TECHNICAL SUPPLEMENT
CAR WASH
SPECIAL PERMIT

128 PLEASANT VALLEY STREET
METHUEN, MA 01844

November 6, 2023

SUBMITTED TO:

CITY OF METHUEN
ZONING BOARD OF APPEALS
TOWN HALL
METHUEN, MA 01844

Prepared for:

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CAQ 418

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1.0 INTRODUCTION

BACKGROUND:

Alan Kamal is hereby submitting an application to the City of Methuen, for a car wash, under Zoning By-Laws, Section V-D – Use Regulations – Special Permit in a BH Zone.

The site is situated on Pleasant Valley Street and is owned by the Alan Kamal. The lot configuration (triangular) will require property offset waivers along the front and left side lot lines.
The current submittal proposes a single bay car wash, consisting of 1,588 Square Feet in a BH-5 Zone – Business Highway.
Due to the existing wetlands on Phase III, a Notice of Intent will be filed under the Wetlands Protection Act and the City of Worcester Wetlands By-law.

Supplemental Information under Section XI – Special Permits

XI – B – 2 - Special Permit Criteria

1. *Social, Economic, or Community needs which are to be served by the proposal* – The proposed car wash operation will be the re-development of an unoccupied site. It will be compatible with surrounding businesses.
2. *Traffic flow and safety, including parking and loading* – The site has been designed to provide internal queuing of traffic, with one way traffic flow in and out via two separate curb cuts. Although there are no requirements for parking spaces, three are provided.
3. *Adequacy of utilities and other public services* – Pleasant Valley Street is serviced by all utilities at an adequate level to supply the needs of this proposal.
4. *Neighborhood character and social structures* – A car wash is compatible with surrounding character and as a business it will fit in with the neighborhood.
5. *Impacts on the natural environment* – The proposed structure will replace the previously demolished residence, garage and shed. There are no wetlands or otherwise sensitive environment.
6. *Potential fiscal impact, including impact on City services, tax base, and employment.* Said analysis shall conform with the Rules and Regulations of the SPGA – The tax base will increase based on the proposed use and structure. It is situated in a developed area and therefore well supplied with utilities. The proposed development is consistent with the Rules and Regulations of the Zoning Board of Appeals (SPGA).
7. *Consistency with the most recent City of Methuen Master Plan* – This project is consistent with neighborhood (BH).

DRAINAGE CALCULATIONS

128 Pleasant Valley Street had s single family residence, which has been torn down. Previously this lot was part of a gravel operation and as such the soils on the site do not reflect the NRCS Soils, on the upper 10 feet or so. Test pits reflect the presence of sandy/gravelly soils underlying the silt loam fill. Permeability tests were conducted in the area of the proposed infiltration, using a Guelph Permeameter, with results of upwards of 30 in/hr. The drainage calculations were completed using the Cornell Atlas and Rawls infiltration rates. A second run of the drainage calculations was run using 50% of te actual infiltration rate obtained in the field testing. To be conservative the NRCS soil characteristics were used.

The Drainage Calculations for this lot have been reviewed and the existing conditions will be held. The site was analyzed in three Design Points (E-1, E-2 & E-3), for existing conditions. Design Point #E-1 is the discharge from the front-east, Design Point #E-2 is the discharge from the front west and Design Point #E-3 represents the offsite discharge to the abutting property.
The proposed conditions have been analyzed under this submittal, reflecting the same general site conditions. Design Point #P-1 reflects the runoff to street, from the front. Design Point #P-2 corresponds to E-2 and has been re-routed to flow to the west side of the property, via a small depressed area. Design Point #P-3 corresponds to E-3 and consists of the offsite drainage, being re-routed to bypass this lot. Design Point #P-4 consists of the building and the pavement, which will be collected and routed through a sediment separator and infiltrated via a subsurface system. This analysis is based on the Cornell Atlas rates.

CAQ, has performed an hydrological analysis for the applicant of the project, for the impacted areas.
This report reviews the hydrological impacts of the proposed development. The post-construction characteristics of the property were analyzed.
This system is designed to mitigate the potential for increased stormwater flows, due to the site development.

In April, 2008, DEP adopted a new Stormwater Management Policy to address the non-point pollution discharges. The Policy prescribes specific stormwater management standards for the development of projects, including urban pollutant removal criteria for projects that may impact environmental resource areas. Compliance is achieved through the implementation of "Best Management Practices" (BMP's) in the design.
CAQ Engineering Associates, Inc. has incorporated BMP's in the proposed SWM for the applicant of the project. Components that have been included are:

- Sedimentation Pond – forebay
- Drainage Pond – infiltration basin

System Performance

As demonstrated below, these components, in combination will effectively mitigate post-construction rate of runoff and pollutant loading of stormwater runoff from the site. The system is projected to:

- Exceed the minimum pollutant (TSS) removal rate of 80%.
- Attenuate peak discharges, while maintaining them within the system.
- Prevent downstream flooding.

The two, ten, twenty five and one hundred year storm events were reviewed. The tables below list the rainfall intensities used for each storm event.

Table 1 - Intensities

Storm Event	*24 Hour Rainfall*	*Cornell Atlas*
2 year event	*3.20 inches*	*3.20 inches*
10 year event	*4.60 inches*	*4.92 inches*
25 year event	*5.40 inches*	*5.99 inches*
100 year event	*6.60 inches*	*7.65 inches*

Table 2 – Comparative Analysis

Pre-construction Conditions	*Post-construction Conditions*
D.P. # E-1 Cornell	***D.P. #P-1 - Cornell***
2 yr event = 0.00 cfs	2 yr event = 0.00 cfs
10 yr event = 0.06 cfs	10 yr. event = 0.00 cfs
50 yr. event = 0.13 cfs	50 yr. event = 0.01 cfs
100 yr. event = 0.26 cfs	100 yr. event = 0.06 cfs
D.P. #E-2	***D.P. #P-2***
2 yr event = 0.00 cfs	2 yr event = 0.00 cfs
10 yr event = 0.00 cfs	10 yr. event = 0.00 cfs
50 yr. event = 0.01 cfs	50 yr. event = 0.01 cfs
100 yr. event = 0.02 cfs	100 yr. event = 0.00 cfs
D.P. #E-3	***D.P. #P-3***
2 yr event = 0.09 cfs	2 yr event = 0.11 cfs
10 yr event = 0.67 cfs	10 yr. event = 0.60 cfs
50 yr. event = 1.15 cfs	50 yr. event = 1.24 cfs
100 yr. event = 1.19 cfs	100 yr. event = 2.00 cfs

D.P. #P-4 is the infiltration pond handling the runoff from the building roof and the pavement. The analysis is based on infiltration where the 1000 year storm is above the top of the leaching, however still below the overflow elevation of 80.25.

For the 2 yr storm the maximum elevation is 74.75 with Rawls exfiltration and 74.48 with the 50% of field testing.

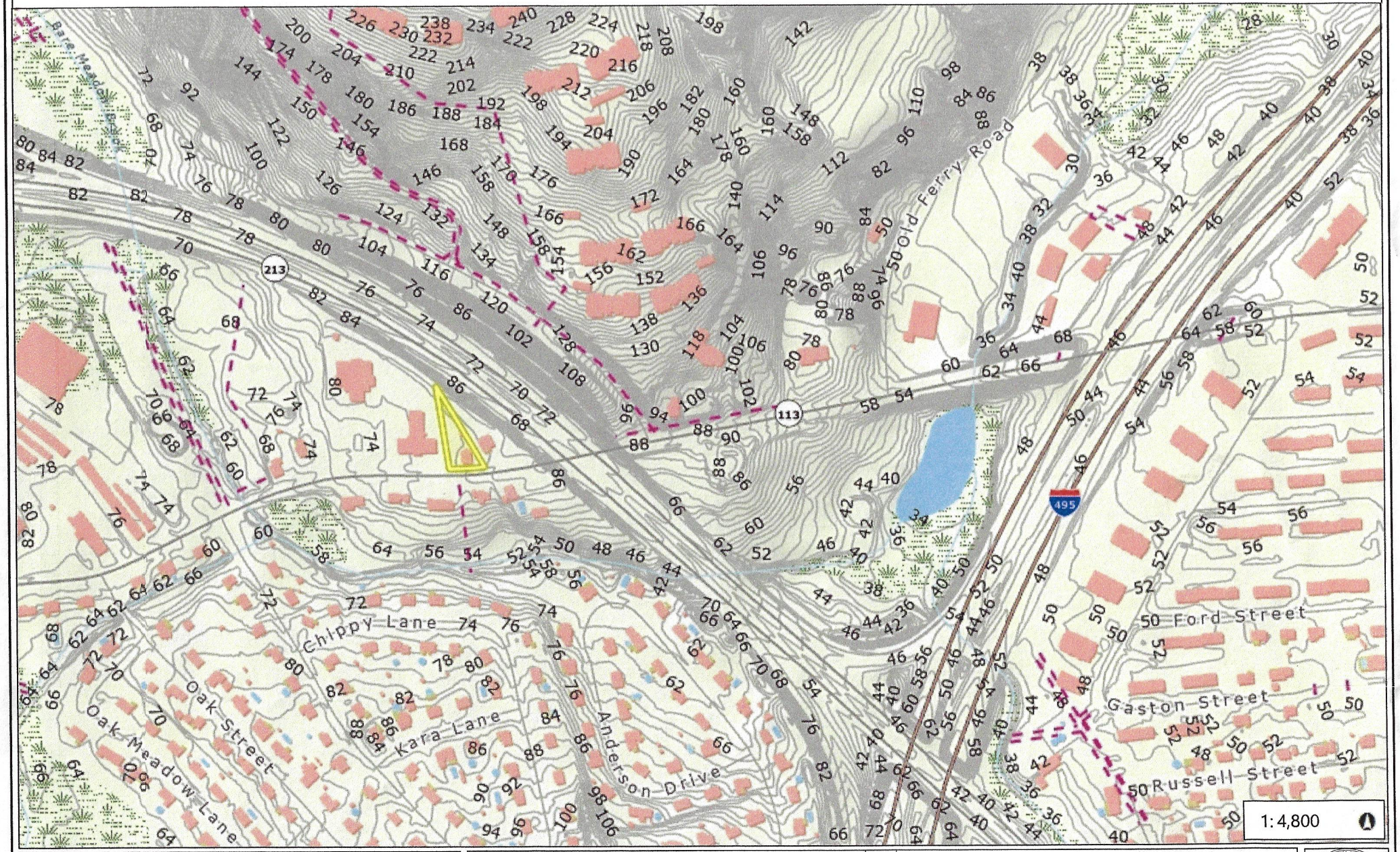
For the 10 yr storm the maximum elevation is 75.30 with Rawls exfiltration and 75.00 with the 50% of field testing

For the 50 yr storm the maximum elevation is 75.66 with Rawls exfiltration and 75.31 with the 50% of field testing

For the 100 yr storm the maximum elevation is 79.96 with Rawls exfiltration and 75.82 with the 50% of field testing

City of Methuen

7/19/2023



Data Sources: Produced by Merrimack Valley Planning Commission (MVPC) using data provided by the City of Methuen & MassIT/MassGIS. MVPC AND THE CITY OF METHUEN MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, CONCERNING THE ACCURACY, COMPLETENESS, RELIABILITY, OR SUITABILITY OF THESE DATA. THE CITY OF METHUEN AND MVPC DOES NOT ASSUME ANY LIABILITY ASSOCIATED WITH THE USE OR MISUSE OF THIS INFORMATION.

Legend

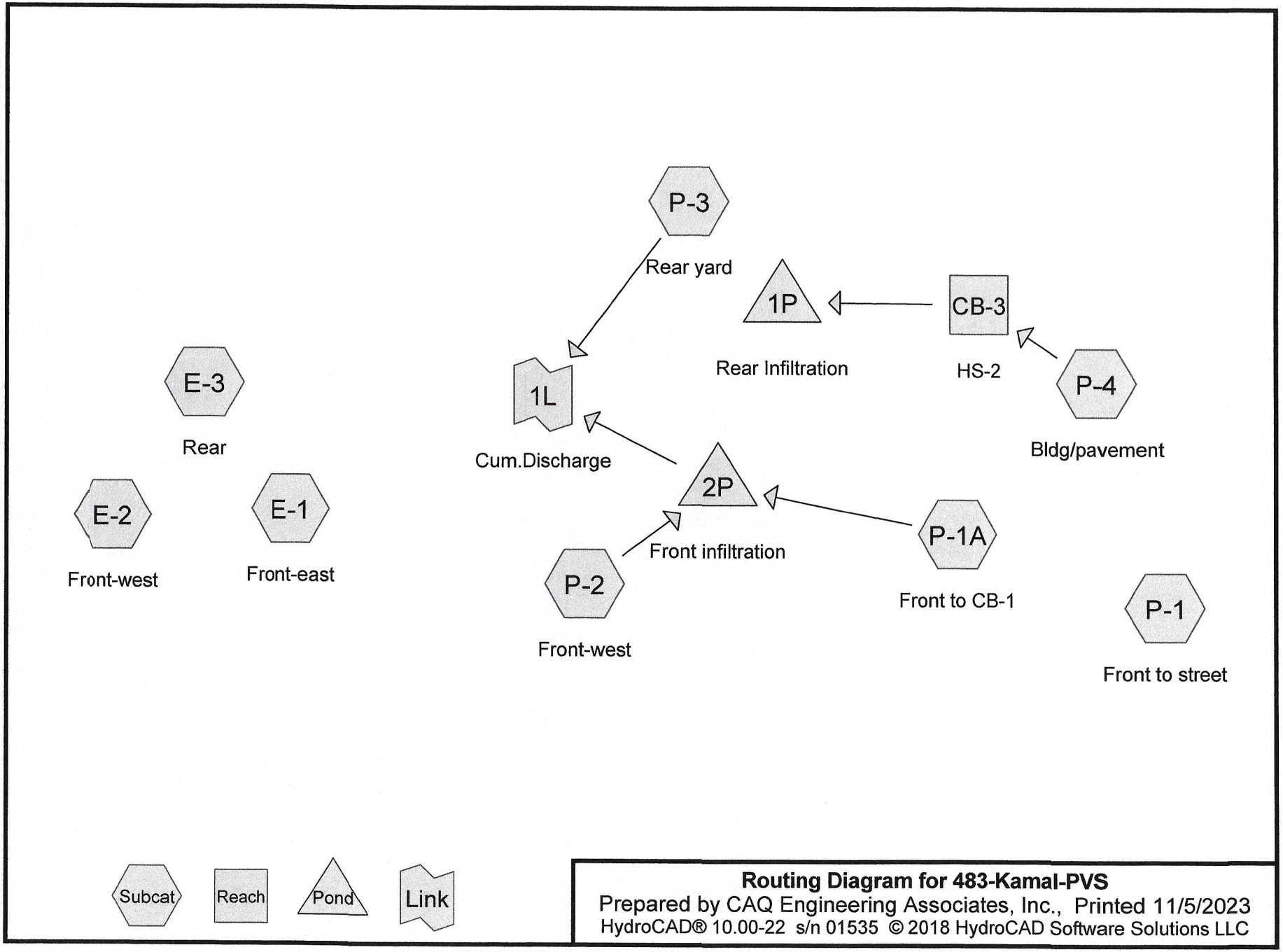
- Municipal Boundary
- Parcels
- Building
- Deck
- Pool
- Roads
- Interstate
- Major Road
- Local Road
- Easements
- Rail Line
- Hydrographic Features
- Streams
- Wetlands
- Contour Lines
- MVPC_Hillshade

CITY OF METHUEN MASSACHUSETTS INCORPORATED 1726

Projection: NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001

DRAINAGE

PRE-DEVEVELOPMENT CONDITIONS

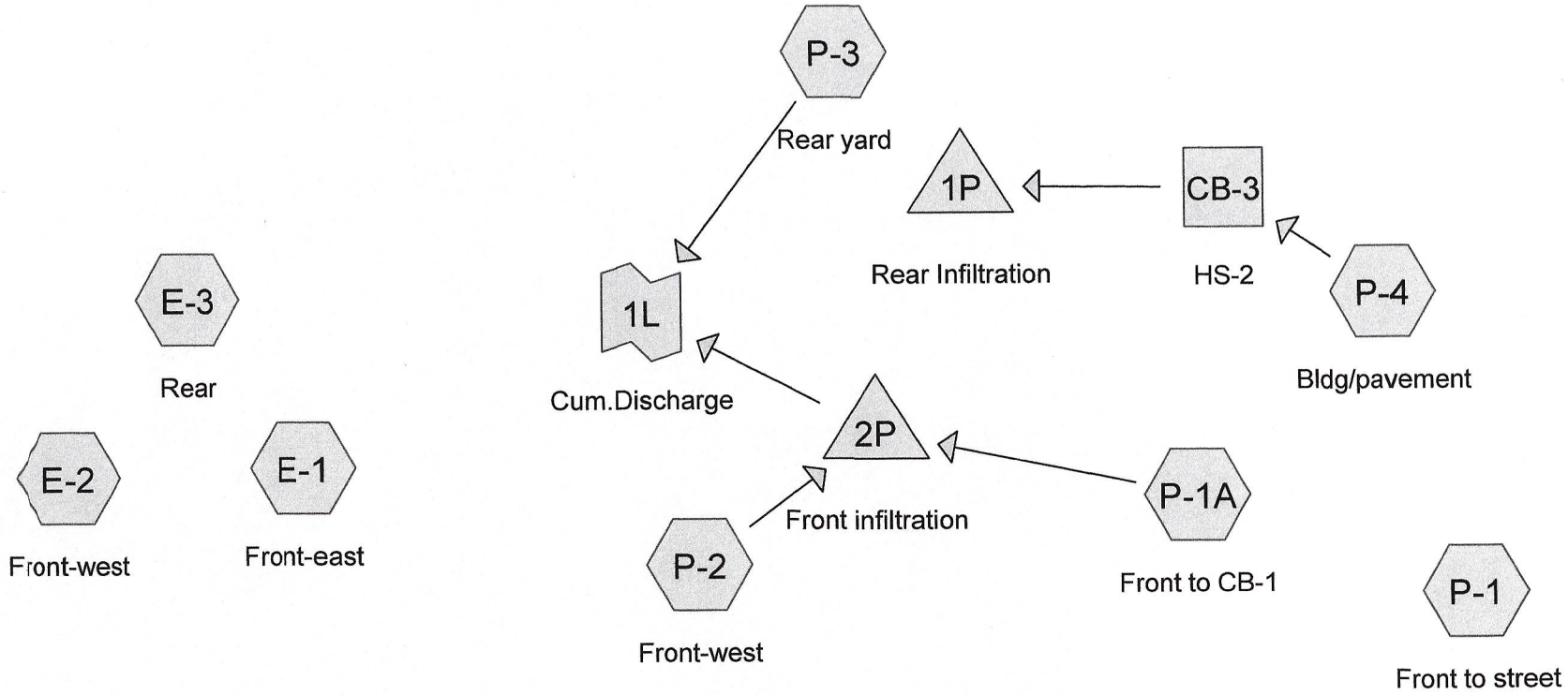


Routing Diagram for 483-Kamal-PVS

Prepared by CAQ Engineering Associates, Inc., Printed 11/5/2023

DRAINAGE

POST-DEVELOPMENT CONDITIONS



Subcat Reach Pond Link

Routing Diagram for 483-Kamal-PVS

Prepared by CAQ Engineering Associates, Inc., Printed 11/5/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.504	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-3, P-1, P-1A, P-2, P-3, P-4)
0.375	61	>75% Grass cover, Good, HSG B (E-3, P-3, P-4)
0.143	98	Paved parking, HSG A (E-1, E-3, P-1A, P-4)
0.025	98	Paved parking, HSG B (P-4)
0.115	98	Roofs, HSG A (E-3, P-3, P-4)
1.161	**60**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.761	HSG A	E-1, E-2, E-3, P-1, P-1A, P-2, P-3, P-4
0.399	HSG B	E-3, P-3, P-4
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.161		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.07"
Tc=6.0 min CN=48 Runoff=0.00 cfs 0.000 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>0.21"
Tc=6.0 min CN=55 Runoff=0.09 cfs 0.008 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>2.20"
Tc=6.0 min CN=92 Runoff=0.13 cfs 0.006 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>0.26"
Tc=6.0 min CN=57 Runoff=0.11 cfs 0.008 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>2.12"
Tc=0.0 min CN=91 Runoff=0.76 cfs 0.030 af

Reach CB-3: HS-2 Avg. Flow Depth=0.27' Max Vel=6.98 fps Inflow=0.76 cfs 0.030 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=0.75 cfs 0.030 af

Pond 1P: Rear Infiltration Peak Elev=74.48' Storage=183 cf Inflow=0.75 cfs 0.030 af
Discarded=0.36 cfs 0.030 af Primary=0.00 cfs 0.000 af Outflow=0.36 cfs 0.030 af

Pond 2P: Front infiltration Peak Elev=79.58' Storage=89 cf Inflow=0.13 cfs 0.006 af
Discarded=0.04 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.006 af

Link 1L: Cum.Discharge Inflow=0.11 cfs 0.008 af
Primary=0.11 cfs 0.008 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.053 af Average Runoff Depth = 0.54"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.00 cfs @ 12.96 hrs, Volume= 0.000 af, Depth> 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 0.09 cfs @ 12.02 hrs, Volume= 0.008 af, Depth> 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.13 cfs @ 11.97 hrs, Volume= 0.006 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 0.76 cfs @ 11.89 hrs, Volume= 0.030 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

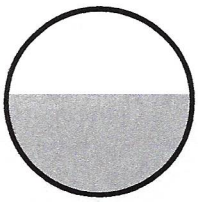
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 2.12" for 2yr event
Inflow = 0.76 cfs @ 11.89 hrs, Volume= 0.030 af
Outflow = 0.75 cfs @ 11.89 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.98 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 2.12" for 2yr event
Inflow = 0.75 cfs @ 11.89 hrs, Volume= 0.030 af
Outflow = 0.36 cfs @ 11.97 hrs, Volume= 0.030 af, Atten= 52%, Lag= 4.6 min
Discarded = 0.36 cfs @ 11.97 hrs, Volume= 0.030 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 74.48' @ 11.97 hrs Surf.Area= 945 sf Storage= 183 cf

Plug-Flow detention time= 2.8 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (761.1 - 758.5)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.36 cfs @ 11.97 hrs HW=74.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 1.75" for 2yr event
Inflow = 0.13 cfs @ 11.97 hrs, Volume= 0.006 af
Outflow = 0.04 cfs @ 12.10 hrs, Volume= 0.006 af, Atten= 67%, Lag= 8.3 min
Discarded = 0.04 cfs @ 12.10 hrs, Volume= 0.006 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.58' @ 12.10 hrs Surf.Area= 226 sf Storage= 89 cf

Plug-Flow detention time= 21.1 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 20.8 min (780.1 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.04 cfs @ 12.10 hrs HW=79.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=78.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 0.23" for 2yr event
Inflow = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af
Primary = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.47"
Tc=6.0 min CN=48 Runoff=0.06 cfs 0.003 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>0.82"
Tc=6.0 min CN=55 Runoff=0.67 cfs 0.031 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>3.76"
Tc=6.0 min CN=92 Runoff=0.22 cfs 0.011 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>0.94"
Tc=6.0 min CN=57 Runoff=0.60 cfs 0.027 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>3.67"
Tc=0.0 min CN=91 Runoff=1.26 cfs 0.053 af

Reach CB-3: HS-2 Avg. Flow Depth=0.39' Max Vel=7.70 fps Inflow=1.26 cfs 0.053 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.26 cfs 0.053 af

Pond 1P: Rear Infiltration Peak Elev=75.00' Storage=492 cf Inflow=1.26 cfs 0.053 af
Discarded=0.40 cfs 0.053 af Primary=0.00 cfs 0.000 af Outflow=0.40 cfs 0.053 af

Pond 2P: Front infiltration Peak Elev=79.77' Storage=139 cf Inflow=0.22 cfs 0.011 af
Discarded=0.06 cfs 0.010 af Primary=0.13 cfs 0.001 af Outflow=0.19 cfs 0.011 af

Link 1L: Cum.Discharge Inflow=0.60 cfs 0.028 af
Primary=0.60 cfs 0.028 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.126 af Average Runoff Depth = 1.30"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.003 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 0.67 cfs @ 11.99 hrs, Volume= 0.031 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.60 cfs @ 11.99 hrs, Volume= 0.027 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

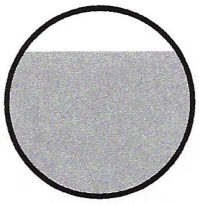
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 3.67" for 10-yr event
Inflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af
Outflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.70 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.55 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 3.67" for 10-yr event
Inflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af
Outflow = 0.40 cfs @ 11.99 hrs, Volume= 0.053 af, Atten= 68%, Lag= 6.2 min
Discarded = 0.40 cfs @ 11.99 hrs, Volume= 0.053 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.00' @ 11.99 hrs Surf.Area= 945 sf Storage= 492 cf

Plug-Flow detention time= 6.3 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 6.1 min (752.8 - 746.8)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.40 cfs @ 11.99 hrs HW=74.99' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.40 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 3.03" for 10-yr event
Inflow = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af
Outflow = 0.19 cfs @ 12.05 hrs, Volume= 0.011 af, Atten= 12%, Lag= 5.2 min
Discarded = 0.06 cfs @ 12.05 hrs, Volume= 0.010 af
Primary = 0.13 cfs @ 12.05 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.77' @ 12.05 hrs Surf.Area= 310 sf Storage= 139 cf

Plug-Flow detention time= 23.4 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 22.8 min (772.9 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.06 cfs @ 12.05 hrs HW=79.77' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.13 cfs @ 12.05 hrs HW=79.77' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.23 fps)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 0.85" for 10-yr event
Inflow = 0.60 cfs @ 12.00 hrs, Volume= 0.028 af
Primary = 0.60 cfs @ 12.00 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=48 Runoff=0.13 cfs 0.006 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>1.35"
Tc=6.0 min CN=55 Runoff=1.15 cfs 0.051 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>4.74"
Tc=6.0 min CN=92 Runoff=0.27 cfs 0.014 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>1.50"
Tc=6.0 min CN=57 Runoff=0.98 cfs 0.043 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>4.64"
Tc=0.0 min CN=91 Runoff=1.57 cfs 0.067 af

Reach CB-3: HS-2 Avg. Flow Depth=0.50' Max Vel=7.73 fps Inflow=1.57 cfs 0.067 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.35 cfs 0.067 af

Pond 1P: Rear Infiltration Peak Elev=75.31' Storage=716 cf Inflow=1.35 cfs 0.067 af
Discarded=0.42 cfs 0.067 af Primary=0.00 cfs 0.000 af Outflow=0.42 cfs 0.067 af

Pond 2P: Front infiltration Peak Elev=79.79' Storage=144 cf Inflow=0.27 cfs 0.014 af
Discarded=0.06 cfs 0.012 af Primary=0.28 cfs 0.002 af Outflow=0.34 cfs 0.014 af

Link 1L: Cum.Discharge Inflow=1.24 cfs 0.045 af
Primary=1.24 cfs 0.045 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.183 af Average Runoff Depth = 1.89"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.13 cfs @ 11.99 hrs, Volume= 0.006 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 1.15 cfs @ 11.98 hrs, Volume= 0.051 af, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.27 cfs @ 11.96 hrs, Volume= 0.014 af, Depth> 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 12.02 hrs, Volume= 0.000 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.98 cfs @ 11.98 hrs, Volume= 0.043 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 1.57 cfs @ 11.89 hrs, Volume= 0.067 af, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

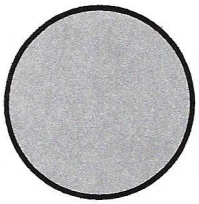
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 4.64" for 50-yr event
Inflow = 1.57 cfs @ 11.89 hrs, Volume= 0.067 af
Outflow = 1.35 cfs @ 11.88 hrs, Volume= 0.067 af, Atten= 14%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.73 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 4.64" for 50-yr event
Inflow = 1.35 cfs @ 11.88 hrs, Volume= 0.067 af
Outflow = 0.42 cfs @ 12.01 hrs, Volume= 0.067 af, Atten= 69%, Lag= 7.8 min
Discarded = 0.42 cfs @ 12.01 hrs, Volume= 0.067 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.31' @ 12.01 hrs Surf.Area= 945 sf Storage= 716 cf

Plug-Flow detention time= 8.9 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 8.7 min (751.2 - 742.5)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 12.01 hrs HW=75.31' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 3.85" for 50-yr event
Inflow = 0.27 cfs @ 11.96 hrs, Volume= 0.014 af
Outflow = 0.34 cfs @ 12.00 hrs, Volume= 0.014 af, Atten= 0%, Lag= 2.4 min
Discarded = 0.06 cfs @ 12.01 hrs, Volume= 0.012 af
Primary = 0.28 cfs @ 12.00 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.79' @ 12.01 hrs Surf.Area= 317 sf Storage= 144 cf

