#### Appendix A

A total of (7) structures were identified to be inspected but were inaccessible. These are listed in **Table A.5** and include a description as to why they were not inspected.

Table A.5 - Inaccessible Manholes

Structure ID	Structure Location	Comment
A-5029	Gorham St / Holland St	Suspect MH buried or does not exist
S2-1566	Cross St / Pearl St	Steel plate potentially covering MH
S2-1579		MH cover broken
1-5284	Community Path / Buena Vista	Suspect MH buried or does not exist
1-5433	Rd / Meacham Rd	Suspect MH buried or does not exist
1-6433		Suspect MH buried or does not exist
1-6434		Suspect MH buried or does not exist

During the field investigations a confined space entry was attempted within the drain manhole at the intersection of Medford Street and School Street. This structure is not listed within the City's GIS and was therefore given a manhole ID of 30-5112A, since it is located downstream from manhole 30-5112 on School Street. A confined space entry was not conducted within 30-5112A due to the gas meter alarm Lower Explosive Limit (LEL) readings that were above allowable limits. A petroleum odor along with an orange stain was observed from an inlet coming from the northwest side of Medford Street (See **Figure A.9**). The orange stain can be a sign of petroleum infiltrating through groundwater. A gas station is located at the intersection of Medford Street and School Street.



Figure A.9 – MH 30-5112A observed petroleum odors and orange discoloration



#### Appendix A

#### Recommendations

The field investigations that were conducted will improve the accuracy of the City's hydraulic model. Alongside the model improvements, it is recommended the City update their GIS for overall connectivity and to further capture the findings from the fieldwork.

In some scenarios, the manhole inspection findings raised additional questions as to overall system connectivity. Assumptions in these cases were made in the hydraulic model. CCTV is recommended to further refine the City's GIS and hydraulic model in the following areas:

- Broadway Street / Cross Street:
  - o Determine extent of 12" VCP sleeved pipe within mainline combined sewer
  - o Confirm source of connections into S2-2141 from Cross Street
- College Avenue:
  - Determine source of 24-inch connection into box culvert accessible through entry of CA-5916
- Cross Street / Pearl Street:
  - o Confirm connectivity between numerous manholes in intersection
- Elm Street / Chester St:
  - Determine connectivity of drain and combined sewer
- Mystic Avenue / McGrath Highway / Foss Park:
  - o Numerous unknowns within system connectivity
- Tannery Brook Conduit:
  - Evaluate condition of conduit
  - Portion of CS/SS and potentially the Tannery Brook Conduit goes under #69 Gold Star Rd in Cambridge and should be assessed for condition and potentially rerouted. Other sections of conduit extending under buildings should be evaluated

The structures identified with flap gates, debris, corrosion, or fractures should be evaluated to determine if maintenance or repairs are needed. The source of the petroleum odors and orange discoloration within drain manhole 30-5112A at School Street and Medford Street should be mitigated. In addition, it is recommended the structures that are shown in the City's GIS, but not found in the field, should be investigated with a metal detector and raised to grade for access if they exist.

#### **Appendix**

Appendix F – Manhole Inspection Table

Appendix G - Manhole Inspection Reports

Appendix H - Confined Space Entry Notes

Appendix I – City GIS Markups



# **APPENDIX B**

**Data Gap Analysis** 

#### Appendix B

This section summarizes the gaps or issues found in the data provided by the City of Somerville in order to expand and refine its *InfoWorks ICM* Hydraulic Model in the tributary areas of flow meters and the methodology used to bridge the data gaps in the model.

#### 1. Manholes with missing data:

- A total of 90 manholes out of 121 had missing rim elevations. Rim elevations for these manholes were updated based on LiDAR data.
- Node invert elevations were filled in by subtracting manhole depths, where available, from rim
  elevations or by assigning the lowest upstream elevation of any of the conduits exiting the
  manhole.

#### 2. Conduits with missing data:

- A total of 70 conduits out of 118 had missing either upstream or downstream invert elevation.
   Missing invert elevations were updated with the help of Infoworks ICM inference routine.
- A total of 26 conduits out of 118 had missing size (diameter). Missing conduit size was filled
  by adopting the diameter of the nearest upstream or downstream conduit, in that order, with
  available data.

#### 3. Discrepancy between GIS data and field data:

At two locations (CA-2397, Holland St and CA-2398, Morrison Ave), field data for pipe invert
elevations updated in model was creating step-up with the downstream conduit data from
City's GIS. At these locations, City GIS data was ignored, and field data was retained as it
was in the model.

#### 4. Connectivity issues in City's GIS data:

At Mystic Ave, downstream connectivity of manhole S2-6086 was missing in the City's GIS
data. In the model, connectivity is assumed to MH 30-5476 looking at the pipe sizes and
invert elevations.



## Appendix B

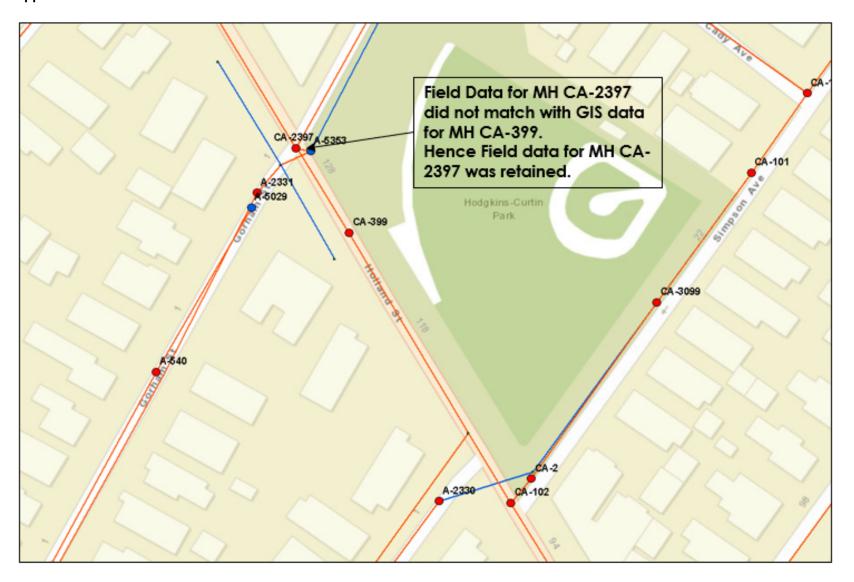


Figure B1. Discrepancy between City's GIS data and Field data at Holland Street



## Appendix B

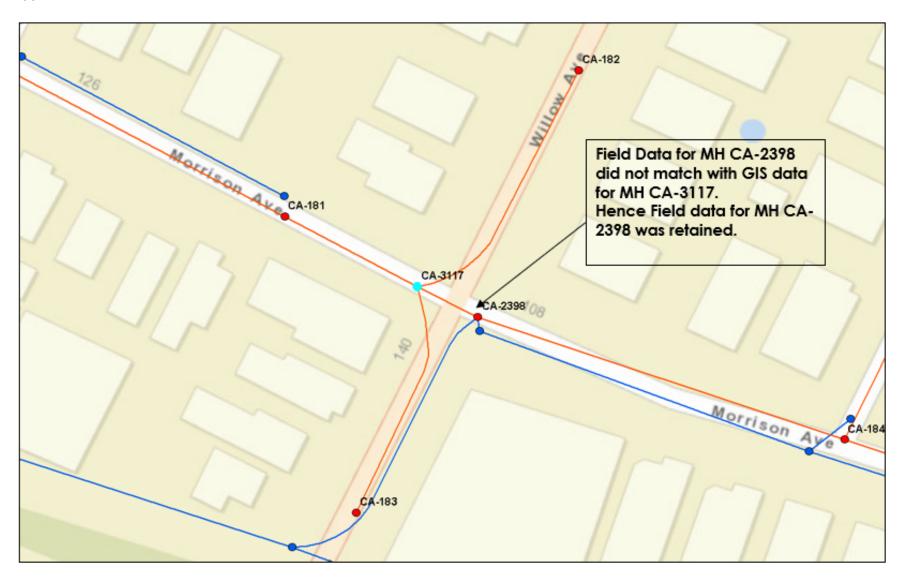


Figure B2. Discrepancy between City's GIS data and Field data at Morrison Avenue



### Appendix B

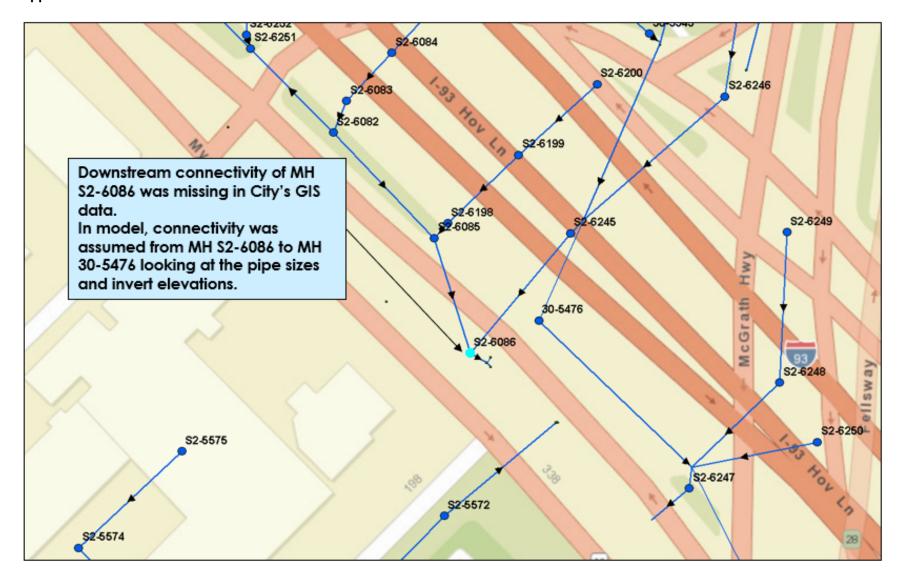


Figure B3. Connectivity Issues in City's GIS data at Mystic Avenue



# **APPENDIX C**

**Comparison Between Metered and Modeled DWFs** 



Table C.1: Comparison Between Metered and Modeled Peak DWFs

Flore Mater Nove	Outstand Tomas	Peak Dry Weather Flow (MGD)		
Flow Meter Name	System Type	Meter	Model	% Difference
Tannery Br North (2)	Combined	0*	0	0
School St	Storm	0	0	0
Marshall St**	Storm	0.87	0.84	-3%
North St	Storm	0	0	0
Pearl St	Combined	0.81	0.81	0%
Newton St	Combined	0.53	0.57	8%
Murdock Street	Combined	0	0	0
Mystic Ave	Combined	0	0	0
Grove St	Combined	2.01	1.87	-7%
Palmer Avenue	Combined	0.06*	0.12	N/A*
Tannery Br	Combined	1.32	1.27	-4%
Mystic 72in	Storm	0	0	0
Properzi Way	Combined	0.22	0.19	-14%

<sup>\*</sup> Random spikes, suspected meter error. Likely cause due to meter malfunction thus set to zero.



<sup>\*\*</sup> Marshall Street meter is installed in storm drain. This meter records diurnal flow during DWF condition. This is possibly due to cross connection between combined and storm system at manhole CA-784 located at junction of Glenwood Road and Vernon Street. The model also predicts a good calibration at Marshall Street meter.

Table C.2: Comparison Between Metered and Modeled Cumulative DWF Volumes

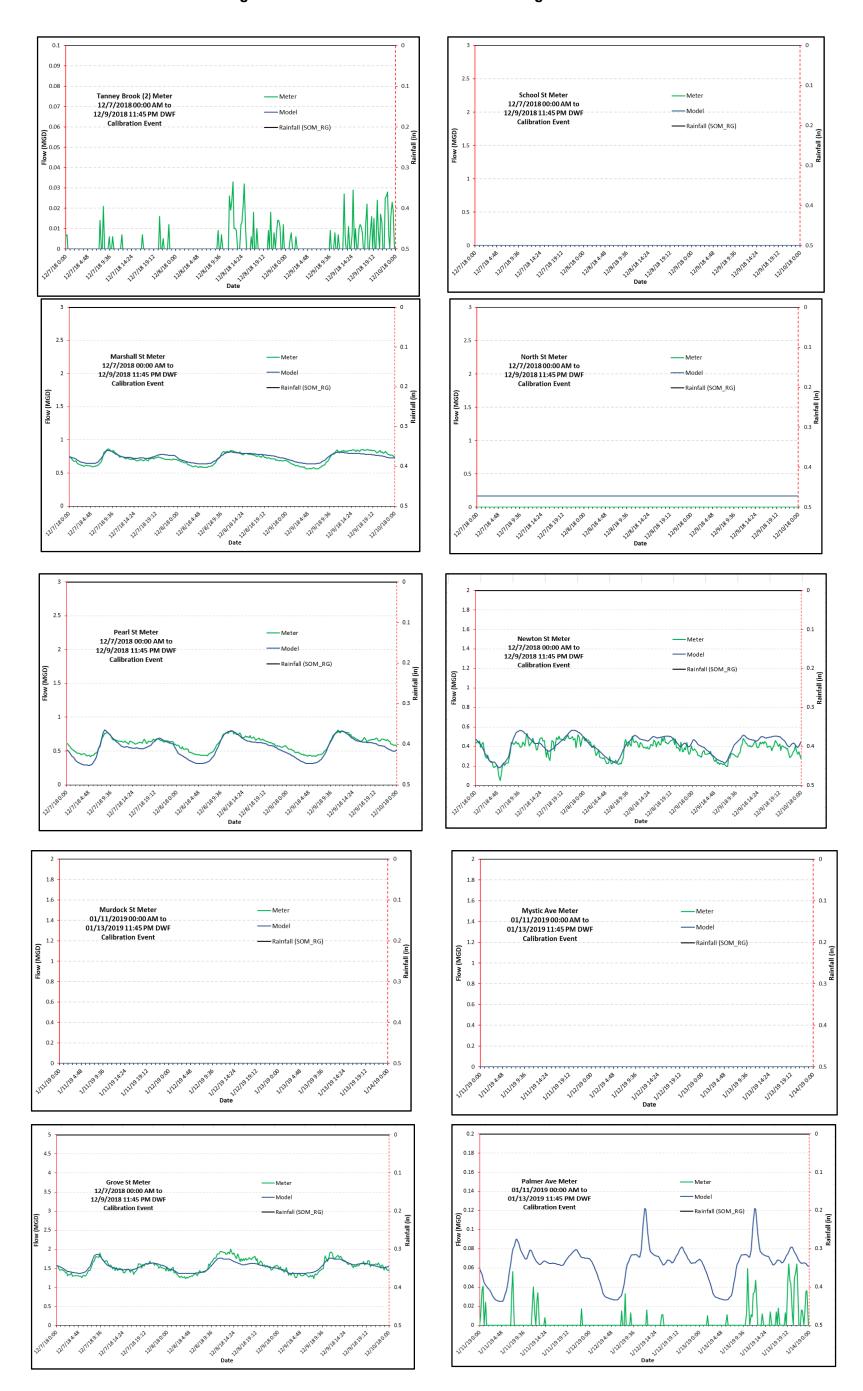
Flour Motor Nove	Occatava Terra	Cumul	Cumulative DWF Volumes (MGD)		
Flow Meter Name	System Type	Meter	Model	% Difference	
Tannery Br North (2)	Combined	0	0	0	
School St	Storm	0	0	0	
Marshall St**	Storm	2.16	2.21	2%	
North St	Storm	0	0	0	
Pearl St	Combined	1.82	1.64	-10%	
Newton St	Combined	1.12	1.26	13%	
Murdock Street	Combined	0	0	0	
Mystic Ave	Combined	0	0	0	
Grove St	Combined	4.66	4.65	0%	
Palmer Avenue*	Combined	0.01	0.19	0.18	
Tannery Br	Combined	3.35	2.8	-16%	
Mystic 72in	Storm	0	0	0	
Properzi Way	Combined	0.5	0.55	10%	

