YANTIC RIVER
CONSULTANTS, LLC

PRELIMINARY
STORMWATER MANAGEMENT REPORT

WATERFORD WOODS APARTMENTS
384 & 394 WILLETTS AVE. EXT.
WATERFORD, CT

PREPARED FOR

SIG CON ASSOCIATES, LLC
606 POST ROAD EAST #320
WESTPORT, CT 06880

DATE: NOVEMBER 18, 2020
REVISED:

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TABLES

PROJECT DESCRIPTION

Sig Con Associates, LLC is proposing to construct a residential multi-family development on two undeveloped parcels of land on the south side of Willetts Avenue Extension totaling 26.64 acres.

- 0.48-acre parcel located at 384 Willetts Avenue Extension identified as Map 140, Lot 9190 on the Town of Waterford Tax Assessor Mapping
- 26.16-acre parcel located at 394 Willetts Avenue Extension identified as Map 140, Lot 9192 on the Town of Waterford Tax Assessor Mapping

The combined parcels are hereinafter referred to as the Site.

The Site is in the Commercial Multi-Family District (C-MF). Per Section 16.1.2 of the Zoning Regulations multi-family developments are listed as a permitted use within the district, which requires a Site Plan approval per Section 18.1.a.

The multi-family development will consist of the construction of three (3) apartment buildings with a total of 98 units with a mix of 58 one-bedroom and 40 two-bedroom dwelling units. Main access to the development will be provided from the north via Willetts Avenue Extension. Additional site work will include:

- Clearing and grubbing.
- Demolition and removal of the existing outbuilding on 384 Willetts Avenue Extension.
- Excavation and disposal of construction and demolition debris stockpiled throughout the Site.
- Construction of a new curb cut to the north on Willetts Avenue Extension.
- 28’ main access drive with 24’ wide internal access drives including a looped connection to improve vehicular circulation and emergency access throughout the development.
- Paved parking situated in close proximity to the apartment buildings and site amenities with a total of 167 spaces including 6 handicapped accessible.
- Concrete pedestrian sidewalks connecting the apartment buildings with interior amenities and the existing public sidewalk along the south shoulder of Willetts Avenue Extension.
- Outdoor recreation areas including a mix of active recreation, passive recreation, and community spaces.
- Drainage improvements including a stormwater collection network, grass-lined treatment swales, subsurface infiltration systems, and detention ponds.
- Connection to water, sewer, electric, gas and telecom services in Willetts Avenue Extension.
- Landscaping including a mixture of street trees, shrubs, foundation plantings and planting beds
- Building and street lighting.
- Erosion and sedimentation control measures.

EXISTING SITE DESCRIPTION

The subject Site is currently undeveloped except for a small outbuilding along Willetts Avenue Extension. The Site is generally wooded with an internal network of gravel roads leading to stockpiles of construction and demolition debris, such as brick, concrete, timber, and etc. There are also signs of rock quarrying at the southwest corner of the site.

TOPOGRAPHY – The existing topography generally consists of gentle to moderately sloping terrain from the northeast along Willetts Avenue to the southwest towards two (2) wetland areas on Site and Fenger Brook. Existing slopes in the upland areas of the Site range from 4% to 7% with steeper slopes around the perimeter of the delineated inland wetland areas.

SOILS – The USDA NRCS Web Soil Survey indicates that the upland area of the Site contain Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky (73C) soils, which have a hydrologic soil group classification (HSG) of B. Inland wetland areas are designed as Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, very rocky, which have an HSG of D. Deep observation test holes were performed at the site, which generally confirmed the NRCS soil types within upland areas.

DRAINAGE – The Site drains from the northeast along Willetts Avenue towards wetland systems to the southwest and south. Three (3) existing drainage areas were delineated based upon topography and field observation.

- SITE-EX-01 is 8.182 acres and consists of the northern portion of the site, which drains to a wetland area along the westerly property line.
- SITE-EX-02 is 2.495 acres and consists of the southeastern corner of the site draining to a wetland area along the east and southern property line.
- SITE-EX-03 is 6.764 acres and consists of a peninsula of upland at the southeast corner of the site, which drains from a high point at the center to the perimeter wetlands.

Based upon CT DEEP mapping, the entire Site lies within the Southeast Shoreline subregional drainage basin 2000, which is part of the Southeast Coast major basin 2. However, based upon the "Jordan Brook Watershed Management Plan Final Report, Town of Waterford, Connecticut", dated February 2000, prepared by Fuss & O'Neill, Inc., the Site is included within the Jordan Brook subregional basin 2201 (hereinafter JBWMP). A detailed review of the hydrologic conditions of the subregional watershed was not performed as part of this review, however the recommendations of the JBWMP were followed as a conservative measure.

PEAK FLOW CONTROL & FLOOD PROTECTION

Stormwater runoff from the proposed multi-family development will be collected through a series of rain gardens, swales, yard drains, catch basins, and drainage piping and discharged to a series of treatment, infiltration, and detention areas on the Site.

Peak flow rates for pre-development and post-development conditions were calculated using SCS TR-55 methodology. Hydrology Studio 2020 v.3.0.0.16 was used to generate peak flows from the watershed with the following parameters:

PRE-DEVELOPED CONDITIONS (Drainage Area Map DA-01A)

- DRAINAGE AREAS: As described above, the Site has three (3) existing drainage areas.
  - SITE-EX-01 is 8.182 acres and consists of the northern portion of the site, which drains to a wetland area along the westerly property line.
  - SITE-EX-02 is 2.495 acres and consists of the southeastern corner of the site draining to a wetland area along the east and southern property line.
  - SITE-EX-03 is 6.764 acres and consists of a peninsula of upland at the southeast corner of the site, which drains from a high point at the center to the perimeter wetlands.

- **RAINFALL:** Precipitation frequency and depth estimates (rainfall data) were obtained from NOAA Atlas 14, Volume 10, Version 2 at Lat. 41.3376 Long. -72.1197, which corresponds with the geographic location of the Site.
- **RUNOFF COEFFICIENT:** Composite Curve Numbers (CN) were calculated based on the land cover types for the site for HSG B. Land cover types consist of impervious buildings and pavement, meadow/brush, open space vegetated areas, woods, and wetlands. Wetland areas were excluded from the drainage areas and calculations.
- **TIME OF CONCENTRATION:** Time of concentration (Tc) was estimated for the basin based on the SCS method, with sheet and shallow concentrated flow from the hydraulically most distant point of the watershed to the discharge point.

POST-DEVELOPED CONDITIONS (Drainage Area Map DA-02A)

- **DRAINAGE AREA:** For direct comparison with existing conditions, the same three design points were evaluated.
  - SITE-PR-01 is 6.988 acres and consists of the north/northwest portion of the developed site.
  - SITE-PR-02 is 3.689 acres and consists of the eastern portion of the developed site.
  - SITE-PR-03 is 6.764 acres consists of a peninsula of upland at the southeast corner. There is no change from existing conditions.
- **RAINFALL:** Same as Pre-Developed Conditions.
- **CURVE NUMBER:** Same methodology as Pre-Developed Conditions. Composite Curve Numbers (CN) were calculated based on the land cover types for the proposed multi-family residential development for HSG B.
- **TIME OF CONCENTRATION:** Same methodology as Pre-Developed Conditions.

COMPARISON

A summary of flows for existing and proposed conditions, without consideration of infiltration or detention is provided below with a complete output provided in the enclosed Hydrology Studio Report.

STORM EVENT	AREA 01			AREA 02			AREA 03			TOTAL SITE		
	SITE-EX-01	SITE-PR-01	EX vs. PR	SITE-EX-02	SITE-PR-02	EX vs. PR	SITE-EX-03	SITE-PR-03	EX vs. PR	SITE-EX	SITE-PR	EX vs. PR
2-yr	1.15	4.62	3.47	0.30	2.80	2.50	0.81	0.81	0.00	2.26	7.20	4.94
5-yr	3.09	7.90	4.80	0.86	4.62	3.76	2.34	2.34	0.00	6.29	14.44	8.15
10-yr	5.20	10.88	5.68	1.49	6.26	4.77	4.03	4.03	0.00	10.71	20.72	10.01
25-yr	8.63	15.31	6.68	2.52	8.66	6.14	6.83	6.83	0.00	17.98	30.34	12.36
50-yr	11.45	18.70	7.25	3.37	10.50	7.13	9.14	9.14	0.00	23.95	37.82	13.87
100-yr	14.69	22.46	7.77	4.36	12.51	8.15	11.82	11.82	0.00	30.85	46.19	15.34

TABLE 1: PEAK FLOW COMPARISON - EXISTING VS. PROPOSED (NO DETENTION)

As shown in the table above, the proposed multi-family development (SITE-PR) results in an increase in peak flow rates as compared to existing conditions (SITE-EX) without consideration of infiltration

or detention. To attenuate peak flow rates, subsurface infiltration and detention ponds are proposed, which will collect runoff from the collection network and attenuate peak flow rates and volumes. Further discussion is provided below.

INFILTRATION & DETENTION (Drainage Area Map DA-03A)

The proposed stormwater network consists of a series of infiltration and detention methods to attenuate peak flow rates.

PROPOSED AREA 01A (PR-01A)

Stormwater runoff within PR-01A will discharge to the following structures:

- INF-01A – Stormtech SC-740 subsurface infiltration systems consisting of 20 units to promote treatment and infiltration.
- INF-01B – Stormtech SC-740 subsurface infiltration systems consisting of 40 units to promote treatment and infiltration.
- POND-01A – Wet extended detention pond used for peak runoff attenuation with a shallow 5" deep wet pool to promote treatment and infiltration.
    - POND-01A will discharge through outlet control structure 01A (OCS 01A) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.

PROPOSED AREA 02A (PR-02A)

Stormwater runoff within PR-02A will discharge to the following structures:

- POND-02A – Wet extended detention pond used for peak runoff attenuation with a shallow 9" deep wet pool to promote treatment and infiltration from contributing area.
    - POND-02A will discharge through outlet control structure 02A (OCS 02A) with staged outlets to regulate outflow, emergency overflow weir, and riprap plunge pool to dissipate energy and velocity before flowing towards the downstream wetlands.

The combination of subsurface infiltration systems and wet extended detention ponds have been sized to attenuate peak flow rates and volumes as compared to pre-development conditions for the 2-, 5-, 10-, 25-, 50-, and 100-year storm events.

STORM EVENT	AREA 01			AREA 02			AREA 03			TOTAL SITE		
	SITE-EX-01	SITE-PR-01A	EX vs. PR	SITE-EX-02	SITE-PR-02A	EX vs. PR	SITE-EX-03	SITE-PR-03	EX vs. PR	SITE-EX	SITE-PR-DET-A	EX vs. PR
2-yr	1.15	1.19	0.04	0.30	0.34	0.04	0.81	0.81	0.00	2.26	2.24	-0.01
5-yr	3.09	2.56	-0.53	0.86	0.80	-0.07	2.34	2.34	0.00	6.29	5.27	-1.02
10-yr	5.20	4.23	-0.97	1.49	1.25	-0.24	4.03	4.03	0.00	10.71	9.36	-1.36
25-yr	8.63	7.01	-1.62	2.52	1.97	-0.55	6.83	6.83	0.00	17.98	15.61	-2.37
50-yr	11.45	8.89	-2.56	3.37	2.68	-0.69	9.14	9.14	0.00	23.95	20.51	-3.44
100-yr	14.69	12.15	-2.54	4.36	3.54	-0.82	11.82	11.82	0.00	30.85	26.11	-4.74

TABLE 2: PEAK FLOW COMPARISON - EXISTING VS. PROPOSED (WITH DETENTION)

As shown in Table 2 above, incorporation of the infiltration and detention systems into the proposed development results in a minor decrease in peak flow rates as compared to existing conditions for the entire Site. Although the results show a negligible increase for the 2-year storm within subarea 01 and 02, these minor increases are eliminated for entire Site due to offsetting times to peak flow. The plan provides for zero net increase in peak flow rates and volumes for all storms up to the 100-year event.

STORMWATER QUALITY & TREATMENT

The proposed development has been designed to reduce stormwater runoff and pollutant loads to the maximum extent possible and to treat the required water quality volume and flow per the CT DEEP 2004 Stormwater Quality Manual (2004 DEEP Manual). The proposed measures incorporated into the plan include:

- Maximize conservation and preservation of natural features. Impervious surfaces and buildings generally fall within historic limits of site disturbance activities. Stone walls, rock outcrops, and specimen trees have been preserved.
- Minimize clearing and grubbing maintain native vegetation on site. Where clearing of the mature tree vegetation is proposed within 50' of the delineated inland wetlands, native shrubs are proposed and conservation seed mix will be placed to provide a minimum 50' upland protection zone as recommended in the JBWMP.
- Minimize building footprint. Buildings have been designed to accommodate site grades and unit areas were condensed to maximizing the number of units in a limit footprint area.
- Minimize impervious surfaces for roadways and parking. Curb cuts and access drives are the minimum required for adequate site access and the proposed parking quantity is the minimum allowed per zoning requirements. Impervious area totals 11.5% of the total site, which is substantially lower than the 18% to 30% impervious cover referenced in Section 3.1.2.3 of the JBWMP for "intermediate" level uses such as multi-family.
- Disconnect impervious areas where possible, such as sidewalks. Disconnected impervious areas were not subtracted from the treatment calculations as a conservative measure.
- Collect, treat, and infiltrate to encourage groundwater recharge including the incorporation of base level and secondary controls to improve water quality as recommended by the JBWMP.

WATER QUALITY VOLUME & FLOW (Drainage Area Map DA-04A)

Water quality volumes and flows were calculated for all proposed impervious surfaces for the driveway, parking and building areas in accordance with the 2004 DEEP Manual.

AREA	DA	IA	WQV	WQF	PROPOSED TREATMENT			
Label	acre	acre	acre-ft	cfs	Method	Vol	Flow	Note
01A-1	1.674	0.505	0.045	0.370	Sedimentation & Filter Pond	0.093	N/A	100% WQV Retention
01A-2	2.556	0.658	0.060	0.495	Isolator Row	N/A	3.0	100% WQF Treatment
01A-3	0.280	0.135	0.011	0.127	Vegetated Swale to Wet Pond	0.041	N/A	100% WQV Retention
01B-1	0.950	0.544	0.045	0.504	Isolator Row	N/A	1.35	100% WQF Treatment
02A-1	2.525	1.221	0.102	0.804	HG4 to Wet Pond	0.090	0.8	100% WQF Treatment

TABLE 3: PROPOSED TREATMENT SUMMARY

As shown in Table 3 above, the proposed treatment measures will adequately retain the calculated water quality volume and/or treat the calculated water quality flow, removing 80% or more of total suspended solids and floatable debris for the first inch of rainfall before discharging to the Site wetlands

GROUNDWATER RECHARGE VOLUME

Existing non-wetland soils are classified as Charlton-Chatfield complex (HSG B) and the wetland soils as Ridgebury, Leicester, and Whitman (HSG D). Required Groundwater Recharge Volumes (GRV) were calculated in accordance with 2004 DEEP Manual based upon the area of each Hydrologic Soil Group.

GRV (required) = 0.041 acre-feet
GRV (provided) = 0.140 acre-feet

The combination of sediment and filtration basins, subsurface infiltration systems, and shallow depressions within each wet extended detention pond provide adequate capacity to fully retain over 3 times the recommended groundwater recharge volume, thereby exceeding the GRV requirement.

CONCLUSION

There will be no increase in peak flow rates or volumes discharging to the downgradient wetlands or adjacent properties. The stormwater network will maintain approved drainage patterns and utilize a combination of subsurface infiltration and detention ponds to regulate any increase in run-off on site. No adverse impacts to the site, adjacent wetlands, or municipal system are anticipated.