Plug-Flow detention time= 22.3 min calculated for 0.014 af (99% of inflow)
Center-of-Mass det. time= 21.2 min (768.2 - 747.0)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.06 cfs @ 12.01 hrs HW=79.79' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.26 cfs @ 12.00 hrs HW=79.79' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.26 cfs @ 0.28 fps)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 1.39" for 50-yr event
Inflow = 1.24 cfs @ 11.99 hrs, Volume= 0.045 af
Primary = 1.24 cfs @ 11.99 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>1.64"
Tc=6.0 min CN=48 Runoff=0.26 cfs 0.012 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.02 cfs 0.001 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>2.30"
Tc=6.0 min CN=55 Runoff=1.99 cfs 0.087 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.06 cfs 0.003 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>6.25"
Tc=6.0 min CN=92 Runoff=0.35 cfs 0.018 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>2.50"
Tc=6.0 min CN=57 Runoff=1.66 cfs 0.072 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>6.16"
Tc=0.0 min CN=91 Runoff=2.04 cfs 0.089 af

Reach CB-3: HS-2 Avg. Flow Depth=0.50' Max Vel=7.73 fps Inflow=2.04 cfs 0.089 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.37 cfs 0.089 af

Pond 1P: Rear Infiltration Peak Elev=75.82' Storage=1,055 cf Inflow=1.37 cfs 0.089 af
Discarded=0.46 cfs 0.089 af Primary=0.00 cfs 0.000 af Outflow=0.46 cfs 0.089 af

Pond 2P: Front infiltration Peak Elev=79.80' Storage=147 cf Inflow=0.36 cfs 0.019 af
Discarded=0.06 cfs 0.015 af Primary=0.38 cfs 0.004 af Outflow=0.44 cfs 0.019 af

Link 1L: Cum.Discharge Inflow=2.00 cfs 0.076 af
Primary=2.00 cfs 0.076 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.282 af Average Runoff Depth = 2.92"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.26 cfs @ 11.99 hrs, Volume= 0.012 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.02 cfs @ 12.00 hrs, Volume= 0.001 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 1.99 cfs @ 11.98 hrs, Volume= 0.087 af, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.003 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.35 cfs @ 11.96 hrs, Volume= 0.018 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.01 cfs @ 12.00 hrs, Volume= 0.001 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 1.66 cfs @ 11.98 hrs, Volume= 0.072 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 2.04 cfs @ 11.89 hrs, Volume= 0.089 af, Depth> 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

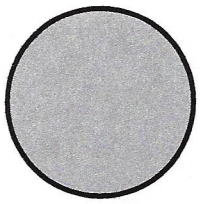
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 6.16" for 100-yr event
Inflow = 2.04 cfs @ 11.89 hrs, Volume= 0.089 af
Outflow = 1.37 cfs @ 12.00 hrs, Volume= 0.089 af, Atten= 33%, Lag= 6.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.73 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.01 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 11.85 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 6.16" for 100-yr event
Inflow = 1.37 cfs @ 12.00 hrs, Volume= 0.089 af
Outflow = 0.46 cfs @ 12.06 hrs, Volume= 0.089 af, Atten= 66%, Lag= 3.4 min
Discarded = 0.46 cfs @ 12.06 hrs, Volume= 0.089 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.82' @ 12.06 hrs Surf.Area= 945 sf Storage= 1,055 cf

Plug-Flow detention time= 12.9 min calculated for 0.089 af (100% of inflow)
Center-of-Mass det. time= 12.7 min (750.9 - 738.2)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.46 cfs @ 12.06 hrs HW=75.81' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 5.16" for 100-yr event
Inflow = 0.36 cfs @ 11.96 hrs, Volume= 0.019 af
Outflow = 0.44 cfs @ 11.96 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.96 hrs, Volume= 0.015 af
Primary = 0.38 cfs @ 11.96 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.80' @ 11.96 hrs Surf.Area= 321 sf Storage= 147 cf

Plug-Flow detention time= 21.2 min calculated for 0.018 af (99% of inflow)
Center-of-Mass det. time= 19.5 min (763.5 - 743.9)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.06 cfs @ 11.96 hrs HW=79.79' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.33 cfs @ 11.96 hrs HW=79.79' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.33 cfs @ 0.31 fps)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 2.34" for 100-yr event
Inflow = 2.00 cfs @ 11.97 hrs, Volume= 0.076 af
Primary = 2.00 cfs @ 11.97 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.504	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-3, P-1, P-1A, P-2, P-3, P-4)
0.375	61	>75% Grass cover, Good, HSG B (E-3, P-3, P-4)
0.143	98	Paved parking, HSG A (E-1, E-3, P-1A, P-4)
0.025	98	Paved parking, HSG B (P-4)
0.115	98	Roofs, HSG A (E-3, P-3, P-4)
1.161	**60**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.761	HSG A	E-1, E-2, E-3, P-1, P-1A, P-2, P-3, P-4
0.399	HSG B	E-3, P-3, P-4
0.000	HSG C	
0.000	HSG D	
0.000	Other	
1.161		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.07"
Tc=6.0 min CN=48 Runoff=0.00 cfs 0.000 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>0.21"
Tc=6.0 min CN=55 Runoff=0.09 cfs 0.008 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>2.20"
Tc=6.0 min CN=92 Runoff=0.13 cfs 0.006 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>0.26"
Tc=6.0 min CN=57 Runoff=0.11 cfs 0.008 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>2.12"
Tc=0.0 min CN=91 Runoff=0.76 cfs 0.030 af

Reach CB-3: HS-2 Avg. Flow Depth=0.27' Max Vel=6.98 fps Inflow=0.76 cfs 0.030 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=0.75 cfs 0.030 af

Pond 1P: Rear Infiltration Peak Elev=74.48' Storage=183 cf Inflow=0.75 cfs 0.030 af
Discarded=0.36 cfs 0.030 af Primary=0.00 cfs 0.000 af Outflow=0.36 cfs 0.030 af

Pond 2P: Front infiltration Peak Elev=79.48' Storage=67 cf Inflow=0.13 cfs 0.006 af
Discarded=0.07 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.006 af

Link 1L: Cum.Discharge Inflow=0.11 cfs 0.008 af
Primary=0.11 cfs 0.008 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.053 af Average Runoff Depth = 0.54"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.00 cfs @ 12.96 hrs, Volume= 0.000 af, Depth> 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 0.09 cfs @ 12.02 hrs, Volume= 0.008 af, Depth> 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.13 cfs @ 11.97 hrs, Volume= 0.006 af, Depth> 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 0.76 cfs @ 11.89 hrs, Volume= 0.030 af, Depth> 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

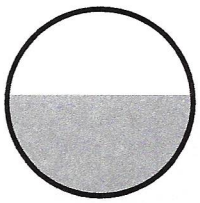
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 2.12" for 2yr event
Inflow = 0.76 cfs @ 11.89 hrs, Volume= 0.030 af
Outflow = 0.75 cfs @ 11.89 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.98 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 2.12" for 2yr event
Inflow = 0.75 cfs @ 11.89 hrs, Volume= 0.030 af
Outflow = 0.36 cfs @ 11.97 hrs, Volume= 0.030 af, Atten= 52%, Lag= 4.6 min
Discarded = 0.36 cfs @ 11.97 hrs, Volume= 0.030 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 74.48' @ 11.97 hrs Surf.Area= 945 sf Storage= 183 cf

Plug-Flow detention time= 2.8 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (761.1 - 758.5)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.36 cfs @ 11.97 hrs HW=74.47' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.36 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area =	0.043 ac, 71.31% Impervious, Inflow Depth > 1.75" for 2yr event			
Inflow =	0.13 cfs @	11.97 hrs, Volume=	0.006 af	
Outflow =	0.07 cfs @	12.07 hrs, Volume=	0.006 af, Atten= 51%, Lag= 6.2 min	
Discarded =	0.07 cfs @	12.07 hrs, Volume=	0.006 af	
Primary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.48' @ 12.07 hrs Surf.Area= 185 sf Storage= 67 cf

Plug-Flow detention time= 9.5 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 9.4 min (768.7 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.06 cfs @ 12.07 hrs HW=79.47' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=78.50' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 0.23" for 2yr event
Inflow = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af
Primary = 0.11 cfs @ 12.01 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.47"
Tc=6.0 min CN=48 Runoff=0.06 cfs 0.003 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>0.82"
Tc=6.0 min CN=55 Runoff=0.67 cfs 0.031 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>3.76"
Tc=6.0 min CN=92 Runoff=0.22 cfs 0.011 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>0.94"
Tc=6.0 min CN=57 Runoff=0.60 cfs 0.027 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>3.67"
Tc=0.0 min CN=91 Runoff=1.26 cfs 0.053 af

Reach CB-3: HS-2 Avg. Flow Depth=0.39' Max Vel=7.70 fps Inflow=1.26 cfs 0.053 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.26 cfs 0.053 af

Pond 1P: Rear Infiltration Peak Elev=75.00' Storage=492 cf Inflow=1.26 cfs 0.053 af
Discarded=0.40 cfs 0.053 af Primary=0.00 cfs 0.000 af Outflow=0.40 cfs 0.053 af

Pond 2P: Front infiltration Peak Elev=79.71' Storage=121 cf Inflow=0.22 cfs 0.011 af
Discarded=0.10 cfs 0.011 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.011 af

Link 1L: Cum.Discharge Inflow=0.60 cfs 0.027 af
Primary=0.60 cfs 0.027 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.126 af Average Runoff Depth = 1.30"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.003 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 0.67 cfs @ 11.99 hrs, Volume= 0.031 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 12.39 hrs, Volume= 0.000 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.60 cfs @ 11.99 hrs, Volume= 0.027 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=4.92"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

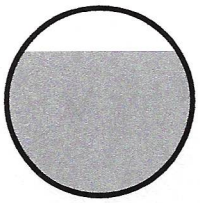
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 3.67" for 10-yr event
Inflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af
Outflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.70 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.55 fps, Avg. Travel Time= 0.1 min

Peak Storage= 1 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 3.67" for 10-yr event
Inflow = 1.26 cfs @ 11.89 hrs, Volume= 0.053 af
Outflow = 0.40 cfs @ 11.99 hrs, Volume= 0.053 af, Atten= 68%, Lag= 6.2 min
Discarded = 0.40 cfs @ 11.99 hrs, Volume= 0.053 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.00' @ 11.99 hrs Surf.Area= 945 sf Storage= 492 cf

Plug-Flow detention time= 6.3 min calculated for 0.053 af (100% of inflow)
Center-of-Mass det. time= 6.1 min (752.8 - 746.8)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.40 cfs @ 11.99 hrs HW=74.99' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.40 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 3.03" for 10-yr event
Inflow = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af
Outflow = 0.10 cfs @ 12.07 hrs, Volume= 0.011 af, Atten= 55%, Lag= 6.6 min
Discarded = 0.10 cfs @ 12.07 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.71' @ 12.07 hrs Surf.Area= 281 sf Storage= 121 cf

Plug-Flow detention time= 11.7 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 11.5 min (761.6 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.10 cfs @ 12.07 hrs HW=79.71' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=78.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 0.83" for 10-yr event
Inflow = 0.60 cfs @ 11.99 hrs, Volume= 0.027 af
Primary = 0.60 cfs @ 11.99 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=48 Runoff=0.13 cfs 0.006 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>1.35"
Tc=6.0 min CN=55 Runoff=1.15 cfs 0.051 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>4.74"
Tc=6.0 min CN=92 Runoff=0.27 cfs 0.014 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.36"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>1.50"
Tc=6.0 min CN=57 Runoff=0.98 cfs 0.043 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>4.64"
Tc=0.0 min CN=91 Runoff=1.57 cfs 0.067 af

Reach CB-3: HS-2 Avg. Flow Depth=0.50' Max Vel=7.73 fps Inflow=1.57 cfs 0.067 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.35 cfs 0.067 af

Pond 1P: Rear Infiltration Peak Elev=75.31' Storage=716 cf Inflow=1.35 cfs 0.067 af
Discarded=0.42 cfs 0.067 af Primary=0.00 cfs 0.000 af Outflow=0.42 cfs 0.067 af

Pond 2P: Front infiltration Peak Elev=79.77' Storage=139 cf Inflow=0.27 cfs 0.014 af
Discarded=0.11 cfs 0.013 af Primary=0.12 cfs 0.001 af Outflow=0.23 cfs 0.014 af

Link 1L: Cum.Discharge Inflow=1.00 cfs 0.044 af
Primary=1.00 cfs 0.044 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.183 af Average Runoff Depth = 1.89"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.13 cfs @ 11.99 hrs, Volume= 0.006 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 1.15 cfs @ 11.98 hrs, Volume= 0.051 af, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.01 cfs @ 12.02 hrs, Volume= 0.001 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.27 cfs @ 11.96 hrs, Volume= 0.014 af, Depth> 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.00 cfs @ 12.02 hrs, Volume= 0.000 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 0.98 cfs @ 11.98 hrs, Volume= 0.043 af, Depth> 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 1.57 cfs @ 11.89 hrs, Volume= 0.067 af, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=5.99"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

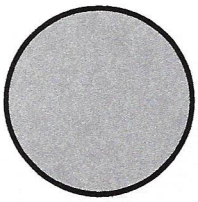
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 4.64" for 50-yr event
Inflow = 1.57 cfs @ 11.89 hrs, Volume= 0.067 af
Outflow = 1.35 cfs @ 11.88 hrs, Volume= 0.067 af, Atten= 14%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.73 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 2.75 fps, Avg. Travel Time= 0.1 min

Peak Storage= 2 cf @ 11.89 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 4.64" for 50-yr event
Inflow = 1.35 cfs @ 11.88 hrs, Volume= 0.067 af
Outflow = 0.42 cfs @ 12.01 hrs, Volume= 0.067 af, Atten= 69%, Lag= 7.8 min
Discarded = 0.42 cfs @ 12.01 hrs, Volume= 0.067 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.31' @ 12.01 hrs Surf.Area= 945 sf Storage= 716 cf

Plug-Flow detention time= 8.9 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 8.7 min (751.2 - 742.5)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 12.01 hrs HW=75.31' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 3.85" for 50-yr event
Inflow = 0.27 cfs @ 11.96 hrs, Volume= 0.014 af
Outflow = 0.23 cfs @ 12.05 hrs, Volume= 0.014 af, Atten= 15%, Lag= 4.9 min
Discarded = 0.11 cfs @ 12.04 hrs, Volume= 0.013 af
Primary = 0.12 cfs @ 12.05 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.77' @ 12.04 hrs Surf.Area= 309 sf Storage= 139 cf

Plug-Flow detention time= 11.8 min calculated for 0.014 af (100% of inflow)
Center-of-Mass det. time= 11.6 min (758.6 - 747.0)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.11 cfs @ 12.04 hrs HW=79.77' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.11 cfs @ 12.05 hrs HW=79.77' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.11 cfs @ 0.22 fps)

Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 1.35" for 50-yr event
Inflow = 1.00 cfs @ 11.99 hrs, Volume= 0.044 af
Primary = 1.00 cfs @ 11.99 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Front-east Runoff Area=3,727 sf 15.80% Impervious Runoff Depth>1.64"
Tc=6.0 min CN=48 Runoff=0.26 cfs 0.012 af

Subcatchment E-2: Front-west Runoff Area=752 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.02 cfs 0.001 af

Subcatchment E-3: Rear Runoff Area=19,708 sf 10.57% Impervious Runoff Depth>2.30"
Tc=6.0 min CN=55 Runoff=1.99 cfs 0.087 af

Subcatchment P-1: Front to street Runoff Area=1,828 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.06 cfs 0.003 af

Subcatchment P-1A: Front to CB-1 Runoff Area=1,500 sf 89.47% Impervious Runoff Depth>6.25"
Tc=6.0 min CN=92 Runoff=0.35 cfs 0.018 af

Subcatchment P-2: Front-west Runoff Area=382 sf 0.00% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.001 af

Subcatchment P-3: Rear yard Runoff Area=15,129 sf 11.32% Impervious Runoff Depth>2.50"
Tc=6.0 min CN=57 Runoff=1.66 cfs 0.072 af

Subcatchment P-4: Bldg/pavement Runoff Area=7,528 sf 87.30% Impervious Runoff Depth>6.16"
Tc=0.0 min CN=91 Runoff=2.04 cfs 0.089 af

Reach CB-3: HS-2 Avg. Flow Depth=0.50' Max Vel=7.73 fps Inflow=2.04 cfs 0.089 af
6.0" Round Pipe n=0.010 L=9.0' S=0.0333 '/' Capacity=1.33 cfs Outflow=1.37 cfs 0.089 af

Pond 1P: Rear Infiltration Peak Elev=75.82' Storage=1,055 cf Inflow=1.37 cfs 0.089 af
Discarded=0.46 cfs 0.089 af Primary=0.00 cfs 0.000 af Outflow=0.46 cfs 0.089 af

Pond 2P: Front infiltration Peak Elev=79.79' Storage=144 cf Inflow=0.36 cfs 0.019 af
Discarded=0.11 cfs 0.016 af Primary=0.30 cfs 0.002 af Outflow=0.41 cfs 0.019 af

Link 1L: Cum.Discharge Inflow=1.94 cfs 0.075 af
Primary=1.94 cfs 0.075 af

Total Runoff Area = 1.161 ac Runoff Volume = 0.282 af Average Runoff Depth = 2.92"
75.67% Pervious = 0.878 ac 24.33% Impervious = 0.282 ac

Summary for Subcatchment E-1: Front-east

Runoff = 0.26 cfs @ 11.99 hrs, Volume= 0.012 af, Depth> 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
3,138	39	>75% Grass cover, Good, HSG A
589	98	Paved parking, HSG A
3,727	48	Weighted Average
3,138		84.20% Pervious Area
589		15.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-2: Front-west

Runoff = 0.02 cfs @ 12.00 hrs, Volume= 0.001 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment E-3: Rear

Runoff = 1.99 cfs @ 11.98 hrs, Volume= 0.087 af, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
371	98	Paved parking, HSG A
1,712	98	Roofs, HSG A
9,022	39	>75% Grass cover, Good, HSG A
8,603	61	>75% Grass cover, Good, HSG B
19,708	55	Weighted Average
17,625		89.43% Pervious Area
2,083		10.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1: Front to street

Runoff = 0.06 cfs @ 12.00 hrs, Volume= 0.003 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,828	39	>75% Grass cover, Good, HSG A
1,828		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-1A: Front to CB-1

Runoff = 0.35 cfs @ 11.96 hrs, Volume= 0.018 af, Depth> 6.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,342	98	Paved parking, HSG A
158	39	>75% Grass cover, Good, HSG A
1,500	92	Weighted Average
158		10.53% Pervious Area
1,342		89.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-2: Front-west

Runoff = 0.01 cfs @ 12.00 hrs, Volume= 0.001 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
382	39	>75% Grass cover, Good, HSG A
382		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-3: Rear yard

Runoff = 1.66 cfs @ 11.98 hrs, Volume= 0.072 af, Depth> 2.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
7,495	61	>75% Grass cover, Good, HSG B
2,001	39	>75% Grass cover, Good, HSG A
3,921	39	>75% Grass cover, Good, HSG A
1,712	98	Roofs, HSG A
15,129	57	Weighted Average
13,417		88.68% Pervious Area
1,712		11.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Subcatchment P-4: Bldg/pavement

Runoff = 2.04 cfs @ 11.89 hrs, Volume= 0.089 af, Depth> 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=7.65"

Area (sf)	CN	Description
1,588	98	Roofs, HSG A
200	98	Paved parking, HSG A
225	61	>75% Grass cover, Good, HSG B
1,068	98	Paved parking, HSG B
443	39	>75% Grass cover, Good, HSG A
288	39	>75% Grass cover, Good, HSG A
3,716	98	Paved parking, HSG A
7,528	91	Weighted Average
956		12.70% Pervious Area
6,572		87.30% Impervious Area

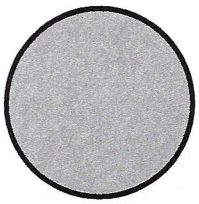
Summary for Reach CB-3: HS-2

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 6.16" for 100-yr event
Inflow = 2.04 cfs @ 11.89 hrs, Volume= 0.089 af
Outflow = 1.37 cfs @ 12.00 hrs, Volume= 0.089 af, Atten= 33%, Lag= 6.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.73 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.01 fps, Avg. Travel Time= 0.0 min

Peak Storage= 2 cf @ 11.85 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 1.33 cfs

6.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 9.0' Slope= 0.0333 '/'
Inlet Invert= 76.30', Outlet Invert= 76.00'



Summary for Pond 1P: Rear Infiltration

Inflow Area = 0.173 ac, 87.30% Impervious, Inflow Depth > 6.16" for 100-yr event
Inflow = 1.37 cfs @ 12.00 hrs, Volume= 0.089 af
Outflow = 0.46 cfs @ 12.06 hrs, Volume= 0.089 af, Atten= 66%, Lag= 3.4 min
Discarded = 0.46 cfs @ 12.06 hrs, Volume= 0.089 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.82' @ 12.06 hrs Surf.Area= 945 sf Storage= 1,055 cf

Plug-Flow detention time= 12.9 min calculated for 0.089 af (100% of inflow)
Center-of-Mass det. time= 12.7 min (750.9 - 738.2)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	681 cf	**10.00'W x 94.50'L x 2.50'H Prismatoid** 2,363 cf Overall - 661 cf Embedded = 1,702 cf x 40.0% Voids
#2	74.50'	661 cf	**18.0" Round CMP_Round 18"** x 4 Inside #1 L= 93.5'
		1,342 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	74.00'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.80'	**18.0" Round Culvert** L= 3.8' Ke= 0.900

Inlet / Outlet Invert= 76.00' / 79.80' S= -1.0000 '/' Cc= 0.900
n= 0.010 PVC, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.46 cfs @ 12.06 hrs HW=75.81' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
↑—**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 2P: Front infiltration

Inflow Area = 0.043 ac, 71.31% Impervious, Inflow Depth > 5.16" for 100-yr event
Inflow = 0.36 cfs @ 11.96 hrs, Volume= 0.019 af
Outflow = 0.41 cfs @ 12.00 hrs, Volume= 0.019 af, Atten= 0%, Lag= 2.1 min
Discarded = 0.11 cfs @ 12.00 hrs, Volume= 0.016 af
Primary = 0.30 cfs @ 12.00 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 79.79' @ 12.00 hrs Surf.Area= 318 sf Storage= 144 cf

Plug-Flow detention time= 11.3 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 11.1 min (755.0 - 743.9)

Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	222 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.50	10	0	0	10
79.00	51	14	14	52
80.00	427	209	222	431

Device	Routing	Invert	Outlet Devices
#1	Discarded	78.50'	**15.000 in/hr Exfiltration over Wetted area**
#2	Primary	79.75'	**25.0' long Broad-Crested Rectangular Weir**
			Head (feet) 1.50
			Coef. (English) 1.50

Discarded OutFlow Max=0.11 cfs @ 12.00 hrs HW=79.79' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.29 cfs @ 12.00 hrs HW=79.79' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.29 cfs @ 0.30 fps)

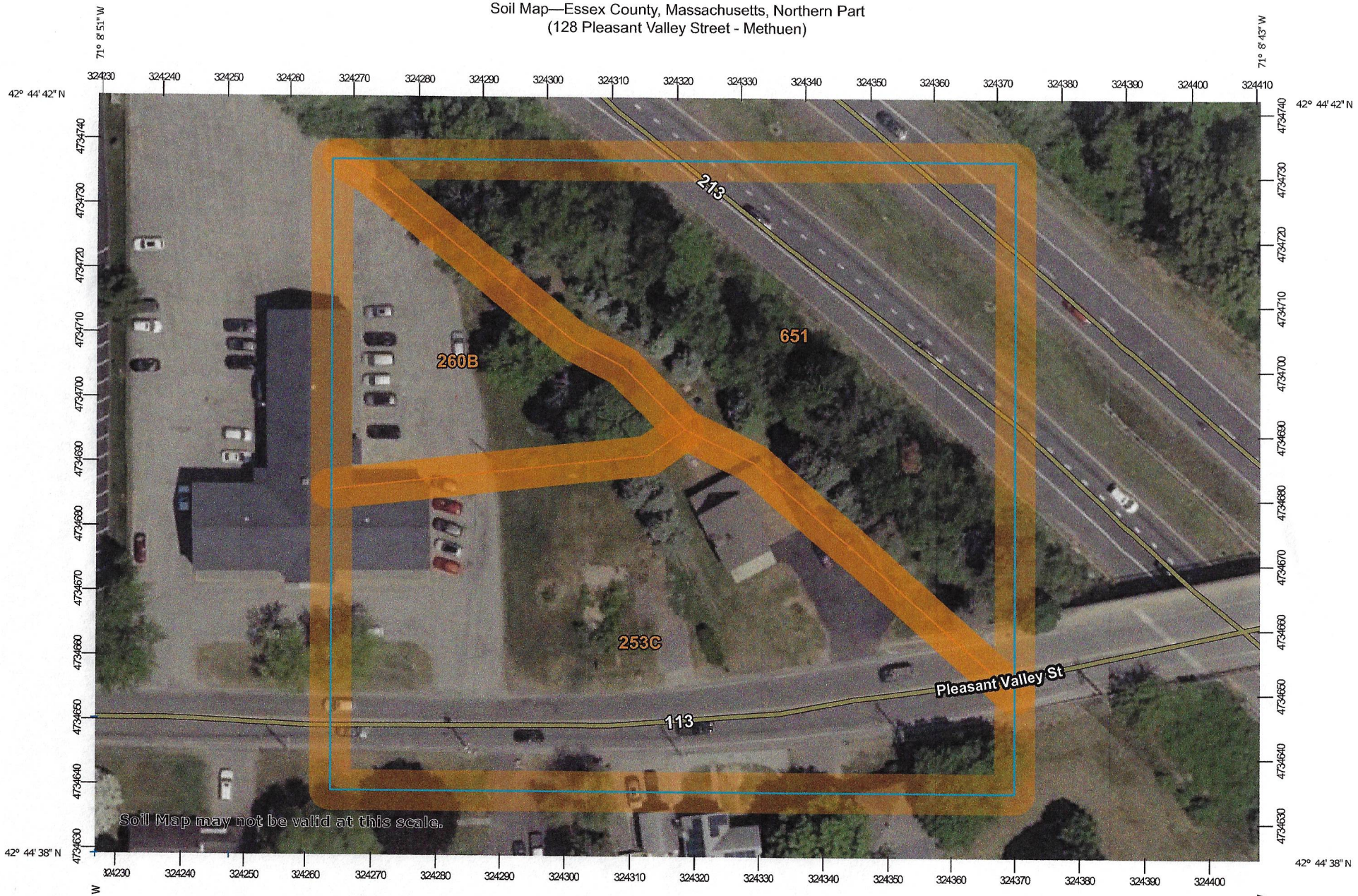
Summary for Link 1L: Cum.Discharge

Inflow Area = 0.391 ac, 17.95% Impervious, Inflow Depth > 2.29" for 100-yr event
Inflow = 1.94 cfs @ 11.99 hrs, Volume= 0.075 af
Primary = 1.94 cfs @ 11.99 hrs, Volume= 0.075 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

USDA SOILS INFORMATION

Soil Map—Essex County, Massachusetts, Northern Part
(128 Pleasant Valley Street - Methuen)



Map Scale: 1:828 if printed on A landscape (11" x 8.5") sheet.

