STORM WATER ANALYSIS

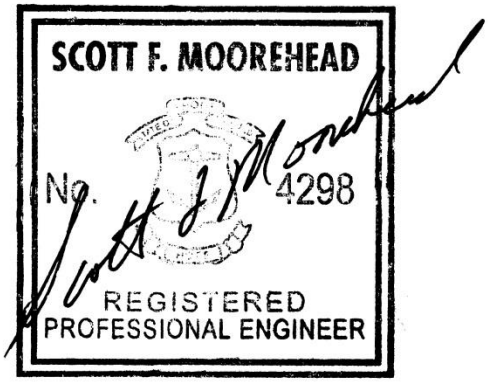
For

IVY PLACE REDEVELOPMENT

MAP 106, BLOCK 7, LOT 12
15 Ivy Street and Taunton Avenue

EAST PROVIDENCE RI

September 2020



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Attachments for City submission: Operation & Maintenance Plan, Site Plans

Attachments for RIDEM submission: RIDEM Appendix A Checklist, Operation & Maintenance Plan, Site Plans, Soil Evaluation Data, SESC Plan

Project Description

The Ivy Place Redevelopment consists of improvements to the site located at 15 Ivy Street in East Providence, RI. The site is identified as assessors Map 106, Block 7, Lot 12. The site is located on the northeast corner of the intersection of Ivy Street and Taunton Avenue. The redevelopment project will construct three buildings with 13 residential units. Areas not covered by buildings will be used as parking and landscape areas. The total site area is approximately 0.46 acres.

The site development, lot grading, storm water mitigation and utilities are designed to meet the City of East Providence standards. The site is serviced by municipal water and sewer. There are no freshwater wetlands on the site. The site falls under the infill project requirements of the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM 3.2.6).

Site Information

Existing Site

The existing site was previously developed with a house, theater and bituminous parking areas but is currently vacant. This stormwater analysis is conducted based on the current "*vacant*" condition of the site (sheet 18). There are no freshwater wetlands on the site. A TR-55 analysis of the "*previously developed*" existing condition is also included (sheet19) for comparison.

Proposed Site

Under the infill rules of the RISDISM, Section 3.2.6, the project must meet the recharge and water quality requirements along with pollution prevention and stormwater best management practices.

The new impervious surfaces on the site are 155,794 sf. **The intent of the project is to provide treatment of the entire area of new impervious surfaces on the site.** The catch basin sediment trap, sediment forebay and sand filter will provide pretreatment and WQ treatment for the project.

The proposed activities on the site do not qualify as Land Use with Higher Potential Pollutant Loads (LUPHHL) and no illicit discharges are expected or proposed. Pollution prevention best management practices will be utilized on the project site. A Soil Erosion and Sediment Control Plan and an Operation and Maintenance Plan will be prepared for the project.

Soil Characteristics

A copy of the Web Soil Survey of Rhode Island depicting the subject property is included in this report.

Merrimac Urban Land (MU – soil type A): Urban Land Complex with A soil group in surrounding lands

100-Year Flood Plain

The site is located in flood hazard zone X (area determined to be outside the 0.2% annual chance floodplain, area of minimal flood hazard) per FEMA flood map 44009 C0309K, dated October 2, 2015.

Rainfall Data

The 24 hour (Type III) design rainfall amounts (in inches) used in these calculations is as follows:

County/Storm Event	WQ	1-Year	10-Year	25-Year	100-Year
Providence County	1.2"	2.7	4.9	6.1	8.7

Drainage Narrative

The proposed storm water drainage system has been designed to safely collect and convey surface runoff and is designed to comply with the requirements of the Rhode Island Stormwater Design and Installation Standards Manual for treatment of the water quality volume and mitigation of peak storm events. The Soil Conservation Service TR-55 method was used to evaluate the pre and post development surface cover curve numbers and the peak flows.

