Appendix F: Sewer Analysis

Kimley»Horn

M E M O R A N D U M

Date: October 5, 2015

To: David Pinto
Development Director
Legacy Partners Residential, Inc.

CC: Michael Choi, P.E., LEEP AP
Kimley-Horn and Associates, Inc.

From: Roque Quiroz, EIT
Kimley-Horn and Associates, Inc.

Subject: Mission Place Mixed Use Residential Project Memorandum

Introduction

Kimley-Horn and Associates, Inc. prepared this sewer analysis to determine whether the existing sewer mainline along Fairview Avenue would accommodate the increased sewer demand from the proposed Mission Place mixed-use development. Summary of our analysis is below for the proposed routing along with the following attachments:

- Attachment A – Proposed Flow Calculations From Buildings
- Attachment B – Sewer Lateral Hydraulic Calculations and Pipe Sections
- Attachment C – City of South Pasadena Sewer Map
- Attachment D – Existing Sewer Main Hydraulic Calculations and Pipe Sections
- Attachment E – Flow Metering Results

Sewer Capacity Verification

Onsite Sewer: The following analysis is based on a proposed 6" diameter sanitary sewer PVC pipe at 1% slope to service the proposed Mission Place mixed use development on the site. The development will provide a new lateral connection to the existing mainline along Fairview Avenue or Mission Street.

a. Capacity Verification Of Proposed 6"Φ SS: The proposed line will service the proposed mixed-use development for the demand calculated below (includes 2.5 factor per LA County).

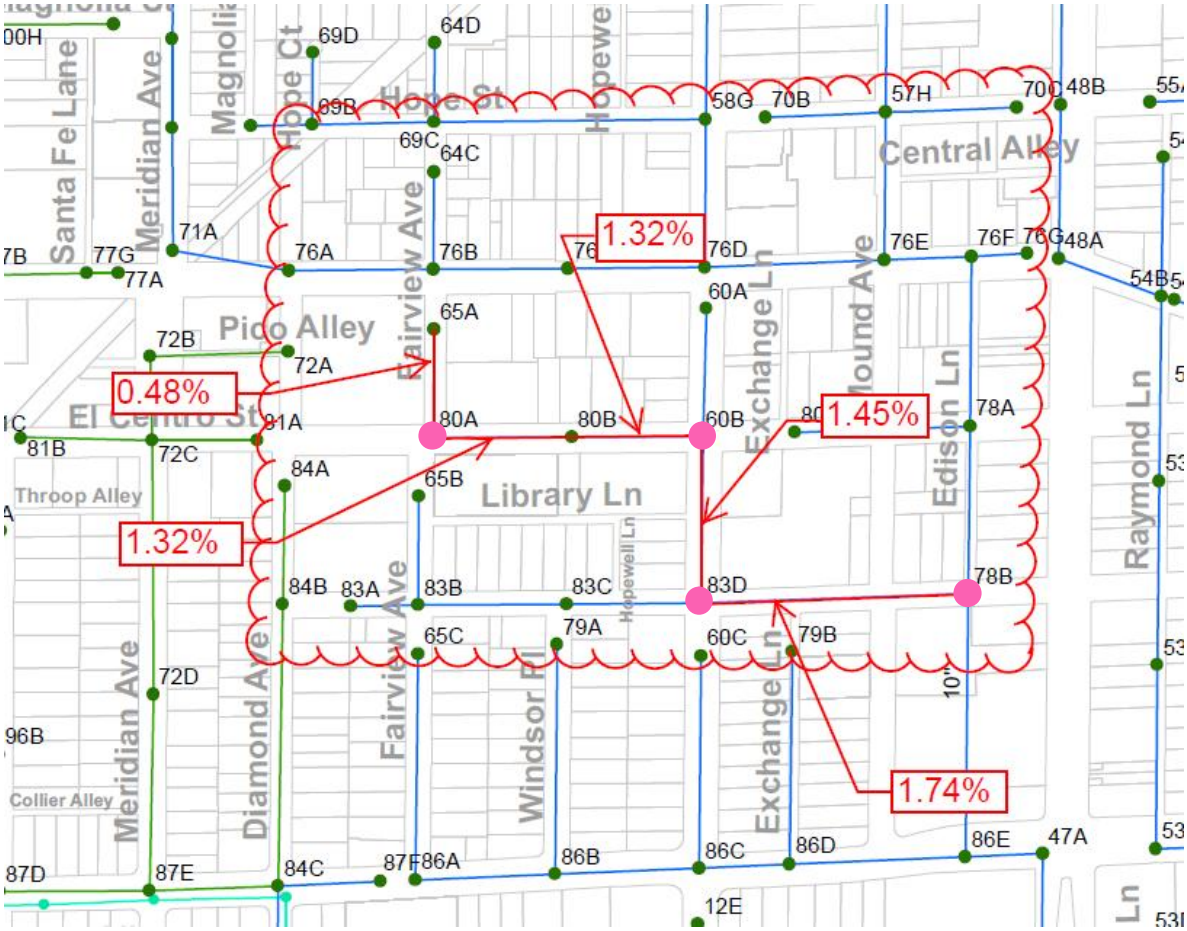
i. Q_{Demand} = 0.05 cfs (See Attachment A)
ii. $Q_{Pipe\ Capacity}$ = 0.36 cfs (See Attachment B)*
iii. $Q_{Pipe\ Capacity} > Q_{Demand}$, Therefore ok

b. Cleaning Velocity Verification Of Proposed 6"Φ SS:

i. Minimum Cleaning Velocity for SS pipe, $V_{Cleaning}$ = 3.0 fps (Per City of Los Angeles Sewer Design Manual—Part F, Section F231)
ii. V_{Pipe} = 3.71 fps (See Attachment B)*
iii. $V_{Pipe} > V_{Cleaning}$, Therefore ok

*****$Q_{Pipe\ Capacity}$ *based on d/D = 0.5, d = depth of flow, and D = pipe diameter*

c. Existing Capacity For Downstream Sewer System Based On Metering Data: The location requirement for capacity verification and metering was provided by the City. See Exhibit below for locations of manholes 78B, 83D, 60B, and 80A utilized for metering:



Sewer System Loading Tabulation:

The tabulation below shows impact of our project to the adjacent sewer system based on the maximum flow rate from the metering data (See Attachment E).

Loading From Project Site: 0.05 cfs

Manhole Location	Metering Flow Rate (MGD)	Metering Flow Rate (cfs)	Metering Flow & Project Site Flow Rate (cfs)	Pipe Diameter, D (inches)	Pipe Slope (ft/ft)	Normal Depth, d (feet)	Normal Depth, d (inches)	Capacity Used (d/D)	Percent Used (%)	Capacity Check (50% Maximum)
80A	0.001	0.002	0.052	8	0.0048	0.1	1.2	0.15	15	Ok
60B	0.035	0.054	0.104	8	0.0132	0.11	1.32	0.165	16.5	Ok
83D	0.055	0.085	0.135	8	0.0145	0.12	1.44	0.18	18	Ok
78B	0.709	1.097	1.147	10	0.0174	0.32	3.84	0.384	38.4	Ok

Attachment A

Proposed Flow Calculations From Buildings

PROPOSED FLOW - Mission Place Mixed-Use Project

UNIT TYPE	BUILDING	UNIT OF USAGE	QUANTITY	Unit Of Measure (SF)	UNITS (Dimensionless)	FLOW (GPD/UNITS)	FLOW (GPD)
GARRETS	Building 1	EA	8	--	--	120	960
TOWNHOMES (1-BEDROOM)	Building 1	EA	4	--	--	130	520
TOWNHOMES (2-BEDROOM)	Building 1	EA	1	--	--	180	180
FLATS (1-BEDROOM)	Building 1	EA	28	--	--	120	3360
FLATS (2-BEDROOM)	Building 1	EA	8	--	--	160	1280
RETAIL	Building 1	SF	3700	1000	3.7	80	296
GARRETS	Building 2	EA	8	--	--	120	960
LOFTS (1-BEDROOM)	Building 2	EA	34	--	--	120	4080
RETAIL	Building 2	SF	3800	1000	3.8	80	304

NOTES:
1. GPD/UNITS per LA County Sanitation District Connection Fee Ordinance.
2. Peak Factor Based on County Requirement.
3. Proposed development unit types and quantities based on info provided by GMP Architects.

TOTAL GPD =	11940	
TOTAL CFS =	0.018	
2.5 Peak Factor:	0.046	CFS
	29850	GPD

Attachment B

Hydraulic Calculations and Pipe Sections

Mission Place - 6" SS Capacity Half Full

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Normal Depth	0.25	ft
Diameter	0.50	ft

Results

Discharge	0.36	ft^3/s
Flow Area	0.10	ft^2
Wetted Perimeter	0.79	ft
Hydraulic Radius	0.13	ft
Top Width	0.50	ft
Critical Depth	0.31	ft
Percent Full	50.0	%
Critical Slope	0.00518	ft/ft
Velocity	3.71	ft/s
Velocity Head	0.21	ft
Specific Energy	0.46	ft
Froude Number	1.48	
Maximum Discharge	0.78	ft^3/s
Discharge Full	0.73	ft^3/s
Slope Full	0.00250	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	50.00	%
Downstream Velocity	Infinity	ft/s

Mission Place - 6" SS Capacity Half Full

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.25	ft
Critical Depth	0.31	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00518	ft/ft

Mission Place - 6" SS Capacity Half Full Cross Section

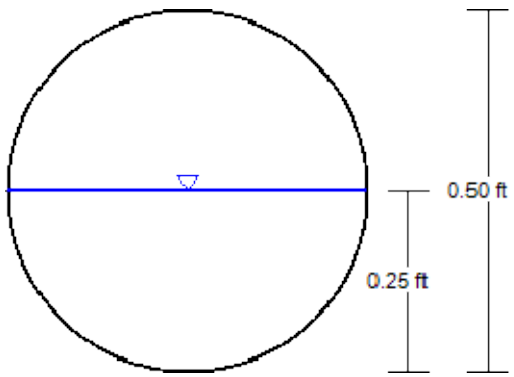
Project Description

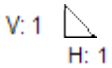
Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Normal Depth	0.25	ft
Diameter	0.50	ft
Discharge	0.36	ft³/s

Cross Section Image





Mission Place - 6" SS Normal Depth

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	0.50	ft
Discharge	0.05	ft^3/s

Results

Normal Depth	0.09	ft
Flow Area	0.02	ft^2
Wetted Perimeter	0.43	ft
Hydraulic Radius	0.05	ft
Top Width	0.38	ft
Critical Depth	0.11	ft
Percent Full	17.7	%
Critical Slope	0.00423	ft/ft
Velocity	2.13	ft/s
Velocity Head	0.07	ft
Specific Energy	0.16	ft
Froude Number	1.51	
Maximum Discharge	0.78	ft^3/s
Discharge Full	0.73	ft^3/s
Slope Full	0.00005	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	17.73	%
Downstream Velocity	Infinity	ft/s

Mission Place - 6" SS Normal Depth

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.09	ft
Critical Depth	0.11	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00423	ft/ft

Mission Place - 6" SS Capacity Normal Depth Cross Section

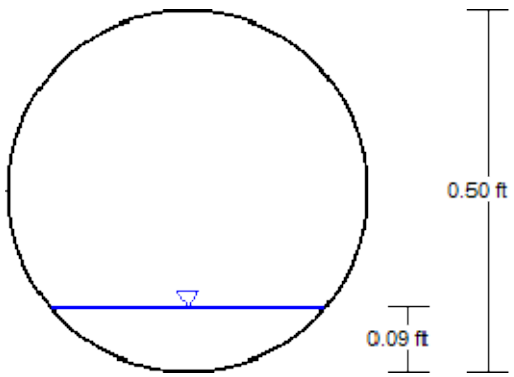
Project Description

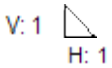
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Normal Depth	0.09	ft
Diameter	0.50	ft
Discharge	0.05	ft^3/s

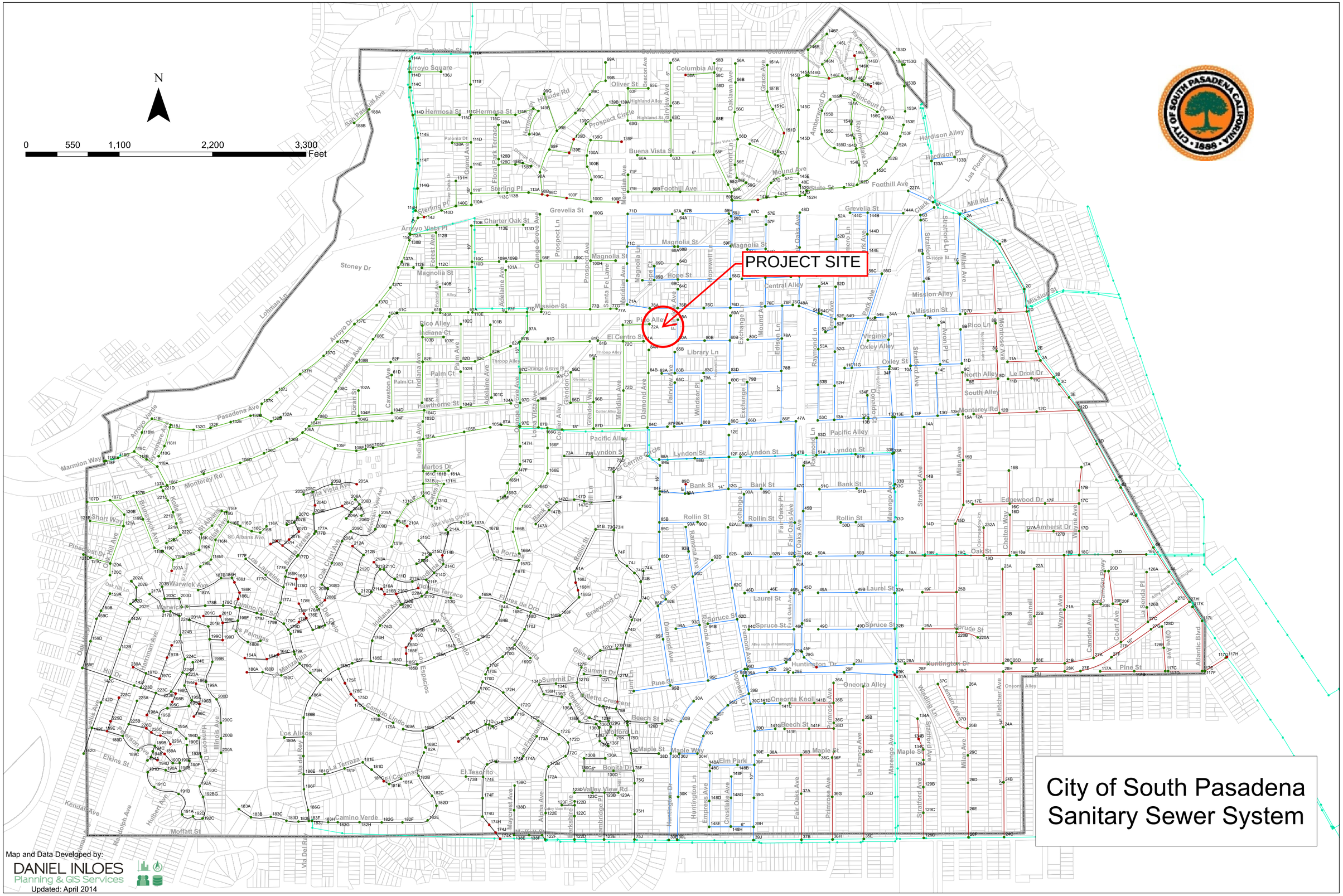
Cross Section Image





Attachment C

City of South Pasadena Sewer Map


N
0
550
1,100
2,200
3,300
Feet
PROJECT SITE
City of South Pasadena
Sanitary Sewer System
Map and Data Developed by:
DANIEL INLOES
Planning & GIS Services
Updated: April 2014