<sup>\*</sup> Random spikes, suspected meter error, thus actual flow difference presented instead.

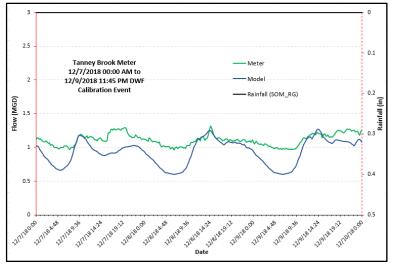


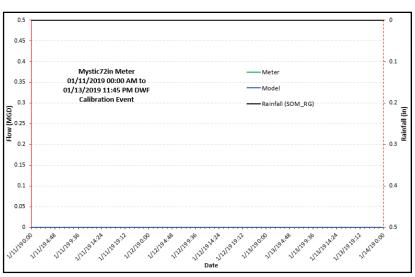
<sup>\*\*</sup> Marshall Street meter is installed in storm drain. This meter records diurnal flow during DWF condition. This is possibly due to cross connection between combined and storm system at manhole CA-784 located at junction of Glenwood Road and Vernon Street. The model also predicts a good calibration at Marshall Street meter.

Figure C.1 Metered vs. Modeled Flows During DWF









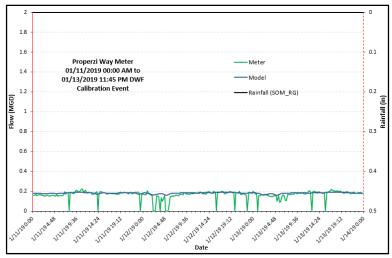




Table C.3: Comparison Between Metered and Modeled DWF Peak Water Depth

Flow Meter Name	System Type		Water Depth (ft)		
Flow Meter Name	System Type	Meter Mode		Difference	
Tannery Br North (2)	Combined	0.11	0.13	0.02	
School St	Storm	0.26	0.08	-0.18	
Marshall St**	Storm	0.35	0.41	0.06	
North St	Storm	0	0	0	
Pearl St	Combined	1.38	1.17	-0.21	
Newton St	Combined	0.96	0.83	-0.13	
Murdock Street	Combined	0.88	0.72	-0.16	
Mystic Ave	Combined	1.6	0.2	-1.4	
Grove St	Combined	0.8	0.96	0.16	
Palmer Avenue*	Combined	0.5	0.27	-0.23	
Tannery Br	Combined	0.28	0.47	0.19	
Mystic 72in	Storm	2	1.49	-0.51	
Properzi Way	Combined	0.63	0.69	0.06	

<sup>\*\*</sup> Marshall Street meter is installed in storm drain. This meter records diurnal flow during DWF condition. This is possibly due to cross connection between combined and storm system at manhole CA-784 located at junction of Glenwood Road and Vernon Street. The model also predicts a good calibration at Marshall Street meter.



# **APPENDIX D**

**Comparison Between Metered and Modeled WWFs** 



Table D.1: Comparison Between Metered and Modeled Peak WWF During Calibration Storms

Fl. M. ( N	Storm for which the	Peak Wet Weather Flow (MGD)		
Flow Meter Name	model is calibrated	Meter	Model	% Difference
Tannery Br North (2)	November 2, 2018	2.41	2.703	12%
School St	November 2, 2018	0.554	0.8	44%
Marshall St	December 21,2018	27.6	28.9	5%
North St	November 2, 2018	1.31	1.18	-10%
Pearl St	November 2, 2018	4.52	4.56	1%
Newton St	November 2, 2018	7.7	7.71	0%
Murdock Street	December 21,2018	0.4	0.53	33%
Mystic Ave	December 21,2018	3.5	4.42	26%
Grove St	November 2, 2018	6.1	7.3	20%
Palmer Avenue	December 21,2018	0.309	0.288	-7%
Tannery Br	November 2, 2018	33	26	-21%
Mystic 72in	December 21,2018	4.8	2.54	-47%
Properzi Way	December 21,2018	1.28	1.12	-13%

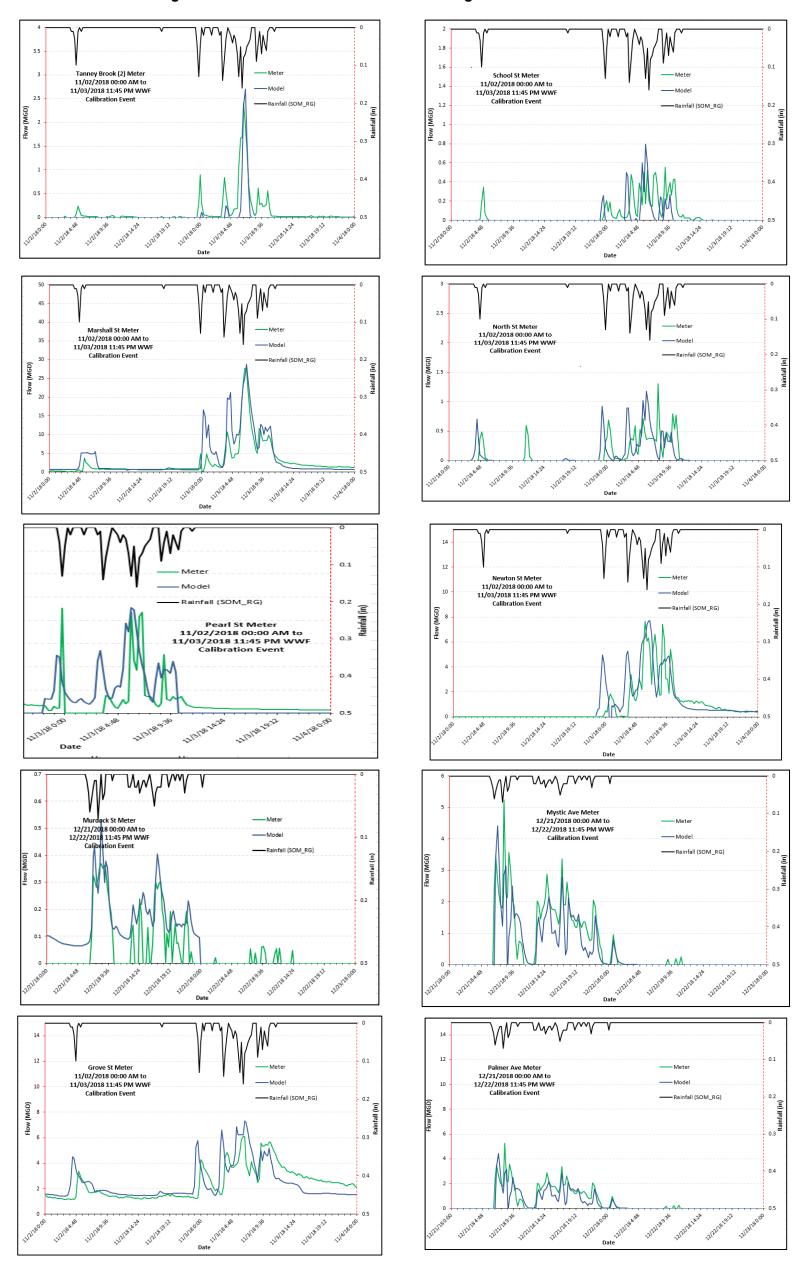


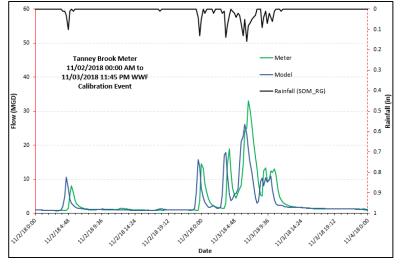
Table D.2: Comparison Between Metered and Modeled Cumulative WWF Volume During Calibration Storms

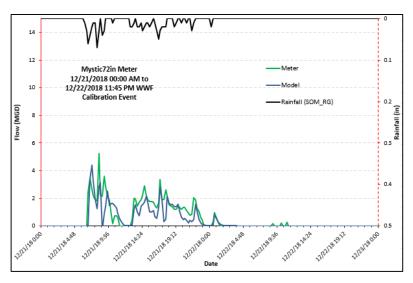
Flow Motor Nove	Storm for which the		Cumulative Volume (MG)		
Flow Meter Name	model is calibrated	Meter	Model	% Difference	
Tannery Br North (2)	November 2, 2018	0.121	0.088	-27%	
School St	November 2, 2018	0.09	0.06	-33%	
Marshall St	December 21,2018	5.44	7.27	-34%	
North St	November 2, 2018	0.19	0.18	-5%	
Pearl St	November 2, 2018	0.65	0.76	17.7%	
Newton St	November 2, 2018	1.7	1.94	14%	
Murdock Street	December 21,2018	0.081	0.12	48%	
Mystic Ave	December 21,2018	1.063	0.81	-24%	
Grove St	November 2, 2018	4.85	4.9	1%	
Palmer Avenue	December 21,2018	0.019	0.027	42%	
Tannery Br	November 2, 2018	7.16	6.35	-11%	
Mystic 72in	December 21,2018	0.88	0.87	-1%	
Properzi Way	December 21,2018	0.54	0.55	2%	



Figure D.1 Metered vs. Modeled Flows during Calibration Storms







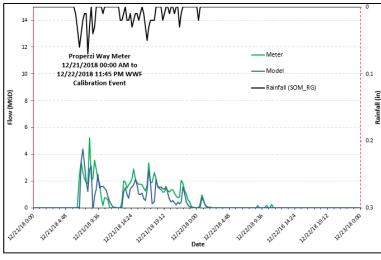


Table D.3: Comparison between metered and modeled peak WWFs during validation storms

	Storm for which the	Peak Wet	: Weather F	low (MGD)
Flow Meter Name	model is calibrated	Meter	Model	% Difference
Tannery Br North (2)	November 09, 2018	2.28	2.57	13%
School St	November 09, 2018	0.533	0.74	39%
Marshall St	November 09, 2018	24.5	26.4	8%
North St	November 09, 2018	0.872	1.02	17%
Pearl St	November 09, 2018	6.2	4.42	-29%
Newton St	November 09, 2018	8.9	8	-10%
Murdock Street	December 31, 2018	0.345	0.47	36%
Mystic Ave	January 24, 2019	13	9.2	-29%
Grove St	November 09, 2018	7.2	7.1	-1%
Palmer Avenue	January 24, 2019	0.864	0.822	-5%
Tannery Br	November 09, 2018	32	24.41	-24%
Mystic 72in	January 24, 2019	6.5	5.63	-13%
Properzi Way	December 31, 2018	0.967	1.035	7%