Storm water runoff from the new impervious surfaces will be directed to the on-site stormwater system for water quality treatment, groundwater recharge and peak storm mitigation. The bituminous parking areas will be graded so that runoff will be collected in the deep sump catch basin. This catch basin will provide an initial sediment trap prior to runoff discharge into the sediment forebay. The sediment forebay provide pretreatment of the runoff prior to the sand filter. The sand filter is the primary source of water quality treatment of the stormwater runoff. Rooftop runoff is directed toward the galley infiltration system.

The *Intellisolve Hydraflow* model was used to evaluate the stormwater best management practices. Design reports and hydrographs results are included in this report.

The post-development watershed follows the same runoff patterns as the existing condition. Stormwater runoff flows south and west on the site toward the existing municipal stormwater drainage system in Taunton Avenue. A storm water management plan addresses design and maintenance of the water quality controls, erosion and sediment control measures and the water quantity control measures.

Storm Water Management System Design

The stormwater management system is comprised of a catch basin sediment trap, a sediment forebay and a sand filter area. The catch basin sediment trap and sediment forebay will provide pretreatment of the stormwater runoff before directing the flow to the sand filter area for water quality treatment.

An Intellisolve Hydraflow model was developed to evaluate the proposed drainage condition on the site. Runoff from the parking areas is directed first to the catch basin sediment trap which will overflow to the sediment forebay. Once the sediment forebay fills to the water quality weir, runoff will be directed to the sand filter area. The model assumes that both the sediment trap and sediment forebay are full with all runoff entering the sand filter. The sand filter provides water quality treatment. When the sand filter area is filled, the overflow directs excess stormwater to the galley infiltration system.

The development area of the site has Group A soils. Recharge volume calculations use the Soil Group A recharge factor F = 0.60. (Reference RISDISM Table 3-4)

Stormwater Treatment System:
Catch Basin Sediment Trap/Sediment Forebay/Sand Filter

There are two sub-watershed areas:

1. Runoff to the sediment forebay and sand filter
2. Rooftop runoff to galley infiltration system

The forebay/sand filter must be sized to 75% of the Water Quality Volume.

Catch Basin Sediment Trap:

A catch basin sediment trap is provided prior to the sediment forebay. The proposed trap is a six foot square basin with a 5 foot sump and a catch basin top. The storage volume is 180 cf.

To Sediment Forebay:
Proposed Impervious Area (A_{imp}): 7568 sf of parking area (7025sf) and walkways (543sf)

Recharge Volume: Re_v = (1" x F x A_{imp}) / 12
= 1 inch x .60 x 7568 x (1 ft/12 in) = 378 cf

Water Quality Volume: WQ_v = (1" x A_{imp}) / 12
= 1 inch x 7568 x (1 ft/12 in) = 631 cf

Surface Area Calculation
Per Section 6.4.1 of the RISDISM, the required surface area of the sediment forebay is calculated by: As = 5750 x Q ; where Q = %WQv ÷ 86,400 sec and %WQv = 25%

Q = (.25 x WQv) ÷ 86,400 sec = (.25 x 631) ÷ 86,400 sec = .0018 cfs
As = 5750 x Q = 5750 x .0018 = 11 sf (req'd) = 26 sf min (provided) **OK**

Length to Width Ratio
The minimum length to width ratio is 1:1 or greater. 2:1 ratio provided **OK**

Minimum Volume Calculation
Volume (min) = .25 x WQ_v =.25 x 631 = 158 cf (req'd) < 200 cf (20 cf provided at overflow weir + 180 in sediment trap) **OK**

Required Treatment Volume: Forebay + Sand Filter must provide 75% of WQ_v
75% of WQv: 0.75 x WQ_v =.75 x 631 = 473cf
Sediment Forebay provides 200 cf, therefore, the
Sand Filter must provide 473 - 200 = **273 cf**

Sand Filter Design Criteria/Required Volume Computations
The design guidelines include:

- The bottom of the sand filter shall be located at or above the seasonal high groundwater table (SHGT).
- Size the sand filter to store the remaining volume of the 75% of the WQV.
- Treatment area shall consist of an 24" deep sand bed and a 12" deep ponding layer
- Design Infiltration Rate (RISDISM Table 5-3): Sand: 8.27 in/hr

Minimum required filter area is: $A_f = (WQ_v)(d_f)/[(k)(h_f + d_f)(t_f)]$
Where: A_f = Surface area of filter bed (ft^2)
d_f = Filter bed depth= 30" = 2.5'
k = coefficient of permeability of filter media (ft/day)
= 1.0 ft/day for bioretention (sandy loam) soils
h_f = avg height of water above soil bed (ft) = 8"/2 = 0.330'
t_f = design filter bed drain time (2 days max)

Sand Filter Req'd: $A_f = (273)(2.5)/[(1.0)(.33 + 2.5)(2)] = 120$ sf

Af; Using the WQv of 273 cf - A_f = 120 sf (req'd) < 173 sf (provided) **OK**

The sediment trap and forebay provides 200 cf and the sand filter provides 276 cf of storage at elevation 75.67 – the overflow weir elevation – for a total of 476 cf.

System 1 provides 476 cf of storage and treatment volume within the sediment trap, sediment forebay and the sand filter. The calculations require a treatment volume of 473 cf (75% of the WQv). The proposed system exceeds the required treatment volume. **OK**

To Galley Infiltration Area:
Proposed Impervious Area (A_{imp}): 7096 sf of rooftops

Recharge Volume: Re_v = (1" x F x A_{imp}) / 12
= 1 inch x .60 x 7096 x (1 ft/12 in) = 355 cf
Water Quality Volume: WQ_v = (1" x A_{imp}) / 12
= 1 inch x 7096 x (1 ft/12 in) = 591 cf
The two rows of 12 galleys provide 2,042 cf of storage. The proposed system exceeds the required treatment volume. **OK**

Groundwater Separation and Design Elevations
Seasonal high groundwater elevations and separation to proposed best management practices are shown on the site plans.

Summary of Results
The storm water system is designed to maintain post-development peak runoff rates and volumes at or below pre-development rates. The TR-55 (pre-development) and Hydraflow model results (post development) are summarized below. Based on a comparison to the current *vacant* land existing condition, there is a small increase in peak flow in the post-development condition will be captured in the City MS4 system. As shown below, there is a substantial decrease in peak flows from the site when compared with the *previously developed* existing site condition.

Post-Development Storm Water Modelling

Sub-Watershed	1.2" WQv	1 yr (cfs)	10 yr (cfs)	25 yr (cfs)	100 yr (cfs)
Rooftops to galleys	0.15	0.36	0.65	0.88	1.17
Overland to Sand Filter	0.00	0.25	0.70	0.96	1.53
Remaining Area to road	0.00	0.00	0.11	0.16	0.28

Overall site

Storm Event (year)	Pre-developed Peak Flow (cfs) (*vacant* land)	Pre-dev Peak Flow (cfs) (*previously developed*)	Post dev – Galley outflow*	Post dev – Remaining Area to road	Post dev – Total Peak Flow (cfs)*	Change in Peak Flow (cfs) from "*vacant*" land condition
WQv(1.2")	0.00	0.00	0.00	0.00	0.00	0.0
1	0.00	0.22	0.00	0.00	0.00	0.0
10	0.00	0.85	0.00	0.11	0.11	+0.11
25	0.00	1.26	0.00	0.16	0.16	+0.16
100	0.26	2.19	0.00	0.28	0.28	+0.02