N

0 10 20 40 60 Meters

0 40 80 160 240 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
253C	Hinckley loamy sand, 8 to 15 percent slopes	1.2	44.9%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	0.4	14.9%
651	Udorthents, smoothed	1.0	40.2%
Totals for Area of Interest		**2.6**	**100.0%**

Essex County, Massachusetts, Northern Part

253C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 19, Sep 10, 2023

Essex County, Massachusetts, Northern Part

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vjsn
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 5 inches: fine sandy loam
H3 - 5 to 21 inches: sandy loam
H4 - 21 to 27 inches: loamy sand
H5 - 27 to 60 inches: Error

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash

Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 15 percent
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 19, Sep 10, 2023

Soil Map—Essex County, Massachusetts, Northern Part

Map Scale: 1:3,790 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N 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 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 18, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	14.5	19.5%
32B	Wareham loamy sand, 3 to 8 percent slopes	6.0	8.2%
253C	Hinckley loamy sand, 8 to 15 percent slopes	7.0	9.4%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	9.8	13.3%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	4.5	6.1%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	9.8	13.2%
307E	Paxton fine sandy loam, 25 to 35 percent slopes, extremely stony	2.9	3.9%
602	Urban land	3.4	4.6%
651	Udorthents, smoothed	16.1	21.7%
Totals for Area of Interest		**74.1**	**100.0%**

PERMEABILITY TESTS

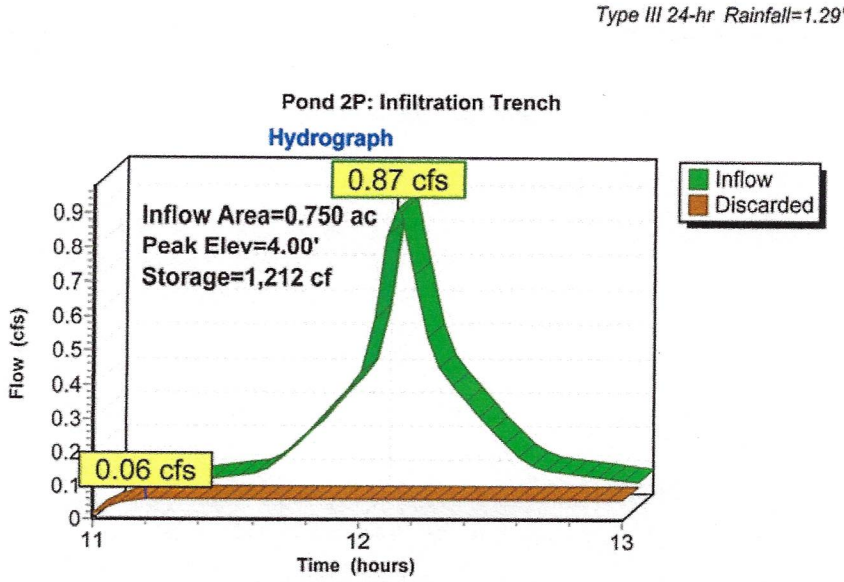


Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

[18] Rawls, Brakensiek and Saxton, 1982

GP FIELD DATA SHEET

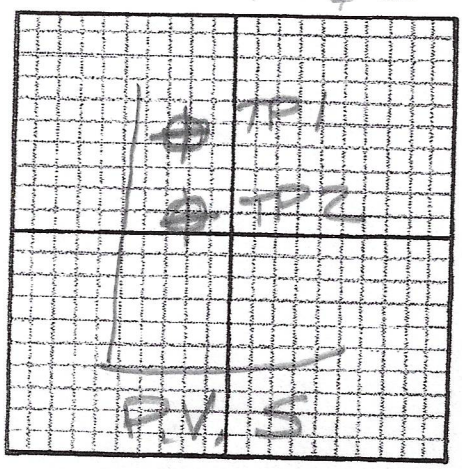
SECTION 1: SITE INFORMATION

Date 8/7/23 Investigator CARLOS QUINTAL

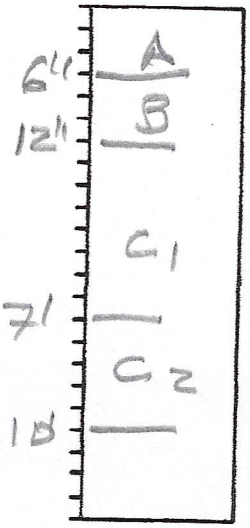
Site Location 128 PLEASANT VALLEY ST METHUEN

Dominant Soil Type(s) SUDBURY FINE SANDY LOAM

Site Map:



Soil Profile Description (horizon depth, texture, structure, color, etc.):



Presence of special soil conditions (mottling, water table depth, hardpan, induration, compacted layers, etc.):

NO WATER
NO MOTTLES

Comments and Notes (topography, slope, vegetation, etc.):

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025. Santa Barbara, CA 93130 USA
Phone: 805-964-3525 - Fax: (805) 683-2189 - Email: sales@soilmoisture.com
Website: http://www.soilmoisture.com

SOILMOISTURE®

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTAL Date: 8/7/23

Location: 128 P. V. ST Test Id: PT-2

Depth of hole: 40" Radius: 3 CM (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		20		
:17	0,28	25	5	17,65
:23	0,27	30	5	18,75
:51	0,30	35	5	16,67
1:10	0,32	40	5	15,79
1:29	0,32	45	5	15,79
1:44	0,25	50	5	20,00
2:04	0,33	55	5	15,00
2:24	0,33	60	5	15,00
2:43	0,32	65	5	15,79
3:01	0,30	70	5	16,67
3:20	0,32	75	5	15,79

Steady rate for 3 consecutive readings (R_1): 16,6

Water level in well = 10 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		25		
:14	0,23	30	5	21,42
:27	0,22	35	5	23,08
:42	0,25	40	5	20,00
:53	0,18	45	5	27,27
1:10	0,28	50	5	17,65
1:23	0,22	55	5	23,08
1:38	0,25	60	5	20,00
1:52	0,23	65	5	21,43
2:06	0,23	70	5	21,43
2:20	0,23	75	5	21,43

Steady rate for 3 consecutive readings (R_2): 21,7

Comments:

Kf = 0,577 in/min = 34,62 in/hr

Guelph Permeameter Data Sheet

Investigator: CARLOS QUINTAL Date: 8/7/23

Location: 128 PLEASANT VALLEY Test Id: PM #1

Depth of hole: 36" Radius: 3 CM (standard calcs assume 3 cm radius)

Reservoirs used during test (check one): Combined: ✓ Inner only: _____

Reservoir constant used: 35.22

Water level in well = 5 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		20		
:16	0.26	25	5	18.75
:32	0.26	30	5	18.75
:50	0.30	35	5	16.67
1:08	0.30	40	5	16.67
1:27	0.32	45	5	15.79
1:45	0.30	50	5	16.67
2:04	0.32	55	5	15.79
2:23	0.32	60	5	15.79
2:42	0.32	65	5	15.79
3:00	0.30	70	5	16.67
3:21	0.35	75	5	14.3

Steady rate for 3 consecutive readings (R_1): 16.5

Water level in well = 10 cm

Time *t* (min)	D*t* (min)	Water level in reservoir *h* (cm)	D*h* (cm)	Rate of change D*h*/ D*t*
0		25		
:13	0.22	30	5	23.08
:27	0.23	35	5	21.42
:41	0.23	40	5	21.43
:54	0.22	45	5	23.08
1:09	0.25	50	5	20.00
1:22	0.22	55	5	23.08
1:36	0.23	60	5	21.43
1:50	0.23	65	5	21.43
2:04	0.23	70	5	21.43
2:18	0.23	75	5	21.43

Steady rate for 3 consecutive readings (R_2): 21.4

Comments:

Kf = 0.572 IN/MIN = 34.32 IN/HR

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 16.5000

Res Type	35.2
H	5
a	3
H/a	1.67
a*	0.36
C0.01	0.81
C0.04	0.84
C0.12	0.8
C0.36	0.8
C	0.8
R	####
Q	9.89
pi	3.14

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 0.80315
$Q =$ 9.6855

$K_{fs} =$ 2.91E-02 cm/sec
####### cm/min
2.91E-04 m/sec
6.88E-01 inch/min
1.15E-02 inch/sec

$\Phi_m =$ 8.09E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 21.4000

Res Type	35.22
H	10
a	3
H/a	3.3333
a*	0.36
C0.01	1.2184
C0.04	1.2902
C0.12	1.2875
C0.36	1.2875
C	1.2875
R	21.400
Q	12.562
pi	3.1415

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 1.28754
$Q =$ 12.5618

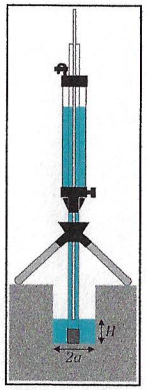
$K_{fs} =$ 1.93E-02 cm/sec
####### cm/min
1.93E-04 m/ses
4.55E-01 inch/min
7.59E-03 inch/sec

$\Phi_m =$ 5.35E-02 (cm^2/min)

Average

$K_{fs} =$ 2.42E-02 cm/sec
1.45E+00 cm/min
2.42E-04 m/s
5.72E-01 inch/min
9.53E-03 inch/sec

$\Phi_m =$ 6.72E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 16.5000

Steady State Rate of Water Level Change ("R2" in cm/min): 21.4000

1.95

$Q_1 =$ 0.594

$Q_2 =$ 0.7704

$C_1 =$ 0.80315

$C_2 =$ 1.28754

Res Type:	2.16
H1/a:	1.66667
H2/a:	3.33333
C1-0.01:	0.80949
C2-0.01:	1.21841
C1-0.04:	0.84206
C2-0.04:	1.29023
C1-0.12:	0.80315
C2-0.12:	1.28754
C1-0.36:	0.80315
C2-0.36:	1.28754

$G_1 =$ 0.00496

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 1.17E-04 cm/sec
6.99E-03 cm/min
1.17E-06 m/sec
2.75E-03 inch/min
4.59E-05 inch/sec

$\Phi_m =$ 1.45E-02 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm), H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	$G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$

PT - 2

Guelph Permeameter Calculations

Input

Result

Support: ali@soilmoisture.com

Head #1

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 5
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 16.6000

Res Type	35.2
H	5
a	3
H/a	1.67
a*	0.36
C0.01	0.81
C0.04	0.84
C0.12	0.8
C0.36	0.8
C	0.8
R	####
Q	9.74
pi	3.14

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 0.80315
$Q =$ 9.7442

$K_{fs} =$ 2.93E-02 cm/sec
####### cm/min
2.93E-04 m/sec
6.92E-01 inch/min
1.15E-02 inch/sec

$\Phi_m =$ 8.14E-02 (cm^2/min)

Head #2

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1
Enter water Head Height ("H" in cm): 10
Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 4

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

Steady State Rate of Water Level Change ("R" in cm/min): 21.7000

Res Type	35.22
H	10
a	3
H/a	3.3333
a*	0.36
C0.01	1.2184
C0.04	1.2902
C0.12	1.2875
C0.36	1.2875
C	1.2875
R	21.700
Q	12.738
pi	3.1415

$\alpha^* =$ 0.36 (cm^{-1})

$C =$ 1.28754
$Q =$ 12.7379

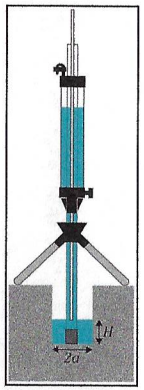
$K_{fs} =$ 1.95E-02 cm/sec
####### cm/min
1.95E-04 m/ses
4.62E-01 inch/min
7.69E-03 inch/sec

$\Phi_m =$ 5.43E-02 (cm^2/min)

Average

$K_{fs} =$ 2.44E-02 cm/sec
1.47E+00 cm/min
2.44E-04 m/s
5.77E-01 inch/min
9.62E-03 inch/sec

$\Phi_m =$ 6.78E-02 (cm^2/min)



Two Head Method

Reservoir Type (enter "1" for Combined and "2" for Inner reservoir): 1

Enter the first water Head Height ("H1" in cm): 5
Enter the second water Head Height ("H2" in cm): 10

Enter the Borehole Radius ("a" in cm): 3

Enter the soil texture-structure category (enter one of the below numbers): 3

1. Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.
2. Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.
3. Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.
4. Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macropors, etc

$\alpha^* =$ 0.12 (cm^{-1})

Steady State Rate of Water Level Change ("R1" in cm/min): 16.6000

Steady State Rate of Water Level Change ("R2" in cm/min): 21.7000

1.95

$Q_1 =$ 0.5976

$Q_2 =$ 0.7812

$C_1 =$ 0.80315

Res Type:	2.16
H1/a:	1.66667
H2/a:	3.33333
C1-0.01:	0.80949
C2-0.01:	1.21841
C1-0.04:	0.84206
C2-0.04:	1.29023
C1-0.12:	0.80315
C2-0.12:	1.28754
C1-0.36:	0.80315
C2-0.36:	1.28754

$C_2 =$ 1.28754

$G_1 =$ 0.00496

$G_2 =$ 0.00397

$G_3 =$ 0.05569

$G_4 =$ 0.02415

$K_{fs} =$ 1.42E-04 cm/sec
8.50E-03 cm/min
1.42E-06 m/sec
3.34E-03 inch/min
5.57E-05 inch/sec

$\Phi_m =$ 1.44E-02 (cm^2/min)

Calculation formulas related to shape factor (C). Where H_1 is the first water head height (cm), H_2 is the second water head height (cm), a is borehole radius (cm) and α^* is microscopic capillary length factor which is decided according to the soil texture-structure category. For one-head method, only C_1 needs to be calculated while for two-head method, C_1 and C_2 are calculated (Zang et al., 1998).

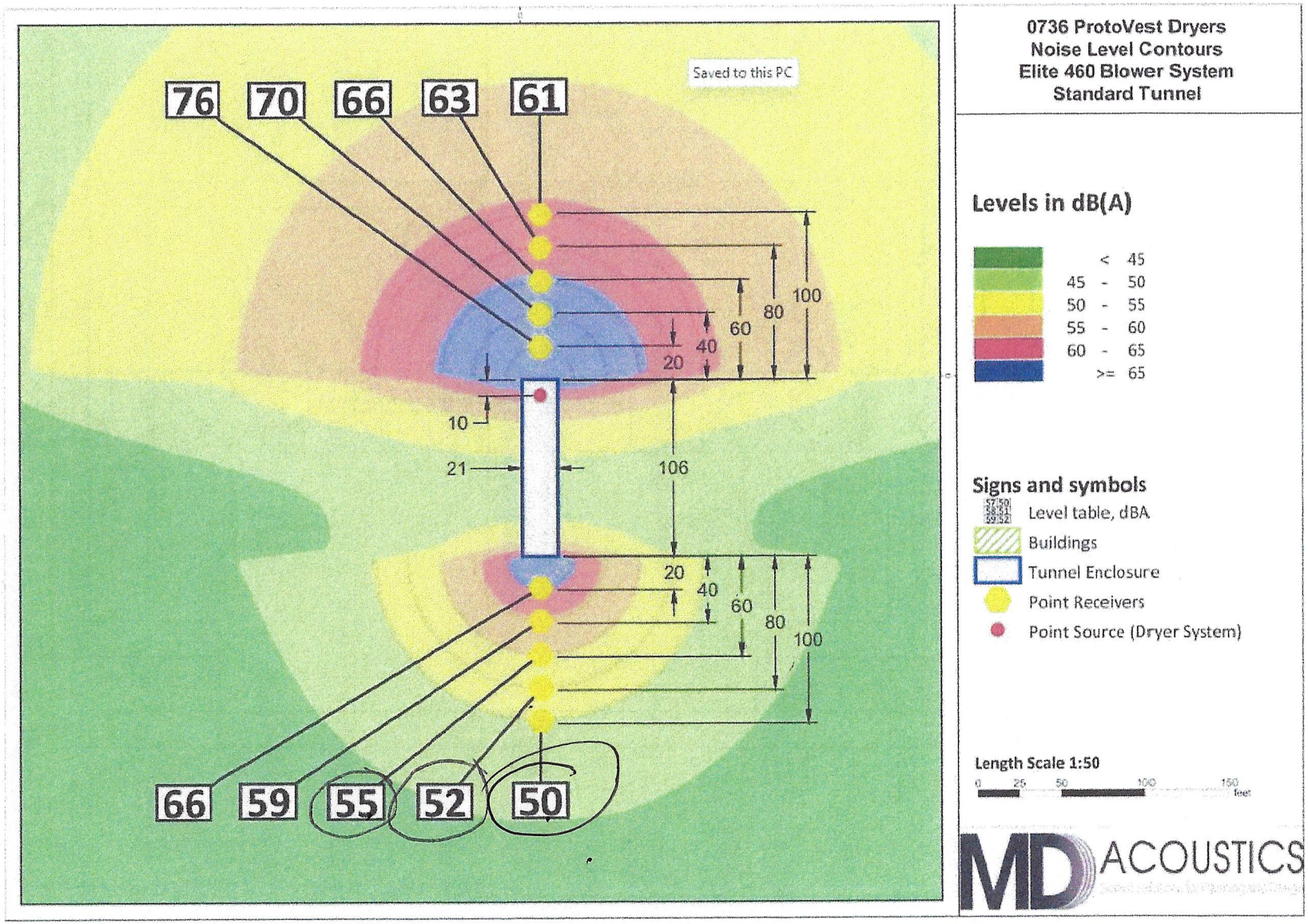
Soil Texture-Structure Category	$\alpha^*(cm^{-1})$	Shape Factor
Compacted, Structure-less, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01	$C_1 = \left(\frac{H_1/a}{2.102 + 0.118(H_1/a)}\right)^{0.655}$ $C_2 = \left(\frac{H_2/a}{2.102 + 0.118(H_2/a)}\right)^{0.655}$
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04	$C_1 = \left(\frac{H_1/a}{1.992 + 0.091(H_1/a)}\right)^{0.683}$ $C_2 = \left(\frac{H_2/a}{1.992 + 0.091(H_2/a)}\right)^{0.683}$
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$
Coarse and gravely sands; may also include some highly structured soils with large and/or numerous cracks, macro pores, etc.	0.36	$C_1 = \left(\frac{H_1/a}{2.074 + 0.093(H_1/a)}\right)^{0.754}$ $C_2 = \left(\frac{H_2/a}{2.074 + 0.093(H_2/a)}\right)^{0.754}$

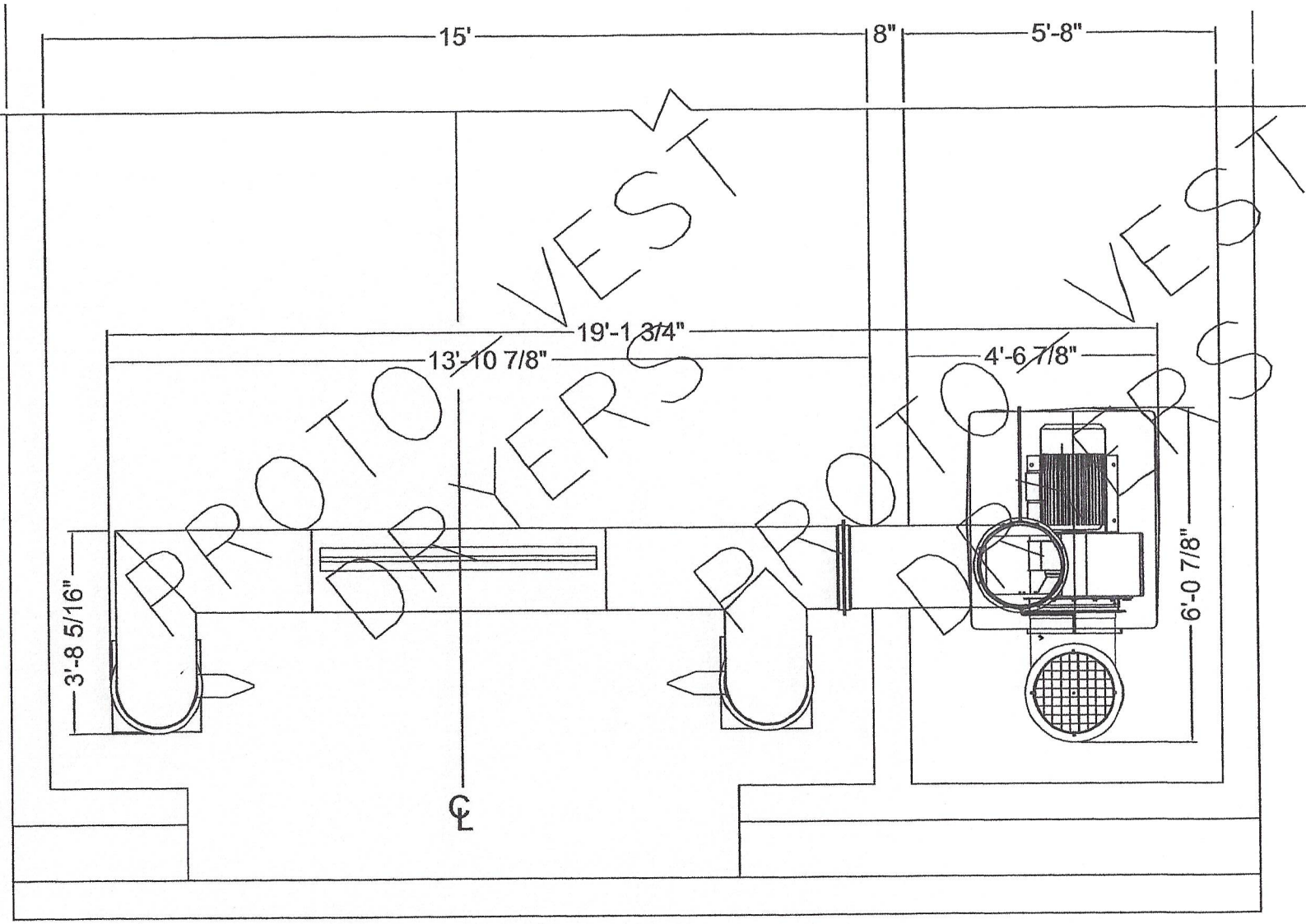
Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm^2/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi\left(\frac{H_1}{\alpha^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)\alpha^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	
Two Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$ $Q_2 = \bar{R}_2 \times 35.22$	$G_1 = \frac{H_2 C_1}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_2 = \frac{H_1 C_2}{\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $K_{fs} = G_2Q_2 - G_1Q_1$ $G_3 = \frac{(2H_2^2 + a^2C_2)C_1}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $G_4 = \frac{(2H_1^2 + a^2C_1)C_2}{2\pi(2H_1H_2(H_2 - H_1) + a^2(H_1C_2 - H_2C_1))}$ $\Phi_m = G_3Q_1 - G_4Q_2$
Two Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$ $Q_2 = \bar{R}_2 \times 2.16$	

EQUIPMENT NOISE

Elite 460 Noise Levels





SIGN TO CONFRIM MEASUREMENTS OF YOUR REQUIREMENTS: X _____

CAD DRAWING NAME: WINDSHEAR DRIVER SIDE BLOWER ROOM		TITLE:	CUSTOM MAG WINDSHEAR A.T. W/ SIL. PKG PLAN VIEW BLOWER ON DRIVER SIDE
LAST DATE EDITED: 10/16/23	BY: RI		
DRAWN BY: A. AVITIA	SCALE: NONE		
DATE CREATED: 2/11/19	SHEET: 1 OF 2		

Proto-Vest Dryers

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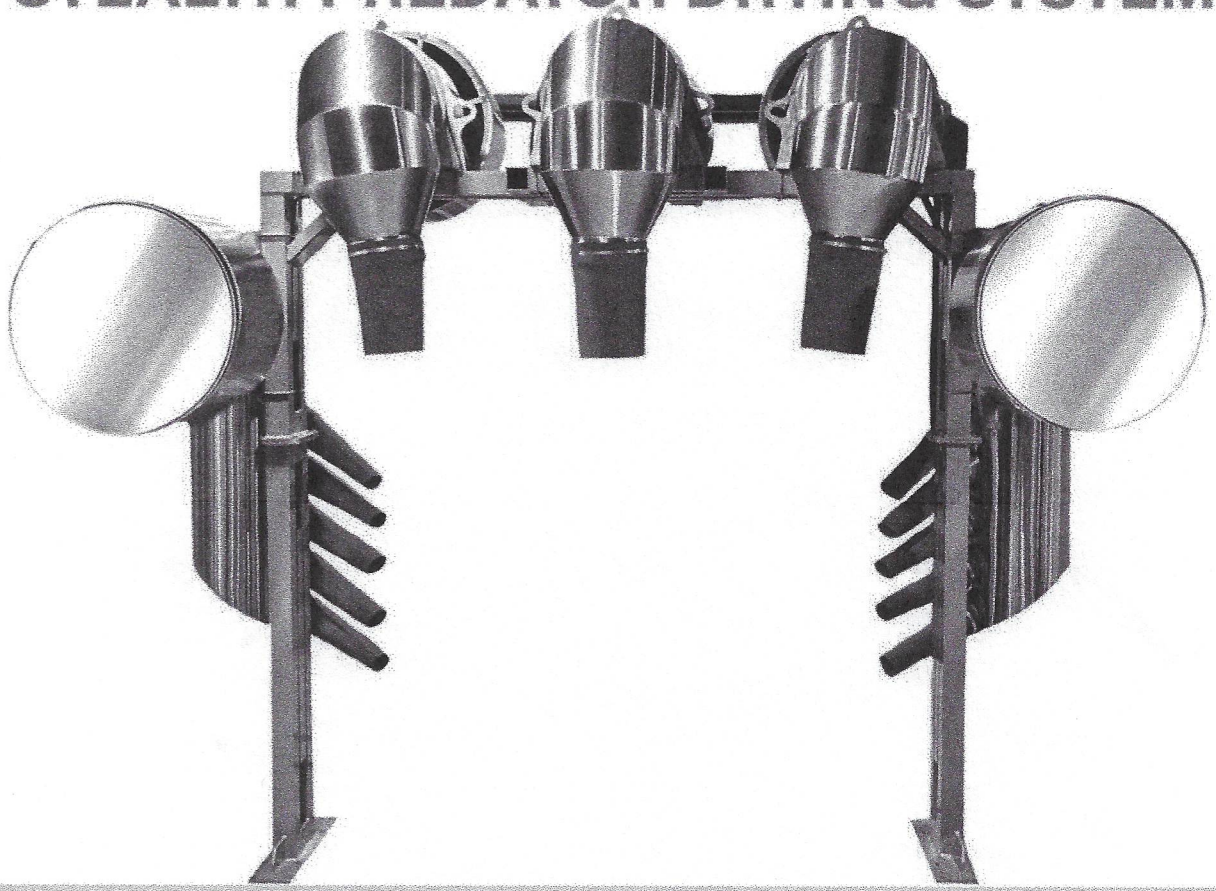
STEALTH PREDATOR DRYING SYSTEM



THE FIRST "ULTRA QUIET" DRYING SYSTEM

- ✔Patent pending Reverse flow technology
- ✔Producers construced from 304 surgical stainless steel
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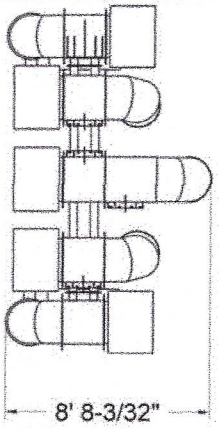
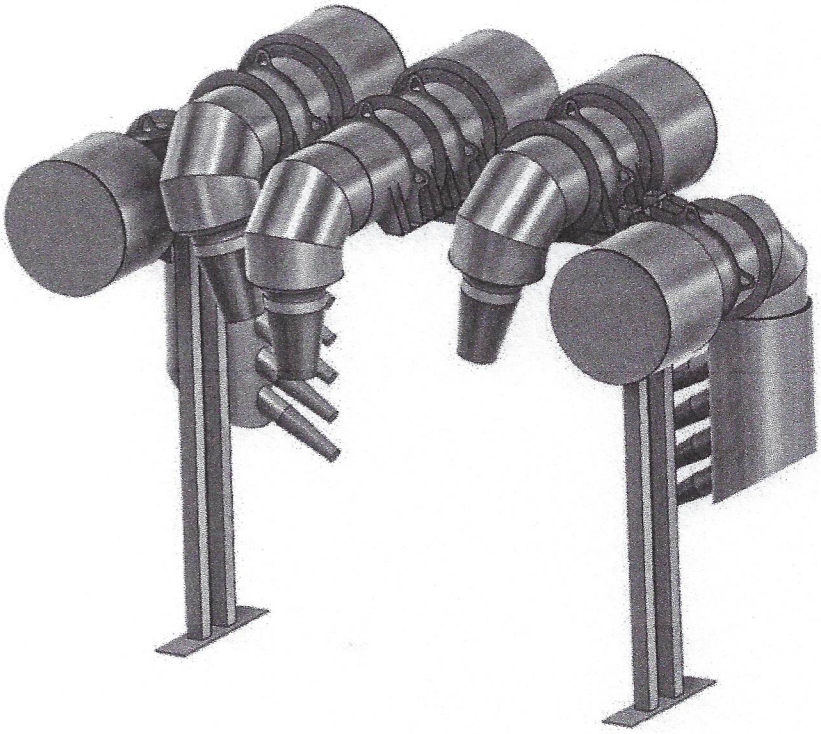
Stealth Predator Ultra-Quiet Drying System Specifications

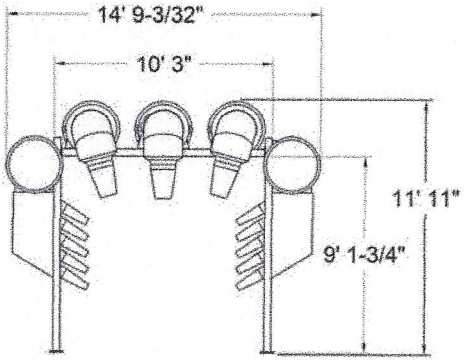
30HP System - Total Sound 60Hz		80HP System - Total Sound 60Hz
	Q = sound source	
65	dBA at Q=1, 30 feet	69.4 dBA at Q=1, 30 feet
61.8	dBA at Q=1, 45 feet	66.5 dBA at Q=1, 45 feet
60.2	dBA at Q=1, 55 feet	64.9 dBA at Q=1, 55 feet

Meets OSHA Sound Exposure Requirements

✓ **The Stealth Predator features patent pending "Reverse flow air technology" which creates the first "Ultra-Quiet Dryer" and is the most powerful Ultra Quiet Dryer ever designed.**







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SPECIFICATIONS

15' 2" Bay Width
12' 0" Ceiling Height
96" Standard Clearance

Closed cell foam nozzles available in red, blue, black

Ducts-Stainless Steel
Molded Aluminum Impellors
Stainless Steel Motor Housings

Slotted flanges for adjustability of air outlet and air intake direction

TRAFFIC REPORT

MEMORANDUM

TO: Mr. Carlos Quintal
CAQ Engineering Associates
733 Turnpike Street, No. 261
North Andover, MA 01845

FROM: Mr. Jeffrey S. Dirk, P.E.*, PTOE, FITE
Managing Partner *and*
Mr. Matthew P. Pelletier
Transportation Engineer
Vanasse & Associates, Inc.
35 New England Business Center Drive
Suite 140
Andover, MA 01810-1066
(978) 269-6830
jdirk@rdva.com
**Professional Engineer in CT, MA, ME, NH, RI, and VA*

DATE: October 31, 2023

RE: 9829

SUBJECT: Transportation Impact Assessment
Proposed Car Wash – 128 Pleasant Valley Street (Route 113)
Methuen, Massachusetts

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed construction of an automated car wash to be located at 128 Pleasant Valley Street (Route 113) in Methuen, Massachusetts (hereafter referred to as the "Project"). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project along Route 113. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE),[1] the Project is expected to generate approximately 416 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with 31 vehicle trips expected during the weekday morning peak hour, 21 vehicle trips expected during the weekday evening peak hour, and 46 vehicle trips expected during the Saturday midday peak hour;

2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with all movements along Route 113 approaching the Project site driveway shown to continue to operate at level-of-service (LOS) A with negligible vehicle queuing;

3. All movements exiting the Project site driveway to Route 113 are predicted to operate at LOS C during the peak hours with vehicle queues of up to one (1) vehicle predicted;

[1] *Trip Generation,* 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.