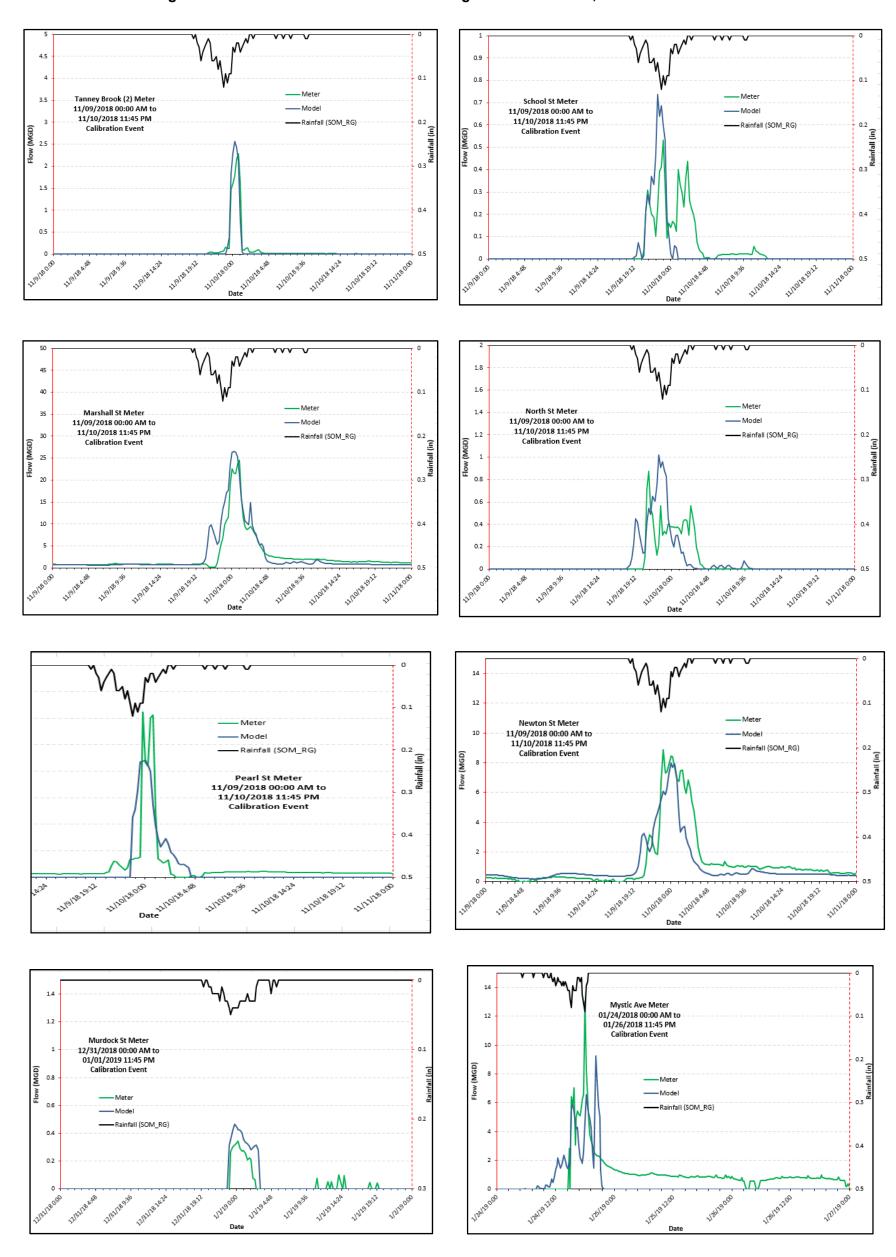
Table D.4: Comparison Between Metered and Modeled Cumulative WWF Volume During Validation Storms

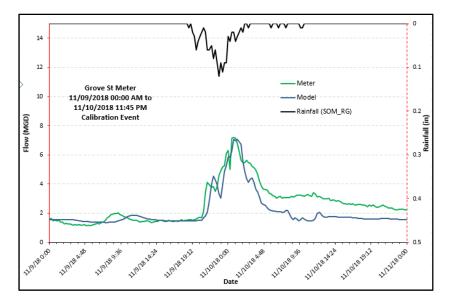
Flow Motor Name	Storm for which the model is	Cumu	Cumulative Volume (MG)  Meter Model % Differer	
Flow Meter Name	calibrated	Meter		
Tannery Br North (2)	November 09, 2018	0.14	0.13	-7%
School St	November 09, 2018	0.08	0.06	-25%
Marshall St	November 09, 2018	5.13	5.57	9%
North St	November 09, 2018	0.12	0.14	17%
Pearl St	November 09, 2018	0.39	0.47	21%
Newton St	November 09, 2018	2.53	2.1	-17%
Murdock Street	December 31, 2018	0.036	0.061	69%
Mystic Ave	January 24, 2019	1.085	0.8	-26%
Grove St	November 09, 2018	5.27	4.25	-19%
Palmer Avenue	January 24, 2019	0.043	0.109	0.066*
Tannery Br	November 09, 2018	6.04	5.4	-11%
Mystic 72in	January 24, 2019	0.86	1.08	26%
Properzi Way	December 31, 2018	0.824	0.902	9%

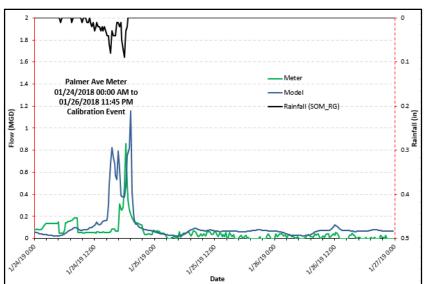
<sup>\*</sup>Actual flow difference is more appropriate as the % error is misleading due to the small values

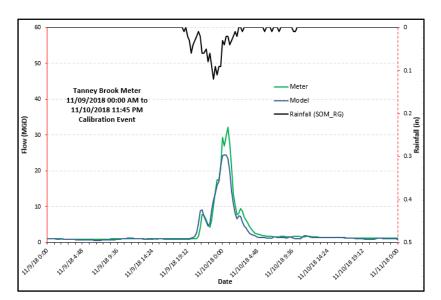


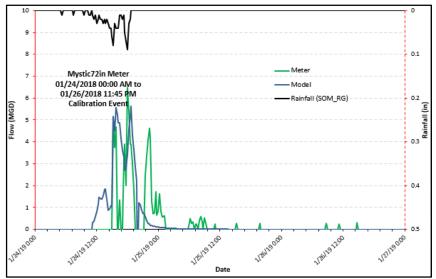
Figure D.2 Metered vs. Modeled Flows during the November 09, 2018 Validation Storm











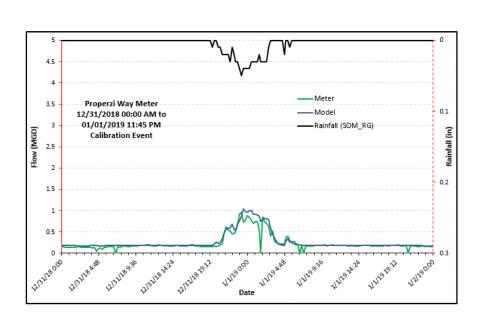


Table D.5: Comparison Between Metered and Modeled Peak Water Depth During Calibration Storms

Fl. M. ( . N	Storm for which the	Water Depth (ft)		(ft)
Flow Meter Name	model is calibrated	Meter	Meter Model Differe	
Tannery Br North (2)	November 2, 2018	0.55	0.68	0.13
School St	November 2, 2018	0.63	0.43	-0.2
Marshall St	December 21,2018	1.95	1.89	-0.06
North St	November 2, 2018	0.33	0.43	0.1
Pearl St	November 2, 2018	2.12	1.83	-0.29
Newton St	November 2, 2018	4	3.91	-0.09
Murdock Street	December 21,2018	1.02	0.87	-0.15
Mystic Ave	December 21,2018	3.4	3.77	0.37
Grove St	November 2, 2018	1.49	2.68	1.19
Palmer Avenue	December 21,2018	0.984	0.708	-0.276
Tannery Br	November 2, 2018	1.83	1.41	-0.42
Mystic 72in	December 21,2018	4.07	4.06	-0.01
Properzi Way	December 21,2018	1.63	1.53	-0.1



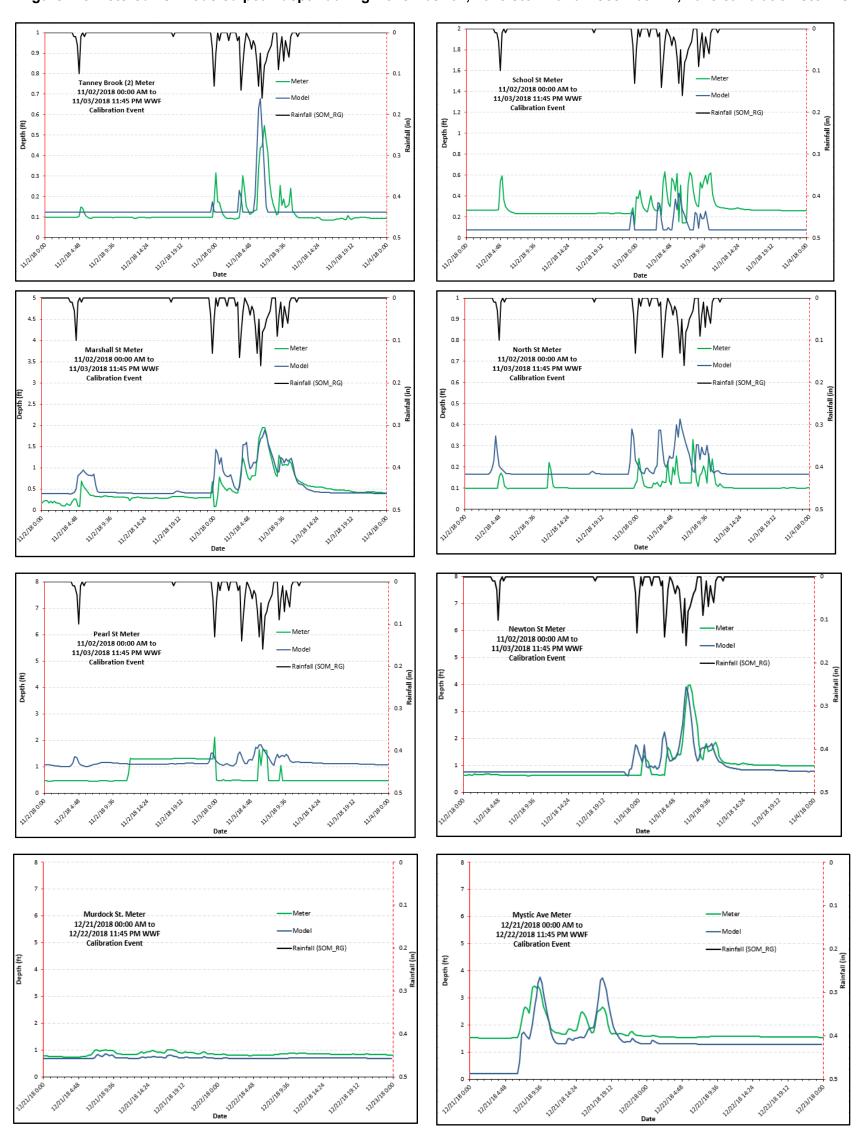
Table D.6: Comparison Between Metered and Modeled Peak Water Depth During Validation Storms

Flow Motor Name	Storm for which the model is	Water Depth (ft)		h (ft)
Flow Meter Name	calibrated	Meter	Model	Difference
Tannery Br North (2)	November 09, 2018	0.55	0.66	0.11
School St	November 09, 2018	0.71	0.41	-0.3
Marshall St	November 09, 2018	1.94	1.8	-0.14
North St	November 09, 2018	0.26	0.4	0.14.
Pearl St	November 09, 2018	2.22	1.81	-0.41
Newton St	November 09, 2018	4.52	4.29	-0.23
Murdock Street	December 31, 2018	1	0.85	-0.15
Mystic Ave	January 24, 2019	6.7	4	-2.7
Grove St	November 09, 2018	1.51	2.57	1.06
Palmer Avenue	January 24, 2019	1.5	4.2	2.7
Tannery Br	November 09, 2018	1.82	0.5	-1.32*
Mystic 72in	January 24, 2019	7.3	4.24	-3.06*
Properzi Way	December 31, 2018	1.852	1.809	0.043

<sup>\*</sup> The reason for such large difference during this storm is unknown; future calibration efforts shall include further investigation.



Figure D.5 Metered vs. Modeled peak depth during November 02, 2018 storm and December 21, 2018 calibration storms