*post-development routed through the sand filter and infiltration system

Conclusion
As designed, the proposed site development will manage storm water runoff from the new impervious surfaces and site development. The stormwater management system will provide recharge, water quality treatment and peak flow mitigation for increased runoff associated with the proposed site development. Drainage flow patterns will be unchanged to the extent possible. It is our professional opinion that as designed, the proposed storm water drainage system will mitigate the impacts of any increased stormwater runoff from the development and comply with the infill requirements of the RISDISM.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.018	2	734	124	----	------	------	post to WQ basin
2	Reservoir	0.000	2	954	0	1	72.49	27.0	thru WQ basin
4	SCS Runoff	0.149	2	726	569	----	------	------	Rooftops To Infiltration Galleys
5	Combine	0.149	2	726	569	2, 4	------	------	Total to galleys: WQ+roofs
6	Reservoir	0.000	2	714	0	4	70.09	18.7	Thru Inf Galleys
8	SCS Runoff	0.001	2	746	11	----	------	------	Remaining Area to Road
10	Combine	0.001	2	746	11	6, 8,	------	------	overall post
11	SCS Runoff	0.000	2	n/a	0	----	------	------	overall exist cond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.240	2	726	900	----	------	------	post to WQ basin
2	Reservoir	0.107	2	740	87	1	75.71	282	thru WQ basin
4	SCS Runoff	0.356	2	726	1,425	----	------	------	Rooftops To Infiltration Galleys
5	Combine	0.356	2	726	1,512	2, 4	------	------	Total to galleys: WQ+roofs
6	Reservoir	0.000	2	786	0	4	70.69	202	Thru Inf Galleys
8	SCS Runoff	0.032	2	726	131	----	------	------	Remaining Area to Road
10	Combine	0.032	2	726	131	6, 8,	------	------	overall post
11	SCS Runoff	0.000	2	n/a	0	----	------	------	overall exist cond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.696	2	726	2,509	----	------	------	post to WQ basin
2	Reservoir	0.663	2	726	1,219	1	75.84	304	thru WQ basin
4	SCS Runoff	0.654	2	726	2,691	----	------	------	Rooftops To Infiltration Galleys
5	Combine	1.317	2	726	3,910	2, 4	------	------	Total to galleys: WQ+roofs
6	Reservoir	0.000	2	696	0	4	71.52	599	Thru Inf Galleys
8	SCS Runoff	0.114	2	726	412	----	------	------	Remaining Area to Road
10	Combine	0.114	2	726	412	6, 8,	------	------	overall post
11	SCS Runoff	0.005	2	920	161	----	------	------	overall exist cond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.963	2	726	3,482	----	------	------	post to WQ basin
2	Reservoir	0.934	2	726	1,983	1	75.88	312	thru WQ basin
4	SCS Runoff	0.816	2	726	3,383	----	------	------	Rooftops To Infiltration Galleys
5	Combine	1.750	2	726	5,366	2, 4	------	------	Total to galleys: WQ+roofs
6	Reservoir	0.000	2	684	0	4	72.01	834	Thru Inf Galleys
8	SCS Runoff	0.164	2	726	590	----	------	------	Remaining Area to Road
10	Combine	0.164	2	726	590	6, 8,	------	------	overall post
11	SCS Runoff	0.031	2	756	540	----	------	------	overall exist cond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	1.552	2	726	5,694	----	------	------	post to WQ basin
2	Reservoir	1.524	2	726	3,838	1	75.96	325	thru WQ basin
4	SCS Runoff	1.166	2	726	4,882	----	------	------	Rooftops To Infiltration Galleys
5	Combine	2.690	2	726	8,720	2, 4	------	------	Total to galleys: WQ+roofs
6	Reservoir	0.000	2	652	0	4	73.11	1,367	Thru Inf Galleys
8	SCS Runoff	0.276	2	726	1,002	----	------	------	Remaining Area to Road
10	Combine	0.276	2	726	1,002	6, 8,	------	------	overall post
11	SCS Runoff	0.261	2	734	1,960	----	------	------	overall exist cond