Attachment D

Existing Sewer Main Hydraulic Calculations And Pipe Sections

Normal Depth - MH 80A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00480	ft/ft
Diameter	0.67	ft
Discharge	0.052	ft^3/s

Results

Normal Depth	0.10	ft
Flow Area	0.03	ft^2
Wetted Perimeter	0.53	ft
Hydraulic Radius	0.06	ft
Top Width	0.48	ft
Critical Depth	0.10	ft
Percent Full	14.8	%
Critical Slope	0.00408	ft/ft
Velocity	1.60	ft/s
Velocity Head	0.04	ft
Specific Energy	0.14	ft
Froude Number	1.08	
Maximum Discharge	1.19	ft^3/s
Discharge Full	1.10	ft^3/s
Slope Full	0.00001	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	14.78	%
Downstream Velocity	Infinity	ft/s

Normal Depth - MH 80A

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.10	ft
Critical Depth	0.10	ft
Channel Slope	0.00480	ft/ft
Critical Slope	0.00408	ft/ft

Cross Section - MH 80A

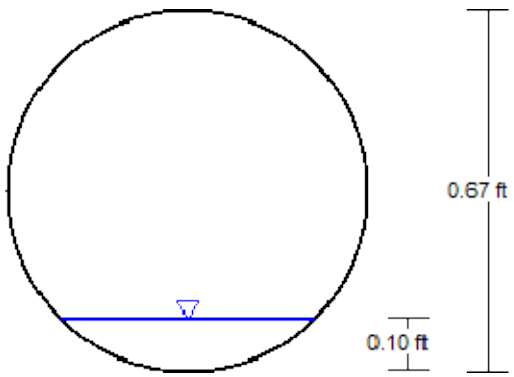
Project Description

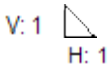
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00480	ft/ft
Normal Depth	0.10	ft
Diameter	0.67	ft
Discharge	0.052	ft^3/s

Cross Section Image





Normal Depth - MH 60B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01320	ft/ft
Diameter	0.67	ft
Discharge	0.104	ft^3/s

Results

Normal Depth	0.11	ft
Flow Area	0.04	ft^2
Wetted Perimeter	0.55	ft
Hydraulic Radius	0.07	ft
Top Width	0.49	ft
Critical Depth	0.15	ft
Percent Full	16.2	%
Critical Slope	0.00388	ft/ft
Velocity	2.81	ft/s
Velocity Head	0.12	ft
Specific Energy	0.23	ft
Froude Number	1.81	
Maximum Discharge	1.97	ft^3/s
Discharge Full	1.83	ft^3/s
Slope Full	0.00004	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	16.19	%
Downstream Velocity	Infinity	ft/s

Normal Depth - MH 60B

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.11	ft
Critical Depth	0.15	ft
Channel Slope	0.01320	ft/ft
Critical Slope	0.00388	ft/ft

Cross Section - MH 60B

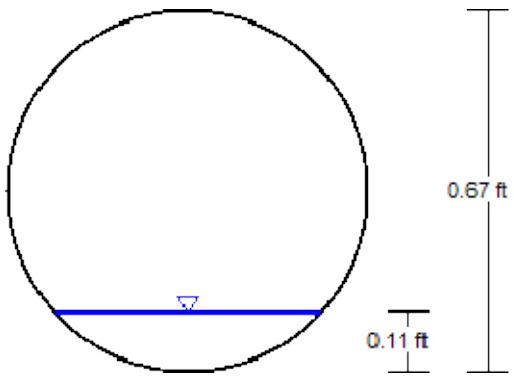
Project Description

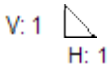
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01320	ft/ft
Normal Depth	0.11	ft
Diameter	0.67	ft
Discharge	0.104	ft^3/s

Cross Section Image





Normal Depth - MH 83D

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01450	ft/ft
Diameter	0.67	ft
Discharge	0.135	ft^3/s

Results

Normal Depth	0.12	ft
Flow Area	0.04	ft^2
Wetted Perimeter	0.59	ft
Hydraulic Radius	0.07	ft
Top Width	0.51	ft
Critical Depth	0.17	ft
Percent Full	18.0	%
Critical Slope	0.00382	ft/ft
Velocity	3.14	ft/s
Velocity Head	0.15	ft
Specific Energy	0.27	ft
Froude Number	1.91	
Maximum Discharge	2.06	ft^3/s
Discharge Full	1.92	ft^3/s
Slope Full	0.00007	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	17.97	%
Downstream Velocity	Infinity	ft/s

Normal Depth - MH 83D

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.12	ft
Critical Depth	0.17	ft
Channel Slope	0.01450	ft/ft
Critical Slope	0.00382	ft/ft

Cross Section - MH 83D

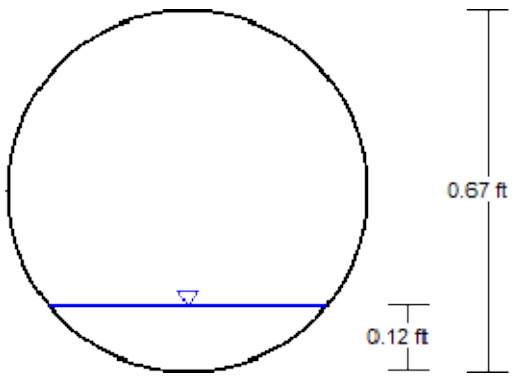
Project Description

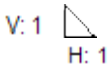
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01450	ft/ft
Normal Depth	0.12	ft
Diameter	0.67	ft
Discharge	0.135	ft^3/s

Cross Section Image





Normal Depth - MH 78B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01740	ft/ft
Diameter	0.83	ft
Discharge	1.147	ft^3/s

Results

Normal Depth	0.32	ft
Flow Area	0.19	ft^2
Wetted Perimeter	1.11	ft
Hydraulic Radius	0.17	ft
Top Width	0.81	ft
Critical Depth	0.48	ft
Percent Full	37.9	%
Critical Slope	0.00415	ft/ft
Velocity	6.05	ft/s
Velocity Head	0.57	ft
Specific Energy	0.89	ft
Froude Number	2.20	
Maximum Discharge	4.04	ft^3/s
Discharge Full	3.75	ft^3/s
Slope Full	0.00163	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	37.92	%
Downstream Velocity	Infinity	ft/s

Normal Depth - MH 78B

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.48	ft
Channel Slope	0.01740	ft/ft
Critical Slope	0.00415	ft/ft

Cross Section - MH 78B

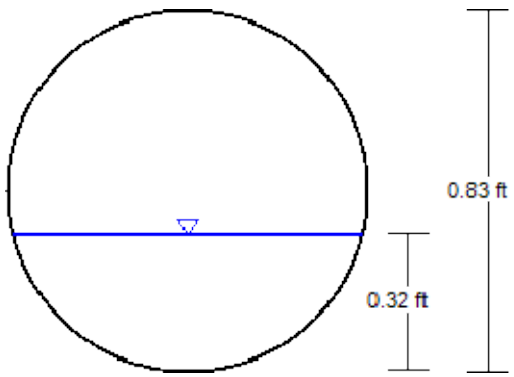
Project Description

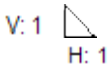
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01740	ft/ft
Normal Depth	0.32	ft
Diameter	0.83	ft
Discharge	1.147	ft^3/s

Cross Section Image





Attachment E

Flow Metering Results

Site Report

09-25-2015

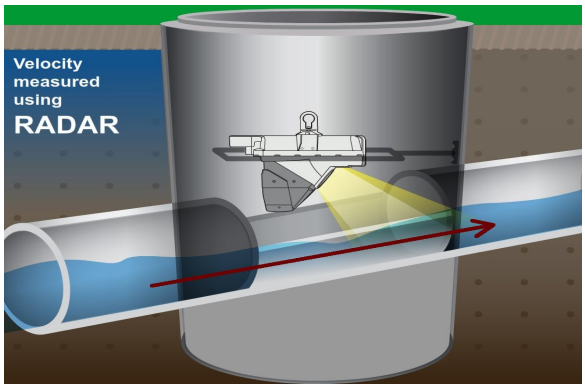
Confidential Proprietary Information

Legacy Partners	988 Fairview Av
El Centro & Fairview	Manhole No.80A

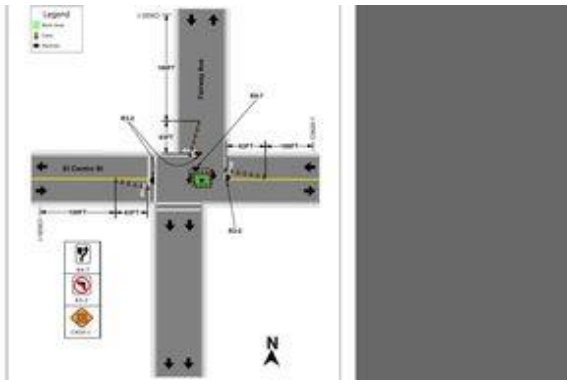
Access:	System Type:	
Manhole in roadway at intersection	Sanitary [X] Storm [ ]	Install Date: 9/24/2015

Map

Technology



Traffic Plan



Flow Meter			
Meter Depth: 67.27"			
Meter SN:*			
*			
Avg Velocity	Avg Measured Level		Multiplier
*	0.13"		1.0
Gas			
O2	H2S	CO	LEL
20.9	0	0	0
Notes			
*			
Traffic Safety			
Used cones, signs & a flagger.			
Land Use			
Residential	Commercial	Industrial	Trunk
X			

Manhole Depth	80"
Pipe Size	8"
Inner Pipe Size (In/Out)	8"/8"
Pipe Shape	Round
Pipe Condition	OK
Manhole Material	Brick
Silt (inches)	0
Velocity Profile Data	*
Velocity Profile Taken	
Sensor Offset	12.73"
Sensor Dist. to Crown	4.73"
Flow Direction	Downstream
Flow Heading	East

Meter Site Document

Legacy Partners

El Centro & Fairview

988 Fairview Av

Site

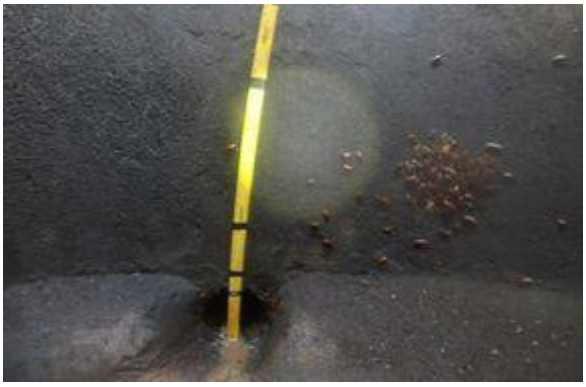
Manhole Before Install

Installation Process

Installed

Upstream

Downstream



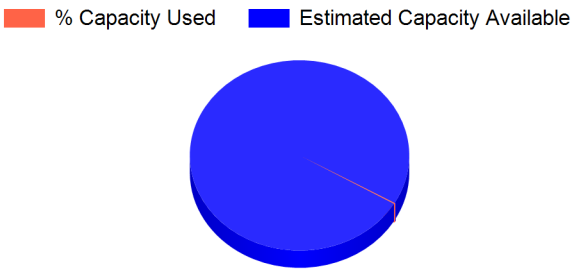
Temporary Flow Study

Legacy Partners

El Centro & Fairview

Meter Start Date		From	9/11/2015 12:00:00 AM
Meter Stop Date		To	9/25/2015 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	0.104	0.003	0.000
Maximum	1.110	0.230	0.001
Minimum	0.100	0.000	0.000
Pipe Size		8.000	
Estimated Capacity (mgd)			
Capacity Used			
Sensor Type		Hach - Flodar	

