	0.040	
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$		hr.	0.256	= 0.256

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**					
7. Surface description		WOODS					
8. Manning's roughness coeff., n		0.100					
9. Paved or unpaved		UNPVD					
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40					
11. Flow Length, L	ft.	1206.0					
12. Watercourse slope, s	ft./ft.	0.034					
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	1.49					
14. $T_t = \frac{L}{3600 * V}$	hr.	0.225	+				= 0.225

Channel flow

Segment ID						
15. Channel Bottom width, b	ft.					
16. Horizontal side slope component, z (z horiz:1 vert)	ft.					
17. Depth of flow, d	ft.					
18. Cross sectional flow area, A (assume trapazoidal)	ft.^{2}					
19. Wetted perimeter, P_w	ft.					
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.					
21. Channel slope, s	ft./ft.					
22. Manning's roughness coeff., n						
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.					
24. Flow length, L	ft.					
25. $T_t = \frac{L}{3600 * V}$	hr.		+			= 0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.481

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ Developed]
Watershed: PRWS-41
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		A-B		
1. Surface description (Table 3-1)		GRASS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3. Flow Length, L (< 300ft)	ft.	68.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.088		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.091	=	0.091

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID							
7. Surface description							
8. Manning's roughness coeff., n							
9. Paved or unpaved							
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.						
11. Flow Length, L	ft.						
12. Watercourse slope, s	ft./ft.						
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.						
14. $T_t = \frac{L}{3600 * V}$	hr.		+				= 0.000

Channel flow

Segment ID							
15. Channel Bottom width, b	ft.						
16. Horizontal side slope component, z (z horiz:1 vert)	ft.						
17. Depth of flow, d	ft.						
18. Cross sectional flow area, A (assume trapazoidal)	ft.^{2}						
19. Wetted perimeter, P_w	ft.						
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.						
21. Channel slope, s	ft./ft.						
22. Manning's roughness coeff., n							
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.						
24. Flow length, L	ft.						
25. $T_t = \frac{L}{3600 * V}$	hr.		+				= 0.000
26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25)	hr.						0.091

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ ***Developed***]
Watershed: PRWS-42
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**
1. Surface description (Table 3-1)		GRASS
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240
3. Flow Length, L (< 300ft)	ft.	34.0
4. Two-year 24-hr rainfall, P_2	in.	3.59
5. Land slope, s	ft./ft.	0.059
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.061 = 0.061

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID
7. Surface description
8. Manning's roughness coeff., n
9. Paved or unpaved
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved) ft.
11. Flow Length, L ft.
12. Watercourse slope, s ft./ft.
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$ fps.
14. $T_t = \frac{L}{3600 * V}$ hr. + = 0.000

Channel flow

Segment ID
15. Channel Bottom width, b ft.
16. Horizontal side slope component, z (z horiz:1 vert) ft.
17. Depth of flow, d ft.
18. Cross sectional flow area, A (assume trapazoidal) ft.^{2}
19. Wetted perimeter, P_w ft.
20. Hydraulic Radius, $R = \frac{A}{P_w}$ ft.
21. Channel slope, s ft./ft.
22. Manning's roughness coeff., n
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$ fps.
24. Flow length, L ft.
25. $T_t = \frac{L}{3600 * V}$ hr. + = 0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. ~~0.061~~

Min Tc = 0.1 hr

SLR

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
By: MCB
Date: 03/15/23
Location: Middlebury, CT
Checked:
Date:
Circle one: Present [✓ Developed]
Watershed: PRWS-50
Circle one: [✓ T_c] T_t
Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**		
1. Surface description (Table 3-1)		WOODS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.400		
3. Flow Length, L (< 300ft)	ft.	100.0		
4. Two-year 24-hr rainfall, P_2	in.	3.59		
5. Land slope, s	ft./ft.	0.090		
6. $T_t = \dfrac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.185	=	0.185

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**					
7. Surface description		WOODS					
8. Manning's roughness coeff., n		0.100					
9. Paved or unpaved		UNPVD					
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.40					
11. Flow Length, L	ft.	210.0					
12. Watercourse slope, s	ft./ft.	0.105					
13. Average velocity, $V = \dfrac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	2.62					
14. $T_t = \dfrac{L}{3600 * V}$	hr.	0.022	+			=	0.022

Channel flow

Segment ID							
15. Channel Bottom width, b	ft.						
16. Horizontal side slope component, z (z horiz:1 vert)	ft.						
17. Depth of flow, d	ft.						
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$						
19. Wetted perimeter, P_w	ft.						
20. Hydraulic Radius, $R = \dfrac{A}{P_w}$	ft.						
21. Channel slope, s	ft./ft.						
22. Manning's roughness coeff., n							
23. $V = \dfrac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.						
24. Flow length, L	ft.						
25. $T_t = \dfrac{L}{3600 * V}$	hr.		+			=	0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.207

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Southford Park
Location: Middlebury, CT
Circle one: Present [✓ Developed]
Circle one: [✓ T_c] T_t
By: MCB
Checked:
Watershed: PRWS-51
Subwatershed:
Date: 03/15/23
Date:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**	
1. Surface description (Table 3-1)		GRASS	
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240	
3. Flow Length, L (< 300ft)	ft.	30.0	
4. Two-year 24-hr rainfall, P_2	in.	3.59	
5. Land slope, s	ft./ft.	0.083	
6. $T_t = \dfrac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,(s^{0.4})}$	hr.	0.048	= 0.048

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID		**B-C**	**C-D**			
7. Surface description		BIT	BIT			
8. Manning's roughness coeff., n		0.015	0.015			
9. Paved or unpaved		PVD	PVD			
10. Depth of flow, d (default values: d=.4 unpaved, d=.2 paved)	ft.	0.20	0.20			
11. Flow Length, L	ft.	358.0	246.0			
12. Watercourse slope, s	ft./ft.	0.045	0.037			
13. Average velocity, $V = \dfrac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	7.21	6.53			
14. $T_t = \dfrac{L}{3600 * V}$	hr.	0.014	+ 0.010			= 0.024

Channel flow

Segment ID		**D-E**	**E-F**	**F-G**		
15. Channel Bottom width, b	ft.	12" HDPE	15" HDPE	18" HDPE		
16. Horizontal side slope component, z (z horiz:1 vert)	ft.	--	--	--		
17. Depth of flow, d	ft.	FULL	FULL	FULL		
18. Cross sectional flow area, A (assume trapazoidal)	$ft.^2$	0.79	1.23	1.77		
19. Wetted perimeter, P_w	ft.	3.14	3.93	4.71		
20. Hydraulic Radius, $R = \dfrac{A}{P_w}$	ft.	0.25	0.31	0.38		
21. Channel slope, s	ft./ft.	0.027	0.076	0.029		
22. Manning's roughness coeff., n		0.012	0.012	0.012		
23. $V = \dfrac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	8.13	15.78	11.01		
24. Flow length, L	ft.	289.0	165.0	48		
25. $T_t = \dfrac{L}{3600 * V}$	hr.	0.010	+ 0.003	+ 0.001		= 0.014