APPENDIX A
DRAINAGE AREA MAPS

Existing Conditions DA-01A
Proposed Conditions DA-02A
Proposed Detention DA 03A
Proposed Treatment DA-04A

LEGEND

ITEM	CN B
D.A. LIMIT	
TC PATH - SHEET	
TC PATH - SHALLOW	
TC PATH - CHANNEL	
NRCS SOIL	
IMPERVIOUS	98
OPEN SPACE (GOOD)	61
MEADOW/BRUSH	58
WOODS (GOOD)	55
WETLANDS (WOODS)	77(D)

WILLETTS AVENUE EXTENSION

NRCS SOIL BOUNDARY

UPSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

DRAINAGE AREA 'SITE-EX-02'
TOTAL AREA = 2.495 AC
WOODS (GOOD) = 2.495

61C

306

3

73C

ELEV.= 71±

SHEET FLOW - 200'
MEADOW/WOODS @ 5.5%

ELEV.= 60±

DRAINAGE AREA 'SITE-EX-01'
TOTAL AREA = 8.182 AC
IMPERVIOUS = 0.058
OPEN SPACE (GOOD) = 0.818
MEADOW/BRUSH (GOOD) = 0.434
WOODS (GOOD) = 6.872

SHALLOW CONC.- 650'
WOODS @ 4.8%

ELEV.= 44±

SHEET FLOW - 200'
MEADOW/WOODS @ 5.0%

ELEV.= 34±

SHALLOW CONC.- 210'
WOODS @ 5.7%

WETLANDS
AREA = 5.585 AC

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 22±

17

73C

DISCHARGE POINT AT INLAND WETLANDS
ELEV. = 29±

DRAINAGE AREA 'SITE-EX-03'
TOTAL AREA = 6.764 AC
WOODS (GOOD) = 6.764

WETLANDS
AREA = 3.609 AC

3

DOWNSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

SCALE: 1" = 160'

160 0 160

PROJECT NO:	DATE:	SHEET NO:
00096 - 001	11/18/20	DA-01A

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WATERFORD WOODS

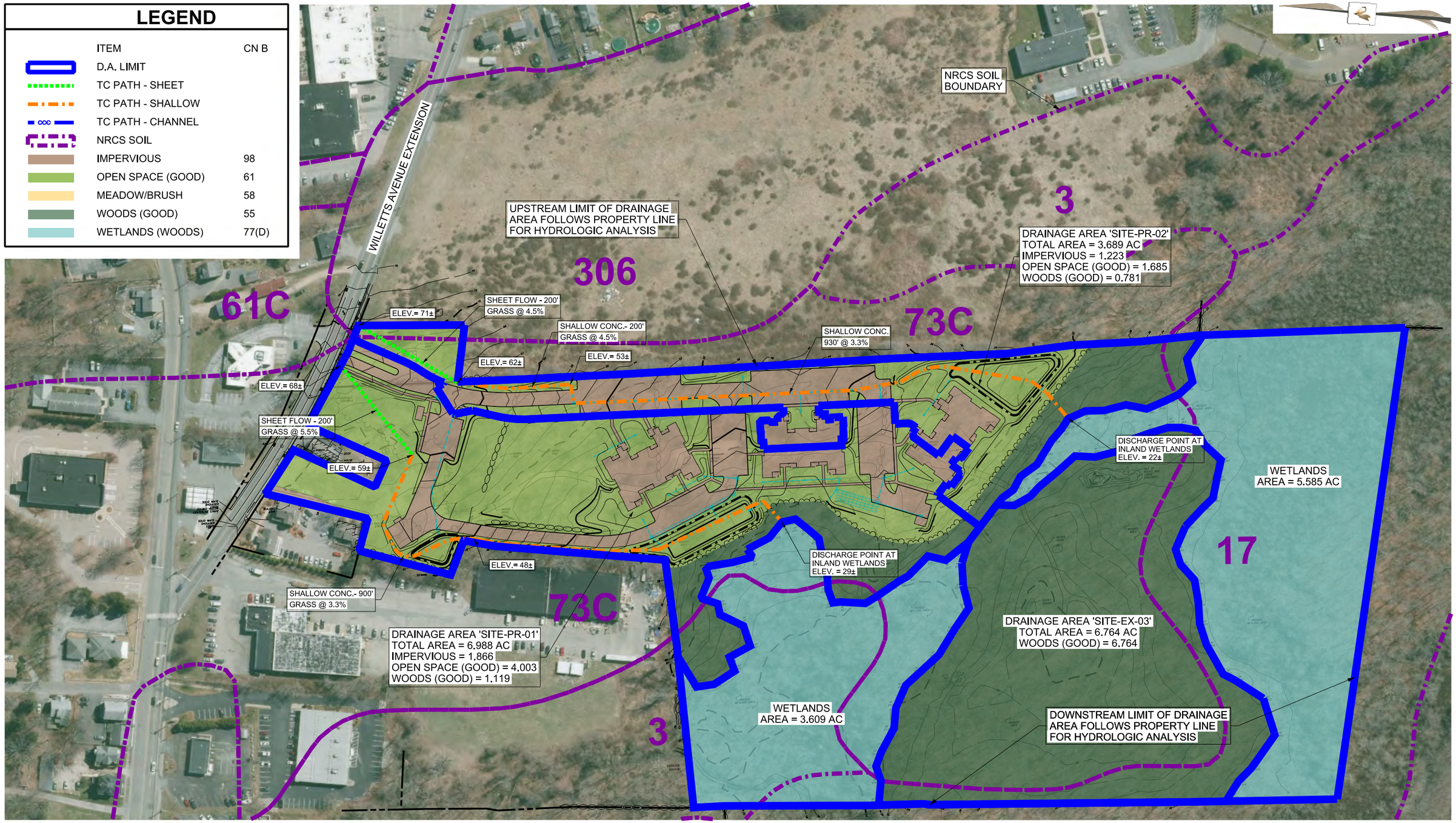
PREPARED FOR SIG CON ASSOCIATES, LLC

DRAINAGE MAP - EXISTING CONDITIONS SITE ONLY

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT

LEGEND

ITEM	CN B
D.A. LIMIT	
TC PATH - SHEET	
TC PATH - SHALLOW	
TC PATH - CHANNEL	
NRCS SOIL	
IMPERVIOUS	98
OPEN SPACE (GOOD)	61
MEADOW/BRUSH	58
WOODS (GOOD)	55
WETLANDS (WOODS)	77(D)



SCALE: 1" = 160'

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WATERFORD WOODS

PREPARED FOR SIG CON ASSOCIATES, LLC

DRAINAGE MAP - PROPOSED CONDITIONS SITE ONLY

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT

LEGEND

ITEM	CN B
D.A. LIMIT	
TC PATH - SHEET	
TC PATH - SHALLOW	
TC PATH - CHANNEL	
NRCS SOIL	
IMPERVIOUS	98
OPEN SPACE (GOOD)	61
MEADOW/BRUSH	58
WOODS (GOOD)	55
WETLANDS (WOODS)	77(D)

WILLETTS AVENUE EXTENSION

NRCS SOIL BOUNDARY

DRAINAGE AREA 'INF-01B'
TOTAL AREA = 0.950 AC
IMPERVIOUS = 0.544
OPEN SPACE (GOOD) = 0.406
WOODS (GOOD) = 0.000

DRAINAGE AREA 'POND-02A'
TOTAL AREA = 2.525 AC
IMPERVIOUS = 1.221
OPEN SPACE (GOOD) = 1.304
WOODS (GOOD) = 0.000

DRAINAGE AREA 'PR-02A'
TOTAL AREA = 1.164 AC
IMPERVIOUS = 0.002
OPEN SPACE (GOOD) = 0.381
WOODS (GOOD) = 0.781

61C
306
73C
3
73C
3
17

WETLANDS
AREA = 5.585 AC

DRAINAGE AREA 'POND-01A'
TOTAL AREA = 2.480 AC
IMPERVIOUS = 0.859
OPEN SPACE (GOOD) = 1.594
WOODS (GOOD) = 0.027

DRAINAGE AREA 'INF-01A'
TOTAL AREA = 2.029 AC
IMPERVIOUS = 0.440
OPEN SPACE (GOOD) = 1.589
WOODS (GOOD) = 0.000

DRAINAGE AREA 'PR-01A'
TOTAL AREA = 1.529 AC
IMPERVIOUS = 0.023
OPEN SPACE (GOOD) = 0.414
WOODS (GOOD) = 1.092

DRAINAGE AREA 'SITE-EX-03'
TOTAL AREA = 6.764 AC
WOODS (GOOD) = 6.764

WETLANDS
AREA = 3.609 AC

DOWNSTREAM LIMIT OF DRAINAGE AREA FOLLOWS PROPERTY LINE FOR HYDROLOGIC ANALYSIS

SCALE: 1" = 160'

160 0 160

PROJECT NO:	DATE:	SHEET NO:
00096 - 001	11/18/20	DA-03A

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WATERFORD WOODS

PREPARED FOR SIG CON ASSOCIATES, LLC

DRAINAGE MAP - PROPOSED DETENTION

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT

LEGEND

ITEM	CN B
D.A. LIMIT	
TC PATH - SHEET	
TC PATH - SHALLOW	
TC PATH - CHANNEL	
NRCS SOIL	
IMPERVIOUS	98
OPEN SPACE (GOOD)	61
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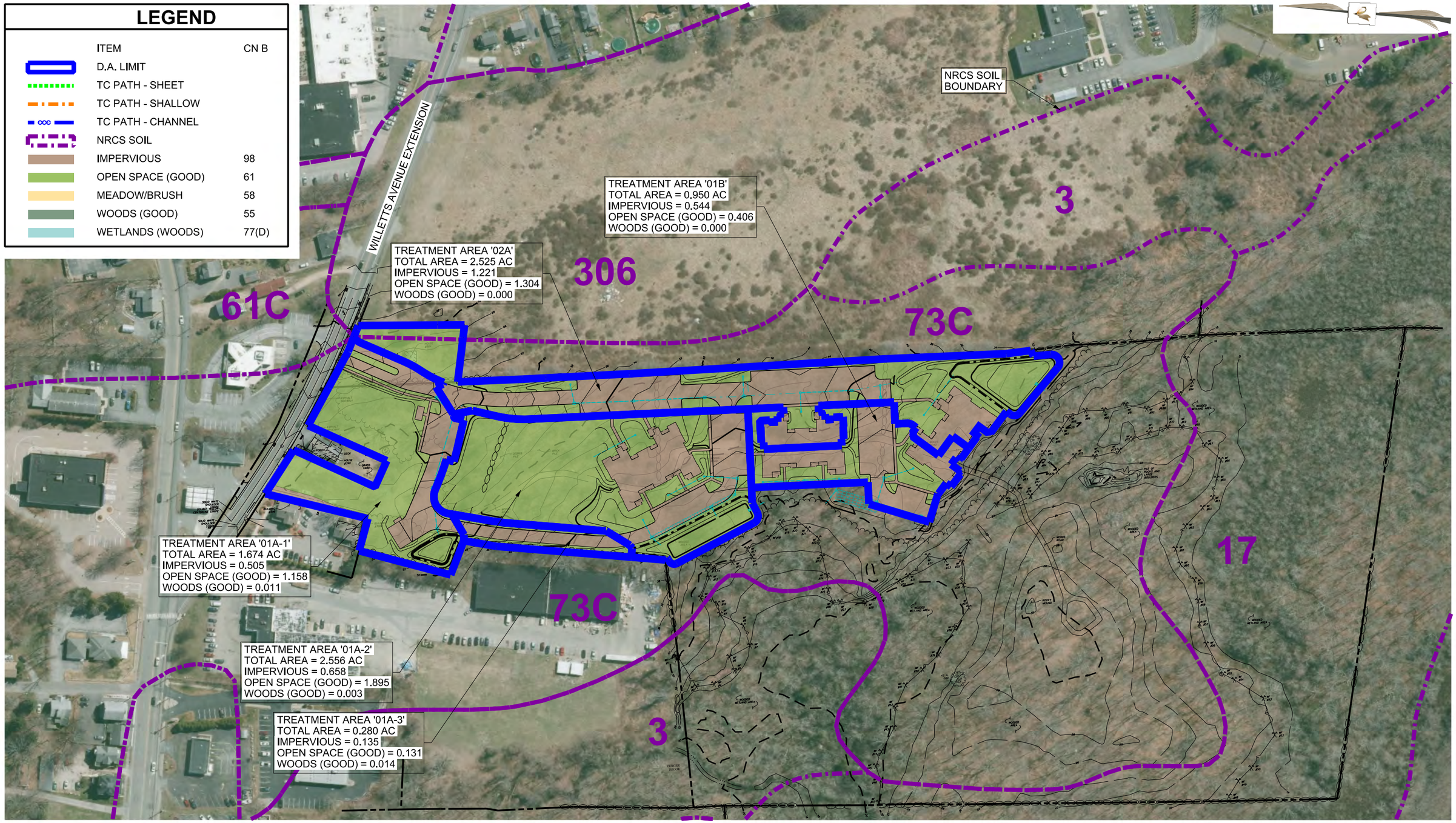

SCALE: 1" = 160'

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PROJECT NO:	DATE:	SHEET NO:
00096 - 001	11/18/20	DA-04A

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WATERFORD WOODS

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DRAINAGE MAP - PROPOSED TREATMENT

384 & 394 WILLETTS AVE. EXT. WATERFORD, CT

APPENDIX B
HYDROLOGIC COMPUTATIONS

HYDROLOGY STUDIO REPORT

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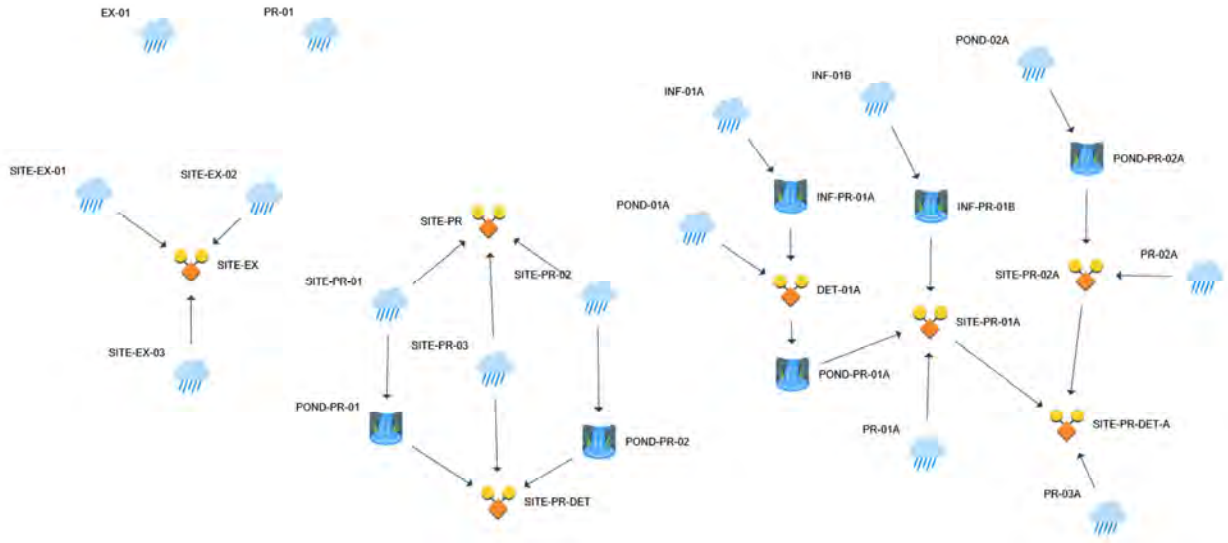
Basin Model

Hydrology Studio v 3.0.0.16

Project Name: Waterford Woods

11-23-2020



Hydrograph by Return Period

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	EX-01		9.328		20.10	30.75	47.38	60.64	75.64
2	NRCS Runoff	PR-01		14.24		27.12	39.27	57.79	72.27	88.49
3	NRCS Runoff	SITE-EX-01		1.146		3.092	5.196	8.632	11.45	14.69
4	NRCS Runoff	SITE-EX-02		0.299		0.861	1.486	2.519	3.372	4.359
5	NRCS Runoff	SITE-EX-03		0.811		2.335	4.028	6.830	9.141	11.82
6	Junction	SITE-EX		2.256		6.287	10.71	17.98	23.95	30.85
7	NRCS Runoff	SITE-PR-01		4.615		7.896	10.88	15.31	18.70	22.46
8	NRCS Runoff	SITE-PR-02		2.798		4.623	6.259	8.663	10.50	12.51
9	NRCS Runoff	SITE-PR-03		0.811		2.335	4.028	6.830	9.141	11.82
10	Junction	SITE-PR		7.916		14.44	20.72	30.34	37.82	46.19
11	Pond Route	POND-PR-01		0.876		2.949	4.132	8.795	11.56	16.47
12	Pond Route	POND-PR-02		0.244		0.429	0.871	1.410	2.138	3.570
13	Junction	SITE-PR-DET		1.578		5.355	8.228	15.96	21.30	29.90
14	NRCS Runoff	PR-01A		0.311		0.799	1.318	2.155	2.832	3.607
15	NRCS Runoff	POND-01A		2.095		3.372	4.502	6.155	7.407	8.776
16	NRCS Runoff	INF-01A		1.375		2.397	3.326	4.718	5.787	6.966
17	NRCS Runoff	INF-01B		1.803		2.618	3.307	4.283	5.006	5.786
18	NRCS Runoff	PR-02A		0.229		0.594	0.986	1.619	2.131	2.719
19	NRCS Runoff	POND-02A		2.818		4.247	5.481	7.242	8.554	9.976
20	NRCS Runoff	PR-03A		0.810		2.334	4.025	6.826	9.135	11.81
21	Pond Route	INF-PR-01A		0.989		2.264	3.243	4.625	5.648	6.841
22	Pond Route	INF-PR-01B		0.649		1.547	2.338	3.108	4.111	4.967
23	Junction	DET-01A		2.931		5.627	7.742	10.77	13.04	15.60
24	Pond Route	POND-PR-01A		0.408		1.520	2.734	3.984	4.788	8.811
25	Junction	SITE-PR-01A		1.189		2.561	4.231	7.010	8.887	12.15
26	Pond Route	POND-PR-02A		0.248		0.400	0.682	1.196	1.465	2.127
27	Junction	SITE-PR-02A		0.341		0.795	1.251	1.974	2.684	3.536
28	Junction	SITE-PR-DET-A		2.244		5.266	9.355	15.61	20.51	26.11