Estimated Capacity Usage

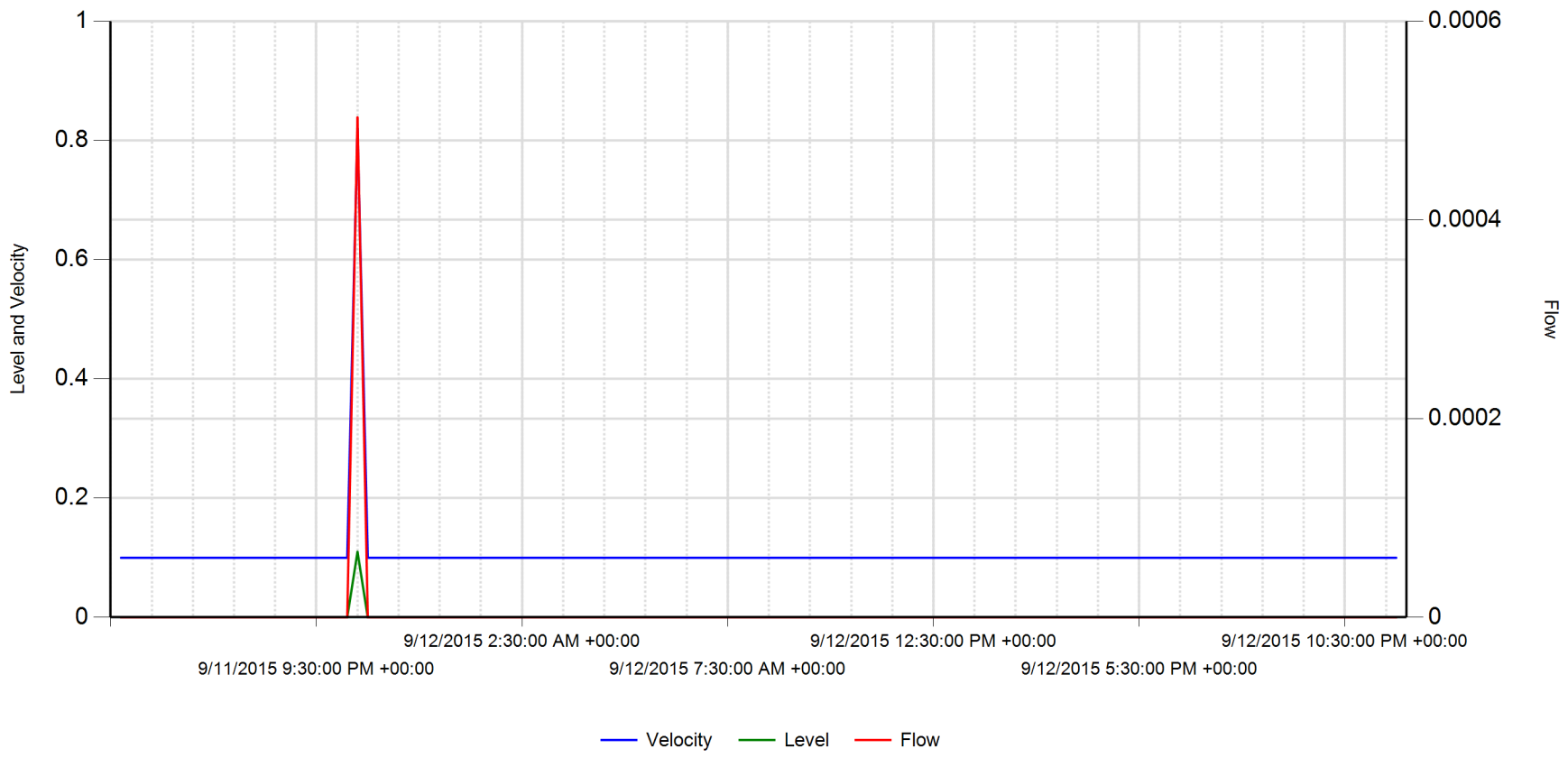


Utility Systems, Science and Software

6190 Fairmount Ave. Suite E
San Diego, CA 92021

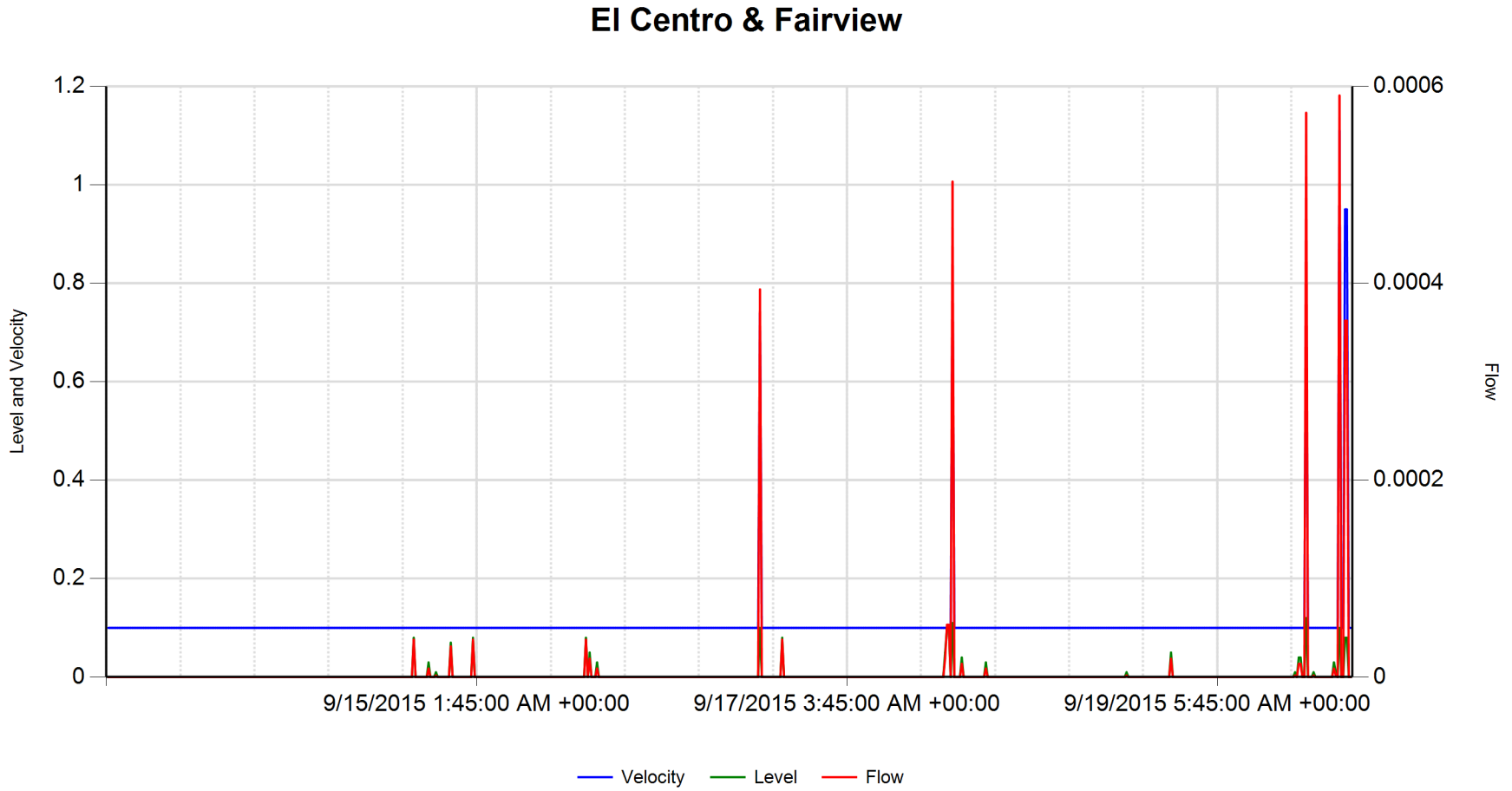
601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705

El Centro & Fairview



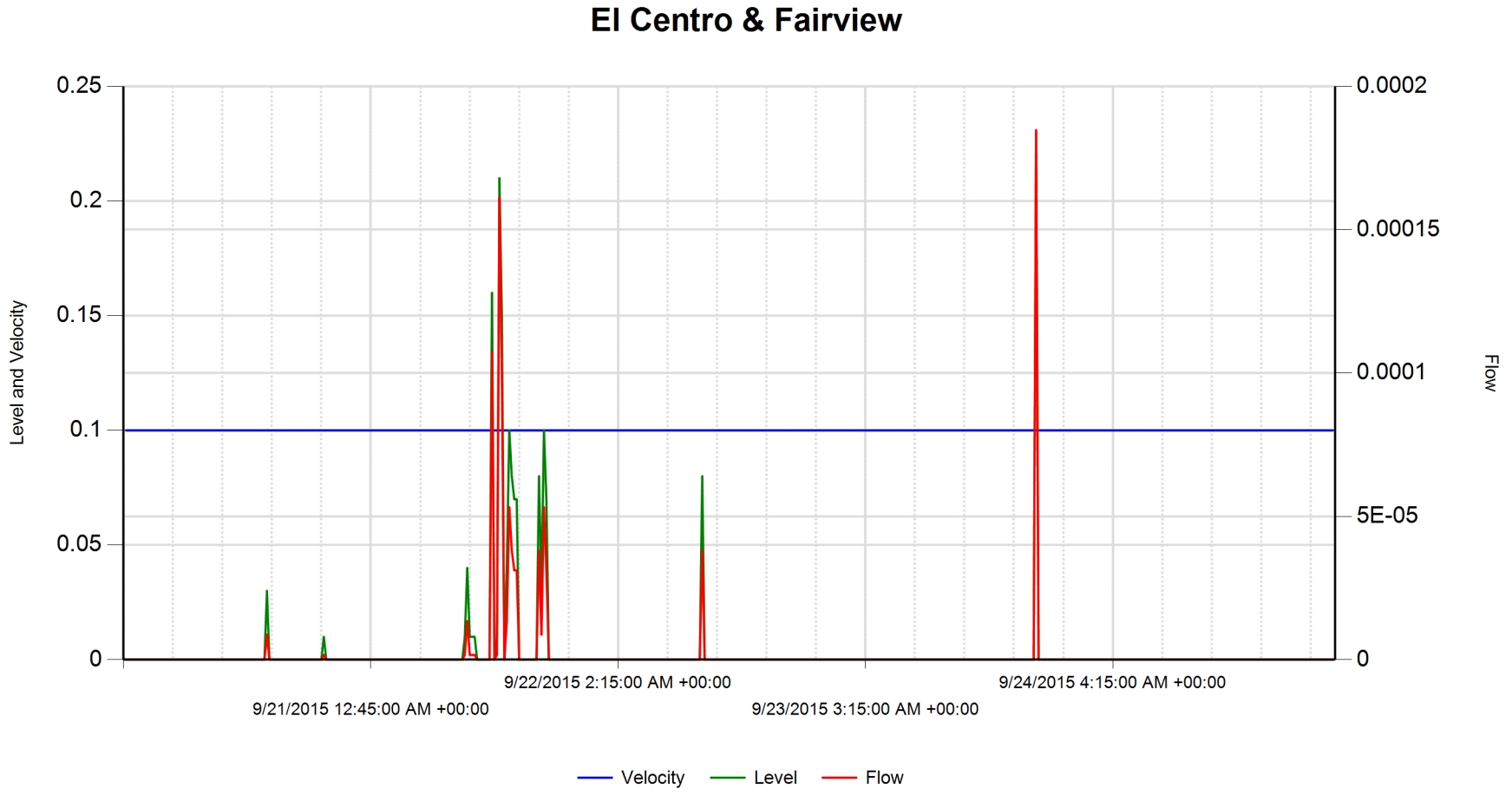
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.106	0.001	0.000	**RainFall**	Inches
Maximum	0.820	0.110	0.001		
Minimum	0.100	0.000	0.000		

9/25/2015 11:26:30 AM



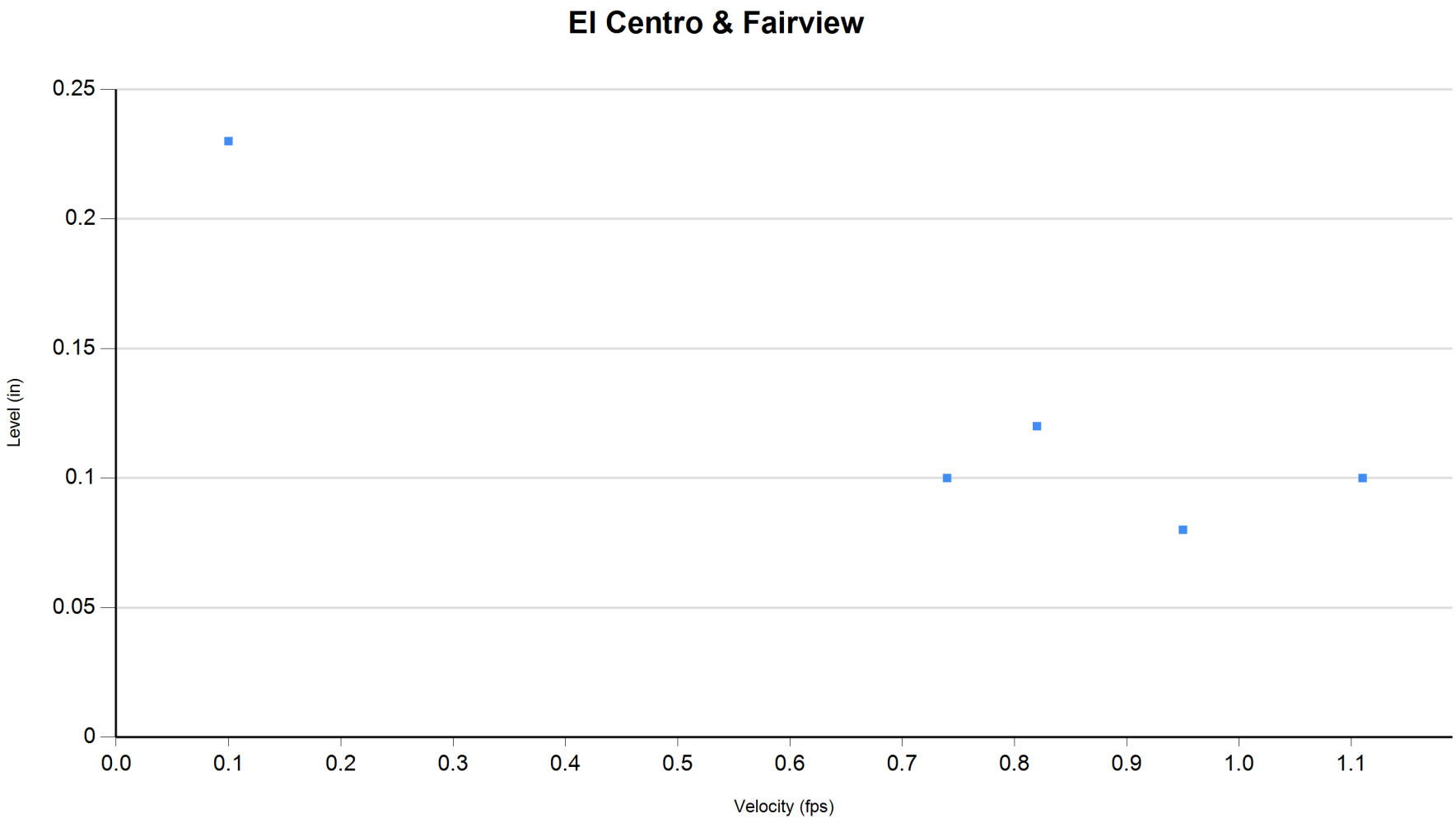
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.107	0.002	0.000	**RainFall**	Inches
Maximum	1.110	0.120	0.001		
Minimum	0.100	0.000	0.000		