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. ~~0.087~~

Min Tc=0.1 hr

NOAA Atlas 14, Volume 10, Version 3
Location name: Town of Middlebury, Connecticut, USA*
Latitude: 41.5135°, Longitude: -73.1493°
Elevation: 738.88 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.363** (0.277-0.472)	**0.430** (0.328-0.560)	**0.539** (0.410-0.705)	**0.630** (0.477-0.827)	**0.755** (0.555-1.03)	**0.850** (0.613-1.18)	**0.948** (0.665-1.36)	**1.06** (0.706-1.55)	**1.21** (0.780-1.82)	**1.33** (0.838-2.04)
10-min	**0.514** (0.392-0.669)	**0.609** (0.464-0.793)	**0.764** (0.581-0.998)	**0.893** (0.675-1.17)	**1.07** (0.786-1.46)	**1.20** (0.867-1.67)	**1.34** (0.942-1.93)	**1.50** (1.00-2.19)	**1.71** (1.10-2.58)	**1.88** (1.19-2.89)
15-min	**0.605** (0.462-0.787)	**0.717** (0.546-0.933)	**0.900** (0.683-1.18)	**1.05** (0.794-1.38)	**1.26** (0.924-1.72)	**1.42** (1.02-1.97)	**1.58** (1.11-2.26)	**1.76** (1.18-2.58)	**2.01** (1.30-3.04)	**2.21** (1.40-3.40)
30-min	**0.828** (0.632-1.08)	**0.981** (0.747-1.28)	**1.23** (0.935-1.61)	**1.44** (1.09-1.89)	**1.72** (1.26-2.34)	**1.94** (1.39-2.69)	**2.16** (1.51-3.09)	**2.40** (1.61-3.52)	**2.74** (1.77-4.14)	**3.00** (1.90-4.63)
60-min	**1.05** (0.802-1.37)	**1.25** (0.949-1.62)	**1.56** (1.19-2.04)	**1.82** (1.38-2.39)	**2.18** (1.60-2.97)	**2.46** (1.77-3.41)	**2.74** (1.92-3.92)	**3.04** (2.04-4.46)	**3.46** (2.24-5.24)	**3.80** (2.40-5.85)
2-hr	**1.39** (1.07-1.79)	**1.63** (1.25-2.11)	**2.03** (1.55-2.63)	**2.36** (1.79-3.07)	**2.81** (2.08-3.80)	**3.15** (2.29-4.35)	**3.51** (2.48-5.00)	**3.90** (2.63-5.69)	**4.46** (2.90-6.71)	**4.91** (3.12-7.53)
3-hr	**1.61** (1.24-2.07)	**1.89** (1.46-2.44)	**2.36** (1.81-3.05)	**2.74** (2.09-3.56)	**3.27** (2.43-4.42)	**3.67** (2.67-5.05)	**4.09** (2.90-5.82)	**4.56** (3.07-6.62)	**5.24** (3.41-7.85)	**5.80** (3.69-8.85)
6-hr	**2.03** (1.58-2.60)	**2.41** (1.87-3.09)	**3.04** (2.35-3.91)	**3.56** (2.74-4.60)	**4.28** (3.20-5.76)	**4.82** (3.53-6.61)	**5.39** (3.86-7.67)	**6.05** (4.09-8.74)	**7.04** (4.59-10.5)	**7.87** (5.02-11.9)
12-hr	**2.48** (1.94-3.15)	**3.01** (2.35-3.82)	**3.87** (3.02-4.94)	**4.59** (3.55-5.88)	**5.58** (4.20-7.48)	**6.31** (4.67-8.64)	**7.10** (5.13-10.1)	**8.05** (5.47-11.6)	**9.49** (6.21-14.1)	**10.7** (6.86-16.2)
24-hr	**2.90** (2.28-3.66)	**3.59** (2.82-4.53)	**4.72** (3.70-5.98)	**5.66** (4.41-7.20)	**6.95** (5.27-9.28)	**7.90** (5.89-10.8)	**8.94** (6.52-12.7)	**10.2** (6.96-14.6)	**12.2** (8.02-18.0)	**14.0** (8.96-20.9)
2-day	**3.28** (2.60-4.12)	**4.13** (3.27-5.18)	**5.50** (4.34-6.93)	**6.64** (5.21-8.40)	**8.21** (6.28-10.9)	**9.36** (7.04-12.8)	**10.6** (7.85-15.1)	**12.3** (8.39-17.4)	**14.9** (9.79-21.8)	**17.2** (11.1-25.6)
3-day	**3.58** (2.85-4.47)	**4.50** (3.58-5.63)	**6.01** (4.77-7.54)	**7.27** (5.73-9.16)	**8.99** (6.91-11.9)	**10.3** (7.74-13.9)	**11.7** (8.63-16.6)	**13.5** (9.23-19.1)	**16.4** (10.8-23.9)	**19.0** (12.2-28.2)
4-day	**3.84** (3.07-4.78)	**4.82** (3.85-6.01)	**6.43** (5.11-8.04)	**7.76** (6.14-9.76)	**9.60** (7.39-12.7)	**10.9** (8.28-14.8)	**12.4** (9.22-17.6)	**14.4** (9.85-20.3)	**17.5** (11.5-25.4)	**20.2** (13.0-29.9)
7-day	**4.58** (3.68-5.67)	**5.67** (4.55-7.04)	**7.46** (5.97-9.28)	**8.94** (7.11-11.2)	**11.0** (8.49-14.4)	**12.5** (9.47-16.8)	**14.1** (10.5-19.8)	**16.2** (11.2-22.7)	**19.5** (12.9-28.2)	**22.4** (14.5-32.9)
10-day	**5.32** (4.29-6.56)	**6.47** (5.21-7.99)	**8.35** (6.70-10.3)	**9.91** (7.90-12.3)	**12.1** (9.33-15.7)	**13.6** (10.4-18.2)	**15.4** (11.4-21.3)	**17.5** (12.1-24.4)	**20.7** (13.8-29.9)	**23.5** (15.3-34.5)
20-day	**7.61** (6.18-9.32)	**8.82** (7.16-10.8)	**10.8** (8.74-13.3)	**12.5** (10.0-15.4)	**14.8** (11.5-19.0)	**16.5** (12.5-21.6)	**18.3** (13.4-24.8)	**20.3** (14.1-28.1)	**23.2** (15.5-33.2)	**25.6** (16.6-37.3)
30-day	**9.52** (7.76-11.6)	**10.8** (8.77-13.2)	**12.8** (10.4-15.7)	**14.5** (11.7-17.9)	**16.8** (13.1-21.5)	**18.6** (14.2-24.2)	**20.5** (15.0-27.4)	**22.4** (15.6-30.9)	**25.1** (16.8-35.7)	**27.2** (17.7-39.5)
45-day	**11.9** (9.72-14.4)	**13.2** (10.8-16.0)	**15.3** (12.5-18.7)	**17.0** (13.8-20.9)	**19.5** (15.2-24.7)	**21.3** (16.2-27.5)	**23.2** (17.0-30.8)	**25.1** (17.6-34.4)	**27.6** (18.6-39.2)	**29.6** (19.3-42.8)
60-day	**13.8** (11.4-16.8)	**15.2** (12.4-18.4)	**17.4** (14.2-21.1)	**19.2** (15.6-23.5)	**21.7** (17.0-27.4)	**23.6** (18.0-30.3)	**25.5** (18.7-33.8)	**27.4** (19.3-37.5)	**30.0** (20.2-42.4)	**31.9** (20.9-46.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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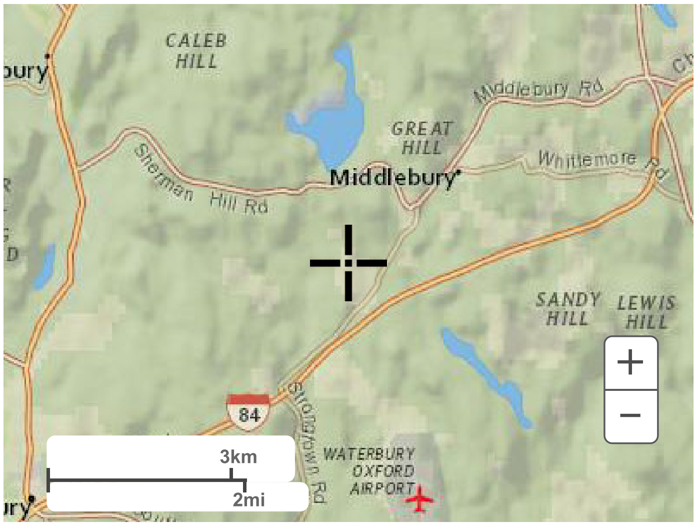
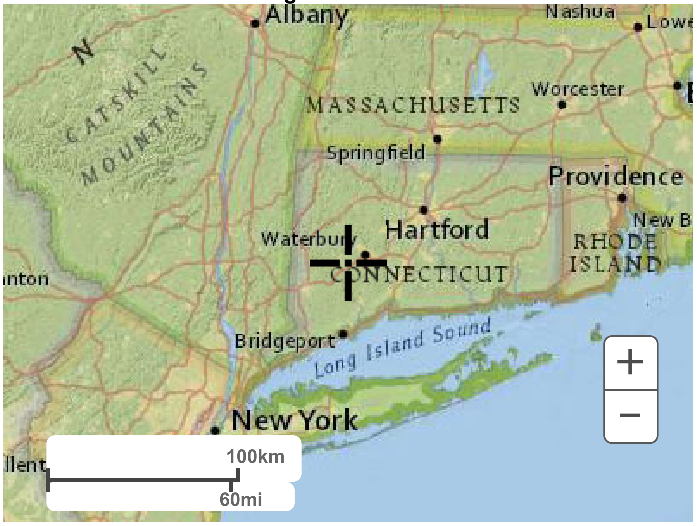
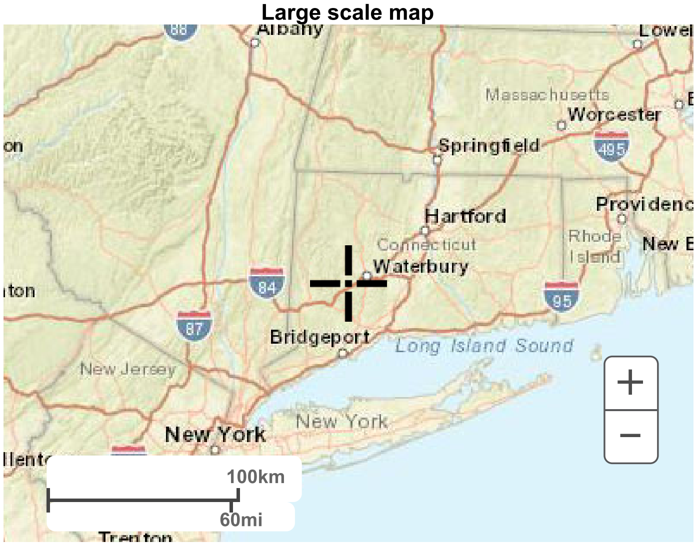
PF graphical