Hydrograph 2-yr Summary

Project Name: Waterford Woods

Hydrology Studio v 3.0.0.16

11-23-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	9.328	12.65	78,149	----		
2	NRCS Runoff	PR-01	14.24	12.58	102,734	----		
3	NRCS Runoff	SITE-EX-01	1.146	12.60	10,688	----		
4	NRCS Runoff	SITE-EX-02	0.299	12.60	2,921	----		
5	NRCS Runoff	SITE-EX-03	0.811	12.60	7,918	----		
6	Junction	SITE-EX	2.256	12.60	21,526	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	4.615	12.33	24,374	----		
8	NRCS Runoff	SITE-PR-02	2.798	12.32	14,401	----		
9	NRCS Runoff	SITE-PR-03	0.811	12.60	7,918	----		
10	Junction	SITE-PR	7.916	12.35	46,693	7, 8, 9		
11	Pond Route	POND-PR-01	0.876	13.13	16,964	7	31.73	9,343
12	Pond Route	POND-PR-02	0.244	14.03	5,059	8	29.01	6,484
13	Junction	SITE-PR-DET	1.578	12.90	29,942	9, 11, 12		
14	NRCS Runoff	PR-01A	0.311	12.38	2,192	----		
15	NRCS Runoff	POND-01A	2.095	12.32	10,595	----		
16	NRCS Runoff	INF-01A	1.375	12.27	6,727	----		
17	NRCS Runoff	INF-01B	1.803	12.10	5,800	----		
18	NRCS Runoff	PR-02A	0.229	12.38	1,635	----		
19	NRCS Runoff	POND-02A	2.818	12.30	13,788	----		
20	NRCS Runoff	PR-03A	0.810	12.60	7,913	----		
21	Pond Route	INF-PR-01A	0.989	12.48	5,543	16	31.36	886
22	Pond Route	INF-PR-01B	0.649	12.37	3,637	17	29.78	1,723
23	Junction	DET-01A	2.931	12.35	16,138	15, 21		
24	Pond Route	POND-PR-01A	0.408	13.55	9,761	23	31.28	6,936
25	Junction	SITE-PR-01A	1.189	12.42	15,591	14, 22, 24		
26	Pond Route	POND-PR-02A	0.248	13.57	4,647	19	29.02	6,568
27	Junction	SITE-PR-02A	0.341	12.55	6,282	18, 26		
28	Junction	SITE-PR-DET-A	2.244	12.52	29,786	20, 25, 27		

Hydrograph 5-yr Summary

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	20.10	12.58	143,800	----		
2	NRCS Runoff	PR-01	27.12	12.53	177,649	----		
3	NRCS Runoff	SITE-EX-01	3.092	12.52	21,793	----		
4	NRCS Runoff	SITE-EX-02	0.861	12.50	6,121	----		
5	NRCS Runoff	SITE-EX-03	2.335	12.50	16,594	----		
6	Junction	SITE-EX	6.287	12.50	44,508	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	7.896	12.32	39,644	----		
8	NRCS Runoff	SITE-PR-02	4.623	12.30	22,903	----		
9	NRCS Runoff	SITE-PR-03	2.335	12.50	16,594	----		
10	Junction	SITE-PR	14.44	12.33	79,141	7, 8, 9		
11	Pond Route	POND-PR-01	2.949	12.75	31,323	7	32.36	13,589
12	Pond Route	POND-PR-02	0.429	13.97	11,988	8	29.69	10,916
13	Junction	SITE-PR-DET	5.355	12.62	59,905	9, 11, 12		
14	NRCS Runoff	PR-01A	0.799	12.28	4,343	----		
15	NRCS Runoff	POND-01A	3.372	12.30	16,555	----		
16	NRCS Runoff	INF-01A	2.397	12.25	11,054	----		
17	NRCS Runoff	INF-01B	2.618	12.10	8,423	----		
18	NRCS Runoff	PR-02A	0.594	12.28	3,256	----		
19	NRCS Runoff	POND-02A	4.247	12.28	20,551	----		
20	NRCS Runoff	PR-03A	2.334	12.50	16,584	----		
21	Pond Route	INF-PR-01A	2.264	12.32	9,785	16	31.74	1,117
22	Pond Route	INF-PR-01B	1.547	12.22	6,006	17	30.17	2,129
23	Junction	DET-01A	5.627	12.32	26,340	15, 21		
24	Pond Route	POND-PR-01A	1.520	12.90	18,916	23	31.92	10,355
25	Junction	SITE-PR-01A	2.561	12.23	29,265	14, 22, 24		
26	Pond Route	POND-PR-02A	0.400	13.55	9,917	19	29.58	10,160
27	Junction	SITE-PR-02A	0.795	12.38	13,173	18, 26		
28	Junction	SITE-PR-DET-A	5.266	12.38	59,022	20, 25, 27		

Hydrograph 10-yr Summary

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	30.75	12.55	207,139	----		
2	NRCS Runoff	PR-01	39.27	12.50	247,960	----		
3	NRCS Runoff	SITE-EX-01	5.196	12.47	32,965	----		
4	NRCS Runoff	SITE-EX-02	1.486	12.45	9,376	----		
5	NRCS Runoff	SITE-EX-03	4.028	12.45	25,418	----		
6	Junction	SITE-EX	10.71	12.47	67,759	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	10.88	12.30	53,568	----		
8	NRCS Runoff	SITE-PR-02	6.259	12.30	30,571	----		
9	NRCS Runoff	SITE-PR-03	4.028	12.45	25,418	----		
10	Junction	SITE-PR	20.72	12.32	109,557	7, 8, 9		
11	Pond Route	POND-PR-01	4.132	12.73	44,502	7	32.97	18,290
12	Pond Route	POND-PR-02	0.871	13.23	18,648	8	30.15	14,239
13	Junction	SITE-PR-DET	8.228	12.57	88,568	9, 11, 12		
14	NRCS Runoff	PR-01A	1.318	12.25	6,482	----		
15	NRCS Runoff	POND-01A	4.502	12.30	21,884	----		
16	NRCS Runoff	INF-01A	3.326	12.23	15,020	----		
17	NRCS Runoff	INF-01B	3.307	12.10	10,684	----		
18	NRCS Runoff	PR-02A	0.986	12.25	4,872	----		
19	NRCS Runoff	POND-02A	5.481	12.28	26,457	----		
20	NRCS Runoff	PR-03A	4.025	12.45	25,403	----		
21	Pond Route	INF-PR-01A	3.243	12.28	13,684	16	31.93	1,226
22	Pond Route	INF-PR-01B	2.338	12.18	8,132	17	30.46	2,408
23	Junction	DET-01A	7.742	12.28	35,568	15, 21		
24	Pond Route	POND-PR-01A	2.734	12.73	27,524	23	32.28	12,946
25	Junction	SITE-PR-01A	4.231	12.52	42,138	14, 22, 24		
26	Pond Route	POND-PR-02A	0.682	13.20	14,808	19	30.02	13,080
27	Junction	SITE-PR-02A	1.251	12.32	19,680	18, 26		
28	Junction	SITE-PR-DET-A	9.355	12.45	87,221	20, 25, 27		

Hydrograph 25-yr Summary

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	47.38	12.52	305,899	----		
2	NRCS Runoff	PR-01	57.79	12.48	355,425	----		
3	NRCS Runoff	SITE-EX-01	8.632	12.43	50,903	----		
4	NRCS Runoff	SITE-EX-02	2.519	12.42	14,640	----		
5	NRCS Runoff	SITE-EX-03	6.830	12.42	39,689	----		
6	Junction	SITE-EX	17.98	12.42	105,232	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	15.31	12.30	74,402	----		
8	NRCS Runoff	SITE-PR-02	8.663	12.28	41,952	----		
9	NRCS Runoff	SITE-PR-03	6.830	12.42	39,689	----		
10	Junction	SITE-PR	30.34	12.32	156,043	7, 8, 9		
11	Pond Route	POND-PR-01	8.795	12.60	64,406	7	33.72	24,041
12	Pond Route	POND-PR-02	1.410	13.07	28,854	8	30.73	19,479
13	Junction	SITE-PR-DET	15.96	12.58	132,948	9, 11, 12		
14	NRCS Runoff	PR-01A	2.155	12.23	9,891	----		
15	NRCS Runoff	POND-01A	6.155	12.28	29,741	----		
16	NRCS Runoff	INF-01A	4.718	12.23	20,975	----		
17	NRCS Runoff	INF-01B	4.283	12.08	13,933	----		
18	NRCS Runoff	PR-02A	1.619	12.23	7,450	----		
19	NRCS Runoff	POND-02A	7.242	12.28	35,018	----		
20	NRCS Runoff	PR-03A	6.826	12.42	39,666	----		
21	Pond Route	INF-PR-01A	4.625	12.27	19,554	16	32.18	1,365
22	Pond Route	INF-PR-01B	3.108	12.17	11,227	17	30.90	2,788
23	Junction	DET-01A	10.77	12.28	49,296	15, 21		
24	Pond Route	POND-PR-01A	3.984	12.70	40,433	23	32.89	17,616
25	Junction	SITE-PR-01A	7.010	12.32	61,551	14, 22, 24		
26	Pond Route	POND-PR-02A	1.196	12.98	22,348	19	30.45	16,991
27	Junction	SITE-PR-02A	1.974	12.25	29,798	18, 26		
28	Junction	SITE-PR-DET-A	15.61	12.37	131,015	20, 25, 27		

Hydrograph 50-yr Summary

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	60.64	12.52	384,652	----		
2	NRCS Runoff	PR-01	72.27	12.48	439,881	----		
3	NRCS Runoff	SITE-EX-01	11.45	12.42	65,512	----		
4	NRCS Runoff	SITE-EX-02	3.372	12.40	18,948	----		
5	NRCS Runoff	SITE-EX-03	9.141	12.40	51,370	----		
6	Junction	SITE-EX	23.95	12.40	135,830	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	18.70	12.28	90,521	----		
8	NRCS Runoff	SITE-PR-02	10.50	12.28	50,705	----		
9	NRCS Runoff	SITE-PR-03	9.141	12.40	51,370	----		
10	Junction	SITE-PR	37.82	12.32	192,596	7, 8, 9		
11	Pond Route	POND-PR-01	11.56	12.58	79,959	7	34.09	27,053
12	Pond Route	POND-PR-02	2.138	12.93	36,806	8	31.17	23,423
13	Junction	SITE-PR-DET	21.30	12.52	168,134	9, 11, 12		
14	NRCS Runoff	PR-01A	2.832	12.23	12,652	----		
15	NRCS Runoff	POND-01A	7.407	12.28	35,756	----		
16	NRCS Runoff	INF-01A	5.787	12.23	25,595	----		
17	NRCS Runoff	INF-01B	5.006	12.08	16,372	----		
18	NRCS Runoff	PR-02A	2.131	12.23	9,540	----		
19	NRCS Runoff	POND-02A	8.554	12.28	41,490	----		
20	NRCS Runoff	PR-03A	9.135	12.40	51,339	----		
21	Pond Route	INF-PR-01A	5.648	12.27	24,117	16	32.42	1,492
22	Pond Route	INF-PR-01B	4.111	12.15	13,567	17	31.23	2,998
23	Junction	DET-01A	13.04	12.28	59,874	15, 21		
24	Pond Route	POND-PR-01A	4.788	12.70	50,437	23	33.39	21,523
25	Junction	SITE-PR-01A	8.887	12.30	76,655	14, 22, 24		
26	Pond Route	POND-PR-02A	1.465	12.97	28,104	19	30.81	20,179
27	Junction	SITE-PR-02A	2.684	12.37	37,644	18, 26		
28	Junction	SITE-PR-DET-A	20.51	12.37	165,639	20, 25, 27		

Hydrograph 100-yr Summary

Project Name: Waterford Woods

11-23-2020

Hydrology Studio v 3.0.0.16

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-01	75.64	12.50	474,030	----		
2	NRCS Runoff	PR-01	88.49	12.47	534,803	----		
3	NRCS Runoff	SITE-EX-01	14.69	12.40	82,325	----		
4	NRCS Runoff	SITE-EX-02	4.359	12.38	23,924	----		
5	NRCS Runoff	SITE-EX-03	11.82	12.38	64,858	----		
6	Junction	SITE-EX	30.85	12.38	171,106	3, 4, 5		
7	NRCS Runoff	SITE-PR-01	22.46	12.28	108,450	----		
8	NRCS Runoff	SITE-PR-02	12.51	12.28	60,403	----		
9	NRCS Runoff	SITE-PR-03	11.82	12.38	64,858	----		
10	Junction	SITE-PR	46.19	12.30	233,711	7, 8, 9		
11	Pond Route	POND-PR-01	16.47	12.52	97,355	7	34.38	29,751
12	Pond Route	POND-PR-02	3.570	12.78	45,838	8	31.54	26,759
13	Junction	SITE-PR-DET	29.90	12.52	208,050	9, 11, 12		
14	NRCS Runoff	PR-01A	3.607	12.22	15,818	----		
15	NRCS Runoff	POND-01A	8.776	12.28	42,399	----		
16	NRCS Runoff	INF-01A	6.966	12.23	30,743	----		
17	NRCS Runoff	INF-01B	5.786	12.08	19,033	----		
18	NRCS Runoff	PR-02A	2.719	12.22	11,939	----		
19	NRCS Runoff	POND-02A	9.976	12.28	48,578	----		
20	NRCS Runoff	PR-03A	11.81	12.38	64,819	----		
21	Pond Route	INF-PR-01A	6.841	12.27	29,206	16	32.83	1,671
22	Pond Route	INF-PR-01B	4.967	12.15	16,133	17	31.48	3,145
23	Junction	DET-01A	15.60	12.27	71,606	15, 21		
24	Pond Route	POND-PR-01A	8.811	12.57	61,634	23	33.72	24,048
25	Junction	SITE-PR-01A	12.15	12.53	93,584	14, 22, 24		
26	Pond Route	POND-PR-02A	2.127	12.87	34,493	19	31.17	23,394
27	Junction	SITE-PR-02A	3.536	12.30	46,432	18, 26		
28	Junction	SITE-PR-DET-A	26.11	12.50	204,835	20, 25, 27		

APPENDIX C
STORMWATER TREATMENT CALCULATIONS

Proposed Area 01A-1
Proposed Area 01A-2
Proposed Area 01A-3
Proposed Area 01-B-1
Proposed Area 02A-1
Groundwater Recharge Calculations

STORMWATER TREATMENT CALCULATIONS [AREA 01A-1]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)
R = Volumetric Runoff Coefficient, 0.050 + 0.009(I)
I = Percent Impervious Cover, Impervious Area / Total Area
DA = Drainage Area (Acres) DA = 1.674 acres
IA = Impervious Area (Acres) IA = 0.505 acres

Determine Percent Impervious Cover (I)

I = 30%

Calculate Volumetric Runoff Coefficient (R)

R = 0.32

Calculate Water Quality Volume

WQV = 0.045 acre-feet

Compute Runoff Depth

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)
WQV = Water Quality Volume (acre-feet)
DA = Drainage Area (acres)

$Q_{(in)}$ = 0.32 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.32 watershed inches P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = 90

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = 0.222 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = 0.33 hours