9/25/2015 11:26:30 AM



	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.100	0.003	0.000	**RainFall**	Inches
Maximum	0.100	0.230	0.000		
Minimum	0.100	0.000	0.000		

9/25/2015 11:26:30 AM



9/11/2015 thru 9/25/2015

9/25/2015 11:26:30 AM

Utility Systems Science and Software

Report Date: 09/25/2015
Customer: Legacy Partners
Group: Flow Monitoring
SiteID: 497

Statistics for MH 80A at El Centro & Fairview: 09/11/2015 thru 9/25/2015

	Flow (GPM)			Flow (MGD)			Velocity (FPS)			Level (inches)				
Date	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Total	Rain
9/11/2015	0.01	0.35	0.00	0.00	0.00	0.00	0.11	0.82	0.10	0.00	0.11	0.00	9	
9/12/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.00	0.00	0	
9/13/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.00	0.00	0	
Week:	**0.00**	**0.35**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.82**	**0.10**	**0.00**	**0.11**	**0.00**	**9**	
9/14/2015	0.00	0.03	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.08	0.00	1	
9/15/2015	0.00	0.03	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.08	0.00	1	
9/16/2015	0.00	0.27	0.00	0.00	0.00	0.00	0.11	0.74	0.10	0.00	0.10	0.00	4	
9/17/2015	0.00	0.35	0.00	0.00	0.00	0.00	0.11	0.82	0.10	0.00	0.11	0.00	7	
9/18/2015	0.00	0.01	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.05	0.00	0	
9/19/2015	0.01	0.41	0.00	0.00	0.00	0.00	0.14	1.11	0.10	0.01	0.12	0.00	20	
9/20/2015	0.00	0.01	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.03	0.00	0	
Week:	**0.00**	**0.41**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**1.11**	**0.10**	**0.00**	**0.12**	**0.00**	**34**	
9/21/2015	0.01	0.11	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.01	0.21	0.00	7	
9/22/2015	0.00	0.03	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.08	0.00	0	
9/23/2015	0.00	0.13	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.23	0.00	2	
9/24/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.00	0.00	0.00	0	
Week:	**0.00**	**0.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.10**	**0.10**	**0.00**	**0.23**	**0.00**	**10**	

Site Report

09-24-2015

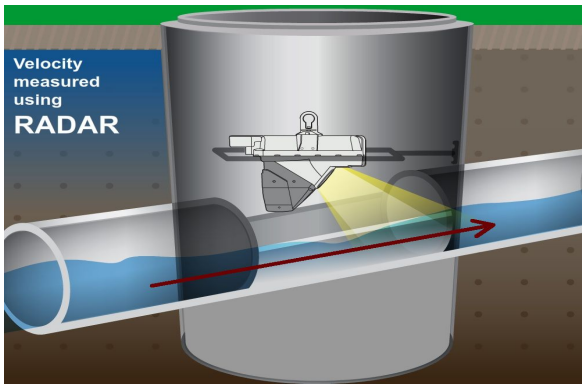
Confidential Proprietary Information

Legacy Partners	1184 El Centro St
El Centro & Fremont	Manhole No.60B

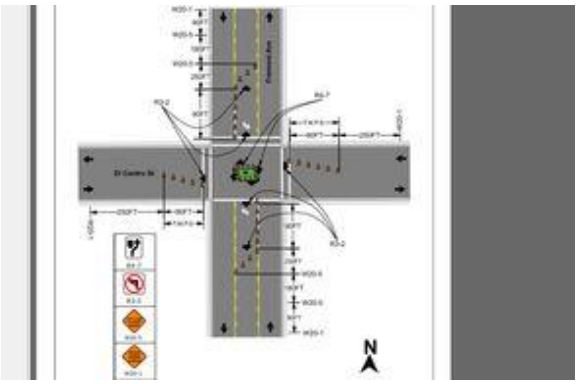
Access:	System Type:	
Manhole in roadway at intersection	Sanitary [X] Storm [ ]	Install Date: 9/11/2015

Map

Technology



Traffic Plan



Flow Meter			
Meter Depth: 109.85"			
Meter SN:*			
*			
Avg Velocity	Avg Measured Level		Multiplier
1.19 fps	0.38"		1.0
Gas			
O2	H2S	CO	LEL
20.9	0	0	0
Notes			
*			
Traffic Safety			
Used cones, signs & a flagger.			
Land Use			
Residential	Commercial	Industrial	Trunk
X	X		

Manhole Depth	124"
Pipe Size	8"
Inner Pipe Size (In/Out)	8"/8"
Pipe Shape	Round
Pipe Condition	OK
Manhole Material	Brick
Silt (inches)	0
Velocity Profile Data	*
Velocity Profile Taken	
Sensor Offset	14.15"
Sensor Dist. to Crown	6.15"
Flow Direction	Downstream
Flow Heading	South

Meter Site Document

Legacy Partners

El Centro & Fremont

1184 El Centro St

Site

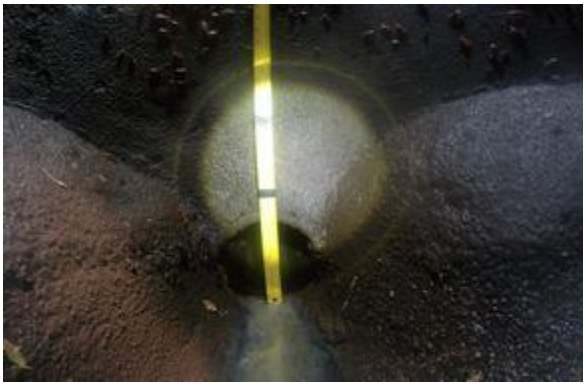
Manhole Before Install

Installation Process

Installed

Upstream

Downstream



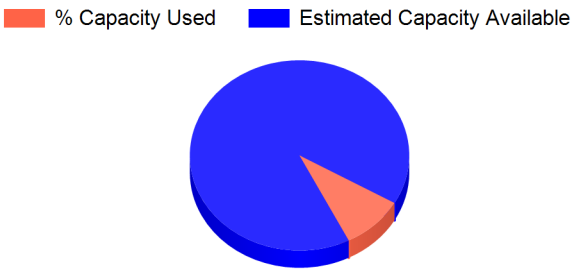
Temporary Flow Study

Legacy Partners

El Centro & Fremont

Meter Start Date		From	9/11/2015 12:00:00 AM
Meter Stop Date		To	9/21/2015 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	0.941	0.528	0.006
Maximum	2.580	0.890	0.035
Minimum	0.000	0.230	0.000
Pipe Size		8.000	
Estimated Capacity (mgd)			
Capacity Used			
Sensor Type		Hach - Flodar	

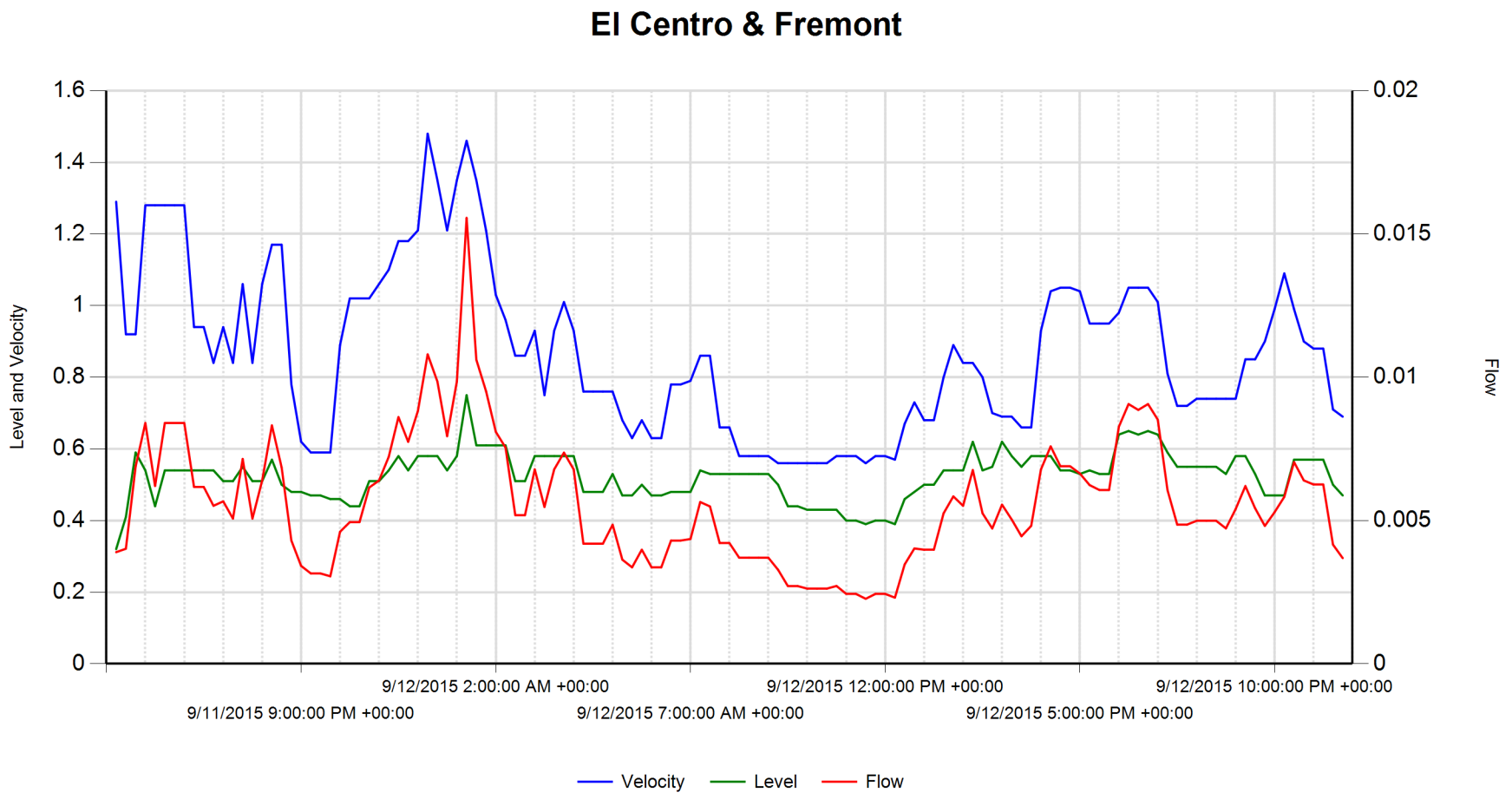
Estimated Capacity Usage



Utility Systems, Science and Software

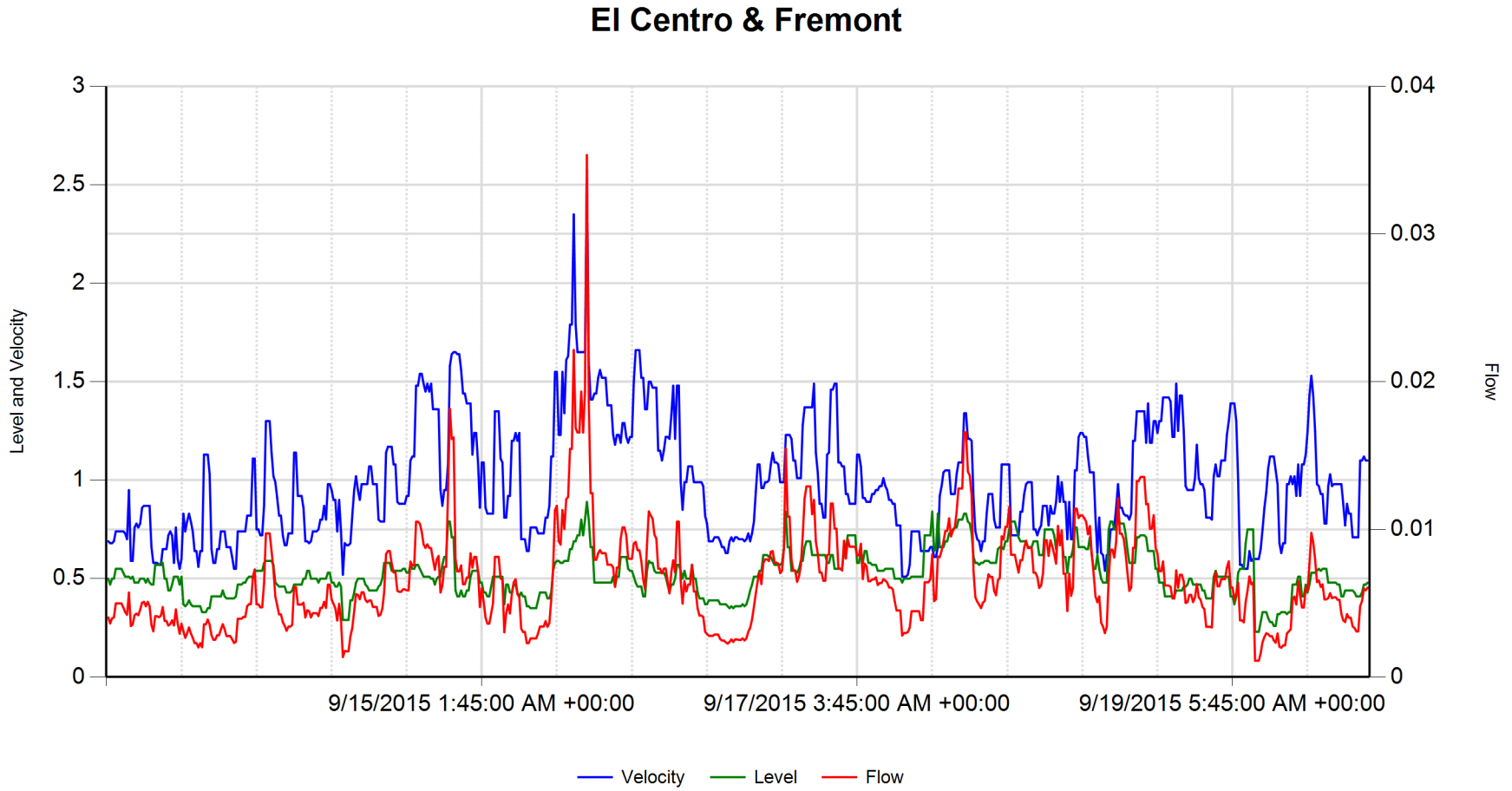
6190 Fairmount Ave. Suite E
San Diego, CA 92021