Large scale terrain



Large scale map



Large scale aerial

APPENDIX G

HYDROLOGIC ANALYSIS – COMPUTER MODEL RESULTS

Drainage Report

Southford Park

764 Southford Road (Route 188)

Middlebury, Connecticut 06762

December 22, 2022

(Revised January 24, 2023;
February 22, 2023; March 15, 2023; August 29, 2023)

Hydrographs Peak Flowrate Summary (cfs)

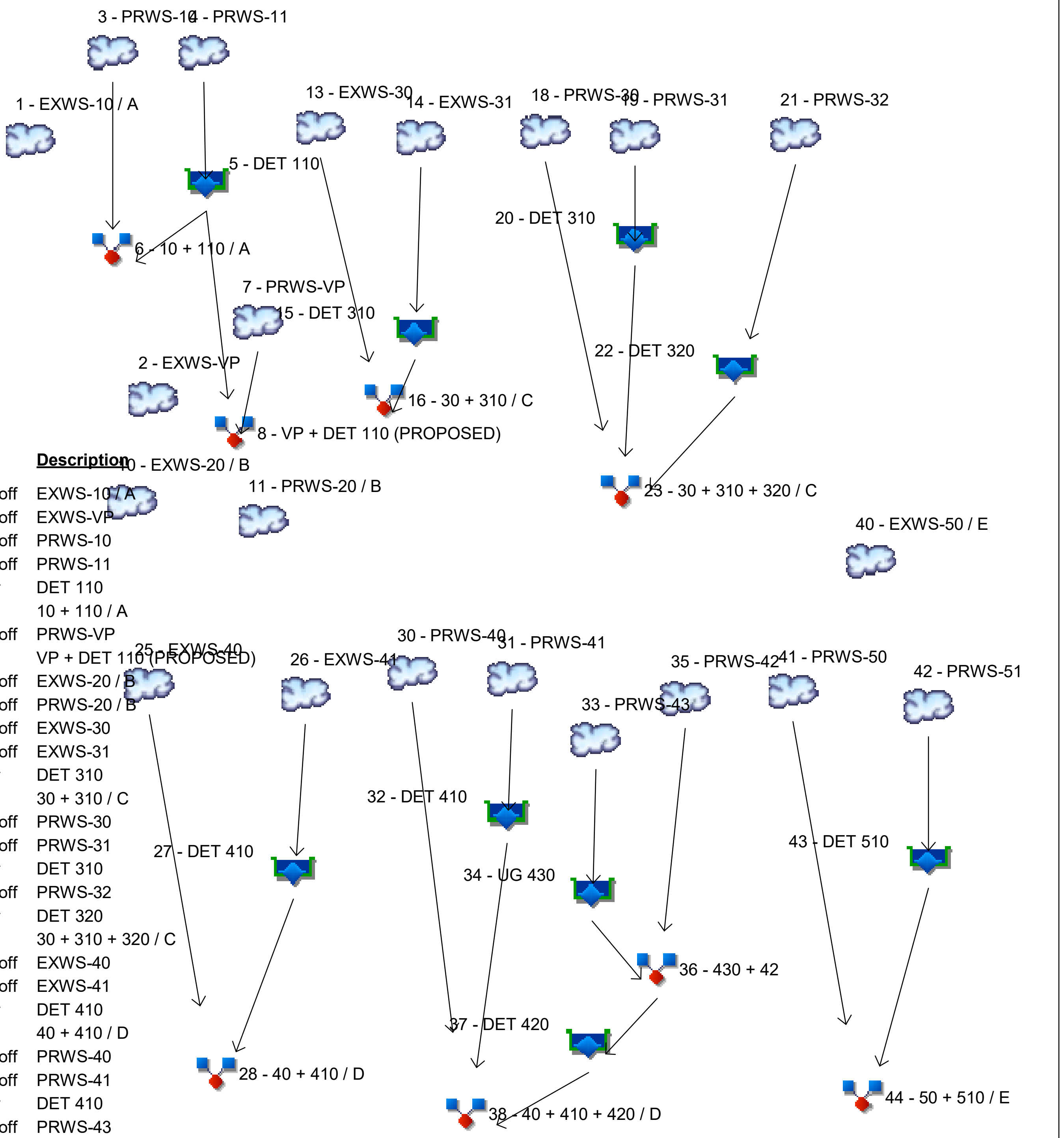
Existing vs. Proposed

Storm Event	2yr		10yr		25yr		50yr		100yr	
	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop	Exist	Prop
Point of Analysis A	15.8	9.5	39.1	23.3	55.1	32.4	67.3	39.3	80.9	46.9
DET 110 W.S. Elev. (ft.) Top of Berm Elev. = 668.0	-	664.5	-	665.1	-	665.4	-	665.6	-	665.9
Point of Analysis B	2.0	2.0	4.9	4.9	7.0	7.0	8.5	8.5	10.2	10.2
Point of Analysis C	36.3	33.8	83.1	79.0	114.0	111.7	137.6	137.0	163.9	162.4
EXDET 310 W.S. Elev. (ft.) Top of Berm Elev. = 652.0	649.4	649.2	650.1	649.9	650.4	650.2	650.7	650.5	651.0	650.7
DET 320 W.S. Elev. (ft.) Top of Berm Elev. = 672.0	-	669.0	-	669.8	-	670.2	-	670.4	-	670.7
Point of Analysis D	21.8	21.3	51.1	46.8	71.0	64.2	85.7	76.7	102.3	96.8
EXDET 410 W.S. Elev. (ft.) Top of Berm Elev. = 677.0	674.3	674.5	675.1	675.1	675.5	675.4	675.8	675.6	676.0	675.9
DET 420 W.S. Elev. (ft.) Top of Berm Elev. = 674.0	-	669.3	-	670.8	-	671.7	-	671.9	-	672.3
UG 430 W.S. Elev. (ft.) Top of Chamber Elev. = 674.4	-	670.6	-	672.1	-	672.9	-	673.5	-	674.2
Point of Analysis E	8.4	7.9	20.1	18.7	28.2	25.6	34.4	30.9	41.2	37.2
DET 510 W.S. Elev. (ft.) Top of Berm Elev. = 638.0	-	635.5	-	636.0	-	636.5	-	636.8	-	637.0

Study Area	**Description**
A	West Wetland to Eight Mile Brook
B	Drainage in Judd Hill Road
C	Eastern Wetland to Avalon Farm Pond
D	Southeastern Wetland
E	Southern Wetland