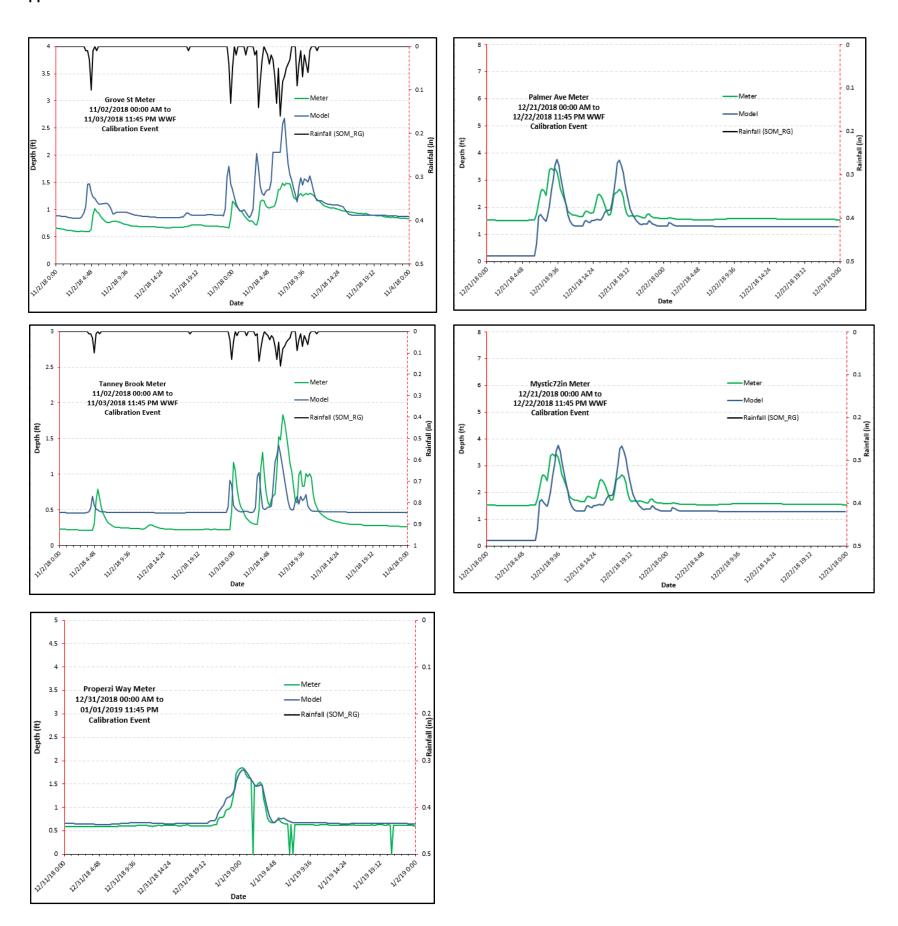
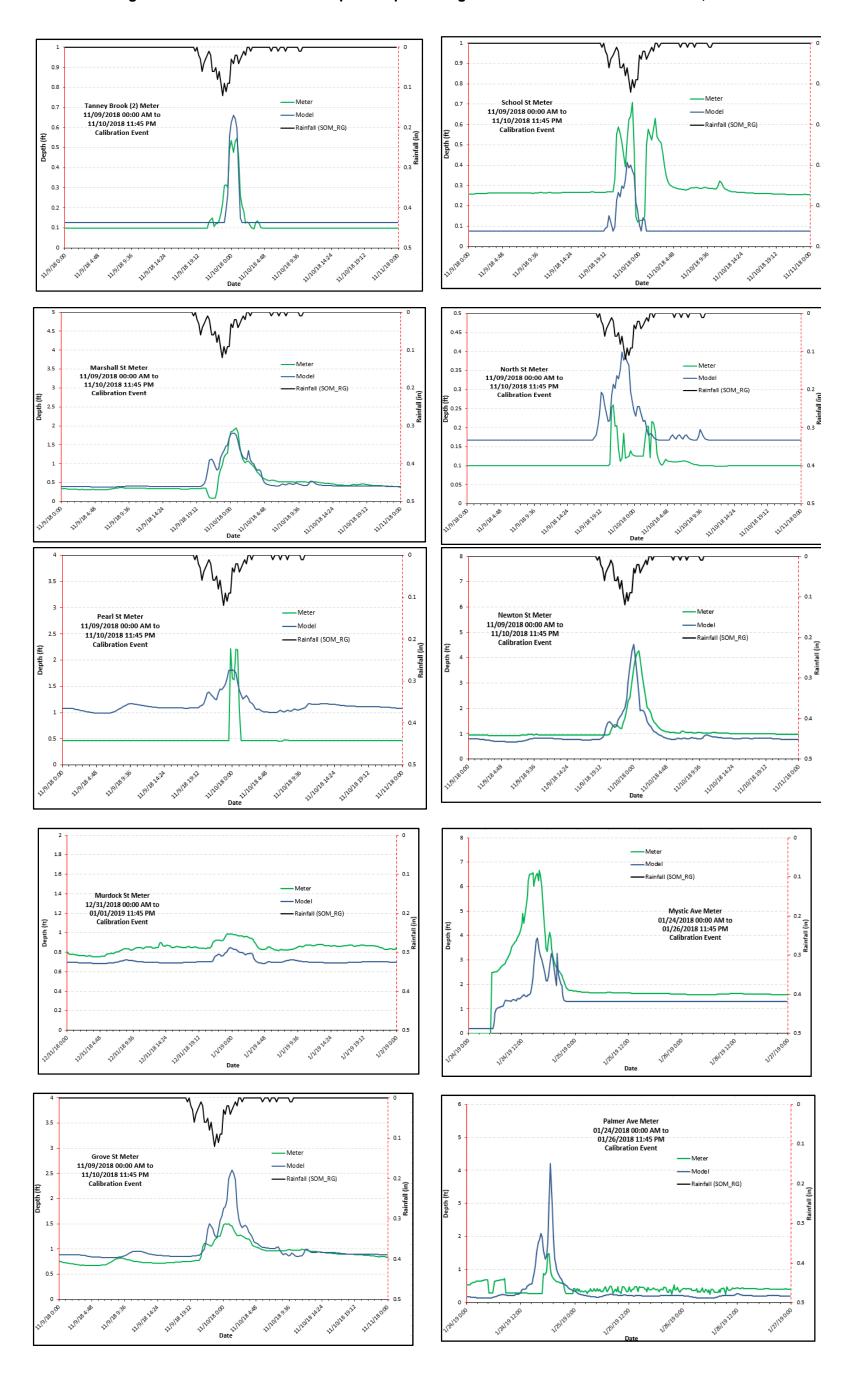
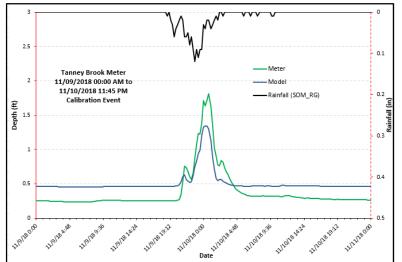
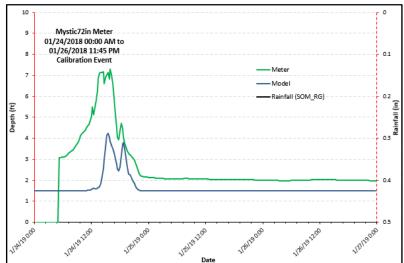


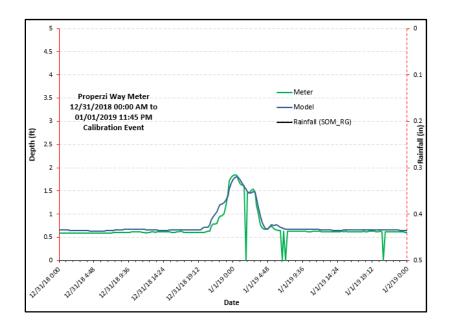
Figure D.6 Metered vs. Modeled peak depth during validation storm on November 09, 2018



# Appendix D







**3** 

# **APPENDIX E**

**ADS Meter Installation Sheets** 



Figure E.1 Properzi Way Meter Install Report

Site Address / Location: Properzi Way  Site Access: Drive	Monitor Series TRITON+ Pipe Size (H x W) 28.00" X 25"  Manhole # N/A Access Drive	Location Type Temporary Pipe Shape Elliptical  System Characteristics Commercial Traffic Medium
	TRITON+ Pipe Size (H x W) 28.00" X 25"  Manhole # N/A Access	Temporary Pipe Shape Elliptical System Characteristics Commercial Traffic
Site Access: Drive	Pipe Size (H x W) 28.00" X 25"  Manhole #  N/A  Access	Pipe Shape Elliptical System Characteristics Commercial Traffic
HD0Sput	Manhole # N/A Access	System Characteristics Commercial Traffic
	N/A Access	Commercial Traffic
	(4504)/4/(00)	***************************************
	Drive	Medium
Sai'dle Architeats G		12.13.2018 10.49
	Installation Installation Date: Thursday, December 13, 2018	Information Installation Type: Doppler Standard Ring and Crank
No. of the second secon	Monitoring Location (Sensors): Upstream 0-5 FT	Monitor Location: Manhole
	Sensors / Devices:	Pressure Sensor Range (psi)
	Peak Combo (CS4), Smart Depth (CS5)  Installation C	0 -5 psi
	Confirmation Time:	Pipe Size (HxW)
	11:30:00 AM	28.00" X 25.00"
	Depth of Flow (Wet DOF) (in) 6"	Range (Air DOF) (in) 22.00"
	Downlooker Physical Offset (in)	Measurement Confidence (in)
	1.50"	0.25"
	Peak Velocity (fps) 0.25	Velocity Sensor Offset (in) 5.00"
12.13.2018 10:37	Silt (in)	Silt Туре
12.10.2010	4" Hydraulic C	Loss
	Sic	ow
	Manhole / Pip	
	Manhole Depth (Approx. FT): N/A	Manhole Configuration Separate Trench
	Manhole Material:	Manhole Condition:
	Brick	Good
	Manhole Opening Diameter (in) N/A	Manhole Diameter (Approx.): N/A
	Manhole Cover	Manhole Frame
	Vented	Normal
	Active Drop Connections No	Air Quality: Safe To Enter
	Pipe Material	Pipe Condition:
	Brick <b>Communicatio</b>	Good n Information:
	Communication Type	Antenna Location
12.13.2018 10:37 —	Wireless <b>Additional Site I</b> n	Drilled Pavement / Concrete
	Additional Site in I.P. 107.80.17.206	no. / Comments:
	dinates: N 42.37994300 W -71.10740600	

Figure E.2 Mystic Avenue Meter Install Report

Sile Alaces Drive    Sile Alaces Drive   Figure Sile is with   Supposed Sile Alaces   Traffic   Traffic   Sile Alaces   Traffic   Traffic   Sile Alaces   Traffic   Traf		te I.D.	Site	APR	erville, MA	Some
Site Auxonal Chine    Site Auxonal Chine   Site Aux		-3264	S2-3	ENVIRONMENTAL SERVICES®		
Figs. Step (4-14 W) Report X 54 201*  Manufacte # Space Clarac Access Troffic Contract Access Troffic		Location Type	U.C. 97.00 (9.40-4)/A90		ЛcGrath Highway	Site Address / Location: Mc
Access Traffic Access Traffic Access Traffic Drive 4soy  Installation Information  Installation Drive  Installation Information  Installation Inform	00000	Pipe Shape	REDWINDS SERVICES.		Driva	Site Access: Dri
Access		Elliptical			Mive	Site Access. Dir
Access		System Characteris Commercial				
Installation Information   Installation Information   Installation Date:   Installation Type   Installation Type   Installation Type   Thursday, December 13, 2018   Doppler Speckal Installation Conference   Manhole   Depth of Form   Manhole   Depth of Flow (Wet DDF) (m)   Manhole   Depth of Flow (Wet DDF) (m)   Measurement Confide   1,38°   0,35°   24,50°   Downlooker Physical Offset (in)   Measurement Confide   1,38°   0,25°   Downlooker Physical Offset (in)   Measurement Confide   1,38°   0,35°   Silt (in)   Silt Type   Dirac   Silt (in)   Dirac	с	Traffic Heavy	Access		Century Bank Size Child Care	Books
Installation Confirmation:  Confirmation Time:  12:00:00 PM  48:00" X 54:00  Depth of Flow (Wet DOF) (in)  Range (Air DOF)  23:5"  Downlooker Physical Offset (in)  Measurement Confide  1:38"  0:25"  Peak Velocity (fps)  Velocity Sensor Offs  0:35  Silt (in)  Silt Type  T"  Hydraulic Comments: Slow  Manhole Depth (Approx. FT): Manhole Material: Manhole Configur  N/A  Separate Trenc  Manhole Material: Manhole Condition  Brick  No  Safe To Enter  Pipe Material  Pipe Condition  Brick  Ocod  Communication Information:	pe: allation on:	Installation Type: Doppler Special Installatio Monitor Location:	Installation Information Installation Information Date: By, December 13, 2018 Fing Location (Sensors): Upstream 0-5 FT	Thursd Monito		Boston Center O' Self-Realization
Confirmation Time: Pipe Size (HzW 12:00:00 PM 48:00" X 54:00 Depth of Flow (Wet DOF) (in) Range Airo." X 54:00 Depth of Flow (Wet DOF) (in) Range Airo." 24:50" 24:50" 24:50" Downlooker Physical Offset (in) Measurement Confide 1:38" 0.25"  Peak Velocity (fps) Velocity Sensor Offs 0:35 Sit (in) Sit Type 7" Dirt Hydraulic Comments: Slow Manhole / Pipe Information: Manhole Pipe Information: Manhole Pipe Information: Manhole Material: Manhole Condition Brick Good Manhole Opening Diameter (in) Manhole Diameter (A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/			o (CS4), Smart Depth (CS5)	Peak Comb	M. W. C. L. C.	The second of the second
Depth of Flow (Wet DOF) (in) 23.5" 24.50"  Downlooker Physical Offset (in) 1.38" 0.25"  Peak Velocity (fps) 0.35  Silt (in) 7"  Hydraulic Comments: Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Configur N/A Separate Trenc Manhole Material: Manhole Opening Diameter (in) Manhole Depth (Approx. FT): Manhole Depth (Approx. FT): Manhole Depth (Approx. FT): Manhole Depth (Approx. FT): Manhole Condition Brick Good Manhole Opening Diameter (in) Manhole Diameter (Arrow Manhole Diameter (Ar	V)	Pipe Size (HxW)	7 W - W - W	Co	ANGLE THE	
23.5"  Downlooker Physical Offset (in)  1.38"  0.25"  Peak Velocity (ftps)  O.35  Silt (in)  Silt Type  7"  Hydraulic Comments:  Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT):  Manhole Material:  Manhole Conditin  Brick  Manhole Pram  Vented  Normal  Active Drop Connections  Air Quality:  No  Safe To Enter  Pipe Material  Pipe Condition  Brick  Good  Communication Information:		48.00" X 54.00"				
1.38" 0.25"  Peak Velocity (fps) Velocity Sensor Offs 0.35  Silt (in) Silt Type 7" Dirt  Hydraulic Comments: Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Configura N/A Separate Trenc  Manhole Material: Manhole Conditi Brick Good  Manhole Opening Diameter (in) Manhole Diameter (A N/A N/A  Manhole Cover Manhole Fram Vented Normal  Active Drop Connections Air Quality: No Safe To Enter Pipe Material Pipe Condition Brick Good  Communication Information:	(in)		N 250 W	Depth		
Peak Velocity (fps) 0.35  Silt (in) 7" Phydraulic Comments: Slow  Manhole / Pipe Information: Manhole Depth (Approx. FT): Manhole Material: Manhole Material: Manhole Opening Diameter (in) Manhole Opening Diameter (in) Manhole Over Manhole Cover Manhole Fram Vented Normal Active Drop Connections Air Quality: No Safe To Enter Pipe Material Pipe Condition Brick Good Communication Information:	ence (in)	Measurement Confidence	oker Physical Offset (in)	Downlo		THE STATE OF THE S
0.35 Silt (in) Silt Type Dirt Hydraulic Comments: Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Confligur N/A Separate Trenc Manhole Material: Manhole Conditi Brick Good Manhole Opening Diameter (in) Manhole Diameter (A N/A N/A Manhole Cover Manhole Fram Vented Normal Active Drop Connections Air Quality: No Safe To Enter Pipe Material Pipe Condition Brick Good Communication Information:	r P V					
Thydraulic Comments: Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Configura N/A Separate Trenc Manhole Material: Manhole Conditi Brick Good  Manhole Opening Diameter (in) Manhole Diameter (A N/A N/A  Manhole Cover Manhole Fram Vented Normal Active Drop Connections Air Quality: No Safe To Enter Pipe Material Pipe Condition Brick Good  Communication Information:	set (in)	velocity sensor Offset (In		P		
Hydraulic Comments:  Slow  Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Configura  N/A Separate Trenc  Manhole Material: Manhole Conditi  Brick Good  Manhole Opening Diameter (in) Manhole Diameter (A  N/A N/A  Manhole Cover Manhole Fram  Vented Normal  Active Drop Connections Air Quality:  No Safe To Enter  Pipe Material Pipe Condition  Brick Good  Communication Information:		Silt Туре	A 76	2:15	12 13 2018 19	
Manhole / Pipe Information:  Manhole Depth (Approx. FT): Manhole Configura N/A Separate Trenc Manhole Material: Manhole Conditit Brick Good  Manhole Opening Diameter (in) Manhole Diameter (A N/A N/A  Manhole Cover Manhole Fram Vented Normal  Active Drop Connections Air Quality: No Safe To Enter Pipe Material Pipe Condition Brick Good  Communication Information:					15,10,6010 11	DANGE OF THE STATE
Manhole Depth (Approx. FT):  N/A  Separate Trence  Manhole Material:  Manhole Conditi  Brick  Good  Manhole Opening Diameter (in)  Manhole Diameter (A  N/A  Manhole Cover  Manhole Cover  Manhole Fram  Vented  Normal  Active Drop Connections  Air Quality:  No  Safe To Enter  Pipe Material  Pipe Condition  Brick  Good  Communication Information:			Slow			CALLEGE AND SHAPE
N/A Separate Trend  Manhole Material: Manhole Conditi  Brick Good  Manhole Opening Diameter (in) Manhole Diameter (A  N/A N/A  Manhole Cover Manhole Fram  Vented Normal  Active Drop Connections Air Quality:  No Safe To Enter  Pipe Material Pipe Condition  Brick Good  Communication Information:	000000000					
Manhole Material:  Brick  Good  Manhole Opening Diameter (in)  Manhole Diameter (A  N/A  Manhole Cover  Manhole Fram  Vented  Normal  Active Drop Connections  No  Safe To Enter  Pipe Material  Brick  Good  Communication Information:				Manno		
Manhole Opening Diameter (in)  N/A  N/A  Manhole Cover  Manhole Fram  Vented  Normal  Active Drop Connections  No  Safe To Enter  Pipe Material  Brick  Good  Communication Information:		Manhole Condition:		N		
N/A N/A  Manhole Cover Manhole Fram  Vented Normal  Active Drop Connections Air Quality:  No Safe To Enter  Pipe Material Pipe Condition  Brick Good  Communication Information:	Samuel Samuel				4 3 1	
Manhole Cover Manhole Fram  Vented Normal  Active Drop Connections Air Quality:  No Safe To Enter  Pipe Material Pipe Condition  Brick Good  Communication Information:	pprox.):	2 2 1		Manhol		
Active Drop Connections Air Quality:  No Safe To Enter  Pipe Material Pipe Condition  Brick Good  Communication Information:	ie	Manhole Frame			A CONTRACT	
No Safe To Enter Pipe Material Pipe Condition Brick Good  Communication Information:		1797	7700,, Q, Q, Q	1		
Pipe Material Pipe Condition Brick Good  Communication Information:				Activ		
Communication Information:		Pipe Condition:	VII			
				11.00		
	on	Antenna Location		Co		
TO 12 2010 10 14 Wireless Drilled Pavement / Co	oncrete	Drilled Pavement / Concre	Wireless	3.77	12 13 2018 1	
Additional Site Info. / Comments:  Serial Number: 40606 I.P. 107.80.16.34		. / comments:				
ADS Project Name: Somerville TFM 2018 Coordinates: N 42.39345700 W -71.08609400				the same of the sa	Somerville TFM 2018	ADS Project Name:

Figure E.3 (72in) Mystic Avenue Meter Install Report

Somerville, MA	NOS	Si	te I.D.
Flow Monitoring Site Installation Report	ENVIRONMENTAL SERVICES®	30	-6204
Site Address / Location: McGrath Highway at Mystic Ave		Monitor Series	Location Type
		TRITON+ Pipe Size (H x W)	Temporary Pipe Shape
Site Access: Drive		72.00" X 72.00""	Circular
		Manhole #	System Characteristics
		N/A	Commercial
Bosion Center Off See Fixed 2 attention		Access Drive	Traffic Heavy  12.13.2018 13:10
	and the second second	Installation Inf	ormation
	Charles and the Control of the Contr	nstallation Date:	Installation Type:
A STATE OF THE STA	The second secon	ay, December 13, 2018	Doppler Special Installation
	100 200	ring Location (Sensors):	Monitor Location:
The second secon		Upstream 0-5 FT ensors / Devices:	Manhole Pressure Sensor Range (psi)
THE RESERVE OF THE PARTY OF THE	No. of the last of	ensors / Devices: ombo (CS-4), CS-6 (LRD)	0 -5 psi
	Tour se	Installation Con	
	Co	onfirmation Time:	Pipe Size (HxW)
		1:00:00 PM	72.00" X 72.00"
	Depth	of Flow (Wet DOF) (in)	Range (Air DOF) (in)
		23"	49"
	Downlo	oker Physical Offset (in)	Measurement Confidence (in)
	1	13.75	0.25"
	P	eak Velocity (fps)	Velocity Sensor Offset (in)
10 10 0010	10.11	0 Silt (in)	20" Silt Type
12.13.2018	13:11	14"	Dirt
		Hydraulic Com	
		Slow/stagr	
		Manhole / Pipe I	
	Manho	ole Depth (Approx. FT): 9"55"	Manhole Configuration
		1anhole Material:	Separate Trench  Manhole Condition:
	IA	Concrete	Good
	Manhole	e Opening Diameter (in)	Manhole Diameter (Approx.):
		N/A	N/A
Annual and a second a second and a second and a second and a second and a second an		Manhole Cover	Manhole Frame
		Vented	Normal
	Activ	e Drop Connections	Air Quality:
		No No	Safe To Enter
	11/2 7/2	Pipe Material Brick	Pipe Condition: Good
		Communication I	
	Co	mmunication Type	Antenna Location
12.13.2018	COLUMN TO SERVICE AND ADDRESS OF THE PARTY O	Wireless	Drilled Pavement / Concrete
	19.41	Additional Site Info	/ Comments:
	ECONOMIC TRANSPORTED TO THE PARTY OF THE PAR		
ADS Project Name: Somerville TFM 2018	Serial Number: 6	63969 I.P. 107.80.27.151 12.39204500 W -71.08613300	

Figure E.4 Murdock Street Meter Install Report

Somerville, MA	ARR	Si	ite I.D.	
Flow Monitoring Site Installation Report	ENVIRONMENTAL SERVICES®	CA-453		
Site Address / Location: Cedar St at Murdock St		Monitor Series	Location Type	
		TRITON+ Pipe Size (H x W)	Temporary Pipe Shape	
Site Access: Drive		12.00" X 12.00""	Circular	
		Manhole #	System Characteristics	
		N/A Access	Commercial Traffic	
		Drive	Medium	
			12.13.2018 14:32	
		Installation In	formation	
		Installation Date:	Installation Type:	
		lay, December 13, 2018 pring Location (Sensors):	Doppler Standard Ring and Crank  Monitor Location:	
	The state of the s	Upstream 0-5 FT	Manhole	
	Committee of the Commit	Gensors / Devices:	Pressure Sensor Range (psi)	
		Peak Combo (CS4)  Installation Co	0 -5 psi	
	c	onfirmation Time:	Pipe Size (HxW)	
	Denth	2:15:00 PM of Flow (Wet DOF) (in)	12.00" X 12.00" Range (Air DOF) (in)	
	Бери	9"	3"	
	Downlo	ooker Physical Offset (in)	Measurement Confidence (in)	
		0 Peak Velocity (fps)	0.25"  Velocity Sensor Offset (in)	
		0.44	0"	
12 13 2018	3 14:33	Silt (in)	Silt Type	
		.5" Hydraulic Cor	Dirt	
		Slow		
	<b>■</b> 4 € 2 1 €	Manhole / Pipe		
	Manne	ole Depth (Approx. FT):  N/A	Manhole Configuration Separate Trench	
	. N	Manhole Material:	Manhole Condition:	
		Brick	Good	
	Manhol	le Opening Diameter (in) N/A	Manhole Diameter (Approx.): N/A	
		Manhole Cover	Manhole Frame	
		Vented	Normal	
	Activ	ve Drop Connections Yes, Outside	Air Quality: Safe To Enter	
		Pipe Material	Pipe Condition:	
		Brick Communication	Good Information:	
	Co	ommunication Type	Antenna Location	
		Wireless	Drilled Pavement / Concrete	
	Serial Number:	Additional Site Info 60809 I.P. 166.219.48.218	o. / comments:	
ADS Project Name: Somerville TFM 20		42.3651800 W -71.10930800		
ADS Project Number:				

Figure E.5 Palmer Avenue Meter Install Report

Somerville, MA	AVEC	Sit	e I.D.
Flow Monitoring Site Installation Report	ENVIRONMENTAL SERVICES®	C1-1355	
Site Address / Location: Palmer Ave at Franklin St		Monitor Series TRITON+	Location Type Temporary
Site Access: Drive		Pipe Size (H x W) 24.00" X 24.00"	Pipe Shape Circular
	Sellment ve	Manhole # N/A Access Drive	System Characteristics Commercial Traffic Light
Capuanc Barly Childhood Center  At Glen Parc			12.13.2018 15:20
		Installation Info	Alexander and the second secon
		stallation Date:	Installation Type:
	AND THE RESERVE OF THE PARTY OF	y, December 13, 2018 ing Location (Sensors):	Doppler Special Installation  Monitor Location:
	MITCHES - CASTIVA VISCONIA	pstream 0-5 FT	Manhole
		nsors / Devices:	Pressure Sensor Range (psi)
	Pe	ak Combo (CS4)	0 -5 psi
	Con	Installation Con	
	Cor	13:00 PM	Pipe Size (HxW) 24.00" X 24.00"
	Depth o	of Flow (Wet DOF) (in)	Range (Air DOF) (in)
	0.50	8"	16.00"
	Downloo	ker Physical Offset (in)	Measurement Confidence (in)
		N/A	0.25"
	Per	ak Velocity (fps)	Velocity Sensor Offset (in)
	-	0	N/A
12-13.201	8 15:17 🦠	Silt (in)	Silt Type
		Hydraulic Com	N/A ments:
	A Service	Water Is Usually Stagnant	
		Manhole / Pipe Information:	
	Manhol	e Depth (Approx. FT):	Manhole Configuration
		N/A	Common Trench
	Ma	anhole Material: Concrete	Manhole Condition: Good
	Maphole	Opening Diameter (in)	Manhole Diameter (Approx.):
	widthtole	N/A	N/A N/A
	A	Manhole Cover	Manhole Frame
	THE PARTY OF THE	Vented	Normal
	Active	Drop Connections	Air Quality:
	100000	No .	Safe To Enter
	100	Pipe Material PVC	Pipe Condition: Good
		Communication I	nomicion.
	Com	Communication I	Antenna Location
19 13 201		nmunication Type Wireless	Antenna Location Drilled Pavement / Concrete
12.13.201	8 15:17	nmunication Type Wireless Additional Site Info.	Antenna Location Drilled Pavement / Concrete
12.13.201  ADS Project Name: Somerville TFM 20	8 15 : 17 Serial Number: 52	nmunication Type Wireless Additional Site Info.	Antenna Location Drilled Pavement / Concrete

Figure E.6 North Street Meter Install Report

Somerville, M	A Stantec 18	ME	s	ite I.D.
Flow Monitoring Site Installation Report		ENVIRONMENTAL SERVICES®	9-5186 MP1	
Site Address / Location: Raymond	Ave at North St		Monitor Series TRITON+	Location Type Temporary
Site Access: Drive			Pipe Size (H x W) 20H x 20W	Pipe Shape Circular
			Manhole #	System Characteristics
			N/A Access Drive	Residential Traffic Light
Powder-House Blvd	66-36 North St Somerville, MA 02144 42.407905, -71.129867	Raymond Ave		10.23.2018 23:37
			Installation In	nformation
		100 CO 10	Installation Date:	Installation Type:
	11/1		ring Location (Sensors):	Doppler Standard Ring and Crank  Monitor Location:
Market Market		The state of the s	Upstream 0-5 FT	Manhole
		The second secon	ensors / Devices:	Pressure Sensor Range (psi)
			leak Combo (CS4)  Installation Co	0 -5 psi
		C	onfirmation Time:	Pipe Size (HxW)
7-67	page 1		11:30:00 AM	20H x 20W
		Depth	of Flow (Wet DOF) (in)	Range (Air DOF) (in)
			1	19
	MODELLE AND A	Downlo	oker Physical Offset (in)	Measurement Confidence (in)
		A SHARE OF THE SHA	N/A	0.38"
	The second second	P	eak Velocity (fps)	Velocity Sensor Offset (in)
X		Two parties	1	N/A
	10.23.2018 2	23:29	Silt (in) 0	Silt Type N/A
			Hydraulic Co	
			Dry Pi	ipe
			Manhole / Pipe	Information:
		Manho	ole Depth (Approx. FT):	Manhole Configuration
			8	Common Trench
		No.	Manhole Material:  Brick	Manhole Condition: Fair
		Manhal	e Opening Diameter (in)	Manhole Diameter (Approx.):
		IVI GITI I O	N/A	N/A
			Manhole Cover	Manhole Frame
			Vented	Normal
		Activ	re Drop Connections	Air Quality:
TO THE WAY IN THE REAL PROPERTY.	THE STATE OF THE S	. %	No	Good
			Pipe Material /itrified Clay Pipe	Pipe Condition: Good
THE PROPERTY OF	A. A.	14 /	Communication	
	19/1/2/	Co	mmunication Type	Antenna Location
	10.23.2018	23:29	Serial	Drilled Pavement / Concrete
	. 20.20107	S/N: 64724 I/P:	Additional Site Inf	o. / Comments:
		3/N: 04/24 I/P:	TO1.00.24.33	
ADS Project Name:	Smerville, MA Stantec 18			