601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705



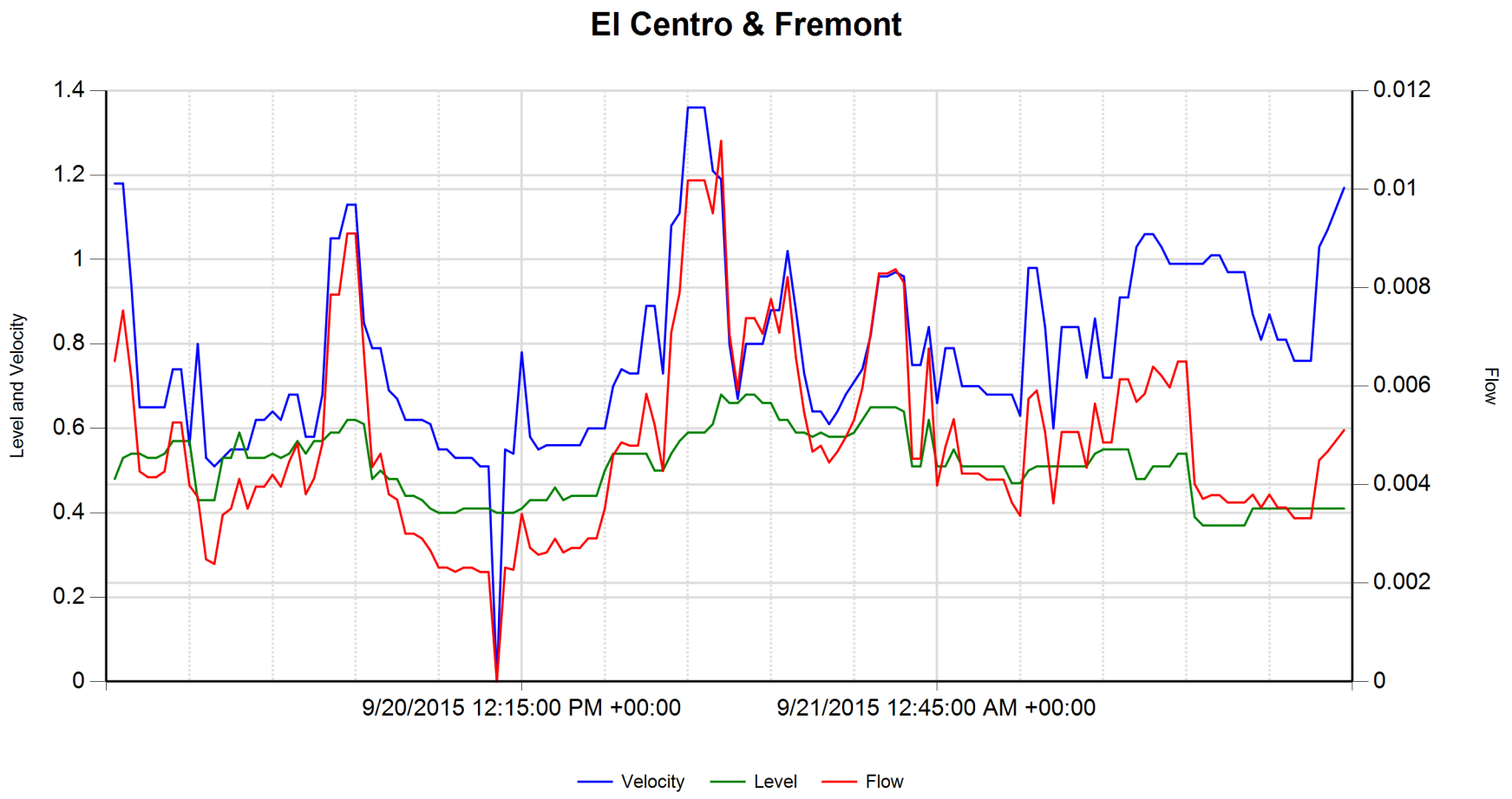
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.869	0.523	0.006	**RainFall**	Inches
Maximum	1.480	0.750	0.016		
Minimum	0.560	0.320	0.002		

9/24/2015 2:05:20 PM



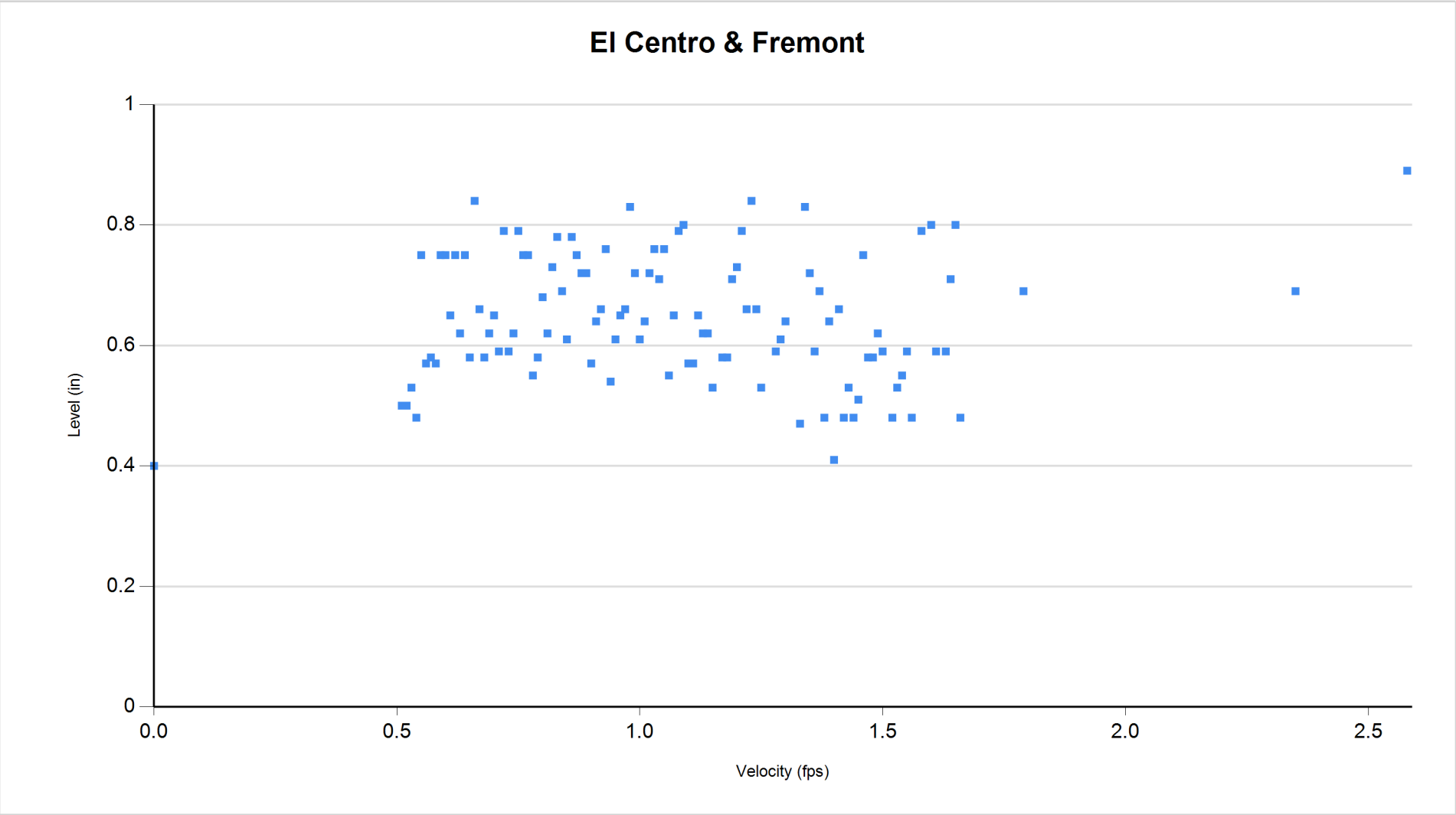
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.989	0.529	0.007	**RainFall**	Inches
Maximum	2.580	0.890	0.035		
Minimum	0.510	0.230	0.001		

9/24/2015 2:05:20 PM



	Velocity (fps)	Level (in)	Flow (mgd)		
Average	0.785	0.511	0.005	**RainFall**	Inches
Maximum	1.360	0.680	0.011		
Minimum	0.000	0.370	0.000		

9/24/2015 2:05:20 PM



9/11/2015 thru 9/21/2015

9/24/2015 2:05:20 PM

Utility Systems Science and Software

Report Date: 09/23/2015
Customer: Legacy Partners
Group: Flow Monitoring
SiteID: 498

Statistics for MH 60B at El Centro & Fremont: 09/11/2015 thru 09/21/2015

	Flow (GPM)			Flow (MGD)			Velocity (FPS)			Level (inches)				
Date	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Total Gal	Rain
9/11/2015	4.36	10.81	2.12	0.01	0.02	0.00	0.98	1.48	0.59	0.52	0.75	0.32	6,283	
9/12/2015	3.35	6.30	1.58	0.00	0.01	0.00	0.76	1.09	0.56	0.52	0.65	0.39	4,824	
9/13/2015	2.96	6.76	1.40	0.00	0.01	0.00	0.80	1.30	0.55	0.46	0.59	0.33	4,257	
Week:	**3.56**	**10.81**	**1.40**	**0.01**	**0.02**	**0.00**	**0.84**	**1.48**	**0.55**	**0.50**	**0.75**	**0.32**	**15,364**	
9/14/2015	4.60	12.62	0.94	0.01	0.02	0.00	1.11	1.65	0.52	0.49	0.79	0.29	6,627	
9/15/2015	6.01	24.55	1.60	0.01	0.04	0.00	1.28	2.58	0.64	0.52	0.89	0.35	8,651	
9/16/2015	4.70	10.75	1.57	0.01	0.02	0.00	0.97	1.49	0.63	0.54	0.84	0.35	6,768	
9/17/2015	5.27	11.51	1.95	0.01	0.02	0.00	0.85	1.34	0.51	0.65	0.84	0.48	7,591	
9/18/2015	5.14	9.41	2.07	0.01	0.01	0.00	1.06	1.49	0.54	0.56	0.83	0.37	7,407	
9/19/2015	3.15	6.79	0.77	0.00	0.01	0.00	0.85	1.53	0.51	0.47	0.75	0.23	4,537	
9/20/2015	3.51	7.63	0.00	0.01	0.01	0.00	0.76	1.36	0.00	0.53	0.68	0.40	5,057	
Week:	**4.63**	**24.55**	**0.00**	**0.01**	**0.04**	**0.00**	**0.98**	**2.58**	**0.00**	**0.54**	**0.89**	**0.23**	**46,638**	
9/21/2015	3.08	4.51	2.30	0.00	0.01	0.00	0.95	1.17	0.76	0.42	0.54	0.37	4,439	
Week:	**3.08**	**4.51**	**2.30**	**0.00**	**0.01**	**0.00**	**0.95**	**1.17**	**0.76**	**0.42**	**0.54**	**0.37**	**4,439**	

Site Report

09-24-2015

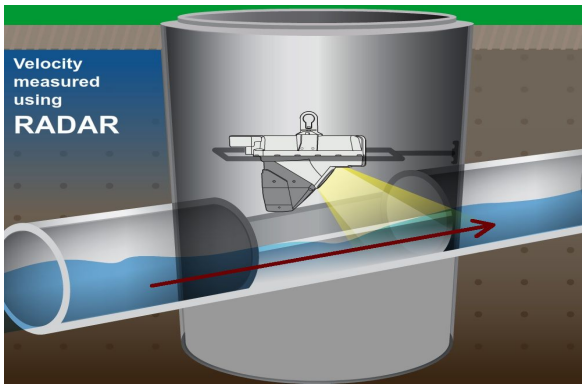
Confidential Proprietary Information

Legacy Partners	1194 Oxley St
Fremont & Oxley	Manhole No.83D

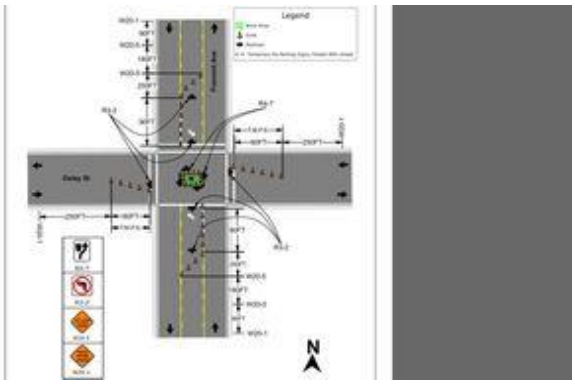
Access:	System Type:	
Manhole in roadway at intersection	Sanitary [X] Storm [ ]	Install Date: 9/11/2015

Map

Technology



Traffic Plan



Flow Meter			
Meter Depth: 72"			
Meter SN:*			
*			
Avg Velocity	Avg Measured Level		Multiplier
1.26 fps	1.11"		1.0
Gas			
O2	H2S	CO	LEL
20.9	0	0	0
Notes			
*			
Traffic Safety			
Used cones, signs & a flagger.			
Land Use			
Residential	Commercial	Industrial	Trunk
X	X		

Manhole Depth	86"
Pipe Size	8"
Inner Pipe Size (In/Out)	8"/8"
Pipe Shape	Round
Pipe Condition	OK
Manhole Material	Brick
Silt (inches)	0
Velocity Profile Data	*
Velocity Profile Taken	
Sensor Offset	13.99"
Sensor Dist. to Crown	5.99"
Flow Direction	Downstream
Flow Heading	East