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Legend

Hyd.	Origin	Description
1	SCS Runoff	EXWS-10 / A
2	SCS Runoff	EXWS-VP
3	SCS Runoff	PRWS-10
4	SCS Runoff	PRWS-11
5	Reservoir	DET 110
6	Combine	10 + 110 / A
7	SCS Runoff	PRWS-VP
8	Combine	VP + DET 110 (PROPOSED)
10	SCS Runoff	EXWS-20 / B
11	SCS Runoff	PRWS-20 / B
13	SCS Runoff	EXWS-30
14	SCS Runoff	EXWS-31
15	Reservoir	DET 310
16	Combine	30 + 310 / C
18	SCS Runoff	PRWS-30
19	SCS Runoff	PRWS-31
20	Reservoir	DET 310
21	SCS Runoff	PRWS-32
22	Reservoir	DET 320
23	Combine	30 + 310 + 320 / C
25	SCS Runoff	EXWS-40
26	SCS Runoff	EXWS-41
27	Reservoir	DET 410
28	Combine	40 + 410 / D
30	SCS Runoff	PRWS-40
31	SCS Runoff	PRWS-41
32	Reservoir	DET 410
33	SCS Runoff	PRWS-43
34	Reservoir	UG 430
35	SCS Runoff	PRWS-42
36	Combine	430 + 42
37	Reservoir	DET 420
38	Combine	40 + 410 + 420 / D
40	SCS Runoff	EXWS-50 / E
41	SCS Runoff	PRWS-50
42	SCS Runoff	PRWS-51
43	Reservoir	DET 510
44	Combine	50 + 510 / E

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	15.76	-------	-------	39.11	55.12	67.27	80.90	EXWS-10 / A
2	SCS Runoff	------	-------	2.540	-------	-------	6.259	8.856	10.83	13.03	EXWS-VP
3	SCS Runoff	------	-------	9.011	-------	-------	21.92	30.71	37.37	44.75	PRWS-10
4	SCS Runoff	------	-------	5.186	-------	-------	9.881	12.84	15.01	17.38	PRWS-11
5	Reservoir	4	-------	1.062	-------	-------	1.928	2.299	2.543	2.779	DET 110
6	Combine	3, 5	-------	9.508	-------	-------	23.28	32.43	39.29	46.88	10 + 110 / A
7	SCS Runoff	------	-------	1.783	-------	-------	4.191	5.814	7.036	8.389	PRWS-VP
8	Combine	5, 7	-------	2.139	-------	-------	5.371	7.361	8.795	10.34	VP + DET 110 (PROPOSED)
10	SCS Runoff	------	-------	1.973	-------	-------	4.930	6.960	8.501	10.22	EXWS-20 / B
11	SCS Runoff	------	-------	1.973	-------	-------	4.930	6.960	8.501	10.22	PRWS-20 / B
13	SCS Runoff	------	-------	31.44	-------	-------	73.92	103.02	125.00	149.38	EXWS-30
14	SCS Runoff	------	-------	13.08	-------	-------	26.74	35.53	42.05	49.18	EXWS-31
15	Reservoir	14	-------	5.291	-------	-------	10.06	12.61	14.65	17.02	DET 310
16	Combine	13, 15	-------	36.32	-------	-------	83.08	114.03	137.64	163.94	30 + 310 / C
18	SCS Runoff	------	-------	23.75	-------	-------	55.84	77.82	94.43	112.84	PRWS-30
19	SCS Runoff	------	-------	12.18	-------	-------	26.22	35.41	42.26	49.79	PRWS-31
20	Reservoir	19	-------	4.397	-------	-------	8.630	11.04	12.79	14.82	DET 310
21	SCS Runoff	------	-------	29.62	-------	-------	48.70	60.47	69.10	78.51	PRWS-32
22	Reservoir	21	-------	6.411	-------	-------	15.47	23.85	30.65	35.59	DET 320
23	Combine	18, 20, 22	-------	33.76	-------	-------	79.02	111.70	137.04	162.37	30 + 310 + 320 / C
25	SCS Runoff	------	-------	19.48	-------	-------	47.17	66.08	80.41	96.33	EXWS-40
26	SCS Runoff	------	-------	9.406	-------	-------	18.23	23.81	27.92	32.41	EXWS-41
27	Reservoir	26	-------	2.316	-------	-------	4.067	5.016	5.363	8.530	DET 410
28	Combine	25, 27	-------	21.78	-------	-------	51.06	71.01	85.68	102.28	40 + 410 / D
30	SCS Runoff	------	-------	16.92	-------	-------	39.89	55.40	67.17	80.32	PRWS-40
31	SCS Runoff	------	-------	11.98	-------	-------	20.45	25.67	29.49	33.66	PRWS-41
32	Reservoir	31	-------	2.543	-------	-------	4.041	4.904	5.211	5.498	DET 410
33	SCS Runoff	------	-------	18.32	-------	-------	30.49	37.98	43.47	49.46	PRWS-43
34	Reservoir	33	-------	2.036	-------	-------	4.648	7.156	8.520	10.63	UG 430
35	SCS Runoff	------	-------	28.08	-------	-------	48.61	61.27	70.54	80.64	PRWS-42
36	Combine	34, 35	-------	29.62	-------	-------	50.81	63.90	75.24	87.22	430 + 42

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
37	Reservoir	36	-------	2.370	-------	-------	4.126	8.014	12.95	15.12	DET 420
38	Combine	30, 32, 37	-------	21.31	-------	-------	46.78	64.17	76.68	96.83	40 + 410 + 420 / D
40	SCS Runoff	------	-------	8.350	-------	-------	20.08	28.20	34.35	41.18	EXWS-50 / E
41	SCS Runoff	------	-------	7.460	-------	-------	17.69	24.61	29.83	35.61	PRWS-50
42	SCS Runoff	------	-------	8.684	-------	-------	17.03	22.34	26.25	30.52	PRWS-51
43	Reservoir	42	-------	1.109	-------	-------	3.350	4.550	6.465	11.40	DET 510
44	Combine	41, 43	-------	8.160	-------	-------	20.03	28.03	33.85	40.85	50 + 510 / E

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	15.76	3	741	2.019	------	------	------	EXWS-10 / A
2	SCS Runoff	2.540	3	738	0.296	------	------	------	EXWS-VP
3	SCS Runoff	9.011	3	729	0.864	------	------	------	PRWS-10
4	SCS Runoff	5.186	3	729	0.468	------	------	------	PRWS-11
5	Reservoir	1.062	3	762	0.467	4	664.63	0.214	DET 110
6	Combine	9.508	3	732	1.332	3, 5	------	------	10 + 110 / A
7	SCS Runoff	1.783	3	726	0.141	------	------	------	PRWS-VP
8	Combine	2.139	3	726	0.609	5, 7	------	------	VP + DET 110 (PROPOSED)
10	SCS Runoff	1.973	3	729	0.192	------	------	------	EXWS-20 / B
11	SCS Runoff	1.973	3	729	0.192	------	------	------	PRWS-20 / B
13	SCS Runoff	31.44	3	738	3.597	------	------	------	EXWS-30
14	SCS Runoff	13.08	3	729	1.189	------	------	------	EXWS-31
15	Reservoir	5.291	3	750	1.188	14	649.36	0.336	DET 310
16	Combine	36.32	3	738	4.786	13, 15	------	------	30 + 310 / C
18	SCS Runoff	23.75	3	738	2.717	------	------	------	PRWS-30
19	SCS Runoff	12.18	3	726	0.942	------	------	------	PRWS-31
20	Reservoir	4.397	3	747	0.942	19	649.20	0.258	DET 310
21	SCS Runoff	29.62	3	726	2.394	------	------	------	PRWS-32
22	Reservoir	6.411	3	750	2.337	21	668.96	1.24	DET 320
23	Combine	33.76	3	738	5.996	18, 20, 22	------	------	30 + 310 + 320 / C
25	SCS Runoff	19.48	3	750	2.812	------	------	------	EXWS-40
26	SCS Runoff	9.406	3	729	0.850	------	------	------	EXWS-41
27	Reservoir	2.316	3	759	0.849	26	674.32	0.435	DET 410
28	Combine	21.78	3	750	3.662	25, 27	------	------	40 + 410 / D
30	SCS Runoff	16.92	3	741	2.123	------	------	------	PRWS-40
31	SCS Runoff	11.98	3	726	0.940	------	------	------	PRWS-41
32	Reservoir	2.543	3	750	0.939	31	674.45	0.487	DET 410
33	SCS Runoff	18.32	3	726	1.464	------	------	------	PRWS-43
34	Reservoir	2.036	3	771	1.463	33	670.60	0.741	UG 430
35	SCS Runoff	28.08	3	726	2.188	------	------	------	PRWS-42
36	Combine	29.62	3	726	3.651	34, 35	------	------	430 + 42