I_a/P = 0.222

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = 440 csm/in

Compute Water Quality Flow

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.370 cfs

Figure 2-1 Solution of Runoff Equation

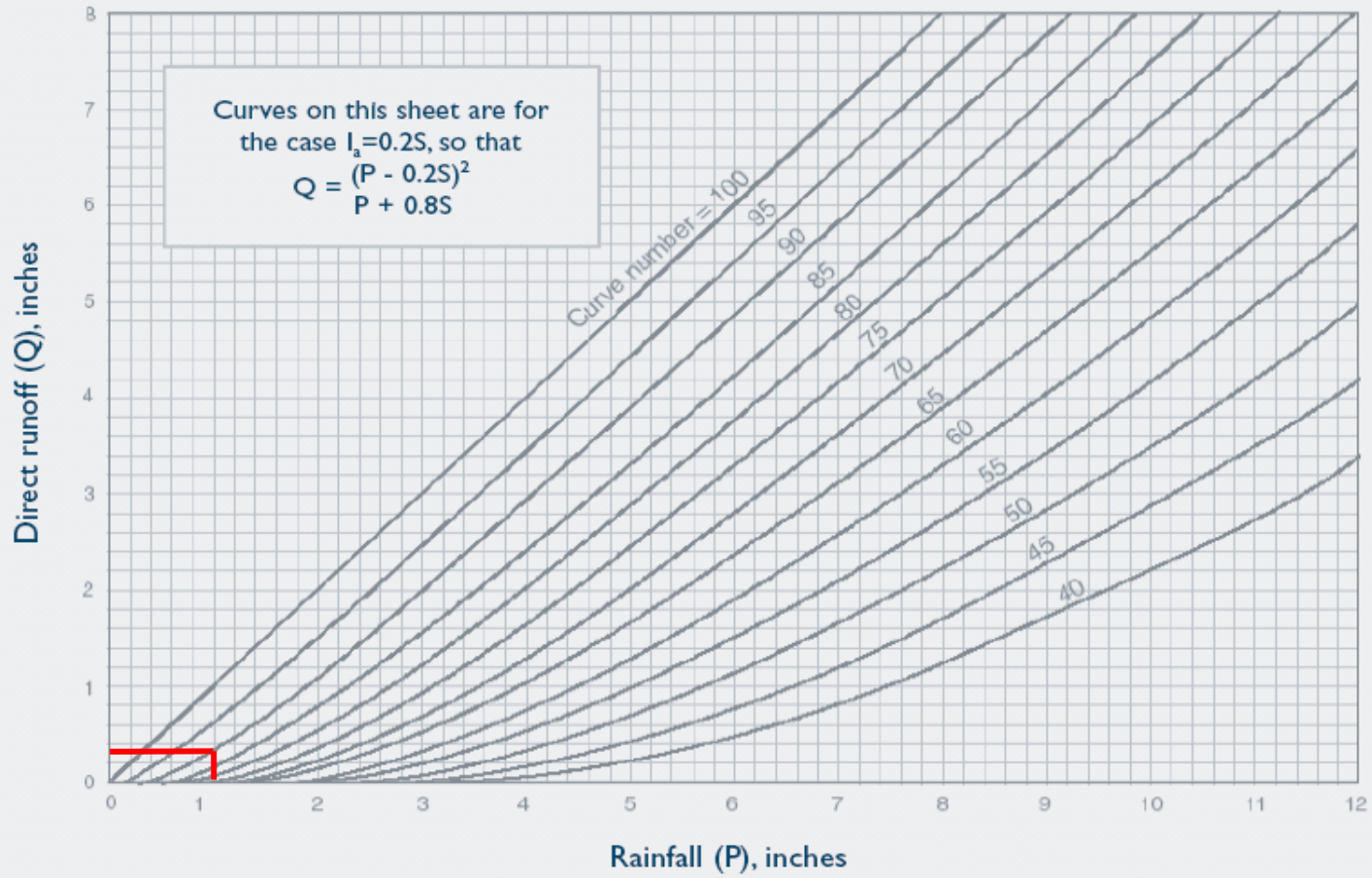
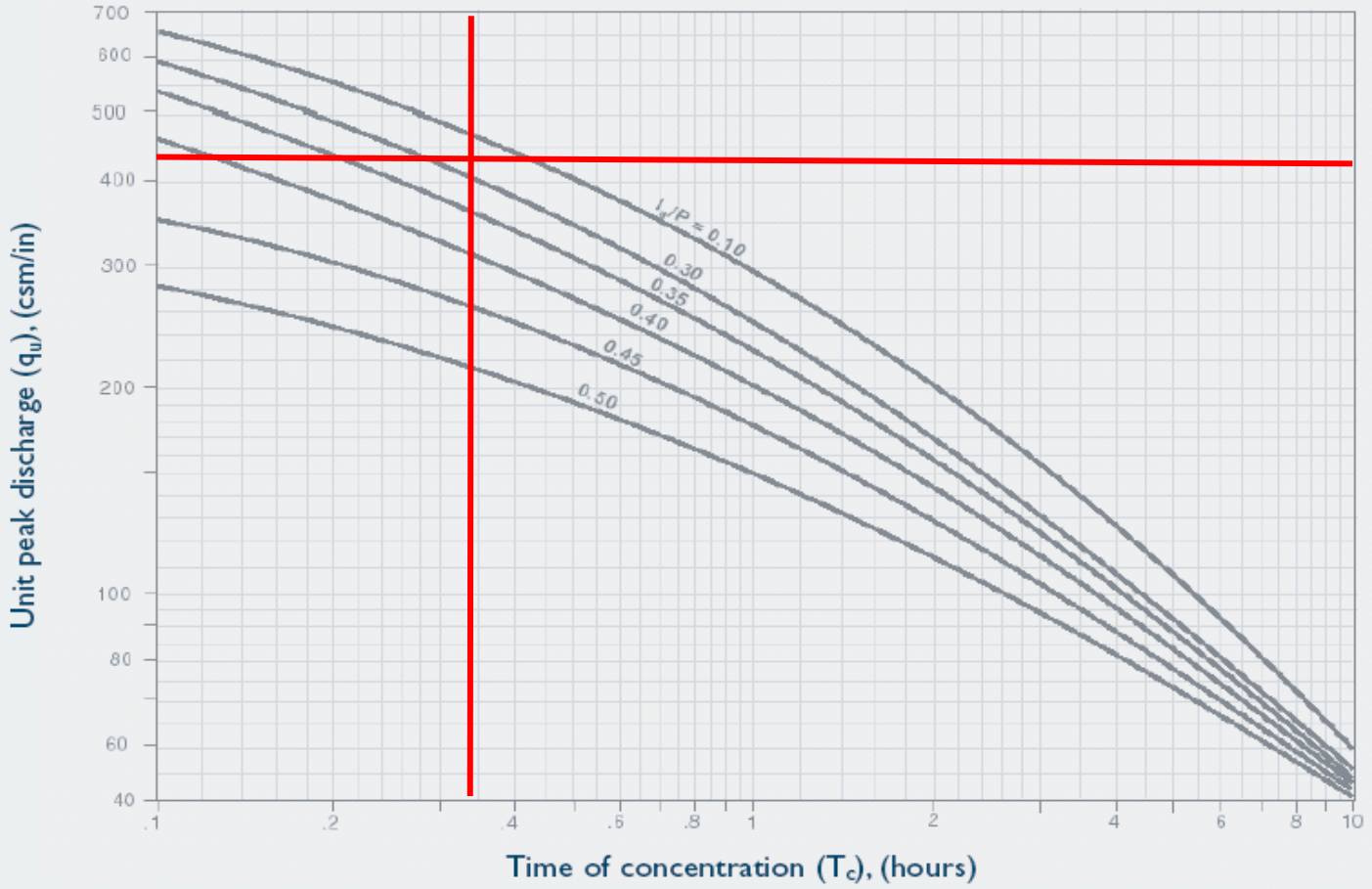


Table 4-1 I_a values for runoff curve numbers

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		

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



Return to Outlet Treatment Summary

STORMWATER TREATMENT CALCULATIONS [AREA 01A-2]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)
R = Volumetric Runoff Coefficient, 0.050 + 0.009(I)
I = Percent Impervious Cover, Impervious Area / Total Area
DA = Drainage Area (Acres) DA = 2.556 acres
IA = Impervious Area (Acres) IA = 0.658 acres

Determine Percent Impervious Cover (I)

I = 26%

Calculate Volumetric Runoff Coefficient (R)

R = 0.28

Calculate Water Quality Volume

WQV = 0.060 acre-feet

Compute Runoff Depth

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)
WQV = Water Quality Volume (acre-feet)
DA = Drainage Area (acres)

$Q_{(in)}$ = 0.28 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.28 watershed inches P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = 88

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = 0.273 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = 0.30 hours

I_a/P = 0.273

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = 440 csm/in

Compute Water Quality Flow

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.495 cfs

Figure 2-1 Solution of Runoff Equation

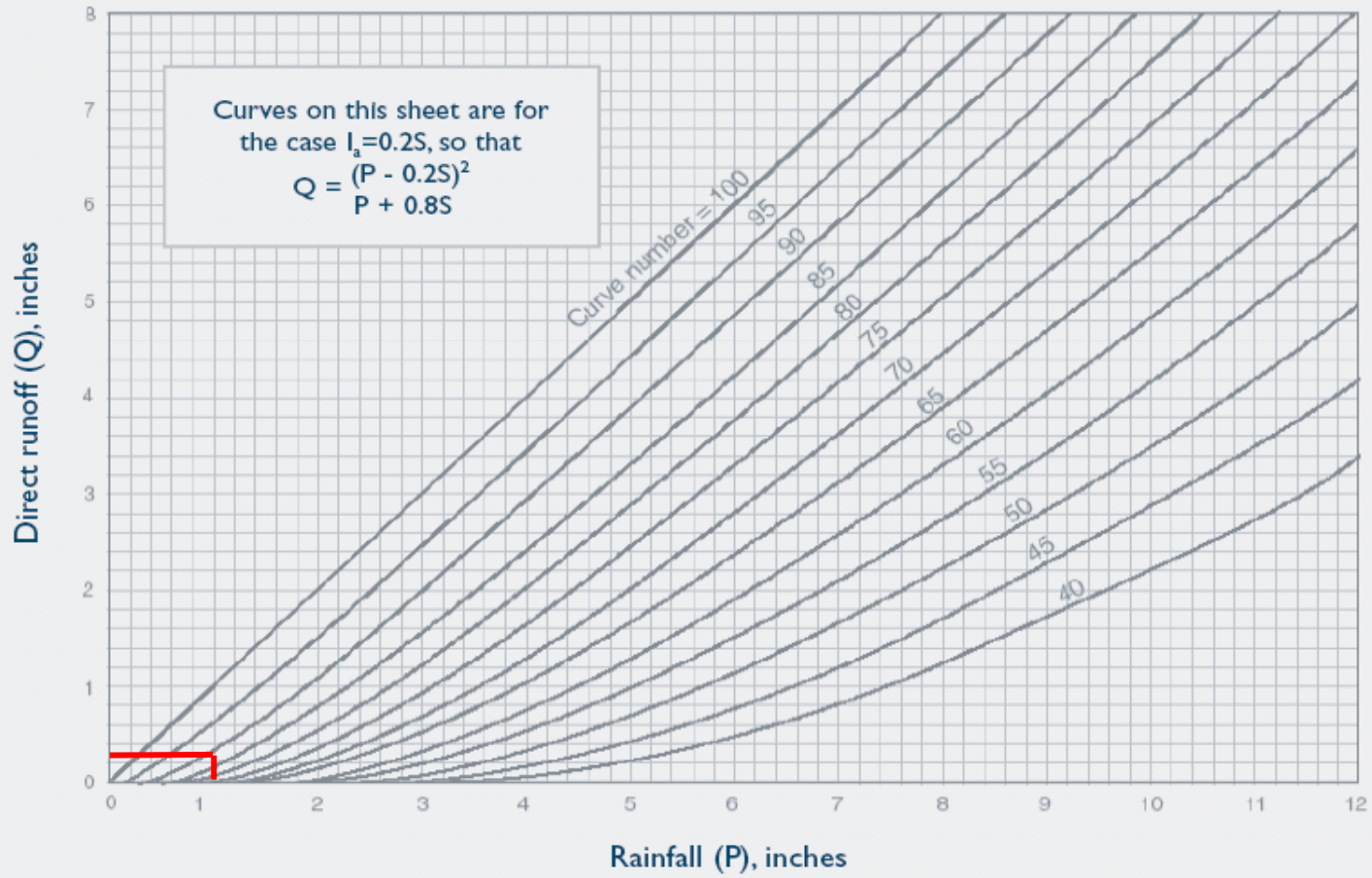
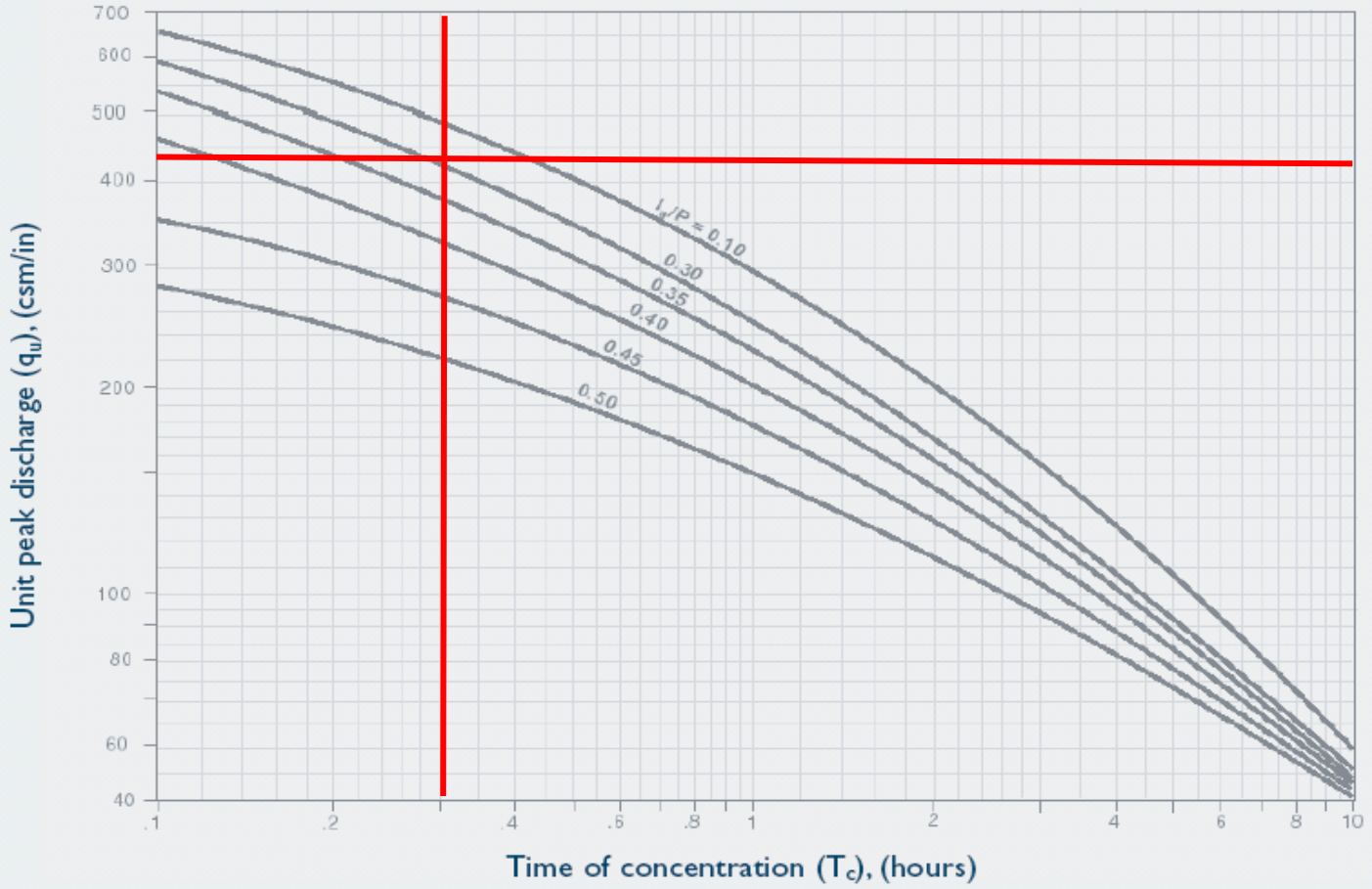


Table 4-1 I_a values for runoff curve numbers

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		

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



Return to Outlet Treatment Summary

STORMWATER TREATMENT CALCULATIONS [AREA 01A-3]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)
R = Volumetric Runoff Coefficient, 0.050 + 0.009(I)
I = Percent Impervious Cover, Impervious Area / Total Area
DA = Drainage Area (Acres) DA = 0.280 acres
IA = Impervious Area (Acres) IA = 0.135 acres

Determine Percent Impervious Cover (I) **Calculate Volumetric Runoff Coefficient (R)**

I = 48% R = 0.48

Calculate Water Quality Volume

WQV = 0.011 acre-feet

Compute Runoff Depth

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)
WQV = Water Quality Volume (acre-feet)
DA = Drainage Area (acres)

$Q_{(in)}$ = 0.48 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.48 watershed inches P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual
CN = 93

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual
I_a = 0.151 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet
T_c = 0.13 hours