Meter Site Document

Legacy Partners

Fremont & Oxley

1194 Oxley St

Site

Manhole Before Install

Installation Process

Installed

Upstream

Downstream

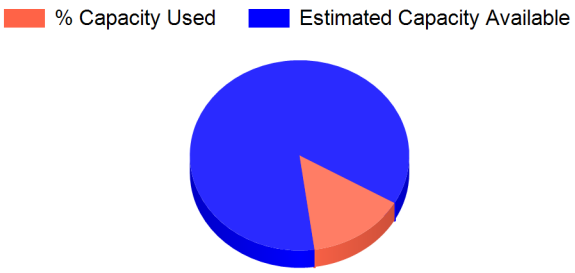
Temporary Flow Study

Legacy Partners

Fremont & Oxley

Meter Start Date		From	9/11/2015 12:00:00 AM
Meter Stop Date		To	9/21/2015 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	1.332	0.697	0.013
Maximum	2.010	1.550	0.055
Minimum	0.740	0.350	0.003
Pipe Size		8.000	
Estimated Capacity (mgd)			
Capacity Used			
Sensor Type		Hach - Flodar	

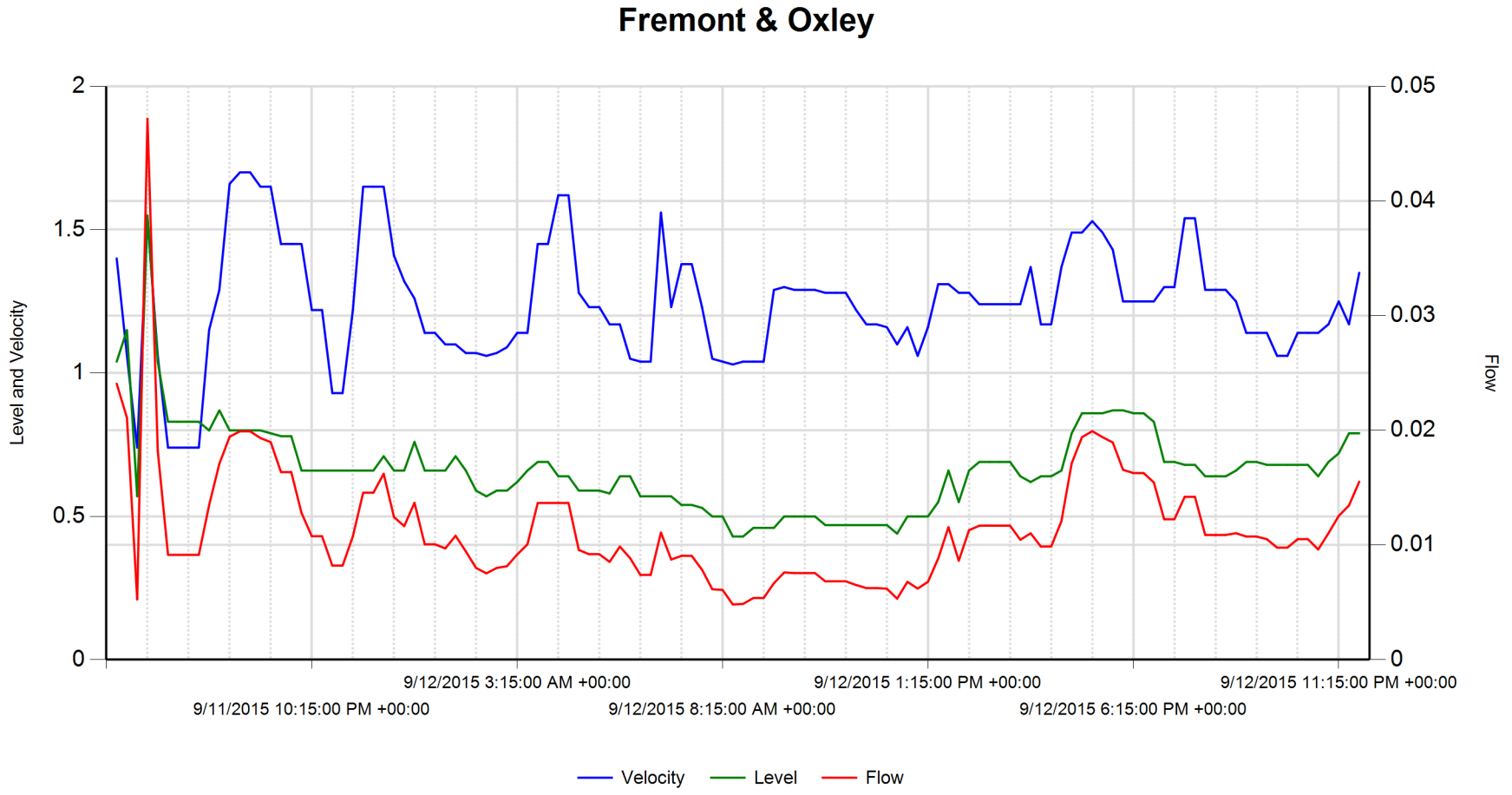
Estimated Capacity Usage



Utility Systems, Science and Software

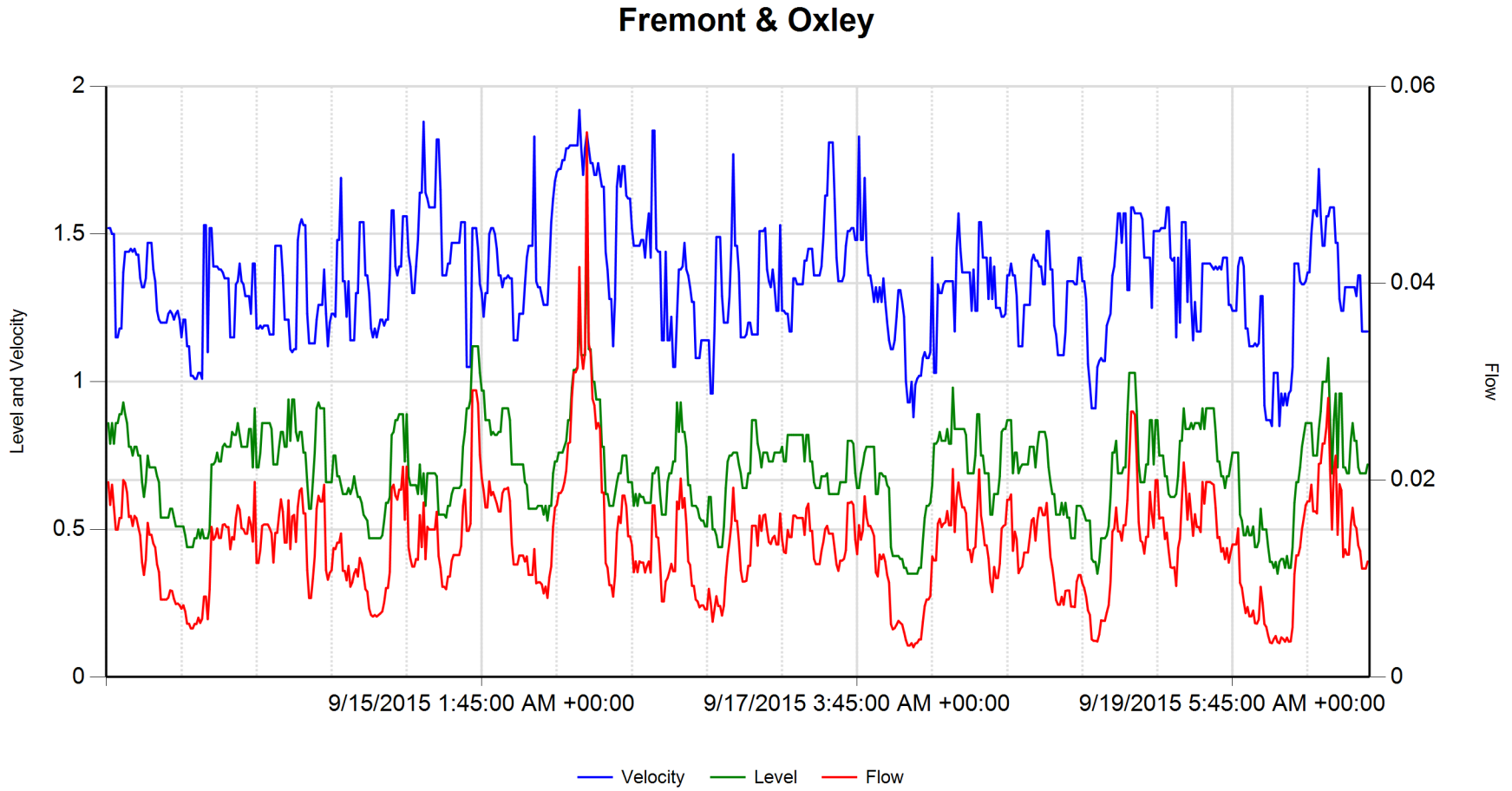
6190 Fairmount Ave. Suite E
San Diego, CA 92021

601 N. Parkcenter Drive Suite 209
Santa Ana, CA 92705



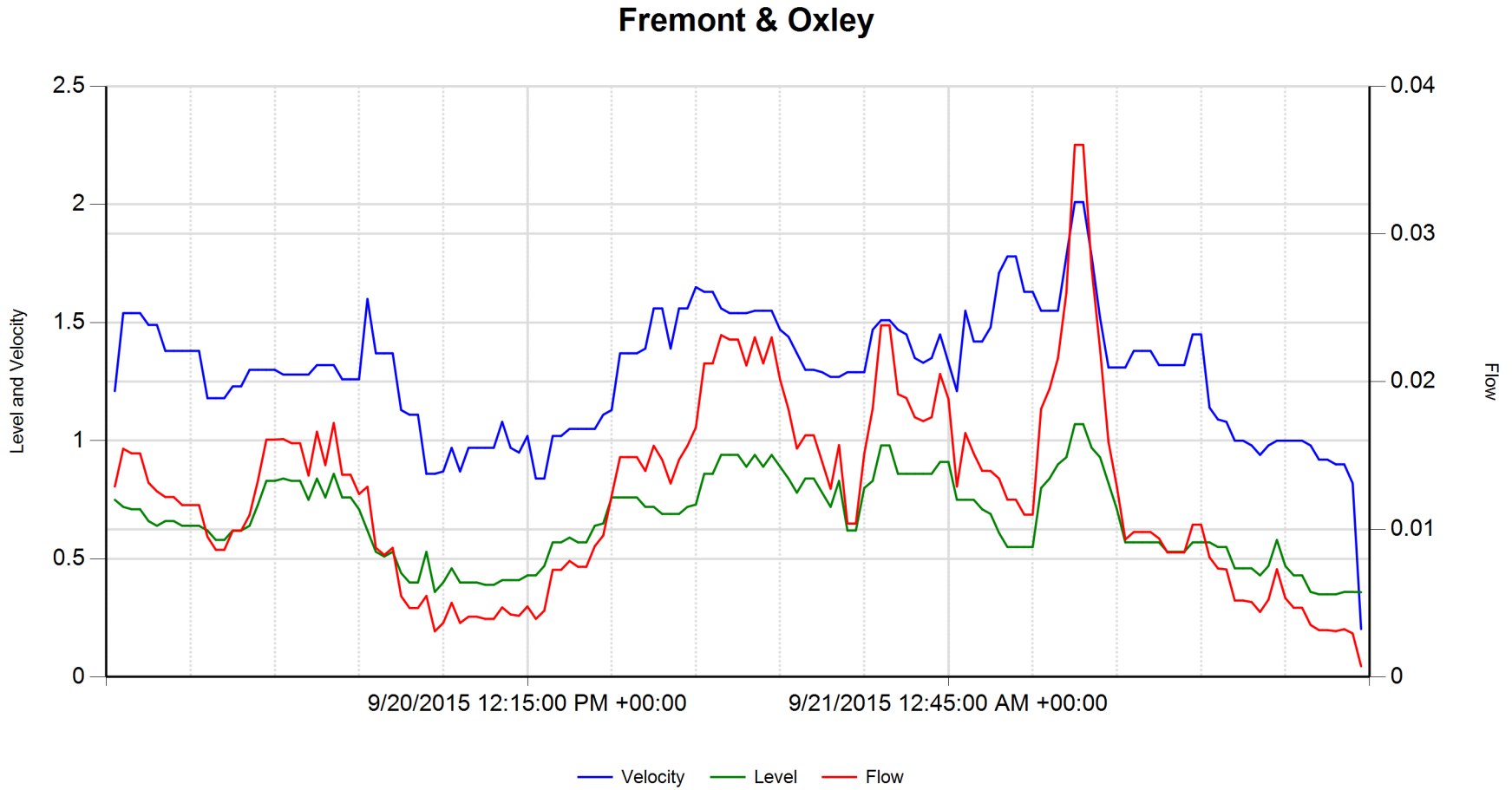
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	1.245	0.667	0.011	**RainFall**	Inches
Maximum	1.700	1.550	0.047		
Minimum	0.740	0.430	0.005		