MB-Model05.gpw	Return Period: 2 Year	Sunday, 08 / 27 / 2023

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
37	Reservoir	2.370	3	993	3.649	36	669.32	1.78	DET 420
38	Combine	21.31	3	741	6.712	30, 32, 37	------	------	40 + 410 + 420 / D
40	SCS Runoff	8.350	3	738	0.964	------	------	------	EXWS-50 / E
41	SCS Runoff	7.460	3	729	0.708	------	------	------	PRWS-50
42	SCS Runoff	8.684	3	726	0.663	------	------	------	PRWS-51
43	Reservoir	1.109	3	771	0.661	42	635.24	0.312	DET 510
44	Combine	8.160	3	729	1.369	41, 43	------	------	50 + 510 / E

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	39.11	3	741	4.731	------	------	------	EXWS-10 / A
2	SCS Runoff	6.259	3	735	0.694	------	------	------	EXWS-VP
3	SCS Runoff	21.92	3	729	1.991	------	------	------	PRWS-10
4	SCS Runoff	9.881	3	729	0.902	------	------	------	PRWS-11
5	Reservoir	1.928	3	762	0.901	4	665.20	0.419	DET 110
6	Combine	23.28	3	729	2.892	3, 5	------	------	10 + 110 / A
7	SCS Runoff	4.191	3	726	0.320	------	------	------	PRWS-VP
8	Combine	5.371	3	726	1.221	5, 7	------	------	VP + DET 110 (PROPOSED)
10	SCS Runoff	4.930	3	729	0.449	------	------	------	EXWS-20 / B
11	SCS Runoff	4.930	3	729	0.449	------	------	------	PRWS-20 / B
13	SCS Runoff	73.92	3	735	8.145	------	------	------	EXWS-30
14	SCS Runoff	26.74	3	729	2.419	------	------	------	EXWS-31
15	Reservoir	10.06	3	750	2.419	14	650.09	0.721	DET 310
16	Combine	83.08	3	738	10.564	13, 15	------	------	30 + 310 / C
18	SCS Runoff	55.84	3	735	6.153	------	------	------	PRWS-30
19	SCS Runoff	26.22	3	726	2.002	------	------	------	PRWS-31
20	Reservoir	8.630	3	747	2.002	19	649.89	0.595	DET 310
21	SCS Runoff	48.70	3	726	4.061	------	------	------	PRWS-32
22	Reservoir	15.47	3	744	4.004	21	669.79	1.84	DET 320
23	Combine	79.02	3	738	12.159	18, 20, 22	------	------	30 + 310 + 320 / C
25	SCS Runoff	47.17	3	747	6.476	------	------	------	EXWS-40
26	SCS Runoff	18.23	3	729	1.659	------	------	------	EXWS-41
27	Reservoir	4.067	3	759	1.658	26	675.12	0.788	DET 410
28	Combine	51.06	3	747	8.134	25, 27	------	------	40 + 410 / D
30	SCS Runoff	39.89	3	741	4.808	------	------	------	PRWS-40
31	SCS Runoff	20.45	3	726	1.655	------	------	------	PRWS-41
32	Reservoir	4.041	3	753	1.654	31	675.12	0.784	DET 410
33	SCS Runoff	30.49	3	726	2.515	------	------	------	PRWS-43
34	Reservoir	4.648	3	756	2.513	33	672.09	1.25	UG 430
35	SCS Runoff	48.61	3	726	3.901	------	------	------	PRWS-42
36	Combine	50.81	3	726	6.415	34, 35	------	------	430 + 42

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Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
37	Reservoir	4.126	3	942	6.413	36	670.83	3.11	DET 420
38	Combine	46.78	3	741	12.875	30, 32, 37	------	------	40 + 410 + 420 / D
40	SCS Runoff	20.08	3	735	2.219	------	------	------	EXWS-50 / E
41	SCS Runoff	17.69	3	729	1.603	------	------	------	PRWS-50
42	SCS Runoff	17.03	3	726	1.312	------	------	------	PRWS-51
43	Reservoir	3.350	3	753	1.310	42	636.06	0.589	DET 510
44	Combine	20.03	3	729	2.914	41, 43	------	------	50 + 510 / E

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	55.12	3	741	6.630	------	------	------	EXWS-10 / A
2	SCS Runoff	8.856	3	735	0.972	------	------	------	EXWS-VP
3	SCS Runoff	30.71	3	729	2.774	------	------	------	PRWS-10
4	SCS Runoff	12.84	3	729	1.184	------	------	------	PRWS-11
5	Reservoir	2.299	3	762	1.183	4	665.54	0.557	DET 110
6	Combine	32.43	3	729	3.957	3, 5	------	------	10 + 110 / A
7	SCS Runoff	5.814	3	726	0.444	------	------	------	PRWS-VP
8	Combine	7.361	3	726	1.627	5, 7	------	------	VP + DET 110 (PROPOSED)
10	SCS Runoff	6.960	3	729	0.629	------	------	------	EXWS-20 / B
11	SCS Runoff	6.960	3	729	0.629	------	------	------	PRWS-20 / B
13	SCS Runoff	103.02	3	735	11.287	------	------	------	EXWS-30
14	SCS Runoff	35.53	3	729	3.234	------	------	------	EXWS-31
15	Reservoir	12.61	3	750	3.234	14	650.43	0.989	DET 310
16	Combine	114.03	3	735	14.521	13, 15	------	------	30 + 310 / C
18	SCS Runoff	77.82	3	735	8.526	------	------	------	PRWS-30
19	SCS Runoff	35.41	3	726	2.717	------	------	------	PRWS-31
20	Reservoir	11.04	3	747	2.717	19	650.22	0.827	DET 310
21	SCS Runoff	60.47	3	726	5.108	------	------	------	PRWS-32
22	Reservoir	23.85	3	741	5.051	21	670.17	2.12	DET 320
23	Combine	111.70	3	738	16.294	18, 20, 22	------	------	30 + 310 + 320 / C
25	SCS Runoff	66.08	3	747	9.023	------	------	------	EXWS-40
26	SCS Runoff	23.81	3	729	2.187	------	------	------	EXWS-41
27	Reservoir	5.016	3	759	2.187	26	675.49	1.01	DET 410
28	Combine	71.01	3	747	11.210	25, 27	------	------	40 + 410 / D
30	SCS Runoff	55.40	3	741	6.662	------	------	------	PRWS-40
31	SCS Runoff	25.67	3	726	2.107	------	------	------	PRWS-41
32	Reservoir	4.904	3	753	2.107	31	675.41	0.967	DET 410
33	SCS Runoff	37.98	3	726	3.176	------	------	------	PRWS-43
34	Reservoir	7.156	3	753	3.175	33	672.87	1.51	UG 430
35	SCS Runoff	61.27	3	726	4.989	------	------	------	PRWS-42
36	Combine	63.90	3	726	8.164	34, 35	------	------	430 + 42

Hydrograph Summary Report

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
37	Reservoir	8.014	3	834	8.161	36	671.67	3.92	DET 420
38	Combine	64.17	3	741	16.931	30, 32, 37	------	------	40 + 410 + 420 / D
40	SCS Runoff	28.20	3	735	3.092	------	------	------	EXWS-50 / E
41	SCS Runoff	24.61	3	729	2.222	------	------	------	PRWS-50
42	SCS Runoff	22.34	3	726	1.738	------	------	------	PRWS-51
43	Reservoir	4.550	3	753	1.737	42	636.53	0.778	DET 510
44	Combine	28.03	3	729	3.958	41, 43	------	------	50 + 510 / E