I_a/P = 0.151

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual
q_u = 600 csm/in

Compute Water Quality Flow

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.127 **cfs**

Figure 2-1 Solution of Runoff Equation

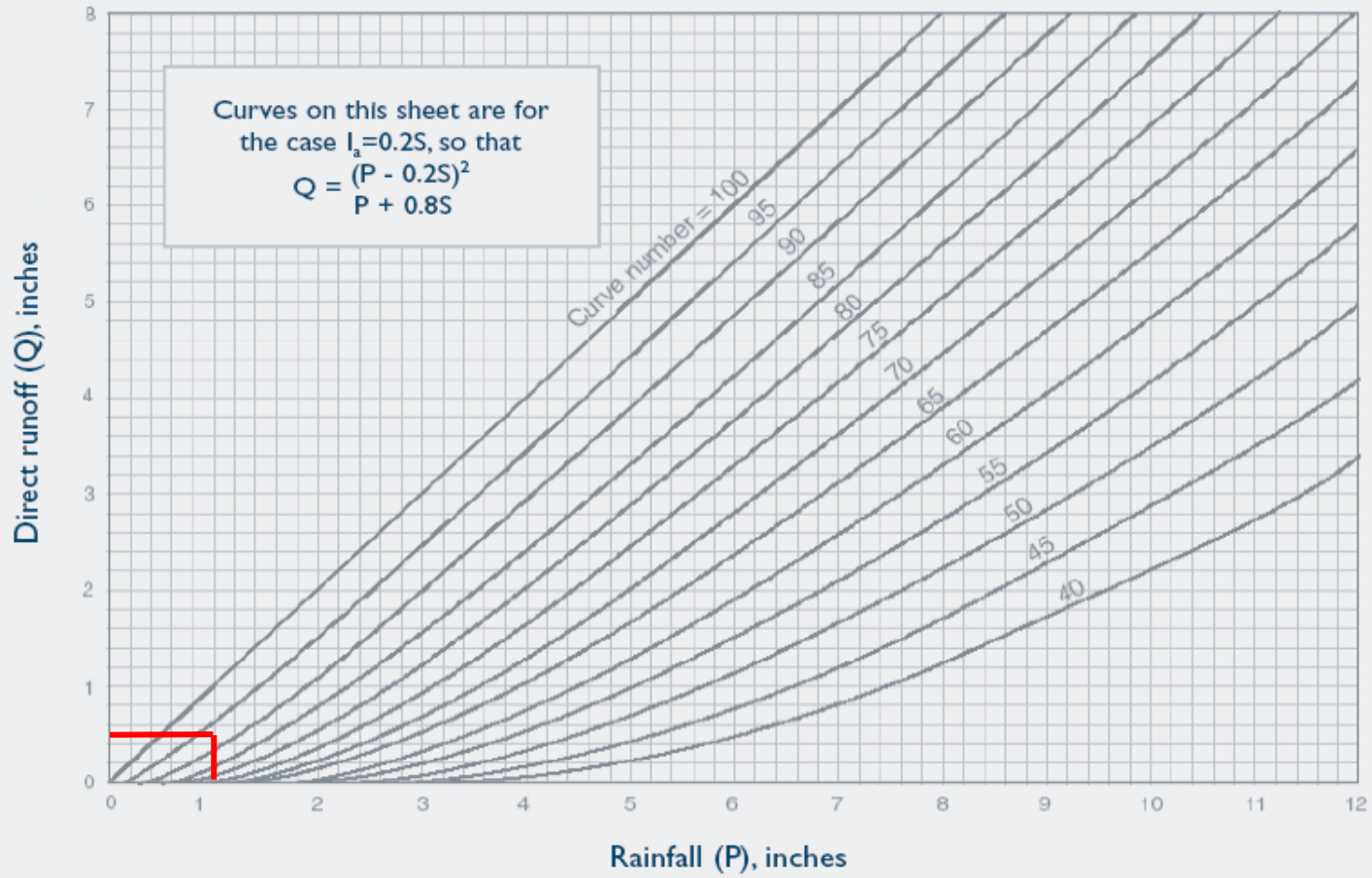


Table 4-1 I_a values for runoff curve numbers

Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)	Curve number	I_a (in)
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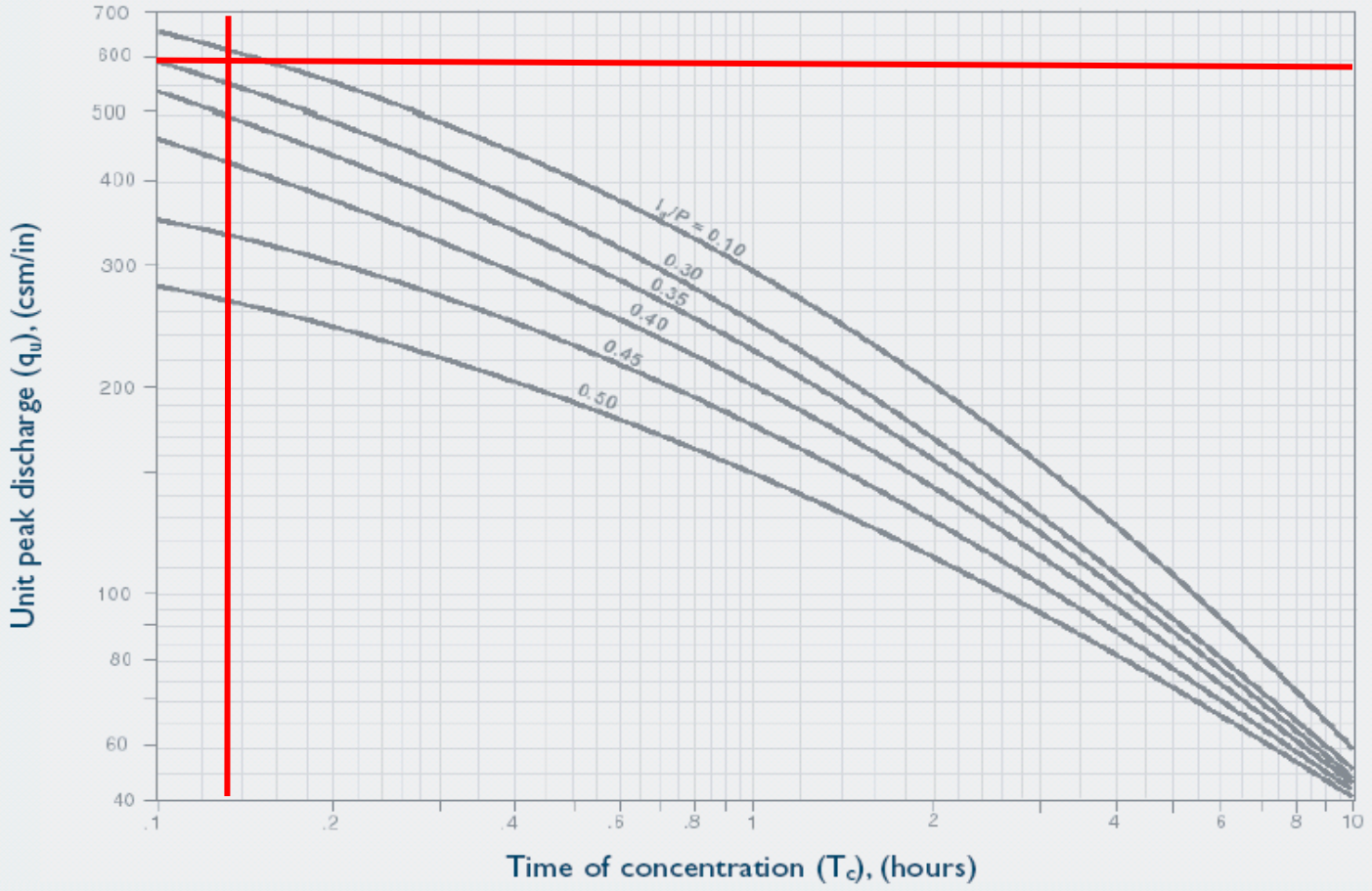


Return to Outlet Treatment Summary

STORMWATER TREATMENT CALCULATIONS [AREA 01B-1]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)
R = Volumetric Runoff Coefficient, 0.050 + 0.009(I)
I = Percent Impervious Cover, Impervious Area / Total Area
DA = Drainage Area (Acres) DA = **0.950** acres
IA = Impervious Area (Acres) IA = **0.544** acres

Determine Percent Impervious Cover (I) **Calculate Volumetric Runoff Coefficient (R)**

I = 57% R = 0.57

Calculate Water Quality Volume

WQV = 0.045 acre-feet

Compute Runoff Depth

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)
WQV = Water Quality Volume (acre-feet)
DA = Drainage Area (acres)

$Q_{(in)}$ = 0.57 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.57 watershed inches P = **1** in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual
CN = **94**

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual
I_a = **0.128** inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet
T_c = **0.13** hours

I_a/P = 0.128

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual
q_u = **600** csm/in

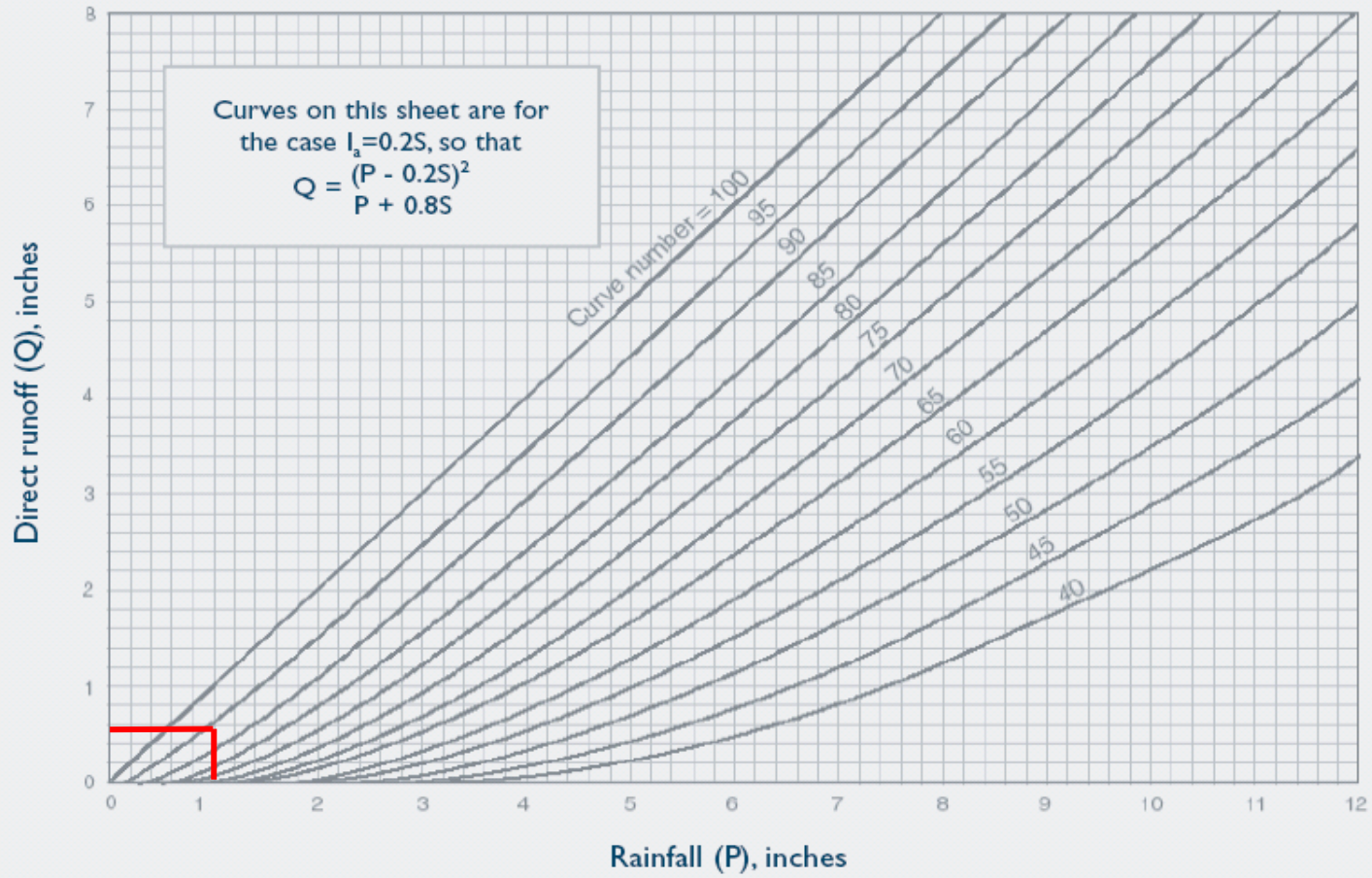
Compute Water Quality Flow

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.504 cfs

Figure 2-1 Solution of Runoff Equation



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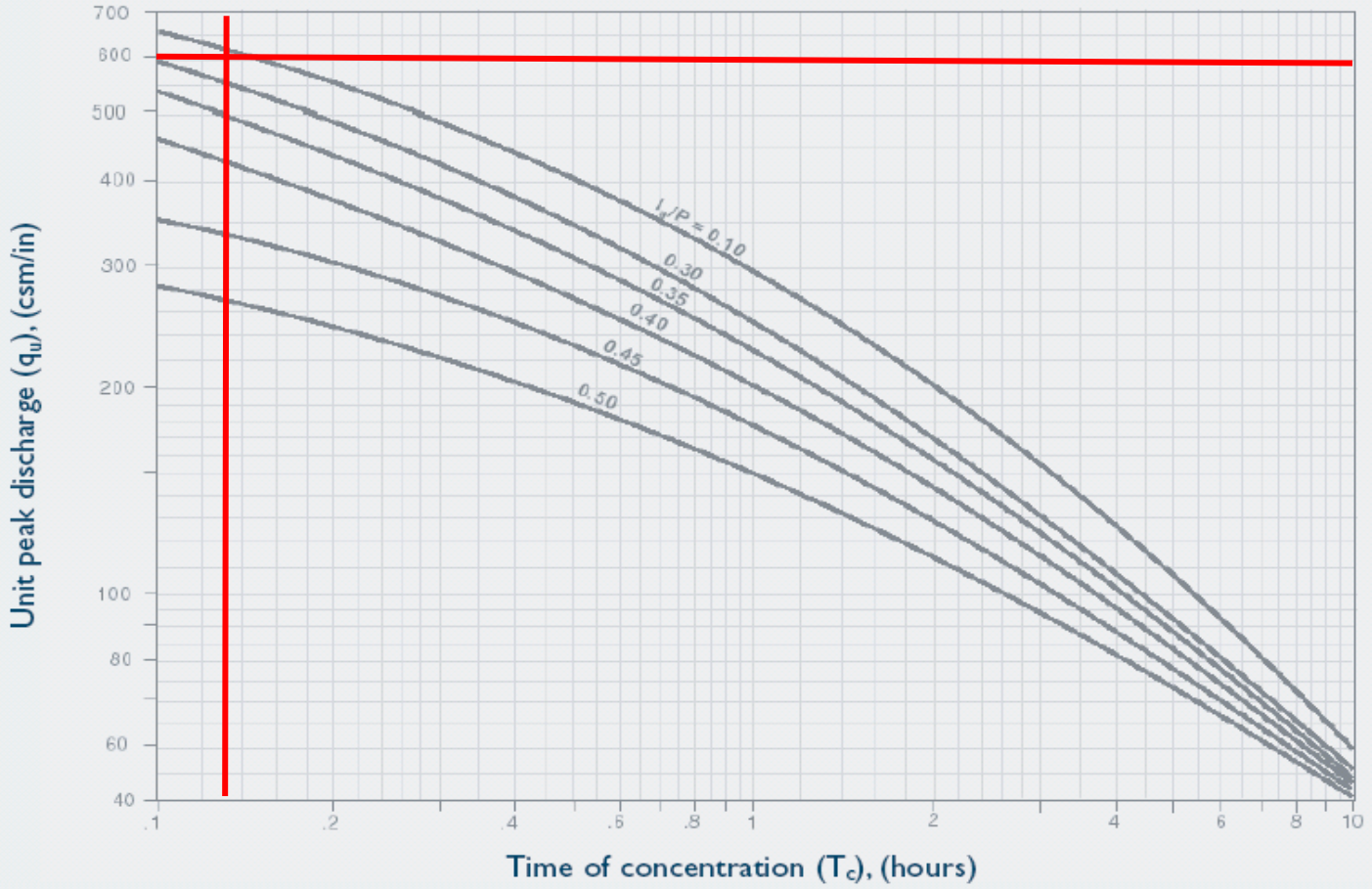

Return to Outlet Treatment Summary

STORMWATER TREATMENT CALCULATIONS [AREA 02A-1]

Compute Water Quality Volume

$$WQV = \frac{(1" \times R \times A)}{12}$$

WQV = Water Quality Volume (acre-feet)
R = Volumetric Runoff Coefficient, 0.050 + 0.009(I)
I = Percent Impervious Cover, Impervious Area / Total Area
DA = Drainage Area (Acres) DA = 2.525 acres
IA = Impervious Area (Acres) IA = 1.221 acres

Determine Percent Impervious Cover (I)

I = 48%

Calculate Volumetric Runoff Coefficient (R)

R = 0.49

Calculate Water Quality Volume

WQV = 0.102 acre-feet

Compute Runoff Depth

$$Q_{(in)} = \frac{(WQV \times 12)}{DA}$$

Q = Runoff Depth (in watershed inches)
WQV = Water Quality Volume (acre-feet)
DA = Drainage Area (acres)

$Q_{(in)}$ = 0.49 watershed inches

Determine NCRS Curve Number (CN)

$Q_{(in)}$ = 0.49 watershed inches P = 1 in

From Appendix B, Figure 2-1 of the 2004 Connecticut Stormwater Manual

CN = 93

Determine Initial Abstraction (I_a)

From Appendix B, Table 4-1 of the 2004 Connecticut Stormwater Manual

I_a = 0.151 inches

Determine Unit Peak Discharge (q_u)

Time of Concentration (T_c), referenced from Pipe Flow Calculation Worksheet

T_c = 0.42 hours

I_a/P = 0.151

From Appendix B, Exhibit 4-111 of the 2004 Connecticut Stormwater Manual

q_u = 420 csm/in

Compute Water Quality Flow

$$WQF = q_u \times DA \times Q_{(in)}$$

WQF = Water Quality Flow (cfs)
qu = unit peak discharge (cfs/mi^2/inch)
DA = drainage area (mi^2)
Q(in) = runoff depth (watershed inches)