4. No apparent safety deficiencies were noted with respect to the motor vehicle crash history in the vicinity of the Project site; and

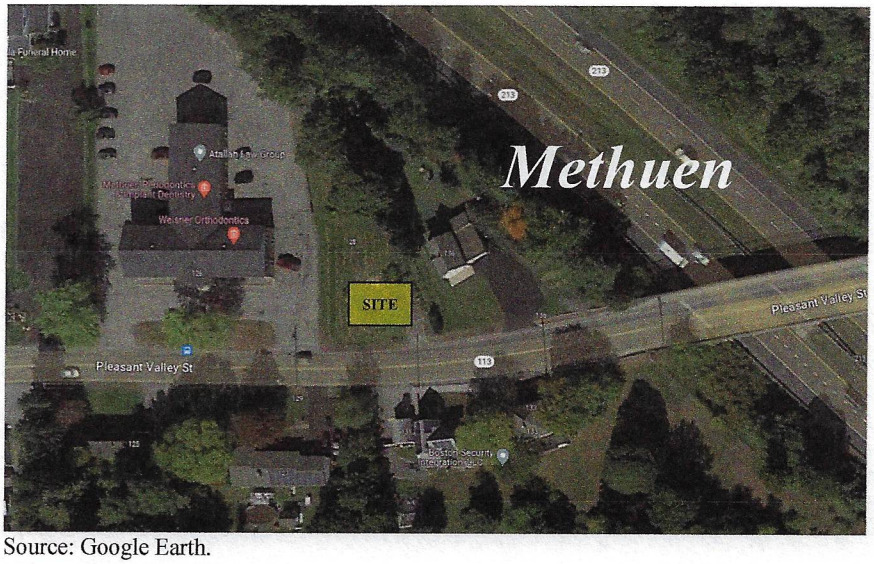
5. Lines of sight at the intersections of the Project site driveways with Route 113 were found to exceed or can be made to exceed the recommended minimum distance for the intersections to operate in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with the implementation of the recommendations defined herein.

The following details our assessment of the Project.

PROJECT DESCRIPTION

The Project will entail the construction of a 1,500 square foot (sf), single-tunnel, automated car wash to be located at 128 Pleasant Valley Street (Route 113) in Methuen, Massachusetts. The Project site encompasses approximately 0.32± acres of previously disturbed land that is bound by Route 213 to the north; Route 113 to the south; a residential property to the east; and a commercial property to the west.



Source: Google Earth.

Access to the Project site will be provided by way of two driveways that will intersect the north side of Route 113 along the property frontage. The eastern driveway will serve as a one-way entrance drive, with the west driveway serving as the corresponding exit drive. Off-street parking will be provided for three (3) vehicles, which exceeds the parking requirements specified in Section VII603, *Parking and Loading Requirements*, of the City of Methuen Comprehensive Zoning Ordinance.[2]

[2]One (1) parking space per 1,200 sf is required for a "Warehouse, Public Utility Station, in house Repair Garage, and Other Uses".

STUDY METHODOLOGY

This study was prepared in consultation with the Massachusetts Department of Transportation (MassDOT) and the City of Methuen; was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; on-street parking; public transportation services; observations of traffic flow; and collection of pedestrian, bicycle, and vehicle counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with MassDOT guidelines. The analysis conducted in stage two identifies existing or projected future capacity, safety, and access issues, as these areas relate to the transportation infrastructure.

The third stage of the study presents and evaluates measures to address deficiencies in the transportation infrastructure, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in September 2023. This inventory included the collection of traffic-volume data and vehicle travel speed measurements, as well as a review of existing pedestrian and bicycle accommodations, public transportation services, and motor vehicle crash data. The following summarizes existing conditions within the study area.

Roadway

Pleasant Valley Street (Route 113)

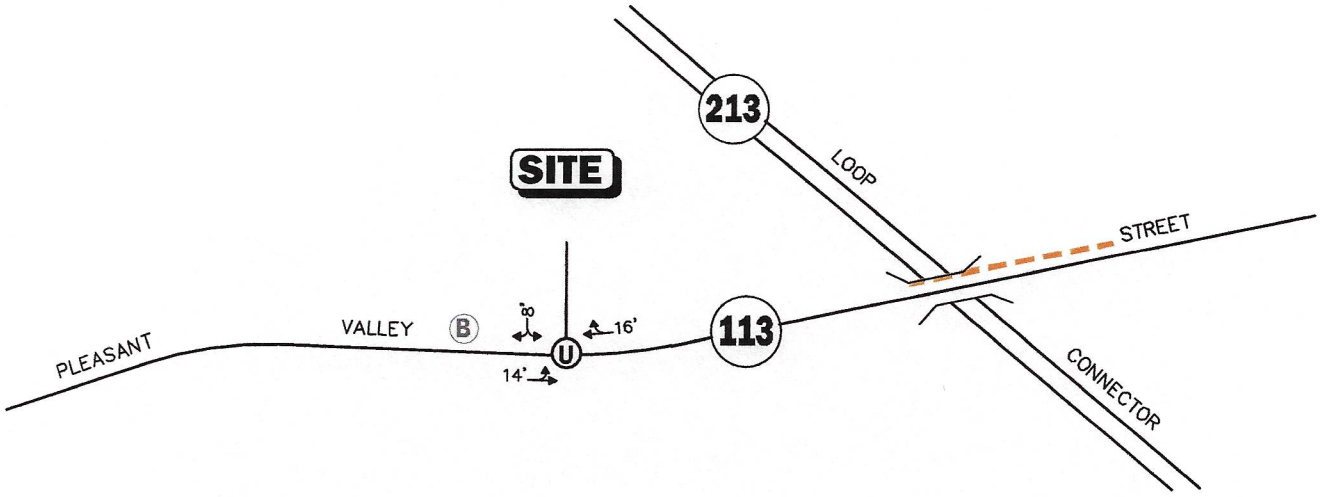
- Two-lane urban minor arterial roadway under City jurisdiction;
- Traverses the study area in a general east-west direction;
- Provides two 13- to 16-foot wide travel lanes that are separated by a double-yellow centerline with 1- to 5-foot wide marked shoulders in the vicinity of the Project site;
- The posted speed limit is 30 miles per hour (mph) in the vicinity of the Project site;
- Sidewalks are not provided along Route 113 within the study area;
- Illumination is provided by way of streetlights mounted on wood poles; and
- Land use within the study area consists of the Project site, residential and commercial properties, and areas of open and wooded space.

Intersection

Table 1 and Figure 1 summarize existing lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersection as observed in September 2023.

Legend:

- Ⓤ Unsignalized Intersection
- Ⓑ Bus Stop
- Sidewalk
- XX' Lane Use and Travel Lane Width



Not To Scale

Figure 1

Existing Intersection Lane Use, Travel Lane Width, and Pedestrian Facilities

Vanasse & Associates inc

Table 1
STUDY AREA INTERSECTION DESCRIPTION

Intersection	Traffic Control Type[a]	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Rte. 113/ Existing Site Driveway	S	1 general-purpose travel lane provided on all approaches	Yes; 1 to 5 feet on Rte. 113	No	Yes; shared traveled-way[b] on Rte. 113

[a]S = assumed stop control for driveway.
[b]Combined shoulder and travel lane width equal to or exceeding 14 feet.

Existing Traffic Volumes

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts were completed in September 2023. The ATR counts were conducted on Route 113 at the Project site on September 21st and 22nd, 2023 (Thursday and Friday, inclusive), and on Saturday, September 30, 2023, in order to record weekday and Saturday traffic conditions over an extended period.

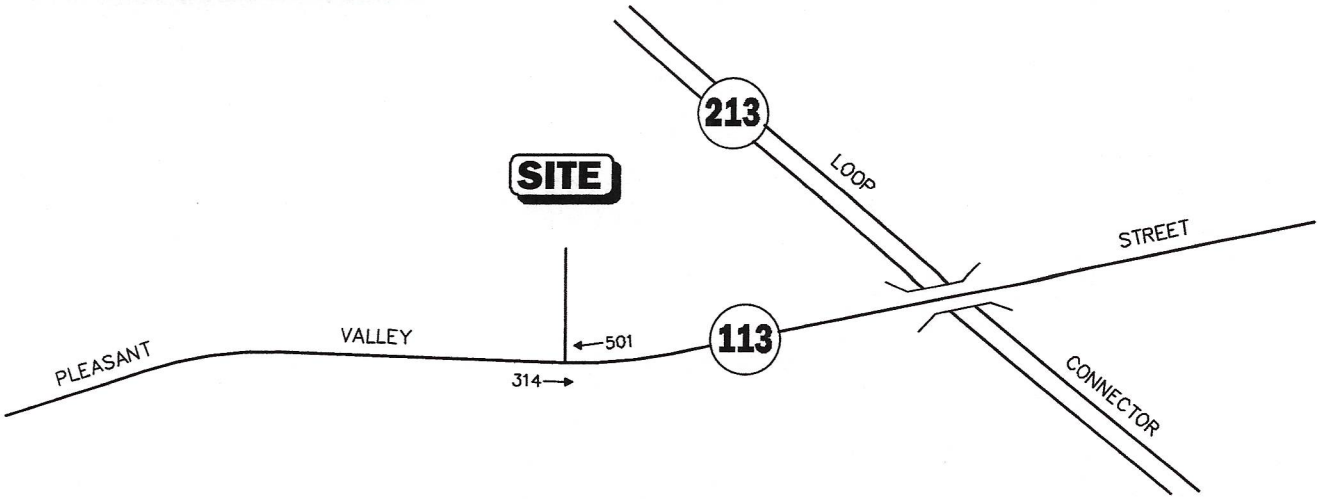
In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, MassDOT weekday seasonal factors for Urban Groups 4-7 roadways (minor arterials, major and minor collectors, and local roads and streets, which includes the functional classification of Route 113) were reviewed.[3] Based on a review of this data, it was determined that traffic volumes for the month of September are approximately 8.7 percent above average-month conditions. As such, a seasonal adjustment was not required as the September traffic volumes are higher than those under average-month conditions.

Based on current guidance from MassDOT,[4] pandemic-related adjustments to traffic counts performed after March 2022 are no longer required except in locations where the predominant land use consists of offices or similar uses. Given that the predominant land use within the study area is residential/commercial, a pandemic-related adjustment was not required.

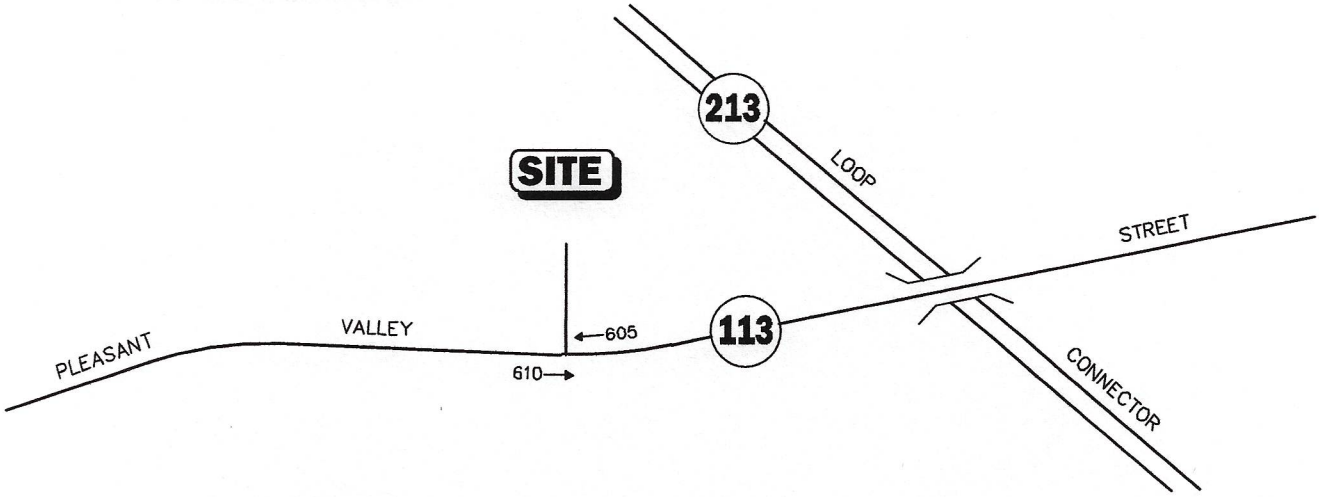
The 2023 Existing traffic volumes are summarized in Table 2, with the weekday morning, weekday evening, and Saturday midday peak-hour traffic volumes graphically depicted on Figure 2. Note that the peak-hour traffic volumes presented in Table 2 were obtained from the aforementioned figure.

[3]MassDOT Statewide Traffic Data Collection; 2019 Weekday Seasonal Factors, Group U4-7.
[4]*Traffic and Safety Engineering 25% Design Submission Guidelines*; MassDOT; Revised March 31, 2022.

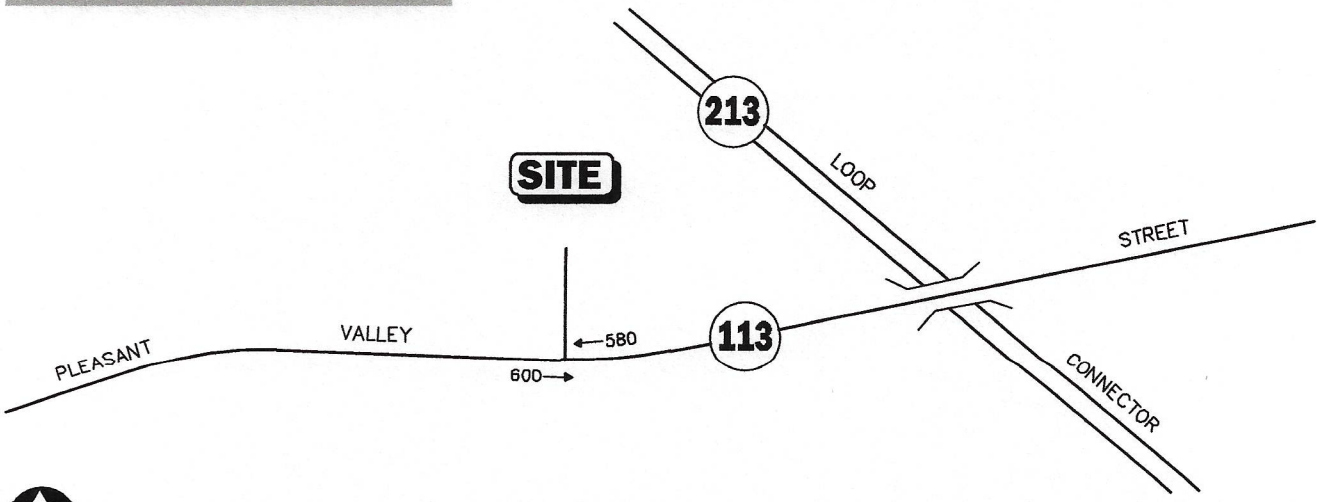
WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



SATURDAY MIDDAY PEAK HOUR



N

Not To Scale

Figure 2

2023 Existing
Peak-Hour Traffic Volumes

Vanasse & Associates inc

Table 2
2023 EXISTING TRAFFIC VOLUMES

Location/Peak Hour	AWT[a]	Saturday[b]	VPH[c]	K Factor[d]	Directional Distribution[e]
Route 113, west of Route 213:	13,660	12,605	--	--	--
Weekday Morning (7:30 – 8:30 AM)	--	--	815	6.0	61.5% WB
Weekday Evening (4:30 – 5:30 PM)	--	--	1,215	8.9	50.2% EB
Saturday Midday (12:15 – 1:15 PM)	--	--	1,180	9.4	50.8% EB

[a]Average weekday traffic in vehicles per day.
[b]Average Saturday traffic in vehicles per day.
[c]Vehicles per hour.
[d]Percent of daily traffic occurring during the peak hour.
[e]Percent traveling in peak direction.
EB = eastbound, WB = westbound.

As can be seen in Table 2, Route 113 in the vicinity of the Project site was found to accommodate approximately 13,660 vehicles on an average weekday and approximately 12,605 vehicles on a Saturday (two-way, 24-hour volumes), with approximately 815 vehicles per hour (vph) during the weekday morning peak hour, 1,215 vph during the weekday evening peak hour and 1,180 vph during the Saturday midday peak hour.

Pedestrian and Bicycle Facilities

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in September 2023. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersections, as well as the location of existing and planned future bicycle facilities. Sidewalks are not provided along Route 113 in the vicinity to the Project site. To the east of the Project site, a sidewalk is provided along the north side of Route 113 across the bridge over Route 213 that extends to the driveway to the Summit Place apartments. Formal bicycle facilities are not provided within the study area; however, Route 113 provides sufficient width (combined travel lane and shoulder) to support bicycle travel in a shared traveled-way configuration (i.e., motor vehicles and bicyclists sharing the roadway).[5]

Public Transportation

Public transportation services are provided within the study area by the Merrimack Valley Regional Transit Authority (MVRTA). The MVRTA provides fixed-route bus service along Route 113 adjacent to the Project site by way of bus Route 1, *Lawrence-Methuen-Haverhill*, which provides service within downtown Lawrence, downtown Haverhill, and Methuen. The Route 1 bus serves Haverhill Station on the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail system (Haverhill Line) and also stops within 1 mile of the Lawrence Station (also on Haverhill Line), which provides service to North Station in Boston. The closest regular stop to the Project site for the Route 1 bus is located at 126 Pleasant Valley Street, which is approximately 150 feet to the west of the Project site (an approximate 1- to 2-minute walking distance). In addition to regular stops, MVRTA buses operate in a flag-stop mode,

[5]A minimum combined travel lane and paved shoulder width of 14 feet is required to support bicycle travel in a shared traveled-way condition.

where a passenger can request service (pick-up or drop-off) along the regular service route where it is safe to do so by signaling to the driver. The MVRTA also provides Dial-a-Ride paratransit services by way of the Ring & Ride program for eligible people who cannot use fixed-route transit all or some of the time due to a physical, cognitive, or mental disability in compliance with the Americans with Disabilities Act (ADA).

The public transportation schedules and fare information are attached.

Spot Speed Measurements

Vehicle travel speed measurements were performed on Route 113 in the vicinity of the Project site in conjunction with the automatic traffic recorder (ATR) counts. Table 3 summarizes the vehicle travel speed measurements.

Table 3
VEHICLE TRAVEL SPEED MEASUREMENTS

	Route 113	
	Eastbound	Westbound
Mean Travel Speed (mph)	32	36
85th Percentile Speed (mph)	37	41
Posted Speed Limit (mph)	30	30

mph = miles per hour.

As can be seen in Table 3, the mean vehicle travel speed along Route 113 in the vicinity of the Project site was found to be 32 mph in the eastbound direction and 36 mph westbound. The measured 85th percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled at or below, was found to be 37 mph in the eastbound direction and 41 mph westbound, which is 7 to 11 mph *above* the posted speed limit in the vicinity of the Project site (30 mph). The 85th percentile speed is used as the basis of engineering design and in the evaluation of sight distances and is often used in establishing posted speed limits.

Motor Vehicle Crash Data

Motor vehicle crash information for the study area was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2016 through 2020, inclusive) in order to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, roadway and weather conditions, and day of occurrence, and presented in Table 4.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY[a]

	Route 113 in the vicinity of the Project Site Driveway
Traffic Control Type[b]	U
Year:	
2016	0
2017	0
2018	0
2019	0
2020	1
Total	1
Average	0.2
Crash Rate[c]	0.04
MassDOT Crash Rate[d]	0.57/0.57
Significant?[e]	No
Type:	
Angle	0
Head-On	0
Rear-End	0
Sideswipe	0
Fixed Object	1
Pedestrian/Bicycle	0
Unknown/Other	0
Total	1
Conditions:	
Clear	1
Cloudy	0
Rain	0
Snow/Ice	0
Fog/Smoke	0
Total	1
Lighting:	
Daylight	1
Dawn/Dusk	0
Dark (Road Lit)	0
Dark (Road Unlit)	0
Total	1
Day of Week:	
Monday-Friday	1
Saturday	0
Sunday	0
Total	1
Severity:	
Property Damage Only	1
Non-fatal Injury	0
Fatalities	0
Not Reported	0
Total	1

[a]Source: MassDOT Safety Management/Traffic Operations Unit records, 2016 through 2020.
[b]Traffic Control Type: U = unsignalized.
[c]Crash rate per million vehicles entering the intersection.
[d]Statewide/District crash rate.
[e]The intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 4).

As can be seen in Table 4, Route 113 in the vicinity of the Project site was shown to have one (1) reported motor vehicle crash over the five-year review period, with the Route 113/Project site driveway (exiting) intersection found to have motor vehicle crash rate *below* both the MassDOT statewide and District average crash rates for similar intersections for the MassDOT Highway Division District in which the intersections are located (District 4). The crash was reported to have occurred on a weekday, under clear weather conditions, during daytime, and was identified as a single-vehicle crash with a fixed roadside object that resulted in property damage only.

A review of the MassDOT statewide High Crash Location List indicates that there are no locations within the study area that are included on MassDOT's Highway Safety Improvement Program (HSIP) listing as a high crash cluster location. In addition, no fatal motor vehicle crashes were reported to have occurred at the study area intersections over the five-year review period.

The detailed MassDOT Crash Rate Worksheets and High Crash Location mapping are provided in the Appendix.

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2030, which reflects a seven-year planning horizon consistent with MassDOT guidelines. Independent of the Project, traffic volumes on the roadway network in the year 2030 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2030 No-Build traffic volumes reflect 2030 Build traffic-volume conditions with the Project.

Future Traffic Growth

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic; however, potential population growth and development external to the study area would not be accounted for in the resulting traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Development by Others

The City of Methuen Planning Division of the Department of Economic and Community Development was contacted in order to determine if there were any projects planned within the study area that would have an impact on future traffic volumes at the study intersections. At this time, information was not provided concerning specific development projects by others to be included in this assessment (if any). To the extent that the City identifies specific projects that would result in an increase in traffic within the study area that would exceed the general traffic growth rate (discussion follows), a supplement to this assessment will be prepared.

General Background Traffic Growth

Traffic-volume data compiled by MassDOT for the City of Methuen were reviewed in order to determine general traffic growth trends in the area. This data indicates that annual traffic volumes have fluctuated over the past several years, with the average growth rate found to be approximately 0.63 percent per year. In order to provide a conservative (high) analysis scenario and a prudent planning assessment for the Project, a higher 1.0 percent per year compounded annual background traffic growth rate was used to account for future traffic growth and presently unforeseen development within the study area.

Roadway Improvement Projects

The City of Methuen was contacted and the MassDOT Project Viewer website was reviewed in order to determine if there were any planned future roadway improvement projects expected to be completed within the study area by 2030. Based on this review, no roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

No-Build Traffic Volumes

The 2030 No-Build condition peak-hour traffic volumes were developed by applying the 1.0 percent per year compounded annual background traffic growth rate to the 2023 Existing peak-hour traffic volumes. The resulting 2030 No-Build weekday morning, weekday evening, and Saturday midday peak-hour traffic volumes are shown on Figure 3.

Project-Generated Traffic

Design year (2030 Build) traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

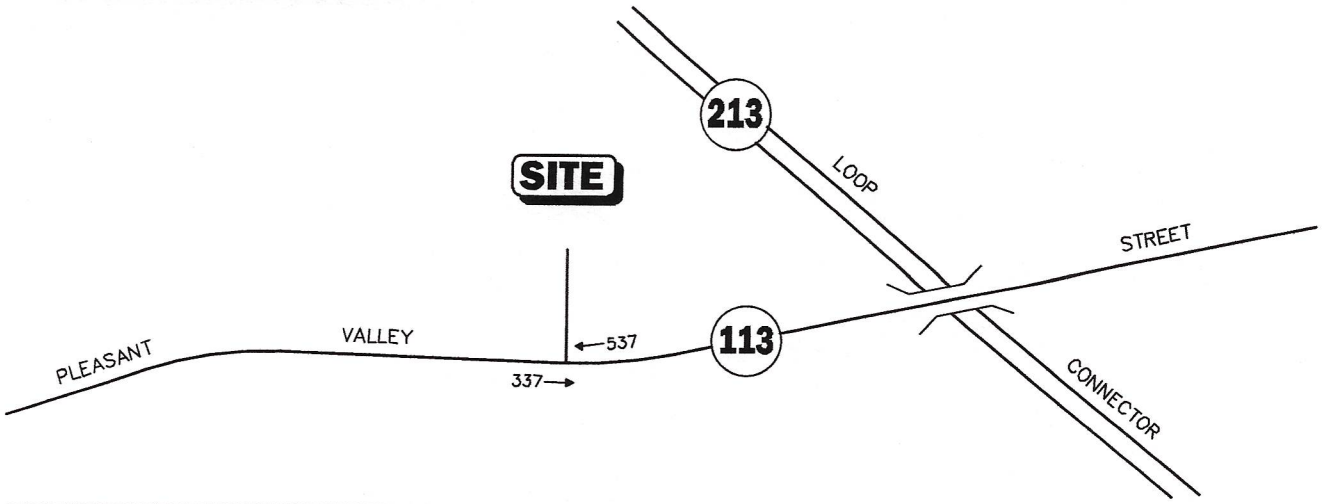
As proposed, the Project will entail the construction of a 1,500 sf, single-tunnel, car wash. In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE for similar land use as that proposed were used. ITE Land Use Code (LUC) 948, *Automated Car Wash*, was used to develop the traffic characteristics of the Project, the results of which are summarized in Table 5.