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	67.27	3	741	8.090	------	------	------	EXWS-10 / A
2	SCS Runoff	10.83	3	735	1.186	------	------	------	EXWS-VP
3	SCS Runoff	37.37	3	729	3.374	------	------	------	PRWS-10
4	SCS Runoff	15.01	3	729	1.395	------	------	------	PRWS-11
5	Reservoir	2.543	3	762	1.394	4	665.80	0.659	DET 110
6	Combine	39.29	3	729	4.768	3, 5	------	------	10 + 110 / A
7	SCS Runoff	7.036	3	726	0.539	------	------	------	PRWS-VP
8	Combine	8.795	3	726	1.932	5, 7	------	------	VP + DET 110 (PROPOSED)
10	SCS Runoff	8.501	3	729	0.767	------	------	------	EXWS-20 / B
11	SCS Runoff	8.501	3	729	0.767	------	------	------	PRWS-20 / B
13	SCS Runoff	125.00	3	735	13.691	------	------	------	EXWS-30
14	SCS Runoff	42.05	3	729	3.849	------	------	------	EXWS-31
15	Reservoir	14.65	3	750	3.849	14	650.68	1.19	DET 310
16	Combine	137.64	3	735	17.540	13, 15	------	------	30 + 310 / C
18	SCS Runoff	94.43	3	735	10.342	------	------	------	PRWS-30
19	SCS Runoff	42.26	3	726	3.259	------	------	------	PRWS-31
20	Reservoir	12.79	3	747	3.259	19	650.45	1.01	DET 310
21	SCS Runoff	69.10	3	726	5.881	------	------	------	PRWS-32
22	Reservoir	30.65	3	738	5.824	21	670.39	2.29	DET 320
23	Combine	137.04	3	735	19.425	18, 20, 22	------	------	30 + 310 + 320 / C
25	SCS Runoff	80.41	3	747	10.978	------	------	------	EXWS-40
26	SCS Runoff	27.92	3	729	2.583	------	------	------	EXWS-41
27	Reservoir	5.363	3	759	2.583	26	675.78	1.20	DET 410
28	Combine	85.68	3	747	13.561	25, 27	------	------	40 + 410 / D
30	SCS Runoff	67.17	3	738	8.082	------	------	------	PRWS-40
31	SCS Runoff	29.49	3	726	2.442	------	------	------	PRWS-41
32	Reservoir	5.211	3	753	2.442	31	675.64	1.11	DET 410
33	SCS Runoff	43.47	3	726	3.664	------	------	------	PRWS-43
34	Reservoir	8.520	3	753	3.663	33	673.49	1.72	UG 430
35	SCS Runoff	70.54	3	726	5.795	------	------	------	PRWS-42
36	Combine	75.24	3	726	9.458	34, 35	------	------	430 + 42

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Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
37	Reservoir	12.95	3	792	9.456	36	671.86	4.10	DET 420
38	Combine	76.68	3	741	19.980	30, 32, 37	------	------	40 + 410 + 420 / D
40	SCS Runoff	34.35	3	735	3.762	------	------	------	EXWS-50 / E
41	SCS Runoff	29.83	3	729	2.695	------	------	------	PRWS-50
42	SCS Runoff	26.25	3	726	2.058	------	------	------	PRWS-51
43	Reservoir	6.465	3	750	2.056	42	636.84	0.902	DET 510
44	Combine	33.85	3	729	4.751	41, 43	------	------	50 + 510 / E

Hydrograph Summary Report

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	80.90	3	738	9.734	------	------	------	EXWS-10 / A
2	SCS Runoff	13.03	3	735	1.427	------	------	------	EXWS-VP
3	SCS Runoff	44.75	3	729	4.049	------	------	------	PRWS-10
4	SCS Runoff	17.38	3	729	1.628	------	------	------	PRWS-11
5	Reservoir	2.779	3	765	1.627	4	666.08	0.773	DET 110
6	Combine	46.88	3	729	5.676	3, 5	------	------	10 + 110 / A
7	SCS Runoff	8.389	3	726	0.645	------	------	------	PRWS-VP
8	Combine	10.34	3	726	2.271	5, 7	------	------	VP + DET 110 (PROPOSED)
10	SCS Runoff	10.22	3	729	0.923	------	------	------	EXWS-20 / B
11	SCS Runoff	10.22	3	729	0.923	------	------	------	PRWS-20 / B
13	SCS Runoff	149.38	3	735	16.388	------	------	------	EXWS-30
14	SCS Runoff	49.18	3	729	4.531	------	------	------	EXWS-31
15	Reservoir	17.02	3	750	4.531	14	650.97	1.41	DET 310
16	Combine	163.94	3	735	20.918	13, 15	------	------	30 + 310 / C
18	SCS Runoff	112.84	3	735	12.379	------	------	------	PRWS-30
19	SCS Runoff	49.79	3	726	3.863	------	------	------	PRWS-31
20	Reservoir	14.82	3	747	3.863	19	650.71	1.21	DET 310
21	SCS Runoff	78.51	3	726	6.728	------	------	------	PRWS-32
22	Reservoir	35.59	3	738	6.671	21	670.64	2.49	DET 320
23	Combine	162.37	3	735	22.913	18, 20, 22	------	------	30 + 310 + 320 / C
25	SCS Runoff	96.33	3	747	13.174	------	------	------	EXWS-40
26	SCS Runoff	32.41	3	729	3.021	------	------	------	EXWS-41
27	Reservoir	8.530	3	756	3.021	26	676.05	1.37	DET 410
28	Combine	102.28	3	750	16.194	25, 27	------	------	40 + 410 / D
30	SCS Runoff	80.32	3	738	9.673	------	------	------	PRWS-40
31	SCS Runoff	33.66	3	726	2.810	------	------	------	PRWS-41
32	Reservoir	5.498	3	756	2.810	31	675.91	1.28	DET 410
33	SCS Runoff	49.46	3	726	4.200	------	------	------	PRWS-43
34	Reservoir	10.63	3	750	4.199	33	674.16	1.95	UG 430
35	SCS Runoff	80.64	3	726	6.681	------	------	------	PRWS-42
36	Combine	87.22	3	726	10.880	34, 35	------	------	430 + 42

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Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
37	Reservoir	15.12	3	792	10.878	36	672.25	4.50	DET 420
38	Combine	96.83	3	744	23.361	30, 32, 37	------	------	40 + 410 + 420 / D
40	SCS Runoff	41.18	3	735	4.514	------	------	------	EXWS-50 / E
41	SCS Runoff	35.61	3	729	3.226	------	------	------	PRWS-50
42	SCS Runoff	30.52	3	726	2.412	------	------	------	PRWS-51
43	Reservoir	11.40	3	741	2.410	42	637.02	0.975	DET 510
44	Combine	40.85	3	729	5.636	41, 43	------	------	50 + 510 / E

Pond Report

Pond No. 5 - DET 110

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 664.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	664.00	13,684	0.000	0.000
1.00	665.00	16,106	0.342	0.342
2.00	666.00	18,341	0.395	0.737
3.00	667.00	20,634	0.447	1.184
4.00	668.00	22,982	0.500	1.684

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	9.00	0.00	0.00
Span (in)	= 15.00	9.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 660.00	664.00	0.00	0.00
Length (ft)	= 113.00	0.00	0.00	0.00
Slope (%)	= 7.52	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	10.00	0.00	0.00
Crest El. (ft)	= 666.50	667.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	664.00	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
1.00	0.342	665.00	10.85 ic	1.68 ic	---	---	0.00	0.00	---	---	---	---	1.681
2.00	0.737	666.00	10.85 ic	2.71 ic	---	---	0.00	0.00	---	---	---	---	2.711
3.00	1.184	667.00	14.64 ic	1.03 ic	---	---	13.62 s	0.00	---	---	---	---	14.64
4.00	1.684	668.00	16.03 ic	0.24 ic	---	---	15.77 s	26.00	---	---	---	---	42.01

Pond Report

Pond No. 1 - EXDET 310

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 648.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	648.00	1,244	0.000	0.000
1.00	649.00	15,021	0.158	0.158
2.00	650.00	28,684	0.493	0.651
3.00	651.00	40,293	0.788	1.439
4.00	652.00	64,746	1.195	2.633

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	1.00	0.00	0.00
Crest El. (ft)	= 651.00	648.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	648.00	---	---	---	---	0.00	0.00	---	---	---	---	0.000
1.00	0.158	649.00	---	---	---	---	0.00	3.33	---	---	---	---	3.330
2.00	0.651	650.00	---	---	---	---	0.00	9.42	---	---	---	---	9.419
3.00	1.439	651.00	---	---	---	---	0.00	17.30	---	---	---	---	17.30
4.00	2.633	652.00	---	---	---	---	46.62	26.64	---	---	---	---	73.26

Pond Report

Pond No. 3 - DET 320

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 667.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	667.00	24,484	0.000	0.000
1.00	668.00	27,540	0.597	0.597
2.00	669.00	30,225	0.663	1.259
3.00	670.00	32,967	0.725	1.985
4.00	671.00	35,765	0.789	2.773
5.00	672.00	38,620	0.854	3.627

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 663.00	0.00	0.00	0.00
Length (ft)	= 119.00	0.00	0.00	0.00
Slope (%)	= 2.10	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 11.20	0.00	0.00	0.00
Crest El. (ft)	= 670.00	667.00	0.00	0.00
Weir Coeff.	= 3.33	1.18	3.33	3.33
Weir Type	= 1	50 degV	---	---
Multi-Stage	= Yes	Yes	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	667.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	0.597	668.00	26.20 ic	---	---	---	0.00	1.18	---	---	---	---	1.184
2.00	1.259	669.00	26.20 ic	---	---	---	0.00	6.70	---	---	---	---	6.698
3.00	1.985	670.00	26.20 ic	---	---	---	0.00	18.46	---	---	---	---	18.46
4.00	2.773	671.00	39.33 ic	---	---	---	24.47 s	14.86 s	---	---	---	---	39.33
5.00	3.627	672.00	42.65 ic	---	---	---	29.57 s	13.06 s	---	---	---	---	42.62