WQF = 0.804 cfs

Figure 2-1 Solution of Runoff Equation

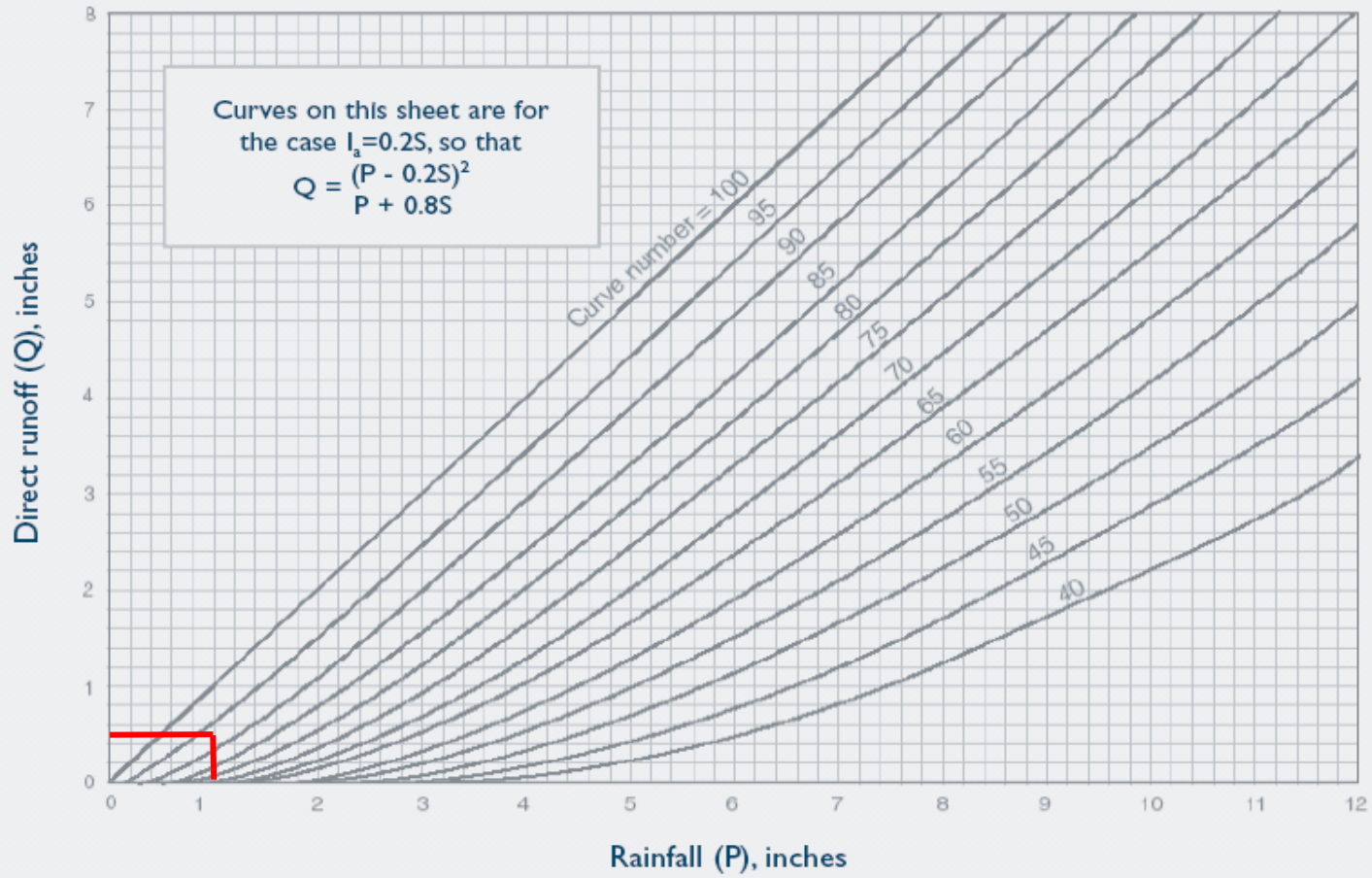

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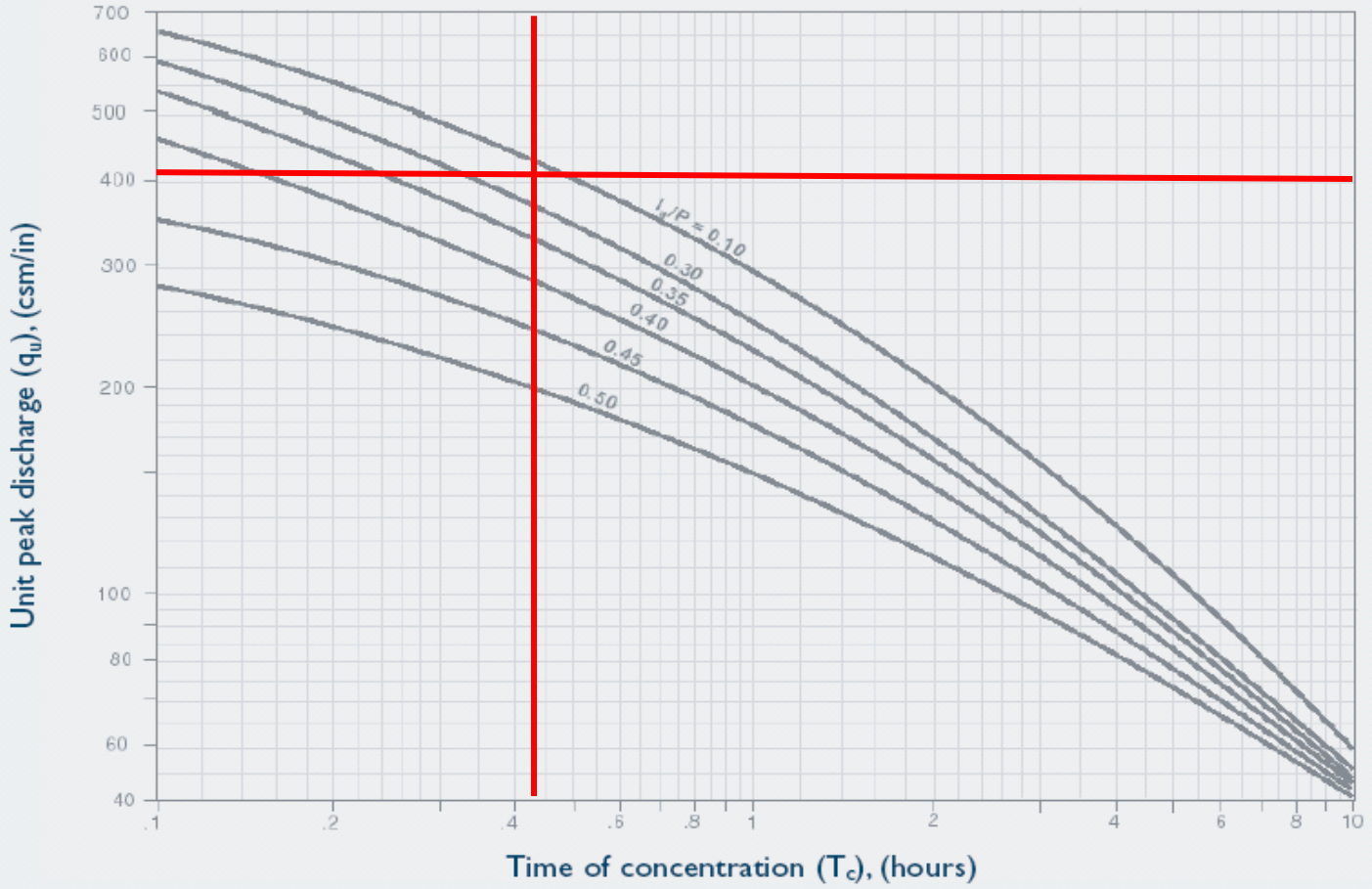
Exhibit 4-111 Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



Return to Outlet Treatment Summary

GROUNDWATER RECHARGE CALCULATIONS

Groundwater Recharge Volume

$$GRV = \frac{(D)(A)(I)}{12}$$

GRV = Groundwater Volume (acre-ft)
D = recharge depth (inches) per LID Table 2.1
A = Site Area (acres)
I = Site Imperviousness

Determine Site Imperviousness (I)

A =	26.635	acres
I_{PRE} =	0.058	acres
I_{POST} =	3.089	acres

$$I = \frac{I_{POST} - I_{PRE}}{A}$$

Calculate Site Imperviousness (I)

I =	0.114	GRV design required

Compute Groundwater Recharge Volume

			HSG A	HSG B	HSG C	HSG D
D =	0.16	Composite		17.441		9.194
A =	26.635	acres				
I =	0.114					

Calculate GRV

GRV =	0.041	acre-ft	GRV design required

Summarize Groundwater Recharge Volume Provided

Structure	GRV Provided				Notes
INF-01A	90.00	CF	0.002	acre-ft	Retention volume below 4" diameter low level outlet at 30.00
INF-01B	300.00	CF	0.007	acre-ft	Retention volume below 4" diameter low level outlet at 28.50
POND-01A	1800.00	CF	0.041	acre-ft	Retention volume below 4" diameter low level outlet at 30.17
POND-02A	3900.00	CF	0.090	acre-ft	Retention volume below 4" diameter low level outlet at 28.50
			0.140	acre-ft	**3.4 times required GRV within retention areas**

APPENDIX D
SUPPLEMENTAL DATA

NRCS SOIL DATA
NOAA RAINFALL DATA

United States Department of Agriculture

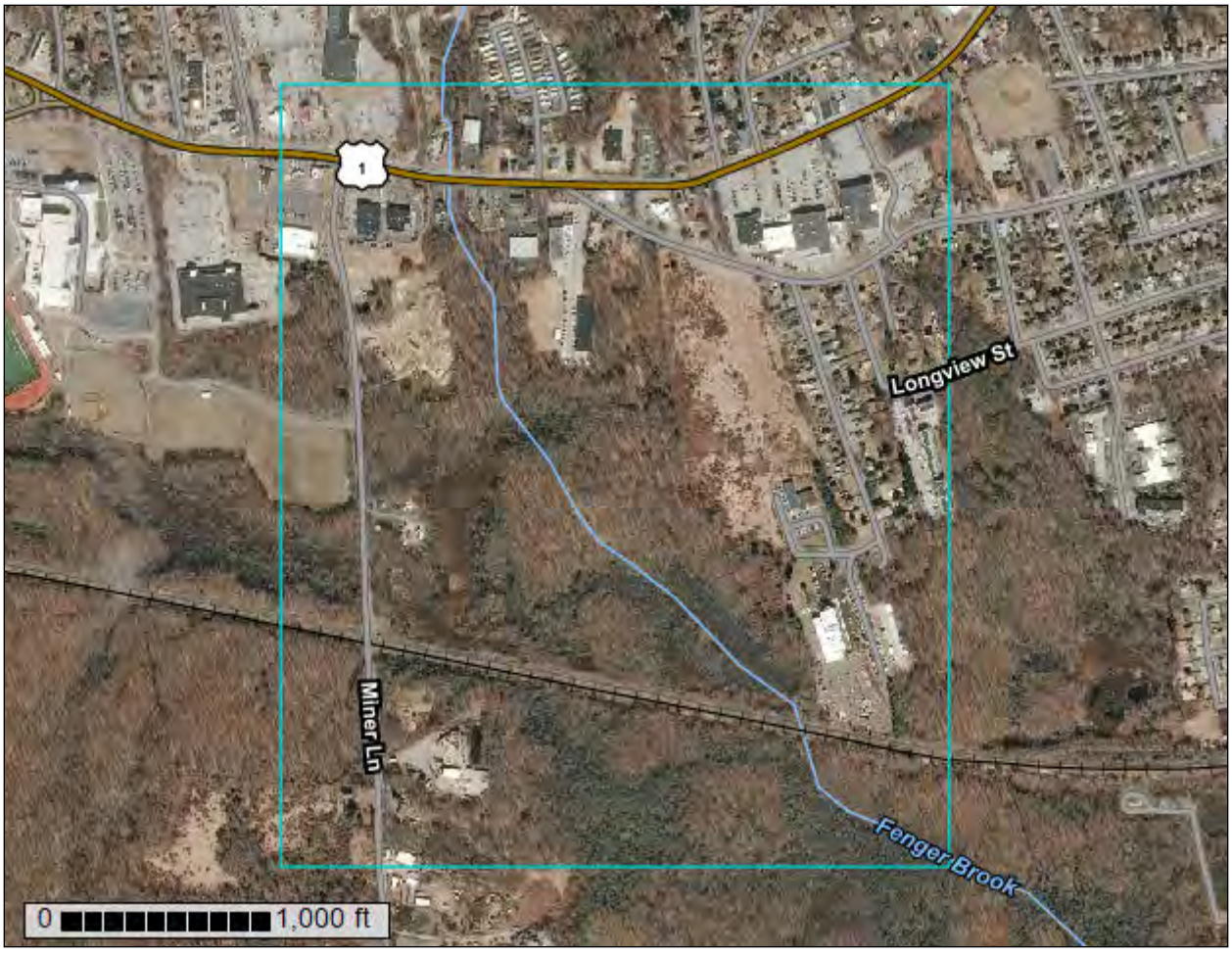
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for State of Connecticut

384 & 394 Willetts Avenue Ext., Waterford



August 27, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (384 & 394 Willetts Avenue Extension, Waterford)

Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 2019

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

Map Unit Legend (384 & 394 Willetts Avenue Extension, Waterford)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	16.2	5.9%
13	Walpole sandy loam, 0 to 3 percent slopes	11.2	4.1%
15	Scarboro muck, 0 to 3 percent slopes	13.1	4.8%
17	Timakwa and Natchaug soils, 0 to 2 percent slopes	35.3	12.8%
23A	Sudbury sandy loam, 0 to 5 percent slopes	26.2	9.5%
50A	Sutton fine sandy loam, 0 to 3 percent slopes	0.7	0.2%
50B	Sutton fine sandy loam, 3 to 8 percent slopes	0.2	0.1%
51B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	0.8	0.3%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	1.6	0.6%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	11.3	4.1%
61B	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony	9.4	3.4%
61C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony	4.2	1.5%
66B	Narragansett silt loam, 2 to 8 percent slopes	12.5	4.5%
67B	Narragansett silt loam, 3 to 8 percent slopes, very stony	10.4	3.8%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	50.7	18.4%
306	Udorthents-Urban land complex	46.5	16.9%
307	Urban land	25.3	9.2%
Totals for Area of Interest		**275.7**	**100.0%**

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

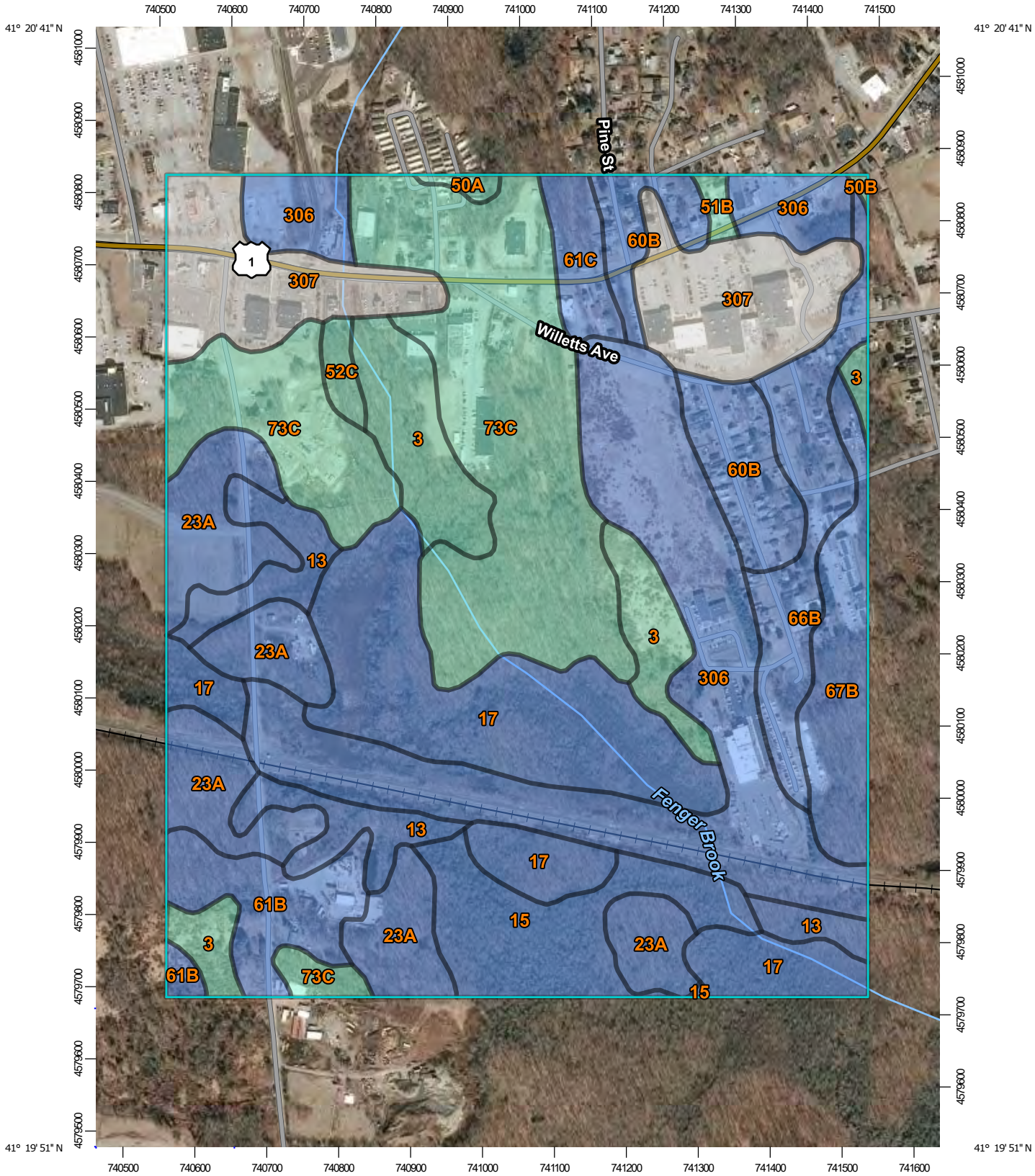
Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts ...



Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

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
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- 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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 2019

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.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	3.2151	16.2	5.9%
13	Walpole sandy loam, 0 to 3 percent slopes	59.6262	11.2	4.1%
15	Scarboro muck, 0 to 3 percent slopes	91.1682	13.1	4.8%
17	Timakwa and Natchaug soils, 0 to 2 percent slopes	33.5514	35.3	12.8%
23A	Sudbury sandy loam, 0 to 5 percent slopes	89.2523	26.2	9.5%
50A	Sutton fine sandy loam, 0 to 3 percent slopes	10.0000	0.7	0.2%
50B	Sutton fine sandy loam, 3 to 8 percent slopes	10.0000	0.2	0.1%
51B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	10.0000	0.8	0.3%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	10.0000	1.6	0.6%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	41.4019	11.3	4.1%
61B	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony	47.0094	9.4	3.4%
61C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony	47.0094	4.2	1.5%
66B	Narragansett silt loam, 2 to 8 percent slopes	41.8879	12.5	4.5%
67B	Narragansett silt loam, 3 to 8 percent slopes, very stony	41.8879	10.4	3.8%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	10.0000	50.7	18.4%
306	Udorthents-Urban land complex	21.0748	46.5	16.9%
307	Urban land		25.3	9.2%

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
Totals for Area of Interest			**275.7**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (384 & 394 Willetts Avenue Extension, Waterford)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 6

Bottom Depth: 48

Units of Measure: Inches

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)

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.