Figure E.7 Tannery Brook Meter Install Report

Jiliei ville, iv	IA Stantec 18	MEG	Sit	te I.D.
Flow Monitoring Site Installation Report		ENVIRONMENTAL SERVICES®	1-6432 MP1	
Site Address / Location: Camero	n Ave at Seven Pines Ave		Monitor Series TRITON+	Location Type Temporary
Site Access: Middle	of Intersection of Cameron Ave, Seven P	Pines Ave and Tannery Broo Row	Pipe Size (H x W) 53.25H x 60.5W	Pipe Shape Rectangular
10 8 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			Manhole #	System Characteristics
C ORGING			N/A	Residential
100			Access	Traffic
			Drive	Medium
Somerville	meron Ave e, MA 02144 2,-71.128684	Inst	Installation Info	Installation Type:
		2000 27 00	y, October 24, 2018 z Location (Sensors):	Doppler Special Installation  Monitor Location:
		NATIONAL PROPERTY OF THE PARTY	stream 0-5 FT	Manhole
		207 20	ors / Devices:	Pressure Sensor Range (psi)
		Peak	Combo (CS4)  Installation Conf	0 -5 psi
		Confi	irmation Time:	
				Pipe Size (HxW)
		1	:43:00 PM	53.25H x 60.5W
		1	:43:00 PM Flow (Wet DOF) (in)	53.25H x 60.5W Range (Air DOF) (in)
		1 Depth of R	:43:00 PM Flow (Wet DOF) (in) 2.25	53.25H x 60.5W Range (Air DOF) (in) 51
		1 Depth of R	:43:00 PM Flow (Wet DOF) (in)	53.25H x 60.5W Range (Air DOF) (in)
		Depth of F	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in)	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in)
		1 Depth of F Downlooke	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A : Velocity (fps) 1.65	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in)  0.38"  Velocity Sensor Offset (in)  N/A
	10.24.2018 0	1 Depth of F Downlooke	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in)	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in)  0.38"  Velocity Sensor Offset (in)  N/A  Silt Type
	10.24.2018 0	1 Depth of F Downlooke	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A : Velocity (fps) 1.65	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in)  0.38"  Velocity Sensor Offset (in)  N/A  Silt Type  N/A
	10.24.2018 0	1 Depth of F Downlooke	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comi	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comr Low Flow Manhole / Pipe In	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in)  0.38"  Velocity Sensor Offset (in)  N/A  Silt Type  N/A  ments: v  nformation:  Manhole Configuration
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Company Low Flow Manhole / Pipe In Depth (Approx. FT): 10	53.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments: v  formation:  Manhole Configuration Common Trench
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Company Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material:	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments: v  nformation:  Manhole Configuration Common Trench Manhole Condition:
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Manhole O	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diarneter (Approx.): N/A
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Manhole O	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A enhole Cover	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A Manhole Frame
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Manhole O	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Come Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A enhole Cover	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diarneter (Approx.): N/A
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Manhole O  Active D	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Com Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A enhole Cover Vented Prop Connections No	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments: v  nformation:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diarneter (Approx.): N/A Manhole Frame Normal Air Quality: Good
	10.24.2018 0	Depth of F Downlooke Peak  2:09  Manhole  Man Active D	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A whole Cover Vented Prop Connections No pe Material	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments: v  Iformation:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A Manhole Frame Normal Air Quality: Good Pipe Condition:
	10.24.2018 0	Depth of F Downlooke Peak  2:09  Manhole  Man Active D	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A E Velocity (fps) 1.65 Silt (in) 0 Hydraulic Company Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A enhole Cover Vented Prop Connections No pe Material Concrete	53.25H x 60.5W  Range (Air DOF) (in) 51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A Silt Type N/A ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diarneter (Approx.): N/A Manhole Frame Normal Air Quality: Good Pipe Condition: Fair
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Man  Manhole O  Active D	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Comm Low Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A whole Cover Vented Prop Connections No pe Material	S3.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A  Silt Type N/A  ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Good Pipe Condition: Fair  Antenna Location
		Depth of F Downlooke  Peak  2:09  Manhole I  Manhole O  Mactive D  Pi	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A Velocity (fps) 1.65 Silt (in) 0 Hydraulic Communication Ir Serial Flow Flow Manhole / Pipe In Depth (Approx. FT): 10 hole Material: Brick pening Diameter (in) N/A whole Cover Vented Concrete Communication Irpe Serial	S3.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A  Silt Type N/A  ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Good Pipe Condition: Fair  Antenna Location Drilled Pavement / Concrete
	10.24.2018 0	Depth of F  Downlooke  Peak  2:09  Manhole I  Manhole O  Ma  Active D  Pi  Comm	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A : Velocity (fps) 1.65 Silt (in) 0 Hydraulic Communication Ir nunication Type Serial Additional Site Info.	S3.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A  Silt Type N/A  ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Good Pipe Condition: Fair  Antenna Location Drilled Pavement / Concrete
ADS Project Name:		Depth of F Downlooke  Peak  2:09  Manhole I  Manhole O  Mactive D  Pi	:43:00 PM Flow (Wet DOF) (in) 2.25 er Physical Offset (in) N/A : Velocity (fps) 1.65 Silt (in) 0 Hydraulic Communication Ir nunication Type Serial Additional Site Info.	S3.25H x 60.5W  Range (Air DOF) (in)  51  Measurement Confidence (in) 0.38"  Velocity Sensor Offset (in) N/A  Silt Type N/A  ments:  Manhole Configuration Common Trench Manhole Condition: Fair Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Good Pipe Condition: Fair  Antenna Location Drilled Pavement / Concrete

Figure E.8 Tannery Brook (2) Meter Install Report

Somerville, MA Stantec 18 🦯		Site I.D.		
Flow Monitoring Site Installation Report	ONMENTAL 1-6	1-6432 MP2		
Site Address / Location: Cameron Ave at Seven Pines Ave	Monitor Series TRITON+	Location Type Temporary		
Site Access: Middle of Intersection of Cameron Ave, Seven Pines Ave and	Pipe Size (H x W)	Pipe Shape Circular		
	Manhole #	System Characteristics		
	N/A	Residential		
	Access	Traffic		
	Drive	Medium		
70-44 Cameron Ave Somerville, MA 02144 42.398822, -71,128584	Installation	10.24.2018 02.12		
	Installation Date:	Installation Type:		
	Wednesday, October 24, 2018  Monitoring Location (Sensors):	Doppler Special Installation  Monitor Location:		
	Upstream 0-5 FT	Manhole		
	Sensors / Devices:	Pressure Sensor Range (psi)		
	Peak Combo (CS4)	0 -5 psi		
		Confirmation:		
	Confirmation Time: 1:43:00 PM	Pipe Size (HxW) 30.5H x 30.5W		
	Depth of Flow (Wet DOF) (in)	Range (Air DOF) (in)		
	0	30.5		
	Downlooker Physical Offset (in)	Measurement Confidence (in)		
	N/A	0.38"		
	Peak Velocity (fps)	Velocity Sensor Offset (in)		
	0	N/A		
10.24.2018 02:07	Silt (in)	Silt Type		
		N/A Comments:		
		/ Pipe		
		pe Information:		
	Manhole Depth (Approx. FT):	Manhole Configuration		
	10 Manhole Material:	Common Trench  Manhole Condition:		
	Brick	Fair		
	Manhole Opening Diameter (in)	Manhole Diameter (Approx.):		
	N/A	N/A		
		Manhole Frame		
	Manhole Cover	With the France		
	Vented	Normal		
	Vented Active Drop Connections	Normal Air Quality:		
	Vented Active Drop Connections No	Normal		
	Vented Active Drop Connections No Pipe Material Concrete	Normal Air Quality: Good Pipe Condition: Fair		
	Vented Active Drop Connections No Pipe Material Concrete Communicati	Normal Air Quality: Good Pipe Condition: Fair on Information:		
	Vented Active Drop Connections No Pipe Material Concrete Communicati Communicati	Normal Air Quality: Good Pipe Condition: Fair on Information: Antenna Location		
10.24.2018 02:09	Vented Active Drop Connections No Pipe Material Concrete Communicati Communicati	Normal Air Quality: Good Pipe Condition: Fair on Information: Antenna Location Drilled Pavement / Concrete		
10.24.2018 02:09	Vented Active Drop Connections No Pipe Material Concrete Communicati Communicati	Normal Air Quality: Good Pipe Condition: Fair on Information: Antenna Location		
10.24.2018 02:09  ADS Project Name: Smerville, MA Stantec 18	Vented Active Drop Connections No Pipe Material Concrete Communicati Communicati Serial Additional Site	Normal Air Quality: Good Pipe Condition: Fair on Information: Antenna Location Drilled Pavement / Concrete		

Figure E.9 School Street Meter Install Report

Somerville, MA		Sit	e I.D.	
Flow Monitoring Site Installation Report	ENVIRONMENTAL SERVICES®	30-5112		
Site Address / Location: School Street At Medford Stree, Somerville	e, MA	Monitor Series TRITON+	Location Type Temporary	
Site Access: Drive		Pipe Size (H x W)	Pipe Shape	
		18.00" X 18.50" Manhole #	Elliptical System Characteristics	
		N/A	Commercial	
		Access	Traffic	
		Drive	Medium	
			Mobil Mobil	
	lact.	Installation Info	ormation Installation Type:	
		October 23, 2018	Doppler Standard Ring and Crank	
		(Location (Sensors):	Monitor Location:	
		tream 0-5 FT ors / Devices:	Manhole Pressure Sensor Range (psi)	
		Combo (CS4)	0 -5 psi	
	Confi	Installation Con	firmation: Pipe Size (HxW)	
		L:16:00 AM	18.00" X 18.50"	
	Depth of F	low (Wet DOF) (in)	Range (Air DOF) (in)	
	Downloade	1.5" r Physical Offset (in)	16.00"  Measurement Confidence (in)	
	Downlooke	N/A	0.38"	
	Peak	Velocity (fps)	Velocity Sensor Offset (in)	
		0	N/A	
The second secon	To A See	Silt (in)	Silt Type N/A	
The state of the s	14.3	Hydraulic Com	ments:	
		Water is Usually  Manhole / Pipe Ir		
A STATE OF THE STA	Manhole I	Depth (Approx. FT):	Manhole Configuration	
		N/A	CSO Flow Divider	
	THE RESERVE AND THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TW	hole Material:	Manhole Condition: Good	
THE REPORT OF THE PARTY OF THE	THE RESERVE TO SHARE THE PARTY OF THE PARTY	Concrete pening Diameter (in)	Manhole Diameter (Approx.):	
		N/A	N/A	
	THE RESIDENCE OF THE PARTY OF T	nhole Cover	Manhole Frame	
	Control of the Contro	Unbolted	Normal	
	1000	rop Connections	Air Quality:	
	Active D	rop Connections No	Air Quality: Safe To Enter	
	Active D	No pe Material	Safe To Enter Pipe Condition:	
	Active D	No	Safe To Enter Pipe Condition: Good	
	Active D	No pe Material Concrete Communication I	Safe To Enter Pipe Condition: Good  formation: Antenna Location	
	Active D	No pe Material Concrete Communication I	Safe To Enter Pipe Condition: Good  formation: Antenna Location Drilled Pavement / Concrete	
	Active D Pi  Comm  Serial Number: 647	No pe Material Concrete Communication II nunication Type Wireless Additional Site Info.	Safe To Enter Pipe Condition: Good  formation: Antenna Location Drilled Pavement / Concrete	

Figure E.10 Marshall Street Meter Install Report

Somerville, MA	MAR	S	Site I.D.	
Flow Monitoring Site Installation Report	ENVIRONMENTAL SERVICES®	30-5116		
Site Address / Location: Stickney Ave at Marshall Street, Somen	vile, MA	Monitor Series	Location Type	
Site Access: Drive		TRITON+ Pipe Size (H x W)	Temporary Pipe Shape	
Site Access. Drive		63.75" X 63.75"	Circular	
		Manhole # N/A	System Characteristics Commercial	
Tion		Access	Traffic	
Way Comment of the Co		Drive	Medium	
		Installation I allation Date:	Installation Type:	
		October 23, 2018 Location (Sensors):	Doppler Standard Ring and Crank  Monitor Location:	
	The state of the s	stream 0-5 FT	Manhole	
	Control of the Contro	sors / Devices: c Combo (CS4)	Pressure Sensor Range (psi) 0 -5 psi	
- 12.25 (WINESE ST. )	1 Car	Installation C		
		irmation Time: I:43:00 PM	Pipe Size (HxW) 63.75" X 63.75"	
		Flow (Wet DOF) (in)	Range (Air DOF) (in)	
		3.75	60.00"	
	Downlooke	er Physical Offset (in)	Measurement Confidence (in) 0.25"	
A STATE OF THE STA	Peak	N/A : Velocity (fps)	Velocity Sensor Offset (in)	
CALL FOR STATE OF THE STATE OF		1.3	N/A	
10.23.201	8 02:56	Silt (in)	Silt Type	
		0 Hydraulic C	N/A omments:	
	The same of the sa	Slow & Smo		
	Manhala	Manhole / Pipe	Manhole Configuration	
	INTERHOTO.	10'	CSO Flow Divider	
pio .	Man	hole Material:	Manhole Condition:	
	Manhale O	Brick pening Diameter (in)	Good  Manhole Diameter (Approx.):	
A Joseph March March	waimole o	N/A	манное манесе (другох.). N/A	
		nhole Cover	Manhole Frame	
		Unbolted Prop Connections	Normal  Air Quality:	
			All Quality.	
	Active D	No	Safe To Enter	
	Active D	No pe Material	Safe To Enter Pipe Condition:	
	Active D	No	Safe To Enter Pipe Condition: Good	
	Active D Pi	No pe Material Brick Communication	Safe To Enter Pipe Condition: Good Information: Antenna Location	
10.23.201	Active D Pi	No pe Material Brick  Communication nunication Type Wireless	Safe To Enter Pipe Condition: Good Information: Antenna Location Manhole Pick / Vent Hole	
10.23.201	Active D Pil Comm Serial Number: 618	No pe Material Brick Communication nunication Type Wireless Additional Site In	Safe To Enter Pipe Condition: Good Information: Antenna Location Manhole Pick / Vent Hole	