Pond Report

Pond No. 2 - EXDET 410

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 671.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	671.00	199	0.000	0.000
2.00	673.00	5,078	0.096	0.096
3.00	674.00	13,483	0.205	0.301
4.00	675.00	22,700	0.411	0.712
5.00	676.00	31,573	0.620	1.332
6.00	677.00	35,000	0.764	2.096

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 672.50	0.00	0.00	0.00
Length (ft)	= 72.00	0.00	0.00	0.00
Slope (%)	= 0.64	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.50	0.50	75.00	0.00
Crest El. (ft)	= 675.00	673.00	676.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	671.00	0.00	---	---	---	0.00	0.00	0.00	---	---	---	0.000
2.00	0.096	673.00	0.00	---	---	---	0.00	0.00	0.00	---	---	---	0.000
3.00	0.301	674.00	1.63 ic	---	---	---	0.00	1.61 s	0.00	---	---	---	1.613
4.00	0.712	675.00	3.61 oc	---	---	---	0.00	3.61 s	0.00	---	---	---	3.605
5.00	1.332	676.00	5.59 oc	---	---	---	4.05 s	1.53 s	0.00	---	---	---	5.586
6.00	2.096	677.00	6.49 oc	---	---	---	5.23 s	1.26 s	195.00	---	---	---	201.48

Pond Report

Pond No. 4 - DET 420

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 667.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	667.00	28,435	0.000	0.000
1.00	668.00	33,298	0.708	0.708
2.00	669.00	35,827	0.793	1.501
3.00	670.00	38,412	0.852	2.353
4.00	671.00	41,054	0.912	3.265
5.00	672.00	43,752	0.973	4.238
6.00	673.00	46,507	1.036	5.274
7.00	674.00	49,318	1.100	6.373

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	8.00	6.00	0.00
Span (in)	= 15.00	8.00	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 665.00	667.00	669.50	0.00
Length (ft)	= 114.00	0.00	0.00	0.00
Slope (%)	= 4.82	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	0.00	0.00	0.00
Crest El. (ft)	= 671.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	667.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
1.00	0.708	668.00	6.93 ic	1.37 ic	0.00	---	0.00	---	---	---	---	---	1.372
2.00	1.501	669.00	6.93 ic	2.17 ic	0.00	---	0.00	---	---	---	---	---	2.170
3.00	2.353	670.00	6.93 ic	2.74 ic	0.47 ic	---	0.00	---	---	---	---	---	3.217
4.00	3.265	671.00	6.93 ic	3.22 ic	1.06 ic	---	0.00	---	---	---	---	---	4.275
5.00	4.238	672.00	14.66 ic	0.79 ic	0.45 ic	---	13.42 s	---	---	---	---	---	14.65
6.00	5.274	673.00	16.03 ic	0.19 ic	0.10 ic	---	15.70 s	---	---	---	---	---	15.99
7.00	6.373	674.00	17.09 ic	0.10 ic	0.05 ic	---	16.93 s	---	---	---	---	---	17.08

Pond Report

Pond No. 7 - UG 430

Pond Data

UG Chambers -Invert elev. = 668.40 ft, Rise x Span = 6.00 x 7.00 ft, Barrel Len = 15.00 ft, No. Barrels = 140, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	668.40	n/a	0.000	0.000
0.60	669.00	n/a	0.203	0.203
1.20	669.60	n/a	0.203	0.405
1.80	670.20	n/a	0.203	0.608
2.40	670.80	n/a	0.203	0.810
3.00	671.40	n/a	0.203	1.013
3.60	672.00	n/a	0.203	1.215
4.20	672.60	n/a	0.203	1.418
4.80	673.20	n/a	0.203	1.620
5.40	673.80	n/a	0.203	1.823
6.00	674.40	n/a	0.203	2.025

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	6.00	9.00	0.00
Span (in)	= 24.00	8.00	9.00	0.00
No. Barrels	= 1	1	2	0
Invert El. (ft)	= 668.40	668.40	671.50	0.00
Length (ft)	= 51.00	0.00	0.00	0.00
Slope (%)	= 4.70	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 674.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	668.40	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.60	0.203	669.00	0.79 ic	0.79 ic	0.00	---	0.00	---	---	---	---	---	0.791
1.20	0.405	669.60	1.41 ic	1.36 ic	0.00	---	0.00	---	---	---	---	---	1.364
1.80	0.608	670.20	1.81 ic	1.80 ic	0.00	---	0.00	---	---	---	---	---	1.797
2.40	0.810	670.80	2.18 ic	2.15 ic	0.00	---	0.00	---	---	---	---	---	2.152
3.00	1.013	671.40	2.48 ic	2.46 ic	0.00	---	0.00	---	---	---	---	---	2.462
3.60	1.215	672.00	4.17 ic	2.66 ic	1.51 ic	---	0.00	---	---	---	---	---	4.170
4.20	1.418	672.60	6.53 ic	2.82 ic	3.62 ic	---	0.00	---	---	---	---	---	6.444
4.80	1.620	673.20	7.96 ic	3.02 ic	4.90 ic	---	0.00	---	---	---	---	---	7.921
5.40	1.823	673.80	9.23 ic	3.22 ic	5.90 ic	---	0.00	---	---	---	---	---	9.125
6.00	2.025	674.40	13.48 ic	3.30 ic	6.76 ic	---	3.37	---	---	---	---	---	13.43

Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Sunday, 08 / 27 / 2023

Pond No. 8 - DET 510

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 634.10 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	634.10	10,784	0.000	0.000
0.40	634.50	11,312	0.101	0.101
0.90	635.00	11,984	0.134	0.235
1.90	636.00	16,662	0.327	0.562
2.90	637.00	18,648	0.405	0.967
3.90	638.00	20,691	0.451	1.419

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	18.00	6.00	10.00	0.00
Span (in)	=	18.00	6.00	10.00	0.00
No. Barrels	=	1	1	1	0
Invert El. (ft)	=	631.00	634.10	635.00	0.00
Length (ft)	=	70.00	0.00	0.00	0.00
Slope (%)	=	1.09	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	Yes	Yes	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	13.00	10.00	1.00	0.00
Crest El. (ft)	=	636.80	637.00	636.30	0.00
Weir Coeff.	=	3.33	2.60	3.33	3.33
Weir Type	=	1	Broad	Rect	---
Multi-Stage	=	Yes	No	Yes	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	634.10	0.00	0.00	0.00	---	0.00	0.00	0.00	---	---	---	0.000
0.40	0.101	634.50	13.04 ic	0.36 ic	0.00	---	0.00	0.00	0.00	---	---	---	0.363
0.90	0.235	635.00	13.04 ic	0.76 ic	0.00	---	0.00	0.00	0.00	---	---	---	0.762
1.90	0.562	636.00	13.04 ic	1.21 ic	2.01 ic	---	0.00	0.00	0.00	---	---	---	3.220
2.90	0.967	637.00	13.04 ic	1.54 ic	3.30 ic	---	3.87	0.00	1.95	---	---	---	10.67
3.90	1.419	638.00	21.20 ic	0.20 ic	0.54 ic	---	18.37 s	26.00	2.09 s	---	---	---	47.19