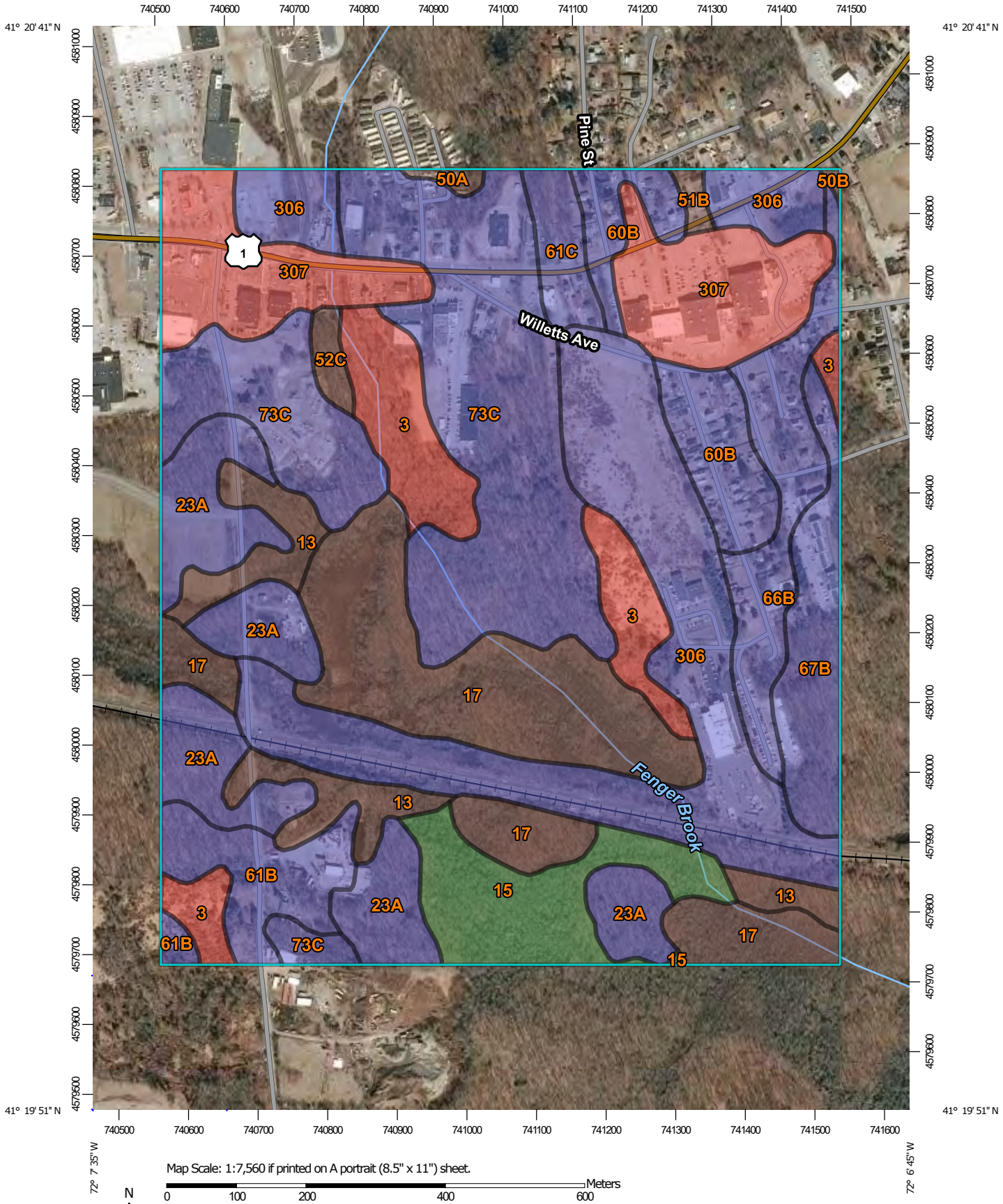
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)



Map Scale: 1:7,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Mar 20, 2019—Mar 27, 2019

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.

Table—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	16.2	5.9%
13	Walpole sandy loam, 0 to 3 percent slopes	B/D	11.2	4.1%
15	Scarboro muck, 0 to 3 percent slopes	A/D	13.1	4.8%
17	Timakwa and Natchaug soils, 0 to 2 percent slopes	B/D	35.3	12.8%
23A	Sudbury sandy loam, 0 to 5 percent slopes	B	26.2	9.5%
50A	Sutton fine sandy loam, 0 to 3 percent slopes	B/D	0.7	0.2%
50B	Sutton fine sandy loam, 3 to 8 percent slopes	B/D	0.2	0.1%
51B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	B/D	0.8	0.3%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	B/D	1.6	0.6%
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	B	11.3	4.1%
61B	Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony	B	9.4	3.4%
61C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes, very stony	B	4.2	1.5%
66B	Narragansett silt loam, 2 to 8 percent slopes	B	12.5	4.5%
67B	Narragansett silt loam, 3 to 8 percent slopes, very stony	B	10.4	3.8%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	50.7	18.4%
306	Udorthents-Urban land complex	B	46.5	16.9%
307	Urban land	D	25.3	9.2%
Totals for Area of Interest			**275.7**	**100.0%**

Rating Options—Hydrologic Soil Group (384 & 394 Willetts Avenue Extension, Waterford)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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NOAA Atlas 14, Volume 10, Version 3
Location name: Waterford, Connecticut, USA*
Latitude: 41.3376°, Longitude: -72.1197°
Elevation: 27.7 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	0.335 (0.258-0.430)	0.401 (0.308-0.515)	0.509 (0.389-0.654)	0.599 (0.457-0.773)	0.722 (0.534-0.963)	0.814 (0.591-1.10)	0.911 (0.645-1.27)	1.02 (0.686-1.44)	1.19 (0.769-1.72)	1.33 (0.838-1.94)
10-min	0.475 (0.365-0.609)	0.568 (0.436-0.729)	0.721 (0.552-0.926)	0.847 (0.645-1.09)	1.02 (0.756-1.36)	1.15 (0.837-1.56)	1.29 (0.914-1.80)	1.45 (0.973-2.04)	1.68 (1.09-2.43)	1.88 (1.19-2.75)
15-min	0.559 (0.429-0.716)	0.669 (0.513-0.858)	0.849 (0.650-1.09)	0.998 (0.760-1.29)	1.20 (0.890-1.61)	1.36 (0.985-1.84)	1.52 (1.08-2.12)	1.71 (1.15-2.40)	1.98 (1.28-2.86)	2.21 (1.40-3.24)
30-min	0.793 (0.609-1.02)	0.948 (0.727-1.22)	1.20 (0.919-1.54)	1.41 (1.07-1.82)	1.70 (1.26-2.27)	1.91 (1.39-2.59)	2.14 (1.52-2.99)	2.40 (1.61-3.39)	2.79 (1.81-4.03)	3.11 (1.97-4.56)
60-min	1.03 (0.790-1.32)	1.23 (0.941-1.57)	1.55 (1.19-1.99)	1.82 (1.39-2.35)	2.19 (1.62-2.93)	2.47 (1.79-3.35)	2.77 (1.96-3.86)	3.10 (2.08-4.37)	3.60 (2.33-5.20)	4.01 (2.54-5.88)
2-hr	1.35 (1.05-1.71)	1.61 (1.25-2.04)	2.04 (1.58-2.59)	2.39 (1.84-3.06)	2.88 (2.15-3.81)	3.25 (2.38-4.37)	3.64 (2.60-5.03)	4.09 (2.76-5.71)	4.75 (3.09-6.79)	5.30 (3.37-7.69)
3-hr	1.56 (1.22-1.97)	1.87 (1.46-2.35)	2.36 (1.84-2.99)	2.78 (2.15-3.52)	3.35 (2.51-4.39)	3.77 (2.78-5.03)	4.22 (3.03-5.80)	4.74 (3.22-6.58)	5.51 (3.60-7.83)	6.14 (3.92-8.87)
6-hr	1.98 (1.57-2.47)	2.37 (1.87-2.95)	2.99 (2.36-3.74)	3.51 (2.75-4.41)	4.22 (3.20-5.49)	4.76 (3.54-6.28)	5.32 (3.85-7.24)	5.98 (4.08-8.21)	6.93 (4.55-9.76)	7.73 (4.96-11.0)
12-hr	2.45 (1.96-3.03)	2.92 (2.33-3.60)	3.68 (2.93-4.56)	4.32 (3.42-5.36)	5.19 (3.98-6.67)	5.84 (4.39-7.63)	6.53 (4.77-8.79)	7.33 (5.04-9.97)	8.50 (5.62-11.9)	9.47 (6.11-13.4)
24-hr	2.87 (2.32-3.50)	3.43 (2.77-4.19)	4.35 (3.51-5.32)	5.11 (4.10-6.28)	6.17 (4.78-7.85)	6.95 (5.28-9.00)	7.79 (5.74-10.4)	8.77 (6.08-11.8)	10.2 (6.80-14.1)	11.5 (7.44-16.1)
2-day	3.18 (2.61-3.84)	3.85 (3.15-4.65)	4.94 (4.03-5.97)	5.84 (4.73-7.10)	7.08 (5.56-8.94)	8.00 (6.15-10.3)	9.00 (6.72-12.0)	10.2 (7.11-13.6)	12.0 (8.04-16.4)	13.6 (8.86-18.8)
3-day	3.44 (2.84-4.12)	4.15 (3.42-4.98)	5.32 (4.37-6.39)	6.28 (5.13-7.59)	7.62 (6.01-9.55)	8.60 (6.65-11.0)	9.67 (7.26-12.8)	11.0 (7.67-14.5)	12.9 (8.67-17.6)	14.6 (9.55-20.1)
4-day	3.68 (3.05-4.39)	4.42 (3.66-5.28)	5.64 (4.65-6.75)	6.64 (5.45-7.98)	8.03 (6.36-10.0)	9.06 (7.02-11.5)	10.2 (7.65-13.3)	11.5 (8.08-15.2)	13.5 (9.10-18.3)	15.2 (10.00-20.9)
7-day	4.37 (3.66-5.16)	5.17 (4.32-6.11)	6.47 (5.39-7.67)	7.55 (6.25-8.99)	9.04 (7.22-11.2)	10.1 (7.92-12.7)	11.3 (8.57-14.7)	12.7 (9.00-16.6)	14.8 (10.0-19.9)	16.6 (10.9-22.5)
10-day	5.06 (4.26-5.94)	5.89 (4.95-6.92)	7.24 (6.07-8.54)	8.37 (6.97-9.90)	9.91 (7.96-12.1)	11.1 (8.68-13.8)	12.3 (9.31-15.8)	13.7 (9.74-17.8)	15.8 (10.7-21.0)	17.5 (11.5-23.7)
20-day	7.17 (6.12-8.33)	8.06 (6.87-9.37)	9.52 (8.08-11.1)	10.7 (9.04-12.5)	12.4 (10.0-14.9)	13.7 (10.8-16.7)	15.0 (11.3-18.7)	16.3 (11.7-20.9)	18.2 (12.4-23.9)	19.6 (13.0-26.3)
30-day	8.94 (7.69-10.3)	9.88 (8.48-11.4)	11.4 (9.76-13.2)	12.7 (10.8-14.7)	14.4 (11.7-17.2)	15.8 (12.5-19.1)	17.1 (13.0-21.2)	18.4 (13.3-23.5)	20.1 (13.9-26.3)	21.4 (14.2-28.4)
45-day	11.1 (9.65-12.8)	12.1 (10.5-13.9)	13.8 (11.9-15.8)	15.1 (12.9-17.5)	17.0 (13.9-20.1)	18.5 (14.7-22.1)	19.9 (15.1-24.3)	21.1 (15.4-26.7)	22.7 (15.7-29.5)	23.7 (15.9-31.4)
60-day	13.0 (11.3-14.8)	14.0 (12.2-16.0)	15.8 (13.6-18.0)	17.2 (14.8-19.8)	19.2 (15.8-22.5)	20.8 (16.6-24.7)	22.2 (16.9-27.0)	23.5 (17.1-29.6)	24.9 (17.3-32.3)	25.8 (17.4-34.1)

[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.

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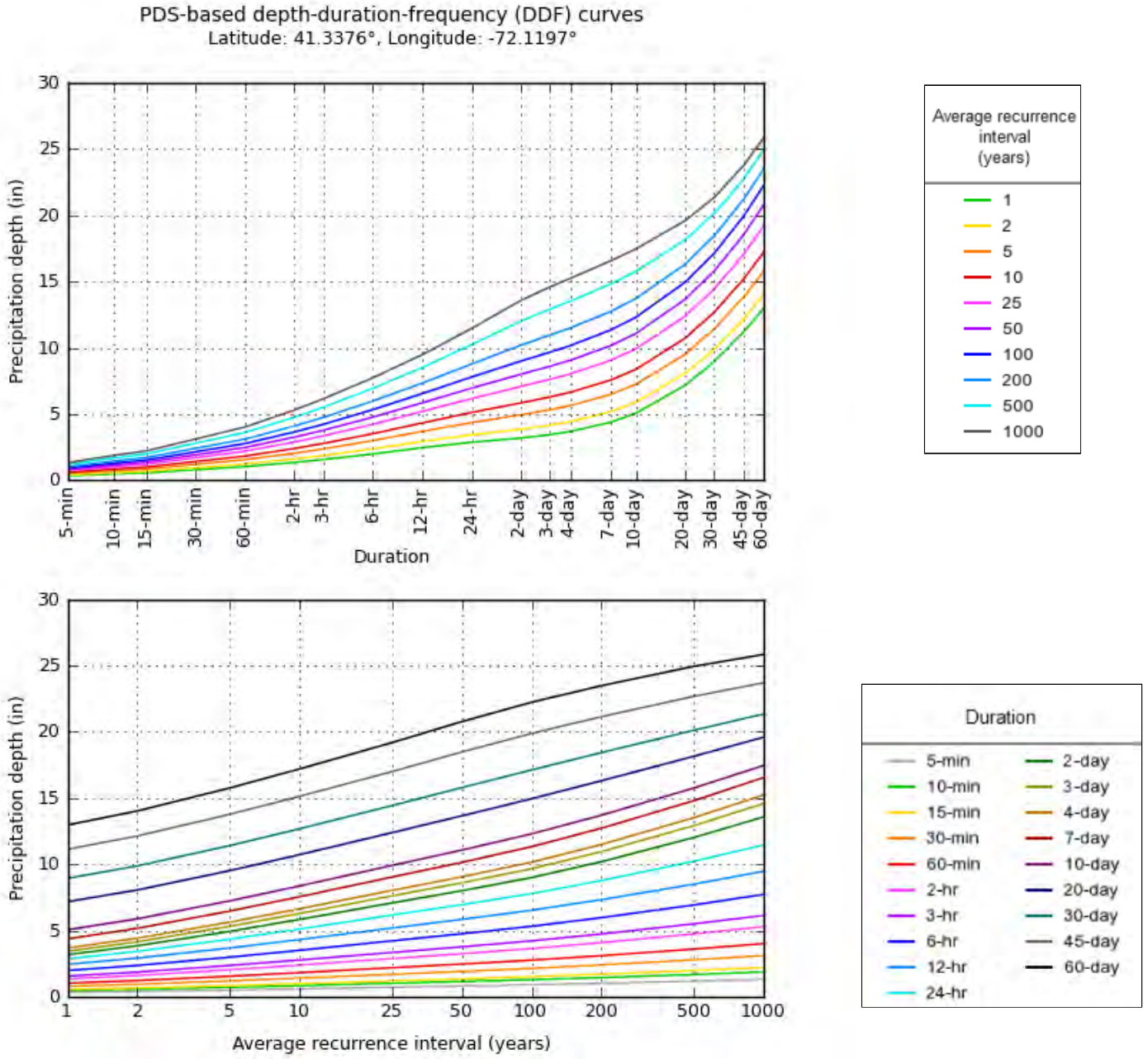
PF graphical