Pond No. 2 - Inf Galleys

Pond Data

UG Chambers - Invert elev. = 70.50 ft, Rise x Span = 4.00 x 4.00 ft, Barrel Len = 52.00 ft, No. Barrels = 2, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 70.00 ft, Width = 6.00 ft, Height = 4.50 ft, Voids = 33.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	70.00	n/a	0	0
0.45	70.45	n/a	93	93
0.90	70.90	n/a	204	297
1.35	71.35	n/a	218	515
1.80	71.80	n/a	218	733
2.25	72.25	n/a	218	951
2.70	72.70	n/a	218	1,169
3.15	73.15	n/a	218	1,388
3.60	73.60	n/a	218	1,606
4.05	74.05	n/a	218	1,824
4.50	74.50	n/a	218	2,042

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	0.00	0.00	0.00
Span (in)	= 6.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 74.00	0.00	0.00	0.00
Length (ft)	= 5.00	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)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (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 cuft	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	70.00	0.00	---	---	---	---	---	---	---	0.000	---	0.000
0.45	93	70.45	0.00	---	---	---	---	---	---	---	0.137	---	0.137
0.90	297	70.90	0.00	---	---	---	---	---	---	---	0.155	---	0.155
1.35	515	71.35	0.00	---	---	---	---	---	---	---	0.173	---	0.173
1.80	733	71.80	0.00	---	---	---	---	---	---	---	0.191	---	0.191
2.25	951	72.25	0.00	---	---	---	---	---	---	---	0.209	---	0.209
2.70	1,169	72.70	0.00	---	---	---	---	---	---	---	0.227	---	0.227
3.15	1,388	73.15	0.00	---	---	---	---	---	---	---	0.245	---	0.245
3.60	1,606	73.60	0.00	---	---	---	---	---	---	---	0.263	---	0.263
4.05	1,824	74.05	0.01 ic	---	---	---	---	---	---	---	0.281	---	0.289
4.50	2,042	74.50	0.47 ic	---	---	---	---	---	---	---	0.299	---	0.771

Pond No. 3 - sed forebay

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 75.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	75.00	26	0	0
0.67	75.67	34	20	20
1.00	76.00	40	12	32

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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 75.67	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 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 cuft	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	75.00	---	---	---	---	0.00	---	---	---	---	---	0.000
0.67	20	75.67	---	---	---	---	0.00	---	---	---	---	---	0.000
1.00	32	76.00	---	---	---	---	2.53	---	---	---	---	---	2.525

Pond No. 1 - WQ Basin

Pond Data

Contours - User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 72.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	72.00	55	0	0
1.00	73.00	55	55	55
2.00	74.00	55	55	110
3.00	75.00	55	55	165
3.01	75.01	167	1	166
3.67	75.67	167	110	276
4.67	76.67	167	167	443

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)	= 2.88	0.00	0.00	0.00
Crest El. (ft)	= 75.67	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 8.270 (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 cuft	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	72.00	---	---	---	---	0.00	---	---	---	0.000	---	0.000
1.00	55	73.00	---	---	---	---	0.00	---	---	---	0.011	---	0.011
2.00	110	74.00	---	---	---	---	0.00	---	---	---	0.011	---	0.011
3.00	165	75.00	---	---	---	---	0.00	---	---	---	0.011	---	0.011
3.01	166	75.01	---	---	---	---	0.00	---	---	---	0.032	---	0.032
3.67	276	75.67	---	---	---	---	0.00	---	---	---	0.032	---	0.032
4.67	443	76.67	---	---	---	---	9.59	---	---	---	0.032	---	9.622

Project: Ivy Place, East Providence User: jzl Date: 09/21/2020
County: Providence State: RI
Subtitle: Post-Development: Rooftops To Infiltration Galleys

TR-55: Sub-Area Land Use and Curve Number Details

Land Use	Hydrologic Soil Group	Area (ac)	Sub-Area Curve Number
Paved parking lots, roofs, driveways	A	0.16	98
Total Area / Weighted Curve Number		0.16	98

TR-55: Sub-Area Time of Concentration Details

Flow Type	Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SHEET	100	0.010	0.011 (smooth)				0.044
			Time of Concentration				0.100