APPENDIX H

WATERSHED MAPS

Drainage Report

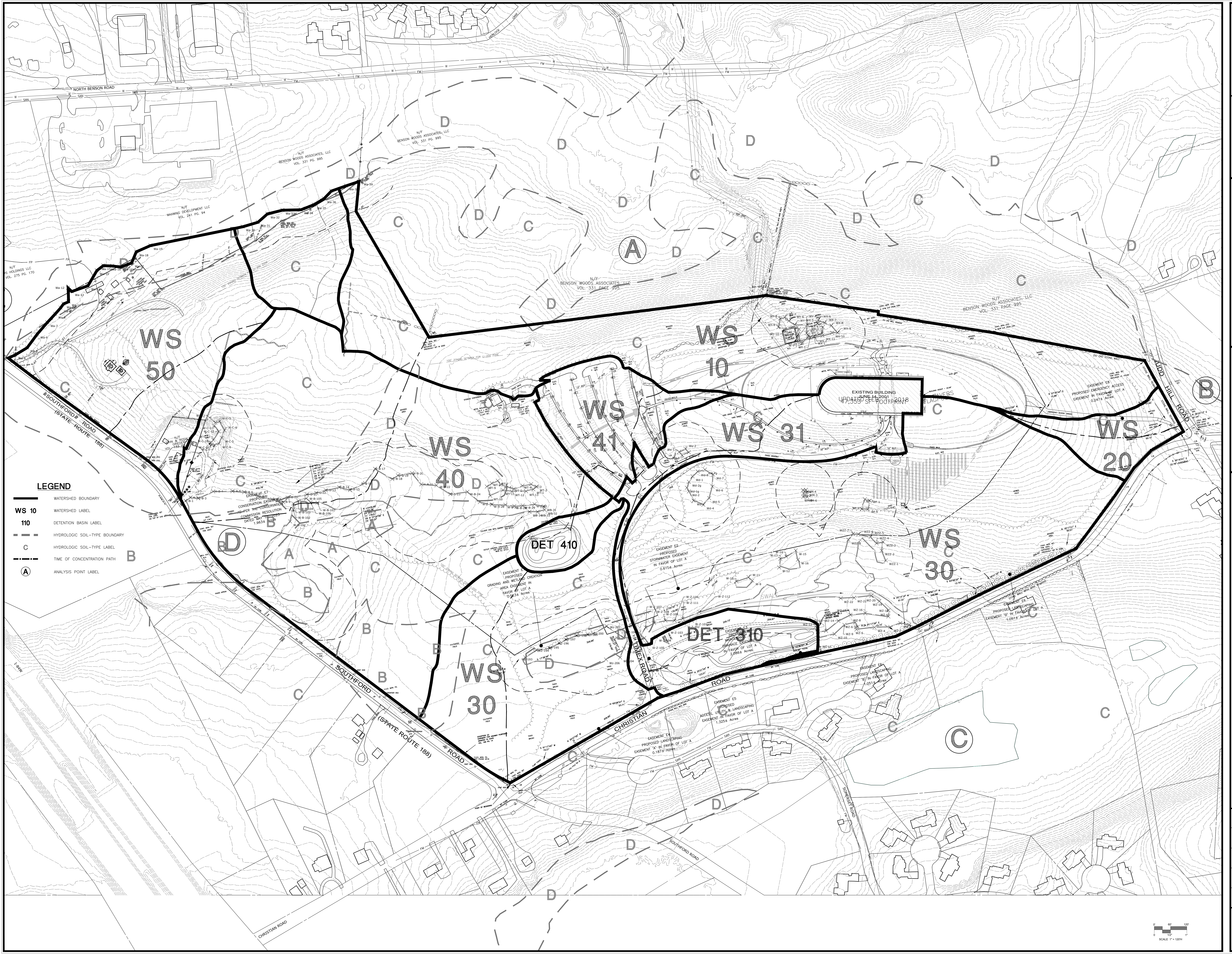
Southford Park

764 Southford Road (Route 188)

Middlebury, Connecticut 06762

December 22, 2022

(Revised January 24, 2023;
February 22, 2023; March 15, 2023; August 29, 2023)



SLR

99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
SLRCONSULTING.COM

DESCRIPTION	DATE	BY
P&Z SUBMISSION	08/29/2023	MCB

WATERSHED MAP - EXISTING CONDITIONS

SOUTHFORD PARK

764 SOUTHFORD ROAD (ROUTE 188)
MIDDLEBURY, CONNECTICUT

MCB DESIGNED	MCB DRAWN	RJM CHECKED

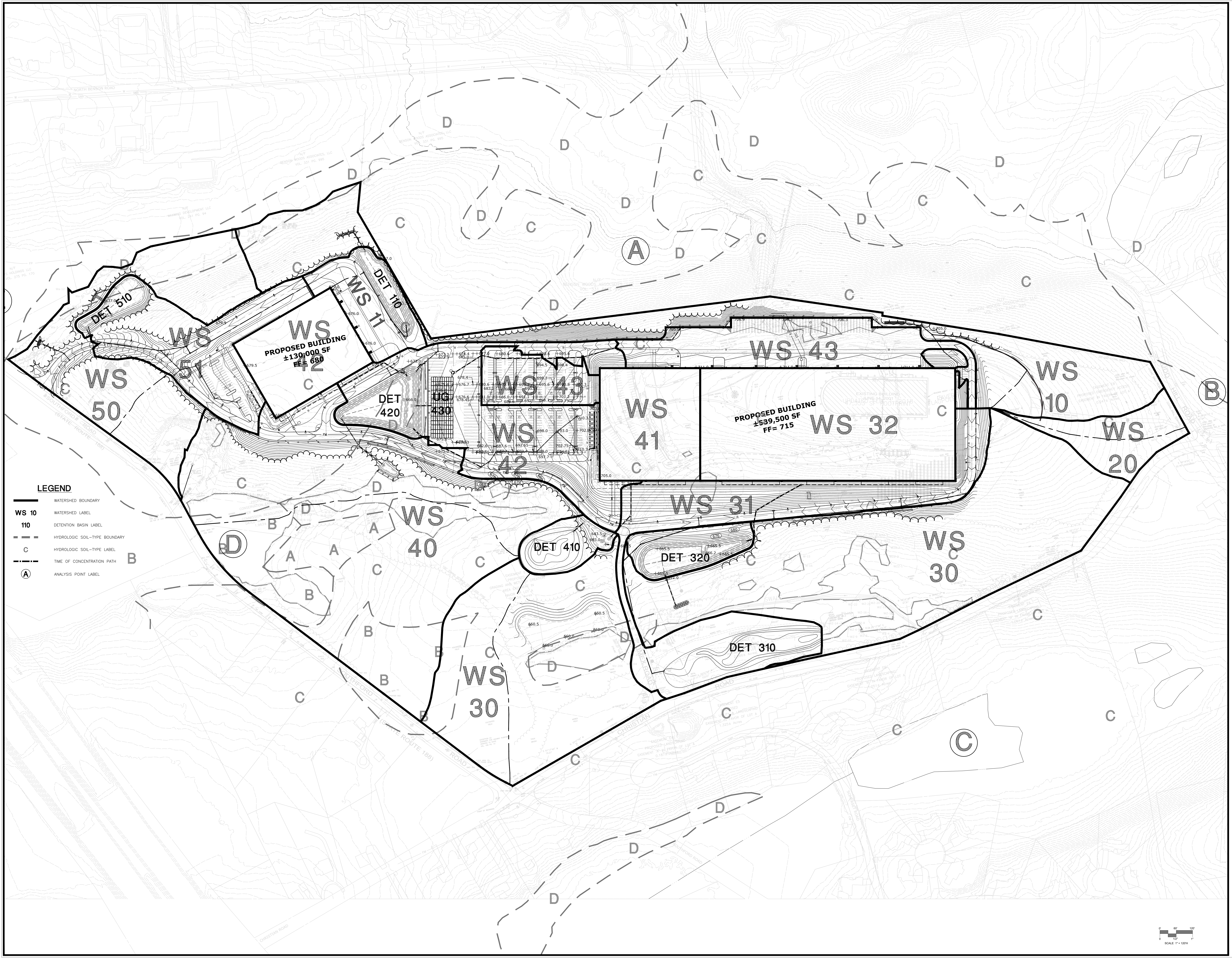
SCALE: 1"=120'

DATE: DECEMBER 22, 2022

PROJECT NO.: 20970.00002

SHEET NO.: 1 OF 2

SHEET NAME: **EXWS**



DESCRIPTION	DATE	BY
TOWN COMMENTS	01/24/2023	MCB
STORMWATER DESIGN CHANGES	03/15/2023	MCB
P&Z SUBMISSION	08/29/2023	MCB

SLR
99 REALTY DRIVE
CHESHIRE, CT 06410
203.271.1773
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WATERSHED MAP - PROPOSED CONDITIONS

SOUTHFORD PARK

764 SOUTHFORD ROAD (ROUTE 188)
MIDDLEBURY, CONNECTICUT

MCB DESIGNED	MCB DRAWN	RJM CHECKED

SCALE 1"=120'

DATE DECEMBER 22, 2022

PROJECT NO. 20970.00002

SHEET NO. 2 OF 2

SHEET NAME **PRWS**