Table 5
TRIP GENERATION SUMMARY

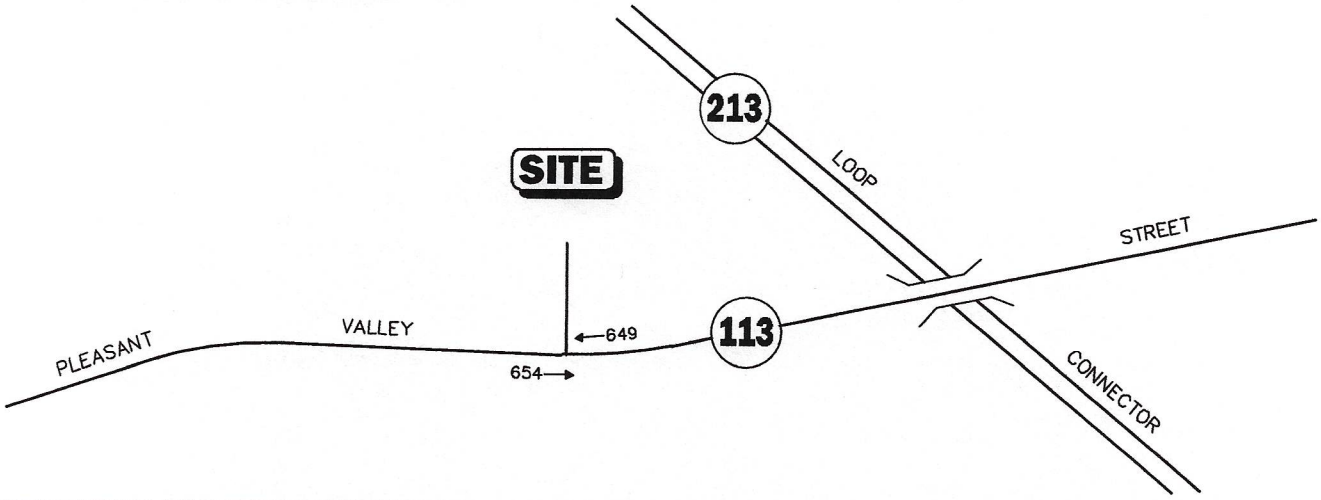
Time Period	Vehicle Trips		
	Entering	Exiting	Total
Average Weekday:[a]	208	208	416
Weekday Morning Peak Hour:[b]	16	15	31
Weekday Evening Peak Hour:[c]	11	10	21
Saturday Midday Peak Hour:[c]	23	23	46

[a]Based on the ratio of the average weekday trip rate to the weekday evening peak-hour trip rate for ITE LUC 947, *Self-Service Car Wash*, applied to the weekday evening peak-hour trip rate.
[b]Based on the hourly distribution of entering and exiting vehicle trips by land use for ITE LUC 947, *Self-Service Car Wash.*
[c]Based on ITE LUC 948, *Automated Car Wash.*

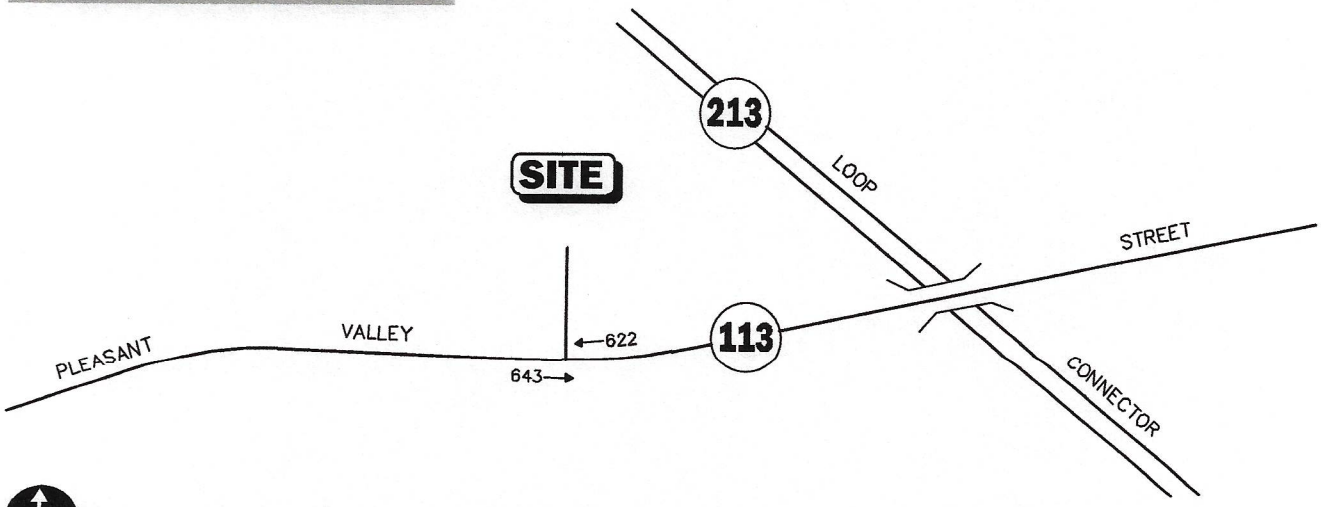
WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



SATURDAY MIDDAY PEAK HOUR



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Not To Scale

Figure 3

2030 No-Build
Peak-Hour Traffic Volumes

Vanasse & Associates inc

Project-Generated Traffic-Volume Summary

As can be seen in Table 5, the Project is expected to generate approximately 416 vehicle trips on an average weekday (two-way volume over the operational day of the Project, or 208 vehicles entering and 208 exiting), with 31 vehicle trips (16 vehicles entering and 15 exiting) expected during the weekday morning peak hour, 21 vehicle trips (11 vehicles entering and 10 exiting) expected during the weekday evening peak hour and 46 vehicle trips (23 vehicles entering and 23 exiting) expected during the Saturday midday peak hour.

Trip Distribution and Assignment

The directional distribution of generated trips to and from the Project site was determined based on a review of existing traffic patterns within the study area and then refined based on a review of the regional roadway network. The general trip distribution for the Project is graphically depicted on Figure 4. The additional traffic expected to be generated by the Project was assigned on the study area roadway network as shown on Figure 5 for the weekday morning, weekday evening and Saturday midday peak hours.

Build Traffic Volumes

The 2030 Build condition traffic volumes consist of the 2030 No-Build traffic volumes with the addition of the traffic expected to be generated by the Project. The 2030 Build weekday morning, weekday evening and Saturday midday peak-hour traffic volumes are graphically depicted on Figure 6.

TRAFFIC OPERATIONS ANALYSIS

In order to assess the potential impact of the Project on the roadway network, a detailed traffic operations analysis (motorist delays, vehicle queuing, and level of service) was performed for the study area intersection. Capacity analyses provide an indication of how well transportation facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

In brief, six levels of service are defined for each type of facility. They are given letter designations ranging from A to F, with LOS "A" representing the best operating conditions and LOS "F" representing congested or constrained operations. An LOS of "E" is representative of a transportation facility that is operating at its design capacity while an LOS of "D" is generally defined as the limit of "acceptable" traffic operations. Since the level of service of a traffic facility is a function of the flows placed upon it, such a facility may operate at a wide range of levels of service depending on the time of day, day of week, or period of the year. The Synchro® intersection capacity analysis software, which is based on the analysis methodologies and procedures presented in the *6th Edition Highway Capacity Manual* (HCM)[6] for unsignalized intersections was used to complete the level-of-service and vehicle queue analyses.

Analysis Results

Level-of-service and vehicle queue analysis were conducted for 2023 Existing, 2030 No-Build, and 2030 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Table 6, with the detailed analysis results attached. For the purpose of this analysis, the Project site driveways were analyzed as a single intersection.

[6] *Highway Capacity Manual*, Transportation Research Board; Washington, DC; 2016.

Legend:

XX	Entering Trips
(XX)	Exiting Trips

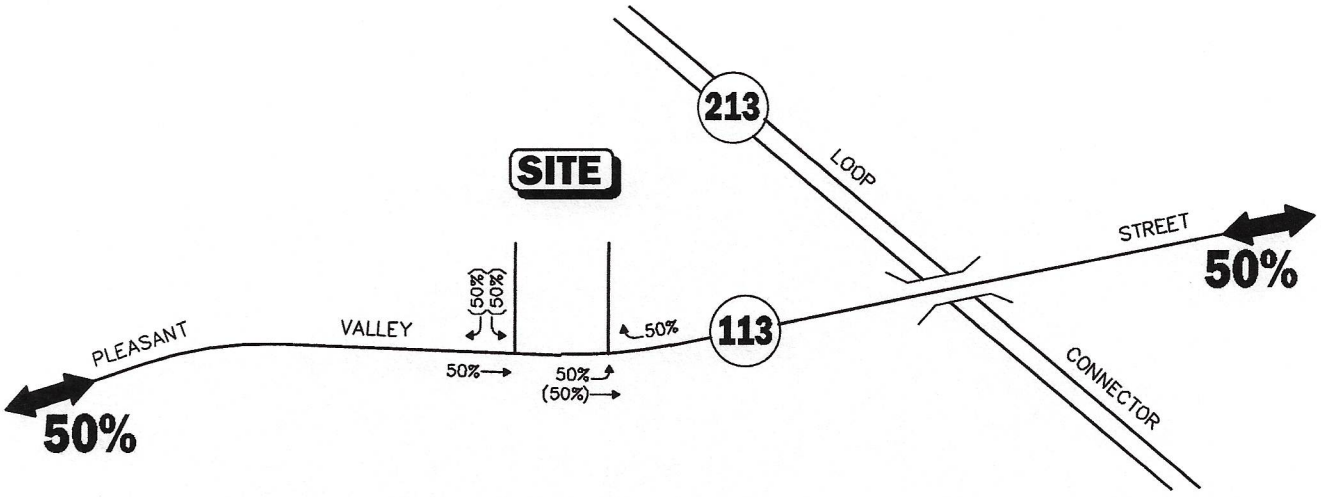

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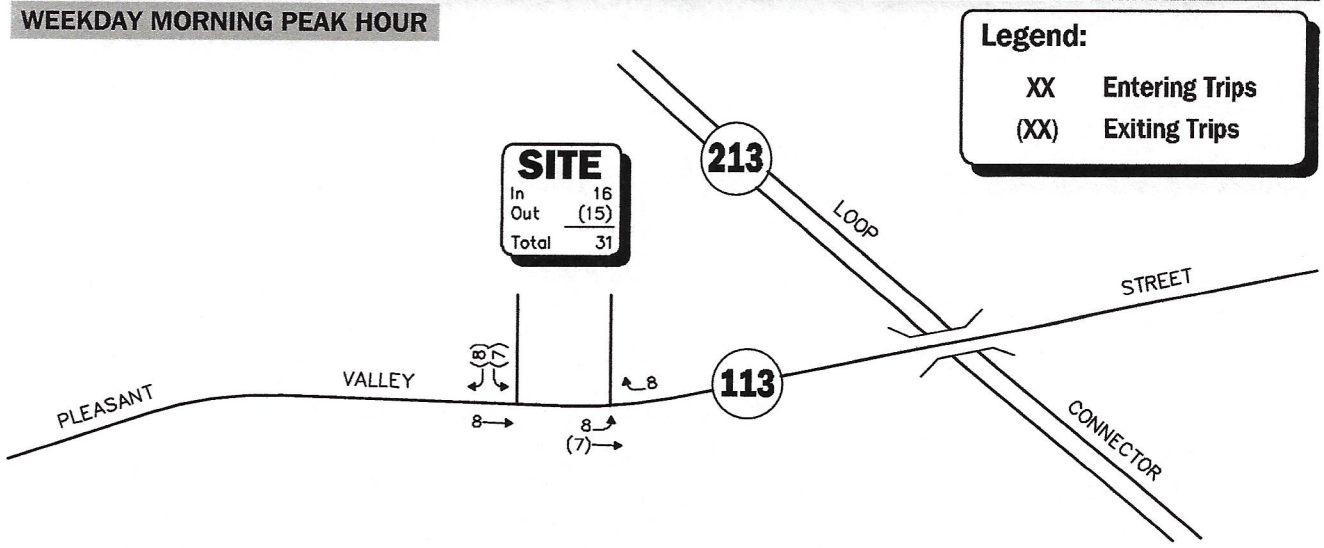
Figure 4

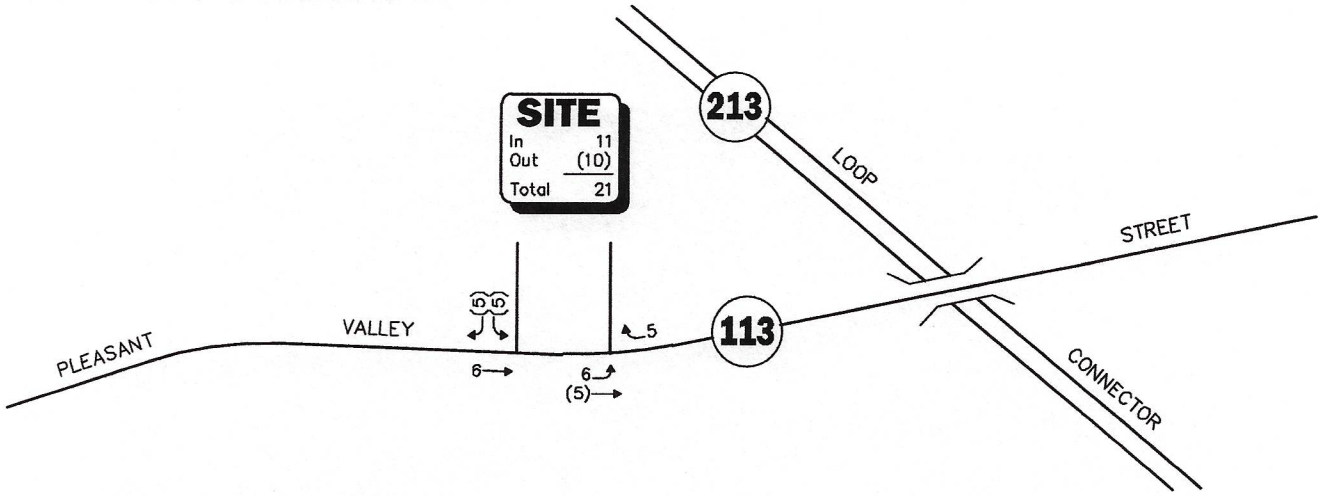
Trip Distribution Map

Vanasse & Associates inc

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



SATURDAY MIDDAY PEAK HOUR

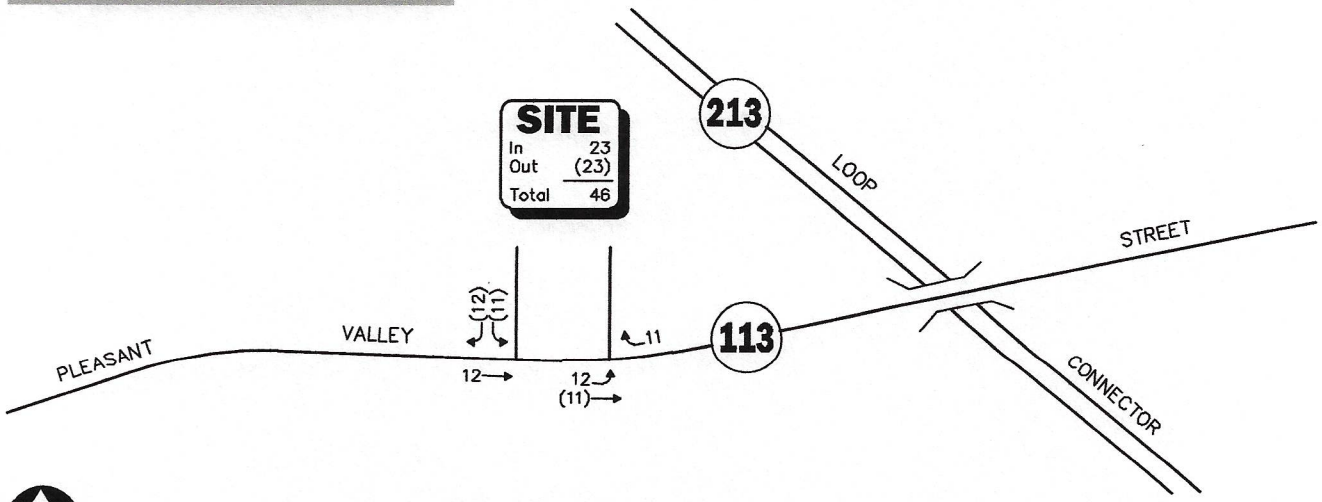


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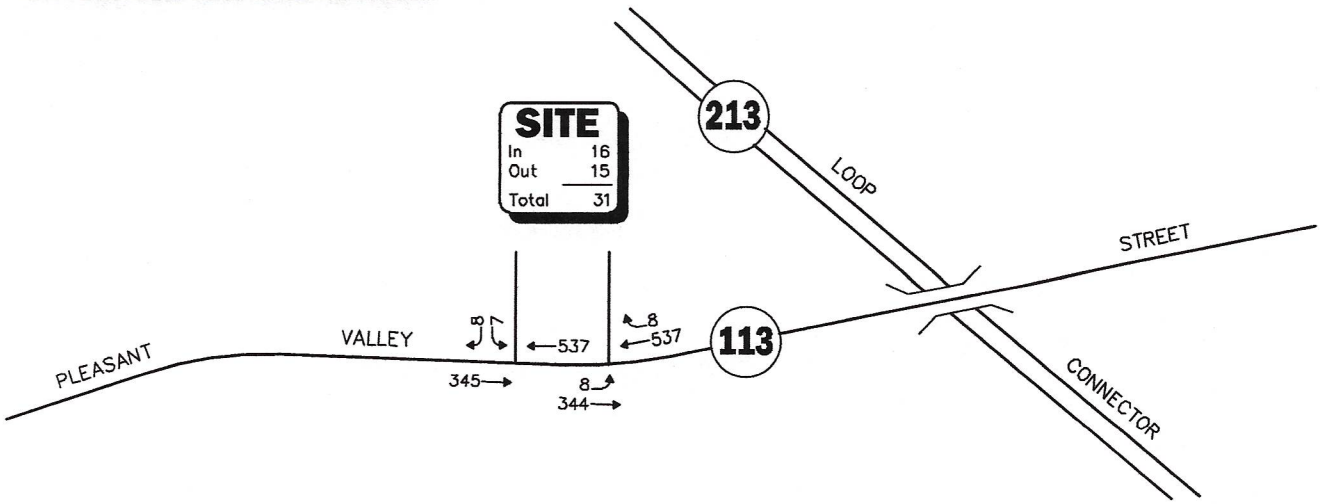
Figure 5

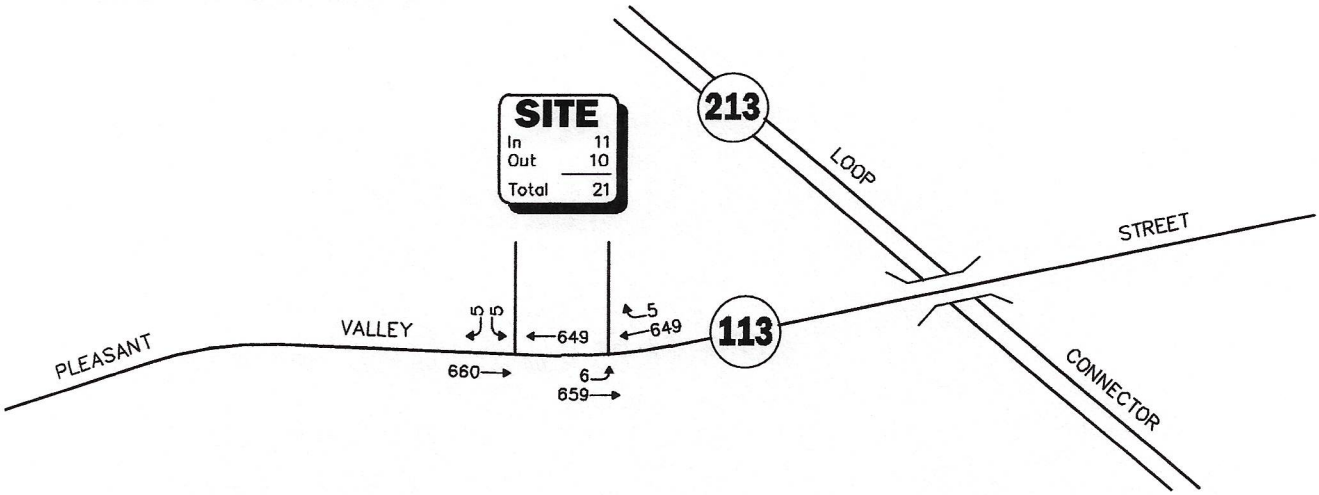
Project-Generated
Peak-Hour Traffic Volumes

Vanasse & Associates inc

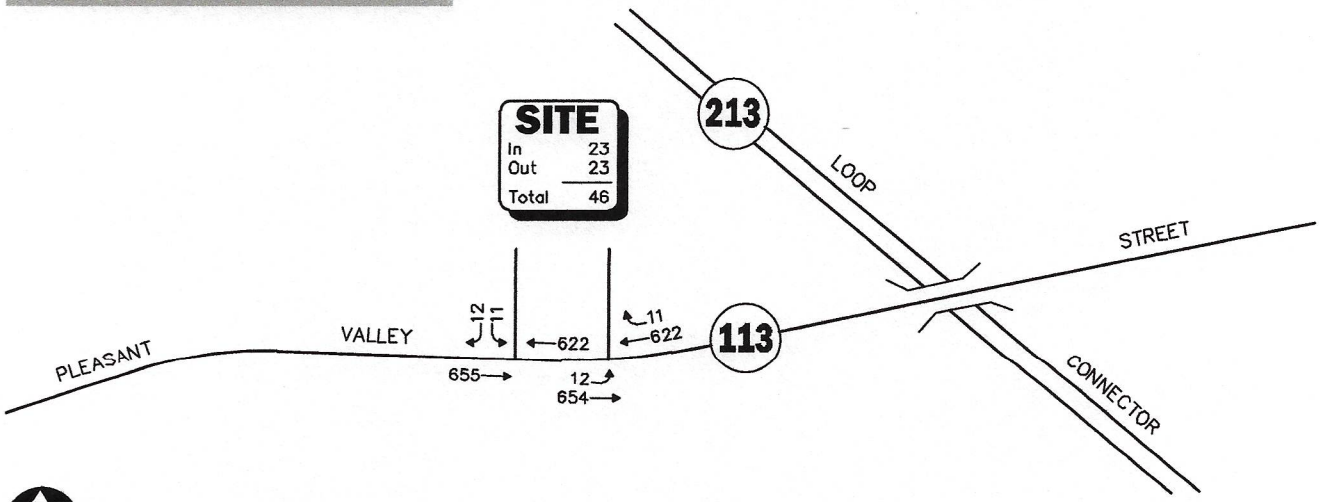
WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR



SATURDAY MIDDAY PEAK HOUR



Not To Scale

Figure 6

2030 Build
Peak-Hour Traffic Volumes

Vanasse & Associates inc

The following is a summary of the level-of-service and vehicle queue analyses for intersections within the study area. For context, we note that an LOS of "D" or better is generally defined as "acceptable" operating conditions.

Route 113 at the Project Site Driveway

All movements exiting the Project site are predicted to operate at LOS C during the peak hours, with vehicle queues of up to one (1) vehicle predicted. All movements along Route 113 approaching the driveway were shown to operate at LOS A during the peak hours with no (0) residual vehicle queuing.

Table 6
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

	2023 Existing				2030 No-Build				2030 Build			
Unsignalized Intersection/Peak-Hour/Movement	Demand[a]	Delay[b]	LOS[c]	Queue[d] 95th	Demand	Delay	LOS	Queue 95th	Demand	Delay	LOS	Queue 95th
Route 113 at the Project Site Driveway												
Weekday Morning:												
Route 113 EB LT/TH	--	--	--	--	--	--	--	--	345	0.2	A	0
Route 113 WB TH/RT	--	--	--	--	--	--	--	--	545	0.0	A	0
Project Site Driveway SB LT/RT	--	--	--	--	--	--	--	--	15	16.1	C	0
Weekday Evening:												
Project Site Driveway EB LT/RT	--	--	--	--	--	--	--	--	660	0.1	A	0
Route 113 NB LT/TH	--	--	--	--	--	--	--	--	654	0.0	A	0
Project Site Driveway SB LT/RT	--	--	--	--	--	--	--	--	10	22.0	C	0
Saturday Midday:												
Route 113 EB LT/TH	--	--	--	--	--	--	--	--	655	0.2	A	0
Route 113 WB TH/RT	--	--	--	--	--	--	--	--	633	0.0	A	0
Project Site Driveway SB LT/RT	--	--	--	--	--	--	--	--	23	22.2	C	1

[a]Demand in vehicles per hour.
[b]Average control delay per vehicle (in seconds).
[c]Level of service.
[d]Queue length in vehicles.
EB = eastbound; SB = southbound; WB = westbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

SIGHT DISTANCE ASSESSMENT

Sight distance measurements were performed at the intersections of the Project site driveways with Route 113 in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)[7] requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an oncoming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 7 presents the measured SSD and ISD at the subject intersections.

Table 7
SIGHT DISTANCE MEASUREMENTS[a]

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD)[b]	Measured
Route 113 at the Project Site Entrance Driveway			
Stopping Sight Distance:			
Route 113 approaching from the east	360	--	500+
Route 113 approaching from the west	360	--	500+
Route 113 at the Project Site Exit Driveway			
Stopping Sight Distance:			
Route 113 approaching from the east	360	--	500+
Route 113 approaching from the west	360	--	500+
Intersection Sight Distance:			
Looking to the east from the Project Site Driveway	360	500	500+
Looking to the west from the Project Site Driveway	360	430	202/400[c]

[a]Recommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2018; and based on a 45 mph approach speed on Route 113.

[b]Values shown are the intersection sight distance for a vehicle turning right or left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

[c]Available sight distance with the selective trimming/removal of vegetation located within the sight triangle areas.

As can be seen in Table 7, with the selective trimming/removal of vegetation located within the sight triangle areas of Project site exit driveway, the available lines of sight to and from the Project site driveway intersections with Route 113 will exceed the recommended minimum sight distance to function in a safe (SSD) and efficient (ISD) manner based on a 45 mph approach speed, which is *above* the measured 85th percentile vehicle travel speed (37/41 mph) in the vicinity of the Project site and the posted speed limit (30 mph).

[7] *A Policy on Geometric Design of Highway and Streets,* 7th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2018.

SUMMARY

VAI has completed a detailed assessment of the potential impacts on the transportation infrastructure associated with the proposed construction of an automated car wash to be located at 128 Pleasant Valley Street (Route 113) in Methuen, Massachusetts. The following specific areas have been evaluated as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the ITE,[8] the Project is expected to generate approximately 416 vehicle trips on an average weekday (two-way volume over the operational day of the Project), with 31 vehicle trips expected during the weekday morning peak hour, 21 vehicle trips expected during the weekday evening peak hour, and 46 vehicle trips expected during the Saturday midday peak hour;

2. The Project will not result in a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions), with all movements along Route 113 approaching the Project site driveway shown to continue to operate at LOS A with negligible vehicle queuing;

3. All movements exiting the Project site driveway to Route 113 are predicted to operate at LOS C during the peak hours with vehicle queues of up to one (1) vehicle predicted;

4. No apparent safety deficiencies were noted with respect to the motor vehicle crash history in the vicinity of the Project site; and

5. Lines of sight at the intersections of the Project site driveways with Route 113 were found to exceed or can be made to exceed the recommended minimum distance for the intersections to operate in a safe and efficient manner based on the appropriate approach speed.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with the implementation of the recommendations that follow.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified as a part of this assessment. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project site will be provided by way of two driveways that intersect the north side of Route 113 along the property frontage. The eastern driveway will be restricted to entering movements only, with the western driveway restricted to exiting movements only. The following recommendations are offered with respect to the design and operation of the Project site access and internal circulation:

[8] Institute of Transportation Engineers, op. cit. 1.

- The Project site driveways should be a minimum of 20 feet in width, unless a reduced width is approved by the Methuen Fire Department, and designed to accommodate the turning and maneuvering requirements of the largest anticipated responding emergency vehicle.

- The dimensions of the parallel parking spaces should be 8-feet and 22-feet long.

- A vehicle queue by-pass lane should be provided around the car wash and a re-circulation lane should be developed at the front of the car wash that does not require vehicles to use Route 113 to re-enter the car wash.

- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided.

- All signs and pavement markings to be installed within the Project site should conform to the applicable standards of the *Manual on Uniform Traffic Control Devices* (MUTCD).[9]

- "ONE WAY" and "DO NOT ENTER" signs should be installed at the Project site driveways and within the Project site to regulate the one-way circulation pattern and to define the entrance and exit driveways.

- Signs and landscaping to be installed as a part of the Project within the intersection sight triangle areas of the Project site driveways should be designed and maintained so as not to restrict lines of sight.

- Existing vegetation located within the sight triangle areas of the Project site driveways should be selectively trimmed or removed and maintained so as to provide the necessary sightlines for the driveways to operate in a safe manner.

- Snow accumulations (windrows) within sight triangle areas should be promptly removed where such accumulations would impede sightlines.

- A peak season operations plan should be developed that includes on-site staffing to manage vehicle queuing.