Figure E.11 Pearl Street Meter Install Report

Somerville,	Somerville, MA		S	ite I.D.	
Flow Monitorin Site Installation Re		ENVIRONMENTAL SERVICES®	30-5600		
Site Address / Location: Pearl Street AT Man	shall Street, Somerville, N	IA	Monitor Series TRITON+	Location Type Temporary	
Site Access: Drive	Site Access: Drive			Pipe Shape Circular	
		Maronall St.	Manhole # N/A Access Drive	System Characteristics Commercial Traffic Medium	
Posts and the second se					
Gilman Square		Sarma			
			Installation Ir		
		THE MANAGEMENT OF THE PARTY OF	stallation Date: ay, October 23, 2018	Installation Type: Doppler Standard Ring and Crank	
	-		ing Location (Sensors):	Monitor Location:	
	A. Comment		pstream 0-5 FT	Manhole	
			nsors / Devices: ak Combo (CS4)	Pressure Sensor Range (psi) 0 -5 psi	
			Installation Co		
		Con	nfirmation Time:	Pipe Size (HxW)	
	TO I		1:01:00 PM	28.00" X 28.00"	
		Depth o	of Flow (Wet DOF) (in) 16.00"	Range (Air DOF) (in) 12.00"	
		Downloo	ker Physical Offset (in)	Measurement Confidence (in)	
			N/A	0.38"	
		Pe	ak Velocity (fps)	Velocity Sensor Offset (in)	
			0.5	4.50"	
Transfer Tr	0.23.2018	O.FO	Silt (in)	Silt Type	
		JU: 28	× **		
		JU: 58	1.0" Hydraulic Co	Sandy	
		JU:58	1.0" Hydraulic Co Very Slow & Sr	Sandy mments: nooth Flow	
			1.0" Hydraulic Co Very Slow & Sr <b>Manhole / Pipe</b>	Sandy mments: nooth Flow Information:	
			1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT):	Sandy mments: nooth Flow Information:  Manhole Configuration	
		Manhol	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT):  12' anhole Material:	Sandy mments: nooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition:	
		Manhol	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT):  12' anhole Material: Brick	Sandy mments: nooth Flow Information:  Manhole Configuration  CSO Flow Divider  Manhole Condition:  Good	
		Manhol	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT):  12' anhole Material:	Sandy mments: nooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition:	
		Manhol Manhole	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT): 12' anhole Material: Brick  Opening Diameter (in)	Sandy mments: mooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.):	
		Manhol Manhole	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT): 12' anhole Material: Brick Opening Diameter (in) N/A Manhole Cover Unbolted	Sandy mments: nooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.): N/A Manhole Frame Normal	
		Manhol Manhole	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT): 12' anhole Material: Brick Opening Diameter (in) N/A Manhole Cover Unbolted e Drop Connections	Sandy mments: nooth Flow Information:  Manhole Configuration	
		Manhol  Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe e Depth (Approx. FT): 12' anhole Material: Brick Opening Diameter (in) N/A Manhole Cover Unbolted	Sandy mments: nooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.): N/A Manhole Frame Normal	
		Manhol  Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT):  12' anhole Material: Brick  Opening Diameter (in) N/A Manhole Cover Unbolted e Drop Connections No Pipe Material Concrete	Sandy mments: mooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.): N/A Manhole Frame Normal Air Quality: Safe To Enter Pipe Condition: Good	
		Manhol  Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT): 12' anhole Material: Brick  Opening Diameter (in) N/A Manhole Cover Unbolted e Drop Connections No Pipe Material Concrete  Communication	Sandy mments: mooth Flow Information:  Manhole Configuration CSO Flow Divider  Manhole Condition: Good  Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Safe To Enter Pipe Condition: Good Information:	
		Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT): 12' anhole Material: Brick  Opening Diameter (in) N/A Manhole Cover Unbolted e Drop Connections No Pipe Material Concrete  Communication Immunication Type Wireless	Sandy Information:  Manhole Configuration CSO Flow Divider  Manhole Condition: Good  Manhole Diameter (Approx.): N/A  Manhole Frame Normal Air Quality: Safe To Enter Pipe Condition: Good  Information: Antenna Location Manhole Pick / Vent Hole	
	0.23.2018	Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT): 12' anhole Material: Brick  Opening Diameter (in) N/A Manhole Cover Unbolted Drop Connections No Pipe Material Concrete  Communication Immunication Type Wireless  Additional Site Inf	Sandy mments: mooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.): N/A Manhole Frame Normal Air Quality: Safe To Enter Pipe Condition: Good Information: Antenna Location Manhole Pick / Vent Hole O. / Comments:	
		Manhole  Manhole  Active	1.0"  Hydraulic Co Very Slow & Sr  Manhole / Pipe  e Depth (Approx. FT): 12' anhole Material: Brick  Opening Diameter (in) N/A Manhole Cover Unbolted e Drop Connections No Pipe Material Concrete  Communication  munication Type Wireless  Additional Site Infection 2101	Sandy mments: mooth Flow Information:  Manhole Configuration CSO Flow Divider Manhole Condition: Good Manhole Diameter (Approx.): N/A Manhole Frame Normal Air Quality: Safe To Enter Pipe Condition: Good Information: Antenna Location Manhole Pick / Vent Hole O. / Comments:	

Figure E.12 Newton Street Meter Install Report

Somerville, MA Stantec 18		MES	Site I.D.		
	Flow Monitoring Site Installation Report  ENVIRONMENTAL SERVICES®		C2-1994 MP1		
Site Address / Location:	Webster Ave at Newton St.		Monitor Series TRITON+	Location Type Temporary	
Site Access:	Drive, Close Off Newton St.		Pipe Size (H x W)	Pipe Shape	
			35.75H x 37.5W Manhole #	Elliptical System Characteristics	
LATE !	Ne Maria		N/A	Commercial	
A - Break	C. C		Access	Traffic	
			Drive	Light	
	39-43 Newton St Somerville, MA 02143 42.377957, -71.095708			10.24.2018 03:56	
			Installation I	AL MANAGEMENT OF THE STATE OF T	
			stallation Date: day, October 24, 2018	Installation Type: Doppler Standard Ring and Crank	
			ng Location (Sensors):	Monitor Location:	
		A COLUMN TO A COLU	ostream 0-5 FT	Manhole	
10 D. 14 M.		THE COURSE WELL TO SEE THE PERSON OF THE PER	nsors / Devices: ak Combo (CS4)	Pressure Sensor Range (psi) 0 -5 psi	
			Installation Co		
		THE RESERVE AND ADDRESS OF THE PARTY OF THE	nfirmation Time:	Pipe Size (HxW)	
	1		3:44:00 PM f Flow (Wet DOF) (in)	35.75H x 37.5W Range (Air DOF) (in)	
			11	24.75	
		Downlook	ker Physical Offset (in)	Measurement Confidence (in)	
			N/A	0.38"	
		Pea	ak Velocity (fps) 0.5	Velocity Sensor Offset (in) N/A	
	10.24.2018 0	13:45	Silt (in)	Silt Type	
			2.5	N/A	
		R.	Hydraulic Co Slow, Smooth F		
		1711	Manhole / Pipe		
		Manhole	e Depth (Approx. FT):	Manhole Configuration	
		No.	30 anhole Material:	Common Trench  Manhole Condition:	
A All Hold	THE REAL PROPERTY.	IVIA	Brick	Fair	
12/12/10	A Part of the Part	Manhole (	Opening Diameter (in)	Manhole Diameter (Approx.):	
1111			N/A	N/A	
Late of the state of		M	Manhole Cover Vented	Manhole Frame Normal	
		Active	Drop Connections	Air Quality:	
			No	Good	
			Pipe Material	Pipe Condition:	
			Concrete	Fair	
			Concrete Communication		
		Com	Communication Type	Information: Antenna Location	
	10.24.2018 0	Com	Communication	I Information: Antenna Location Drilled Pavement / Concrete	
	10 . 24 . 20 18 . 0 Smerville, MA Stantec 18	Com	Communication Imunication Type Serial Additional Site Inf	I Information: Antenna Location Drilled Pavement / Concrete	

Figure E.13 Grove Street Meter Install Report

Somerville, l	MA Stantec 18	NEE	5	Site I.D.	
	Flow Monitoring e Installation Report		CA-2401 MP1		
Site Address / Location: 48 Gr	ove St.		Monitor Series TRITON+	Location Type Temporary	
Site Access: Site L	ocated at Dead End in Cross Wal		Pipe Size (H x W) 24H x 26.25W	Pipe Shape Elliptical	
NGP VAN		Mins	Manhole # N/A Access	System Characteristics Residential Traffic	
Omerville Community Path  attander Bafik  Rockland Trust		× X	Drive	Light CRO'L-	
Non.	50-44 Grove St Somerville, MA 02144 42.396358, -71.120140		Installation		
			tallation Date: ay, October 24, 2018	Installation Type: Pulse Standard Ring and Crank	
		The state of the s	g Location (Sensors):	Monitor Location:	
		The state of the s	stream 0-5 FT	Manhole	
		Control of the Contro	sors / Devices: k Combo (CS4)	Pressure Sensor Range (psi) 0 -5 psi	
	A STATE		Installation C		
			firmation Time:	Pipe Size (HxW)	
			10:27AM	24H x 26.25W	
		Depth of	Flow (Wet DOF) (in) 8	Range (Air DOF) (in) 51	
		Downlooke	er Physical Offset (in)	Measurement Confidence (in)	
			N/A	0.38"	
		Peal	k Velocity (fps)	Velocity Sensor Offset (in)	
	70 00 0070 0	VO - 0.5	2.1 Silt (in)	N/A Silt Type	
	10.23.2018 2	2.25	0	N/A	
		MARCHE AND A PROPERTY OF THE P	Hydraulic C		
			Smootl Manhole / Pipe		
		Manhole	Depth (Approx. FT):	Manhole Configuration	
			10	Common Trench	
		Man	nhole Material:	Manhole Condition:	
1999	The state of the s	Manhole ()	Brick Opening Diameter (in)	Fair  Manhole Diameter (Approx.):	
		Walindle o	N/A	N/A	
A STATE OF THE PARTY OF THE PAR		Ma	anhole Cover	Manhole Frame	
A PORT OF THE PROPERTY OF THE			Vented	Normal	
		Active C	Orop Connections No	Air Quality: Good	
		Pi	ipe Material	Pipe Condition:	
		F-10 /	Brick Communicatio	Fair n Information:	
		Comn	nunication Type	Antenna Location	
	10.23.2018 2	3/97/2003-003	Serial	Drilled Pavement / Concrete	
			Additional Site In	io. / Comments:	
		IS/N: 61477 I/P: 10.	7.80.27.185		
ADS Project Name:	Smerville, MA Stantec 18	S/N: 61477 I/P: 107	7.80.27.185		

Figure E.14 Franey Road Meter Install Report

		NES	Si	ite I.D.	
	Flow Monitoring Site Installation Report		SOM_RG		
Site Address / Location:	. Franey Rd. Somerville DPW		Monitor Series Rain Alert III	Location Type Permanent	
Site Access: [	Drive, climb N 42.396913 w -71.10741	1,	Pipe Size (H x W)	Pipe Shape	
	Trum Trum Hiel		Manhole #	System Characteristics	
	Trum Fred Softball Field	Trum E	Access Walk (Commercial)	Industrial Traffic None	
	Somerville Department of Public Works				
			Installation In	formation	
			tallation Date:	Installation Type:	
			ay, October 24, 2018 ig Location (Sensors):	Rain Gauge  Monitor Location:	
			Rooftop	Building	
			sors / Devices:	Pressure Sensor Range (psi)	
		Raili Ga	uge Tipping Bucket Installation Co	nfirmation:	
		Con	firmation Time:	Pipe Size (HxW)	
		Depth of	Flow (Wet DOF) (in)	Range (Air DOF) (in)	
		Downlook	er Physical Offset (in)	Measurement Confidence (in)	
		Pea	k Velocity (fps)	Velocity Sensor Offset (in)	
			Silt (in)	Silt Type	
			Hydraulic Cor	mments:	
			Manhole / Pipe	Information:	
		Manhole	Depth (Approx. FT):	Manhole Configuration	
		Mai	nhole Material:	Manhole Condition:	
		Manhole C	Opening Diameter (in)	Manhole Diameter (Approx.):	
		M	anhole Cover	Manhole Frame	
		Active	Drop Connections	Air Quality:	
		P	ipe Material	Pipe Condition:	
			Communication	Information:	
		Com	nunication Type	Antenna Location	
			Wireless Additional Site Info	Cabinet	
		S/N:4198 I/P: 107.		or y comments.	
ADS Project Name: ADS Project Number:	Somerville, Ma 32556.11.325				