9/24/2015 2:06:05 PM



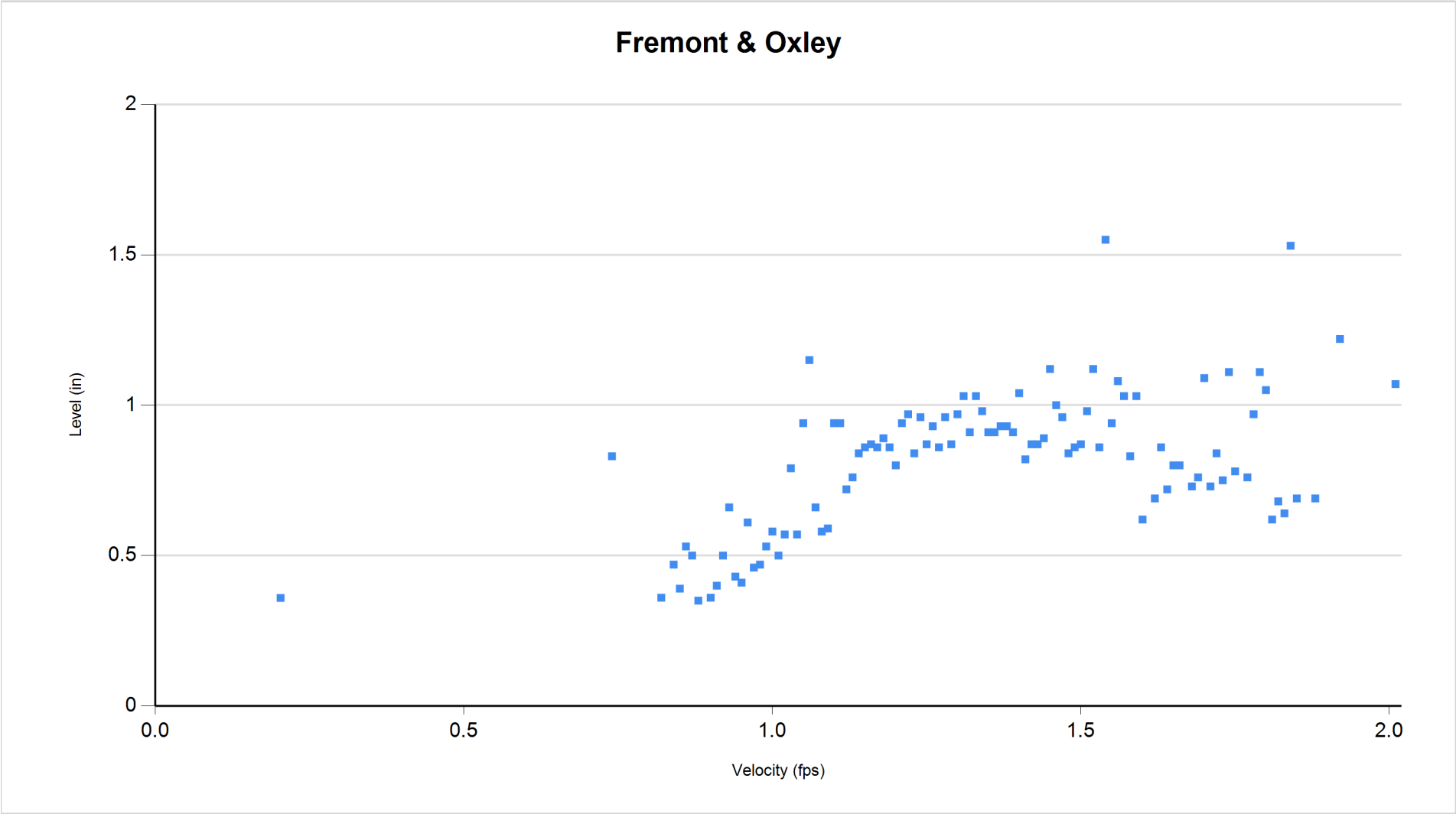
	Velocity (fps)	Level (in)	Flow (mgd)		
Average	1.346	0.702	0.014	**RainFall**	Inches
Maximum	1.920	1.530	0.055		
Minimum	0.850	0.350	0.003		

9/24/2015 2:06:05 PM



	Velocity (fps)	Level (in)	Flow (mgd)		
Average	1.292	0.660	0.012	**RainFall**	Inches
Maximum	2.010	1.070	0.036		
Minimum	0.203	0.350	0.001		

9/24/2015 2:06:05 PM



9/11/2015 thru 9/21/2015

9/24/2015 2:06:05 PM

Utility Systems Science and Software

Report Date: 09/23/2015
Customer: Legacy Partners
Group: Flow Monitoring
SiteID: 499

Statistics for MH 83D at Fremont & Oxley: 09/11/2015 thru 09/21/2015

	Flow (GPM)			Flow (MGD)			Velocity (FPS)			Level (inches)				
Date	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Total Gal	Rain
9/11/2015	8.94	32.76	3.65	0.01	0.05	0.01	1.25	1.70	0.74	0.72	1.55	0.57	12,871	
9/12/2015	8.24	13.90	3.35	0.01	0.02	0.00	1.28	1.54	1.03	0.67	0.93	0.43	11,865	
9/13/2015	8.70	13.76	3.43	0.01	0.02	0.00	1.26	1.55	1.01	0.70	0.94	0.44	12,523	
Week:	**8.62**	**32.76**	**3.35**	**0.01**	**0.05**	**0.00**	**1.26**	**1.70**	**0.74**	**0.70**	**1.55**	**0.43**	**37,259**	
9/14/2015	9.85	20.22	4.27	0.01	0.03	0.01	1.40	1.88	1.05	0.72	1.12	0.47	14,187	
9/15/2015	11.32	38.42	4.92	0.02	0.06	0.01	1.50	1.92	1.05	0.73	1.53	0.53	16,298	
9/16/2015	9.19	13.36	3.91	0.01	0.02	0.01	1.36	1.83	0.96	0.70	0.87	0.44	13,228	
9/17/2015	8.31	14.68	2.11	0.01	0.02	0.00	1.26	1.57	0.88	0.67	0.98	0.35	11,963	
9/18/2015	9.41	18.73	2.52	0.01	0.03	0.00	1.35	1.59	0.91	0.70	1.03	0.35	13,550	
9/19/2015	8.55	19.69	2.39	0.01	0.03	0.00	1.28	1.72	0.85	0.67	1.08	0.35	12,308	
9/20/2015	9.60	25.03	2.15	0.01	0.04	0.00	1.35	2.01	0.84	0.70	1.07	0.36	13,830	
Week:	**9.46**	**38.42**	**2.11**	**0.01**	**0.06**	**0.00**	**1.36**	**2.01**	**0.84**	**0.70**	**1.53**	**0.35**	**95,363**	
9/21/2015	4.03	7.16	0.50	0.01	0.01	0.00	1.04	1.45	0.20	0.47	0.58	0.35	5,802	
Week:	**4.03**	**7.16**	**0.50**	**0.01**	**0.01**	**0.00**	**1.04**	**1.45**	**0.20**	**0.47**	**0.58**	**0.35**	**5,802**	

Site Report 09-24-2015

Confidential Proprietary Information

Legacy Partners	1515 Oxley St
Edison & Oxley	Manhole No.78B

Access:

Manhole in roadway at intersection with alleyway

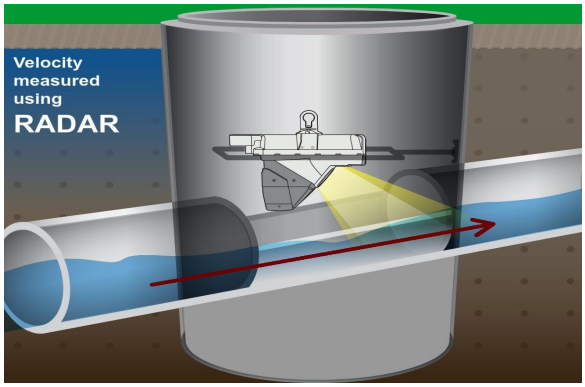
System Type:

Sanitary [X] Storm [ ]

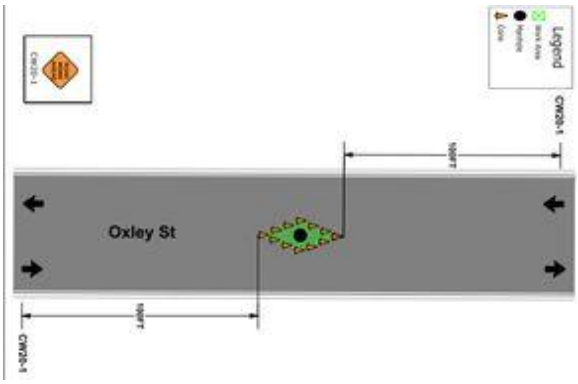
Install Date: 9/11/2015

Map

Technology



Traffic Plan



Flow Meter		
Meter Depth: 79"		
Meter SN:*		
*		
Avg Velocity	Avg Measured Level	Multiplier
3.62 fps	3.88"	1.0

Gas			
O2	H2S	CO	LEL
20.9	0	0	0

Notes
*

Traffic Safety
Used cones, signs & a flagger.

Land Use			
Residential	Commercial	Industrial	Trunk
X	X		

Manhole Depth	96"
Pipe Size	10"
Inner Pipe Size (In/Out)	10"/10"
Pipe Shape	Round
Pipe Condition	OK
Manhole Material	Brick
Silt (inches)	0
Velocity Profile Data	*
Velocity Profile Taken	
Sensor Offset	16.99"
Sensor Dist. to Crown	6.99"
Flow Direction	Downstream
Flow Heading	South

Meter Site Document

Legacy Partners

Edison & Oxley

1515 Oxley St

Site

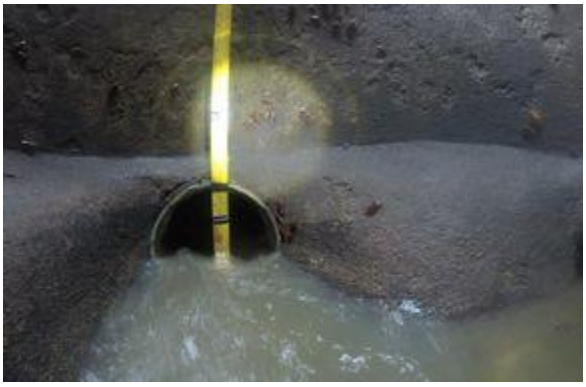
Manhole Before Install

Installation Process

Installed

Upstream

Downstream



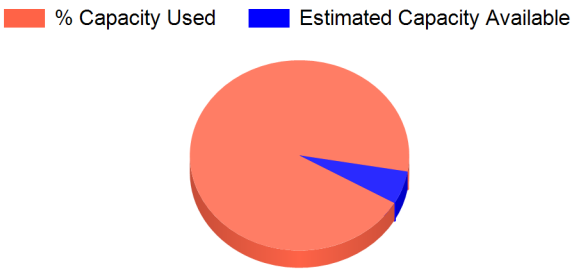
Temporary Flow Study

Legacy Partners

Edison & Oxley

Meter Start Date		From	9/11/2015 12:00:00 AM
Meter Stop Date		To	9/21/2015 12:00:00 AM
Velocity (fps)		Level (in)	Flow (mgd)
Average	3.054	3.830	0.392
Maximum	4.390	5.500	0.709
Minimum	1.620	2.260	0.117
Pipe Size		10.000	
Estimated Capacity (mgd)			
Capacity Used			
Sensor Type		Hach - Flodar	

Estimated Capacity Usage



Utility Systems, Science and Software

6190 Fairmount Ave. Suite E
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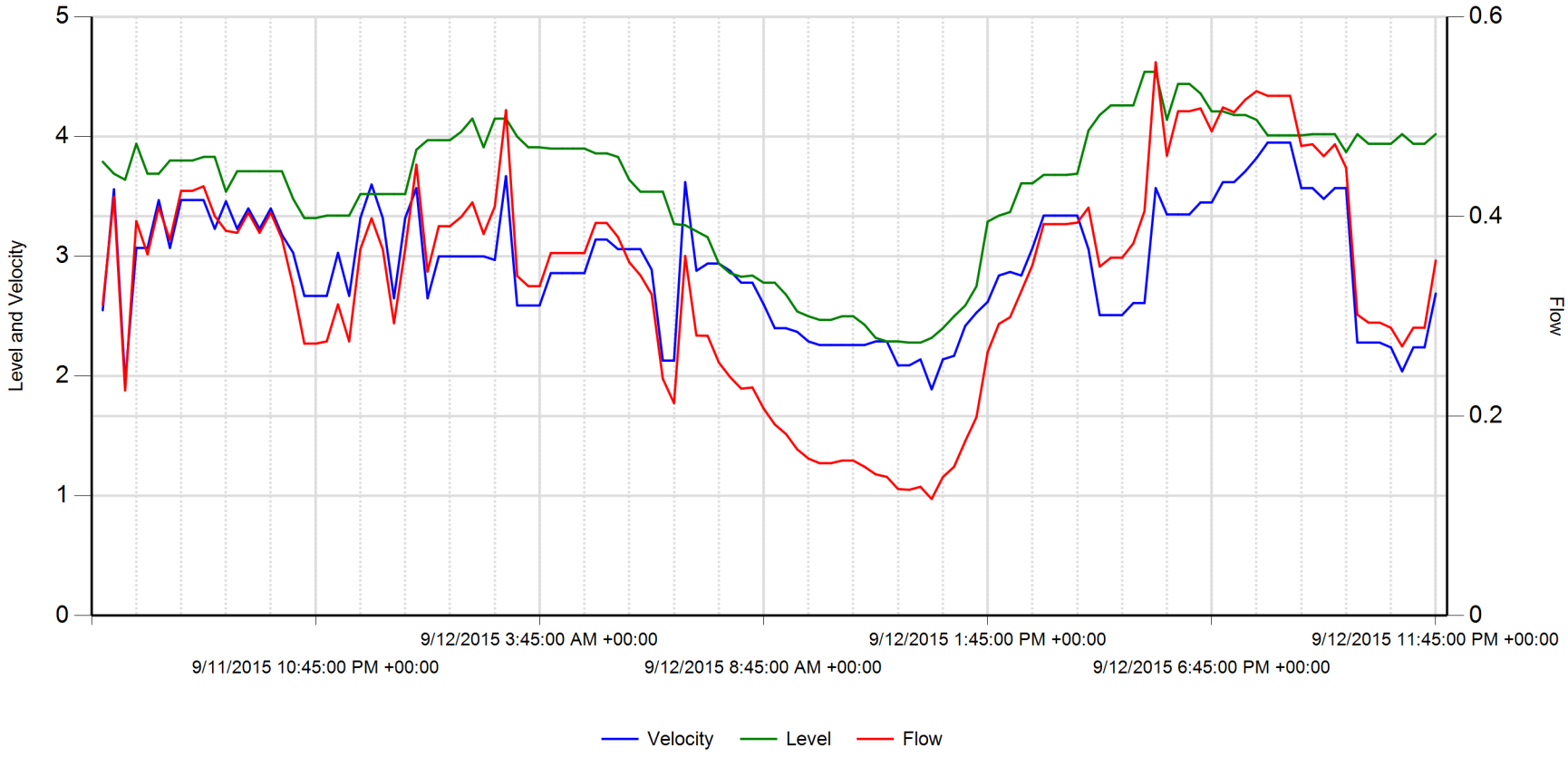
Edison & Oxley



	Velocity (fps)	Level (in)	Flow (mgd)		
Average	2.914	3.574	0.338	**RainFall**	Inches
Maximum	3.950	4.540	0.554		
Minimum	1.890	2.280	0.117		