With implementation of the aforementioned recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing transportation system.

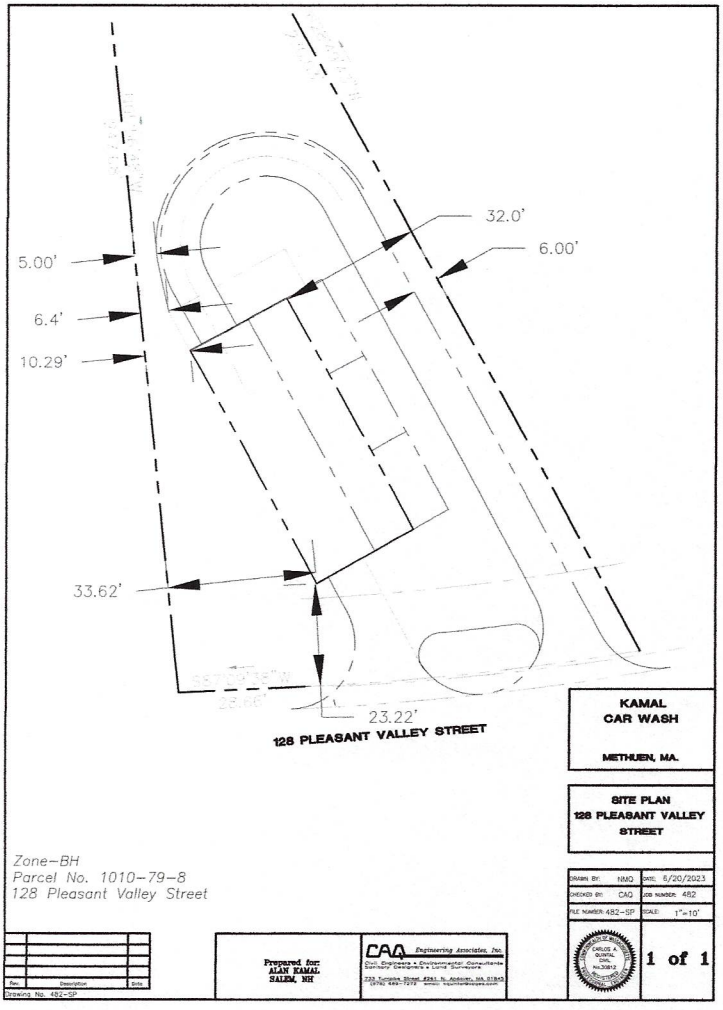
cc: File

[9] *Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

ATTACHMENTS

PROJECT SITE PLAN
AUTOMATIC TRAFFIC RECORDER COUNT DATA
SEASONAL ADJUSTMENT DATA
PUBLIC TRANSPORTATION INFORMATION
VEHICLE TRAVEL SPEED DATA
MASSDOT CRASH RATE WORKSHEET AND HIGH CRASH LOCATION MAPPING
GENERAL BACKGROUND TRAFFIC GROWTH
TRIP-GENERATION CALCULATIONS
CAPACITY ANALYSIS WORKSHEETS

PROJECT SITE PLAN



KAMAL
CAR WASH
METHUEN, MA.

SITE PLAN
128 PLEASANT VALLEY
STREET

Zone–BH
Parcel No. 1010–79–8
128 Pleasant Valley Street

DRAWN BY: NMQ	DATE: 6/20/2023
CHECKED BY: CAQ	JOB NUMBER: 482
FILE NUMBER: 482-SP	SCALE: 1"=10'

Prepared for:
ALAN KAMAL
SALEM, NH

CAA Engineering Associates, Inc.
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Surveyors • Designers • Land Surveyors
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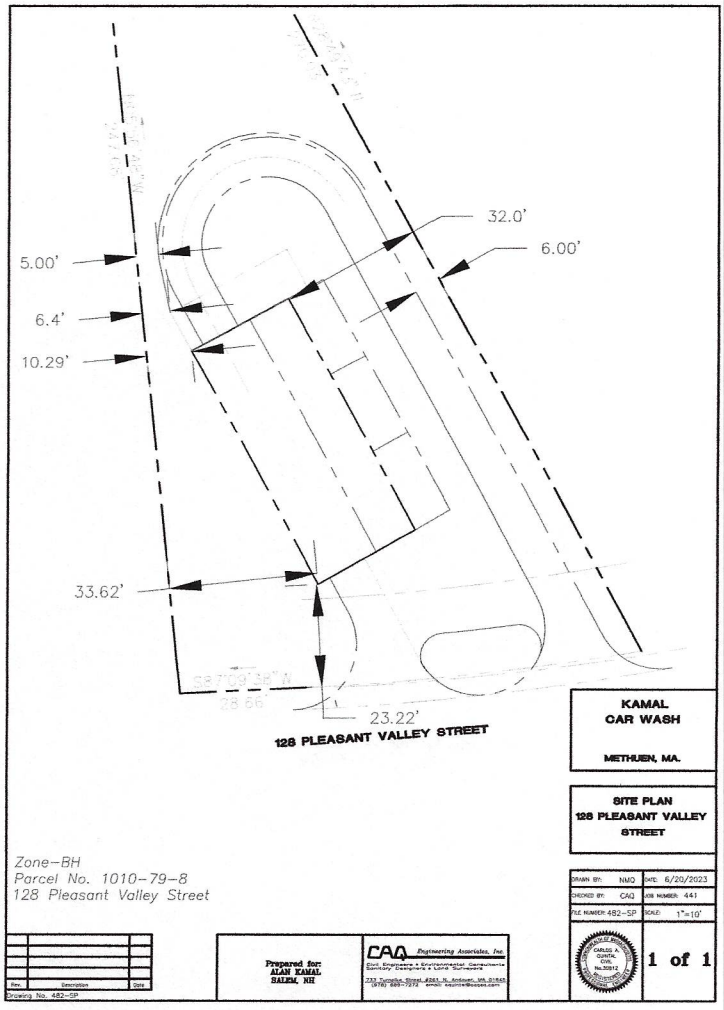
CARLOS A. QUINTAL
CIVIL
No.39812

1 of 1

Rev. | Description | Date

Drawing No. 482-SP



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No.39812

1 of 1

Rev. | Description | Date

Drawing No. 482-SP

AUTOMATIC TRAFFIC RECORDER COUNT DATA

Accurate Counts

978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA

Site Code: 98290001

9/21/2023	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Morning	Afternoon	Morning	Afternon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00	7	90			7	122				
12:15	8	98			7	117				
12:30	10	109			5	95				
12:45	6	109	31	406	3	103	22	437	53	843
1:00	1	104			4	118				
1:15	5	90			8	108				
1:30	3	123			4	124				
1:45	4	121	13	438	2	116	18	466	31	904
2:00	1	113			1	109				
2:15	0	132			1	104				
2:30	4	127			3	111				
2:45	3	128	8	500	3	110	8	434	16	934
3:00	5	156			3	111				
3:15	0	136			10	112				
3:30	4	151			3	121				
3:45	2	140	11	583	2	148	18	492	29	1075
4:00	4	159			7	131				
4:15	3	125			13	145				
4:30	8	163			9	157				
4:45	13	137	28	584	23	152	52	585	80	1169
5:00	11	139			35	142				
5:15	16	171			28	154				
5:30	15	147			32	134				
5:45	17	179	59	636	40	128	135	558	194	1194
6:00	30	132			40	118				
6:15	37	154			48	120				
6:30	39	112			98	100				
6:45	51	124	157	522	124	109	310	447	467	969
7:00	52	105			106	89				
7:15	55	97			119	61				
7:30	74	85			136	58				
7:45	97	94	278	381	112	63	473	271	751	652
8:00	79	81			140	59				
8:15	64	83			113	72				
8:30	100	64			109	61				
8:45	112	54	355	282	80	43	442	235	797	517
9:00	85	62			95	41				
9:15	65	68			96	38				
9:30	89	47			84	28				
9:45	94	43	333	220	93	22	368	129	701	349
10:00	77	44			90	26				
10:15	94	43			91	25				
10:30	86	17			108	14				
10:45	125	23	382	127	95	20	384	85	766	212
11:00	83	20			115	9				
11:15	84	20			126	16				
11:30	91	19			120	7				
11:45	109	7	367	66	123	6	484	38	851	104
Total	2022	4745			2714	4177			4736	8922
Percent	29.9%	70.1%			39.4%	60.6%			34.7%	65.3%

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA

Site Code: 98290001

9/22/2023	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Morning	Afternoon	Morning	Afternon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00	9	121			6	116				
12:15	13	119			8	111				
12:30	12	119			2	124				
12:45	6	126	40	485	4	112	20	463	60	948
1:00	10	109			3	118				
1:15	4	117			4	103				
1:30	2	114			4	98				
1:45	7	113	23	453	2	130	13	449	36	902
2:00	6	161			4	123				
2:15	2	143			5	145				
2:30	2	149			3	140				
2:45	2	167	12	620	1	132	13	540	25	1160
3:00	3	192			4	125				
3:15	5	200			8	131				
3:30	3	190			2	124				
3:45	4	159	15	741	7	129	21	509	36	1250
4:00	8	171			6	129				
4:15	10	179			16	146				
4:30	7	177			15	149				
4:45	6	158	31	685	22	171	59	595	90	1280
5:00	12	159			25	160				
5:15	18	141			24	140				
5:30	19	118			39	130				
5:45	23	143	72	561	40	125	128	555	200	1116
6:00	27	151			35	130				
6:15	34	140			49	120				
6:30	29	130			86	101				
6:45	49	108	139	529	114	108	284	459	423	988
7:00	61	115			87	86				
7:15	50	107			118	82				
7:30	67	108			110	67				
7:45	105	86	283	416	116	51	431	286	714	702
8:00	84	73			123	59				
8:15	91	73			113	57				
8:30	92	70			104	45				
8:45	125	64	392	280	100	52	440	213	832	493
9:00	76	64			103	51				
9:15	92	56			92	39				
9:30	98	39			92	32				
9:45	106	36	372	195	97	36	384	158	756	353
10:00	93	46			78	28				
10:15	73	44			119	32				
10:30	90	36			101	25				
10:45	93	32	349	158	96	26	394	111	743	269
11:00	115	27			92	19				
11:15	100	27			110	23				
11:30	99	12			114	13				
11:45	105	17	419	83	113	8	429	63	848	146
Total	2147	5206			2616	4401			4763	9607
Percent	29.2%	70.8%			37.3%	62.7%			33.1%	66.9%
Grand Total	4169	9951			5330	8578			9499	18529
Percent	29.5%	70.5%			38.3%	61.7%			33.9%	66.1%
ADT		ADT: 14,014		AADT: 14,014						

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA

Site Code: 98290001

9/18/2023	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Week Average	
Time	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	*	*	*	*	*	*	31	22	40	20	*	*	*	*	36	21
1:00	*	*	*	*	*	*	13	18	23	13	*	*	*	*	18	16
2:00	*	*	*	*	*	*	8	8	12	13	*	*	*	*	10	10
3:00	*	*	*	*	*	*	11	18	15	21	*	*	*	*	13	20
4:00	*	*	*	*	*	*	28	52	31	59	*	*	*	*	30	56
5:00	*	*	*	*	*	*	59	135	72	128	*	*	*	*	66	132
6:00	*	*	*	*	*	*	157	310	139	284	*	*	*	*	148	297
7:00	*	*	*	*	*	*	278	473	283	431	*	*	*	*	280	452
8:00	*	*	*	*	*	*	355	442	392	440	*	*	*	*	374	441
9:00	*	*	*	*	*	*	333	368	372	384	*	*	*	*	352	376
10:00	*	*	*	*	*	*	382	384	349	394	*	*	*	*	366	389
11:00	*	*	*	*	*	*	367	484	419	429	*	*	*	*	393	456
12:00 PM	*	*	*	*	*	*	406	437	485	463	*	*	*	*	446	450
1:00	*	*	*	*	*	*	438	466	453	449	*	*	*	*	446	458
2:00	*	*	*	*	*	*	500	434	620	540	*	*	*	*	560	487
3:00	*	*	*	*	*	*	583	492	741	509	*	*	*	*	662	500
4:00	*	*	*	*	*	*	584	585	685	595	*	*	*	*	634	590
5:00	*	*	*	*	*	*	636	558	561	555	*	*	*	*	598	556
6:00	*	*	*	*	*	*	522	447	529	459	*	*	*	*	526	453
7:00	*	*	*	*	*	*	381	271	416	286	*	*	*	*	398	278
8:00	*	*	*	*	*	*	282	235	280	213	*	*	*	*	281	224
9:00	*	*	*	*	*	*	220	129	195	158	*	*	*	*	208	144
10:00	*	*	*	*	*	*	127	85	158	111	*	*	*	*	142	98
11:00	*	*	*	*	*	*	66	38	27	19	*	*	*	*	46	28
Total	0	0	0	0	0	0	6767	6891	7297	6973	0	0	0	0	7033	6932
Day	0		0		0		13658		14270		0		0		13965	
AM Peak							10:00	11:00	11:00	8:00					11:00	11:00
Volume							382	484	419	440					393	456
PM Peak							5:00	4:00	3:00	4:00					3:00	4:00
Volume							636	585	741	595					662	590
Comb Total	0		0		0		13658		14270		0		0		13965	
ADT	ADT: 14,014		AADT: 14,014													

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA

Site Code: 982900S1

9/30/2023	EB		Hour Totals		WB		Hour Totals		Combined Totals	
Time	Morning	Afternoon	Morning	Afternon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00	7	137			11	159				
12:15	12	146			13	149				
12:30	14	132			11	139				
12:45	14	164	47	579	11	153	46	600	93	1179
1:00	8	158			11	139				
1:15	7	139			6	112				
1:30	6	132			4	133				
1:45	9	127	30	556	8	108	29	492	59	1048
2:00	3	143			4	108				
2:15	7	124			3	128				
2:30	7	131			4	114				
2:45	2	116	19	514	4	117	15	467	34	981
3:00	1	143			4	107				
3:15	5	112			3	86				
3:30	6	129			4	130				
3:45	2	122	14	506	2	110	13	433	27	939
4:00	1	129			2	114				
4:15	10	103			9	114				
4:30	0	117			7	116				
4:45	4	123	15	472	8	112	26	456	41	928
5:00	9	115			7	107				
5:15	2	141			8	107				
5:30	4	107			10	106				
5:45	11	109	26	472	9	92	34	412	60	884
6:00	7	113			7	91				
6:15	12	97			17	109				
6:30	10	94			21	93				
6:45	24	113	53	417	50	82	95	375	148	792
7:00	27	96			43	62				
7:15	28	73			37	59				
7:30	42	55			51	60				
7:45	41	60	138	284	48	67	179	248	317	532
8:00	42	86			53	72				
8:15	50	64			73	46				
8:30	50	67			81	40				
8:45	78	67	220	284	90	44	297	202	517	486
9:00	65	48			90	37				
9:15	78	59			105	33				
9:30	83	67			103	31				
9:45	105	44	331	218	124	28	422	129	753	347
10:00	104	32			128	28				
10:15	125	37			129	33				
10:30	111	33			125	27				
10:45	132	34	472	136	129	15	511	103	983	239
11:00	95	34			139	25				
11:15	106	28			161	31				
11:30	130	20			139	10				
11:45	128	20	459	102	133	15	572	81	1031	183
Total	1824	4540			2239	3998			4063	8538
Percent	28.7%	71.3%			35.9%	64.1%			32.2%	67.8%
Grand Total	1824	4540			2239	3998			4063	8538
Percent	28.7%	71.3%			35.9%	64.1%			32.2%	67.8%
ADT		ADT: 12,601		AADT: 12,601						

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA

Site Code: 982900S1

9/30/2023 Time	EB	WB	Total
12:00 AM	47	46	93
1:00	30	29	59
2:00	19	15	34
3:00	14	13	27
4:00	15	26	41
5:00	26	34	60
6:00	53	95	148
7:00	138	179	317
8:00	220	297	517
9:00	331	422	753
10:00	472	511	983
11:00	459	572	1031
12:00 PM	579	600	1179
1:00	556	492	1048
2:00	514	467	981
3:00	506	433	939
4:00	472	456	928
5:00	472	412	884
6:00	417	375	792
7:00	284	248	532
8:00	284	202	486
9:00	218	129	347
10:00	136	103	239
11:00	34	25	59
Total	6296	6181	12477
Percent	50.5%	49.5%	
AM Peak	10:00	11:00	11:00
Volume	472	572	1031
PM Peak	12:00 PM	12:00 PM	12:00 PM
Volume	579	600	1179
Grand Total	6296	6181	12477
Percent	50.5%	49.5%	
ADT		ADT: 12,601	AADT: 12,601

SEASONAL ADJUSTMENT DATA

Massachusetts Highway Department
Statewide Traffic Data Collection
2019 Weekday Seasonal Factors

Factor Group	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Axle Factor
R1	1.22	1.14	1.12	1.06	1.00	0.96	0.87	0.85	0.96	0.99	1.04	1.12	0.85
R2	0.95	0.96	0.98	0.97	0.97	0.93	0.97	0.94	0.96	0.90	0.92	0.93	0.96
R3	1.15	1.06	1.07	1.00	0.89	0.88	0.89	0.89	0.95	0.92	1.02	1.01	0.97
R4-R7	1.09	1.09	1.11	1.02	0.96	0.92	0.89	0.89	0.99	0.98	1.09	1.13	0.98
U1-Boston	1.03	1.01	0.98	0.94	0.94	0.92	0.95	0.93	0.94	0.94	0.97	1.04	0.96
U1-Essex	1.09	1.06	1.03	0.99	0.94	0.90	0.88	0.86	0.93	0.94	0.99	1.06	0.93
U1-Southeast	1.06	1.05	1.01	0.97	0.95	0.93	0.93	0.90	0.94	0.94	0.98	1.04	0.98
U1-West	1.19	1.14	1.09	0.95	0.92	0.89	0.89	0.86	0.91	0.95	0.97	1.07	0.84
U1-Worcester	1.02	1.04	0.97	0.94	0.93	0.91	0.95	0.91	0.93	0.92	0.95	1.10	0.88
U2	1.01	1.00	0.94	0.93	0.91	0.89	0.93	0.90	0.90	0.91	0.94	1.02	0.99
U3	1.06	1.03	0.98	0.94	0.93	0.91	0.95	0.91	0.92	0.93	0.97	1.00	0.98
U4-U7	1.01	1.00	0.95	0.92	0.88	0.86	0.92	0.91	0.92	0.94	0.99	1.04	0.99
Rec - East	1.04	1.16	1.12	0.98	0.92	0.88	0.77	0.81	0.94	1.02	1.08	1.12	0.99
Rec - West	1.30	1.23	1.32	1.18	0.95	0.82	0.70	0.69	0.97	0.96	1.16	1.15	0.98

Round off:
0-999 = 10
>1000 = 100

U = Urban
R = Rural

1 - Interstate
2 - Freeway and Expressway
3 - Other Principal Arterial
4 - Minor Arterial
5 - Major Collector
6 - Minor Collector
7 - Local Road and Street

Recreational - East Group - Cape Cod (all towns) including the town of Plymouth south of Route 3A (stations 7014,7079,7080,7090,7091,7092,7093,7094,7095,7096,7097,7108 and 7178), Martha's Vineyard and Nantucket.

Recreational - West Group - Continuous Stations 2 and 189 including stations 1066,1067,1083,1084,1085,1086,1087,1088,1089,1090,1091,1092,1093,1094,1095,1096,1097,1098,1099,1100,1101,1102,1103,1104,1105,1106,1107,1108,1113,1114,1116,2196,2197 and 2198.

9/14/2021

PUBLIC TRANSPORTATION INFORMATION

ROUTE 1 OUTBOUND
Lawrence-Haverhill via The Loop/Pleasant Valley St.

WEEKDAYS

1	2	3	4	5	6	7	8
Bus starts at Buckley Transportation Center	Bus Leaves from Jackson & Swan	Bus Leaves from The Loop	Bus Leaves from Methuen Plaza Walmart	Bus Leaves from Target Plaza	Bus Leaves from Pleasant Valley & Merrimack	Bus Leaves from Lowell & River	Bus ends at Washington Sq. Transit Station
5:00	5:05	5:20	5:23	5:25	5:30	5:35	5:40
5:30	5:35	5:50	5:53	5:55	6:00	6:05	6:10
6:00	6:05	6:20	6:23	6:25	6:30	6:35	6:40
6:30	6:35	6:50	6:53	6:55	7:00	7:05	7:10
7:00	7:05	7:20	7:23	7:25	7:30	7:35	7:40
7:30	7:35	7:50	7:53	7:55	8:00	8:05	8:10
8:00	8:05	8:20	8:23	8:25	8:30	8:35	8:40
8:30	8:35	8:50	8:53	8:55	9:00	9:05	9:10
9:00	9:05	9:20	9:23	9:25	9:30	9:35	9:40
9:30	9:35	9:50	9:53	9:55	10:00	10:05	10:10
10:00	10:05	10:20	10:23	10:25	10:30	10:35	10:40
10:30	10:35	10:50	10:53	10:55	11:00	11:05	11:10
11:00	11:05	11:20	11:23	11:25	11:30	11:35	11:40
11:30	11:35	11:50	11:53	11:55	**12:00**	**12:05**	**12:10**
12:00	**12:05**	**12:20**	**12:23**	**12:25**	**12:30**	**12:35**	**12:40**
12:30	**12:35**	**12:50**	**12:53**	**12:55**	**1:00**	**1:05**	**1:10**
1:00	**1:05**	**1:20**	**1:23**	**1:25**	**1:30**	**1:35**	**1:40**
1:30	**1:35**	**1:50**	**1:53**	**1:55**	**2:00**	**2:05**	**2:10**
2:00	**2:05**	**2:20**	**2:23**	**2:25**	**2:30**	**2:35**	**2:40**
2:30	**2:35**	**2:50**	**2:53**	**2:55**	**3:00**	**3:05**	**3:10**
3:00	**3:05**	**3:20**	**3:23**	**3:25**	**3:30**	**3:35**	**3:40**
3:30	**3:35**	**3:50**	**3:53**	**3:55**	**4:00**	**4:05**	**4:10**
4:00	**4:05**	**4:20**	**4:23**	**4:25**	**4:30**	**4:35**	**4:40**
4:30	**4:35**	**4:50**	**4:53**	**4:55**	**5:00**	**5:05**	**5:10**
5:00	**5:05**	**5:20**	**5:23**	**5:25**	**5:30**	**5:35**	**5:40**
5:30	**5:35**	**5:50**	**5:53**	**5:55**	**6:00**	**6:05**	**6:10**
6:00	**6:05**	**6:20**	**6:23**	**6:25**	**6:30**	**6:35**	**6:40**
6:30	**6:35**	**6:50**	**6:53**	**6:55**	**7:00**	**7:05**	**7:10**
7:00	**7:05**	**7:20**	**7:23**	**7:25**	**7:30**	**7:35**	**7:40**
8:00	**8:05**	**8:20**	**8:23**	**8:25**	**8:30**	**8:35**	**8:40**
9:00	**9:05**	**9:20**	**9:23**	**9:25**	**9:30**	**9:35**	**9:40**

SATURDAYS

7:00	7:05	7:20	7:23	7:25	7:30	7:35	7:40
8:00	8:05	8:20	8:23	8:25	8:30	8:35	8:40
9:00	9:05	9:20	9:23	9:25	9:30	9:35	9:40
10:00	10:05	10:20	10:23	10:25	10:30	10:35	10:40
10:30	10:35	10:50	10:53	10:55	11:00	11:05	11:10
11:00	11:05	11:20	11:23	11:25	11:30	11:35	11:40
11:30	11:35	11:50	11:53	11:55	**12:00**	**12:05**	**12:10**
12:00	**12:05**	**12:20**	**12:23**	**12:25**	**12:30**	**12:35**	**12:40**
12:30	**12:35**	**12:50**	**12:53**	**12:55**	**1:00**	**1:05**	**1:10**
1:00	**1:05**	**1:20**	**1:23**	**1:25**	**1:30**	**1:35**	**1:40**
1:30	**1:35**	**1:50**	**1:53**	**1:55**	**2:00**	**2:05**	**2:10**
2:00	**2:05**	**2:20**	**2:23**	**2:25**	**2:30**	**2:35**	**2:40**
2:30	**2:35**	**2:50**	**2:53**	**2:55**	**3:00**	**3:05**	**3:10**
3:00	**3:05**	**3:20**	**3:23**	**3:25**	**3:30**	**3:35**	**3:40**
3:30	**3:35**	**3:50**	**3:53**	**3:55**	**4:00**	**4:05**	**4:10**
4:00	**4:05**	**4:20**	**4:23**	**4:25**	**4:30**	**4:35**	**4:40**
4:30	**4:35**	**4:50**	**4:53**	**4:55**	**5:00**	**5:05**	**5:10**
5:00	**5:05**	**5:20**	**5:23**	**5:25**	**5:30**	**5:35**	**5:40**
6:00	**6:05**	**6:20**	**6:23**	**6:25**	**6:30**	**6:35**	**6:40**

Updated 08.17.2023

ROUTE 1 INBOUND

Lawrence-Haverhill via The Loop/Pleasant Valley St.

WEEKDAYS

8 Bus Starts at Washington Sq. Transit Station	9 Bus Leaves from Lowell & River	10 Bus Leaves from Pleasant Valley & Merrimack	11 Bus Leaves from The Loop	12 Bus Leaves from Methuen Plaza Walmart	13 Bus Leaves from Target Plaza	14 Bus Leaves from Jackson & Swan	15 Bus ends at Buckley Transportation Center	Bus continues on as Route
5:00	5:05	5:10	5:20	5:23	5:25	5:35	5:45	24
5:30	5:35	5:40	5:50	5:53	5:55	6:05	6:15	24
6:00	6:05	6:10	6:20	6:23	6:25	6:35	6:45	24
6:30	6:35	6:40	6:50	6:53	6:55	7:05	7:15	24
7:00	7:05	7:10	7:20	7:23	7:25	7:35	7:45	24
7:30	7:35	7:40	7:50	7:53	7:55	8:05	8:15	24
8:00	8:05	8:10	8:20	8:23	8:25	8:35	8:45	24
8:30	8:35	8:40	8:50	8:53	8:55	9:05	9:15	24
9:00	9:05	9:10	9:20	9:23	9:25	9:35	9:45	24
9:30	9:35	9:40	9:50	9:53	9:55	10:05	10:15	24
10:00	10:05	10:10	10:20	10:23	10:25	10:35	10:45	24
10:30	10:35	10:40	10:50	10:53	10:55	11:05	11:15	24
11:00	11:05	11:10	11:20	11:23	11:25	11:35	11:45	24
11:30	11:35	11:40	11:50	11:53	11:55	**12:05**	**12:15**	**24**
12:00	**12:05**	**12:10**	**12:20**	**12:23**	**12:25**	**12:35**	**12:45**	**24**
12:30	**12:35**	**12:40**	**12:50**	**12:53**	**12:55**	**1:05**	**1:15**	**24**
1:00	**1:05**	**1:10**	**1:20**	**1:23**	**1:25**	**1:35**	**1:45**	**24**
1:30	**1:35**	**1:40**	**1:50**	**1:53**	**1:55**	**2:05**	**2:15**	**24**
2:00	**2:05**	**2:10**	**2:20**	**2:23**	**2:25**	**2:35**	**2:45**	**24**
2:30	**2:35**	**2:40**	**2:50**	**2:53**	**2:55**	**3:05**	**3:15**	**24**
3:00	**3:05**	**3:10**	**3:20**	**3:23**	**3:25**	**3:35**	**3:45**	**24**
3:30	**3:35**	**3:40**	**3:50**	**3:53**	**3:55**	**4:05**	**4:15**	**24**
4:00	**4:05**	**4:10**	**4:20**	**4:23**	**4:25**	**4:35**	**4:45**	**24**
4:30	**4:35**	**4:40**	**4:50**	**4:53**	**4:55**	**5:05**	**5:15**	**24**
5:00	**5:05**	**5:10**	**5:20**	**5:23**	**5:25**	**5:35**	**5:45**	**24**
5:30	**5:35**	**5:40**	**5:50**	**5:53**	**5:55**	**6:05**	**6:15**	**24**
6:00	**6:05**	**6:10**	**6:20**	**6:23**	**6:25**	**6:35**	**6:45**	**24**
6:30	**6:35**	**6:40**	**6:50**	**6:53**	**6:55**	**7:05**	**7:15**	**24**
7:00	**7:05**	**7:10**	**7:20**	**7:23**	**7:25**	**7:35**	**7:45**	**24**
8:00	**8:05**	**8:10**	**8:20**	**8:23**	**8:25**	**8:35**	**8:45**	-
9:00	**9:05**	**9:10**	**9:20**	**9:23**	**9:25**	**9:35**	**9:45**	-

SATURDAYS

7:00	7:05	7:10	7:20	7:23	7:25	7:35	7:45	24
8:00	8:05	8:10	8:20	8:23	8:25	8:35	8:45	24
9:00	9:05	9:10	9:20	9:23	9:25	9:35	9:45	24
10:00	10:05	10:10	10:20	10:23	10:25	10:35	10:45	24
10:30	10:35	10:40	10:50	10:53	10:55	11:05	11:15	24
11:00	11:05	11:10	11:20	11:23	11:25	11:35	11:45	24
11:30	11:35	11:40	11:50	11:53	11:55	**12:05**	**12:15**	**24**
12:00	**12:05**	**12:10**	**12:20**	**12:23**	**12:25**	**12:35**	**12:45**	**24**
12:30	**12:35**	**12:40**	**12:50**	**12:53**	**12:55**	**1:05**	**1:15**	**24**
1:00	**1:05**	**1:10**	**1:20**	**1:23**	**1:25**	**1:35**	**1:45**	**24**
1:30	**1:35**	**1:40**	**1:50**	**1:53**	**1:55**	**2:05**	**2:15**	**24**
2:00	**2:05**	**2:10**	**2:20**	**2:23**	**2:25**	**2:35**	**2:45**	**24**
2:30	**2:35**	**2:40**	**2:50**	**2:53**	**2:55**	**3:05**	**3:15**	**24**
3:00	**3:05**	**3:10**	**3:20**	**3:23**	**3:25**	**3:35**	**3:45**	**24**
3:30	**3:35**	**3:40**	**3:50**	**3:53**	**3:55**	**4:05**	**4:15**	**24**
4:00	**4:05**	**4:10**	**4:20**	**4:23**	**4:25**	**4:35**	**4:45**	**24**
4:30	**4:35**	**4:40**	**4:50**	**4:53**	**4:55**	**5:05**	**5:15**	**24**
5:00	**5:05**	**5:10**	**5:20**	**5:23**	**5:25**	**5:35**	**5:45**	**24**
6:00	**6:05**	**6:10**	**6:20**	**6:23**	**6:25**	**6:35**	**6:45**	-

Updated 08.17.2023

MVRTA

Merrimack Valley Regional Transit Authority

85 Railroad Avenue | Haverhill, MA 01835

Fixed Bus Route Information

The Communities We Serve

The MVRTA fixed route bus system operates in the Merrimack Valley communities of Amesbury, Andover, Haverhill, Lawrence, Merrimac, Methuen, Newburyport, North Andover and Salisbury.