TR-55: Watershed Peak Table

Sub-Area Identifier	Peak Flow by Rainfall Return Period 1.2" (cfs)	1-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
OUTLET	0.15	0.36	0.65	0.82	1.17

Project: Ivy Place, East Providence User: jzl Date: 09/21/2020
County: Providence State: RI
Subtitle: Post-Development: To Water Quality Basin

TR-55: Sub-Area Land Use and Curve Number Details

Land Use	Hydrologic Soil Group	Area (ac)	Sub-Area Curve Number
Grass (good)	A	0.08	39
Paved parking lots, roofs, driveways	A	0.17	98
Total Area / Weighted Curve Number		0.25	79

TR-55: Sub-Area Time of Concentration Details

Flow Type	Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SHEET	100	0.030	0.011 (smooth)				0.028
SHALLOW	50	0.030	0.025				0.004
Time of Concentration							0.100

TR-55: Watershed Peak Table

Sub-Area Identifier	Peak Flow by Rainfall Return Period 1.2" (cfs)	1-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
OUTLET	0.00	0.25	0.70	0.96	1.53

Project: Ivy Place, East Providence User: jzl Date: 09/21/2020
County: Providence State: RI
Subtitle: Post-Development: Remaining Area to Road

TR-55: Sub-Area Land Use and Curve Number Details

Land Use	Hydrologic Soil Group	Area (ac)	Sub-Area Curve Number
Grass (good)	A	0.02	39
Paved parking lots, roofs, driveways	A	0.03	98
Total Area / Weighted Curve Number		0.05	74
		====	==

TR-55: Sub-Area Time of Concentration Details

Flow Type	Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SHEET	20	0.030	0.15 (grass)				0.063
			Time of Concentration				0.100
							=======

TR-55: Watershed Peak Table

Sub-Area Identifier	Peak Flow by Rainfall Return Period 1.2" (cfs)	1-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
OUTLET	0.00	0.00	0.11	0.16	0.28

Project: Ivy Place, East Providence User: jzl Date: 09/15/2020
County: Providence State: RI
Subtitle: Vacant Land Existing Condition: Overall Site

TR-55: Sub-Area Land Use and Curve Number Details

Land Use	Hydrologic Soil Group	Area (ac)	Sub-Area Curve Number
Grass (good)	A	0.33	39
Woods/brush (good)	A	0.13	30
Total Area / Weighted Curve Number		0.46	36

TR-55: Sub-Area Time of Concentration Details

Flow Type	Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SHEET	100	0.020	0.24 (grass)				0.388
SHALLOW	120	0.040	0.05 (unpaved)				0.010
Time of Concentration							0.398

TR-55: Watershed Peak Table

Sub-Area Identifier	Peak Flow by Rainfall Return Period 1.2" (cfs)	1-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
OUTLET	0.00	0.00	0.00	0.00	0.26

Project: Ivy Place, East Providence User: jzl Date: 09/23/2020
County: Providence State: RI
Subtitle: Previously Developed Existing Condition: Overall Site

TR-55: Sub-Area Land Use and Curve Number Details

Land Use	Hydrologic Soil Group	Area (ac)	Sub-Area Curve Number
Grass (good)	A	0.21	39
Paved parking lots, roofs, driveways	A	0.25	98
Total Area / Weighted Curve Number		0.46	71
		====	==

TR-55: Sub-Area Time of Concentration Details

Flow Type	Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SHEET	80	0.025	0.15 (grass)				0.204
			Time of Concentration				0.204
							=======