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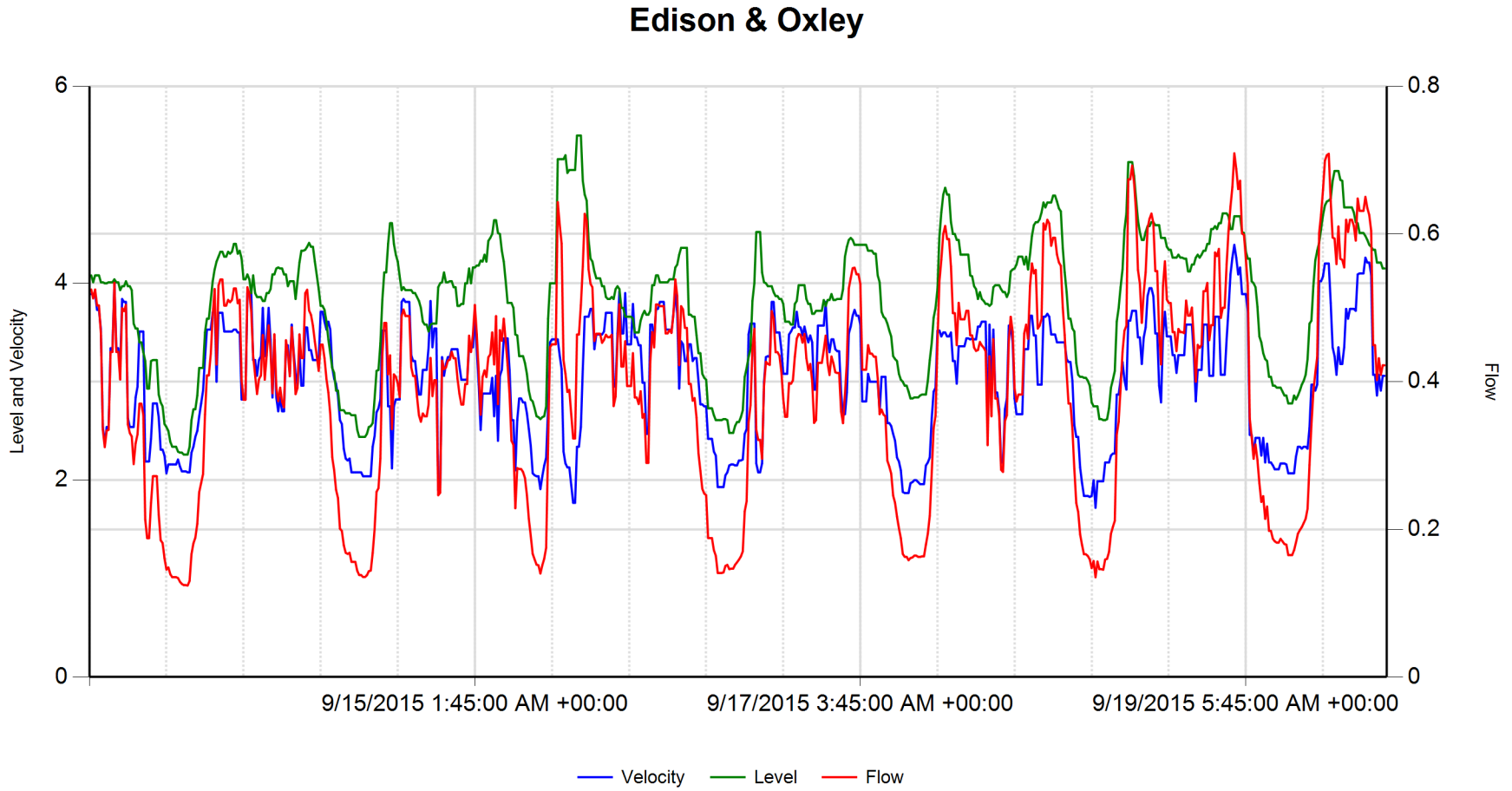

	Velocity (fps)	Level (in)	Flow (mgd)		
Average	3.033	3.841	0.391	**RainFall**	Inches
Maximum	4.390	5.500	0.709		
Minimum	1.720	2.260	0.124		

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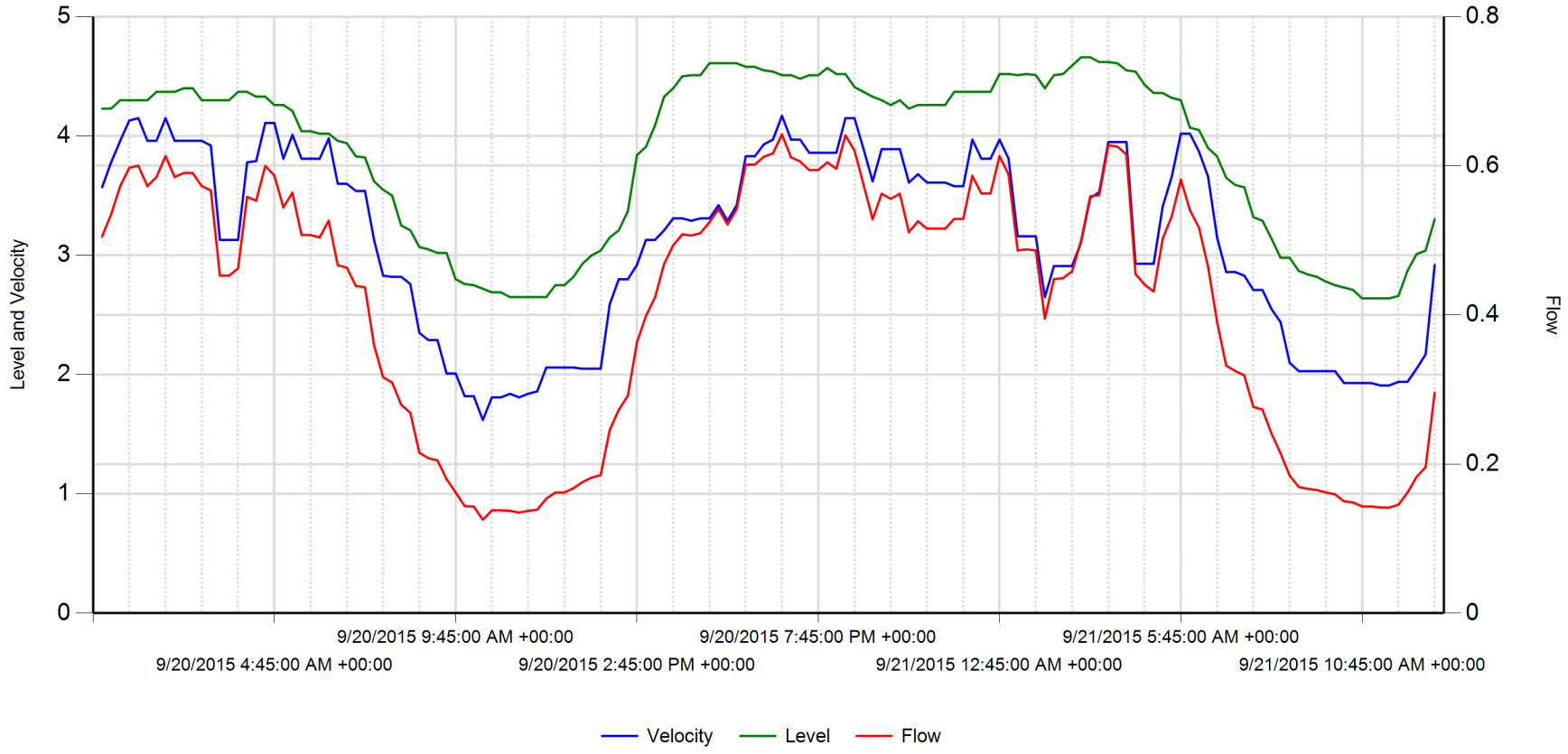
Edison & Oxley



	Velocity (fps)	Level (in)	Flow (mgd)		
Average	3.133	3.855	0.414	**RainFall**	Inches
Maximum	4.170	4.660	0.642		
Minimum	1.620	2.640	0.125		

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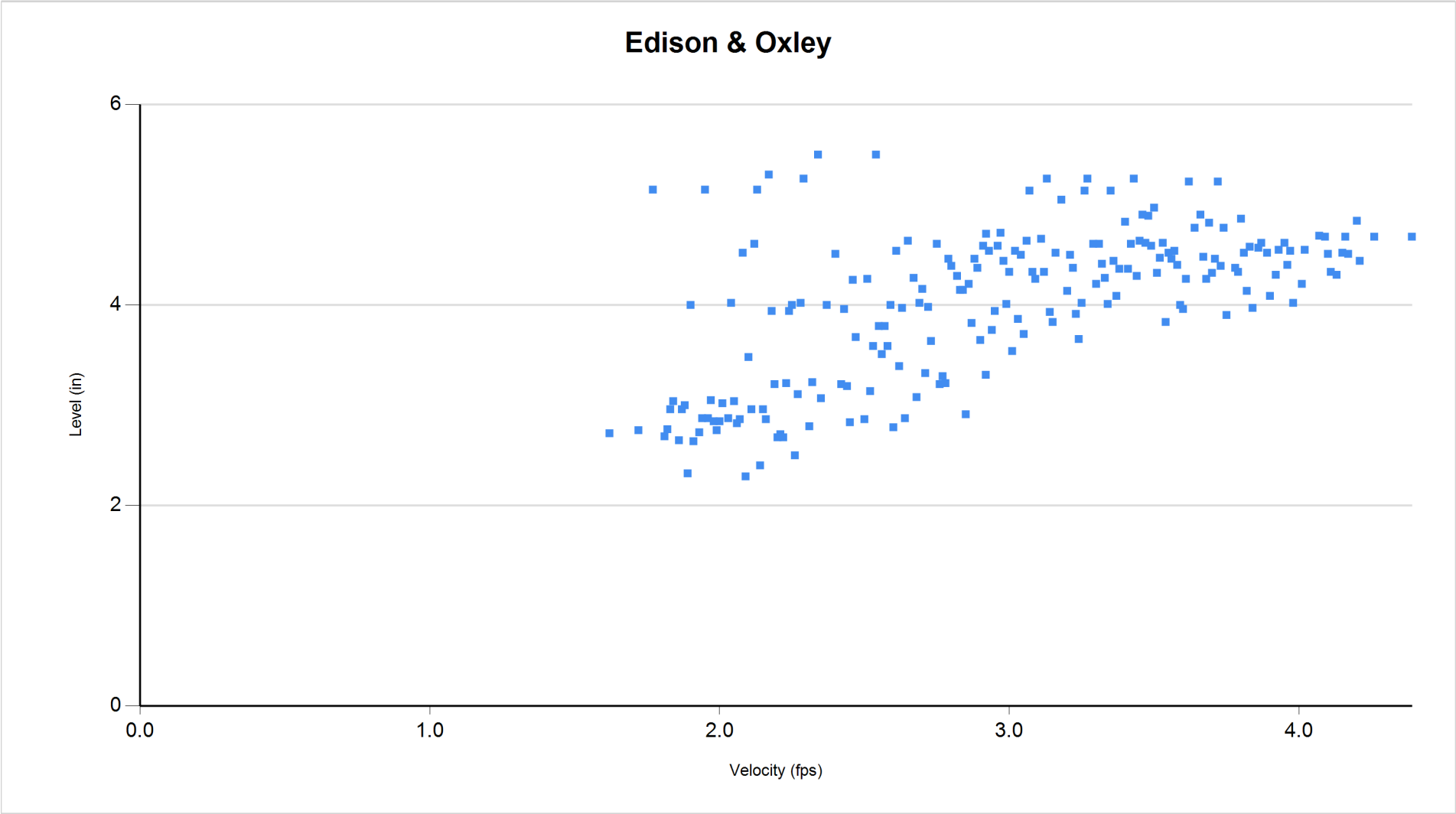

9/11/2015 thru 9/21/2015

9/24/2015 2:04:33 PM

Utility Systems Science and Software

Report Date: 09/23/2015
Customer: Legacy Partners
Group: Flow Monitoring
SiteID: 500

Statistics for MH 78B at Edison & Oxley: 09/11/2015 thru 09/21/2015

	Flow (GPM)			Flow (MGD)			Velocity (FPS)			Level (inches)				
Date	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Total Gal	Rain
9/11/2015	251.44	351.75	147.90	0.36	0.51	0.21	3.02	3.67	1.95	3.73	4.15	3.27	362,067	
9/12/2015	240.60	385.09	81.22	0.35	0.55	0.12	2.96	4.01	1.89	3.58	4.54	2.28	346,462	
9/13/2015	252.20	373.96	86.13	0.36	0.54	0.12	3.02	3.90	2.07	3.62	4.41	2.26	363,172	
Week:	**248.08**	**385.09**	**81.22**	**0.36**	**0.55**	**0.12**	**3.00**	**4.01**	**1.89**	**3.65**	**4.54**	**2.26**	**1,071,701**	
9/14/2015	244.20	349.99	94.16	0.35	0.50	0.14	2.92	3.84	1.90	3.68	4.64	2.44	351,646	
9/15/2015	280.87	446.73	97.45	0.40	0.64	0.14	3.10	3.92	1.77	3.95	5.50	2.62	404,451	
9/16/2015	249.63	385.05	97.95	0.36	0.55	0.14	3.00	3.81	1.93	3.65	4.52	2.48	359,461	
9/17/2015	279.89	430.11	109.97	0.40	0.62	0.16	2.98	3.69	1.87	3.97	4.97	2.83	403,042	
9/18/2015	305.37	492.61	93.92	0.44	0.71	0.14	3.11	4.39	1.72	4.08	5.23	2.61	439,733	
9/19/2015	312.93	492.17	114.76	0.45	0.71	0.17	3.25	4.26	2.07	4.03	5.14	2.78	450,613	
9/20/2015	298.49	445.94	87.12	0.43	0.64	0.13	3.16	4.17	1.62	3.96	4.66	2.65	429,822	
Week:	**281.62**	**492.61**	**87.12**	**0.41**	**0.71**	**0.13**	**3.08**	**4.39**	**1.62**	**3.90**	**5.50**	**2.44**	**2,838,768**	
9/21/2015	140.09	230.74	98.50	0.20	0.33	0.14	2.24	2.92	1.91	2.98	3.65	2.64	201,734	
Week:	**140.09**	**230.74**	**98.50**	**0.20**	**0.33**	**0.14**	**2.24**	**2.92**	**1.91**	**2.98**	**3.65**	**2.64**	**201,734**	