The MVRTA also provides service to the Lowell Transit Center for connections with the Lowell Regional Transit Authority.

Fare Information

FREE

Accessibility

The MVRTA's policy for governing the ADA DOT requirement to transport any wheelchair that does not exceed the capacities of the vehicle and its equipment (lift/ramp) is: Drivers must transport all passengers in wheelchairs whose combined weight and dimensions do not exceed the capacities of the vehicle and its equipment. Please note that if the combination of the customer and wheelchair/scooter exceeds the lift capacity, we may not be able to accommodate your trip.

* Service animals are permitted on all MVRTA vehicles.
* All schedules, brochures and applications are available in braille, audio and large print.

Reasonable Modifications

The MVRTA is dedicated to providing equal access to its services for persons with disabilities as well as any individual who (either on occasions or over an extended period) may require modifications to the MVRTA's policy, practices and procedures. Any individual with disability requesting reasonable modification accommodations for extended period of time is required to complete the form listed on the MVRTA website or by calling (978) 469-6878 to request a form. A decision will be made within three (3) business days from the date of the request.

* In the event that is not practical to make the request in advance, it can also be made with the reservationist (when reserving your trip) or directly with the driver (on the same).
The reservationist, driver and dispatcher will then make a determination of whether the modification can be accommodated.

Violation of these policies could result in loss of riding privileges. In addition, several rules must be observed:

- All passengers are required to wear seatbelts. All wheelchairs and passengers are to be properly secured at all times. Passengers that are not properly secured will not be transported.
- Unsafe behavior or destruction of service property will be caused for immediate expulsion from the vehicle.
- Eating, drinking, smoking, or playing of loud music is not allowed.
- Tipping of drivers is not permitted.

Fixed Bus Route & Schedule Information:
(978) 469-6878
WWW.MVRTA.COM

We hope you will enjoy this service. If you have any questions, suggestions or concerns, contact:

Office of Special Services
85 Railroad Avenue
Haverhill, MA 01835

(978) 469-MVRTA (6878)
option 3

specialservices@MVRTA.com

Schedule & Route Information:
(978) 469-MVRTA (6878)
www.MVRTA.com

What is The MVRTA?

The Merrimack Valley Regional Transit Authority (MVRTA) is a public transportation agency established under the Massachusetts General Law chapter 161B. Member cities and towns of the MVRTA are: Amesbury, Andover, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Merrimac, Methuen, Newbury, Newburyport, North Andover, Rowley, Salisbury, and West Newbury. The MVRTA provides fixed Route bus services, seniors and disabled transportation service, and commuter bus service.

The Merrimack Valley Regional Transit Authority Announces

Ring & Ride

MVRTA

What is Ring & Ride?

Ring & Ride is a curb-to-curb transportation service for the residents of Boxford, Georgetown, Groveland, Newbury/Byfield and West Newbury.

Who Provides Ring & Ride?

The Merrimack Valley Regional Transit Authority provides this service through its operating company using wheelchair lift-equipped MVRTA vehicles.

Effective April 19, 2019

What Trips Can I Take on Ring & Ride?

You can use the service in a variety of ways. Whether you are commuting to and from work, going shopping, visiting friends, or going to a medical appointment, Ring & Ride is there for you.

Where Can I Go With Ring & Ride?

This service allows residents of Boxford, Georgetown, Groveland, Newbury/Byfield and West Newbury to commute anywhere in Amesbury, Boxford, Georgetown, Groveland, Haverhill, Lawrence, Methuen, Newbury/Byfield, Newburyport, North Andover and West Newbury, as well as to the Rowley Train Station and Market Basket in Rowley. This service will allow you to connect to the MVRTA fixed route bus system.

When Does Ring & Ride operate?

Ring & Ride Service Hours:

Monday – Friday 5:00 AM – 7:00 PM
Saturday 9:00 AM – 6:00 PM

* Service on Sunday is provided to Groveland Residents only. Sunday service hours are 9:00 AM – 6:00 PM.

Service is not available on the following holidays: New Year's Day, Martin Luther King Day, President's Day, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, and Christmas Day.

When and How Do I Reserve a Seat?

For reservations, please call **978-469-6878 option 3** Between 8:00 am and 4:30 pm Monday through Friday at least one day prior to service. Trips may be reserved up to two weeks in advance.

When you call, be prepared to provide the following information:

- **Your name**
- **Your home, work, and/or cell phone number**
- **Your exact street address and requested appointment time.**
- **Your exact drop off location and, if you need a return trip, the return information.**

Ring & Ride is a shared ride service intended to safely and effectively accommodate as many customers per trip as possible. You will be given a 30 minute pick-up window at the time you book your ride. Please be ready by the start of the pick-up window, and call the olice of Special Services if your ride does not arrive by the end of the window. Severe weather or traffic conditions may result in the vehicle arriving later than expected. Upon arriving at your stop, the driver is permitted to wait no longer than five minutes for you to board the vehicle.

How Do I Cancel My Ride?

You must call at least one hour before the start of your thirty minute pick-up window, weekdays between 7:00 am and 5:00 pm. Please call **978-469-6878 option 3**. You may also cancel your trip after hours weekdays, or Saturday or Sunday by leaving a message on the voicemail at **978-469-6878 option 3**.

What Else Do I Need To Know About The Service?

There are no special identification cards needed to use Ring & Ride. Although rules may seem unnecessary for responsible adults, it is possible that a Ring & Ride customer may occasionally fail to observe several rules of etiquette. Therefore, in order to make this share ride service convenient for all customers, the policy for No-Shows and Late Cancellation is as follow:

No-Show: This disruption occurs when the MVRTA vehicle arrives at the specified location within a thirty minute window and the passenger is not ready or does not take the scheduled trip.

Late Cancellations: This disruption occurs when a passenger fails to notify MVRTA olice of Special Services of a cancellation at least sixty minute prior to the start of your pick-up window.

Disruption Penalties: The MVRTA Office of Special Services has established the administrative process outlined below to suspend, for a reasonable period of time, the provision of complementary para-transit service to ADA eligible individuals who establish a pattern or practice of missing scheduled trips. Each individual trip history will be assessed to see if a pattern or practice of missing schedule trips exists.

Excessive No Show/Late Cancellations are considered excessive when a customer reserves 7 or more trips within any month and no-shows and/or late cancels 20 percent or more of those scheduled trips. At no time can a customer's no-show/late cancellations exceed 7 within one month without causing violation. This will be considered a pattern or practice of missing trips and the customer will be sent written notification that he/she has violated the

Disruption Penalties Continued:
No-Show/Late Cancellation Policy and is subject to suspension.

*The MVRTA Office of Special Services retains the discretion to impose service suspensions with any disruption that is considered inappropriate up to and including indefinite suspension for a first time disruption.

What Does Ring & Ride Cost?

Ring & Ride Fare Rates Per one Way Trip Are As Follows:

West Newbury	Newbury/Byfield	Groveland	Georgetown	Boxford	
$2.00	$2.00	$0.00	$0.00	$0.00	Amesbury
$2.00	$2.00	$0.00	$0.00	$0.00	Boxford
$2.00	$2.00	$0.00	$0.00	$0.00	Georgetown
$2.00	$2.00	$0.00	$0.00	$0.00	Groveland
$2.00	$2.00	$0.00	$0.00	$0.00	Haverhill
$2.00	$2.00	$0.00	$0.00	$0.00	Lawrence
$2.00	$2.00	$0.00	$0.00	$0.00	Methuen
$2.00	$2.00	$0.00	$0.00	$0.00	Newbury/Byfield
$2.00	$2.00	$0.00	$0.00	$0.00	Newburyport
$2.00	$2.00	$0.00	$0.00	$0.00	North Andover
$2.00	$2.00	$0.00	$0.00	$0.00	West Newbury
$2.00	$2.00	$0.00	$0.00	$0.00	Rowley Train Station
$2.00	$2.00	$0.00	$0.00	$0.00	Rowley Market Basket

VEHICLE TRAVEL SPEED DATA

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: EB

Site Code: 98290001

9/21/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	4	14	8	4	1	0	0	0	0	0	31
1:00	0	0	0	3	7	3	0	0	0	0	0	0	0	13
2:00	0	0	0	3	2	1	2	0	0	0	0	0	0	8
3:00	0	0	0	2	4	2	2	1	0	0	0	0	0	11
4:00	0	0	2	7	11	6	1	1	0	0	0	0	0	28
5:00	0	0	0	11	23	18	5	2	0	0	0	0	0	59
6:00	0	0	3	24	63	44	20	3	0	0	0	0	0	157
7:00	0	0	6	37	126	87	18	4	0	0	0	0	0	278
8:00	1	0	16	88	138	89	22	0	1	0	0	0	0	355
9:00	0	2	18	80	151	72	10	0	0	0	0	0	0	333
10:00	0	3	34	104	156	78	7	0	0	0	0	0	0	382
11:00	0	0	36	119	153	49	9	1	0	0	0	0	0	367
12:00 PM	0	1	27	143	158	67	9	1	0	0	0	0	0	406
1:00	0	1	13	102	220	91	11	0	0	0	0	0	0	438
2:00	0	2	22	113	235	113	13	2	0	0	0	0	0	500
3:00	1	4	72	205	209	83	8	1	0	0	0	0	0	583
4:00	0	0	48	205	252	73	6	0	0	0	0	0	0	584
5:00	0	1	33	202	280	110	8	2	0	0	0	0	0	636
6:00	1	0	4	70	256	175	16	0	0	0	0	0	0	522
7:00	0	0	5	64	187	114	9	2	0	0	0	0	0	381
8:00	0	0	2	45	135	89	10	1	0	0	0	0	0	282
9:00	0	0	1	40	106	53	18	2	0	0	0	0	0	220
10:00	0	0	2	12	62	41	9	1	0	0	0	0	0	127
11:00	0	0	2	5	33	20	4	1	1	0	0	0	0	66
Total	3	14	346	1688	2981	1486	221	26	2	0	0	0	0	6767
			Percentile	15th	50th	85th	95th							
			Speed	28	33	37	40							
			Mean Speed (Average)	32.2										
			10 MPH Pace Speed	26-35										
			Number in Pace	4633										
			Percent in Pace	68.5%										
			Number > 35 MPH	1735										
			Percent > 35 MPH	25.6%										

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: EB

Site Code: 98290001

9/22/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	11	15	7	6	1	0	0	0	0	0	40
1:00	0	0	2	5	8	8	0	0	0	0	0	0	0	23
2:00	0	0	0	4	2	4	2	0	0	0	0	0	0	12
3:00	0	0	0	1	4	10	0	0	0	0	0	0	0	15
4:00	0	0	0	1	12	12	5	0	1	0	0	0	0	31
5:00	0	0	0	6	28	21	12	4	1	0	0	0	0	72
6:00	0	0	1	16	68	47	6	1	0	0	0	0	0	139
7:00	1	0	21	60	109	77	13	2	0	0	0	0	0	283
8:00	0	3	27	107	161	80	14	0	0	0	0	0	0	392
9:00	0	0	20	120	159	63	9	1	0	0	0	0	0	372
10:00	1	1	32	116	127	68	4	0	0	0	0	0	0	349
11:00	0	5	24	152	152	69	17	0	0	0	0	0	0	419
12:00 PM	0	1	42	178	177	72	15	0	0	0	0	0	0	485
1:00	3	1	21	163	180	76	7	2	0	0	0	0	0	453
2:00	0	1	41	211	286	70	11	0	0	0	0	0	0	620
3:00	0	3	56	271	307	94	8	2	0	0	0	0	0	741
4:00	0	1	76	266	250	78	13	1	0	0	0	0	0	685
5:00	0	0	24	177	258	92	9	0	1	0	0	0	0	561
6:00	2	0	15	150	238	112	11	1	0	0	0	0	0	529
7:00	0	0	10	158	176	62	9	1	0	0	0	0	0	416
8:00	0	0	10	76	126	61	6	0	0	1	0	0	0	280
9:00	0	0	3	34	94	48	13	3	0	0	0	0	0	195
10:00	0	0	2	29	70	48	5	4	0	0	0	0	0	158
11:00	0	0	0	7	9	7	4	0	0	0	0	0	0	27
Total	7	16	427	2319	3016	1286	199	23	3	1	0	0	0	7297
			Percentile	15th	50th	85th	95th							
			Speed	27	32	36	39							
			Mean Speed (Average)	31.5										
			10 MPH Pace Speed	25-34										
			Number in Pace	5283										
			Percent in Pace	72.4%										
			Number > 35 MPH	1512										
			Percent > 35 MPH	20.7%										
Grand Total	10	30	773	4007	5997	2772	420	49	5	1	0	0	0	14064
			Percentile	15th	50th	85th	95th							
			Speed	28	32	37	40							
			Mean Speed (Average)	31.9										
			10 MPH Pace Speed	25-34										
			Number in Pace	9900										
			Percent in Pace	70.4%										
			Number > 35 MPH	3247										
			Percent > 35 MPH	23.1%										

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: WB

Site Code: 98290001

9/21/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	1	6	5	5	3	2	0	0	0	0	22
1:00	0	0	0	1	4	8	4	1	0	0	0	0	0	18
2:00	0	0	0	0	2	3	2	1	0	0	0	0	0	8
3:00	0	0	0	6	5	4	3	0	0	0	0	0	0	18
4:00	0	0	0	5	13	22	10	2	0	0	0	0	0	52
5:00	1	0	10	13	48	37	19	2	5	0	0	0	0	135
6:00	0	1	7	35	82	120	55	8	2	0	0	0	0	310
7:00	1	1	13	40	121	201	77	18	1	0	0	0	0	473
8:00	8	5	13	38	136	161	73	7	1	0	0	0	0	442
9:00	1	5	7	32	114	149	52	8	0	0	0	0	0	368
10:00	0	0	4	40	138	161	35	5	0	1	0	0	0	384
11:00	0	1	9	49	199	165	51	10	0	0	0	0	0	484
12:00 PM	1	0	6	38	139	172	71	9	1	0	0	0	0	437
1:00	3	0	6	33	125	207	86	5	1	0	0	0	0	466
2:00	0	0	5	35	136	189	57	10	2	0	0	0	0	434
3:00	6	8	15	35	163	182	77	6	0	0	0	0	0	492
4:00	0	0	6	32	153	275	97	18	3	1	0	0	0	585
5:00	2	1	5	49	214	198	84	5	0	0	0	0	0	558
6:00	0	1	6	35	164	191	38	11	1	0	0	0	0	447
7:00	1	0	4	25	106	107	21	7	0	0	0	0	0	271
8:00	0	0	4	21	87	86	30	5	2	0	0	0	0	235
9:00	3	0	1	13	41	53	17	1	0	0	0	0	0	129
10:00	0	0	3	8	19	37	15	2	1	0	0	0	0	85
11:00	0	0	1	7	11	9	8	1	1	0	0	0	0	38
Total	27	23	125	591	2226	2742	987	145	23	2	0	0	0	6891

	Percentile	15th	50th	85th	95th
	Speed	32	36	41	44

Mean Speed (Average)	35.6
10 MPH Pace Speed	30-39
Number in Pace	4925
Percent in Pace	71.5%
Number > 35 MPH	3899
Percent > 35 MPH	56.6%

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: WB

Site Code: 98290001

9/22/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	2	8	5	4	1	0	0	0	0	0	20
1:00	0	0	1	0	2	3	3	4	0	0	0	0	0	13
2:00	0	0	0	1	10	1	0	1	0	0	0	0	0	13
3:00	0	0	2	0	8	7	1	3	0	0	0	0	0	21
4:00	0	0	2	2	19	19	9	5	2	1	0	0	0	59
5:00	0	0	9	16	33	44	19	6	1	0	0	0	0	128
6:00	0	0	7	25	79	116	48	9	0	0	0	0	0	284
7:00	0	2	13	28	101	178	93	12	3	1	0	0	0	431
8:00	0	0	16	48	108	171	81	12	4	0	0	0	0	440
9:00	0	1	12	31	113	151	62	10	4	0	0	0	0	384
10:00	0	0	7	51	100	169	57	9	1	0	0	0	0	394
11:00	0	1	10	34	132	175	67	9	1	0	0	0	0	429
12:00 PM	0	2	3	20	142	225	59	8	4	0	0	0	0	463
1:00	0	3	8	25	132	202	71	7	1	0	0	0	0	449
2:00	1	2	22	49	171	213	75	7	0	0	0	0	0	540
3:00	0	4	13	58	150	205	68	9	2	0	0	0	0	509
4:00	3	6	23	60	162	237	90	10	4	0	0	0	0	595
5:00	1	1	11	55	188	217	71	11	0	0	0	0	0	555
6:00	0	1	8	63	141	185	51	8	2	0	0	0	0	459
7:00	1	3	7	51	126	70	22	5	1	0	0	0	0	286
8:00	0	2	6	25	71	75	27	6	1	0	0	0	0	213
9:00	1	0	4	11	54	68	18	1	1	0	0	0	0	158
10:00	0	0	1	10	29	43	24	2	1	1	0	0	0	111
11:00	0	0	0	0	8	7	3	1	0	0	0	0	0	19
Total	7	28	185	665	2087	2786	1023	156	33	3	0	0	0	6973
			Percentile	15th	50th	85th	95th							
			Speed	31	36	41	44							
			Mean Speed (Average)	35.6										
			10 MPH Pace Speed	30-39										
			Number in Pace	4831										
			Percent in Pace	69.3%										
			Number > 35 MPH	4001										
			Percent > 35 MPH	57.4%										
Grand Total	34	51	310	1256	4313	5528	2010	301	56	5	0	0	0	13864
			Percentile	15th	50th	85th	95th							
			Speed	31	36	41	44							
			Mean Speed (Average)	35.6										
			10 MPH Pace Speed	30-39										
			Number in Pace	9756										
			Percent in Pace	70.4%										
			Number > 35 MPH	7900										
			Percent > 35 MPH	57.0%										

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: Combined

Site Code: 98290001

9/21/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	5	20	13	9	4	2	0	0	0	0	53
1:00	0	0	0	4	11	11	4	1	0	0	0	0	0	31
2:00	0	0	0	3	4	4	4	1	0	0	0	0	0	16
3:00	0	0	0	8	9	6	5	1	0	0	0	0	0	29
4:00	0	0	2	12	24	28	11	3	0	0	0	0	0	80
5:00	1	0	10	24	71	55	24	4	5	0	0	0	0	194
6:00	0	1	10	59	145	164	75	11	2	0	0	0	0	467
7:00	1	1	19	77	247	288	95	22	1	0	0	0	0	751
8:00	9	5	29	126	274	250	95	7	2	0	0	0	0	797
9:00	1	7	25	112	265	221	62	8	0	0	0	0	0	701
10:00	0	3	38	144	294	239	42	5	0	1	0	0	0	766
11:00	0	1	45	168	352	214	60	11	0	0	0	0	0	851
12:00 PM	1	1	33	181	297	239	80	10	1	0	0	0	0	843
1:00	3	1	19	135	345	298	97	5	1	0	0	0	0	904
2:00	0	2	27	148	371	302	70	12	2	0	0	0	0	934
3:00	7	12	87	240	372	265	85	7	0	0	0	0	0	1075
4:00	0	0	54	237	405	348	103	18	3	1	0	0	0	1169
5:00	2	2	38	251	494	308	92	7	0	0	0	0	0	1194
6:00	1	1	10	105	420	366	54	11	1	0	0	0	0	969
7:00	1	0	9	89	293	221	30	9	0	0	0	0	0	652
8:00	0	0	6	66	222	175	40	6	2	0	0	0	0	517
9:00	3	0	2	53	147	106	35	3	0	0	0	0	0	349
10:00	0	0	5	20	81	78	24	3	1	0	0	0	0	212
11:00	0	0	3	12	44	29	12	2	2	0	0	0	0	104
Total	30	37	471	2279	5207	4228	1208	171	25	2	0	0	0	13658
			Percentile	15th	50th	85th	95th							
			Speed	29	34	39	42							

Mean Speed (Average)	33.9
10 MPH Pace Speed	30-39
Number in Pace	9396
Percent in Pace	68.8%
Number > 35 MPH	5634
Percent > 35 MPH	41.3%

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: Combined

Site Code: 98290001

9/22/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	0	13	23	12	10	2	0	0	0	0	0	60
1:00	0	0	3	5	10	11	3	4	0	0	0	0	0	36
2:00	0	0	0	5	12	5	2	1	0	0	0	0	0	25
3:00	0	0	2	1	12	17	1	3	0	0	0	0	0	36
4:00	0	0	2	3	31	31	14	5	3	1	0	0	0	90
5:00	0	0	9	22	61	65	31	10	2	0	0	0	0	200
6:00	0	0	8	41	147	163	54	10	0	0	0	0	0	423
7:00	1	2	34	88	210	255	106	14	3	1	0	0	0	714
8:00	0	3	43	155	269	251	95	12	4	0	0	0	0	832
9:00	0	1	32	151	272	214	71	11	4	0	0	0	0	756
10:00	1	1	39	167	227	237	61	9	1	0	0	0	0	743
11:00	0	6	34	186	284	244	84	9	1	0	0	0	0	848
12:00 PM	0	3	45	198	319	297	74	8	4	0	0	0	0	948
1:00	3	4	29	188	312	278	78	9	1	0	0	0	0	902
2:00	1	3	63	260	457	283	86	7	0	0	0	0	0	1160
3:00	0	7	69	329	457	299	76	11	2	0	0	0	0	1250
4:00	3	7	99	326	412	315	103	11	4	0	0	0	0	1280
5:00	1	1	35	232	446	309	80	11	1	0	0	0	0	1116
6:00	2	1	23	213	379	297	62	9	2	0	0	0	0	988
7:00	1	3	17	209	302	132	31	6	1	0	0	0	0	702
8:00	0	2	16	101	197	136	33	6	1	1	0	0	0	493
9:00	1	0	7	45	148	116	31	4	1	0	0	0	0	353
10:00	0	0	3	39	99	91	29	6	1	1	0	0	0	269
11:00	0	0	0	7	17	14	7	1	0	0	0	0	0	46
Total	14	44	612	2984	5103	4072	1222	179	36	4	0	0	0	14270
			Percentile	15th	50th	85th	95th							
			Speed	29	34	39	42							
			Mean Speed (Average)	33.5										
			10 MPH Pace Speed	30-39										
			Number in Pace	9153										
			Percent in Pace	64.1%										
			Number > 35 MPH	5513										
			Percent > 35 MPH	38.6%										
Grand Total	44	81	1083	5263	10310	8300	2430	350	61	6	0	0	0	27928
			Percentile	15th	50th	85th	95th							
			Speed	29	34	39	42							
			Mean Speed (Average)	33.7										
			10 MPH Pace Speed	30-39										
			Number in Pace	18549										
			Percent in Pace	66.4%										
			Number > 35 MPH	11147										
			Percent > 35 MPH	39.9%										

Accurate Counts
978-664-2565

Site Code: 982900S1

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: EB

9/30/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	0	0	2	12	20	11	2	0	0	0	0	0	0	47
1:00	0	0	3	8	11	5	2	1	0	0	0	0	0	30
2:00	0	0	0	2	8	8	0	1	0	0	0	0	0	19
3:00	0	0	0	3	6	2	3	0	0	0	0	0	0	14
4:00	0	0	0	5	5	4	1	0	0	0	0	0	0	15
5:00	0	0	3	8	10	2	2	1	0	0	0	0	0	26
6:00	0	0	0	10	21	16	6	0	0	0	0	0	0	53
7:00	0	0	0	14	77	37	7	2	1	0	0	0	0	138
8:00	0	1	0	35	96	62	21	5	0	0	0	0	0	220
9:00	0	0	0	30	175	108	15	3	0	0	0	0	0	331
10:00	0	1	10	48	249	141	20	3	0	0	0	0	0	472
11:00	0	0	0	80	244	126	7	1	0	0	0	1	0	459
12:00 PM	0	0	7	92	315	137	27	0	0	0	0	1	0	579
1:00	0	0	13	55	312	142	33	1	0	0	0	0	0	556
2:00	1	0	6	69	285	130	18	5	0	0	0	0	0	514
3:00	0	0	4	51	279	144	24	4	0	0	0	0	0	506
4:00	2	0	14	70	223	146	15	1	1	0	0	0	0	472
5:00	1	4	11	71	244	121	20	0	0	0	0	0	0	472
6:00	0	1	4	82	212	97	19	2	0	0	0	0	0	417
7:00	0	1	11	55	136	70	9	2	0	0	0	0	0	284
8:00	2	0	3	46	156	66	10	0	1	0	0	0	0	284
9:00	3	1	2	35	111	58	6	2	0	0	0	0	0	218
10:00	2	0	8	34	63	24	4	1	0	0	0	0	0	136
11:00	0	0	0	8	18	6	2	0	0	0	0	0	0	34
Total	11	9	101	923	3276	1663	273	35	3	0	0	2	0	6296
Grand Total	11	9	101	923	3276	1663	273	35	3	0	0	2	0	6296

Stats				
		Percentile	15th	50th	85th	95th
		Speed	30	34	37	40
	Mean Speed (Average)		33.4			
	10 MPH Pace Speed		30-39			
	Number in Pace		4924			
	Percent in Pace		78.2%			
	Number > 35 MPH		1976			
	Percent > 35 MPH		31.4%			