TR-55: Watershed Peak Table

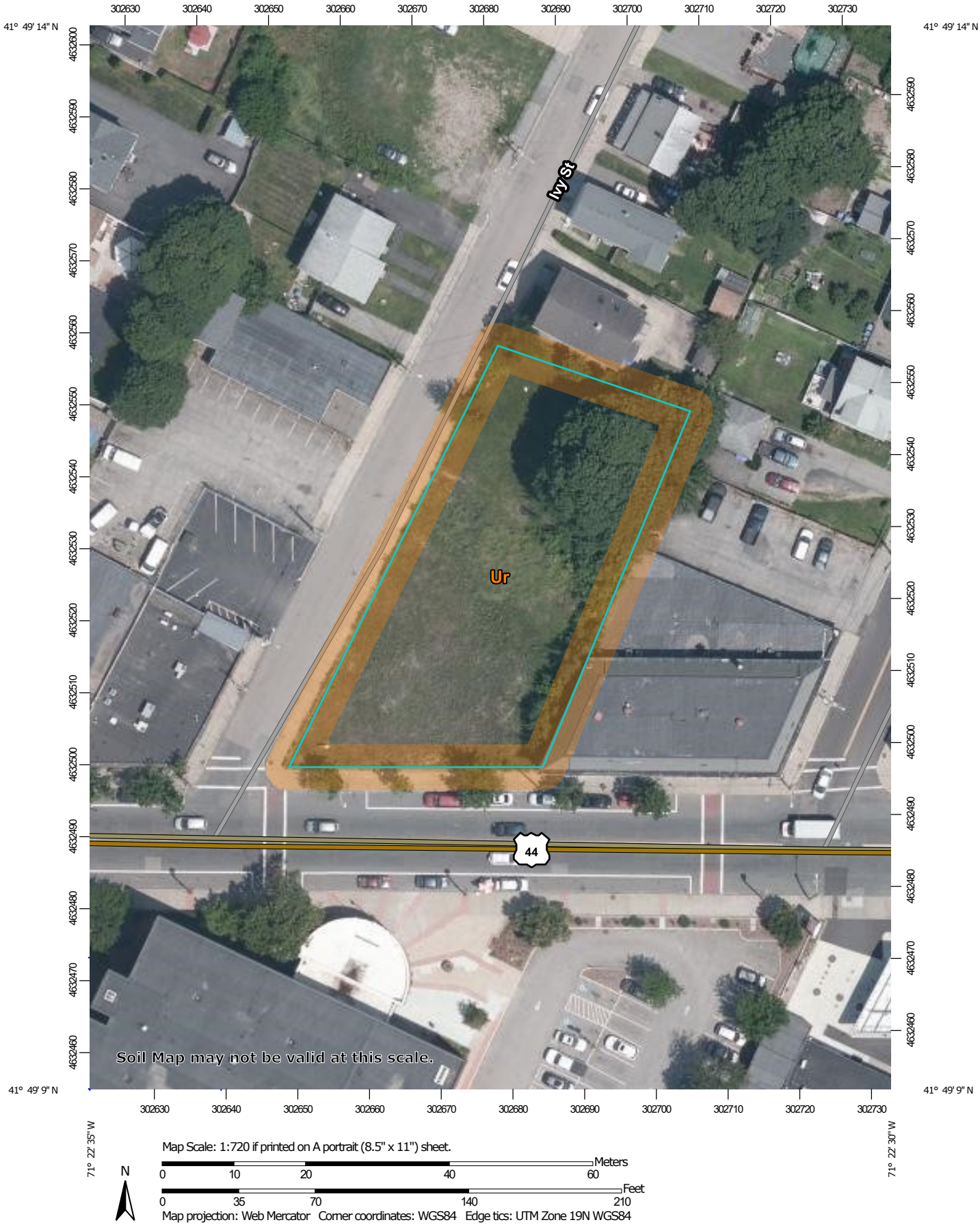
Sub-Area Identifier	Peak Flow by Rainfall Return Period 1.2" (cfs)	1-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	100-Yr (cfs)
OUTLET	0.00	0.22	0.85	1.26	2.19

Ivy Place - Locus Plan

N

0 462.5 925 1,850 Feet

Soil Map—State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties



Map Scale: 1:720 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84