## **APPENDIX F**

**Manhole Inspection Table** 



## Appendix F

### Table F.1 Somerville MVP - Manhole Inspections



Street	Address / Intersection	мн ід	MH Type (DMH, SMH, CMH, COM)	Level of Data Collection (MH Inspection, Photos Only, CSE)	Inspection Date	Comments
Broadway St	Broadway / Paulina St	CA-106	CMH	MH Inspection	11/14/2018	Remnants of flap gate observed on drain inlet from CA-5208 and on inlet from CA-5209
, , , , ,	,,	CA-5208	СМН	MH Inspection	11/14/2018	(1) mainline outlet to CA-106; no connection to CA-5209
		CA-5209	DMH	MH Inspection	11/14/2018	Bulkhead observed on connection towards CA-106; No connection observed to CA-5208
	Broadway / Cross St	S2-2767	СМН	CSE	11/20/2018 12/20/2018	Overflow connection to S2-2141
		S2-2141	СМН	CSE	11/20/2018 12/20/2018	Connection from S2-2767; VCP pipe sleeved at invert of mainline inlet/outlet
		S2-2750 / S2-2309	CMH	MH Inspection	11/20/2018	MH recently lined and portion of structure encased; suspect no longer common manhole
Buena Vista Rd	#26 Thorndike St	1-5792	DMH	Popped for Connectivity	11/21/2018	Could not determine connectivity from surface; recommend CCTV if pipe configuration needed
Cameron Ave	Cameron Ave / Mead St	CA-520	CMH	MH Inspection	11/14/2018	Appears to match GIS; weir observed on connection towards A-722
	Cameron Ave / Seven Pines Ave	1-6432	СМН	Photos Only	10/24/2018	Photos taken as part of flow metering
Cedar St	Cedar St / Community Path	CA-2752	СМН	MH Inspection	11/20/2018	SD and SS combine into MH with (1) CS outlet; flap gate observed on SD inlet
	Cedar St / Murdock St	CA-453	CMH	Photos Only	12/13/2018	Photos taken as part of flow metering
Clarendon Ave	#32 Clarendon Ave	D41DMH9965 / A-5438	DMH	MH Inspection	11/21/2018	Connection to S78CMH9500 confirmed with weir; weir directs base flows to SMH A-729
		S78COM0210 / A-729 S78CMH9500	СМН	MH Inspection CSE	11/21/2018 11/21/2018 12/20/2018	Underflow from Tannery Brook comes into A-729; SD and SS from Clarendon Ave (North) inlet into structure  See CSE notes for details
College Ave	College Ave / Holland St	CA-5916	DMH	CSE	11/21/2018 12/20/2018	Riser offset from structure; see confined space entry notes
Cross St	Cross St / Pearl St	S2-1577	СМН	MH Inspection	11/20/2018	Steel plate in intersection makes it difficult to determine all manholes in street; Inspection report may be for \$2-1566; difficult to confirm connectivity; recommend CCTV or cse
		S2-2481	CMH	MH Inspection	11/20/2018	Difficult to confirm connectivity; recommend CCTV
		S2-1578	CMH	MH Inspection	11/20/2018	Weir observed in manhole with SS service on one side; suspect SS/CS on both sides of weir
		S2-1442	SMH	MH Inspection	11/20/2018	CB inlet observed, unknown where outlet discharges to
Day St	Day St / Elm St	CA-3075	СОМ	MH Inspection	11/21/2018	Common manhole; weir and drop observed
Elm St	Elm St / Chester St	1-5026	CMH	MH Inspection	11/21/2018	Findings do not match GIS; connectivity unknown; recommend CCTV
Elmwood St	Elmwood St / Elmwood Ter	A-532	COM	MH Inspection	11/14/2018	Common mh with weir separating SD and SS
	Elmwood St / Harrison Rd	A-533	СОМ	MH Inspection	11/14/2018	Common MH with SD thru MH; SS service or GW weeping into MH; recommend cleaning
Gold Star Rd	Gold Star Rd / Seven Pines Ave	S78CMH8485/A-732 ACCESS244 / 1-5057	CMH DMH	MH Inspection  Popped for  Connectivity	11/21/2018	No cross connect over to Tannery Brook; outlet goes under house of #69 Gold Star Rd No cross connection observed from CS
Gorham St	Gorham St / Holland St	A-2331	COM	MH Inspection	11/14/2018	Common MH with SD adjacent to SS and weir separating
Gornam St	Gorham St / Tannery Brook ROW	1-5030	DMH	MH Inspection	11/14/2018	Connection in photo is from CB; suspect no cross connection present
Grand Union Blvd	Grand Union Blvd or Assembly Sq Dr	S2-6178	DMH	Popped for	11/20/2018	No additional manholes observed from surface; recommend CCTV to confirm if additional access points at nearby
	(Back northeast corner of Home Depot)			Connectivity		junctions
Grove St	Grove St / Community Path	CA-2401	СОМ	MH Inspection	10/24/2018 11/21/2018	Common MH with CS elevated within MH and SD below; MH inspected and photos taken as part of flow metering
	Grove St / Community Path	C2-6438	DMH	Popped for Connectivity	11/21/2018	Pipe configuration cannot be determined from surface; already have info needed from previous inspection; CSE not conducted
Highland Rd	Highland Rd / Kidder Ave	CA-254	СОМ	MH Inspection	11/20/2018	Common MH with separation weir
Holland St	Holland St / Paulina St / Gorham St	CA-2397	CMH	MH Inspection	11/14/2018	Connection/overflow observed over to A-5353; Overflow observed to Gorham St confirmed to be bulkheaded
		A-5353	СМН	MH Inspection	11/14/2018 12/20/2018	Connection/overflow observed over to CA-2397
Marshall St	Marshall St / Evergreen Ave	30-5119	CMH	MH Inspection	11/20/2018	CI pipe thru MH; turbulent flow from S2-1760 dropping into drain manhole
	Marshall St / Stickney Ave	30-5116	CMH	Photos Only	10/23/2018	PVC pipe thru MH; photos taken as part of flow metering
McGrath Highway /	McGrath Highway / Mystic Ave /	S2-6086	DMH	MH Inspection	12/13/2018	MH configuration does not match GIS; orange discolored flow
Mystic Ave	Foss Park	S2-3215	COM	MH Inspection	12/13/2018	Common MH with tapered weir; outlet drops into unknown chamber
		S2-3264	SMH	Photos Only	12/13/2018	Photos taken as part of flow metering
		30-6204	СМН	Photos Only	12/13/2018	Photos taken as part of flow metering



#### MODEL REFINEMENT AND CALIBRATION REPORT

### Appendix F

Street	Address / Intersection	MHID	MH Type (DMH, SMH, CMH, COM)	Level of Data Collection (MH Inspection, Photos Only, CSE)	Inspection Date	Comments
Medford St	Medford St / School St	30-5112	DMH	Photos Only	10/23/2018	Photos taken as part of flow metering
		30-5112A	DMH	MH Inspection	10/15/2018 12/20/2018	CSE not able to be conducted due to high LEL; petroleum odor and orange discoloration observed
		S2-2686	SMH	MH Inspection	12/20/2018	Overflow to DMH 30-5112A; Fracture observed on MH wall
Morrison Ave	Morrisson Ave / Willow Ave	CA-2398	CMH	MH Inspection	11/20/2018	Overflow weir observed; suspect in-line over to SD; connection not observed in CA-5372
	Morrisson Ave / Highland Rd	CA-2399	CMH	MH Inspection	11/20/2018	Overflow and weir observed from CS towards Highland Rd (South)
Newton St	Newton St / Webster Ave	C2-1994	CMH	Photos Only	10/24/2018	Photos taken as part of flow metering
North St	North St / Raymond Ave	8-5043	DMH	MH Inspection	10/15/2018	MH inspected as part of pre-flow meter investigations
		9-5186	DMH	MH Inspection	10/15/2018 10/24/2018	MH inspected and photos taken as part of flow metering
	North St / Broadway St	9-5187	DMH	Photos Only	10/15/2018	Photos taken as part of pre-flow meter investigations
Palmer Ave	Palmer Ave / Franklin St	C1-1355	DMH	MH Inspection	10/15/2018 12/13/2018	MH inspected and photos taken as part of flow metering
Pearl St	Pearl St / Marshall St	30-5600	СМН	Photos Only	10/15/2018 10/23/2018	Photos taken as part of flow metering
	Pearl St / Cross St	S2-1579	SMH	MH Inspection	11/20/2018	Broken MH frame and cover; did not open
Properzi Way	#100 Properzi Way	C2-1334	CMH	Photos Only	12/13/2018	Photos taken as part of flow metering
Simpson Ave	Simpson Ave / Holland Ave	CA-2	COM	MH Inspection	11/14/2018	Common MH with weir separating flows
	#15 Simpson Ave	CA-3099	COM	MH Inspection	11/14/2018	Common MH with C-shaped channel above lower SS
	Simpson Ave / Cady Ave	CA-100	COM	MH Inspection	11/14/2018	Common MH with SD thru MH with open tap
	#47 Simpson Ave	CA-99	COM	MH Inspection	11/14/2018	Common MH with SD thru MH with open tap
Somerville Ave	Somerville Ave / Properzi Way	C2-1337	CMH	MH Inspection	11/21/2018	Weir observed in manhole with connection towards Properzi Way; Connection sound tested and confirmed to C2-3170
	Somerville Ave / Laurel St	C2-3170	CMH	MH Inspection	11/21/2018	Connection sound tested and confirmed to C2-1337
Washburn Ave	Washburn Ave / Washburn Ter	S78COM8500 / A-731	CMH	MH Inspection	11/21/2018	Confirmed no cross connect over to Tannery Brook SD
Willow Ave	Willow Ave / Lexington Ave	C2-6439	DMH	MH Inspection	11/20/2018	Connection to CS bulkheaded

No. of Manhole Inspections	42
No.Structures popped for connectivity only	4
No. of Photos Only	10
No. of Confined Space Entries (CSE)	4

Total 60



# **APPENDIX G**

**Manhole Inspection Reports** 



**Manhole Inspection Report** 





Manhole Type: Common Manhole

**Latitude / Y:** 42.401855 **Longitude / X:** -71.1237

**General Comments:** Corroded Flap Gates on E and C Pipes

Location of MH - Roadway

Comment -

Manhole Material - Brick

Comment -

Flow - Steady

Comment -

Clarity of Flow - Normal Sewer Appearance

Recommendations- Clean/Remove Depris from invert

**MH#** CA-106

**Catchment Area:** 

**Inspector:** Greg Frazier

Date: 11/14/2018 2:03:33 PM

Temp: <u>33</u>

Weather:\_Sunny

Street: BROADWAY

Cover Size: 24" Other:

Manhole Size: 4' Other:

Drop: N

**Depth to Wet Ring from Rim or Invert:** 

N/A

Weir- (Y/N): N

Rim to top of weir: NA

MH Channel- (Y/N): Y

MH Channel Condition: Fair

Area Around MH Condition:

Paved- Cracked

MH Condition:

Good

	Pipe Size	Material	From / To MH#	Invert Depth (from rim)	Flow Depth (from invert)	Debris Depth (from invert)	Condition
A.	36"	Brick	FIT-148	13.89'	12"	8"	Good
В.	Unknown	Brick	CA-341	13.86'	12"	0"	Good
C.	24"	RCP	CA-5209	12.63'	0"	0"	Good
D.	Unknown	Unknown	CA-107	13.92'	12"	8"	Good
E.	24"	RCP	CA-5208	7.86'	0"	4"	Good
F.							
G.							
н.							

**Manhole Inspection Report** 



D CA - 5208

**Manhole Type:**Storm Manhole

**Latitude / Y:** 42.401853 **Longitude / X:** -71.12374

**General Comments:** 

Location of MH - Roadway
Comment -

<u>Manhole Material - Precast Concrete</u>

Comment -

Flow - Stagnant

Comment -

Clarity of Flow - Clear

Recommendations- Clean/Remove Depris from invert

MH# CA-5208

**Catchment Area:** 

**Inspector:** Greg Frazier

Date: 11/14/2018 2:08:27 PM

Temp: <u>33</u>

Weather:\_Sunny

Street: BROADWAY

Cover Size: 24" Other:

Manhole Size: Other Other: 5' x 6'

Drop: N

**Depth to Wet Ring from Rim or Invert:** 

N/A

**Weir- (Y/N)**: N

Rim to top of weir: NA

MH Channel- (Y/N): N

MH Channel Condition: N/A

Area Around MH Condition:

Paved- Cracked

MH Condition:

Good

	Pipe Size	Material	From / To MH#	Invert Depth (from rim)	Flow Depth (from invert)	Debris Depth (from invert)	Condition
A.	48"	RCP	CA-5207	8.64'	3"	0"	Good
В.							
C.							
D.	24"	RCP	CA-106	8.54'	2"	1"	Good
E.							
F.							
G.							
Н.							

**Manhole Inspection Report** 



**Latitude / Y:** 42.40182 **Longitude / X:** -71.123636

**General Comments:** 

Location of MH - Roadway

Comment -

Manhole Material - Manhole Block

Comment -

Flow - Steady

Comment -

Clarity of Flow - Clear

**Recommendations- No Action** 

MH# CA-5209

**Catchment Area:** 

**Inspector:** Greg Frazier

Date: 11/14/2018 2:42:36 PM

Temp: <u>33</u>

Weather:\_Sunny

Street: BROADWAY

Cover Size: 24" Other:

Manhole Size: 5' Other:

Drop: N

**Depth to Wet Ring from Rim or Invert:** 

N/A

Weir- (Y/N): N

Rim to top of weir: NA

MH Channel- (Y/N): N

MH Channel Condition: N/A

Area Around MH Condition:

Paved- Cracked

MH Condition:

Good

	Pipe Size	Material	From / To MH#	Invert Depth (from rim)	Flow Depth (from invert)	Debris Depth (from invert)	Condition
A.	36"	RCP	CA-5210	8.70'	<1"	0"	Good
В.							
C.	Unknown	Unknown	CA-5212	12.05'	<1"	0"	Good
D.	Unknown	RCP	<u>A-5351</u>	12.30'	<1"	0"	Good
E.							
F.							
G.							
Н.							