Accurate Counts
978-664-2565

Site Code: 982900S1

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: WB

9/30/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	1	0	2	5	15	17	5	1	0	0	0	0	0	46
1:00	0	0	0	4	14	6	3	2	0	0	0	0	0	29
2:00	0	0	0	3	4	5	3	0	0	0	0	0	0	15
3:00	0	0	0	0	2	7	4	0	0	0	0	0	0	13
4:00	0	0	1	2	8	12	2	0	0	0	0	0	1	26
5:00	0	1	0	2	16	11	3	0	1	0	0	0	0	34
6:00	0	0	0	3	39	39	10	2	0	0	0	0	2	95
7:00	0	0	0	5	61	79	29	4	0	0	1	0	0	179
8:00	0	0	6	19	68	153	41	8	0	0	0	0	2	297
9:00	0	0	1	35	132	186	61	3	4	0	0	0	0	422
10:00	1	1	2	25	194	236	47	4	1	0	0	0	0	511
11:00	0	0	2	31	195	295	47	2	0	0	0	0	0	572
12:00 PM	0	0	2	22	227	280	62	6	0	0	1	0	0	600
1:00	0	1	7	25	169	222	62	4	0	2	0	0	0	492
2:00	1	0	1	23	157	226	55	4	0	0	0	0	0	467
3:00	0	0	2	19	171	191	43	7	0	0	0	0	0	433
4:00	1	0	9	30	161	202	49	3	0	1	0	0	0	456
5:00	4	2	1	21	140	197	40	7	0	0	0	0	0	412
6:00	0	3	1	24	174	148	25	0	0	0	0	0	0	375
7:00	1	0	1	35	118	69	22	2	0	0	0	0	0	248
8:00	3	0	0	12	86	75	23	3	0	0	0	0	0	202
9:00	5	0	1	12	38	55	14	3	0	0	0	0	1	129
10:00	3	2	1	18	40	32	6	1	0	0	0	0	0	103
11:00	0	0	0	2	9	8	3	2	0	1	0	0	0	25
Total	20	10	40	377	2238	2751	659	68	6	4	2	0	6	6181
Grand Total	20	10	40	377	2238	2751	659	68	6	4	2	0	6	6181

Stats					
		Percentile	15th	50th	85th	95th
		Speed	32	35	40	42
	Mean Speed (Average)		35.7			
	10 MPH Pace Speed		30-39			
	Number in Pace		4942			
	Percent in Pace		80.0%			
	Number > 35 MPH		3496			
	Percent > 35 MPH		56.6%			

Accurate Counts
978-664-2565

Location : Pleasant Valley Street
Location : West of Route 213
City/State: Methuen, MA
Direction: Combined

Site Code: 982900S1

9/30/2023 Time	0 - 15 MPH	> 15 - 20 MPH	> 20 - 25 MPH	> 25 - 30 MPH	> 30 - 35 MPH	> 35 - 40 MPH	> 40 - 45 MPH	> 45 - 50 MPH	> 50 - 55 MPH	> 55 - 60 MPH	> 60 - 65 MPH	> 65 - 70 MPH	> 70 MPH	Total
12:00 AM	1	0	4	17	35	28	7	1	0	0	0	0	0	93
1:00	0	0	3	12	25	11	5	3	0	0	0	0	0	59
2:00	0	0	0	5	12	13	3	1	0	0	0	0	0	34
3:00	0	0	0	3	8	9	7	0	0	0	0	0	0	27
4:00	0	0	1	7	13	16	3	0	0	0	0	0	1	41
5:00	0	1	3	10	26	13	5	1	1	0	0	0	0	60
6:00	0	0	0	13	60	55	16	2	0	0	0	0	2	148
7:00	0	0	0	19	138	116	36	6	1	0	1	0	0	317
8:00	0	1	6	54	164	215	62	13	0	0	0	0	2	517
9:00	0	0	1	65	307	294	76	6	4	0	0	0	0	753
10:00	1	2	12	73	443	377	67	7	1	0	0	0	0	983
11:00	0	0	2	111	439	421	54	3	0	0	0	1	0	1031
12:00 PM	0	0	9	114	542	417	89	6	0	0	1	1	0	1179
1:00	0	1	20	80	481	364	95	5	0	2	0	0	0	1048
2:00	2	0	7	92	442	356	73	9	0	0	0	0	0	981
3:00	0	0	6	70	450	335	67	11	0	0	0	0	0	939
4:00	3	0	23	100	384	348	64	4	1	1	0	0	0	928
5:00	5	6	12	92	384	318	60	7	0	0	0	0	0	884
6:00	0	4	5	106	386	245	44	2	0	0	0	0	0	792
7:00	1	1	12	90	254	139	31	4	0	0	0	0	0	532
8:00	5	0	3	58	242	141	33	3	1	0	0	0	0	486
9:00	8	1	3	47	149	113	20	5	0	0	0	0	1	347
10:00	5	2	9	52	103	56	10	2	0	0	0	0	0	239
11:00	0	0	0	10	27	14	5	2	0	1	0	0	0	59
Total	31	19	141	1300	5514	4414	932	103	9	4	2	2	6	12477
Grand Total	31	19	141	1300	5514	4414	932	103	9	4	2	2	6	12477

Stats	Percentile	15th	50th	85th	95th
	Speed	30	35	38	41

Mean Speed (Average)	34.6
10 MPH Pace Speed	30-39
Number in Pace	9866
Percent in Pace	79.1%
Number > 35 MPH	5472
Percent > 35 MPH	43.9%

MASSDOT CRASH RATE WORKSHEET AND HIGH CRASH LOCATION MAPPING

Moving Massachusetts Forward. massDOT Highway

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Methuen COUNT DATE : 9/21/2023

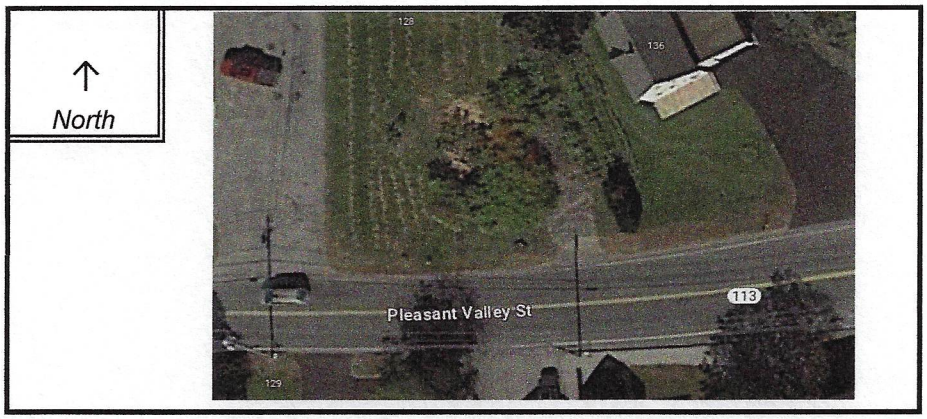
DISTRICT : 4 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Pleasant Valley Street (Route 113)

MINOR STREET(S) : 128 Pleasant Valley Street Driveway

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	-	0	610	605		1,215

" K " FACTOR : 0.090

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : 13,500

TOTAL # OF CRASHES : 1

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : 0.20

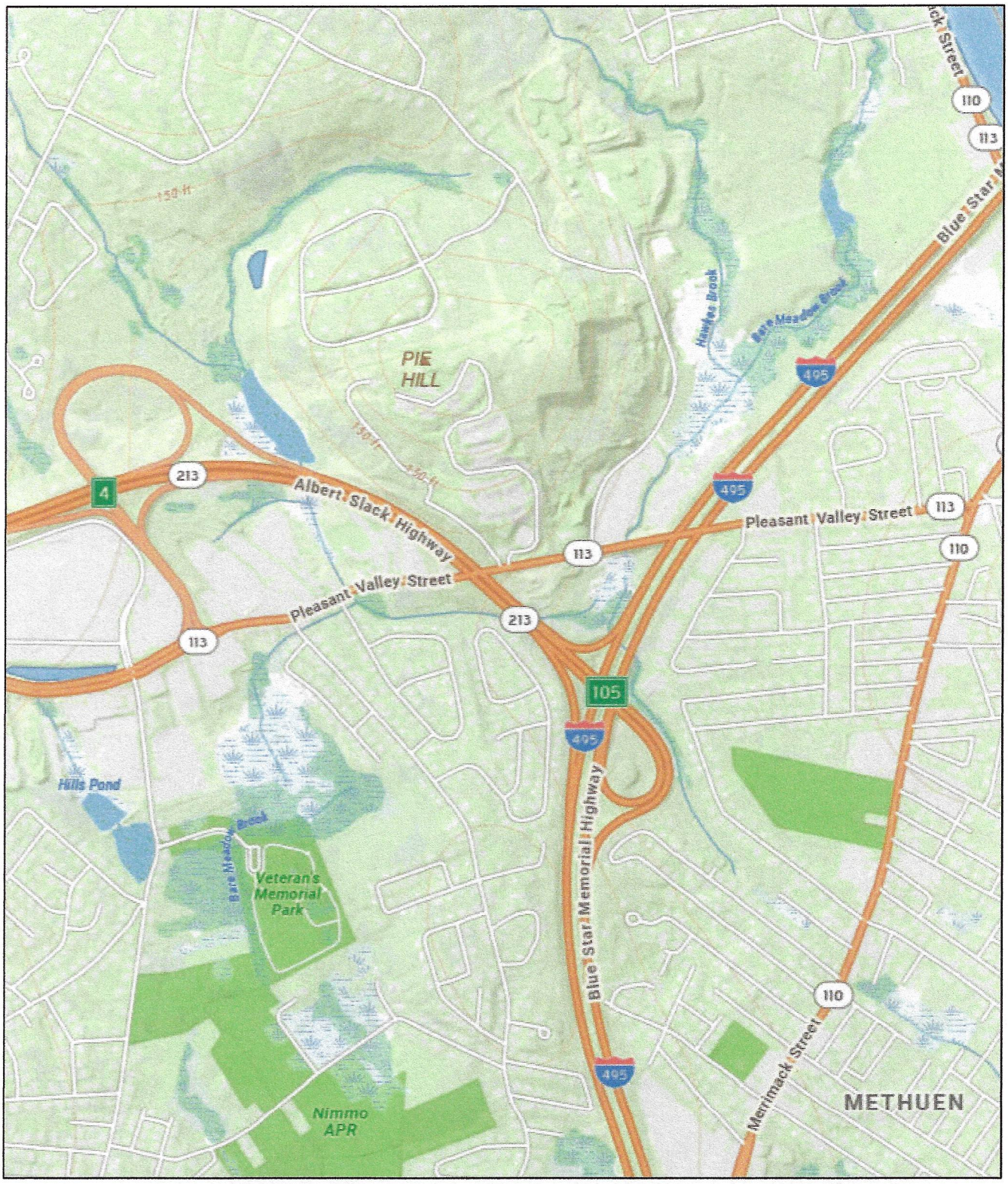
CRASH RATE CALCULATION : 0.04

RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : Below MassDOT Statewide and District Average Crash Rates

Project Title & Date: 9829 - Proposed Car Wash

MassDOT Top Crash Locations



10/6/2023, 4:50:21 PM

1:18,056

0 0.1 0.2 0.4 mi

0 0.17 0.35 0.7 km

MassDOT

GENERAL BACKGROUND TRAFFIC GROWTH

General Background Traffic Growth - Daily Traffic Volumes

CITY/TOWN	ROUTE/STREET	LOCATION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual Growth
Methuen	Pleasant Valley Street (Route 113)	West of I-495						11,944	12,219	12,977	13,198	13,238	13,185	**2.02%**
Methuen	Albert Slack Highway	West of I-495	49,972	50,122	53,370	53,002	52,638	53,480	55,619	58,289	58,755	59,343	60,530	**1.96%**
Methuen	Ramp - I-495 SB to Route 213 WB	Exit 47, Route 213				14,910	14,578	14,491	14,839			15,817	14,984	**-1.42%**
Methuen	Ramp - I-495 NB to Route 213 WB	Exit 47, Route 214				12,523	11,418	11,601	12,065	12,644	12,745	12,872	11,323	**-1.24%**
Methuen	Ramp - Route 213 EB to I-495 NB	Exit 5B, I-495				16,119	15,510	15,758	16,388	17,175	17,312	17,485	14,127	**-1.54%**
Methuen	Ramp - Route 213 EB to I-495 SB	Exit 5A, I-496					11,192	11,125	11,392			12,143	11,445	**-1.32%**
Methuen	I-495	Between Routes 113 and 213 Connector		105,714	107,841	109,935	109,430	108,773	109,907	120,167	119,410	121,436	118,397	**1.32%**
Methuen	Milk Street	Sout of Pleasant Valley Street (Route 113)										5,449	5,427	**-0.40%**
Methuen	Pleasant Valley Street (Route 113)	East of Prospect Street					14,543	14,994	15,339	16,310	16,587	16,637	16,570	**2.22%**
Methuen	Ramp - Route 113 to Route 213 EB	Pleasant Valley Street (Route 113)				5,062	5,056	5,137	5,342			5,694	5,671	**1.27%**
Methuen	Ramp - Route 213 EB to Route 113	Exit 4, Route 113				4,869	4,867	4,945	5,143			5,482	5,460	**1.29%**
Methuen	Ramp - Route 113 to Route 213 WB	Pleasant Valley Street (Route 113)				3,762	3,761	3,878	3,967	4,213	4,285	4,298	4,281	**1.89%**
Methuen	Ramp - Route 213 WB to Route 113	Exit 4, Route 113				4,709	4,707	4,853	4,965	5,273	5,363	5,379	5,357	**1.88%**
Methuen	East Street	East of I-495	16,200	16,102	16,723	15,476	15,507	15,988	15,729	16,704	16,988	17,679	17,608	**0.90%**
														0.63%

TRIP-GENERATION CALCUALTIONS

Graph Look Up

Query | Filter

DATA SOURCE:
Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE:
948

LAND USE GROUP:
(900-999) Services

LAND USE :
948 - Automated Car Wash

LAND USE SUBCATEGORY:
All Sites

SETTING/LOCATION:
General Urban/Suburban

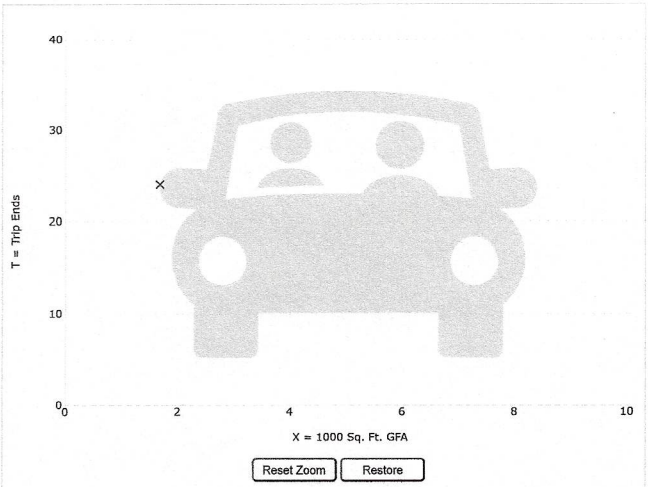
INDEPENDENT VARIABLE (IV):
1000 Sq. Ft. GFA

TIME PERIOD:
Weekday, Peak Hour of Adjacent Street Traffic

TRIP TYPE:
Vehicle

ENTER IV VALUE TO CALCULATE TRIPS:
1.5 Calculate

Data Plot and Equation ***Caution – Small Sample Size***



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Automated Car Wash (948) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Weekday
Peak Hour of Adjacent Street Traffic
One Hour Between 4 and 6 p.m.

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
1

Avg. 1000 Sq. Ft. GFA:
2

Average Rate:
14.20

Range of Rates:
14.20 - 14.20

Standard Deviation:
****

Fitted Curve Equation:
Not Given

R^2:
****

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 21 (Total), 11 (Entry), 10 (Exit)

Graph Look Up

Query | Filter

DATA SOURCE: Trip Generation Manual, 11th Ed

SEARCH BY LAND USE CODE: 948

LAND USE GROUP: (900-999) Services

LAND USE : 948 - Automated Car Wash

LAND USE SUBCATEGORY: All Sites

SETTING/LOCATION: General Urban/Suburban

INDEPENDENT VARIABLE (IV): 1000 Sq. Ft. GFA

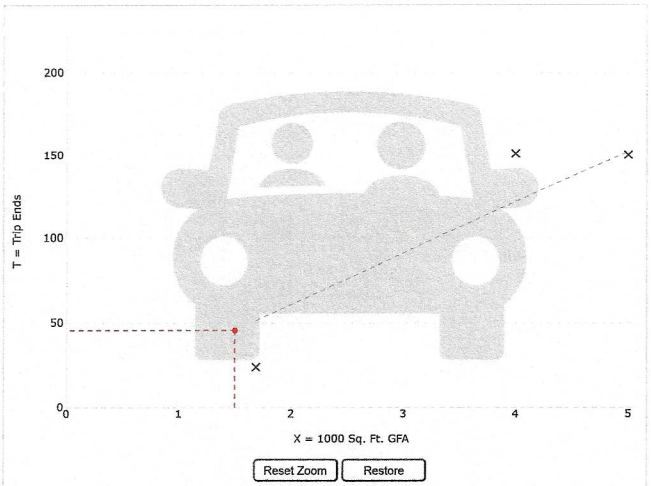
TIME PERIOD: Saturday, Peak Hour of Generator

TRIP TYPE: Vehicle

ENTER IV VALUE TO CALCULATE TRIPS: 1.5 Calculate

Data Plot and Equation

Caution – Small Sample Size



Use the mouse wheel to Zoom Out or Zoom In.
Hover the mouse pointer on data points to view X and T values.

DATA STATISTICS

Land Use:
Automated Car Wash (948) Click for Description and Data Plots

Independent Variable:
1000 Sq. Ft. GFA

Time Period:
Saturday
Peak Hour of Generator

Setting/Location:
General Urban/Suburban

Trip Type:
Vehicle

Number of Studies:
3

Avg. 1000 Sq. Ft. GFA:
4

Average Rate:
30.40

Range of Rates:
14.20 - 37.75

Standard Deviation:
9.63

Fitted Curve Equation:
Not Given

R^2:
****

Directional Distribution:
50% entering, 50% exiting

Calculated Trip Ends:
Average Rate: 46 (Total), 23 (Entry), 23 (Exit)

Proposed Car Wash

Theoretical Daily Rate

$ITE\ LUC\ 947\ Average\ Weekday\ Rate = 108.00$
$ITE\ LUC\ 947\ Weekday\ Evening\ Peak\ Hour\ Rate = 5.54$
$ITE\ LUC\ 948\ Weekday\ Evening\ Peak\ Hour\ Rate = 14.20$
$$ITE\ LUC\ 948\ PM \times \frac{ITE\ LUC\ 947\ Avg.Weekday}{ITE\ LUC\ 947\ PM} = Theoretical\ Avg.Weekday\ Rate$$
$$14.20 \times \frac{108.00}{5.54} = 276.82$$
$T = 1.500 \times 276.82 = 415.23$
$T \approx 416\ [208\ Enter - 208\ Exit]$

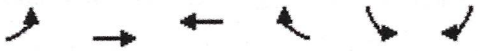
Weekday Morning Peak-Hour Traffic Volumes

$ITE\ LUC\ 947\ Average\ Weekday\ Rate = 108.00$
$ITE\ LUC\ 947\ Weekday\ Morning\ Peak\ Hour\ Rate = 8.00\ (50\%\ Entering, 50\%\ Exiting)$
$$\%\ of\ Daily\ Total\ During\ AM\ Peak\ Hour = \frac{8.00}{108.00} = 7.4\%\ of\ Daily\ Entering\ Traffic$$
$Calculated\ Daily\ Traffic = 416\ [208\ Enter - 208\ Exit]$

$416 \times 0.074 = 30.78 \approx 31$

$T = 31\ [16\ Entering - 15\ Exiting]$

CAPACITY ANALYSIS WORKSHEETS



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	314	501	0	0	0
Future Volume (vph)	0	314	501	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	388	563	0	0	0
Lane Group Flow (vph)	0	388	563	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

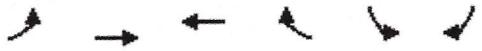
Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	314	501	0	0	0
Future Vol, veh/h	0	314	501	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	81	81	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	388	563	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	563	0	-	0	951	563
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	388	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1008	-	-	-	288	526
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	686	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1008	-	-	-	288	526
Mov Cap-2 Maneuver	-	-	-	-	288	-
Stage 1	-	-	-	-	570	-
Stage 2	-	-	-	-	686	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1008	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	610	605	0	0	0
Future Volume (vph)	0	610	605	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	685	630	0	0	0
Lane Group Flow (vph)	0	685	630	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	610	605	0	0	0
Future Vol, veh/h	0	610	605	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	96	96	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	685	630	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	630	0	-	0	1315	630
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	685	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	952	-	-	-	174	482
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	500	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	952	-	-	-	174	482
Mov Cap-2 Maneuver	-	-	-	-	174	-
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	500	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	952	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	600	580	0	0	0
Future Volume (vph)	0	600	580	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	659	611	0	0	0
Lane Group Flow (vph)	0	659	611	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	600	580	0	0	0
Future Vol, veh/h	0	600	580	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	659	611	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	611	0	-	0	1270	611
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	659	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	968	-	-	-	186	494
Stage 1	-	-	-	-	542	-
Stage 2	-	-	-	-	515	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	968	-	-	-	186	494
Mov Cap-2 Maneuver	-	-	-	-	186	-
Stage 1	-	-	-	-	542	-
Stage 2	-	-	-	-	515	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	968	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	337	537	0	0	0
Future Volume (vph)	0	337	537	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	416	603	0	0	0
Lane Group Flow (vph)	0	416	603	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	337	537	0	0	0
Future Vol, veh/h	0	337	537	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	81	81	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	416	603	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	603	0	-	0	1019	603
Stage 1	-	-	-	-	603	-
Stage 2	-	-	-	-	416	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	975	-	-	-	263	499
Stage 1	-	-	-	-	546	-
Stage 2	-	-	-	-	666	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	975	-	-	-	263	499
Mov Cap-2 Maneuver	-	-	-	-	263	-
Stage 1	-	-	-	-	546	-
Stage 2	-	-	-	-	666	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	975	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	654	649	0	0	0
Future Volume (vph)	0	654	649	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	735	676	0	0	0
Lane Group Flow (vph)	0	735	676	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	654	649	0	0	0
Future Vol, veh/h	0	654	649	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	96	96	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	735	676	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	676	0	-	0	1411	676
Stage 1	-	-	-	-	676	-
Stage 2	-	-	-	-	735	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	915	-	-	-	152	453
Stage 1	-	-	-	-	505	-
Stage 2	-	-	-	-	474	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	915	-	-	-	152	453
Mov Cap-2 Maneuver	-	-	-	-	152	-
Stage 1	-	-	-	-	505	-
Stage 2	-	-	-	-	474	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	915	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	643	622	0	0	0
Future Volume (vph)	0	643	622	0	0	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1987	2111	0	1614	0
Flt Permitted						
Satd. Flow (perm)	0	1987	2111	0	1614	0
Adj. Flow (vph)	0	707	655	0	0	0
Lane Group Flow (vph)	0	707	655	0	0	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

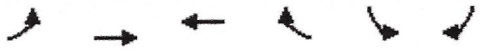
Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	643	622	0	0	0
Future Vol, veh/h	0	643	622	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	91	91	95	95	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	707	655	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	655	0	-	0	1362	655
Stage 1	-	-	-	-	655	-
Stage 2	-	-	-	-	707	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	932	-	-	-	163	466
Stage 1	-	-	-	-	517	-
Stage 2	-	-	-	-	489	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	932	-	-	-	163	466
Mov Cap-2 Maneuver	-	-	-	-	163	-
Stage 1	-	-	-	-	517	-
Stage 2	-	-	-	-	489	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	932	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	8	337	537	8	7	8
Future Volume (vph)	8	337	537	8	7	8
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.929	
Flt Protected		0.999			0.977	
Satd. Flow (prot)	0	1985	2107	0	1691	0
Flt Permitted		0.999			0.977	
Satd. Flow (perm)	0	1985	2107	0	1691	0
Adj. Flow (vph)	10	416	603	9	8	9
Lane Group Flow (vph)	0	426	612	0	17	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	8	337	537	8	7	8
Future Vol, veh/h	8	337	537	8	7	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	81	81	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	416	603	9	8	9

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	612	0	-	0	1044	608
Stage 1	-	-	-	-	608	-
Stage 2	-	-	-	-	436	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	967	-	-	-	254	496
Stage 1	-	-	-	-	543	-
Stage 2	-	-	-	-	652	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	967	-	-	-	251	496
Mov Cap-2 Maneuver	-	-	-	-	251	-
Stage 1	-	-	-	-	536	-
Stage 2	-	-	-	-	652	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	16.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	967	-	-	-	341
HCM Lane V/C Ratio	0.01	-	-	-	0.048
HCM Control Delay (s)	8.8	0	-	-	16.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	6	654	649	5	5	5
Future Volume (vph)	6	654	649	5	5	5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.999		0.932	
Flt Protected					0.976	
Satd. Flow (prot)	0	1987	2109	0	1694	0
Flt Permitted					0.976	
Satd. Flow (perm)	0	1987	2109	0	1694	0
Adj. Flow (vph)	7	735	676	5	5	5
Lane Group Flow (vph)	0	742	681	0	10	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	654	649	5	5	5
Future Vol, veh/h	6	654	649	5	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	89	89	96	96	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	735	676	5	5	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	681	0	-	0	1428	679
Stage 1	-	-	-	-	679	-
Stage 2	-	-	-	-	749	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	912	-	-	-	149	452
Stage 1	-	-	-	-	504	-
Stage 2	-	-	-	-	467	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	912	-	-	-	147	452
Mov Cap-2 Maneuver	-	-	-	-	147	-
Stage 1	-	-	-	-	497	-
Stage 2	-	-	-	-	467	-

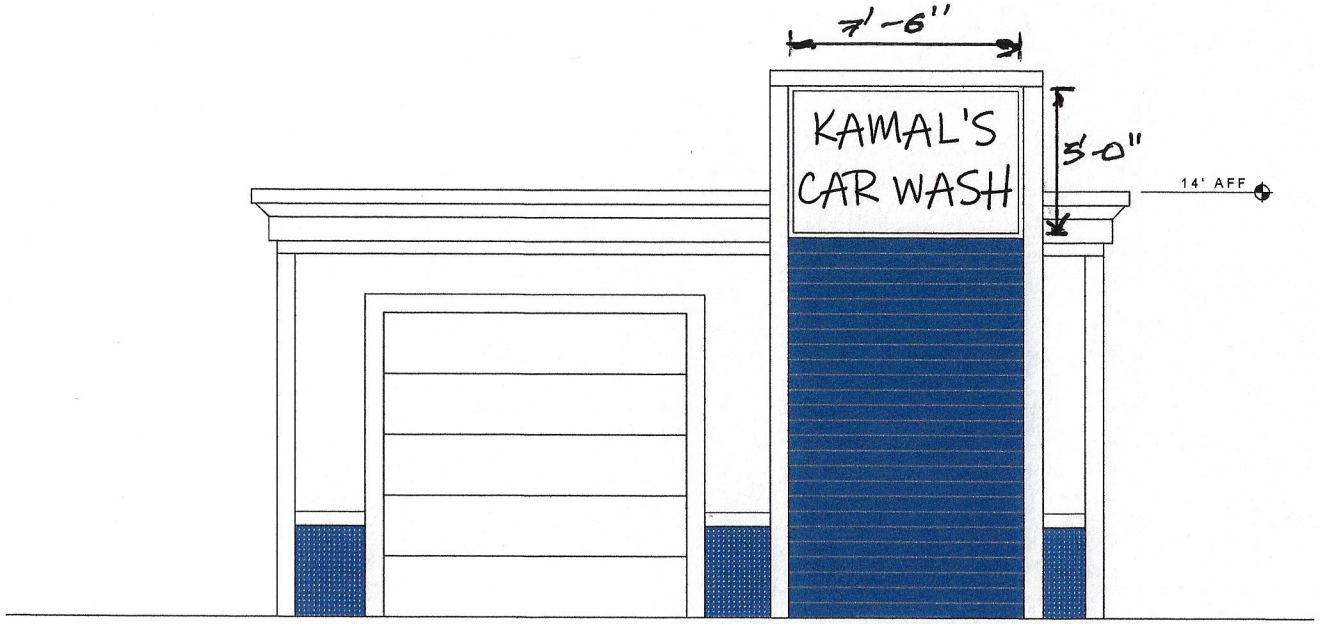
Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	22
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	912	-	-	-	222
HCM Lane V/C Ratio	0.007	-	-	-	0.049
HCM Control Delay (s)	9	0	-	-	22
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	12	643	622	11	11	12
Future Volume (vph)	12	643	622	11	11	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.998		0.930	
Flt Protected		0.999			0.977	
Satd. Flow (prot)	0	1985	2107	0	1693	0
Flt Permitted		0.999			0.977	
Satd. Flow (perm)	0	1985	2107	0	1693	0
Adj. Flow (vph)	13	707	655	12	12	13
Lane Group Flow (vph)	0	720	667	0	25	0
Sign Control		Free	Free		Stop	

Intersection Summary
Control Type: Unsignalized

SIGN INFORMATION



SCALE: 1/4"=1'

#	Revision
1	Draft 8/15/23
2	Draft 8/28/23
3	Draft 11/1/23

KAMAL'S CAR WASH
METHUEN, MA
ELEVATION

DRAWING NO.
A202

DATE: AUGUST 15, 2023
DRAWN BY: DC
CHECKED BY:

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