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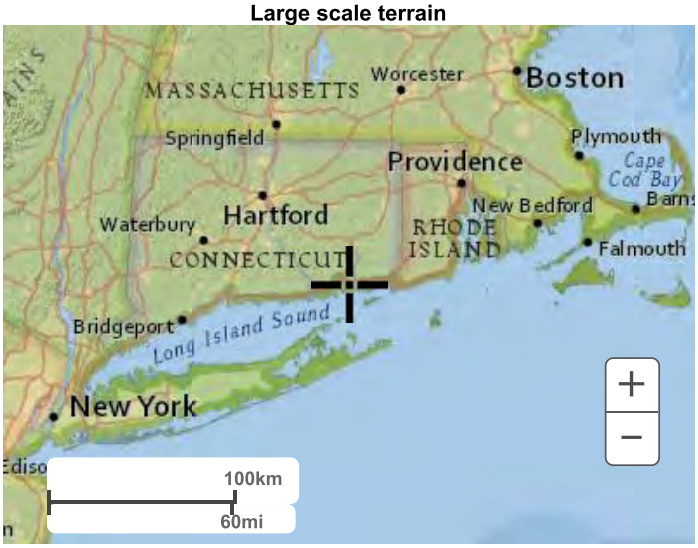
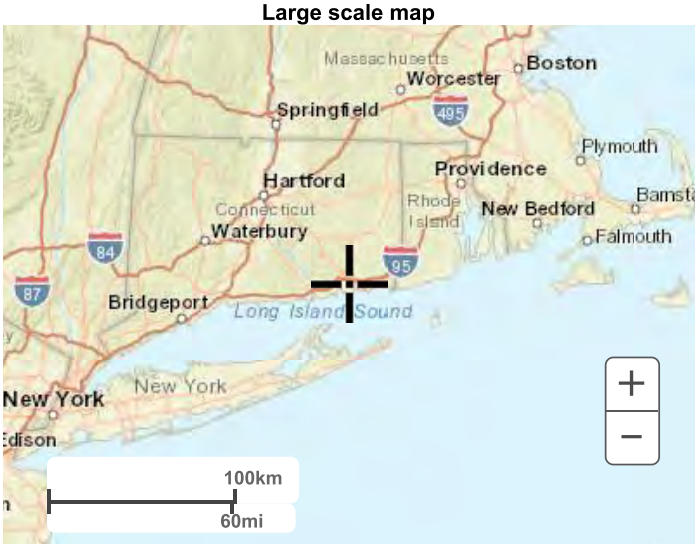
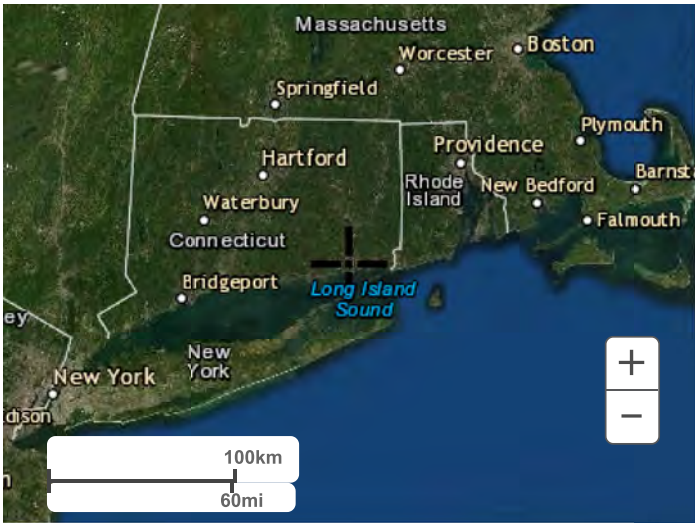
Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 10, Version 3
Location name: Waterford, Connecticut, USA*
Latitude: 41.3376°, Longitude: -72.1197°
Elevation: 27.7 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/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.02** (3.10-5.16)	**4.81** (3.70-6.18)	**6.11** (4.67-7.85)	**7.19** (5.48-9.28)	**8.66** (6.41-11.6)	**9.77** (7.09-13.2)	**10.9** (7.74-15.3)	**12.3** (8.23-17.3)	**14.3** (9.23-20.6)	**15.9** (10.1-23.3)
10-min	**2.85** (2.19-3.65)	**3.41** (2.62-4.37)	**4.33** (3.31-5.56)	**5.08** (3.87-6.56)	**6.13** (4.54-8.18)	**6.92** (5.02-9.38)	**7.75** (5.48-10.8)	**8.70** (5.84-12.3)	**10.1** (6.53-14.6)	**11.3** (7.13-16.5)
15-min	**2.24** (1.72-2.86)	**2.68** (2.05-3.43)	**3.40** (2.60-4.37)	**3.99** (3.04-5.15)	**4.81** (3.56-6.42)	**5.42** (3.94-7.36)	**6.08** (4.30-8.48)	**6.82** (4.58-9.62)	**7.92** (5.12-11.4)	**8.83** (5.59-12.9)
30-min	**1.59** (1.22-2.03)	**1.90** (1.45-2.43)	**2.40** (1.84-3.09)	**2.82** (2.15-3.64)	**3.40** (2.51-4.53)	**3.83** (2.78-5.19)	**4.28** (3.03-5.98)	**4.81** (3.23-6.78)	**5.58** (3.61-8.06)	**6.22** (3.94-9.12)
60-min	**1.03** (0.790-1.32)	**1.23** (0.941-1.57)	**1.55** (1.19-1.99)	**1.82** (1.39-2.35)	**2.19** (1.62-2.93)	**2.47** (1.79-3.35)	**2.77** (1.96-3.86)	**3.10** (2.08-4.37)	**3.60** (2.33-5.20)	**4.01** (2.54-5.88)
2-hr	**0.674** (0.523-0.854)	**0.804** (0.624-1.02)	**1.02** (0.788-1.30)	**1.20** (0.921-1.53)	**1.44** (1.08-1.91)	**1.63** (1.19-2.18)	**1.82** (1.30-2.52)	**2.04** (1.38-2.85)	**2.37** (1.55-3.40)	**2.65** (1.69-3.85)
3-hr	**0.520** (0.407-0.656)	**0.621** (0.486-0.784)	**0.787** (0.613-0.995)	**0.925** (0.716-1.17)	**1.11** (0.837-1.46)	**1.25** (0.925-1.68)	**1.41** (1.01-1.93)	**1.58** (1.07-2.19)	**1.83** (1.20-2.61)	**2.05** (1.31-2.95)
6-hr	**0.331** (0.262-0.413)	**0.395** (0.312-0.493)	**0.499** (0.393-0.625)	**0.586** (0.459-0.736)	**0.705** (0.535-0.916)	**0.794** (0.591-1.05)	**0.889** (0.643-1.21)	**0.998** (0.682-1.37)	**1.16** (0.761-1.63)	**1.29** (0.828-1.85)
12-hr	**0.204** (0.163-0.251)	**0.242** (0.194-0.299)	**0.306** (0.244-0.378)	**0.358** (0.284-0.445)	**0.431** (0.330-0.554)	**0.485** (0.364-0.633)	**0.542** (0.396-0.730)	**0.609** (0.419-0.827)	**0.706** (0.467-0.984)	**0.786** (0.507-1.11)
24-hr	**0.119** (0.097-0.146)	**0.143** (0.116-0.174)	**0.181** (0.146-0.222)	**0.213** (0.171-0.262)	**0.257** (0.199-0.327)	**0.290** (0.220-0.375)	**0.325** (0.239-0.433)	**0.365** (0.253-0.492)	**0.426** (0.284-0.589)	**0.477** (0.310-0.669)
2-day	**0.066** (0.054-0.080)	**0.080** (0.066-0.097)	**0.103** (0.084-0.124)	**0.122** (0.099-0.148)	**0.148** (0.116-0.186)	**0.167** (0.128-0.214)	**0.187** (0.140-0.249)	**0.212** (0.148-0.283)	**0.250** (0.168-0.342)	**0.283** (0.185-0.392)
3-day	**0.048** (0.039-0.057)	**0.058** (0.048-0.069)	**0.074** (0.061-0.089)	**0.087** (0.071-0.105)	**0.106** (0.083-0.133)	**0.119** (0.092-0.152)	**0.134** (0.101-0.177)	**0.152** (0.107-0.201)	**0.179** (0.120-0.244)	**0.203** (0.133-0.279)
4-day	**0.038** (0.032-0.046)	**0.046** (0.038-0.055)	**0.059** (0.048-0.070)	**0.069** (0.057-0.083)	**0.084** (0.066-0.104)	**0.094** (0.073-0.120)	**0.106** (0.080-0.139)	**0.120** (0.084-0.158)	**0.141** (0.095-0.191)	**0.159** (0.104-0.218)
7-day	**0.026** (0.022-0.031)	**0.031** (0.026-0.036)	**0.039** (0.032-0.046)	**0.045** (0.037-0.054)	**0.054** (0.043-0.066)	**0.060** (0.047-0.076)	**0.067** (0.051-0.087)	**0.076** (0.054-0.099)	**0.088** (0.060-0.118)	**0.099** (0.065-0.134)
10-day	**0.021** (0.018-0.025)	**0.025** (0.021-0.029)	**0.030** (0.025-0.036)	**0.035** (0.029-0.041)	**0.041** (0.033-0.051)	**0.046** (0.036-0.057)	**0.051** (0.039-0.066)	**0.057** (0.041-0.074)	**0.066** (0.045-0.088)	**0.073** (0.048-0.099)
20-day	**0.015** (0.013-0.017)	**0.017** (0.014-0.020)	**0.020** (0.017-0.023)	**0.022** (0.019-0.026)	**0.026** (0.021-0.031)	**0.028** (0.022-0.035)	**0.031** (0.024-0.039)	**0.034** (0.024-0.044)	**0.038** (0.026-0.050)	**0.041** (0.027-0.055)
30-day	**0.012** (0.011-0.014)	**0.014** (0.012-0.016)	**0.016** (0.014-0.018)	**0.018** (0.015-0.020)	**0.020** (0.016-0.024)	**0.022** (0.017-0.027)	**0.024** (0.018-0.029)	**0.026** (0.018-0.033)	**0.028** (0.019-0.037)	**0.030** (0.020-0.039)
45-day	**0.010** (0.009-0.012)	**0.011** (0.010-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.013-0.019)	**0.017** (0.014-0.020)	**0.018** (0.014-0.022)	**0.020** (0.014-0.025)	**0.021** (0.015-0.027)	**0.022** (0.015-0.029)
60-day	**0.009** (0.008-0.010)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.010-0.014)	**0.013** (0.011-0.016)	**0.014** (0.012-0.017)	**0.015** (0.012-0.019)	**0.016** (0.012-0.021)	**0.017** (0.012-0.022)	**0.018** (0.012-0.024)

[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.

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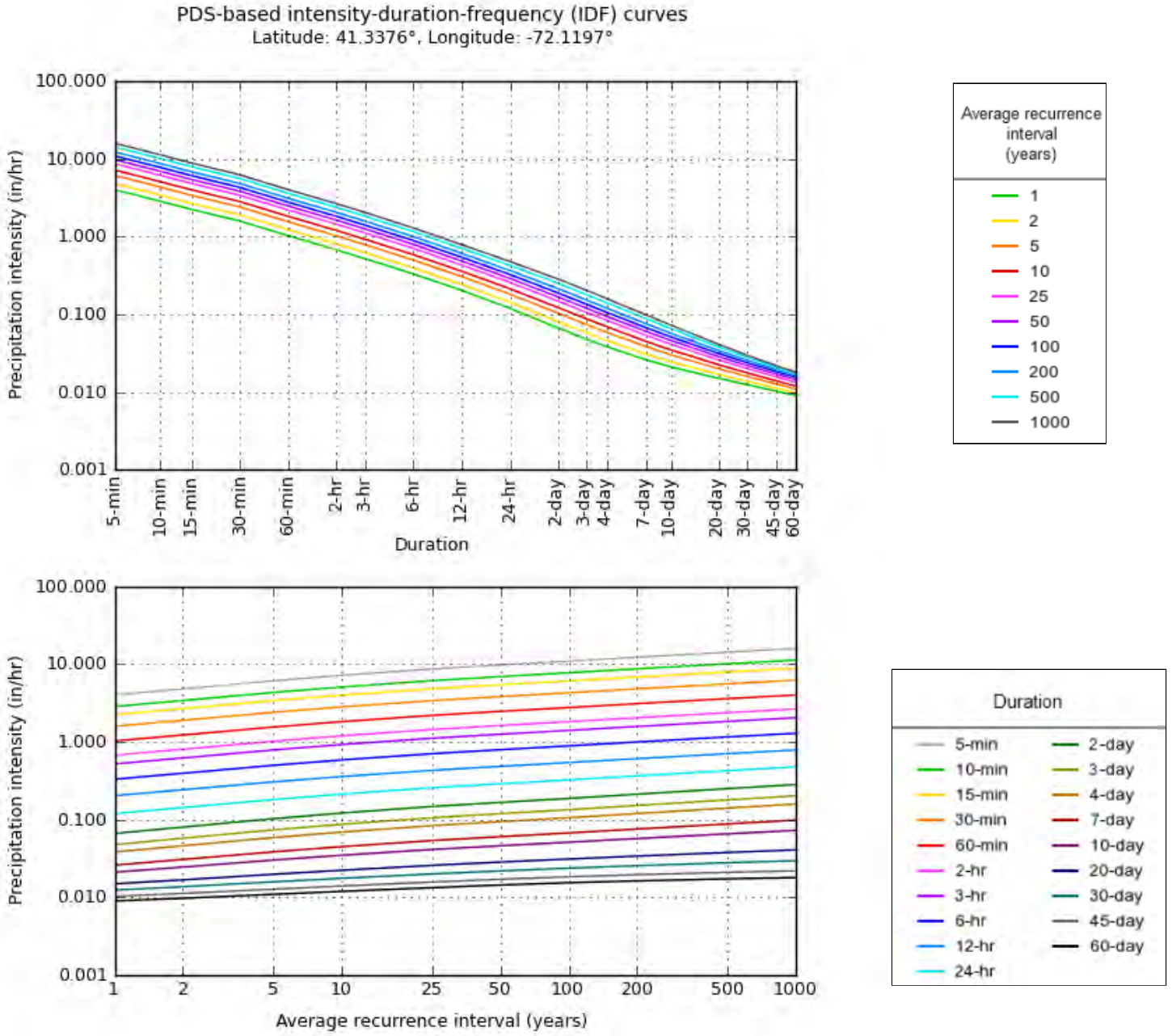
PF graphical



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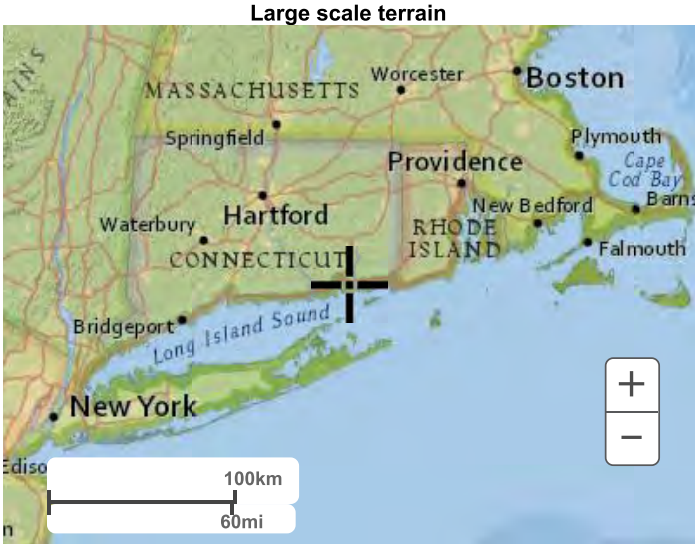

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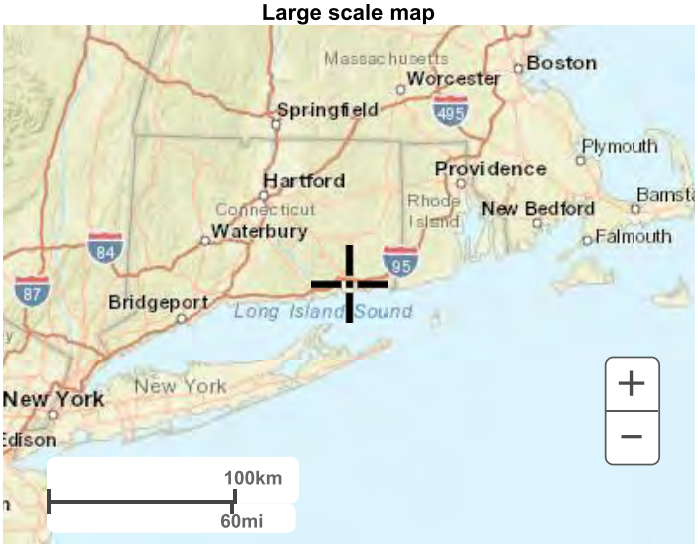
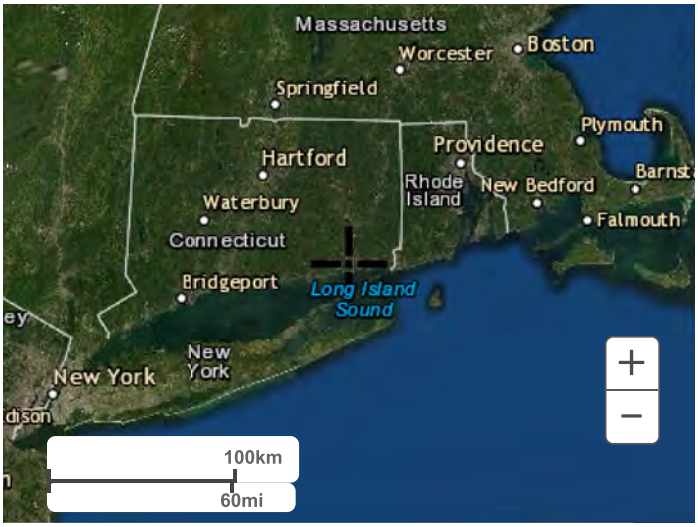


Large scale aerial



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